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BIODIVERSITY OF DRAGONFLIES AND DAMSELFLIES (ODONATA)
OF THE SOUTH-CENTRAL NEARCTIC AND
ADJACENT NEOTROPICAL BIOTIC
PROVINCES

DISSERTATION

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By

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The south-central United States serves as an important biogeographical link and dispersal corridor between Nearctic and Neotropical elements of western hemisphere odonate faunas. Its species are reasonably well known because of substantial collections, but there has been no concerted effort to document the extent of biodiversity and possible geographic affinities of dragonflies and damselflies of this region. The recent discoveries of *Argia leonorae* Garrison, *Gomphus gonzalezi* Dunkle and *Erpetogomphus heterodon* Garrison from southern and western Texas and northern Mexico suggest that Odonata species remain to be discovered in this area, particularly from far south Texas and northern Mexico. I have documented a total of 12,515 records of Odonata found in 408 counties within the south-central U.S. A total of 73 species of damselflies and 160 species of dragonflies was revealed in the region. The 233 (197 in Texas) Odonata species are distributed among 10 families and 66 genera. Illustrated family, generic, and species-level keys are provided.

Since the beginning of this work in the Fall of 1993, one species has been added each to the Louisiana and Oklahoma faunas, and 12 species have been added, previously unreported from Texas, including four new to the U.S. The area of highest Odonata biodiversity overall (161 spp.) is in the Austroriparian biotic province. The greatest

degree of faunal similarity between the south-central U.S. and other intra-continental regions was observed for the eastern (64%) United States. Diversity is a function of area, and as expected, the numbers of breeding birds and Odonata, in each contiguous U.S. state are positively correlated ($r=0.376$, $n=33$, $p=0.031$). There is, however, no strong correlation between land area and species diversity within the region, but those natural biotic provinces (Austroriparian, Texan, Balconian) where aquatic systems and topographic heterogeneity are the greatest provide a broader spectrum of potential Odonata habitats and thus support a greater number of Odonata species.

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CHAPTER 1

INTRODUCTION

Dragonflies and damselflies (Odonata) are so remarkably distinctive in appearance and unique in many aspects of their biology, that they cannot be mistaken for any other type of insect and stand isolated in the present world fauna (Askew 1988). Worldwide, this group is represented by 4,875 recognized species (Davies & Tobin 1984, 1985). There are 436 species of Odonata known from North America, north of Mexico, representing 83 genera and 11 families (Paulson & Dunkle 1996). This number somewhat disguises the fact that, on a world-wide basis and especially in the tropics, the order is among the largest of aquatic groups (McCafferty 1983), placing them as an ecologically important order in aquatic ecosystems.

Dragonfly and damselfly larvae, although most common in ponds, marshes, lakes and streams (Westfall & Tennessen 1996), have exploited a wide range of permanent and temporary aquatic habitats, from brackish pools and estuarine habitats to moist substrates under rocks in otherwise dry stream beds or ponds (McCafferty 1983; Westfall 1984). Dragonfly and damselfly adults and larvae play a major role as beneficial predators, with mosquitoes and other insects making up a large portion of their diets. The larvae also form an important link in food chains for fish and other aquatic vertebrates (Needham 1903; Wilson 1920; Tillyard 1920; Wright 1943a, 1946a; Corbet 1961, 1983; McCafferty 1983; Westfall 1984; Askew 1988). Historically, Odonata have not been acknowledged

as good indicators of water quality, but numerous authors (Gastella 1987; Dolny & Asmera 1989; Bulankova 1997; Chovanec & Raab 1997) have recognized this group in that capacity recently. Schmidt (1985) presented a convenient working scheme using a representative spectrum of Odonata species (RSO) for the rapid evaluation and characterization of aquatic habitats. Both larvae and adults are recreationally important; fly fishermen have patterned tied flies after them, and the terrestrial adults are observed and studied by laymen and scientists because of their color, flying ability, and curious habits. Odonates have served for centuries as favorite subjects of poets, naturalists, and collectors (McCafferty 1983).

Current emphasis on inventorying aquatic insects of the Neotropics (Paulson 1982; Gonzalez & Novelo 1991; Novelo & Gonzalez 1991; Quintero & Aiello 1992; Baumann & Kondratieff 1996; Gonzalez & Novelo 1996; McCafferty & Lugo-Ortiz 1996) and realization of the great risk to aquatic invertebrate biodiversity in temperate regions (Franklin 1988; Haffernik 1989, 1992), prompted me to investigate the status of the odonate fauna of the biotic provinces of Texas and adjoining states of the United States and northeastern Mexico that border the Rio Grande River. Such inventories establish a baseline of biodiversity and biogeographic and ecological affinities and associations against which the continued degradation of species and ecosystem diversity can be measured (1980 National Research Council Report; 1984 International Congress Of Entomology Resolution; 1988 Office Of Technicological Assessment Task Force On Technologies To Maintain Biological Diversity; Wilson 1988, 1989, 1994; Knutson 1989). Protection of aquatic diversity, including that of the riparian zone, should also be

an important priority in temperate regions. The risk to aquatic invertebrate biodiversity in temperate regions, including probable species extinctions, is great and continuing, yet has received little effective attention (Franklin 1988; Hafernack 1989, 1992). Assessment and protection of biodiversity in temperate, as well as in tropical systems, and particularly in dispersal corridors between them, must be a priority of the highest order (Franklin 1988).

Distributional studies of Odonata in the Nearctic region of North America generally, have not involved systematic sampling of watersheds, vegetative or physiographic regions, but have focused largely on political entities such as counties, states and provinces (e.g. Ferguson 1940; Needham and Westfall 1955; Bick and Bick 1957; Cannings and Stuart 1977; Williams 1982). Needham and Heywood (1929), Needham and Westfall (1955), Walker (1958), and Walker and Corbet (1975) have provided the primary manuals for the identification of dragonflies (suborder Anisoptera) of North America: the only comprehensive treatments of the damselflies (suborder Zygoptera), have been those of Needham and Heywood (1929) and most recently Westfall and May (1996) for North America and Walker (1953) for Canada. The Neotropical fauna of Mexico was last treated by Calvert (1901-1908) in *Biologia Centrali-Americana*.

There has never been a concerted effort to document the biodiversity and geographic affinities of the Odonata of the south-central U.S. and northeastern Mexico. The fauna is known only from a scattering of biogeographic and taxonomic studies and from a substantial number of largely unpublished private and institutional collections. Over half of the North American species of Odonata still unknown as larvae are from the

southwestern U.S. (McCafferty *et al.* 1990).

Description of the Study Area

The south-central Nearctic Region, as defined herein (Fig. 1), covers approximately 1.2 million km², of which 695,000 km² are in Texas. It includes the seven biotic provinces of Texas and the portions of those provinces from Arkansas, Oklahoma, Louisiana, New Mexico and northeastern Mexico that immediately join Texas. The Mississippi River forms the eastern boundary, and the Navahonian biotic province bounds the western edge of the region. A considerable amount of work has been done on the distribution of vegetation types in Texas (Bray 1901, 1905; Carter 1931; Tharp 1926, 1939), Louisiana (Viosca 1933; Holland 1944), Arkansas (Turner 1935; Stroud & Hanson 1981) and Oklahoma (Ortenburger 1928a,b; Bruner 1931). There is a tremendous variety in the environments available for vegetative and animal communities, largely controlled by climactic conditions and topography. There is a north-south line that divides the south-central U.S., passing through central Oklahoma and Texas into regions of moisture sufficiency and moisture deficiency (Blair 1950), dictating plant and animal distributions in the region. Cope (1880) recognized three major biotas represented in Texas. He distinguished a Sonoran fauna, an Austroriparian fauna and a Neotropical fauna. I recognize a further division of seven distinct regional biotic provinces, as outlined by Blair and Hubbell (1938), Dice (1943), and Blair (1950) that differ in topography, temperature, vegetation, soil type, geology and climate. They are: 1) Chihuahuan, 2) Navahonian, 3) Kansan, 4) Balconian, 5) Tamaulipan, 6) Texan, and 7) Austroriparian

(Fig. 1).

Mean annual precipitation ranges from 147 cm/yr in the eastern parts of the region to less than 25 cm/yr in the western, arid areas such as El Paso. Most of the precipitation falls during March-May. Temperature is also an important factor in dictating plant and animal communities, and ranges from an average of 22.8° C in subtropical Brownsville, Texas, to 13.6° C in the Texas panhandle, resulting in a shorter growing season in the latter. Major vegetation types include eastern pines and hardwoods, central prairies and grasslands, and western semi-desert areas. Elevation ranges from sea level along the coastal areas to 2,667 m (Guadalupe Peak, Culberson Co., TX) in Guadalupe Mountains National Park. The major watersheds (Fig. 2) in the region drain in an eastward or southeastward direction, with nearly all of them entering or approaching the Austroriparian province. These stream systems provide important dispersal routes for the westward distribution of species of the Austroriparian province into more arid, treeless environments (Blair 1950).

The Austroriparian province, as defined by Dice (1943), encompasses the Gulf coastal plain from extreme east Texas to the Atlantic Ocean. This biotic region's western boundary is limited by the availability of moisture. The typical vegetation types include longleaf (*Pinus palustris* Miller) and loblolly pine (*P. taeda* Linnaeus) and hardwood forests variously comprised of sweetgum (*Liquidambar styraciflua* Linnaeus), post oak (*Quercus stellata* Wangenheim) and blackjack oak (*Quercus marilandica* Muenchhausen) (Fig. 3). The lowland hardwood forests of southeastern portion of this province, in addition to those mentioned above, are typically characterized by magnolia (*Magnolia*

grandiflora Linnaeus), tupelo (*Nyssa sylvatica* Marshall), and water oaks (*Quercus nigra* Linnaeus). Other plants typical of this region include Spanish moss (*Tillandsia usneoides* (Linnaeus)) and palmetto (*Sabal minor* (Jacquin)).

The Texan biotic province includes a broad ecotone between the forests of the Austroriparian province in the eastern portion of this region and the western grasslands. The Balcones escarpment forms an abrupt boundary to the west, otherwise delineated by a line based on soil type. This area was once characterized by tall grass prairies (Fig. 4) supported by clay soils, but cultivation of much of the area has led to sandy soils characterized by combination oak-hickory forests, dominated usually by post and black jack oaks and hickory (*Carya texana* Buckley). This province is classified by Thornthwaite (1948) as having a moist humid climate, receiving little excess of water than that required for growth. The drainage pattern of the Texan province is an important biogeographical feature (Blair 1950). The Red and Trinity rivers, along with their tributaries, drain the northern part of this province. Both of these rivers enter the Austroriparian province before emptying into the Gulf. The southern portion of this province is drained largely by the Brazos (Fig. 5), Colorado, San Marcos, and Guadalupe rivers (Fig. 8).

One of the unique features in this province is the Arbuckle Mountains in south-central Oklahoma just north of the Red River. This area is dominated by granite and travertine limestone geologic formations. One of the most prominent of these formations is Turner Falls Park near Davis, Murray Co., Oklahoma (Fig. 6). In the park is a 25 m waterfall on Honey Creek.

I follow Blair (1950) who delineated the Kansan province differently than did Dice (1943). Dice limited the province, excluding the Permian redbeds, while Blair included the areas north of the Edwards Plateau and south of the Red River. It is characterized by a mixture of eastern forest species and western grassland species. Notable exceptions to the monotonous prairies of this province are Palo Duro Canyon State Park (Fig. 7) that has been characterized as a relict habitat, and Caprock Canyon State Park. Moisture decreases from east to west in this province and Thornthwaite (1948) considered the region moisture deficient.

The Balconian biotic province is defined by the Edwards Plateau of Texas and derives its name from the Balcones fault zone forming its southern and eastern boundaries (Blair 1950). It is characterized by scrub forests of juniper (*Juniperus* spp.) and oaks (*Quercus* spp.), including stunted live oaks (*Q. virginiana* Miller).

Further south, the Tamaulipan province extends from southern Texas into eastern Mexico. This semi-arid region is dominated by mesquite (*Prosopis glandulosa* Torrey), *Acacia* spp., *Mimosa* spp. and prickly pear (*Opuntia* spp.). Thornthwaite (1948) noted a marked deficiency of moisture for plant growth, with some growth occurring year round. This province is drained in the north largely by the Nueces River (Fig. 9) and its tributaries and is poorly drained in the southern portion by minor tributaries of the Rio Grande (Fig. 10).

The Chihuahuan province includes the Trans-Pecos area of Texas, excluding the Guadalupe Mountains. It extends southward into the Mexican states of Chihuahua and Coahuila and is largely drained by the Rio Grande. This biotic region is more diverse in

physiographic features than all others in the region (Blair 1950). The climate in this area is arid and moisture deficient (Thornthwaite 1948), and the vegetation is variable, but basin areas up to 1,500 m in elevation include grasses, desert shrubs, and creosote bush (*Larrea tridentata* de Candolle). Streams in this area are usually small and intermittent, with permanent streams being spring fed (Figs. 11-12). The various mountains, including the Chisos and Davis ranges, show a vertical zonation of plant communities, with elevations above 1,500 m predominated by Emory oak (*Quercus emoryi* Torrey) and cedars (*Juniperus* spp.).

The Navahonian province barely enters the northern edge of the western panhandle of Texas (Culberson County) at the southern extension of the Guadalupe Mountains (Figs. 13-14). A vertical zonation in elevation, similar to that of the Chihuahuan province exists in this area. Trees dominant at elevations above 2,500 m include various pines (*Pinus* spp.), oaks (*Quercus* spp.) and Douglas Fir (*Pseudotsuga menziesii* (Mirbel)).

This region is an important biogeographical link and dispersal corridor between Nearctic and Neotropical elements of western hemisphere odonate faunas. A few species of dragonflies and damselflies probably remain to be discovered in North America, mainly because certain species known from the Antilles and northern Mexico may eventually be found in the southern U.S. (McCafferty *et al.* 1990). The large number of Odonata larvae still unknown to science from the southwestern U.S. is attributable to relatively less collecting effort (McCafferty *et al.* 1990) and the fact that species densities are low and habitats sparse and patchy (Provonsha and McCafferty 1973). The larval

descriptions of many of these regional species are insufficient for identification purposes (McCafferty *et al.* 1990). The rarity of many species in the eastern part of this region accounts for the large number of unknown larvae there. This region contains a highly diverse odonate fauna, because of its unique geographic position and highly variable physical composition relative to other physiographic provinces.

Past Regional Odonata Studies

The earliest major documentation of Odonata in Texas was by Hagen (1861). A number of species accounts from Texas and Mexico then appeared in Calvert's *Biologia Centrali-Americana* (1901-1908). Several catalogs (Hagen 1861; Banks 1892; Muttkowski 1910) and broad scale works (Needham and Heywood 1929; Needham and Westfall 1955; Westfall and May 1996) have included incidental records for states in the entire south-central U.S. region. It wasn't until the work of Williamson (1914) that specific attention was paid to areas of the south-central U.S.; he recorded Odonata he had collected on a trip to Oklahoma and Texas seven years earlier. Several localized studies within Texas have supplemented these works. Tucker (1908) reported 15 species of Odonata he collected in Plano, Collin County, Texas, coincidentally in the same year as Williamson was making his first trek through the state. Ferguson (1940) gave a preliminary list of 51 species for Dallas County and subsequently (1942) listed species for 12 additional Texas counties, with some scattered records for Louisiana. Stewart and Murphy (1968) and Solon and Stewart (1972) documented several species in their Denton County dispersal studies. Williams (1982) listed 72 species for McLennan County in central Texas, near Waco, and Laswell and Mitchell (1997) surveyed the Anisoptera in

ponds of Erath County, central Texas. Albright (1952) studied the Odonata fauna of San Antonio and surrounding areas in an unpublished thesis. Young and Bayer (1979) made extensive collections from numerous lotic and lentic habitats along the Guadalupe River basin of central Texas, reporting 44 species of Anisoptera, and provided a key to the larvae of all 61 species of dragonflies known to have occurred in the area at that time. Additional studies have concentrated on regional areas, including those of Tinkham (1934) and Gloyd (1958), who together recorded 50 species from the Big Bend Region of Trans-Pecos Texas.

East Texas has received considerably more attention than have other areas in the state. Harwell (1951) and Alexander (1954) reported on the Odonate fauna of northeastern Texas; and Laswell *et al.* (1998) documented historical collections made from the Navasota River drainage in southeast Texas. Donnelly (1978) provided the foundation for my later work (Abbott *et al.* 1997) in the Big Thicket Primitive Region of east Texas, with his list of 93 species for Sam Houston National Forest.

I reported the following new species records for Texas: *Aeshna psilus* Calvert, *Somatochlora georgiana* Walker, *Dythemis maya* Calvert, *Micrathyria didyma* (Sélys), *Sympetrum illotum* (Hagen), *Tauriphila azteca* Calvert, and *Tramea insularis* Hagen (Abbott 1996). Johnson's (1972a) treatise on Texas Zygoptera, listing 53 species with keys, was the only comprehensive faunal analysis of that group for the state. Only Kennedy (1921) has made a major effort to describe larvae of several species in the region.

Species lists have also been published for the peripheral states of this region (Fig.

15). Bick (1957) was the first publication dealing with the Odonata fauna of Louisiana on a state-wide basis. Numerous incidental records for that state (Schufeldt 1884; Calvert 1893; Hine 1904, 1906; Glick 1939; Behre 1950) and a few regional studies (Foster & Smith 1901; Foster 1915; Montgomery 1927; Wright 1937, 1939, 1943b) already existed, but there had never been a treatment of its entire fauna. Since Bick's initial work in Louisiana, listing 101 species, several workers (Mulhern 1971; Walls & Walls 1971; Bick 1978, 1990; Barr *et al.* 1978; Barr 1979; Westfall & Tennessen 1979; Louton 1982; Vidrine 1988; Vidrine & Allen 1993; Vidrine *et al.* 1988, 1992a,b) have added to the knowledge of the Louisiana fauna. Most recently, Mauffray (1997) updated the current knowledge of that state's fauna, which now stands at 124 species (33 Zygoptera and 91 Anisoptera).

The Odonata in Arkansas were known from only incidental references or regional studies (Adams 1900; Bick 1959; Whitcomb & Bell 1964; Houston 1970; Rickett 1976), until Harp & Rickett (1977), and Harp (1983a) presented the first comprehensive, state-wide lists for the Anisoptera and Zygoptera, respectively, present in the state. Subsequent additions (Farris & Harp 1982; Harp 1983b, 1985; Harp & Harp 1996; Phillips 1996) brought its known number of Odonata to 133 species (36 Zygoptera and 97 Anisoptera).

As with the other states in the region, the early known odonate fauna of Oklahoma consisted of only incidental county records (Williamson 1908; 1912a,b, 1914; Bick 1951) and smaller regional coverages (Ortenberger 1926; Bird 1933; Pritchard 1935, 1936). Bird (1932) made the first comprehensive listing of species for the state and Bick and Bick (1957) revised his work, documenting 126 species (48 Zygoptera and 78

Anisoptera).

The New Mexico Odonata fauna has been the poorest known of the region. Few miscellaneous records (Calvert 1902; Currie 1903; Needham and Cockrell 1903; Kennedy 1918; Ahrens 1938; Kormondy 1960; Dunkle 1975; Bick 1978; Garrison 1984) are found in the taxonomic and regional literature. Evans (1995) presented a checklist, largely based on these studies and museum collections, reporting 97 species (30 Zygoptera and 67 Anisoptera) for the state.

These lists have been helpful additions to the knowledge of dragonfly and damselfly distributions in this region, but generally have not involved the systematic sampling of stream systems or vegetational or physiographic subregions as carried out in this study (except Bick 1957 and Bick & Bick 1957), nor association with abiotic and biotic parameters of occurrence, necessary for biogeographic analysis. Since these lists, I have added one species each to the Louisiana and Oklahoma faunas, 12 species previously unreported from Texas, including four new to the U.S., and presented a preliminary checklist of the 233 species found in the entire region (Abbott 1996; Abbott & Stewart 1998).

CHAPTER 2

METHODS AND MATERIALS

Collecting Trips

Collections from over 1,000 different locations were made in the seven natural biotic provinces (Fig. 1) from representative lentic and lotic habitats and variable-sized streams in the 19 natural watersheds (Fig. 2) of the defined south-central U.S. and northeastern Mexico region. Access to collection sites was largely made from detailed county maps prepared by the Department of Transportation in each of the regional states. Counties are shown for each state in Figure 16.

Intensive sampling, with emphasis on Texas, began in September, 1993 and included more than 40 expeditions transecting the biotic provinces or concentrating in such areas as the Guadalupe Mountains National Park of the Navahonian Province and the Big Thicket Primitive Area of east Texas. Collection of adults and larvae involved sampling all traversed lotic habitats and selected lentic habitats. Locations that had a high diversity were revisited seasonally, and known seasonal emergence patterns were used to locate and obtain rare or infrequently encountered species. Documentation of the fauna of states adjacent to Texas was based primarily on both published and unpublished records of acknowledged collectors and museum holdings, and supplemented by limited sampling. I used the relational database Alpha V™ to manage all field/laboratory collections/data and literature records, and MapLinx Professional™ version 5.0 to

generate distributional maps for species.

Adults were collected primarily with an aerial net, but on a few occasions, a 6 m malaise trap equipped with two alcohol collecting heads was used. One or more of these traps were suspended across small streams and rivers. Smaller individuals were placed in glassine envelopes and submerged in 99% acetone for 4-6 hrs, while larger specimens were left in the acetone overnight, then removed and allowed to dry completely before being stored permanently in polyethylene envelopes with data cards. Larvae were collected by sampling selected microhabitats in ponds, lakes, streams and other bodies of water, using a dipnet with a 1 mm mesh size. In appropriate substrates, such as sand, sieves were used to collect larvae. Exuviae were hand collected from emergence sites. Both exuviae and larvae were placed in Kahle's solution and then rinsed and preserved permanently in 80% ethanol upon returning to the laboratory.

Representative series were deposited in the Texas A&M University (TAMU) Entomological Collection and the University of North Texas (UNT) Insect Collection as voucher specimens. Single records or rare species are being kept in my personal collection.

Collections Examined

In addition to my own collections and literature records, I examined all regional material from the extensive and previously undocumented Beatty collection housed at the Frost Entomological Museum of Penn State University (PSU). Additional museum collections examined included the Arkansas State University Museum of Zoology

(ASUMZ), Florida State Collection of Arthropods (FSCA), International Odonata Research Institute (IORI), Sul Ross State University (SRSU), the Texas A&M Insect Collection (TAMU), and Welder Wildlife Refuge (WELD). Individuals with large personal regional collections who donated records and/or material included T.W.

Donnelly (Binghamton, New York), S.W. Dunkle (Collin County Community College) and D.R. Paulson (University of Puget Sound). Additional individuals and institutions who donated study material included O.S. Flint, Jr. (United States National Museum, Smithsonian Institution), J. Gelhaus (Academy of Natural Sciences of Philadelphia), K. Heth (Bacone College), S. Jasper (Texas A&M University), J.H. Kennedy (University of North Texas), B.C. Kondratieff (Colorado State University), R. Larsen (Roswell, New Mexico), W. Mauffray (Gainesville, Florida), C.R. Nelson (University of Texas, Austin), and R.D. Worthington (Floristic Inventories of the Southwest Program). In addition, numerous species were documented by photographs of readily identifiable species in the region taken by R.A. Behrstock and R.A. Honig and confirmed by myself.

Rearing Studies

Numerous distribution records were based on reared species. Mature larvae used in rearing correlation studies were transported alive to the laboratory in portable styrofoam, "six-pack," rearing chambers containing stream water, as described by Szczytko and Stewart (1979). Larvae were transferred in the laboratory, to a conditioned Frigid Units Living Stream™ or to aquaria with the appropriate substrate and aeration, maintained at collection temperatures and photoperiod. Reared adults were then collected

and associated with their exuviae.

Odonata Determinations

Species determinations were based primarily on adult material, using a Wild™ M5a 50x dissecting scope equipped with 10-20x oculars. The major taxonomic references and keys used included Garrison (1984, 1990, and 1994), Johnson (1972a), Needham and Westfall (1955) and Westfall and May (1996).

Preparation of Illustrations

A *camera lucida* attached to the Wild microscope was used to make initial crude pencil drawings on thin tracing paper. I then burnished these sketches onto Bristol drawing paper before inking the final drawing with Koh-I-Noor Rapidograph™ pens equipped with various sized nibs (000, 0, 01). Bilaterally symmetrical drawings were made using the same technique, but drawing only the left side, folding the tracing paper and burnishing the right side before transferring the entire illustration to drawing paper. Most of the illustrations were prepared from my own specimens or those of other institutions. Some illustrations have been redrawn and appropriate credit has been given. Wing figures were produced by photographing them using high contrast film or directly scanning them digitally.

CHAPTER 3

RESULTS

Odonata Biodiversity

A total of 12,515 records of Odonata were documented from 408 counties (Fig. 17) within the south-central U.S. These records include personal collections, valid literature records, verified material in museum and personal collections, and verified photographic records. A total of 73 species of damselflies and 160 species of dragonflies was revealed in this region. These 233 Odonata species are distributed among 10 families and 66 genera and include one species each from Louisiana and Oklahoma and 12 species from Texas (including four new to the U.S. (Abbott 1996; Abbott and Stewart 1998), that I have added since the beginning of this work in the Fall of 1993; 197 of these occur in Texas (Table 1). Two families, Coenagrionidae (56 spp.) and Libellulidae (77 spp.), accounted for 57% of the total species richness (Table 2). Five genera (*Libellula*, 20 spp.; *Enallagma*, 19 spp.; *Argia*, 18 spp.; *Ischnura*, 11 spp.; *Gomphus*, 11 spp.) had ten or more species and accounted for 34% of the total number of species.

The higher classification used in the checklist below follows that of Davies and Tobin (1984, 1985). Species-level classification follows that of Garrison (1997).

SOUTH CENTRAL U.S. ODONATA CHECKLIST

Suborder Zygoptera
Superfamily Calopterygoidea

Family Calopterygidae

Subfamily Calopteryginae

Genus *Calopteryx* Leach, 1815*Calopteryx dimidiata* Burmeister*Calopteryx maculata* (Beauvois)

Subfamily Hetaerinae

Genus *Hetaerina* Sélys, 1853*Hetaerina americana* (Fabricius)*Hetaerina titia* (Drury)*Hetaerina vulnerata* Hagen in Sélys

Superfamily Lestoidea

Family Lestidae

Subfamily Lestinae

Genus *Archilestes* Sélys, 1872*Archilestes grandis* (Rambur)Genus *Lestes* Leach, 1815*Lestes alacer* Hagen*Lestes disjunctus* SélysSubspecies *australis* Walker*Lestes forficula* Rambur*Lestes inaequalis* Walsh*Lestes rectangularis* Say*Lestes sigma* Calvert*Lestes unguiculatus* Hagen*Lestes vigilax* Hagen in Sélys

Family Protoneuridae

Subfamily Protoneurinae

Genus *Neoneura* Sélys, 1860*Neoneura aaroni* Calvert*Neoneura amelia* CalvertGenus *Protoneura* Sélys, 1857*Protoneura cara* Calvert

Superfamily Coenagrionoidea

Family Coenagrionidae

Subfamily Argiinae

Genus *Argia* Rambur, 1842*Argia alberta* Kennedy*Argia apicalis* (Say)*Argia barretti* Calvert*Argia bipunctulata* (Hagen)*Argia cuprea* (Hagen)*Argia fumipennis* (Burmeister)*Argia hinei* Kennedy

- Argia immunda* (Hagen)
Argia leonora Garrison
Argia lugens (Hagen)
Argia moesta (Hagen)
Argia munda Calvert
Argia nahuana Calvert
Argia plana Calvert
Argia rhoadsi Calvert
Argia sedula (Hagen)
Argia tibialis (Rambur)
Argia translata Hagen in Séllys
- Subfamily Coenagrioninae
- Genus *Chromagrion* Needham, 1903
 Chromagrion conditum (Séllys)
 Genus *Nehalennia* Séllys, 1850
 Nehalennia integricollis Calvert
 Genus *Neoerythromma* Kennedy, 1920
 Neoerythromma cultellatum (Séllys)
- Subfamily Ischnurinae
- Genus *Acanthagrion* Séllys, 1876
 Acanthagrion quadratum Séllys
 Genus *Amphiagrion* Séllys, 1876
 Amphiagrion abbreviatum (Séllys)
 Genus *Enallagma* Charpentier, 1840
 Enallagma antennatum (Say)
 Enallagma aspersum (Hagen)
 Enallagma basidens Calvert
 Enallagma boreale Séllys
 Enallagma civile (Hagen)
 Enallagma concisum Williamson
 Enallagma cyathigerum (Charpentier)
 Enallagma daeckii (Calvert)
 Enallagma divagans Séllys
 Enallagma doubledayi (Séllys)
 Enallagma dubium Root
 Enallagma durum (Hagen)
 Enallagma exsulans (Hagen)
 Enallagma geminatum Kellicott
 Enallagma novaehispaniae Calvert
 Enallagma praevarum (Hagen)
 Enallagma signatum (Hagen)
 Enallagma traviatum
 Subspecies *westfalli* Donnelly

- Enallagma vesperum* Calvert
- Genus *Hesperagrion* Calvert, 1920
 - Hesperagrion heterodoxum* (Sélys)
- Genus *Ischnura* Charpentier, 1840
 - Ischnura barberi* Currie
 - Ischnura damula* Calvert
 - Ischnura demorsa* (Hagen)
 - Ischnura denticollis* (Burmeister)
 - Ischnura hastata* (Say)
 - Ischnura kellicotti* Williamson
 - Ischnura perparva* McLachlan in Sélys
 - Ischnura posita* (Hagen)
 - Ischnura prognata* (Hagen)
 - Ischnura ramburii* (Sélys)
 - Ischnura verticalis* (Say)
- Subfamily Pseudagrioninae
 - Genus *Telebasis* Sélys, 1865
 - Telebasis byersi* Westfall
 - Telebasis salva* (Hagen)
- Suborder Anisoptera
 - Superfamily Aeshnoidea
 - Family Petaluridae
 - Subfamily Petalurinae
 - Genus *Tachopteryx* Sélys, 1859
 - Tachopteryx thoreyi* (Hagen in Sélys)
 - Family Aeshnidae
 - Subfamily Aeshninae
 - Tribe Aeshnini
 - Genus *Aeshna* Fabricius, 1775
 - Aeshna constricta* Say
 - Aeshna dugesi* Calvert
 - Aeshna multicolor* Hagen
 - Aeshna psilus* Calvert
 - Aeshna umbrosa* Walker
 - Genus *Coryphaeschna* Williamson, 1903
 - Coryphaeschna ingens* (Rambur)
 - Tribe Anactini
 - Genus *Anax* Leach, 1815
 - Anax amazili* (Burmeister)
 - Anax junius* (Drury)
 - Anax longipes* Hagen
 - Anax walsinghami* McLachlan
 - Tribe Gynacanthini

Genus *Gynacantha* Rambur, 1842

Gynacantha nervosa Rambur

Subfamily Brachytroninae

Tribe Brachytronini

Genus *Epiaeschna* Hagen, 1877

Epiaeschna heros (Fabricius)

Genus *Nasiaeschna* Förster, 1900

Nasiaeschna pentacantha (Rambur)

Tribe Gomphaeschnini

Genus *Basiaeschna* Sélys, 1883

Basiaeschna janata (Say)

Genus *Boyeria* McLachlan, 1896

Boyeria vinosa (Say)

Genus *Gomphaeschna* Sélys, 1871

Gomphaeschna antilope (Hagen)

Gomphaeschna furcillata (Say)

Family Gomphidae

Subfamily Gomphinae

Tribe Gomphini

Genus *Arigomphus* Needham, 1897

Arigomphus lentulus (Needham)

Arigomphus maxwelli (Ferguson)

Arigomphus submedianus (Hagen)

Arigomphus villosipes (Sélys)

Genus *Dromogomphus* Sélys, 1854

Dromogomphus armatus Sélys

Dromogomphus spinosus Sélys

Dromogomphus spoliatus (Hagen in Sélys)

Genus *Erpetogomphus* Sélys, 1857

Erpetogomphus compositus Hagen in Sélys

Erpetogomphus crotalinus (Hagen in Sélys)

Erpetogomphus designatus Hagen in Sélys

Erpetogomphus eutainia Calvert

Erpetogomphus heterodon Garrison

Erpetogomphus lampropeltis Kennedy

Genus *Gomphus* Leach, 1815

Subgenus *Gomphurus* Needham, 1901

Gomphus externus Hagen

Gomphus gonzalezi Dunkle

Gomphus hybridus Williamson

Gomphus modestus Needham

Gomphus ozarkensis Westfall

Gomphus vastus Walsh

- Subgenus *Gomphus* Leach, 1815
 - Gomphus apomyius* Donnelly
 - Gomphus grasinellus* (Walsh)
 - Gomphus lividus* (Sélys)
 - Gomphus militaris* Hagen in Sélys
 - Gomphus oklahomensis* Pritchard
- Genus *Stylurus* Needham, 1897
 - Stylurus intricatus* (Hagen in Sélys)
 - Stylurus laurae* Williamson
 - Stylurus plagiatus* (Sélys)
- Tribe Octogomphini
 - Genus *Stylogomphus* Fraser, 1922
 - Stylogomphus albistylus* (Hagen in Sélys)
- Subfamily Onychogomphinae
 - Genus *Ophiogomphus* Sélys, 1854
 - Ophiogomphus westfalli* Cook & Daigle
- Subfamily Gomphoidinae
 - Genus *Aphylla* Sélys
 - Aphylla angustifolia* Garrison
 - Aphylla protracta* (Hagen)
 - Aphylla williamsoni* (Gloyd)
 - Genus *Phyllogomphoides* Belle, 1970
 - Phyllogomphoides albrighti* (Needham)
 - Phyllogomphoides stigmatus* (Say)
 - Genus *Progomphus* Sélys, 1854
 - Progomphus borealis* McLachlan in Sélys
 - Progomphus obscurus* (Rambur)
- Subfamily Hageniinae
 - Genus *Hagenius* Sélys, 1854
 - Hagenius brevistylus* Sélys
- Superfamily Cordulegastroidea
 - Family Cordulegastridae
 - Subfamily Cordulegastrinae
 - Genus *Cordulegaster* Leach, 1815
 - Cordulegaster maculata* Sélys
 - Cordulegaster obliqua* (Say)
- Superfamily Libelluloidea
 - Family Corduliidae
 - Subfamily Corduliinae
 - Genus *Epithea* Burmeister, 1839
 - Subgenus *Epicordulia* Sélys, 1871
 - Epithea princeps* Hagen
 - Subgenus *Tetragoneuria* Hagen, 1861

- Epitheca costalis* (Sélys)
Epitheca cynosura (Say)
Epitheca petechialis (Muttkowski)
Epitheca semiaquea (Burmeister)
Epitheca spinosa (Hagen in Sélys)
Epitheca stella Williamson in Muttkowski
 Genus *Helocordulia* Needham, 1901
Helocordulia selysii (Hagen in Sélys)
Helocordulia uhleri Sélys
 Genus *Neurocordulia* Sélys, 1871
Neurocordulia alabamensis Hodges
Neurocordulia molesta (Walsh)
Neurocordulia obsoleta (Say)
Neurocordulia virginiensis Davis
Neurocordulia xanthosoma (Williamson)
 Genus *Somatochlora* Sélys, 1871
Somatochlora filosa (Hagen)
Somatochlora georgiana Walker
Somatochlora linearis (Hagen)
Somatochlora margarita Donnelly
Somatochlora ozarkensis Bird
Somatochlora tenebrosa (Say)
 Subfamily Macromiinae
 Genus *Didymops* Rambur, 1842
Didymops transversa (Say)
 Genus *Macromia* Rambur, 1842
Macromia alleghaniensis Williamson
Macromia annulata Hagen
Macromia illinoensis Walsh
Macromia pacifica Hagen
Macromia taeniolata Rambur
 Family Libellulidae
 Subfamily Brachydiplacinae
 Genus *Micrathyria* Kirby, 1889
Micrathyria aequalis (Hagen)
Micrathyria didyma (Sélys)
Micrathyria hagenii Kirby
 Subfamily Leucorrhiniinae
 Genus *Brachymesia* Kirby, 1889
Brachymesia furcata (Hagen)
Brachymesia gravida (Calvert)
Brachymesia herbida (Gundlach)
 Genus *Celithemis* Hagen, 1861

Celithemis amanda (Hagen)
Celithemis bertha Williamson
Celithemis elisa (Hagen)
Celithemis eponina (Drury)
Celithemis fasciata Kirby
Celithemis ornata (Rambur)
Celithemis verna Pritchard

Subfamily Libellulinae

Genus *Cannaphila* Kirby, 1889

Cannaphila insularis Kirby

Genus *Libellula* Linnaeus, 1758

Libellula auripennis Burmeister

Libellula axilena Westwood

Libellula comanche Calvert

Libellula composita (Hagen)

Libellula croceipennis Sélys

Libellula cyanea Fabricius

Libellula deplanata Rambur

Libellula flavida Rambur

Libellula forensis Hagen

Libellula incesta Hagen

Libellula luctuosa Burmeister

Libellula lydia Drury

Libellula needhami Westfall

Libellula nodisticta Hagen

Libellula pulchella Drury

Libellula quadrimaculata Linnaeus

Libellula saturata Uhler

Libellula semifasciata Burmeister

Libellula subornata (Hagen)

Libellula vibrans Fabricius

Genus *Orthemis* Hagen, 1861

Orthemis discolor (Burmeister)

Orthemis ferruginea (Fabricius)

Subfamily Sympetrinae

Genus *Erythemis* Hagen, 1861

Erythemis collocata (Hagen)

Erythemis plebeja (Burmeister)

Erythemis simplicicollis (Say)

Erythemis vesiculosa (Fabricius)

Genus *Erythrodiplax* Brauer, 1868

Erythrodiplax berenice (Drury)

Erythrodiplax connata (Burmeister)

- Erythrodiplax funerea* (Hagen)
Erythrodiplax fusca (Rambur)
Erythrodiplax minuscula (Rambur)
Erythrodiplax umbrata (Linnaeus)
 Genus *Pachydiplax* Brauer, 1868
 Pachydiplax longipennis (Burmeister)
 Genus *Pseudoleon* Kirby, 1889
 Pseudoleon superbus (Hagen)
 Genus *Sympetrum* Newman, 1833
 Sympetrum ambiguum (Rambur)
 Sympetrum corruptum (Hagen)
 Sympetrum costiferum (Hagen)
 Sympetrum illotum (Hagen)
 Sympetrum internum Montgomery
 Sympetrum occidentale Bartenef
 Subspecies *fasciatum* Walker
 Sympetrum vicinum (Hagen)
 Subfamily Trithemistinae
 Genus *Brechmorhoga* Kirby, 1894
 Brechmorhoga mendax (Hagen)
 Genus *Dythemis* Hagen, 1861
 Dythemis fugax Hagen
 Dythemis maya Calvert
 Dythemis nigrescens Calvert
 Dythemis velox Hagen
 Genus *Macrothemis* Hagen, 1868
 Macrothemis imitans Karsch
 Macrothemis inacuta Calvert
 Macrothemis inequiunguis Calvert
 Genus *Paltothemis* Karsch, 1890
 Paltothemis lineatipes Karsch
 Subfamily Palpopleurinae
 Genus *Perithemis* Hagen, 1861
 Perithemis domitia (Drury)
 Perithemis tenera (Say)
 Subfamily Trameinae
 Tribe Trameini
 Genus *Miathyria* Kirby, 1889
 Miathyria marcella (Sélys in Sagra)
 Genus *Pantala* Hagen, 1861
 Pantala flavescens (Fabricius)
 Pantala hymenaea (Say)
 Genus *Tauriphila* Kirby, 1889

Tauriphila azteca Calvert
 Genus *Tramea* Hagen, 1861
Tramea calverti Muttkowski
Tramea carolina (Linnaeus)
Tramea insularis Hagen
Tramea lacerata Hagen
Tramea onusta Hagen
 Tribe Zygommatini
 Genus *Tholymis* Hagen, 1867
Tholymis citrina Hagen
 Subfamily Urothemistinae
 Genus *Macrodiplax* Brauer, 1868
Macrodiplax balteata (Hagen)

Uncertain And Dubious Records

Several species that have been reported previously in the region are not included in this checklist, because of misidentifications, synonymy, or lack of good historical information and material to substantiate regional presence. Some of these dubious records are discussed under the relevant species, others are listed below.

***Lestes congener* Hagen.** This species was reported from "Texas" by Hagen (1861), and all subsequent records (Albright 1952; Westfall & May 1996) apparently trace back to it. Specimens are unavailable for verification, and I did not find it in the region, although it may occur here. See discussion under expected species.

***Lestes dryas* Kirby.** Albright (1952) listed this species from Texas. His specimens are unavailable for examination, and the source of the record is unclear. Walker (1953) reported it from Oklahoma with no further data. Westfall and May (1996) considered this species doubtful for both Texas and Oklahoma. I have not found it in the region.

***Lestes forcipatus* Rambur.** Erroneous determinations prior to Walker's (1952)

description of *L. disjunctus australis* account for records of this species in the region. Calvert (1893) reported it from Texas (See Walker 1953); all were *L. disjunctus*. Bird (1932) reported this species from Oklahoma and Bick and Bick (1957) examined his specimens and found them to be *L. disjunctus*. Foster and Smith (1901) and Foster (1915) reported this species from "lower Louisiana." These records are considered erroneous determinations of *L. disjunctus*.

***Lestes simplex* Hagen.** This species, originally described by Hagen (1861) from Mexico, has been reported in Texas by Sélys (1862), Calvert (1901-1908) and later by Williamson (1914). Williamson reported a male and a female *L. simplex* from Clifton, Texas (Bosque Co.). They were taken at the type locality of the closely related *L. alacer*, and upon re-examination by L.K. Gloyd were found to be *L. alacer* (Johnson 1972a). Neither Johnson nor I have confirmed this species in Texas.

***Hetaerina sempronia* Hagen.** Calvert (1901-1908) listed this species from Texas without seeing it (see Johnson 1972a). These records were probably based on the variable *H. titia*. This species has not been verified in Texas. See discussion under this genus for further detail.

***Hetaerina tricolor* (Burmeister).** Synonym of *H. titia*.

***Amphiagrion saucium* (Burmeister).** This species was reported by Albright (1952) from Texas. Specimens are not available for examination and the basis for the record is unclear. The closest record of this species is from Mississippi. The very similar *A. abbreviatum*, considered a variation of the former in the early literature, and still by some today, is present in New Mexico and Oklahoma. Bick and Bick (1957) discussed in detail

Bird's (1932) record of this species from Oklahoma. They also referred to *A. abbreviatum*. Westfall and May (1996) discussed the taxonomic confusion surrounding these two species.

***Argia intruda* Williamson.** Synonym of *A. moesta*.

***Argia putrida* Williamson.** Synonym of *A. moesta*.

***Argia rita* Kennedy.** Synonym of *A. munda*.

***Argia vivida* Hagen in Selys.** Various reports of this species (e.g. Williamson 1932) from Oklahoma and Texas refer to *A. plana* (see Gloyd 1958).

***Enallagma cyathigerum* (Charpentier).** This species was reported by Albright (1952) from Texas. Specimens are not available for examination and the basis for the record is unclear. It is widespread in western New Mexico, but no records have been verified for Texas.

***Enallagma laurenti* Calvert.** Bird (1932) reported this species from LeFlore County, Oklahoma, based on Williamson's (1914) record of *E. pollutum*. Bick and Bick (1957) judged this record to be *E. vesperum*.

***Enallagma piscinarum* Williamson.** Synonym of *E. geminatum*.

***Enallagma pollutum* (Hagen).** Foster and Smith (1901) reported this species from "lower Louisiana." Both Bick (1957) and Mauffray (1997) discussed that this record was prior to Calvert's (1919) description of *E. vesperum*. No records have been verified for Louisiana; however, Mauffray (1997) expects it to occur in the St. Tammany-Washington Parish area. Williamson (1914) reported this species from LeFlore County, Oklahoma. Bick and Bick (1957) judged this record to refer to *E. vesperum*.

***Ischnura credula* Hagen.** Synonym of *I. ramburii*.

***Ischnura utahensis* Muttkowski.** Synonym of *I. barberi*.

***Nehalennia irene* (Hagen).** Foster (1915) reported this species from Madison Parish, Louisiana, prior to Calvert's (1913) description of *N. integricollis*. No verified records for this species in Louisiana exist.

***Gynacantha hyalina* Sélys.** Williamson (1923) recorded a male in NMNH from Acadia Parish, Louisiana. This is a widely distributed Oriental species not found in North America. See Mauffray (1997) for complete discussion and specifics of data labels.

***Arigomphus pallidus* (Rambur).** All records of this species for Louisiana and Texas were prior to Ferguson's (1950) description of *A. maxwelli* and probably refer to that species.

***Arigomphus subapicalis* Williamson.** Synonym of *A. lentulus*.

***Gomphus (Gomphurus) fraternus* (Say).** Vidrine (1992) reported this species from Louisiana as an historical record, far southwest of its known range. Mauffray (1997) considers it doubtful in that state.

***Gomphus (Gomphus) abbreviatus* Hagen in Sélys.** Foster and Smith (1901) reported this species from Louisiana prior to Donnelly's (1966) description of *G. apomyius* to which it probably refers.

***Gomphus (Gomphus) exilis* Sélys.** This species was listed in an unpublished manuscript by Beatty and Beatty as *G. flavocaudatus*, from Nacogdoches County, Texas. It was subsequently reported in that state (Abbott 1996; Abbott *et al.* 1997; Abbott & Stewart 1998) based on that record, but no specimen has been found for verification. This species

is not currently known west of the Mississippi River and should be considered doubtful for Texas.

***Gomphus (Gomphus) flavocaudatus* Walker.** Reported from Louisiana, this is a synonym of *G. exilis*. See above for discussion.

***Gomphus (Gomphus) minutus* Rambur.** Foster and Smith (1901) reported this species from "lower Louisiana." This is far west of its known range and should be verified.

***Gomphus (Gomphus) spicatus* Hagen in Sélys.** Foster and Smith (1901) reported this species from "lower Louisiana." This is far south of its known range and should be verified.

***Macromia annulata* Hagen.** Bird (1932) reported this species from Latimer County, Oklahoma. Bick and Bick (1957) discussed the basis for this record as an erroneous determination of *Cordulegaster obliqua*.

***Macromia australensis* Williamson.** Synonym of *M. illinoiensis*.

***Macromia wabashensis* Williamson.** This species has been reported from Texas (Williams 1982) and Oklahoma (Needham & Westfall 1955). These records are currently thought to be extremely yellow forms of *M. taeniolata* or a hybrid between *M. taeniolata* and *M. pacifica* (Dunkle pers. comm; Garrison 1995). See Abbott and Stewart (1998) for a detailed discussion.

***Epitheca (Tetragoneuria) canis* McLachlan.** Bird (1932) reported this species from Latimer County, Oklahoma. Bick and Bick (1957) discussed that the basis for this record as an erroneous determination of *E. spinosa*.

***Somatochlora ensigera* Martin.** Bird (1932) reported this species from Latimer County,

Oklahoma. Bick and Bick (1957) discussed that the basis for this record as an erroneous determination of *S. linearis*.

***Celithemis monomelaena* Williamson.** Synonym of *C. fasciata*.

***Libellula exusta* Say.** Foster and Smith (1901) reported this species from "lower Louisiana." Bick (1957) believed, as do I, that these records refer to the southern form of this species, *L. deplanata*, which does occur in our region.

***Nannothemis bella* (Uhler).** Foster and Smith (1901) reported this species from "lower Louisiana." There are no verified specimens of its occurrence there, but Mauffray (1997) listed it as an expected species.

***Sympetrum pallipes* (Hagen).** Needham and Westfall (1955) reported this species from Texas. There appear to be no specimens to verify its occurrence there. It is found in northern New Mexico.

***Sympetrum semicinctum* (Say).** Records of this species in Oklahoma and Texas are prior to Walker's (1951) description of *S. occidentale fasciatum*. Walker believes these records belong to this form. I have found no verifiable records of *S. occidentale* in Texas, although it does occur both in New Mexico and Oklahoma. See discussion under that species.

Possible Additions To The Region

Several species may remain to be documented in the region, because of the close proximity of verified records in the peripheral areas.

***Lestes congener* Hagen.** This species occurs in northwestern New Mexico and

northeastern Arkansas. It has not been documented in Oklahoma or the northern panhandle of Texas, but may exist there.

Lestes dryas Kirby. This species ranges southward into northern New Mexico and may exist in Texas or Oklahoma (see dubious records above).

Enallagma carrunculatum. This species is found in Northern New Mexico and the extreme western panhandle of Oklahoma (Cimarron Co.). It may occur further south in New Mexico and in the northern panhandle of Texas.

Gynacantha mexicana Sélys. This Mexican species approaches our southwestern border and may eventually be found in the lower Rio Grande Valley.

Oplonaescha armata (Hagen). This western species is found as far east as San Miguel Co., New Mexico, and may eventually be found in the western panhandle of Texas.

Ophiogomphus severus Hagen. This species is found widespread in the north-central parts of New Mexico and may eventually be found in our region.

Sympetrum danae (Sulzer). This species ranges southward to include extreme North-central New Mexico, but may eventually be found in western Oklahoma or Texas.

Sympetrum obtrusum (Hagen). This species ranges southward to central New Mexico, but may eventually be found in western Oklahoma or Texas.

Sympetrum pallipes (Hagen). This species is widespread throughout central and northern New Mexico, and may eventually be found in western Oklahoma or Texas.

Several species range westward to the Mississippi River. Some of these (e.g. *Enallagma weewa* Byers, *Gomphus* (*Gomphus*) *hodgesi* Needham, *Ophiogomphus australis* Carle, *Stylurus amnicolus* (Walsh), *Cordulegaster bilineata* (Carle), and *C.*

erronea Hagne in Séllys) may eventually be found in our region.

Seasonal Distribution

The flight season of most species of Odonata in this region extends from the spring through the summer months and occasionally persisting into the fall (Table 3). The onset and duration of emergence, however, is variable. Many more temperate species (e.g. *Enallagma daeckii*, *Basiaeschna janata*, *Gomphaeschna furcillata*, *Gomphus apomyius*, *Cordulegaster maculata*, *Didymops transversa*, *Libellula deplanata*) in this area have early (March - May) and explosive emergences and then soon disappear. The year-round temperatures, averaging 23° C, and subtropical climate in the southern portions of the region result in several species emerging year round. Fifteen species (including *Enallagma civile*, *Ischnura posita*, *Anax junius*, *Erythemis simplicicollis*) were collected or documented as adults in every month. Several species (*Phyllogomphoides stigmatus*, *Somatochlora filosa*, *Pseudoleon superbus*, *Sympetrum ambiguum*) were found late in the year. The longitudinal gradient in temperature seen in the region results in emergence in the more northern areas being one to several weeks later than in the subtropical southern areas.

Damselflies (Zygoptera) generally emerge as soon as temperatures permit in the spring and continue throughout much of the summer. This results in a heterogeneous age structure, often allowing more than one generation per year. Many of the smaller coenagrionid damselflies (*Ischnura* spp.) have multiple (2-3) generations per year. The larger lestids, calopterygids and coenagrionids generally require a full year for

development.

Many dragonflies (Anisoptera) differ from damselflies in having an obligate larval diapause, followed by a synchronous spring or early summer emergence. This results in a homogenous age structure and a sudden disappearance later in the summer or fall. Most species require at least a year to develop, and some (*Cordulegaster* spp.), require longer.

Development time is generally longer for those species restricted to lotic situations than those found in lentic systems. A similar general seasonal progression, with the peak months in June and July, for species in the entire south-central U.S. was seen by Bick (1957) in Louisiana. These percentages (n=233) of species present each month of the year are: January (7%), February (9%), March (32%), April (50%), May (73%), June (83%), July (76%), August (72%), September (53%), October (35%), November (21%), December (8%). Species present early in the year (January-February) were also generally present later in the year (November-December).

Geographic Distribution

The biotic province of highest Odonata biodiversity overall (161 spp.) is the Austroriparian biotic province (Table 4). This province had the highest number of species (69%) restricted to it within the region. The next closest province, with 15% of the species was the Tamaulipan. The Texan province had nearly the same percent species richness, 61%, as the Austroriparian, but only two species (*Enallagma doubledayi* and *E. antennatum*) were restricted to the region. The Navahonian province had the lowest percent species richness, 33%, which can be explained by the relatively small area of that

province extending into the region.

I looked at species diversity in terms of habitat diversity and land area. To evaluate this, I plotted the diversity of the regional Odonata versus the log area of the seven natural biotic provinces in the region (Fig. 18). Two important generalizations seem apparent about the diversity of the south-central U.S. Odonata fauna. First, there is no strong correlation between land area and species diversity within the region. For example the Austroriparian province is only slightly larger than the Kansan and Chihuahuan provinces, yet it supports twice as many species of Odonata. The Balconian province contains less than one-fourth of the land area in the Austroriparian province, yet it supports half as many species. Secondly, those natural biotic provinces (Austroriparian, Texan, Balconian) where aquatic systems and topographic heterogeneity are the greatest, and thus the area of potential Odonata habitat (streams, rivers, lake shores, ponds and wetlands) is the highest, support a greater number of Odonata species.

I graphed the percentage of Odonata species occurring in each of the seven natural biotic provinces with similar percentages for another aquatic insect group, the caddisflies (Trichoptera), and a terrestrial group, the butterflies (Lepidoptera) (Fig. 19). Data for the latter two groups were taken from Moulton (pers. comm.) and Stanford and Opler (1993) and Opler (1994), respectively. Species richness in the Odonata and Trichoptera would predictably correlated closely to precipitation and water availability. In the Odonata, diversity at first steadily increases from east to west; then as water becomes more scarce westward, species richness decreases. Trichoptera show a similar trend, with the greatest species richness in the Austroriparian province and the least in the Kansan and

Navahonian provinces. These higher diversities in the center of the region probably reflect the north-south alignment with the intercontinental land connection and consequent migration corridor.

Butterflies as a group are not as strongly tied to water as either Odonata or Trichoptera and show a slightly different pattern. Species richness is spread more or less evenly over the provinces except for a dramatic increase in the Tamaulipan. Texas has the richest butterfly fauna in the U.S., influenced largely by the lower Rio Grande Valley (Robbins & Opler 1997). Numerous tropical lowland butterflies have been recorded in Cameron, Hidalgo, and Starr counties as vagrants. However, many species have their only breeding populations in the United States in the lower Rio Grande Valley (Robbins & Opler 1997). The marked increase in diversity in the Tamaulipan province is explained by this and the lack of differentiating between vagrant tropical and subtropical species only rarely entering Texas from the south and those with breeding populations in the state. Davis and Schmidly (1994) correctly pointed out that if patterns of species richness and endemism were similar for different groups of organisms, then knowing these patterns for any group, such as the Odonata, would be sufficient to determine "biological" priorities among potential sites for conservation. The pattern for these groups, however, are clearly not the same and require individual critical study.

Species richness throughout the south-central U.S., by county, is shown in Fig. 20. Within the region studied, 47 counties lack any record of Odonata species. Most are contained in the panhandle of Texas, where diversity is lowest and collecting emphasis has not been placed on collection effort. One area of high species diversity stands out,

San Jacinto County, Texas. Sam Houston National Forest is located in this county and is the center of this high diversity, with 94 species. The area was well-studied by Donnelly (1978) and is the type locality for several species. It has been studied more recently by Abbott *et al.* (1997) as part of the larger Big Thicket Primitive Area, as defined by Peacock (1994). This area is diverse both in landscape and aquatic habitat and has therefore been the focus of high collection effort. The National Park Service identifies ten distinct ecosystems in the area. Each of these ecosystems is home to many aquatic insects and serves as a western boundary for the distributions of a largely eastern fauna. The only other centers of Odonata diversity of which I am aware in the U.S., that rival this area are Patuxent Wildlife Research Center in Maryland, where Orr (1996) documented 105 species, and Acadia National Park and vicinity in Maine, where White (1989) reported 97 species.

Following Davis and Schmidly (1994), I have depicted species diversity along a series of quadrats positioned along two transects that traverse the region (Fig. 21). One stretches north to south from Boise City, OK, to Brownsville, TX. The other begins in Animas, NM, in the western portion of the region and continues eastward to New Orleans, LA. In this analysis, species diversity shows an irregular trend along the transect from Boise City, OK, to Brownsville, TX (Fig. 22, transect A). The lowest areas of diversity are in the panhandle of Texas. Three major shifts in diversity are evident. The first is between the extreme western panhandle of Oklahoma (quadrat 1) and the northern panhandle of Texas (quadrat 2), where diversity is among the lowest in these states. The second is on either side of the Edwards Plateau (quadrats 12-13), where diversity peaks.

The third major shift along this transect occurs between the central South Texas Plains (quadrat 16) and the subtropical brushlands of quadrat 17, where diversity increases.

The pattern along the east-west transect between Animas, NM, and New Orleans, LA (Fig. 22, transect b), shows an irregular increase. Diversity is highest in the Sam Houston National Forest (quadrat 19) and lowest at the southern tip of the high plains (quadrats 10-11). Three other areas stand out along this transect with high diversity. They are just east of the Guadalupe Mountains (quadrat 7), the Balcones Canyonlands of the Edwards Plateau (quadrats 11-13) and the coastal tip of Louisiana (quadrat 27).

Texas is a keystone state relative to understanding the distributional patterns of several species that reach their limits within the region. The regional fauna includes many species that occur throughout the U.S., Mexico and even South America. The greatest degree of faunal similarity between the south-central U.S. and other intra-continental regions was observed for the eastern United States, 64% (Table 5). A similarity of 47% was observed between southern Mexico and Central America, while only 36% similarity was observed with the northern U.S. and Canada. The highest observed percent similarity in the faunas of the eastern U.S. and southern Mexico and Central America, reveal mixing zones, and at least short-distance dispersal corridors within the region.

Dispersal Corridors

The south-central Nearctic Region (Fig. 1) is important as a boundary (Paulson 1982) for some species of the largely eastern fauna of central and east Texas (Texan and

Austroriparian Provinces) that represent a temperate element, and those of south Texas and northeastern Mexico (Tamaulipan Province), representing a subtropical element. However, for other species, these provinces are actually a mixing zone, and at least a short distance dispersal corridor. For example, my records indicate that of the 177 species occurring in the Austroriparian and Texan Provinces, 81 species (46%) also occur in the Tamaulipan Province, and 59 species (33%) cross the Rio Grande to the south into northeastern Mexico (Fig. 23a). Conversely, of the 108 species in the northeastern Mexican states of Tamaulipas and Nuevo Leon, 80 species (74%) cross the Rio Grande entering Texas, and 61 species (57%) occur in the Austroriparian and Texan Provinces (Fig. 23b).

A similar boundary or mixing phenomenon exists near the Rio Grande River between the more northern Kansan/Navahonian/Balconian and the more southern Chihuahuan provinces. Of the 142 species occurring in the Kansan, Navahonian and Balconian provinces, 84 species (59%) also occur in the Chihuahuan Province, and many of these cross the Rio Grande farther south into northeastern Mexico (Fig. 24a). Conversely, of the 50 species in the northern Mexican states of Coahuila and Chihuahua, 41 species (82%) cross the Rio Grande entering Texas, with 39 (46%) of them occurring in the Kansan, Navahonian, and Balconian provinces (Fig. 24b).

The Balconian province represents diverse species assemblages from the northern and southern provinces bordering or near it. Fifty percent (99) of the 199 species occurring in the northern Navahonian/Kansan/Texan/Austroriparian provinces occur in the southern Chihuahuan/Tamaulipan provinces. Conversely, 93 (69%) of the 135

species occurring in the southern Chihuahuan/Tamaulipan provinces occur in the northern Kansan/Texan/Austroriparian provinces. These examples and recent discoveries of dispersals across the Rio Grande (Abbott 1996), including *Neoneura amelia* Calvert, *Neoerythromma cultellatum* Hagen in Sélys, *Aeshna psilus* Calvert, *Dythemis maya* Calvert, *Micrathyria didyma* (Sélys), *Tauriphila azteca* Calvert and *Tramea insularis* Hagen, from Mexico into Texas suggest that the area is indeed a dispersal corridor and that future dispersals across it may occur. These distinct species assemblages and mixing zones undoubtedly relate to the climate and vegetational characteristics defining these provinces. The Rio Grande border is a more effective barrier among certain groups than for others. The cordulegastrids and corduliids are poorly represented in Mexico and Central and South America, while groups such as the coenagrionids, aeshnids and libellulids are much more widely distributed and are well represented in these areas (Paulson 1982).

Species Richness Of U.S. Odonata

Among the aquatic insect groups, species of dragonflies and damselflies are relatively well known in most of the continental U.S. The majority of the states have been studied well enough to assume the resident fauna is reasonably well-known. By reviewing the major references for these states, I counted the number dragonflies and damselflies known for each state (Table 6).

The number of Odonata species recorded per state ranges from 53 in North Dakota to 197 in Texas. Species richness tends to be higher on the Atlantic seaboard than

along the Pacific coastal states. For example, Virginia has 184 species, closely followed by New York (175 spp.), New Jersey (172 spp.) and Pennsylvania (170 spp.). Despite their larger size Washington has 75 species, Oregon 62, and 102 species have been documented in California. Robins and Opler (1997) showed an increase in butterfly diversity from north to south with a less pronounced pattern in birds. A similar trend is not apparent in Odonata. For example of the five states with the greatest species richness for Odonata, Texas (197), Virginia (184), New York (175), Alabama (173) and New Jersey (172), two are in the southern U.S. and three are mid-Atlantic or Northeastern.

Following Robins and Opler (1997), I recorded the number of breeding birds for each state in the U.S. (Table 6). Because species richness is generally a function of area, the number of breeding birds and Odonata are expected to be positively correlated. After omitting incompletely documented states, a Spearman rank correlation coefficient did show a positive correlation ($r=0.376$, $n=33$, $p=0.031$).

Taxonomy Of south-central U.S. Odonata

The following adult keys have been constructed to include the verified south-central U.S. Odonata fauna. The adult key to family has been modified from Westfall and Tennessen (1996) and Westfall and May (1997). Generic and species level keys have been modified from the primary literature cited under the appropriate sections when available. Single genera or species are always keyed immediately. Families are organized phylogenetically and for ease in accessing groups, genera and species are arranged alphabetically.

Individual species accounts consist of the following information: (1) common (english) name, taken from Paulson and Dunkle (1996) and updated at <http://www.ups.edu/biology/museum/NAdragons.html>, (2) reference to figures and distribution maps, (3) a brief synonymy and taxonomic history, including synonyms and misspellings from other regional works, (4) type locality and when known depository (Table 7), (5) a summary of regional biotic provinces and watersheds, (6) the general distribution summary of states, provinces and countries (Table 8), (7) Seasonal distribution, (8) a description of the species, (9) measurements, including total length, length of the abdomen and hind wing, (10) a brief description of the preferred habitat, and (11) a brief discussion of relationships with similar species and congeners, notes on reproductive and biological behavior, and a summary of the biological literature pertaining to the species. Frequently used adult characters are shown in Figs. 25-37.

KEY TO FAMILIES OF ADULT SOUTH-CENTRAL ODONATA

1. Front and hind wings similar in size and shape, having quadrangles instead of triangles and subtriangles (Fig. 32-33); eyes well separated on top of the head by more than their own width (Fig. 25); males with 2 inferior caudal appendages (Fig. 28); wings held together or only slightly (45°) held apart above the abdomen **Suborder Zygoptera 2**
- 1'. Front and hind wings not similar in size and shape, the hind wing considerably wider basally, each having a triangle and subtriangle (Fig. 34-37); eyes meet middorsally on top of head, or if separated, by less than their width (Fig. 29);

- males with a single inferior caudal appendage (Fig. 277); wings held horizontally over the abdomen when perched **Suborder Anisoptera** 5
- 2(1). Antenodal crossveins numerous (Fig. 32); postnodal crossveins not in line with veins below them; quadrate with several crossveins **Calopterygidae** (p. 45)
- 2'. Only 2 antenodal crossveins present (Figs. 140-146); postnodal crossveins in line with veins below them; quadrate without crossveins 3
- 3(2'). Veins M_3 and R_s arise nearer the arculus than the nodus (Figs. 53-54) **Lestidae** (p. 68)
- 3'. Veins M_3 and R_s arise nearer the nodus than the arculus (Figs. 33, 144-145) 4
- 4(3'). Anal vein absent or greatly reduced; Cu_2 absent or at most only 1 cell length; quadrate rectangular (Fig. 33) **Protoneuridae** (p. 100)
- 4'. Anal vein and Cu_2 not reduced (Figs. 144-145); quadrate trapezoidal **Coenagrionidae** (p. 110)
- 5(1'). Triangles of fore wings less than twice as far from arculus as in hind wing; triangles in both wings similar in shape 6
- 5'. Triangles of fore wings twice or more as far from arculus as those in hind wing; triangles in fore wings generally elongated transversely, in hind wing longitudinally 9
- 6(5). Eyes meet on top of head for a considerable distance (Fig. 36); pterostigma supported by an oblique brace crossvein at or near its end **Aeshnidae** (p. 316)

- 6'. Eyes widely separated or meeting at only a single point; pterostigma with or without a brace vein 7
- 7(6'). Eyes close together or barely meeting; labium with a median cleft (Fig. 31); pterostigma without a brace crossvein; ovipositor extending beyond tip of abdomen
 **Cordulegastridae - Cordulegaster** (p. 439)
- 7'. Eyes widely separated; labium with or without a median cleft (Fig. 31); pterostigma with a brace crossvein; ovipositor never extending beyond tip of abdomen 8
- 8(7'). Front margin of labium with a median cleft (Fig. 31); pterostigma longer than 1/4 the distance from nodus to distal end of R₁; fore wing subtriangle generally divided into 2 or more cells .. **Petaluridae - Tachopteryx** (p. 312)
- 8'. Front margin of labium entire; pterostigma shorter than 1/4 the distance from nodus to distal end of R₁; fore wing subtriangle generally single celled
 **Gomphidae** (p. 356)
- 9(5'). Anal loop generally foot-shaped, with well-developed toe (Fig. 37); males without anal triangle and anal margin of hind wing rounded as in females (Fig. 37); no tubercle on rear margin of eye **Libellulidae** (p. 500)
- 9'. Anal loop generally foot-shaped, but with little development of the toe (Fig. 36); hind wing of males with an anal triangle and anal margin angulate (Fig. 36); generally with a shallow tubercle on rear margin of each eye (Fig. 29) ...
 **Corduliidae** (p. 445)

CHAPTER 4

CALOPTERYGIDAE

Broad-winged Damsels

This family is represented in North America by two genera, *Hetaerina* and *Calopteryx*. Both occur in the south-central U.S. region. Species of *Calopteryx* are largely confined to the Northern Hemisphere, while *Hetaerina* are restricted to the New World and become most diverse in the tropics. Their large size and strong metallic coloration have led to the designation "Birds of Paradise" among Odonata (Needham and Heywood 1929). Adults often exhibit strong sexual dimorphism, with males being brighter and more heavily pigmented. As their common name implies the wings are broad and not stalked, with five rows of cells basally. They have a characteristic flight, where both forewings and hindwings beat together with a slight hesitation before each downstroke, reminiscent of satyr butterflies (Dunkle 1990). Historically this group has been placed in the families Agridae and Agrionidae.

This family can be separated from all other North American damselflies by the numerous (five or more) antenodal crossveins found in both wings. All other North American families have two antenodal crossveins. The long, parallel-sided shape of the quadrangle, transversed by numerous crossveins, is also diagnostic. Other venational characteristics include postnodal crossveins that are not lined up with those below them. The weakly formed and occasionally absent pterostigma lacks a bracevein. The first

antennal segment is greatly elongated and depressed against the head.

Adults seldom stray far from the streams in which they have spent the majority of their life, perching on the riparian vegetation and surrounding rocks. They don't oviposit in tandem, but instead the male will guard the female from a nearby perch. Elaborate courtship behaviors have been documented in species of *Calopteryx* (Johnson 1962a; Waage 1984). In addition, this family has been the subject of numerous other studies in territoriality and oviposition (Alcock 1982, 1983, 1987a; Beatty & Beatty 1970; Grether & Grey 1996; Johnson 1962b; Waage 1974, 1979a) that have provided great insight into Zygoptera behavior.

Larvae are slender and long-legged, generally found clinging to vegetation in streams. They have a deep median notch in the labium that is more or less diamond-shaped. The palpal lobes of the labium end in three curved hooks. The basal joint of the antenna is longer than all six succeeding segments combined, readily separating them from other North American families. The eggs are elongate and deposited singly in submergent dead or living plant tissues.

KEY TO ADULT GENERA OF CALOPTERYGIDAE

1. Median space, proximal to arculus, without crossveins; anterior margin of quadrangle straight (Figs. 38-39); pterostigma absent in males, present and distinctly white in females *Calopteryx*
- 1'. Median space with several crossveins (Figs. 40-45); anterior margin of quadrangle convex; small pterostigma usually present in both sexes (absent in *H. vulnerata*) .

Genus *Calopteryx* Leach

Jewelwings

Agrion Fabricius, 1775.

Calepteryx Leach, 1815.

Calopteryx Burmeister, 1839.

Sylphis Sélys, 1853.

There has been considerable taxonomic confusion surrounding the name *Calopteryx* (Muttkowski 1910c; Schmidt 1948; Calvert *et al.* 1949; Montgomery 1954). Linnaeus described all of his species of Odonata in the genus *Libellula*, including those now considered in *Calopteryx*. Fabricius (1775) divided this group and erected the genus *Agrion*. It, however, also included members of the family Coenagrionidae. There was no type species designated by Fabricius, but Latreille (1810) later designated the European species *virgo* as the type of *Agrion*. Leach (1815), however, included *virgo* in his genus *Calepteryx* (later emended to *Calopteryx* by Burmeister 1839) in a publication that was apparently widely circulated more than five years before its publication date, making it the correct name by precedence. The name *Agrion* is still used by some workers, but has largely been abandoned due to this confusion.

The name *Calopteryx* means "beautiful wings" and is appropriately descriptive of

the group. These damselflies are large and have bodies colored with brilliant metallic greens and blues. They have long black legs equipped with numerous spines. The wings of the females are more uniformly colored and not as dark as those of the males. The pterostigma is absent in males, but a white pseudopterostigma, divided by crossveins, is present in females.

This Holarctic genus is represented in North America by five species, two of which are found in the south-central U.S. The wing patterns of these two species are different and allow for easy field identification. Adults stay close to the stream side, moving from bush to bush or limb to limb in a characteristic fluttering flight. Various courtship behaviors have been described in this genus. Waage (1984) showed that females of both species in our region respond to male courtship with specific displays that signal differences in receptivity. For example, wing spreading constitutes a rejection while wing-flipping an invitation. Lindeboom (1998) studied post-copulatory behavior in females of this genus. Waage (1980) studied adult sex ratios and reproductive potential in this genus and Oppenheimer and Waage (1987) described hand-pairings for obtaining controlled matings in *Calopteryx* under field conditions.

Mate recognition in these species is by color patterns and flight behavior (Buchholtz 1955; Pajunen 1966). Diagnostic features for species recognition, therefore, consist of wing patterns, relative wing width, color of male ventral abdominal segments, and pterostigma size in females. Structures that are traditionally of great taxonomic value in Odonata, such as male abdominal appendages, phallus, and female ovipositor, have little taxonomic distinction in Nearctic species of *Calopteryx* (Johnson 1974).

The larvae are large and easily separated from *Hetaerina* species by the deep cleft extending nearly to the base of the prementum. The lateral caudal gills are also distinctly flattened. The larvae are not very active. They are sit and wait predators clinging to roots and stems in the current.

Johnson (1974) gave taxonomic keys for adults and known distributional patterns for the Nearctic species. Tennessen (1984) provided keys to the final instar larvae of Nearctic *Calopteryx* species.

KEY TO ADULT SPECIES OF *CALOPTERYX*

1. Wings opaque, mostly or entirely dark brown to black (fig. 38); length of wings about 3 times their greatest width *maculata*
- 1'. Wings mostly hyaline or slightly smoky, with a dark band in the apical 1/4 to 1/6 (may be lacking in females) (fig. 39); length of wings 3.5 times or more their greatest width *dimidiata*

Calopteryx dimidiata Burmeister

Sparkling Jewelwing

(Fig. 39, Map 1)

Calopteryx dimidiata Burmeister, 1839: 829.

Calopteryx apicalis Burmeister, 1839: 827.

Calopteryx cognata Rambur, 1842: 222.

Calopteryx syriaca Rambur, 1842: 224.

Agrion apicalis, Kirby, 1890: 97.

Agrion dimidiata, Kirby, 1890: 97.

Agrion dimidiatum apicale, Muttkowski, 1910: 28.

Type. Kentucky [*sic*].

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Brazos, Mississippi, Neches, Ouachita, Red, Sabine, Trinity.

General Distribution. UNITED STATES: AL, DE, DC, FL, GA, KY, LA, MD, MA, MS, NJ, NY, NC, PA, RI, SC, TN, TX, VA.

Seasonal Distribution. Mar. 1 (LA) - Sep. 10 (LA).

Identification. This species is relatively uncommon in the south-central U.S. and its western-most records are limited to the Big Thicket Primitive Area of east Texas. Its distribution essentially is that of a coastal plain species. The body and face are brilliant metallic blue-green. The labium and antennae are black and there is a pair of prominent tubercles present at the rear on each side of the head. In males, the wings are hyaline, except for the apical 1/4 to 1/6, lack a pterostigma, and are 3.5-4 times as long as wide. The ventral abdominal segments are black.

The female is similar to the male, but wings may or may not be black-tipped and may or may not have a pterostigma. Most females within our region have a pterostigma greater than 2 mm in length and comprising 2-5 cells. If the apical bands are present they

may be like those of the male or present in the hindwings only. The abdomen is metallic, but darker than in males and segment 10 has a vestigial dorsal carina and spine.

The larva was described by Wright (1946b). It is comparatively smaller than *C. maculata*, averaging no longer than 18 mm. The median gill possesses stout spines and many long hairlike setae along margins. Each premental lobe has a single seta and the lateral carinae of abdominal segments 9 and 10 possess stout spines on their posterior margin.

This species is readily distinguishable from *C. maculata*, where their ranges overlap, by the blackening of the apical fourth of their wings.

Size. Total length: 37-49 mm; abdomen: 29-40 mm; hindwing: 23-31 mm.

Habitat. Sandy bottomed streams and occasionally rivers with open canopy.

Discussion. Johnson (1973a) looked at the variability, distribution and taxonomy of *C. dimidiata*. He found that female wing color patterns and pterostigma size have little to no seasonal variation, but rather occur in geographic clines. Johnson presented data from six states and found a general trend towards larger size and an increase in numbers of andromorphic (with apical bands) versus heteromorphic (lacking apical bands) females at southern latitudes.

The distributions of *C. dimidiata* (Map 1) and *C. maculata* (Map 2) widely overlap and both species have similar courtship behaviors. Male territories center around oviposition sites at which the initial stages of pair formation occur (Waage 1984). Waage found that *C. maculata* and *C. dimidiata* females respond to male courtship with specific displays, signalling differences in receptivity. *Calopteryx maculata* males persist in

courtship regardless of female response, while *C. dimidiata* males will stop courting when presented with a rejection (wing spreading) or neutral response from the female. Waage presented evidence suggesting that these differences are based on interspecific differences in oviposition behavior.

Waage (1988) described the reproductive behavior of a sympatric population of *C. dimidiata* and *C. maculata*, in Massachusetts, at the northern edge of the former species' range. He found that female *C. maculata* oviposit at the water surface which exposes them to disturbance by males attempting to mate. Females are therefore likely to remate to secure postcopulatory guarding when changing oviposition sites and males are expected to be persistent in courtship. Female *C. dimidiata* submerge to oviposit, which frees them from male disturbance and means that males have less control over female access to oviposition sites. Males therefore have less influence on mating by females and would be expected not to persist in courtship of non-receptive females.

Johnson and Westfall (1970) and Johnson (1972a) found that *C. dimidiata* apparently has a narrower range of habitat requirements than *C. maculata* and often exists in isolated colonies, as is seen in Texas and Louisiana populations. Dispersal inland from the breeding sites is much more limited in *C. dimidiata*.

Calopteryx maculata (Beauvois)

Ebony Jewelwing

(Fig. 38, Map 2)

Agrion maculata Beauvois, 1805: 85.

Calopteryx holosericea Burmeister, 1839: 828.

Calopteryx maculatum, Burmeister, 1839: 829.

Calopteryx materna Say, 1839: 32.

Calopteryx opaca Say, 1839: 32.

Type. N. America; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Kansan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Mississippi, Neches, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CO, CT, DE, DC, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NH, NJ, NY, NC, OH, OK, PA, RI, SC, SD, TN, TX, VT, VA, WV, WI; CANADA: Man., N.B., N.S., Ont., Que.

Seasonal Distribution. Mar. 1 (LA) - Oct. 31 (LA).

Identification. This common, large, black species, is widely distributed in the eastern part of the region. It may occasionally be confused with very dark forms of *Hetaerina titia*, but mature *C. maculata* are black with a strong blue-green iridescence on the body that is lacking in *H. titia*. The males have a metallic blue-green head, with black antennae and labrum. There is only the remnant of a tubercle present on each side of the head, posteriorly. The thorax is black with strong metallic blue-green coloration dorsally and on the sides. Older, mature males have solid black wings and lack a pterostigma. Wings

in teneral specimens are lighter and more brown in color. The length of the wings is about three times their greatest width. The abdomen is metallic blue-green dorsally and black ventrally, except for the light white area on the posterior of sterna 8 and segments 9 and 10.

Females are similar to males, with wings usually paler, becoming progressively darker apically. There is a large, conspicuous white pseudoptero stigma (enclosing numerous cells) that is distinctly widened in the middle. The abdomen is darker than in males. The ventral and lateral areas of segments 8, 9 and 10 are light brown in color. There is often a dorsal white stripe on the dorsum of segments 8, 9 and 10 as well.

Needham (1903) first illustrated the larvae of this species. The median gill of the larva lacks stout spines with only a few long hairlike setae interspersed among shorter ones along the margins. Lateral carinae of abdominal segments 9 and 10 with long hairlike setae, but no spines are present. A single seta is present on each premental lobe and the legs are distinctly banded. This species can be separated from its closest relative, *C. maculata*, by wing color.

Size. Total length: 37-57 mm; abdomen: 30-47 mm; hindwing: 25-37 mm.

Habitat. Small, slow moving, canopy covered streams.

Discussion. This species ranks among the most studied of damselflies (Johnson 1962b; Waage 1972, 1974, 1979a,b, 1980, 1983, 1984; Alcock 1979, 1983, 1987a; Ballou 1984; Forsyth & Montgomerie 1987; Erickson 1989; Erickson & Reid 1989; Mesterton-Gibbons *et al.* 1996; Pither & Taylor 1998) in North America. Martin (1939) described its life history and she found nymphs to be distinctly local in occurrence and restricted to

slow creeks and quiet areas of running streams. The primary factors affecting their distribution within streams are rate of flow, depth of water and the type of vegetation present. Johnson and Westfall (1970) found that *C. maculata* adults occur along a wide variety of stream-riverine conditions and often disperse well inland. Eda (1969) collected a partial gynandromorph of this species in New York. The right forewing and both hindwings were normal, but the left forewing lacked a pterostigma.

Johnson (1962a) and Waage (1974, 1975, 1978, 1979b, 1984) have studied various aspects of the reproductive behavior of this species. Males will vigorously compete among themselves for territories with submergent vegetation, the prime oviposition habitat for females. Males attract females with a "cross display," where the male faces somewhat opposite the female with his hindwings deflected downward at right angles to his body, and the forewings and abdomen are raised, revealing the ventral pale area of the abdomen. The majority of mating and oviposition occurs in the early afternoon and a single male may guard multiple females, resulting in sometimes large congregations. Females will oviposit in submergent vegetation from 10 to 120 minutes and usually don't submerge themselves. The various displays and behaviors of northern and southern populations may differ somewhat (Johnson 1962a). For an excellent summary of these behaviors the reader is directed to Dunkle (1990). Tennessen (1998) reported the interesting behavior of a *C. maculata* female using her ovipositor to steady herself, on a leaf, while feeding on a mayfly.

Genus *Hetaerina* Hagen in Sélys

Rubyspots

Hetaerina Hagen in Sélys, 1853.

This is a primarily tropical genus becoming most diverse in Central and South America. The group is represented in the U.S. by only three species, all of which occur in the region. The common name "Rubyspots" comes from the basal red spots on the wings of males. Members of this group can be separated from all other North American species by their relatively large size and the presence of this spot. Some specimens of the variable *H. titia*, however, have entirely black wings. This group is found around streams and rivers, rarely venturing far from flowing water.

Females usually have amber colored wings and are more robust than males. The simple, small, white pterostigma is often absent in one or both sexes of this genus. It is present in all our species, except *H. vulnerata*. The wings are narrower and the body is more slender than *Calopteryx*. The thorax is metallic red and black in males and metallic green and brown in females. In both sexes, the thorax is marked with pale lines and the legs are long, slender, spiny and usually black or brown in color. Venational characters include an arculus that is strongly angled, a median space with several crossveins and a quadrangle that curves forward (Figs. 40, 41, 45). The abdomen is metallic dorsally and pale ventrally.

The larvae are quite similar in form to those of *Calopteryx*. They are long-legged, clinging to vegetation and debris in streams. They have a much shallower premental cleft

than in *Calopteryx*, only reaching to the base of the palpal lobes. The lateral caudal gills may or may not be banded and are strongly triangular in cross-section, not as flat as *Calopteryx*.

The tremendous variability and widespread distributions of two of our species, *H. americana* and *H. titia*, have lead to misidentifications and the description of numerous subspecies and races. Calvert (1901-1908) reported three males of *H. sempronia* Hagen in Sélys from San Antonio, TX. Calvert, however, did not actually examine these specimens himself and the variability of *H. titia* most likely accounts for this record (Johnson 1972a). Some *H. sempronia* look similar to *H. titia* in wing pattern, but the known distribution of *H. sempronia* is from Veracruz, Mexico, south to Columbia.

Johnson (1973b) presented a comprehensive study of the distributional patterns for all three species of *Hetaerina* occurring in the region. Garrison (1990) revised the entire genus providing adult keys and adding numerous new figures to the literature.

KEY TO ADULT SPECIES OF *HETAERINA*

MALES

1. Basal spot of forewing usually bright red, that of hindwing much duller, often brown, sometimes with extensive dark brown areas on one or both pairs of wings (Figs. 42-44); inferior caudal appendages in lateral view curving strongly upward, in ventral view fairly straight and generally convergent throughout their length (Fig. 43) *titia*
- 1'. Basal spots of both pairs of wings largely bright red (may be pink or orange-

- brown in teneral), rest of wings hyaline or smoky, not dark brown (Figs. 40, 45); inferior caudal appendages in lateral view not curving strongly upward, in ventral view distinctly concave on inner side and not convergent throughout their length (Figs. 46, 48) 2
- 2(1). Superior caudal appendages quite variable but always with 1 or 2 large, tooth-like, medial lobes, terminal projections of inferior appendages shorter than their distance apart at the widest point (Fig. 46); common throughout area
 *americana*
- 2'. Superior caudal appendages without a distinct medial lobe, terminal projections of inferior appendages longer than their distance apart at the widest point (Fig. 48); South-central New Mexico south *vulnerata*

FEMALES

1. Dorsal carina of abdominal segment 10 usually terminating in a prominent spine that projects beyond every point of the apical margin of the segment; wings usually uniformly tinted dark brown or darker apically than basally (Fig. 41-44) .
 *titia*
- 1'. Dorsal carina of abdominal segment 10 usually not terminating in a prominent spine although a small one may be present; wings darker basally than apically, often nearly hyaline beyond nodus, never uniformly dark (Fig. 40, 45) 2
- 2(1). Dark metallic color of mesepisternum reaching or nearly reaching the mesopleural suture along its entire length, the pale stripe flanking it almost always very narrow

(Fig. 49); pterostigma present in both sexes (Fig. 40); dorsal carina of abdominal segment 10 often terminating in a small blunt spine, which seldom projects beyond every point of the apical margin of that segment; common throughout area

..... *americana*

- 2'. Dark metallic color of mesepisternum not nearly reaching the mesopleural suture, the pale stripe flanking it usually as wide or wider than the metallic green stripe of the mesepisternum (Fig. 52); pterostigma absent in both sexes (Fig. 45); dorsal carina of abdominal segment 10 not terminating in a spine; south-central New

Mexico south *vulnerata*

Hetaerina americana (Fabricius)

American Rubyspot

(Figs. 40, 46, 49, Map 3)

Agrion americana Fabricius, 1798: 287.

Lestes basalis Say, 1839: 35.

Hetaerina americana, Hagen in Sélys, 1853: 41.

Hetaerina californica Hagen in Sélys, 1859a: 440.

Hetaerina basalis, Hagen in Sélys, 1859a: 441.

Hetaerina pseudoamericana Walsh, 1862: 223.

Hetaerina texana Walsh, 1863: 227. *

Hetaerina scelerata Walsh, 1863: 267.

Type. N. America; Presumably lost.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AZ, AR, CA, CO, CT, DE, DC, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, PA, RI, SC, SD, TN, TX, UT, VT, VA, WV, WI, WY;
CANADA: Ont., Que.; MEXICO: BCS, CHS, CHI, COA, COL, DGO, GRO, HGO, JAL, MEX, MCH, MOR, NAY, NLN, OAX, PUE, QRO, SLP, SIN, SON, TAM, VER;
south to Guatemala and Honduras.

Seasonal Distribution. Mar. 11 (TX) - Nov. 9 (TX).

Identification. This is a widespread species occurring throughout the entire south-central U.S., Mexico and parts of Central America. Males of this large damselfly have a metallic red head and thorax. The abdomen is metallic green with pale caudal appendages. The wings have at least the basal fourth red, although those of teneral specimens may be brown. Males can be readily separated from other *Hetaerina* in the region by the superior caudal appendages (Fig. 46). Although, variable, the anterior margin of the mesal lobe meeting the mesal margin of the appendage at almost a right angle is distinctive.

Females are largely metallic green and duller than males. The abdomen is pale

laterally, including the ovipositor. There is a pale narrow mid-dorsal line running along the abdomen as well. Females can be reliably separated from the other two species in this region by the thoracic pattern (Fig. 49).

The larva has been described and illustrated by Needham (1903), Garman (1917) and Walker (1953). It has no lateral spines on abdominal segment 8 and the gills are not distinctly banded. The prementum is trapezoidal in shape and generally not petiolate. The premental cleft is narrow, at least three times as long as wide.

Size. Total length: 36-51 mm; abdomen: 29-40 mm; hindwing: 24-31 mm.

Habitat. Streams and rivers with open canopies.

Discussion. Males and females will perch horizontally on twigs and leaves of riparian vegetation, although females often perch higher (Dunkle 1990). Sexes may also congregate near the water at night to roost (Kellicott 1890).

Numerous aspects of this species's distribution, behavior and ecology have been well studied. Although this is principally a lotic species, Johnson (1966a) showed experimentally that larvae and teneral adults exposed to still water returned to still water habitats after they had matured.

Calvert (1901-1908) discussed the extensive variability seen in this species. There are populations that lack a pterostigma, but these seem to be most abundant west of the Sierra Nevada Mountains in California (Garrison 1990) and all individuals seen by the author in this region have been pterostigmatous. Garrison (1990) has collected apterostigmatous individuals as far east as Grant and Lincoln counties, in southwestern New Mexico. Johnson (1963) recorded an increase in the length of the basal red

markings in the wings of males, throughout the season, in three different populations in Texas. He found the basal red markings of males collected in April to range from 20-35% of the length of the wing. Males sampled at the same localities in September, however, had substantially larger red markings, ranging from 35-50% of the wing length.

Weichsel (1987) described the life history of *H. americana* and McCafferty (1979) described its feeding behavior. Bick and Sulzback (1966), Johnson (1961, 1962b, 1963), and Weichsel (1987) have studied various aspects of its reproductive and territorial behavior. Grether & Grey (1996) and Grether (1995, 1996a,b) studied factors of selection and competition with reference to wing coloration in *H. americana*.

***Hetaerina titia* (Drury)**

Smoky Rubyspot

(Figs. 41-44, 47, 50-51, Map 4)

Libellula titia Drury, 1773: 83.

Calopteryx tricolor Burmeister, 1839: 827.

Hetaerina septentrionalis Sélys, 1853a: 36.

Hetaerina tricolor race *limbata*, Sélys, 1853a: 43.

Hetaerina rupinsulensis Walsh, 1862: 383.

Hetaerina rupamnensis Walsh, 1863: 230.

Hetaerina titia race? *bipartita*, Sélys, 1873a: 481.

Type. BMNH?

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, DC, FL, GA, IL, IN, IA, KS, KY, LA, MD, MI, MS, MO, NE, NC, OH, OK, PA, SC, TN, TX, VA, WV, WI; MEXICO: CHS, COL, GRO, NAY, NLN, QTR, SLP, TAB, TAM, VER; south to Costa Rica.

Seasonal Distribution. Mar. 25 (TX) - Nov. 16 (TX).

Identification. This is a large variable damselfly, widely dispersed east of the Kansan and Chihuahuan biotic provinces. The clypeus, labrum, anterior portion of the frons and the basal antennal segment in the male are all light tan giving way to a darker brown to black head. The dorsum of the pterothorax ranges from a deep metallic red to black and the lateral regions bronzy-green. As much as the basal fourth of the forewing is red and often diffused with brown. The red does not extend beyond the quadrangle and the antenodal interspace is always clear or only slightly tinged with brown. Tips of both wings are usually brown. The basal fourth of the hindwing is brown (red in *H. americana*), but red veins may be present. The remainder of the wing may be clear to smoky dark brown or black (Figs. 41-44). The superior caudal appendages (Fig. 47) will serve as diagnostic characters for separating this species from others in the genus.

The female is similar to the male, but the head is lighter in front and variably

metallic green dorsally. The pterothorax is metallic green and the abdomen is metallic green to brown. The wings are amber to brown. The dorsal carina of abdominal segment 10 usually ends in a prominent spine projecting well beyond every point of its apical margin. In both sexes there is a white pterostigma that darkens extensively with age. It is variable in size, surmounting 1-3 or more cells.

The larva was described by Byers (1930) and it can be separated from the two species in the region by the sharp tubercles behind the eyes and the presence of lateral spines on abdominal segment 8. The caudal gills are distinctly banded and shorter and more triangular than in *H. americana* or *H. vulnerata*.

Size. Total length: 39-53 mm; abdomen: 30-43 mm; hindwing: 25-31 mm.

Habitat. Small to medium-sized streams and rivers with strong current.

Discussion. The variability of this species has led to numerous synonyms and the recognition of several races and forms. Johnson (1963) studied sympatric populations of *H. americana* and *H. titia* on the Guadalupe River in Gruen and Comfort, Texas, and at the Llano River in Junction, Texas. A third population of *H. titia* was observed at Chinquipin Creek east of Lufkin, Texas. After observing differences in breeding and territorial behavior, Johnson found that the female body color patterns were consistent and that the females bred with their specific male type. He considered the *H. tricolor* form to be a possible valid species. He also found the flight seasons of the two forms to be different. For those localities, the flight season for *H. tricolor* was late March through late May and *H. titia* was late May through late September. Florida collections (FSCA) revealed occasional intergrades between the two female color patterns of the thorax and

showed no apparent difference in flight season. This lead Johnson and Westfall (1970) to place *H. tricolor* in the *H. titia* complex. We follow Garrison (1990) who considers them forms of one species, based on the lack of detectable morphological differences between sexes of either form.

Like *H. americana*, both sexes of *H. titia* perch horizontally on vegetation along the shore. They tend to prefer perches higher up and are more wary than the former (Dunkle 1990). Johnson (1961, 1963) described breeding and oviposition behavior and interspecific territoriality in this species. He found that females will invite mating by hovering and reject males with a display similar to that seen in *C. maculata*, involving a simultaneous spreading of the wings and bending of the abdomen upward. Guarded above by males, females will spend up to two hours ovipositing underwater in wet wood (Harp 1986).

***Hetaerina vulnerata* Hagen in Sélys**

Canyon Rubyspot

(Figs. 45, 52, Map 5)

Hetaerina vulnerata Hagen in Sélys, 1853a: 40.

Type. Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, NM, UT; MEXICO: CHS, CHI, COA, DFE, DGO, GTO, HGO, MCH, MOR, NAY, NLN, OAX, PUE, QRO, SIN, TAM, VER; Guatemala, Honduras; south to Columbia.

Seasonal Distribution. Jul. 2 (NLN) - Sep. 6 (NLN).

Identification. This southwestern species closely resembles *H. americana*. The male labrum is pale yellow with a central dark brown spot. The clypeus and basal antennal segment are both tan in color. The top of the head is dark brown to black with metallic bronze reflections. The pterothorax is a deep metallic red dorsally with a black middorsal carina. Laterally it is paler in color. There are deep red basal spots in both wings that become more intense with age. The venation on the ventral side of this basal spot is white. The tips of the wings are often edged with brown. The basal abdominal segments are dark brown-black dorsally each with a narrow light yellow band anteriorly. The caudal appendages are light tan to brown (Fig. 45).

Females are very similar to males, but the lighter coloration is more extensive. The pterothorax is metallic green dorsally with metallic green stripes laterally, but these are less extensive than in males and may be wanting or absent. Wings lack the intense basal red spots of the males, but are suffused with orange basally. *H. vulnerata* was thought to be completely apterostigmatous, but Garrison (1990) reported specimens from Canon Huasteca National Park in Neuvo Leon, Mexico, that are pterostigmatous. Though they show other differences, Garrison describes them as "easily referable to *H. vulnerata*."

The larva was described by Provonsha and McCafferty (1973) and can readily be separated from the only other western species of *Hetaerina* in the region. The proximal half of the mentum is narrower and the median cleft is broader and more tear dropped shape than in *H. americana*. Larvae of *H. vulnerata*, also have a pair of submedian spines on the posterior margin of the tenth abdominal sternite. These are either entirely absent or represented by short, stiff, inconspicuous setae in *H. americana*.

Size. Total length: 36-49 mm; abdomen: 28-41 mm; hindwing: 25-32 mm.

Habitat. Streams and rivers with open canopies.

Discussion. Although the ranges of *H. americana* and *H. vulnerata* overlap, Provonsha and McCafferty (1973) reported that they had never collected the two species from the same locality, suggesting that the populations may be ecologically isolated. The post-copulatory mate guarding behavior by males was described by Alcock (1982). He found that males remain with their respective female mates after copulation. Males will even adopt the unusual behavior of leaving their territory to accompany females in tandem on a search for oviposition sites elsewhere. He will then perch and guard the female while she submerges underwater to oviposit.

Tucker (1908) reported *H. vulnerata* from Plano, Collin Co., Texas and as reported by Johnson (1972), the similarities in wing pattern between it and *H. americana* probably account for this record. *Hetaerina vulnerata* is a southwestern species and it is unlikely that it has ever occurred in north central Texas. Johnson (1973b) reported two males of *H. vulnerata* from Bexar County, Texas. The Balconian locality is considerably east of the normal range for this species and the specimens are unavailable for

confirmation. Westfall and May (1996) listed it in Texas as doubtful and it has not been included here.

CHAPTER 5

LESTIDAE

Spreadwings

This rather large family is represented by two genera in North America, *Archilestes* and *Lestes*. The former is a small New World genus with only a few species in the Nearctic and Neotropics. The latter is one of the largest zygopteran genera in the world. The name Lestidae apparently has two possible derivations. One is from the French word *leste*, meaning nimble (Askew 1988), in reference to the agility that species in this group exhibit in flight. A second possible derivation is that *leste* refers to a robber or a thief who ambush their victims.

Members of this family can generally be recognized by their unique posture when at rest. They will perch with their wings slightly apart and not closed over their abdomens as generally seen in other damselflies; although coenagrionids will occasionally perch with their wings apart. Species are large to medium-sized with distinctly petiolate wings, with only two antenodal crossveins and the postnodal crossveins are in a line with the veins directly below them. Veins M_3 and R_s originate closer to the arculus than the nodus distinguishing them from all other North American families. The quadrangle is short and trapezoidal in shape. The relatively long (at least twice as long as wide) pterostigma surmounts at least two cells and is supported by a proximal brace vein.

The legs are armed with long spines. The suture between the mesepimeron and metepisternum is only visible in its upper third, as in coenagrionids. The anterior hamules of males are elongate becoming triangular distally. The superior caudal appendages are forceps-like. Females oviposit, usually in tandem, in submerged or floating vegetation.

The larvae of this family are characterized by a distinctly petiolate labium. The narrow basal portion of the prementum is at least as long as the expanded distal portion is wide. The labial palpi each possess a long movable hook equipped with two to three raptorial setae. The first antennal segment is much shorter than subsequent segments. Gills are flattened and lack a nodus. Larvae are long and slender and use their gills when swimming vigorously to actively escape predators or disturbances.

KEY TO ADULT GENERA OF LESTIDAE

1. Forewing quadrangle with proximal side no more than 1/2 the length of the posterior side (Fig. 53); vein M_2 arises about 1 cell beyond the nodus;
pterostigma greater than 3 mm *Archilestes grandis*
- 1'. Forewing quadrangle with proximal side no more than 1/3 the length of the posterior side (Fig. 54); vein M_2 arises several cells distal to the nodus;
pterostigma no more than 2.8 mm *Lestes*

Genus *Archilestes* Sélys

Great Spreadwings

Archilestes Sélys, 1862.

Cyptolestes Williamson, 1921.

Superlestes Williamson, 1921.

This is a small group of rather large damselflies. There are only two species in North America. *Archilestes californica* McLachlan is western occurring as far east as New Mexico. The larger *A. grandis* occurs in the South-central U.S. As its name implies, it may be readily distinguished from species of *Lestes* by its large size and robust stature. *Archilestes* are generally found perching on vegetation around pools or backwaters of slowmoving streams. Their wings have a short, broad quadrangle with the proximal side no more than one-half the length of the posterior side (Fig. 53). Vein M_2 arises little more than one cell beyond the nodus. The ventral margin of the ovipositor is much larger and has coarser teeth than in *Lestes*. The anterior hamules are expanded and boot-shaped; a condition not seen in any of the *Lestes* species occurring in our region. Garrison (1982a) provided an up to date key with illustrations for males of seven of the eight species in this New World genus.

***Archilestes grandis* (Rambur)**

Great Spreadwing

(Figs. 28-53, Map 6)

Lestes grandis Rambur, 1842: 244.

Archilestes grandis, Sélys, 1862: 294.

Type. Colombia.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio, Trinity.

General Distribution. UNITED STATES: AL, AZ, AR, CA, CO, DE, IL, IN, IA, KS, KY, MD, MO, NE, NM, NJ, NC, OH, OK, PA, SC, SD, TN, TX, UT, VA, VT, WV, WI; MEXICO: BCS, CHS, CHI, DFE, DGO, GTO, GRO, HGO, JAL, MOR, NAY, NLN, OAX, PUE, QRO, SLP, SIN, TAB, TAM, VER; Central America south to Colombia and Venezuela.

Seasonal Distribution. Mar. 17 (TX) - Oct. 30 (OK).

Identification. *Archilestes grandis*, found commonly in the Texan biotic province westward, is the largest damselfly in the U.S. It can be readily identified in the field based on its large size, lestid perching behavior and distinct bright yellow thoracic stripes.

In life the eyes of males are blue above and white below. The mesepisternum consist of a complete dark, metallic green stripe that is no more than half the width of the sclerite. This stripe is generally not contiguous with the middorsal carina, but

occasionally may be narrowed towards the middle. Each mesepimeron bears a metallic green or black stripe that is variable in size and appearance. It may extend the full length or slightly more than half of the width of the sclerite. The remainder of the pterothorax is yellow, resulting in two broad, pale stripes. The wings are often smoky, becoming darker at the tips. The pterostigma is long, greater than 3 mm, and surmounts 2.5 to 5 cells.

The first 1/3 to 1/2 of the abdomen is dark metallic green dorsally, becoming yellow or tan ventrolaterally. This pattern becomes obscured with age. Segment 9 has a narrow, dark, middorsal stripe and black apical and ventrolateral carinae. Segment 10 has a proximally directed dark median triangle on the dorsum. Mature males develop a white pruinosity laterally and basally on segments 1 and 2, all of segments 9 and 10, and on the sterna of segments 7 and 8. The inferior caudal appendages taper apically and are divergent. The superior appendages have a prominent medial projection at their midlength (Fig. 28).

Females are more robust than males. The general coloration is similar to that of males, but with the head paler. The dark mesepisternum and mesepimeron stripes are often narrower and sometimes nearly lacking. The paler proximal abdominal segments are often bluish. Segment 10 is generally tan to almost entirely black. The basal plate of the ovipositor is truncate posterolaterally. The margins of the valves are very strongly and coarsely toothed. Needham (1904) described the larva.

Size. Total length: 50-62 mm; abdomen: 38-47; hindwing: 31-39 mm.

Habitat. Small permanent ponds and streams of slow or moderate flow.

Biology. Gloyd (1980) reported that this species was only known from the southwest

U.S. up until the 1920's, but it has since steadily undergone a dramatic range expansion northward (Ahrens 1935; Ferris 1951; Montgomery 1966; Paulson and Garrison 1977). It now occurs as far north as western New England. Bick and Bick (1970) described the reproductive and oviposition behavior for an Oklahoma population. They found that neither males nor females exhibited any type of courtship behavior, and unreceptive females showed no refusal signs, but rather were simply not at the water or escaped by rapid flight when unreceptive. They didn't observe a pair ovipositing from beginning to end, but found the longest time of oviposition witnessed by them to be 109 min. Ingram (1976) gave an account of the life history of a North Carolina population. Garman (1932) described habitat preference and notes on oviposition of this species in Kentucky and Ahrens (1935) did the same for a population in southwestern Pennsylvania. Moskowitz and Bell (1998) presented some notes on water quality for this species.

Genus *Lestes* Leach

Spreadwings

Lestes Leach, 1815.

Puella Brullé, 1832.

Anapetes Charpentier, 1840.

This globally distributed genus includes medium to large-sized damselflies. Nine species occur in our region, all but one (*L. rectangularis*) in Texas, and all adults can be separated fairly easily upon close examination of male caudal appendages and female

color pattern. The metallic green and bronze colors of this group combined with elongate abdomens and a characteristic perching stance, with wings spread, will distinguish these from other damselflies in our region.

Males have a characteristic blue face and eyes. Males often develop a distinct pruinose appearance towards the rear of the head, between the wings of the thorax and posterior abdominal segments 9 and 10. Wings are never patterned, but hyaline and stalked basally. A long pterostigma, surmounting two or more cells, is characteristic (Fig. 54). The inferior caudal appendages of all species in our region are distinctly longer than half the length of the superior appendages, and the inferior appendages of one species, *L. inaequalis*, are longer than the superiors.

Females have brown eyes and are generally less pruinose. They are often pale in color and have long legs with tibial spurs longer than intervening spaces, approaching those of *Argia*. Upon closer examination, venational differences will readily serve to separate the two groups. The thoracic color pattern is often characteristic and useful in identification. The abdomen is generally uniformly dark and often distinctly ringed, particularly through the middle segments.

The larvae are readily distinguished from *Archilestes* by a combination of characters of the labium and caudal gills. The labial palp has a large, lateral end hook separated from a smaller, medial hook by a toothed lobe. There are generally one to two setae present on the labial palp basal to the movable hook. Many of the closely related species have larvae that are not easily separated without a large series of specimens.

Spreadwings generally inhabit permanent and ephemeral fishless bodies of

standing water including small sheltered lakes and ponds, with an abundance of emergent vegetation. Oviposition usually occurs in tandem and takes place in emergent vegetation. In our area, species undergo egg diapause and hatch in response to the warming temperatures of the encroaching spring. *Lestes inaequalis*, and a few other N.A. species, are unique among the group, developing in slow moving pools of streams. *Lestes rectangularis* is one of several North American species capable of surviving in conditions of high salinity.

KEY TO ADULT SPECIES OF *LESTES*

MALES

1. Inferior caudal appendages distinctly longer than superiors (Fig. 58)
 *inaequalis*
- 1'. Inferior caudal appendages at most 2/3 the length of superiors 2
- 2(1'). Inferior caudal appendages slender in apical half and sigmoid in shape with
 apexes divergent (Figs. 61-62) 3
- 2'. Inferior caudal appendages may be slender, but never sigmoid in shape and
 apexes not divergent (Figs. 55-57) 4
- 3(2). In dorsal view, inferior caudal appendages greater than 3/4 the length of
 superior appendages (Fig. 62); inferiors with basal tooth narrow and acute;
 length of abdomen generally less than 31 mm *unguiculatus*
- 3'. In dorsal view, inferior caudal appendages 3/4 the length of superior
 appendages (Fig. 60); inferiors with basal tooth broad and blunt; length of

- abdomen usually greater than 31 mm *sigma*
- 4(2'). Superior caudal appendages with a distinct basal and similarly shaped distal tooth (Figs. 56, 59) 5
- 4'. Superior caudal appendages with a distinct basal tooth only (Figs. 55, 57, 64) 6
- 5(4). Hindwing less than 2/3 length of abdomen; in lateral view inferior caudal appendages curve sharply downward in distal portion (Fig. 59); length of abdomen generally greater than 35 mm *rectangularis*
- 5'. Hindwing 2/3 length of abdomen; in lateral view, inferior caudal appendages straight (Fig. 56); length of abdomen generally less than 35 mm .. *disjunctus*
- 6(4'). Inferior caudal appendages very slender when viewed laterally (Fig. 64b); superior caudal appendages 1.5-1.9 mm in length, inner margins only sparsely serrated (Fig. 64a) *vigilax*
- 6'. Inferior caudal appendages much stouter when viewed laterally (Figs. 55b, 57b); superior caudal appendages 1-1.1 mm in length, inner margins strongly serrated (Figs. 55a, 57a) 7
- 7(6'). Thin dorsal metallic green stripes on thorax not connected with middorsal carina; inferior caudal appendages equal in length to superiors (Fig. 57) *forficula*
- 7'. Broad, dorsal black stripe of thorax contiguous with middorsal carina; inferior caudal appendages 3/4 or less the length of superiors (Fig. 55) *alacer*

FEMALES

1. Dorsum of thorax solid metallic green or with metallic green stripes or spots 2
- 1'. Dorsum of thorax lacking metallic green areas; dark areas may be bronze or
coppery in appearance 4
- 2(1). Posterolateral margin of ovipositor distinctly broad *inaequalis*
- 2'. Posterolateral margin of ovipositor acutely angulate 3
- 3(2'). A dark spot present above each metapleural carina; outer surface of tibiae
generally pale; mesepisterna with a metallic green stripe no wider than 0.3 mm
at narrowest point, widening only slightly posteriorly; metallic green stripe on
mesepimeron, when present, parallel *forficula*
- 3'. Dark spots absent from metapleural carina; tibiae uniformly brown in color (in
young specimens tibiae may be pale); metallic green stripe on mesepisterna
parallel for most of its length and more than 1/2 width of sclerite
..... *vigilax*
- 4(1'). Dark stripes on mesepisterna only faintly distinguishable from otherwise pale
thorax, in older specimens entire mesothorax may become heavily pruinose;
abdomen dark lacking strongly contrasting pale areas *sigma*
- 4'. Mesepisterna and mesepimera both with complete dark stripes extending
nearly full length, separated by a pale stripe at or just anterior to humeral
suture, this pattern never entirely obscured even in older specimens 5
- 5(4'). A dark spot present on thorax above and/or below metapleural carina
..... *alacer*

- 5'. No dark spot present on thorax above or below metapleural carina 6
- 6(5)'. Abdominal segment seven 1.5 times or greater the length of ovipositor
(excluding styli); meso- and metatibiae and tarsi entirely dark brown or only
slightly pale on outer surface; abdomen greater than 35 mm 7
- 6'. Abdominal segment seven less than 1.5 times the length of ovipositor
(excluding styli); meso- and metatibiae pale on outer surface, tarsi entirely
dark; abdomen less than 35 mm 8
- 7(6)'. Meso- and metatibiae and tarsi dark brown (tibiae may be pale in young
specimens); wing tips with numerous doublelength cells in marginal cell row;
antehumeral stripe reddish-brown; postnodal crossveins generally 15 or
greater; abdomen 42-50 mm *vigilax*
- 7'. Meso- and metatibiae and basal half of tarsi pale; wing tips with few
doublelength cells in marginal row; antehumeral stripe blue-gray to yellow;
postnodal crossveins generally no more than 12; abdomen 34-44 mm
..... *rectangularis*
- 8(6)'. Posterior of head black except occiput; abdomen bronze-brown to black
dorsally *disjunctus*
- 8'. Posterior of head with distinct pale areas reaching compound eyes; abdomen
generally green dorsally *unguiculatus*

***Lestes alacer* Hagen**

Plateau Spreadwing

(Fig. 55, Map 7)

Lestes alacer Hagen, 1861: 67.

Type. Pecos R., Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Brazos, Canadian, Cimarron, Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio, Trinity.

General Distribution. UNITED STATES: AZ, NM, OK, TX; MEXICO: CHS, COA, DFE, DGO, HGO, MEX, MCH, MOR, NLN, OAX, PUE, TAM, VER; south to Costa Rica.

Seasonal Distribution. Jan. 3 (TX) - Oct. 17 (TX).

Identification. This is principally a southwestern U.S. species found as far east as the Texan biotic province in our area and throughout Mexico. Males have a largely blue face and black head dorsally. The mesepisternum is black medially and pale blue or yellow laterally. It is confluent with the dorsal half of the mesepimeron. The remaining ventral half of the mesepimeron is dark and the remaining pterothorax is pale with a dark stripe of variable width running along the metapleural suture. The abdomen is slender, especially towards the middle. A ventrolateral spot is present on segments 3-5. Segments 6-7 are dark ventrolaterally. These areas along with segments 1-2 and 8-10 become heavily pruinose with age.

Females are similarly colored to males, but with larger pale spots lateral and posterior to ocelli. Markings above mesopleural suture similar to male, but the pterothorax is pale ventrally except for a dark spot just above anterior end of metapleural carina and posteromedial spot of sternum. The coloration of abdominal segments 3-5 is similar to males. Segments 6-10 are similar, but with dark ventrolateral dark areas less extensive. Segment 1 is pale in young individuals. The posterolateral margin of ovipositor basal plate is acutely angulate. Novelo and Gonzales (1991) described the larva.

Size. Total length: 34-45 mm; abdomen: 28-36 mm; hindwing: 19-25 mm.

Habitat. Still, slow moving waters.

Discussion. Little is known about the biology of this principally Mexican and Southwestern U.S. species. It emerges in early January in our area and flies through October. Bird (1933) gave a brief description on oviposition and habitat preference.

Lestes disjunctus Sélys

Common Spreadwing

(Figs. 54, 58, Map 8)

Lestes disjunctus Sélys, 1862: 302.

Lestes disjunctus australis Walker, 1952: 64.

Type Locality. Vaneman Swamp, Bluffton, Wells Co., Indiana; UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AK, AL, AR, AZ, CA, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY; CANADA: Alb., B.C., Man., N.B., Nfld., N.S., N.W.T., Ont., P.E.I., Que., Sask., Yuk.

Seasonal Distribution. Mar. 14 (TX) - Dec. 4 (LA).

Identification. This is certainly the most widespread lepidid in our region, occurring in all major watersheds and biotic provinces. The face and eyes of males are bright blue with a small, pale spot lateral to each lateral ocelli. The eyes are blue in life, fading ventrally. There is a pale blue-green stripe on the mesopleural suture that extends the full length of the suture and is confluent with the pale areas of the metepisternum at the border of the mesepimeron. The rest of the pterothorax varies from pale to black. The legs are dark brown. With age individuals become heavily pruinose ventrolaterally, occasionally obscuring the entire pterothorax.

The abdomen is largely dark with a metallic green luster dorsally. Abdominal segments 1-2 become black laterally with age. The distinct dark ventrolateral spots on segments 6-7 may be lacking on segments 3-5. Heavy pruinosity develops laterally on

segments 1-2, ventrolaterally on segments 7-8 and completely on segments 9-10 (more noticeably on 9 than 10). The distal medial tooth of each superior caudal appendage is acute, blunt and distinctly smaller than the basal tooth (Fig. 56a). The inferior appendages are nearly as long as the superior appendages.

The general coloration of females is like that of males. The eyes are blue in life with a thin middle band of brown fading to white ventrally. The pale stripe running along the mesopleural suture is complete and confluent with the metathoracic area. Females lack pruinosity on the abdomen, but the rear of the head becomes pruinose, along with the coxae and ventrolateral margins of the pterothorax.

Laterally abdominal segments 7-10 are uniformly pale yellow, except for the ventrolateral rim of segment 9. The basal plate of the ovipositor has the posterolateral corner produced to form a distinct acute tooth, longer than its basal width. The ovipositor reaches well beyond the margin of segment 10, but does not reach the tips of the paraprocts. Garman (1917) described the larva.

The subspecies *L. d. australis* is found everywhere within our boundaries except the extreme western edge where it is replaced by the more northern distributed nominate subspecies, *L. d. disjunctus* Sélys. *Lestes disjunctus* is smaller than most of the lestids in our region. Females are very similar to those of *L. rectangularis*, and may be easily confused, but for size, a more robust abdomen, and the yellow tarsi and tinted wing tips of *L. rectangularis*.

Size. Total length: 36-46 mm; abdomen: 28-36 mm; hindwing: 18-25 mm.

Habitat. Still, slow moving waters, including, permanent or ephemeral ponds, marshes

and lakes with moderate vegetation.

Discussion. This species has received considerable attention by workers due to both its abundance and two distinct forms. *L. d. australis* is similarly colored to *L. forcipatus* and their claspers closely resemble one another. Early records for both of these species must be viewed with caution as a result. Montgomery (1941) first noted that most early records for *L. disjunctus* and *L. forcipatus* are hopelessly confused. Bird (1932) reported *L. forcipatus* throughout central Oklahoma, but Bick and Bick (1957) examined his specimens and found them all to be *L. d. australis*.

The nominate subspecies generally does not extend south of north-central New Mexico, but it has been taken along side *L. d. australis* in Caprock Canyons State Park, Briscoe Co., Texas. It can be separated from *L. d. australis* by a darker color pattern, smaller size (33-40 mm) and a more strongly developed distal tooth on the superior caudal appendages. The fact that both of these forms are found together may imply that they are distinct species. Westfall and May (1996) gave a complete synopsis of each subspecies and Walker (1952, 1953) discussed the relationship of *L. disjunctus* with *L. forcipatus*.

L. disjunctus australis emerges early in our region, mid-March, and flies throughout the rest of the year. Bick (1957) suggested an early spring/late fall emergence for this species in Louisiana, but I have mid-summer records from Louisiana. This species does, however, seem to be most abundant in the fall as Mauffray (1997) pointed out. Sawchyn and Gillot (1974) described the life history of *L. d. disjunctus* and Ingram (1976) described the life history of *L. d. australis*. Bick and Bick (1961) discussed

reproductive behavior and population structure in *L. d. australis*. Males are not territorial and individuals are often seen a considerable distance, several 100 m, from any body of water. Mating activity in this univoltine species tends to peak in the late afternoon, ca. 5p. Oviposition occurs in tandem in green stems of cattails above the water line. Females will usually oviposit over a hundred eggs. Dunkle (1990) summarized the reproductive behavior of this species. The larvae can tolerate considerable salinity. Cannings *et al.* (1980) found *L. disjunctus* along with two other species of lestids to be common inhabitants of saline lakes in British Columbia.

Ericksen (1984) studied the physiological ecology of this species in a Rocky Mountain bog pond and found that it did not gain any competitive advantage through unique thermal adaptation. Anholt (1997) studied a population in eastern Ontario, Canada, to determine sexual size dimorphism and sex-specific survival in adults. He found that there was no difference in the mass of mated and unmated males, but that females were more than 50% heavier than males. He also found males to be eight times more abundant than females, however females were more active than males.

***Lestes forficula* Rambur**

Rainpool Spreadwing

(Fig. 57, Map 9)

Lestes forficula Rambur, 1842: 247.

Lestes striata Sélys, 1862: 309.

Type. IRSN.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan, Texan.

Watershed(s): Nueces, Rio Grande, San Antonio, San Jacinto.

General Distribution. UNITED STATES: TX; MEXICO: CAM, OAX, QTR, TAB, TAM, VER, YUC; throughout Central America and West Indies; south to Argentina and Brazil.

Seasonal Distribution. May 7 (TX) - Sept. (TX).

Identification. This tropical species barely reaches the southern limits of our area. It is pale in color and easily recognized by the narrow, bright metallic green thoracic stripes. Males become heavily pruinose with age, however, and these stripes are often partially obscured. The middorsal carina is pale yellow bordered on each side by a thin black line. The mesepisternum is pale blue to yellow and there is a thin metallic green antehumeral stripe extending much less than $\frac{1}{2}$ the width of the sclerite. This stripe is nearly parallel, widening only slightly posteriorly. It lies closer to the middorsal carina but is widely separated from both it and the humeral suture. A second thinner metallic green stripe runs nearly the full length of the mesepimeron. Immature individuals have a dark spot above the anterior end of the metapleural carina on an otherwise pale yellow thorax. Dark stripes develop along both the interpleural and metapleural sutures. These expand with age. In mature individuals the entire ventral side of the pterothorax, including coxae, becomes heavily pruinose.

Except for a small ventrolateral pale spot, abdominal segment 1 is black. Segments 2-6 are dark metallic green dorsally, expanding slightly subapically on segments 3-5. Starting with segment 6 there is considerable darkening ventrolaterally to the end of the abdomen. These areas become darker with age. Segments 1, 8-10 and the lateral part of 2 all become heavily pruinose. The inferior caudal appendages are nearly as long as the superior appendages (Fig. 57b).

The general coloration of the head and pterothorax in the female is very similar to that of the male. The mesothorax is pale yellow with a dark hairline and a posterior spot on the humeral suture. There is a thin antehumeral metallic green stripe that is nearly absent in teneral individuals. There are also dark hairline stripes along the interpleural and metapleural sutures. With age, slight pruinosity develops on the coxae and metathorax. Abdominal segment 1 varies in color from blue to entirely dark. The middle segments, 2-6, are similar to those of the male and segments 7-10 are dark brown dorsally becoming paler laterally. The basal plate of the ovipositor is produced into a long, acuminate tooth. Calvert (1928) described and illustrated the larva.

Size. Total length: 35-43; abdomen: 28-36 mm; hindwing: 17-24 mm.

Habitat. Ponds, pools, other standing bodies of water, and possibly slow reaches of streams, with heavy emergent vegetation.

Discussion. The biology of this species is poorly known. Garcia-Diaz (1938) described females ovipositing, both accompanied and unaccompanied by males, in sedges 8-10 inches above the water surface. This species probably flies year round farther south in its range and has been taken in a variety of habitats including rain pools (Paulson 1984),

rivers (Garcia-Diaz 1938) and sewage ponds.

***Lestes inaequalis* Walsh**

Plateau Spreadwing

(Fig. 58, Map 10)

Lestes inaequalis Walsh, 1862: 385.

Type. Unknown.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Mississippi, Neches, Ouachita, Red, Sabine, St. Francis.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KY, LA, ME, MD, MA, MI, MN, MS, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WV; CANADA: N.B., Ont., Que.

Seasonal Distribution. Apr. 7 (LA) - Aug. 18 (LA).

Identification. This is a large eastern species that is confined to localized populations of the piney woods of the Austroriparian biotic province in our area. Males have a dark metallic green head, generally with pale spots lateral to the ocelli. The rear of the head is yellow and the eyes are blue above, eventually changing to a greenish-yellow below. The pterothorax is metallic green except for black on the middorsal and antecular carinae and a thin line along the humeral suture. The mesepimeron is metallic green for its full width

posteriorly, but narrows to half this width anteriorly. The entire pterothorax is yellow ventrolaterally. In older individuals there may be dark spots externally on the coxae. The pterothorax may become entirely pruinose with maturity, but never completely obscures the color pattern.

Abdominal segments 1-8 are metallic green dorsally and pale yellow laterally. Lateral areas on segments 8-10 vary from yellow to almost entirely black. Lateral parts of segment 1 and all of segments 9 and 10 become heavily pruinose with age. Males of this species are unique in the U.S., having the inferior caudal appendages longer than the superior appendages (Fig. 58).

Females are very similar in general color to males, but the metallic-green of the pterothorax may be partly replaced by brown with bronze reflections. The middorsal carina and narrow stripe along the humeral suture are always pale. In life, the eyes are distinctly brown above, gradually becoming yellowish ventrally. The color pattern of the abdomen is like that of the male with the following exceptions. Segment 1 is metallic green dorsally on the apical 2/3 only. Segments 7, 8 and 10 are pale laterally and segment 9 may or may not have a basal black band and dark lateral markings. The posterolateral margin of the ovipositor basal plate is truncate and lacks a tooth. The larva was described by Westfall and Tennessen (1973).

Its large size and bright green metallic color make it easily recognizable in the field. It is similar only to *L. vigilax* in our area, but larger and generally more brilliantly marked.

Size. Total length: 45-60 mm; abdomen: 35-47 mm; hindwing: 25-31.

Habitat. Canopy covered permanent ponds, lakes, slow moving streams and marshes with plenty of emergent vegetation and heavily wooded shorelines.

Discussion. The reproductive behavior has never been reported. The diet of this large species includes smaller damselflies (Dunkle 1990). They are easily disturbed and are generally found perching in shady areas during the heat of the day. Dunkle (1990) reported the unique behavior of tandem pairs ovipositing in the top surface of lily pads.

Lestes rectangularis Say

Slender Spreadwing

(Fig. 59, Map 11)

Lestes rectangularis Say, 1839: 34.

Type. United States.

Regional Distribution.

Biotic Province(s): Austroriparian, Kansan, Texan.

Watershed(s): Arkansas, Canadian, Cimarron, Mississippi.

General Distribution. UNITED STATES: AL, AR, CO, CT, DE, DC, FL, GA, IL, IN, IA, KS, KY, ME, MD, MA, MI, MN, MS, MO, NE, NH, NJ, NY, NC, ND, OH, OK, PA, RI, SC, TN, VT, VA, WV, WI; CANADA: Man., N.B., N.S., Ont., Que.

Seasonal Distribution. May (OK) - Aug. 1 (OK).

Identification. This species is one of the most common in the northeastern U.S., but it is

only found in the northern parts of our region. The unusually long abdomen and pale blue antehumeral stripes make this species readily identifiable in the field. In life, the eyes of the males are blue above and white below. The rear of the head is black becoming pruinose at maturity. The antehumeral area is black except for a pale blue middorsal and antealar carina. There is a pale blue stripe on the lateral quarter of the mesepisterna that extends onto the dorsal edge of the mesepimeron. The rest of the mesepimeron is black and the remaining lateral and ventral areas of the pterothorax are pale yellow. These areas become slightly pruinose with age. All of the femora have a black line running their length on the outside. The tibiae are almost entirely yellow with a black line only apparent anteriorly.

Abdominal segments 1 and 2 are black dorsally and pale yellow or blue laterally. The dark dorsal line of segment 2 is narrowed at its middle to form 2 distinct spots, obscured in older individuals. Segments 3-7 have a dorsal stripe that is lighter, more tan or brown, and only a little darker than the lateral pale areas. Segments 8-10 are black dorsally and pale yellow laterally. Segments 9 and 10 darken with age so that only the pale yellow apical and basal rings remain. This species is unique among *Lestes* in our area, having the inferior caudal appendages distinctly and strongly curved downward.

The color pattern of the female is very similar to that of the male, but the abdomen is a uniform black dorsally and tan laterally. The black of the antehumeral and metepisternal areas is less extensive than in males. Segments 9 and 10 are pale laterally becoming darker ventrally. The posterolateral corner of the ovipositor's basal plate is acute and generally forms a distinctive tooth. Needham (1903) described the larva and

provided figures.

Size. Total length: 37-52 mm; abdomen: 30-44 mm; hindwing: 20-25 mm.

Habitat. Lakes or ponds with regular shade and dense emergent vegetation; often found in bays and sand-bottomed lakes.

Discussion. Gower and Kormondy (1963) described the life history, seasonal regulation and reproductive behavior of a western Pennsylvania population of *L. rectangularis*. They found that more than 50% of the population emerged during the first 7 days of a 2-3 week emergence period. Individuals were most active in mid-afternoon and females will oviposit in tandem or alone, usually in cattail leaves. They are reluctant to fly over open water and the female never submerges herself during oviposition. Walker (1953) showed that adults were most abundant in shade and readily took shelter in thick vegetation during the heat of the day.

Lestes sigma Calvert

Chalky Spreadwing

(Figs. 60-62, Map 12)

Lestes sigma Calvert, 1901: 49.

Type. "United States, Texas, probably near the Nueces River - Mexico, Iguala in Guerro."

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan, Texan.

Watershed(s): Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio.

General Distribution. UNITED STATES: OK, TX; MEXICO: CHI, GRO, JAL, NLN, OAX, SLP, SIN, SON, TAM, VER; El Salvador, Honduras; south to Costa Rica.

Seasonal Distribution. May 9 (TX) - Sept. 7 (TX).

Identification. This is a Central American species that ranges as far north as the Red River. Males have extensive blue on the face. Some individuals may have spots lateral to the lateral ocelli expanded into triangles. The rear of the head is yellow in juveniles but quickly becomes pruinose and black with maturity. The eyes, in life, are blue dorsally fading to a paler white below. The pterothorax is gray to tan with extensive black markings including an elongated antehumeral spot just above the humeral suture. The middorsal and antealar carinae often appear black. There is an irregular stripe half the length of the mesepimeron just below the humeral suture. The stripe along the interpleural suture is often extensive, covering the majority of the metepisternum. There are two black spots, which may be connected, above the anterior and posterior ends of the metapleural carina and another large spot below this carina. This black may become more extensive with age, eventually covering the entire pterothorax. A heavy pruinescence will cover this and extend down to the legs and trochanters. The pterostigma may be somewhat bicolored, dark brown or black anteriorly and yellow posteriorly.

The abdominal segments 3-7 are dark dorsally and confluent with ventrolateral markings. Segments 8-10 are completely black, except for lighter brown posterodorsal

and lateral spots on 10. Segments 1-2 and 8-10 all become heavily pruinose, with 10 lighter than the others. Superior and inferior caudal appendages are dark and the latter are distinctly sigmoid in form (Fig. 60).

The general color pattern of the female is like that of the male, but with the black and pruinescence less extensive. Mature individuals become very dark with age, however. Eyes, in life, are like those of the male, but generally duller. The black on the dorsum of abdominal segment 1 encompasses only the apical half of that segment. The black on the ventrolateral parts of segments 3-5 generally are not confluent with the dorsal stripe. Segments 1-2 and 8-10 become heavily pruinose with age. The basal plate of the ovipositor has a distinct posterolateral acuminate tooth. Westfall and May (1996) provided an illustration of the labial palp and included this species in their larval key.

Older males of *L. forficula* may be confused with this species in the field, but close examination of the caudal appendages will easily separate them. The only other species in our area with sigmoid inferior appendages is *L. unguiculatus*; a species that is more northerly distributed and is generally smaller in size.

Size. Total length: 39-47 mm; abdomen: 31-37 mm; hindwing: 20-25 mm.

Habitat. Temporary pools and ponds.

Discussion. Little is known of the biology, life history or reproductive behavior of this species. Johnson (1975) reviewed the geographic distribution of this species. He discussed the history of the reports of this species from New Mexico. All such records apparently trace back to Muttkowski (1910) and Sublette and Sublette (1967). Records in neither source could be substantiated and it is unlikely that this species reaches that far

northwest. Bick (1978) reported a single male from Marshall County, Oklahoma. This is the northernmost record for this species and remains the only record north of the Red River.

Johnson (1975) found that variation in the caudal appendages of this damselfly was equal to differences between other lestid species. The basal tooth on the superior caudal appendages can take the form of a distinct pointed tooth (Fig. 62) or a rounded lobe (Fig. 58).

***Lestes unguiculatus* Hagen**

Lyre-tipped Spreadwing

(Fig. 63, Map 13)

Lestes unguiculata Hagen, 1861: 70.

Type. Bergen Hill, New Jersey; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Canadian, Mississippi, Red.

General Distribution. UNITED STATES: AR, CA, CO, CT, DC, ID, IL, IN, IA, KS, KY, ME, MA, MI, MN, MO, MT, NE, NV, NH, NJ, NY, ND, OH, OK, OR, PA, RI, SD, TN, TX, UT, VT, WA, WV, WI, WY; CANADA: Alb., B.C., Man., N.B., N.S., Ont., P.E.I., Que., Sask.

Seasonal Distribution. Jun. 10 (TX).

Identification. This species is found commonly throughout the northern U.S. and southern Canada. It just extends into the northern reaches of the Texan and Austroriparian biotic provinces in our area. The head of the male is dark black with a metallic copper or green luster that generally fades with age. The usual pale spots on the outside of the lateral ocelli are present. The antehumeral area is black with a metallic luster. The middorsal and antealar carinae are pale. There is a thin pale yellow or green antehumeral stripe extending $2/3$ - $4/5$ the length of the humeral suture. The mesepimeron is mostly black. The yellow, pale green metepisternum is divided into an anterior spot and a posterior stripe by a black diagonal stripe. The metepimeron is pale in young individuals but darkens with age. There are strong, distinctive black lines on the outside of the femora and tibiae. The abdomen is relatively short, among the lepidids in our area. It is dark metallic green dorsally and pale yellow or blue ventrolaterally. Dark ventrolateral markings are faint on segments 5 and 6, becoming more pronounced posteriorly.

The general color pattern of the female is similar to that of the male only with more extensive pale areas throughout. There is a pale yellow antehumeral stripe that extends the full length of the humeral suture. There are dark triangular markings in the posterodorsal corners of the metepisternum, otherwise the entire metathorax is pale. The color pattern of the abdomen is very similar to that of males. There is a distinct posterolateral tooth present on the basal plate of the ovipositor. Walker (1914a) illustrated and described the larva.

This is one of only two species (the other is *L. sigma*) in our area with sigmoid inferior caudal appendages (Fig. 63). The above description, distributions and size should help separate the two.

Size. Total length: 31-44 mm; abdomen: 25-35 mm; hindwing: 17-24 mm.

Habitat. Open pools, ponds, sloughs and slow reaches of streams.

Discussion. This species is scarce within the region, barely entering our northern limits. It has been documented in Oklahoma (Bird 1932) and Arkansas (Harp 1983). Tinkham (1934) reported three females from the Davis Mountains in west Texas and Albright (1952) listed the species, as a "record furnished by a letter from A.H. Ferguson" in an unpublished thesis of the Odonata surrounding San Antonio. Sid Dunkle recently collected this species from Caprock Canyons State Park, Briscoe Co., Texas, representing the first verified collections of it in that state.

Sawchyn and Gilbert (1974) described the life history in Saskatchewan. Bick and Hornuff (1965) discussed its reproductive behavior and noted that unpaired males shifted perch sites for no detectable reason about once every minute. Males infrequently wing-warned as they flew towards intruders, but a lack of aggressiveness resulted in loss of territory. Mating occurs in the early afternoon, between 1:30 and 3:00 and involves no courtship or display signals. Copulation lasted an average of 25 minutes, but was never a continuous process; each pair momentarily breaking contact. Oviposition generally occurs in tandem, but may occur alone, and lasts an average of 1.5 hours. Pairs generally oviposited in vegetation, 10-12" above the water surface, as is typical in *Lestes*. Females, however, may submerge themselves underwater for short periods.

***Lestes vigilax* Hagen**

Swamp Spreadwing

(Figs. 27, 64, Map 14)

Lestes vigilax Hagen in Sélys, 1862: 306.**Type.** New Jersey; MCZ.**Regional Distribution.***Biotic Province(s):* Austroriparian.*Watershed(s):* Mississippi, Ouachita, Red, Sabine, Trinity.**General Distribution.** UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, IA, KY, LA, ME, MD, MA, MI, MN, MS, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VA, WV, WI; CANADA: N.B., N.S., Ont., Que.**Seasonal Distribution.** Mar. 31 (LA) - Oct. 31 (TX).**Identification.** This is a large metallic species that is restricted in our area to the Austroriparian province. The face of the male is pale blue in front contrasting with green sides. The top of the head is dark metallic green or black. The usual pale spots to the outside of the ocelli are faint or entirely absent. The eyes in life are brilliant blue on top fading to white below. The thorax and abdomen are a dark metallic green or black. There is a jagged pale brown humeral stripe and the middorsal and antealar carinae are both pale. The mesepimeron is dark except for the pale anteroventral corner. The metepisternum and remainder of the pterothorax are pale yellow ventrally. The legs are

dark externally.

The abdomen is dark metallic green dorsally and pale yellow ventrally. Most individuals have a very fine pale line running dorsally down segments 2-5. The ventrolateral markings are absent, but the pattern expands subapically on segments 6-10. Older individuals become pruinose on segments 1 and 9 and the basal portion of 10. The inferior caudal appendages are thin and nearly as long as the superior appendages.

Females are very similar to males, but the eyes are duller in life; brown above fading ventrally. The pale humeral stripe is wider and always runs the full length of the suture. The dark areas of the thorax are bronze or brown. The ventrolateral areas of the pterothorax are pale yellow. Abdominal segments 8 and 9 are always pale laterally and segment 10 generally only has a narrowed dark stripe. There is a distinct posterolateral tooth on the basal plate of the ovipositor. Walker (1914b) illustrated the larvae and provided a key for Canadian *Lestes*.

This is a widespread species that could be confused with *L. inaequalis* in the field. *L. vigilax*, however is slightly smaller and generally darker in color.

Size. Total length: 43-55 mm; abdomen: 36-45 mm; hindwing: 23-27 mm.

Habitat. Generally found in shaded acidic waters such as bogs, lakes, swamps, ox-bows and slow streams.

Discussion. Much of the biology and reproductive behavior of this species still remains unknown. O'Briant (1972) briefly reported on the reproductive behavior of this species. She found that males made contact with females without courtship display and that they oviposited in tandem in emergent vegetation, never submerging, as is typical in other

Lestes. Wright (1943b) noted that this species prefers heavily shaded areas.

CHAPTER 6

PROTONEURIDAE

Threadtails

This is a family of very slender damselflies that are circumtropical in distribution. In the Northern Hemisphere, they are mainly restricted to Central America. Only three species, in two genera, occur in the U.S. and all are limited to southern Texas. The adults and larvae generally resemble those of the closely related family, Coenagrionidae. The adults may be readily separated by a characteristically reduced venation and bright metallic colors in males.

These damselflies have a strongly rectangular and elongate quadrangle. The venation is reduced, with the anal vein and Cu_2 absent in some species. Cu_1 is reduced to the length of three cells in all of our species. The area between Cu and the wing margin is devoid of crossveins, and there are only two antenodal crossveins in both pair of wings. The pterostigma is rather short, generally subtending a single cell (Figs. 140-141).

The larvae have a single premental seta located on each side, which is unusual among coenagrionids, and the palpal setae may range from 3-5. The gills have a well-developed nodus, generally leaving the basal portion of the gill darker and more heavily sclerotized. Of the three species in our area, only the larva of *Neoneura aaroni* is known.

KEY TO ADULT GENERA OF PROTONEURIDAE

1. M_2 arises near the 4th and 3rd postnodal crossveins in the fore- and hindwing, respectively; anal vein present for length of one cell only in both fore- and hindwing (Fig. 140) *Neoneura*
- 1'. M_2 arises near the 5th and 4th postnodal crossveins in the fore- and hindwing, respectively; anal vein absent in both fore- and hindwing (Fig. 141)
 *Protoneura cara*

Genus *Neoneura* Leach

Threadtails

Neoneura Sélys, 1860.

Caenoneura Kirby, 1890.

This is a moderately large group of generally brightly colored orange and black damselflies. There are only two species who range into the U.S. and the southern limits of Texas. Members of this genus more closely resemble coenagrionids than other members of the family. They, however, can be easily distinguished by the venational characters presented in the keys. The most useful characters for differentiating between species in this genus are the male caudal appendages and the prothoracic hind lobes of the female.

Williamson (1917) revised the entire genus, with keys and excellent figures for adults.

Larvae of this group are restricted to running waters, generally with a rocky substrate. Morphologically the larvae are strikingly similar to the larvae of *Protoneura* and are often indistinguishable. The larvae of both our species are undescribed, but Westfall and May (1996) provide a key with *N. aaroni* included, based on reared material. Adults generally prefer shaded areas of floating or emergent vegetation near the larval habitat.

KEY TO ADULT SPECIES OF *NEONEURA*

- 1. In male abdominal segments 2 and 3 pale to bright orange dorsally and area below humeral suture orange; posterior margin of pronotum in female with symmetrical lobe on each side of median lobe (Fig. 73) *amelia*
- 1'. In male abdominal segments 2 and 3 black dorsally and area below humeral suture black; posterior margin of pronotum in female with median lobe only, lateral lobes, if present, much reduced (Fig. 67) *aaroni*

Neoneura aaroni Calvert

Coral-fronted Threadtail

(Figs. 65-70, Map 15)

Neoneura aaroni Calvert, 1903: 139.

Type. Texas; ANSP.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan.

Watershed(s): Colorado, Guadalupe, Nueces, Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: NLN; Guatemala.

Seasonal. May 17 (TX) - Sept. 17 (TX).

Identification. The face in mature males is bright orange. The rest of the head is orange-black with a divergent dark stripe posterior to the median ocellus. The antennae are black with an orange ring basally. The middorsal thoracic carina and stripe are black. The orange antehumeral stripe usually reaches the humeral suture in its anterior half. The rest of the pterothorax is black with some less-defined paler areas. The legs are light brown with dark stripes on the femora and tibiae. In mature males the thorax, including legs, become pruinose.

The abdomen of teneral males is light brown with dark apical bands on segments 3-6. Segments 9 and 10 are almost entirely black dorsally. In mature males the abdomen is nearly solid black. Some individuals may have pale apical bands on segments 1-2 and 9-10. The abdomen becomes lightly pruinose with age. The superior caudal appendages are black, occasionally having an external orange stripe. They are notched apically and the ventral lobe is distinctly hooked when viewed laterally (Fig. 66). The inferior appendages are longer and rounded apically. There is a dorsomedial prominence for 1/4 to 1/3 their length. Calvert (1901-1908) described the color of males at various ages in detail and this may be of some help to the reader.

The head and thorax of the female are pale brown. There is a very thin black line that extends from the lateral ocellus to each eye. The middorsal carina is pale with a fragmented dark middorsal stripe. The posterior tubercles and medial borders of the mesostigmal plates are both black (Fig. 68). The hairline black humeral stripe is generally broken or lacking at its middle. The legs are generally pale. The abdomen is dark dorsally, with subapical bands and lateral stripes on the middle segments and segment 10 is pale laterally. The larva is undescribed.

Size. Total length: 30-37 mm; abdomen: 23-30 mm; hindwing: 16-19 mm.

Habitat. Protected areas of slow-moving rivers and streams with emergent or floating vegetation, detritus or debris.

Discussion. This species has been collected from only 11 widely dispersed Texas counties, spanning from the Hill Country west to the Devils River and south to the Gulf Coast. It has been infrequently taken farther south. Bick (1983) discussed several Odonata at risk in the U.S. and Canada. He assigned category of rare to *N. aaroni* based on its limited distribution and seemingly narrow range of tolerance.

Neoneura amelia Calvert

Amelia's Threadtail

(Figs. 71-76, 139, Map 16)

Neoneura amelia Calvert, 1903: 138.

Type. Cubilguitz, Vera Paz, Guatemala; BMNH.

Regional Distribution.

Biotic Province(s): Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: CAM, CHS, COL, NAY, OAX, QTR, SLP, SON, TAB, VER; throughout Central America; south to Panama.

Regional Temporal Distribution. Apr. 25 (TX) - Aug. 20 (TX).

Identification. Williamson (1917) reported that the male is quite variable in the degree of black on the head, thorax and first three abdominal segments. The eyes in life are brown above, fading to pale green. The face is bright red and only slightly paler red on top. The area posterior to the ocelli is black. The antennae are black with a basal orange ring. The middorsal stripe and carina are black. The antehumeral stripe is orange and a dark humeral stripe covers only the posterior 2/3 of the respective suture. The remaining pterothorax varies from orange to black laterally. A black stripe is present only on the anterior mesepimeron. The metapleural suture and the venter of the pterothorax vary from tan to black.

The abdomen is black with narrow pale apical bands on segments 3-9. Abdominal segment 1 is orange for the apical 1/4 to 1/3 of its length, dorsally. Segment 2 is orange dorsally with a dark apical band and segments 3-7 have a thin orange stripe running middorsally. Segments 1-6 are pale ventrolaterally. The inferior caudal appendages closely resemble those of *N. aaroni*, while the deeply bifurcated superior appendages differ in their black or orange color and an external stripe for about 2/3 the

length of segment 10 (Figs. 65-66).

The female is very similar to that of *N. aaroni* in color with the following notable exceptions. Abdominal segments 8-9 are usually pale laterally and segment 10 is generally orange. The mesostigmal plates are also similar to those of *N. aaroni* only with a lateral ridge forming the posterior border of the plate (Fig. 67). The larva is undescribed.

Neoneura amelia closely resembles our other *Neoneura*, *N. aaroni*, but is typically much more orange on both the pterothorax and abdomen.

Size. Total length: 30-35 mm; abdomen: 24-29 mm; hindwing: 16-18 mm.

Habitat. Protected, well-shaded areas of slow-moving rivers and streams with emergent or floating vegetation, detritus or debris.

Discussion. This principally Central American species was only recently reported from the U.S., at our southern border in Hidalgo County, Texas (Abbott and Stewart 1998; Nikula 1998). I have taken this species in only two sheltered locations of the lower Rio Grande. It was collected among trash and debris in shady areas at both La Lomita Community and Anzulduas County Park. It probably inhabits similar, but less accessible, areas throughout the southern course of the river. A presumed *N. aaroni* teneral male of this recently discovered U.S. inhabitant was unknowingly collected at a slough of Bentsen-Rio Grande State Park, Texas, 10 years earlier by D.R. Paulson. Despite its bright color, this species' cryptic behavior of hovering low in shaded areas over water, has undoubtedly resulted in its being overlooked in the field. Westfall and May (1996) found adults perching on emergent vegetation of clear lakes in the immediate vicinity of stream

outlets.

Genus *Protoneura* Sélys

Threadtails

Protoneura Sélys, 1857.

A single species of this genus, *P. cara*, ranges as far north as the Hill Country of southern Texas. The males are readily distinguished in the field by an overall slender stature and a long thin characteristically ringed abdomen. Most species, including ours, are brightly colored orange and black. The females are more robust and duller in color. The wings lack an anal vein beyond the anal crossing (Fig. 140). This is unique among all other damselflies in our area. The legs in general, are armed with short tibial spurs.

Members of this genus inhabit small, slow streams, ditches and seepages, as well as larger streams, and are often found on ponds or sheltered lake shores with abundant litter or submerged vegetation as adults (Westfall and May 1996). Williamson (1915) restricted the genus to the current recognized group and Donnelly (1989a) discussed the relationships of the Central American species including *P. cara*.

***Protoneura cara* Calvert**

Orange-striped Threadtail

(Figs. 77-79, 140, Map 17)

Protoneura cara Calvert, 1903: 143.

Type. MEXICO.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan.

Watershed(s): Guadalupe, Nueces, Rio Grande, San Antonio.

General Distribution. UNITED STATES: TX; MEXICO: CAM, GRO, JAL, MOR, NAY, OAX, SLP, SON, TAM, VER; south to Guatemala and Honduras.

Seasonal Distribution. Jun. 19 (TX) - Oct. 14 (TX).

Identification. This is a relatively rare species that has only been documented in a few counties within the Hill Country of South Texas and the lower Rio Grande Valley. Males have a bright orange face with a dark black central spot. The top of the head is black with orange spots lateral to each antenna. The antehumeral area is mostly dark black with a metallic luster. The middorsal carina and 2/3 of the antealar carina are orange. The mesepimeron is black with orange margins and the mesopleural suture is traversed by a thin black line bordered by a wider orange stripe laterally. The legs are pale in color darkening slightly at their apices.

The first abdominal segment is black with a narrow pale apical band. Segment 2 is pale orange and segments 3-7 are dark dorsally, each with a pale basal ring. Segments 8-9 are black, each with pale ventrolateral margins and apical rings. Segment 10 is black except for a pale band posterolaterally.

The female is stockier, but otherwise very similar to the male in general

appearance. The abdomen differs only slightly in coloration. The dorsum of segments 1-2 and 10 are almost entirely black and the dark areas of the middle segments are expanded subapically. The mesostigmal plates are subtriangular in shape and have a prominent pale knob medially (Fig. 79).

Size. Total length: 34-38 mm; abdomen: 27-32 mm; hindwing: 16-19 mm.

Habitat. Well-shaded, slow moving streams, seepages and sheltered pond and lake shores with ample leaf litter.

Discussion. A photograph was taken of an ovipositing pair at the Houston Arboretum in 1988. These were probably an accidental introduction with aquatic plants (R. Orr, pers. comm.). They have not been documented there since. Oviposition typically occurs near the margin of slow moving water in floating and submerged vegetation and debris. The larva has not been discovered, but based on observations of *P. viridis* by Westfall (1964), it may live in leaf litter of small trickles and pools.

CHAPTER 7

COENAGRIONIDAE

Pond Damsels

This globally distributed family is the most diverse of the damselflies and accounts for nearly 50% of the species belonging to the suborder. Coenagrionids are the dominant damselfly family in North America and in our area. Fifty-six species and ten genera are found in our region. They are generally not metallic, but males may be marked with bright blues, greens, yellows, oranges and reds. Most are small and dainty and can be numerous in appropriate habitats. Many are pond inhabitants, but several, including members of the genus *Argia*, are found around streams. Many species are a challenge to identify in the field because of the similarity between species. Females are often dichromatic, with a homochromatic form looking like the male and a heterochromatic form differing from the male in both color and pattern.

The petiolate wings are hyaline and held closed over the abdomen when at rest. There are only two antenodal crossveins and the postnodal crossveins are generally in line with those below them. The veins M_3 and R_s originate much closer to the nodus than the arculus. The anal vein is fused with the posterior margin of the wing proximally, but is visibly free distally. The veins Cu_1 and Cu_2 are fully developed and extend beyond the level of the origin of vein M_2 . The quadrangle is rather short and trapezoidal in shape. The pterostigma is also short and generally surmounts only one or two cells. The legs are

shorter than those of other Zygopteran families in our area. The male superior caudal appendages are shorter than abdominal segment 10 and are not forcipitate or pincer-like.

The larvae are generally green or brown in color with a head that is quadrate or occasionally transversely elongate. Their eyes are quite prominent and the antennae are of normal length except for a shortened segment one. The prementum lacks a median cleft and the premental setae may number from zero (*Argia*) to five. The palpi are armed with a long articulating lateral hook and a medial shorter terminal hook. The gills are flattened, but may have a prominent midrib down their length and occasionally a nodus is present.

The reproductive territorial behavior of a number of species has been reviewed or studied by Bick (1972) and Bick and Bick (1980). Several Nearctic groups occurring in our region have been revised (Garrison 1984; Garrison 1994a; Bick and Bick 1995).

KEY TO ADULT GENERA OF COENAGRIONIDAE

- 1. Spines on 2nd and 3rd tibiae long, twice the length of intervening spaces, at least proximally *Argia*
- 1'. Spines on 2nd and 3rd tibiae, at most barely longer than the intervening spaces 2
- 2(1'). Prominent, moundlike ventral thoracic tubercle bearing numerous long, stiff setae; wings nearly equal in length to abdomen; robust red and black species *Amphiagrion abbreviatum*
- 2'. No prominent ventral thoracic tubercle present; wings at most 3/4 the length

- of the abdomen; more slender, usually not red and black (except *Telebasis*)
 3
- 3(2'). Dorsum of thorax and abdomen metallic green to bronze with some blue on abdominal segments 8-10; inferior caudal appendages of male with serrated posterior border in lateral view; prothoracic femora with 2 distinct external black stripes, 1 at base of spines *Nehalennia integricollis*
- 3'. Dorsum of thorax and abdomen usually not metallic green; inferior caudal appendages of male generally not serrated; prothoracic femora without black stripe or with one black stripe which may cover entire external surface 4
- 4(3'). Postocular area entirely pale or with pale spots ranging from narrow linear areas to large round spots, sometimes confluent with each other or with pale crest of occiput 5
- 4'. Postocular area dark, without pale spots, although crest of occiput may be pale
 14
- 5(4'). Vein M_2 arising proximal to or near 4th and 3rd postnodal crossveins in fore- and hindwings, respectively 6
- 5'. Vein M_2 arising near 5th and 4th postnodal crossveins or beyond in fore- and hindwings, respectively 8
- 6(5). Black humeral stripe divided along its entire length by a narrow, pale stripe; prothorax with a pale dorsomedial spot *Enallagma* (in part)
- 6'. Black humeral stripe entire along its length or lacking; prothorax without a pale, dorsomedial spot or entirely pale 7

- 7(6'). Anterior margin of forewing quadrangle less than 1/2 as long as distal margin; femora with a black apical band; costal margin of pterostigma usually twice as long as proximal margin *Neoerythromma cultellatum*
- 7'. Anterior margin of forewing quadrangle nearly as long as distal margin; femora without a dark apical band; costal margin of pterostigma at most slightly longer than proximal margin *Ischnura* (in part)
- 8(5'). Vein Cu₁ of forewing extends well beyond level of origin of M_{1a}, whereas Cu₁ of hindwing usually extends only to level of origin of M_{1a}; costal margin of forewing pterostigma (and often hindwing pterostigma) may be shorter than proximal margin *Hesperagrion heterodoxum* (in part)
- 8'. Vein Cu₁ similar in fore- and hindwings extending to or well beyond level of origin of M_{1a}; costal margin of pterostigma as long or longer than proximal margin in both pairs of wings 9
- 9(8'). Anal crossing links Cu to posterior border in fore- and hindwings 10
- 9'. Anal crossing links Cu to A, not reaching posterior border, in forewing and usually hindwings 11
- 10(9'). Abdominal segment 10 of male in lateral view two and one-half times higher than long, the dorsum projecting dorsoposteriorly; female with a pit on each side of the middorsal carina (Fig. 82) and cerci close together at base; southwest Texas *Acanthagrion quadratum*
- 10'. Abdominal segment 10 of male in lateral view less than twice as high as long, the dorsum flat, directed straight rearward; female without pits near middorsal

- carina, and cerci separated at base, usually by width of one cercus
- *Enallagma* (in part)
- 11(9'). Males 12
- 11'. Females 13
- 12(11). Abdominal segment 10 with a posterodorsally projecting bifid process at least
1/2 as long as segment; pterostigma of forewing different in shape, color or
size from pterostigma of hindwing *Ischnura* (in part)
- 12'. Abdominal segment 10 with at most a very low, widely bifid prominence 1/4
as long as segment; pterostigma of fore- and hindwings similar in color, shape
and size *Enallagma* (in part)
- 13(11'). Humeral suture usually pale, but if black stripe is present, then no apical spine
on venter of abdominal segment 8 *Ischnura* (in part)
- 13'. Humeral suture usually with a black stripe, but if pale, then an apical spine is
present on venter of abdominal segment 8 *Enallagma* (in part)
- 14(4'). Costal margin of pterostigma in forewing (and often hindwing) shorter than
proximal margin; female with ventroapical spine on abdominal segment 8;
thoracic middorsal black marking reaching humeral suture, thus pale
antehumeral stripe is split into anterior and posterior spots
- *Hesperagrion heterodoxum* (in part)
- 14'. Costal margin of pterostigma much longer than length of proximal margin;
female without a ventroapical spine on abdominal segment 8; thoracic
markings not as above 15

- 15(14'). M_{1a} extending for the length of 7-8 cells; metepimeron largely bright yellow; male predominantly blue and green *Chromagrion conditum*
- 15'. M_{1a} extending for the length of 4-5 cells; metepimeron predominantly pale red *Telebasis*

Genus *Acanthagrion* Sélys

Wedgetails

Acanthagrion Sélys, 1876.

Myagrion Förster, 1914.

This genus is species rich in the Neotropics and represents the ecological equivalent of *Enallagma* in North America (Westfall and May 1996). A single species approaches our southern boundaries. Most members of this genus are blue and black in color and have distinctive postocular spots. The wings are hyaline and petiolate as is the typical condition for the family. Vein M_2 usually arises near the 5th and 4th postnodal crossveins in the fore- and hindwing respectively (Fig. 142). The tibial spurs are only slightly longer than the spaces between them. The males may be readily distinguished by the characteristic downward sloping arrangement of the superior caudal appendages (Fig. 80) and the elevated abdominal segment 10.

Females may be readily separated from all other genera in our region by the cerci that touch or nearly touch medially, and the distinctive mesepisternal pits that are

contiguous with the middorsal carina (Fig. 82).

The most distinctive feature of this *Enallagma*-like larvae are the unusually long gills, greater than 3/4 the body length. They have 3 premental setae and 4 palpal setae. This group was revised by Leonard (1977), who provided keys and figures to adults of almost all known species. Kennedy (1916) illustrated the penes in this group.

***Acanthagrion quadratum* Sélys**

Mexican Wedgetail

(Figs. 80-82, 142, Map 18)

Acanthagrion gracile var. *quadratum* Sélys, 1876: 309.

Acanthagrion gracile, Calvert, 1902: 115.

Type. Mexico; IRSN.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: CHS, HGO, NLN, OAX, PUE, QRO, SLP, TAB, TAM, VER, YUC; south to Nicaragua.

Seasonal Distribution. Mar. 19 (TAM) - Sep. 7 (NLN).

Identification. The male, in life, has black eyes above fading to white below. The face is blue, with varying degrees of black markings. There are blue subcircular postocular

spots that are outlined in black. Generally there are pale spots lateral to each lateral ocellus. The middorsal carina varies from entirely black to partly blue. The middorsal stripe is black and extends $\frac{2}{5}$ to $\frac{1}{2}$ the width of the mesepisternum. There is a thin blue antehumeral stripe less than $\frac{1}{2}$ the width of the middorsal stripe. It is followed by a wider black humeral stripe. The remainder of the pterothorax is blue fading to cream ventrally. The legs are blue basally and pale distally with incomplete black stripes.

The abdominal segments 1-3 and 7-9 are blue, while segments 4-6 and 10 are pale or cream in color. There is a black subquadrate spot dorsally on segment 1. There is also a black dorsal stripe extending the full length of segment 2. All of the dorsum on segments 3-6 is black, with the exception of a narrow basal ring. The majority of segment 7 is black except for blue ventrolateral margins and apex. There is a black vertical streak on segments 8 and 9. Segment 10 is black for half its dorsal length. Abdominal segment 10 is highly elevated. The black superior caudal appendages are distinctive and slope downward at a $45-60^\circ$ angle (Fig. 80). The inferior caudal appendages are pale with black apically.

The female has eyes that fade from brown dorsally to cream ventrally, in life. The color pattern of the head and thorax are similar to that of the male but with the pale color more extensive. The mesostigmal plates are subtriangular with a distinct sulcus outlining the posterior margin (Fig. 82). The middorsal carina bifurcates at about $\frac{1}{4}$ of its length from the anterior end. There are distinctive pits just behind this bifurcation. The legs are similar to those of the male, but with the black more reduced.

The abdominal color pattern is similar to that of the male for segments 1-6.

Abdominal segments 7-8 are black dorsally, except for pale basal and apical rings. Segment 8 sometimes has blue for the apical 1/4 of its segment. Segment 9 is blue dorsally and black dorsolaterally. Segment 10 is blue dorsally and yellow ventrolaterally, occasionally with a narrow black apical ring. The larva remains undescribed, but based on reared material, Westfall and May (1996) included it in their key and our key is adapted from this work. This species may be confused in the field with a dark *Enallagma exsulans*.

Size. Total length: 29-33 mm; abdomen: 23-27 mm; hindwing: 15-18 mm.

Habitat. Weedy ponds and slow backwaters; perhaps intermittent streams.

Discussion. Nothing is published and very little is known of the habitat requirements for this species. Williamson (1916) made a few notes on this (as *A. gracilis*) and other *Acanthagrion* species.

Genus *Amphiagrion* Sélys

Red Damsels

Amphiagrion Sélys, 1876.

This small Nearctic genus is widely distributed throughout the United States. Only one species, possibly two, occur in our area. This group is instantly recognizable in the field by their stocky build and striking red and black coloration, the darker areas of which may become profuse with age. Its members also possess a distinctive large, heavily setose ventral tubercle posterior to the metathoracic legs. The costal margin of

the pterostigma is much longer than the R_1 margin (Fig. 143). The caudal appendages of the male are distinctive, with the superior appendages steeply declivent.

There has been considerable confusion between the two currently recognized species in this genus. The more robust western *A. abbreviatum* was considered a variety of the slimmer more eastern distributed *A. saucium* for a long time. Leonora K. Gloyd was working on a revision of this group before her death and at one time had planned on describing a third form from the midwestern states southwest into Arizona. It is still unclear what the relationship of these forms are. A specimen referable to the mid-American form was collected by G. Bick in Boiling Springs State Park, Woodward County, Oklahoma, and is now in the Florida State Collection of Arthropods.

The larvae are very similar to those of *Chromagrion* in that the posterolateral margins of the head are sharply angulate. Despite the widespread nature of this group in North America, individuals never seem to stray far from their breeding sites (Walker 1953). Adults of both species seem to fly low amongst vegetation (Westfall and May 1997).

Amphiagrion abbreviatum (Sélys)

Western Red Damsel

(Figs. 83-85, 143, Map 19)

Pyrrhosoma abbreviatum Sélys, 1876: 1299.

Amphiagrion saucium, Kennedy, 1915b: 326.

Amphiagrion abbreviatum, Walker and Ricker, 1938: 148.

Type. N. America.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Texan.

Watershed(s): Canadian, Red, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, ID, MT, NV, NM, OK, OR, UT, WA, WY; CANADA: Alb., B.C., Sask.; MEXICO: BCA.

Seasonal Distribution. Apr. 4 (OK) - Aug. 7 (NM).

Identification. The head and thorax of males are profusely hairy. The head is mostly dark red in younger individuals, changing to almost entirely black with age. There may be a small amount of red around the antennal bases, ocelli, occipital ridge and eyes. Postocular spots are generally lacking. The pterothorax is usually strongly black, but sometimes the metathorax is red except for sutures. There is a prominent ventral tubercle behind the metathoracic legs. The legs are short and vary from red to yellow with black stripes. They become increasingly darker with age, especially proximally. The wings are hyaline with light red venation and a dark pterostigma.

The abdomen is noticeably short, not much longer than the wings, and red, with black apical rings on segments 3-6. There are often black, dorsolateral spots, that increase in size, on segments 2-7. Segments 8-10 are black with only a thin red middorsal line. The superior and inferior caudal appendages are light red. The superior caudal appendages are strongly slanted downward (Figs. 83-84).

The female is uniformly tan, often lacking dark pigmentation, with generally dark dorsolateral spots at the apices of the abdominal segments. Occasionally there are paired, dorsal, subapical spots on segments 3, 4 or 5 to 9. There is a dark crescent on the frontal suture and darker spots between the ocelli. Occasionally outlines of large postocular spots are visible. The caudal appendages are all pale.

Size. Total length: 23-28 mm; abdomen: 17-21 mm; hindwing: 15-19 mm.

Habitat. Sunlit, shallow, hard-bottomed marshy ponds or sloughs with vertical perches.

Discussion. This species has only been taken in the northern and western limits of our area. Very little is known of its reproductive behavior and biology (Bick and Bick 1980). Walker (1953) noted, however, that populations can become quite large in areas of suitable habitat. Pritchard and Kortellow (1997) studied the roosting and perching behavior of a Canadian population of this species. They found *A. abbreviatum* conspicuously absent from the heavily treed areas, apparently due to the absence of sunlit vertical perches. *Amphiagrion abbreviatum* roosts parallel to these vertical perches at night and press their bodies closer to the perches in response to intruders during the early morning before they are warm enough to fly.

Genus *Argia* Rambur

Dancers

Argia Rambur, 1842.

Hygoneura Sélys, 1854.

Diargia Calvert, 1909.

Chalcargia Kennedy, 1920.

Cyanargia Kennedy, 1920.

Heliargia Kennedy, 1920.

Leptargia Kennedy, 1920.

Micrargia Kennedy, 1920.

This is an extremely species rich group, confined entirely to the New World. Garrison (1994a) reported that there have been over 150 names proposed for this group, but only 110 are to be considered valid. The problems of name association with specimens were discussed by Sélys (1865), Calvert (1901-1908) and Fraser (1946). Calvert (1901-1908) developed a key to the Central American species known at the time and Garrison (1994a) recently conducted a marvelous review of the species known from the United States with numerous illustrations and keys to adults. Johnson (1972a) presented excellent keys for many of the species in the region (15 of 18). He presented many diagnostic illustrations based on Gloyd's (1958) analysis of the group in the Big Bend area of Texas.

Garrison (1994a) discussed a combination of three characters that can be used to readily separate this genus from all other coenagrionids. First, the wings are stalked well before the level of anal crossing (Ac) so that the distance between the ending of petiolation and the origination of the Ac is longer than the Ac (Fig. 144). Secondly, the tibial spurs, multicellular movable projections (see Dunkle 1989b, for discussion of spurs versus spines), in both sexes are longer than their intervening spaces (this is also seen in

some species of *Nehalennia*, but none that occur in our area). Third, males possess a pair of tori, specialized pad-like structures on the declivous posterodorsal surface of abdominal segment 10 (Fig. 87). Gloyd (1958) was the first to describe and illustrate these structures. The superior caudal appendages are quite short, while the inferior appendages are longer and often bifurcate. Females lack a vulvar spine on abdominal segment 8. Moulton *et al.* (1987) and Justus *et al.* (1990) examined the mesostigmal plates of nine species, all occurring in our area, using electron microscopy.

The larvae are quite distinctive in appearance; they are generally dorsoventrally compressed and rather short and stout. The postocular lobes are well-rounded and prominent, bearing setae. The antennae are 7-segmented and usually no longer than the head. They lack premental setae and generally possess 1-4 palpal setae. The palpal lobes distad to the movable hook are divided into two pointed branches, the medial one of which is longer and terminal. The gills are rather short and broad rarely less than $2/3$ as broad as long. They are generally rounded distally and lacking a nodus.

Adults of this group are commonly seen because of their habit of alighting on open sunny perches, such as along paths and streams. Most species are confined to streams or other lotic situations, but some are associated with lakes and ponds. The female oviposits in tandem or solitary. Some species such as the common big river species, *A. moesta*, may completely submerge themselves, remaining underwater for extended periods of more than half an hour (Westfall and May 1996).

The keys below include 18 of the 29 species reported in North America north of Mexico and are modified from Garrison's (1994a) excellent revision of the group and

Westfall and May (1996).

KEY TO ADULT SPECIES OF *ARGIA*

MALES

1. Middorsal carina with separate lines on each side running parallel to, but not confluent with, the carina itself; these lines may be confluent at the anterior or posterior end, or markings may be obscured by black in mature individuals; large, length of abdomen 33-41 mm; hindwings usually with 5-6 postquadrangular antenodal cells *lugens*
- 1'. Middorsal area of thorax with a single line; thoracic markings are seldom obscured by black or pruinosity; abdomen usually less than 35 mm; hindwings usually with 3-4 postquadrangular antenodal cells 2
- 2(1'). Thoracic dorsum metallic copper often with red reflections *cuprea*
- 2'. Thoracic dorsum pale not metallic 3
- 3(2'). Epiproct twice as long as wide, extending almost to tips of superior caudal appendages (Fig. 93), these appendages acutely cleft apically; eastern part of region *bipunctulata*
- 3'. Epiproct short, extending little beyond base of superior caudal appendages, if any 4
- 4(3'). Superior caudal appendages in dorsomedial view widely divergent, the upper branch thicker than the longer, ventrally directed blunt branch (Fig. 119)

- *tibialis*
- 4'. Superior caudal appendages in dorsomedial view not widely divergent, distal margin may be entire, dentate, forked or tridentate 5
- 5(4'). Mesal margin of superior caudal appendage in dorsomedial view with a long, ventrally pointed tooth, followed distally by a smaller blunt tooth (Fig. 88) ...
..... *apicalis*
- 5'. Mesal margin of superior caudal appendage in dorsomedial view smoothly curved (Fig. 90), with a small ventral tooth (Fig. 114) or with a mesoventrally directed blunt lobe (Fig. 111) 6
- 6(5'). Inferior caudal appendages in lateral view not bifid (Fig. 103, 106, 114) 7
- 6'. Inferior caudal appendages in lateral view bifid (Fig. 90, 96, 102) 8
- 7(6). Wings amber; torus large, transversely elongate and greater than the width of the superior caudal appendage in dorsal view (Fig. 115); hindwing 19.5-21 mm *rhoadsi*
- 7'. Wings hyaline; torus small, circular and less than the width of each superior caudal appendage in dorsal view (Fig. 107); hindwing 22-27 mm
..... *moesta*
- 8(6'). Superior caudal appendage in dorsomedial view with a mesally or mesoventrally directed lobe (not tooth) along the mesal edge followed along distal margin by a robust, obtuse black tooth (Fig. 96, 102, 109), or ventrally directed costate ridge (Fig. 98) 9
- 8'. Superior caudal appendage in dorsomedial view with no mesally or

- mesoventrally directed lobe, usually armed with a decumbent tooth or divided into subequal branches (Fig. 90) 12
- 9(8). The middle lobe of the superior caudal appendage is small and ventrally recurved (Fig. 99); the apical margin of the superior appendage in posterior view lacks a tooth (Fig. 98); the upper branch of the inferior appendages are usually roundly pointed with a small anteapical tooth; New Mexico and extreme west Texas, south through northern Mexico *hinei*
- 9'. The middle lobe of the superior caudal appendage clearly visible and directed mesally or ventrally (Fig. 103); apical margin of superior appendage in posterior view with a well developed tooth (may be small in *A. leonorae*); the upper branch of the inferior appendages usually terminating in a sharp tooth 10
- 10(9'). The forewing with 3 postquadrangular cells; superior caudal appendages in dorsal view with medial margin subequal to outer margin, appearing quadrate (Fig. 103); the middle lobe of superior appendage small and somewhat recurved; small species (hindwing 15-19 mm) *leonorae*
- 10'. The forewing with 4 postquadrangular cells; superior caudal appendages in dorsal view with medial margin shorter than outer margin, appearing elongate posterodistally (Fig. 97, 111); the middle lobe of superior appendage with a prominent distal tooth; larger species (hindwing 19-21 mm) 11
- 11(10'). Superior caudal appendage in posterior view with middle lobe directed mesoventrally; the distance between tip of middle lobe and tooth about twice

- the distance between tooth and outer tip of appendage; body pale blue in color *nahuana*
- 11'. Superior caudal appendage in posterior view with middle lobe directed ventrally; the distance between tip of lobe and tooth subequal to distance between tooth and outer tip of appendage; body pale violet in color
..... *fumipennis*
- 12(8)'. Superior caudal appendage in dorsal view straight, twice as long as wide, sides parallel and tip unidentate (Fig. 117) or divided (Figs. 87, 91) 13
- 12'. Superior caudal appendage in dorsal view thick and stocky, less than twice as long as wide, sides are curvilinear with apical margin often differentiated into divided branches or acutely pointed (Figs. 121) 15
- 13(12)'. Dorsum of abdominal segments 3-6 largely pale, only posterior 1/5 of each segment black; larger species, hindwing 22-25 mm; superior caudal appendage in dorsal view robust toward base, tip divided with inner branch the longer (Fig. 91); Texas Hill Country southward *barretti* (in part)
- 13'. Dorsum of abdominal segments 3-6 largely black; smaller species, hindwing 16-20mm; superior caudal appendage in dorsal view mostly linear, tip weakly divided or supporting one tooth 14
- 14(13)'. Tip of superior caudal appendage in dorsomedial view weakly divided, the inner branch a decumbent tooth, the outer branch a simple lobe (Fig. 87); torus well defined and transverse; dorsal margin of lower branch of inferior caudal appendage smooth (Fig. 86); Oklahoma and New Mexico *alberta*

- 14'. Tip of superior caudal appendage in dorsomedial view truncate, the middle angle supporting a decumbent tooth; torus poorly defined; dorsal margin of lower branch of inferior caudal appendage serrate (Fig. 116) *sedula*
- 15(12)'. Superior caudal appendage in dorsomedial view appearing divided with subequal branches (Figs. 91, 101) 16
- 15'. Superior caudal appendage in dorsomedial view entire, but armed with a single decumbent tooth at extremity (Figs. 109, 113) 17
- 16(15)'. Superior caudal appendage in dorsomedial view with inner branch distinctly longer than outer branch (Fig. 91); inferior caudal appendage longer than high, upper branch a broadly based triangle (Fig. 90); rear of head mostly black ...
..... *barretti* (in part)
- 16'. Superior caudal appendage in dorsomedial view with branches equal (Fig. 101); paraproct as high or higher than wide (Fig. 100); rear of head mostly pale *immunda*
- 17(15)'. Superior caudal appendage in dorsomedial view longer along the middle margin, the area ending in a tooth (Figs. 109, 121) 18
- 17'. Superior caudal appendage in dorsomedial view rounded apically (Fig. 113) .
..... *plana*
- 18(17)'. Rear of head black; dorsum of abdominal segments 3-6 predominately black with pale basal rings one each segment *translata*
- 18'. Rear of head pale; dorsum of abdominal segments 3-6 predominately pale, with no more than distal 1/4 black; Texas Hill Country westward ... *munda*

FEMALES

1. Middorsal area of thorax consisting of a dark line along carina and a separate streak on each side or with these areas confluent only at the anterior or posterior ends; posterior lobes of mesostigmal plates very long, prominent and distinctly diverging; two rows of cells between Cu_2 and hindmargin of wing *lugens*
- 1'. Middorsal area of thorax with a single dark line or stripe, or if divided as above (as in some *A. moesta*) the posterior lobes of the mesostigmal plates are not so prominent and do not diverge distinctly; one row of cells between Cu_2 and hind margin of wing 2
- 2(1'). Mesostigmal plates each with a small lobe just lateral to the mesepisternal pit and with a distinct dorsal posterior ridge medial to each lobe (Fig. 132); large species with abdomen generally longer than 32 mm; pterostigma surmounting more than 1 cell *moesta*
- 2'. Mesostigmal plates without a small lobe just lateral to the mesepisternal pit and or lacking a distinct dorsal posterior ridge (Fig. 126, 137); smaller, abdomen generally shorter than 32 mm; pterostigma surmounting no more than 1 cell 3
- 3(2'). Middorsal and humeral stripes and rear of head brilliant metallic red with coppery reflections; hind margin of prothorax quadrate *cuprea*
- 3'. Middorsal and humeral stripes not metallic red and lacking coppery reflections; hind margin of prothorax not quadrate 4

- 4(3'). Posterior lobe of mesostigmal plate forming a flange-like ridge, extending at least 3/4 the width of plate and increasing in height medially (Fig. 137); abdominal segments 8-10 pale dorsally *sedula*
- 4'. Posterior lobe of mesostigmal plate, if present, variously formed but very rarely with ventral surface visible in strict lateral view; if ventral surface of plate is entirely visible (*A. alberta*), then at least segments 8 and 9 with dorsal black markings 5
- 5(4'). Dorsum of abdominal segments 3-6 (and segment 4 in *A. bipunctulata*) almost entirely black, the pale areas restricted to basal transverse band and/or a dorsal hairline or spindle-shaped mark 6
- 5'. Dorsum of abdominal segments 3-6 with pale areas usually considerably more extensive 12
- 6(5). Mesepisternal tubercles fairly prominent with deep mesepisternal pits (Fig. 139) *translata*
- 6'. Mesepisternal tubercles not prominent, usually absent 7
- 7(6'). Middorsal thoracic stripe less than 1/10 width of thoracic dorsum 8
- 7'. Middorsal thoracic stripe 1/4 or more the width of thoracic dorsum 9
- 8(7). Posterior lobe of mesostigmal plates large and prominent in lateral view; wings distinctly smoky; abdominal segments 9-10 mostly pale dorsally *rhoadsi*
- 8'. Posterior lobe of mesostigmal plates small and not prominent in lateral view; wings hyaline or only slightly smoky; abdominal segments 9-10 black dorsally

- *apicalis* (in part)
- 9(7'). Postocular spots absent or reduced and scarcely larger than the ocelli, pale stripe bordering posterodorsal margin of eye; abdominal segment 8 mostly pale dorsally, segment 9 black; abdomen less than 24 mm
- *bipunctulata*
- 9'. Postocular spots present and at least twice the diameter of the ocelli, pale stripe absent; abdominal segment 8 with extensive dark areas dorsally or if entirely pale, then segment 9 is also pale; abdomen greater than 25 mm ... 10
- 10(9'). Forewing with 3 postquadrangular antenodal cells *leonorae*
- 10'. Forewing with 4 postquadrangular antenodal cells 11
- 11(10'). Abdominal segments 3-7 with distal black bands complete and well-defined laterally; pale dorsal stripe of segment 9 often not extending to base of segment, sometimes merely an apical spot; arms of middorsal thoracic carina anterior to its bifurcation forming an angle of 90° or more
- *tibialis*
- 11'. Abdominal segments 3-7 with distal black bands absent, divided laterally, or containing a pale lateral spot; pale dorsal stripe of segment 9 always extending to base of segment; arms of middorsal thoracic carina anterior to its bifurcation forming an angle considerably less than 90°
- *apicalis* (in part)
- 12(5'). Mesepisternal pits prominent and deep, very little covered by the posterior lobes of the mesostigmal plates (Fig. 133) *munda*

- 12'. Mesepisternal pits not especially large, usually at least 1/2 covered by the lobes of the mesostigmal plates (Fig. 123, 135) 13
- 13(12'). Middorsal thoracic stripe less than 1/3 the width of the thoracic dorsum, often little more than a hairline *apicalis* (in part)
- 13'. Middorsal thoracic stripe greater than 1/3 the width of the thoracic dorsum ..
..... 14
- 14(13'). Abdominal segments 8 and 9 entirely pale dorsally or with black spots on segment 9 15
- 14'. Abdominal segments 8 and 9 both with definite black areas 16
- 15(14). Mesepisternal tubercle present, although quite broad and low, not prominent; posterior lobe of mesostigmal plates subangulate (Fig. 135); black markings on segment 2 consisting of an apical spot thinly connected to a smaller basal spots *plana*
- 15'. Mesepisternal tubercle entirely absent; mesostigmal plate without a posterior lobe, although the posterior margin may be somewhat elevated, giving the appearance of a lobe in lateral view; black markings on segment 2 usually consisting of a stripe extending almost the length of the segment
..... *immunda*
- 16 (14'). Abdominal segments 3-4, and often 5, with subbasal black spots or streaks not confluent with the apical black band; abdomen no longer than 28 mm 17
- 16'. Abdominal segments 3-4 with black stripe usually more or less broadly confluent with the apical black band, or with the dorsum entirely black, if

- these stripes aren't confluent with apical band, then abdomen is longer than 30 mm 18
- 17(16). Mesostigmal plates without a posterior lobe; middorsal thoracic carina bifurcating well behind the posterior border of the mesostigmal plates and diverging widely *alberta*
- 17'. Mesostigmal plates with a distinct posterior lobe (Fig. 122); middorsal thoracic carina bifurcating only slightly behind the posterior border of the mesostigmal plates, and not diverging widely *nahuana*
- 18(16'). Abdomen longer than 30 mm; posterior lobe of mesostigmal plates large and directed distinctly medially *barretti*
- 18'. Abdomen 28 mm or less; posterior lobe of mesostigmal plates smaller and directed posteriorly and only slightly medially (Fig. 124) 19
- 19(18'). Posterior lobe of mesostigmal plates usually subacute and not apparently bilobed in lateral view *hinei*
- 19'. Posterior lobe of mesostigmal plates rounded and appearing very slightly scoop-shaped or bilobed in lateral view *fumipennis*

Argia alberta Kennedy

Paiute Dancer

(Figs. 86, 87, 122, Map 20)

Type. Owens River, Laws, Inyo County, California; USNM.

Regional Distribution.

Biotic Province(s): Kansan, Texan.

Watershed(s): Cimarron, Colorado, Red.

General Distribution. UNITED STATES: AZ, CA, CO, ID, IA, KS, MT, NE, NV, NM, OK, OR, SD, UT, WY.

Seasonal Distribution. Aug. 16 (OK).

Identification. The dark coloration and elongate, linear cerci will readily distinguish this small species from all others in our area, except *A. sedula*. The labrum of the male is a paler blue than the rest of the head. The eyes are dark blue dorsally becoming paler ventrally. There is a dark wide "T" spot anterior to the median ocellus. There are small blue postocular spots. The pterothorax is a pale blue, violet or even brown, but is generally darker dorsally becoming lighter laterally. The black middorsal stripe is nearly twice the width of the pale antehumeral stripe. The black humeral stripe is forked at its upper third and is half the width of the pale antehumeral stripe. The legs are pale, but with blue basally on femora and anteriorly on the inner surface of the tibiae. The tarsi are dark, often black. The wings are hyaline with a light brown pterostigma subtending a single cell. There are 3 postquadrangular cell in each wing.

Abdominal segments 1 and 2 are blue. Segment 1 has a black spot dorsobasally. Segment 2 has a nearly full-length black stripe laterally. Segments 3-7 are dark black dorsally with a basal blue ring, and blue-brown laterally. Segments 8-10 are blue with

dark ventrolateral markings. The epiproct is small, when viewed dorsally, in the apical cleft of segment 10. The tori are separated by a distance equal to their width. The superior caudal appendages are about half the length of segment 10. They are divergent dorsally with a prominent ventrally directed, internal hook at their apex. The inferior appendages are distinctly bifid with the lower branch rounded and projecting only slightly posteriorly. The upper branch is more pointed and distinctly directed dorsally.

The head of the female is generally paler than in the male and in dried specimens may even appear olive gray or tan. The postocular spots are much larger. The humeral stripe of the pterothorax is narrower than in males and symmetrically forked in its upper half. The legs are similarly colored to the male, but with black markings less extensive. The mesostigmal plates have no special modifications, lacking a posterior lobe. The medial posterior border is raised into a distinct rim (Fig. 122). The middorsal thoracic carina bifurcates, diverging widely, well behind the posterior border of each mesostigmal plate and mesepisternal tubercles are lacking.

Size. Total length: 27-32 mm; abdomen: 21-25 mm; hindwing: 16-20 mm.

Habitat. Small flowing streams or marshy springs.

Discussion. *Argia alberta* is primarily a Great Basin species whose distribution extends only to western Oklahoma and southern New Mexico in our region. It is most commonly taken at creeks, but northern specimens have been taken at hot springs (Westfall and May 1996). Provonsha (1975) reported that oviposition occurs in tandem.

Argia apicalis (Say)

Blue-fronted Dancer

(Figs. 88-89, 123, 144, Map 21)

Agrion apicalis Say, 1839: 40.*Argia apicalis* Sélys, 1865: 414.**Type.** United States; lost.**Regional Distribution.***Biotic Province(s):* Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.*Watershed(s):* Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, Saint Francis, Trinity, White.**General Distribution.** UNITED STATES: AL, AR, CO, DE, DC, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, NE, NJ, NM, NY, NC, ND, OH, OK, PA, SC, SD, TN, TX, VA, WV, WI; CANADA: Ont.; MEXICO: NLN.**Seasonal Distribution.** Mar. 21 (TX) - Nov. 24 (LA).**Identification.** The head of the male is pale blue anterior to the ocelli. There is black behind the ocelli with stripes extending forward to the base of the antennae. There are pale blue occipital spots that are sometimes connected. The pterothorax is pale blue, but may have a green cast to it in preserved specimens. The lower lateral third and ventral

parts of the pterothorax are pale yellow and become somewhat pruinose with age. The black thoracic markings are never obscured, though the middorsal carina is thinly lined with black. The humeral suture bears only a hairline black stripe widening above and below. The legs are pale, darkly marked with black on the outer surfaces of the femora and inner surfaces of the tibiae and tarsi. The wings are hyaline with a brown pterostigma subtending one cell. There are four and three postquadrangular cells in the fore- and hindwing respectively.

The abdominal color pattern is black dorsally on segments 1-7, except for pale blue basal rings on segments 3-7. These black markings widen posteriorly to touch the sterna. Segments 8-10 are uniformly pale blue over their entire length. The ventrolateral areas of these segments are black. The superior caudal appendages are short and blunt when viewed laterally, but when viewed posteriorly two decurved hooks are visible. The inferior appendages extend out beyond the superiors, but both are shorter than or subequal in length to segment 10. These inferior appendages are distinctly bifid. The tori are raised above the plane of view.

The head of the female is very similarly colored to that of the male. The dark humeral stripe is usually very thin, as in the male, but occasionally may extend to the mesepimeron. The mesostigmal plates lack posterior lobes, but when viewed laterally the anterior carina is usually visible. The mesepisternal tubercles are very small or absent entirely. The legs are colored as in the male. The wings are hyaline, but with a lighter pterostigma than in males. The abdominal color pattern is similar to the male, but often with more extensive black markings. Segments 8-10 are black dorsally, each with a pale

brown dorsolateral stripe.

This common species may be confused with *A. tibialis* and *A. moesta* females at first glance. The very narrow middorsal thoracic stripe and reduced humeral stripe will distinguish this species, however, from all others in our area. The male superior caudal appendages are distinctive.

Size. Total length: 33-40 mm; abdomen: 26-32 mm; hindwing: 21-25 mm.

Habitat. Large rivers and occasionally streams, lakes or ponds.

Discussion. This species flies with a characteristic dancing movement (Westfall and May 1996). Bick (1963) and Bick and Bick (1965a) studied a population of this species residing at a small pasture pond in Marshall County, Oklahoma. They found that males and females reached reproductive age at an average of 8.4 and 7.0 days, respectively. Maximum activity was at noon. They found males at the water 44% of the days they lived and females only 20%; however, males only mated on 20% of these days and females 89%. Repeat matings, in both sexes, were rare. The movement from roosting sites to the water was characterized by a random shifting, with males arriving at the water earlier than females and spacing themselves at six-foot intervals. Copulation occurred a short distance from the main concentration of males and lasted 16 minutes. Ovipositing females were gregarious laying eggs, either in tandem (75% of the time) or alone, in willow roots, boards and sticks. Males turn dark while in tandem Dunkle (1990).

Upon further study of this Oklahoma population, Bick and Bick (1965b) found that males occurred in two color phases: bright blue and gray-black, and that color change could not be correlated positively with age or reproduction. The gray-black phase seemed

to be the more temporary condition, but intervening changes in both directions with a maximum of eight in 12 days was recorded. In the same study they found that females occurred in three color phases: brown, turquoise and gray-black. Changes occurred as with males and could not be correlated to age or reproduction.

Dunkle (1990) discussed males exhibiting intra- and interspecific competition, flicking their wings as a warning to intruders in their territory, and that males live more than a month. On hot days they thermoregulate by raising their abdomen to a 60° angle, reducing the surface area exposed to the sun.

Williamson (1906) discussed the copulation in this species. Johnson (1972b) illustrated the variable thoracic stripe patterns seen in individuals along the periphery of its southeastern distribution. He found both a broad-striped form, with a wide full length humeral stripe, and the more typical form with a reduced pattern, as seen in our area. Bick and Bick (1980) listed numerous references dealing with sperm translocation, copulation and oviposition in this species.

Argia barretti Calvert

Comanche Dancer

(Figs. 90-91, 124, Map 22)

Argia barretti Calvert, 1902: 87.

Type. Linares, Nuevo Leon, Mexico; ANSP.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Tamaulipan.

Watershed(s): Guadalupe, Rio Grande, Nueces, San Antonio.

General Distribution. UNITED STATES: TX; MEXICO: MEX, PUE, SLP, TAM.

Seasonal Distribution. May 10 (TX) - Nov. 5 (TX).

Identification. The face of the male is blue except for a black hairline stripe on the frontoclypeal suture. The large pale postocular spots are broadly confluent with the compound eyes. There is a distinct thin blue occipital bar present between these spots and it is usually divided medially. There is a pale yellow " Δ " lateral to each lateral ocellus and a thin black "T" anterior to the median ocellus. The pterothorax is blue with a strong black middorsal stripe that is half as wide as the blue antehumeral stripe next to it. The humeral stripe is straight, but narrows posteriorly. The legs are solid black exteriorly and lighter medially. The wings are of the typical hyaline condition with a small pterostigma subtending a single cell. There are usually 5 and 4 postquadrangular cells in the fore- and hindwings respectively.

The abdomen is predominately blue dorsally with black ventrolateral stripes widening posteriorly and becoming more pronounced on segments 6 and 7. These ventrolateral stripes form a confluent ring posteriorly around each segment. Segment 7 is almost entirely black dorsally and segments 8-10 are blue dorsally with only a narrow black stripe laterally. The superior caudal appendages are only $2/3$ the length of the inferior appendages. These superior appendages are distinctly bifid in dorsal view. The inferior appendages are bifid with the upper branch directed dorsally and the lower branch

directed posteriorly; the angle between the two is approximately 90° . The tori are as long as they are wide.

The female color pattern is very similar to that of the male, but paler, often with tan or light brown colors replacing blues. The dark thoracic markings are less extensive. The humeral stripe is diffuse brown for the lower half of the suture and black in its upper half. The mesostigmal plates in dorsal view possess a posterior lobe that is large, less than half the width of the plate itself. These lobes are not constricted basally and their apices are directed medially. The mesepisternal tubercles are present, but generally small and reduced in size. The legs are lighter with less extensive black markings. The wings are hyaline, but with the pterostigma lighter than in males.

This relatively large blue species can be recognized by its limited southern distribution in our area and its straight, strongly bifid superior caudal appendages (Fig. 90). The medial branch is longer than the lateral branch. The similar *A. alberta* is smaller and has a more northern distribution.

Size. Total length: 38-43 mm; abdomen: 31-34 mm; hindwing: 22-25 mm.

Habitat. Rivers and streams.

Discussion. This species has a primarily Mexican distribution, occurring in the states of Nuevo Leon and Tamaulipas in our area, northward to the Hill Country of Texas. Gloyd (1932) reported it for the first time after its description in Kimble County, Texas.

Oviposition occurs in tandem on floating debris at the rivers edge. The larva is unknown, as are details of its reproductive behavior.

***Argia bipunctulata* (Hagen)**

Seepage Dancer

(Figs. 92-93, 125, Map 23)

Agrion bipunctulatum Hagen, 1861: 90.*Argia bipunctulata* Hagen in Sélys, 1865: 415.**Type.** Georgia; MCZ.**Regional Distribution.***Biotic Province(s):* Austroriparian, Texan.*Watershed(s):* Arkansas, Neches, Red.**General Distribution.** UNITED STATES: AL, AR, DE, DC, FL, GA, KS, KY, LA, MD, MI, MS, MO, NH, NJ, NY, NC, OH, OK, PA, SC, TN, TX, VA.**Seasonal Distribution.** May 17 (TX) - Aug. 26 (OK).**Identification.** The smallest *Argia* in the United States, this eastern species is primarily restricted to the Austroriparian province of our region. Its small size and unusually large bifid epiproct will readily distinguish it from all others in our region (Fig. 93). The face of the male is light blue with only a single medial black spot at the base of the labrum and on either side of the postclypeus. The top of the head is black and postocular spots are lacking. There is a pale blue medially divided occipital bar, a small circular spot lateral to each lateral ocellus and a narrow stripe bordering each compound eye. The pterothorax is entirely black dorsally and pale blue laterally, with a narrow pale

antehumeral stripe that is half the width of the black humeral stripe. The metapleural suture is highlighted by a thin black line. The legs are pale with black stripes on the outer surfaces of the femora and tibiae. The tarsi are black. The wings are hyaline with a light brown pterostigma subtending a single cell. There are 3 postquadrangular cells in both wings.

The color of abdominal segments 1 and 2 is blue becoming paler laterally. There is a single median black spot at the base of segment 1 and a pair of black spots at the posterior margin of segment 2. The latter spots may be confluent and often join with the black apical ring on segment 2. There is a dark band on the apical quarter of segment 3 that surrounds a pale blue spot laterally. Segments 4 and 5 have a black band for a third of the segment. Segment 6 may have an apical band occupying as much as half of the segment. Segment 7 is entirely black except for a blue basal ring. Segments 8-10 are entirely blue. The superior and inferior caudal appendages are approximately the same length. In dorsal view, the tori are as large and as wide as the superior appendages (Fig. 93).

The female coloration is very similar to that of the male, but with pale colors often yellow or tan. There are small postocular spots that may be fused with a stripe confluent with the compound eye. The mesostigmal plates have poorly developed lobes. The medial corner of the rear margin of each plate projects medially (Fig. 125). The mesepisternal tubercles are lacking. The abdominal color is mostly black dorsally, with only a light basal ring on segments 3-7. Segment 8 is pale dorsally and black laterally. Segments 9 and 10 are solid black.

Size. Total length: 23-30 mm; abdomen: 18-24 mm; hindwing: 13-18 mm.

Habitat. Associated with sunny sphagnum seepages (Garrison 1994), small lakes, ponds and streams.

Discussion. The absence of available perching sites on the open ground in this species' habitat generally results in its perching vertically on grass stems singly and in pairs (Dunkle 1990).

Argia cuprea (Hagen)

Coppery Dancer

(Figs. 94-95, 128, Map 24)

Agrion cupreum Hagen 1861: 96.

Argia cuprea, Hagen in Sélys, 1865: 409.

Type. Cordova, Mexico; see Garrison (1994a) for discussion.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan.

Watershed(s): Nueces, Rio Grande, San Antonio.

General Distribution. UNITED STATES: TX; MEXICO: HGO, NAY, NLN, QRO, SLP, TAB, VER; south to Venezuela & Bolivia.

Seasonal Distribution. Apr. 12 (TX) - Aug. 16 (TX).

Identification. This species of the Texas Hill Country and eastern Mexico is instantly

recognizable, since it is the only species in our area with brilliant cherry red eyes and a metallic coppery-red thorax. The thorax and mostly black abdomen are marked with blue.

The male has brilliant red eyes in life. The front of the head, including the labrum, clypeus and frons are metallic coppery-red. There is a small oblong yellow spot lateral to each ocellus and a pair of small round blue postocular spots. The pterothorax is brilliant metallic red with coppery reflections. The middorsal carina is thinly lined with black and the antehumeral stripe is lacking. The sides of the thorax are blue, fading to pale yellow ventrally. There is a black spot on the upper portion of the metapleural suture. The legs are black, but with a pale brown stripe on the outer surface of the femora and tibiae. The wings are typically hyaline with a dark brown pterostigma subtending a single cell. There are 5 and 4 postquadrangular cells in the fore- and hindwing respectively.

The first abdominal segment is blue with a black spot dorsally that may be confluent with the lateral spots basally. Segments 2-7 are black with a shiny luster dorsally and basal blue rings. This black extends to the ventral side in the distal 1/5 of each segment. The rest of the abdomen is blue laterally, fading ventrally. Segment 8 is black dorsally with extensive blue basally and laterally. The blue is interrupted, laterally, by a black stripe extending to segment 10. Segments 9 and 10 are blue except for the above mentioned lateral black stripe. The superior caudal appendages are branched and about 3/4 the length of the inferior appendages (Fig. 94). The lower lobe of the latter is long and acute. When viewed dorsally, the tori are only about 1/2 as wide as the superior

appendages (Fig. 95).

The coloration of the female closely resembles that of the male. The front of the head is pale yellowish. There is a pale antehumeral stripe extending approximately half the width of the middorsal stripe. The dark humeral stripe is twice the width of the antehumeral stripe and consists of an isolated spot at its upper end. The mesostigmal plates have strongly explanate lobes (Fig. 128) that may lend to confusion with the sympatric *A. translata*. The color pattern described above and the posteriorly deflected mesal margin of the mesostigmal lobes, when viewed laterally, will immediately separate the two. The mesostigmal lobes in *A. translata* are planar (Fig. 139). The mesepisternal tubercles are present.

Abdominal segments 2-8 are black dorsally. There is a pale middorsal line extending the length of those segments. Segments 3-7 have a pale basal ring that is interrupted in the middle of segments 3 and 4. Segment 8 is black dorsally and often has 2 stripes, isolated by a pale area, extending the length of the segment. In other specimens there are 2 basal black spots that don't extend to the end of the segment. Segment 9 has 2 basal spots dorsally that extend half the length of the segment. Segments 8 and 9 also have a lateral black stripe. Segment 10 is nearly all blue.

Size. Total length: 39-42 mm; abdomen: 27-34 mm; hindwing: 22-25 mm.

Habitat. Rivers and streams with emergent vegetation.

Discussion. This species was not known from the United States until 1985 (Westfall and May 1996). It has been taken from the Nueces and West Frio Rivers of the Texas Hill Country quite frequently since (Flint 1993; G. Harp & D. Petr pers. comm.; pers. obs.).

Nothing has been published on the reproductive behavior and biology of this species.

***Argia fumipennis* (Burmeister)**

Variable Dancer

(Figs. 96-97, 127, Map 25)

Agrion violaceum Hagen, 1861: 90.

Argia violacea Hagen in Sélys, 1865: 404.

Argia fumipennis violacea Gloyd, 1968: 2.

Type. Berkeley Springs, Virginia.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine

General Distribution. UNITED STATES: AL, AR, AZ, CO, CT, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, SC, SD, TN, TX, UT, VA, WI, WV, WY; CANADA: N.B., N.S., Ont., Que.; MEXICO: DGO, HGO, NLN, SLP; south to Guatemala.

Seasonal Distribution. Mar. 21 (TX) - Nov. 6 (TX).

Identification. This common, but variable species, *A. fumipennis*, was split into three subspecies by Gloyd (1968) based on wing color and body maculation. The only

subspecies occurring in our range is *A. f. violacea*. It is the most widely distributed of the three subspecies and occurs throughout our area. The head of the male is purple. There are large postocular spots that are contiguous with the eyes and the dark hind margin of the head. Occasionally these spots may be connected by a transverse stripe. The pterothorax is purple fading to yellow ventrally and laterally. There is a dark middorsal stripe and a purple antehumeral stripe. The forked humeral stripe is half as wide as the antehumeral stripe and extends $\frac{3}{5}$ the length of the suture before splitting. The smaller of the two forks is no more than a hairline and extends along the mesopleural suture. The legs are pale, but distinctly marked with black on the anterior surface of the femora and to a less extent on the tibiae. The wings are typical of the group, as they are hyaline and the pterostigma subtends a single cell. There are 4 and 3 postquadrangular cells in the fore- and hindwings respectively.

The abdomen becomes distinctly violet or pale purple in older individuals. Segment 1 is marked with a transverse dark spot. Segment 2 has a large dark lateral spot on each side. These may be nearly connected dorso-posteriorly. The middle segments, 3-6, each have a pair of more or less dark triangular spots anterior to a dark posterior ring, with which they may be confluent. Segment 7 is entirely black except for a posterior purple ring. Segments 8-10 are pale blue with a dark ventrolateral stripe. The superior caudal appendages, when viewed dorsolaterally, have a ventrally projecting tooth originating from the subapical margin and a more blunt lobe projecting ventrally from the medial margin. In lateral view, these appendages slope distinctly downward (Fig. 96). The inferior appendages are longer than the aforementioned.

The female is much duller in general color than the male. The dark markings on the head are lighter than in the male and often more brown than black. The pterothorax is very similar to that of the male as are the legs, but with less extensive dark pigmentation. The mesostigmal plates have a posterior lobe that is transversely flattened and slightly concave ventrally (Fig. 127). Mesepisternal tubercles are reduced or often absent entirely.

The abdomen is paler than in the male and generally purple or brown. Segment 1 is as in the male, segment 2 has a dark dorsolateral spot constricted or separated towards the middle of the segment. Segments 3-6 have an elongate dorsolateral spot basally and a shorter, wider spot apically on each side. The dark basal and apical spots on segment 6 are confluent. Segment 7 has a full length lateral black stripe on each side of the segment. Segments 8-10 are light brown.

This species may be confused with several sympatric species in our area, namely *A. leonorae*, *A. hinei* and *A. nahuana*. The male caudal appendages of all three species are very similar, but they can be separated based on characters given in the keys and individual descriptions. *Argia fumipennis violacea* is larger (HW 18-23) than *A. leonorae* (HW (15-19)). The latter almost always has 3 postquadrangular cells in the forewing as compared to *A. f. violacea* which has 4. A close examination of the male caudal appendages and female mesostigmal plates is generally required for confident identification from *A. hinei* and *A. nahuana*.

Size. Total length: 29-34 mm; abdomen: 23-28 mm; hindwing: 18-23 mm.

Habitat. Shallow streams with exposed rocks and small lakes.

Discussion. Bick and Bick (1982) and Bick (1972) described the behavior of this species. Kellicott (1899) reported that oviposition usually takes place in pairs on submerged plants and rubbish. This species appears to be most prevalent on exposed rocks in shallow streams with a gentle current in calcareous regions. Small lakes on the course of a little stream, especially those formed by a dam, are favorable localities for this species. Adult males fly over the stream and settle on bare ground, while females are generally found a considerable distance from water, often high up on the slope of the valley. Female *A. f. violacea* apparently don't descend below the surface of the water as in some other *Argia* (*A. moesta*). The above information is largely taken from Walker (1953).

***Argia hinei* Kennedy**

Lavender Dancer

(Figs. 98-99, 128, Map 26)

Argia hinei Kennedy, 1918: 258.

Type. Sespe River, Fillmore, Ventura County, California; UMMZ.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan.

Watershed(s): Red, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, NV, NM, TX; MEXICO: BCA,

COA, SIN.

Seasonal Distribution. Apr. 9 (TX) - Sep. 3 (TX).

Identification. This species is closely related to *A. fumipennis violacea*, but has a much smaller range within our area. It is only found in the extreme parts of western Texas, including the Big Bend area and southern New Mexico. The head of the male is violet in color. There is a black line that runs through the ocelli between the compound eyes. This line is sometimes interrupted in the middle. There are large violet postocular spots behind this line. There is a black middorsal stripe on the violet pterothorax and the violet antehumeral stripe is nearly as wide as the middorsal stripe. The black humeral stripe is only 1/3 or less as wide as either of these. This stripe is often forked in the upper 1/2 to 1/3 of its length. The pterothorax is pale laterally and ventrally. The legs are pale with a black stripe on the outer surfaces of the femora that is divided for its entire length by a pale stripe. The outer surfaces of the tibiae are entirely black. The wings are hyaline with the pterostigma subtending a single cell. There are 4 and 3 postquadrangular cells in the fore- and hindwings, respectively.

The abdomen is largely violet on segments 1-7, with a pale yellow venter. There is a dark black dorsal spot basally on segment 1. Segment 2 has a black lateral stripe that may be interrupted in the middle, forming two spots. There is a dark narrow ring apically on segments 2-7. Segments 3-6 have an apical black spot confluent with this ring. Segment 7 is black except for the pale basal ring. Segments 8-10 are blue with a small ventrolateral-black spot apically on 8 and in the middle of the ventral margin on 9. The bifid inferior caudal appendages are longer than the superior appendages. The latter are

cupped ventrally. There is an outwardly directed tooth on the inner edge and ventrally directed subapical black tubercle on the latter appendage. The middle lobe of this trifold appendage is broad with a heavily-sclerotized ridge. The apical margin is distinctly cupped. The lower lobe of the bifid inferior appendage is rounded or more triangular. There is a small swelling projecting dorsally from the apex of the superior lobe. The tori are equal in width to the superior appendage. The epiproct is half the length of the same appendage and projects posteriorly beyond the tori.

The head and thorax of the female are as in the male, but with brown instead of violet. The mesostigmal plates (Fig. 128) are distinctive with a narrow posteriorly directed lobe that is recurved medially. There are no mesepisternal tubercles present. The abdomen is patterned much the same as in the male. Segments 2-6 have a narrow apical black ring and a dark lateral stripe that extends the full length of the segment, widening in its apical fifth. This widened area may become confluent with the same on the opposite side in the posterior segments. Segments 2-7 also have a dark oblique stripe ventrolaterally. This stripe sometimes becomes confluent with the dorsolateral stripe. Segment 7 is black dorsally with only a pale thin middorsal line and basal ring. Segments 8 and 9 have a dorsolateral stripe that nearly reaches the apex of each respective segment.

Gloyd (1958) discussed the similarities and differences of *A. hinei* and *A. fumipennis violacea*, which may be difficult to tell apart at first, where they are sympatric. She described *A. hinei* as a more slender species, with a more "delicate and orchid-like" purple color. There are distinct differences in the male caudal appendages and female mesostigmal plates that will serve to separate the two species.

Size. Total length: 30-35 mm; abdomen: 24-28 mm; hindwing: 17-21 mm.

Habitat. Semidesert creeks, streams and rivers.

Discussion. Nothing has been published on the biology and reproductive behavior of this species.

***Argia immunda* (Hagen)**

Kiowa Dancer

(Figs. 100-101, 129, Map 27)

Agrion immundum Hagen, 1861: 93.

Argia immunda Hagen in Sélys, 1865: 401.

Type. Tampico, Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Colorado, Guadalupe, Neches, Nueces, Red, Rio Grande, Sabine, San Antonio, San Jacinto.

General Distribution. UNITED STATES: AR, AZ, CA, KS, NM, NV, OK, SD, TX; MEXICO: CHS, CHI, COL, GRO, HGO, JAL, MOR, NAY, NLN, OAX, PUE, SLP, SIN, TAM, VER; south to Belize.

Seasonal Distribution. Apr. 2 (TX) - Nov. 6 (TX).

Identification. This is a widespread species commonly collected from eastern Texas and

Oklahoma westward. It is not easily confused with any other species in our region because of the combination of a distinct pale, black, pale, black pattern on abdominal segments 4-6 and the presence of only 3 postquadrangular cells in both pair of wings. The males head is largely pale violet. There is a distinct, but irregular black bar between the eyes and large violet postocular spots. There is a pale blue or violet antehumeral stripe and a black middorsal stripe of approximately the same width. The black humeral stripe is forked in its upper 1/2-1/3 and the metapleural suture is denoted by a black line. The ventral side of the pterothorax is often mottled with darker coloration. The legs are largely dark. The femora have pale stripes running lengthwise, the inner sides of the tibiae are pale and the tarsi are black. The wings are the typical hyaline with a dark pterostigma subtending a single cell. There are generally only 3 postquadrangular cells in both fore- and hindwings.

The abdomen is pale violet or sometimes blue with black maculation. Segment 1 contains a basal black spot and a small antero- and posterolateral spot. Segment 2 has 3 spots, an apical and basal superior spot and an inferior middle spot. These are all generally confluent. Segments 3-6 are marked with black postbasally and on the apical 1/3 of each segment laterally. On segments 4-6 these postbasal streaks are generally confluent with the opposite side. This forms the distinct pale, dark, pale, dark pattern of the abdomen. Segment 7 is entirely black with a thin pale basal ring. Segments 8-10 are blue with a ventrolateral black streak. The superior caudal appendages are divided at the tip and the inferior appendages are sharply bifurcate. The lower lobe is rounded and the superior lobe is acutely directed dorso-posteriorly.

The female is similarly colored to the male but paler and with more tan. The forked humeral stripe is very thin, scarcely covering the suture. The pale antehumeral stripe is often marked with darker spots. The mesostigmal plates lack a posterior lobe. The posterior margin is often slightly elevated medially. The middorsal thoracic carina bifurcates widely, well behind the posterior margin and mesepisternal tubercles are lacking. The abdomen is marked much as in the male, but with segment 7 not as black and similar to segment 6. Segments 8 and 9 are pale with a dark ventrolateral stripe. Segment 10 is entirely pale.

Size. Total length: 33-38 mm; abdomen: 25-31 mm; hindwing: 19-25 mm.

Habitat. Streams and rivers.

Discussion. Bick (1972) reviewed the territorial and reproductive behavior of this species.

Argia leonorae Garrison

Leonora's Dancer

(Figs. 102-103, 130, Map 28)

Argia leonorae Garrison, 1994a: 315.

Type. Parque Turistico Nacataz, Municipio de Garcia, Nuevo Leon, Mexico; FSCA.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Tamaulipan, Texan.

Watershed(s): Brazos, Guadalupe, Rio Grande, San Antonio.

General Distribution. UNITED STATES: TX; MEXICO: NLN.

Seasonal Distribution. May 26 (TX) - Sep. 15 (TX).

Identification. This is a small blue, uncommon but widely distributed, species in south central and western Texas. The male *A. leonora* has a dark head with a pair of postocular spots that may vary somewhat in size. There may be a blue line at the rear of the occiput, but when present, postocular spots never touch this line. Garrison (1994a) reported that specimens from Reeves County, Texas, had these postocular spots considerably reduced and lacked the blue line at the rear of the occiput. The anterior margin of black posterior to the median ocellus forms a "T." The pterothorax is blue gradually becoming paler laterally. There is a broad, black middorsal stripe and a dark humeral stripe that is forked in its upper 1/3. The lower arm is only half the width of the upper arm. The upper forks of this stripe may be broadly joined. The legs are blue, becoming paler medially with the inner and outer surfaces of the femora largely black. The wings are hyaline and the light brown pterostigma subtends a single cell. There are 3 postquadrangular cells in both fore- and hindwings.

The abdomen is blue with black markings that become more pronounced posteriorly. Segment 1 is blue with a single antehumeral black spot on each side, as well as a black spot, dorsally, on the basal half of the segment. Segment 2 has an irregular dorsolateral stripe that is constricted medially and expanded in the posterior quarter of the segment so that it becomes confluent with the other side. There is also a small black spot laterally on half of segment 2. The apical third to half of segments 3-5 are black with a

pale posterolateral spot. Segments 6 and 7 are similar to 3-5, but with black extending dorsally to the basal tenth or more of the segment. Segments 8-10 are blue, with segment 8 having black extending ventrally to the anterior half of the segment. The epiproct is narrow and white, extending beyond the level of the tori. The superior caudal appendages are dark and the inferior appendages are small and quadrad in shape. These appendages have a small decumbent lobe posteromedially followed by a smaller, distal tooth. The bifid inferior appendages are about twice the length of the superiors with the lower lobe rounded.

The female is similarly patterned to the male, but as usual the pale colors are tan. The head is dark, but not as great as in the male, isolating a pale transverse mark anterior to the median ocellus. The pale postocular spots are larger. The dark humeral stripe is forked at about half its length. The mesostigmal plates are triangular and have a costate rim (Fig. 130). There is a poorly developed mesostigmal lobe. The area between the branches of the middorsal thoracic carina is small, with a rounded transverse swollen area anteriorly.

Abdominal segment 1 has a small dorsobasal black spot. Segment 2 has a black dorsolateral stripe, as in the male, but reduced and separated dorsally and medially. Segments 3-5 are pale with the distal third of each segment black with a dorsolateral extension to basal part of segment. Segments 6 and 7 are as in 3-5, but the black dorsolateral areas are confluent dorsally obscuring the pale middorsal stripe. Segments 8 and 9 are pale with a black dorsolateral stripe and a narrow pale middorsal line becoming wider on 9. Segment 10 is almost completely pale with only brown on the dorsolateral

areas. Some specimens in Texas have segments 3-7 all black dorsally, except for the extreme bases. The larva remains unknown.

It may be easily confused with the larger sympatric species, *A. nahuana*, in the field. Both it and *A. leonorae* have a ventrally directed median lobe off the superior caudal appendage. *A. leonorae*, however, only has 3 postquadrangular cells in the forewing; *A. nahuana* has four.

Size. Total length: 28-32 mm; abdomen: 21-26 mm; hindwing: 15-19 mm.

Habitat. Small streams and seepages.

Discussion. This species was first collected in Brooks County, Texas, in 1928 (Garrison 1994). T.W. Donnelly and G.H. Beatty collected it in 1954 at Balmorhea State Park in Reeves County, Texas. As a result it was commonly referred to as the "Balmorhea Damselfly" by many odonatologists in correspondence (e.g. US Department of the Interior 1996). It wasn't formally described until 1984 when Garrison revised the Nearctic members of the genus.

Little is known about its biology. Garrison (1994a) reported that it frequents small streams and seepages such as the "muddy banked rivulets" of Mustang Creek in Williamson County, Texas, and scattered sedge-ridden swales above the Rio Sabinal in Bandera County, Texas. Further collecting will undoubtedly show this species to occur in southeastern New Mexico and additional areas of southern and central Texas (Garrison 1994). It is also represented by a small series from Nuevo Leon and is expected to occur in the surrounding northern Mexican states.

***Argia lugens* (Hagen)**

Sooty Dancer

(Figs. 104-105, 131, Map 29)

Agrion lugens Hagen, 1861: 95.*Hyponeura lugens* Hagen in Sélys, 1865: 382.*Argia lugens* Gloyd, 1968: 272.**Type.** Mexico; ZMHB.**Regional Distribution.***Biotic Province(s):* Chihuahuan, Kansan, Tamaulipan.*Watershed(s):* Brazos, Canadian, Rio Grande.**General Distribution.** UNITED STATES: AZ, CA, CO, NM, OK, OR, TX, UT; MEX: BCA, CHI, DGO, HGO, NAY, OAX, SON, VER.**Seasonal Distribution.** May 21 (TX) - Oct. 22 (TX).**Identification.** This large dark damselfly (HW usually greater than 28 mm) occurs in the western Chihuahuan and Tamaulipan biotic provinces, in our area. The head of mature males is obscured by a heavy black pruinescence. In more teneral specimens the head appears tan with black markings. There are a pair of pale postocular spots that are separated by an occipital bar. The blue to tan pterothorax has a thin black middorsal line and an additional lateral black line on each side that contacts the middorsal carina above. There is a black humeral stripe and a longitudinal stripe running down the middle of the

mesepimeron. Those stripes are often confluent at about a third the length of the humeral stripe, isolating a pale spot at their origins. The pterothorax becomes almost completely dark and the color pattern is obscured by a white pruinescence that is greatest laterally. The wings are typically hyaline or occasionally with a smoky cast. The tan pterostigma subtends 1.5 to 2 cells. The forewing has 5 or 6 postquadrangular cells.

The abdomen is tan with black markings, becoming darker dorsally in mature individuals. Segments 1 and 2 are marked with black stripes extending the full length of the segment dorsolaterally. This stripe widens apically on segment 2 to meet, or nearly meet, the other side. There are also two spots, 1 each, located subapically and subbasally. Segments 3-7 are marked with a dark apical ring that covers $1/5$ - $1/4$ the length of the segment. The sides of these segments have a lateral dark stripe that is confluent with the apical ring. More mature individuals may have these stripes more extensive dorsally. Segments 8 and 9 are nearly completely black in mature individuals with only a few pale spots. Segment 10 becomes dark in older individuals but usually retains the pale color laterally. Superior and inferior caudal appendages are only half the length of segment 10. The superior appendages are bifid with a pointed tooth on both lobes. The inferior appendages have only a small black, dorsally-directed tooth on the apex of the superior lobe. The tori, when viewed dorsally, are thin pads that are confined to the torifer's apical ridge.

The female color pattern is very similar to that of younger males, with the dark markings less extensive. The lateral dark stripes are often contiguous with the middorsal carina as in males, but separated from any other black. The dark humeral stripe and the

stripe in the middle of the mesepimeron are sometimes as in the male, but usually confluent at their origin. The middorsal carina diverges posterior to the metathoracic pits in dorsally. The mesostigmal plates each have distinctly diverging thumb-like posterior lobes (Fig. 131). There are reduced mesepisternal tubercles present and the legs are generally pale with some dark markings on the femora.

The abdominal color pattern is similar to that in the male with the dark stripes laterally on segments 3-7, widening apically to become confluent dorsally. The subapical spots, on the lower sides are often contiguous with the narrow apical ring of each segment. Segments 8 and 9 each have a separate dorsolateral dark stripe. The larva was described by Needham (1903, 1904) and Novelo (1992).

It is not easily confused with any other species in our region. Its closest relative is the Mexican species *A. funcki*, not known from our area. In our area only the smaller *A. moesta* (HW 22-28 mm) is similar and it can be readily distinguished from *A. lugens* by the middorsal thoracic pattern, the male caudal appendages and female mesostigmal plates as described below.

Size. Total length: 41-50 mm; abdomen: 32-41 mm; hindwing: 25-35 mm.

Habitat. Rocky, desert rivers and streams.

Discussion. This species may be the most abundant damselfly at certain desert streams where it perches on emergent and marginal rocks. Kennedy (1917) described its oviposition behavior.

Argia moesta (Hagen)

Powdered Dancer

(Figs. 106-107, 132, Map 30)

Agrion moestum Hagen, 1861: 94.*Agrion putridum* Hagen, 1861: 96.*Argia moesta*, Hagen in Sélys, 1865: 384.*Argia putrida*, Hagen in Sélys, 1865: 385.*Argia intruda* Williamson, 1912a: 200.**Type.** Pecos River, Texas; MCZ.**Regional Distribution.***Biotic Province(s)*: Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.*Watershed(s)*: Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.**General Distribution.** UNITED STATES: AL, AZ, AR, CA, CO, CT, DC, DE, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, NE, NV, NH, NJ, NM, NY, NC, OH, OK, PA, RI, SC, TN, TX, UT, VT, VA, WV, WI; CANADA: N.B., N.S., Ont., Que.; MEXICO: BCA, CHI, COA, JAL, MCH, MOR, NLN, TAB, TAM.**Seasonal Distribution.** Jan. 24 (TX) - Oct. 25 (TX).**Identification.** This large, common, easily recognized species is widely distributed throughout our region and most of the United States, with the exception of the Pacific

Northwest. The distinct white pruinose coloration in mature males is an instant field character. Females can be separated by the presence of a unique dorsal arcuate ridge on the mesostigmal lobe (Fig. 132).

The head of immature males is dark brown, with paler coloration on the labium, labrum, clypeus, genae and frons. In mature individuals there is a dense blue-white pruinosity dorsally on the head. There is a dark brown middorsal stripe and a pale antehumeral stripe approximately half its width. The dark, narrow humeral stripe nearly extends to the antealar carina and is confluent with the mesepimeral stripe anteriorly. The legs are pale with dark stripes on the outer surfaces of the femora and the tarsi are black. The pterothorax, coxae and femora all become pruinose in older individuals. The wings are the typical hyaline with a light brown pterostigma generally subtending 1.5-2 cells. There are 4 and 5 postquadrangular cells in the fore- and hindwings, respectively.

The abdomen is brown basally and distally on segments 9 and 10. The middle segments are much darker, almost black. Segments 1-6 are tan laterally. In older individuals the abdomen becomes black, except for pale areas laterally on segment 1 and basal rings on segments 3-7. The inferior caudal appendages, when viewed laterally, are blunt and rounded, with a dorsally-directed tooth near their apex (Fig. 106). These appendages are not bifid. Dorsally, the tori are circular knobs (Fig. 107)

The female is similar to the male with a general light tan color in younger individuals. The front of the head is light blue or tan. There is darker brown behind the compound eyes, often enclosing two pale postocular spots. The pterothorax is generally a wash of pale blue and brown. The narrow middorsal carina is outlined in black. There is

a very narrow dark humeral stripe. The metapleural suture is unmarked or often with a thin dark line and brown spot in close proximity to the antealar carina. The mesostigmal plates have a distinct posterior lobe with a low ridge that curves over the middle half of each plate, when viewed dorsally. There are mesepisternal tubercles present. The legs are pale, but with dark stripes on the outer surfaces of the femora and the inner surfaces of the tibiae. The tarsi and accompanying spurs are dark. The wings are as in the male.

The abdomen is a pale blue to brown color basally becoming darker posteriorly. There is a pale middorsal stripe running the full length of the abdomen, that is constricted apically at each segment. There is a wide dark brown longitudinal stripe paralleling the above except for pale basal rings. There is a ventrolateral brown spot apically on each of segments 2-7. Segments 8-10 are pale with a dorsolateral dark stripe on segments 8 and 9.

Males of this species can be distinguished from all other species in our area except *A. lugens*, by the unbranched inferior caudal appendages (Fig. 106). The smaller size of *A. moesta* (HW 24-29 mm) will separate it from *A. lugens* (HW 29-35).

Size. Total length: 37-42 mm; abdomen: 28-37 mm; hindwing: 22-29 mm.

Habitat. Swift currents of rivers and lakes with emergent stones and rocky shores.

Discussion. *Argia moesta* and *A. lugens* are the only two species in the United States whose males become entirely pruinose. Williamson (1906a) classified the methods of coupling in a number of Zygoptera genera and specifically described the process for *A. moesta* (as *A. putrida*). Williamson (1912a) concluded *A. putrida* was a synonym of *A. moesta* after examining material from Oklahoma and Texas and classifying male thoracic

color patterns into 5 categories. In the same paper he also described *A. intruda*, from Wister, Oklahoma, later synonymized under *A. moesta*. The synonyms for this species are a result of the variations seen across its range. Females in the southeastern United States may have much more extensive black markings on the thorax and abdomen, such that they are marked more similar to males. They have a wide middorsal stripe that is sometimes divided on each side by a thin pale stripe. The humeral stripe may also be wide and forked medially (Westfall and May 1996).

Borror (1934) described the movements of this species on an Ohio stream. He found that individuals will move as much as 185 m from the stream. Females spend the majority of their time 75-150 m from the water. Johnson (1973c) looked at ovarian development and age recognition in this species. He found that males become pruinose starting middorsally on the thorax and become sexually mature when this pruinescence reaches beyond the black midfrontal stripe. He also found that females aren't receptive to males until they become blue. This color change requires two days after maturation.

Garrison (1994a) noted that "next to *A. translata*, *A. moesta* is probably the most widely distributed species of *Argia*, occurring from about 45° N latitude in Canada to about 20° N in Mexico." Hornuff (1968) illustrated the external male genitalia and discussed the location of sperm during copulation and oviposition in this species. Bick & Bick (1972) found *A. moesta* to be adaptable when invading new areas, by laying eggs in the previously unutilized surface of *Salix* roots. Copulation and oviposition average 22 and 47 minutes, respectively. Females turn dark while in tandem. Tandem pairs will aggregate in large numbers to oviposit in roots, stems, debris and algae, often

submerging themselves more than a meter for periods up to an hour. Dosdall and Parker (1998) reported the first symphoretic association of *A. moesta* with a chironomid (*Nanocladius branchicolus*). Robinson *et al.* (1991) studied the effect of caudal lamellae loss on swimming speed in this species. They found that if two of these lamellae are missing, larger individuals swim faster than smaller ones, but statistically slower than individuals that retain two or three lamellae which swim at the same speed.

***Argia munda* Calvert**

Apache Dancer

(Figs. 108-109, 133, Map 31)

Argia vivida var. *munda* Calvert 1902: 96.

Argia rita Kennedy, 1919: 1.

Argia munda Gloyd, 1958: 17.

Type. Arizona; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan.

Watershed(s): Rio Grande R.

General Distribution. UNITED STATES: AZ, NM, TX; MEXICO: CHI, DGO, SLP.

Seasonal Distribution. May 21 (TX) - Oct. 21 (TX).

Identification. This southwestern species ranges eastward into the Davis Mountain and

Big Bend regions of Texas. The male face is bright blue with the labrum much paler. There are also a pair of large, pale blue postocular spots that are connected by a occipital bar and are widely confluent with each compound eye. There is a black stripe enclosing each lateral ocellus and extending to the compound eyes and occasionally there is a black "T" anterior of the median ocellus. The pterothorax is blue dorsally, becoming paler laterally. There is a black middorsal stripe $1/4$ as wide as the blue antehumeral stripe. The black humeral stripe narrows posteriorly at about $1/2$ its length. The legs are blue with black maculation on the outer femoral surfaces and inner tibial surfaces. The tarsi are brown armed with black spurs. The wings are hyaline with a brown pterostigma generally subtending more than one cell. There are 5 and 4 postquadrangular cells in the fore- and hindwings respectively.

The abdomen is blue, with segment 1 having a black spot at its extreme base. There is a black anteapical spot on each side of segment 2. Segment 3 has an apical black spot on each side. Segments 4-6 have subbasal and subapical black spots that increase in size posteriorly. Segment 7 is nearly completely black except for a basal blue ring. Segments 3-6 have a distal black ring. Segments 8-10 are solid blue. The superior caudal appendages are dome-shaped and the tori are transversely elongate and confined to the apical ridge of each side of the torrifer. (Fig. 109).

The female coloration is very similar to that of the male, but with the blues replaced by paler tan and violet colors. The middorsal carina is pale, as in the male, and outlined on either side by a black stripe. There is a well-developed posterior lobe on each mesostigmal plate, but most notably there is a large, deep mesepisternal pit below each

plate (Fig. 133), but mesepisternal tubercles are lacking. The legs are not marked with as much black as in the males and the wings have a paler pterostigma subtending one or two cells, but are otherwise similar.

The abdomen is pale violet dorsally. Segment 1 is black basally. Segments 2-6 have black subbasal and subapical spots that may be confluent. Segment 7 is completely black dorsally with only a blue basal ring. Segments 8-10 are completely pale.

This species may be confused with *A. vivida* or *A. plana* in the field, but males can readily be distinguished by the dome-shaped superior caudal appendages, "somewhat like halves of a hollow rubber ball" when viewed laterally (Gloyd 1958). The female is immediately distinguished by the deep mesothoracic pit adjacent to each mesostigmal plate (Fig. 133).

Size. Total length: 36-40 mm; abdomen: 29-32 mm; hindwing: 23-27 mm.

Habitat. Primarily found in desert streams.

Discussion. This is an average-sized southwestern species originally described from Arizona and Mexico as a variation of *A. vivida*. Gloyd (1958) first reported it from Limpia Creek (Fig. 11) in Jeff Davis County, Texas. It has been infrequently recollected from this stream and from Oak Creek in Big Bend National Park, Brewster County, Texas. To my knowledge, these are the only collections of this species from Texas and our region.

Gloyd (1958) described the Limpia Creek drainage, based on a letter from G.W. Byers (the original collector) as "a ravine having no more than a trickle of water. The region was one of junipers, scrubby oaks, acacia-like shrubbery, prickly pear and busy

opuntias." It has changed little to date (Fig. 11). Nothing has been published and little is known of the reproductive behavior of this species.

***Argia nahuana* Calvert**

Aztec Dancer

(Figs. 110-111, 134, Map 32)

Argia agrioides var. *nahuana* Calvert, 1902: 99.

Argia nahuana Gloyd, 1958: 18.

Argia saalasi Valle, 1942: 164.

Type. Mexico City, Mexico; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Neches, Nueces, Red, Rio Grande, San Antonio, Trinity.

General Distribution. UNITED STATES: AZ, CA, CO, KS, NV, NM, OK, OR, TX, UT; MEXICO: AGS, BCA, CHI, DFE, DGO, HGO, JAL, MEX, MOR, NAY, NLN.

Seasonal Distribution. Mar. 30 (TX) - Nov. 11 (TX).

Identification. This common southwestern species is found throughout most of our area, except Arkansas and Louisiana. The male head is dark blue with large postocular spots. There is a prominent black bar, running through the lateral ocelli, that is narrowly

confluent with each compound eye and separates the postocular spots from the pale occipital bar. Most individuals have a black stripe on the frontoclypeal suture and a black "T" anterior to the median ocellus. There is a pale blue antehumeral stripe that is nearly as wide as the black middorsal stripe. The dark humeral stripe is forked posteriorly at about half its length. The wings may be hyaline or slightly smoky with a dark pterostigma subtending at most one cell. There are 4 and 3 postquadrangular cells in the fore- and hindwings, respectively. The legs are pale blue with black stripes on the outer femoral and inner tibial surfaces. The tarsi are pale blue armed with black spurs.

The abdomen is blue with a large black anteapical spot and a smaller dark spot below it on segment 2. The apical 1/5 to 1/3 of segments 3-6 is black. Segment 7 is generally black dorsally with a blue middorsal streak of varying width and a blue basal ring. Segments 8-10 are blue with black ventrolateral spots on segments 8 and 9 that may be confluent with one another. The superior caudal appendages are distinct, in dorsal view, with a prominent medially directed medial lobe (Fig. 111). In lateral view, these appendages are no more than 2/3 the length of the inferiors and an apical ventrally directed tooth is often visible (Fig. 110).

The coloration of the female closely approximates that of the male, but with pale brown instead of blue. The middorsal carina is usually pale brown and the pale antehumeral stripe is nearly as wide as the dark middorsal stripe. The mesostigmal plates of this species are instantly recognizable because of the broad transverse expanse of each posterior lobe (Fig. 134). The middorsal carina narrowly bifurcates just behind the posterior border of these plates and the mesepisternal tubercles are small or lacking.

The abdominal color pattern of the female differs from that of the male in the following ways. Segments 3-6 have a basal and apical black spot that is generally not confluent with one another. There is a smaller, abbreviated black spot or streak, below the larger apical spot. Segment 7 is as in the male with a smaller apical spot below. Segments 8 and 9 both have a black spot, dorsolaterally, that may extend the full length of each segment. There is often an additional apical spot laterally on each of these segments. Segment 10 is pale.

This species is similar to *A. fumipennis violacea*, *A. hinei*, and *A. leonora*, but can be easily distinguished by the caudal appendages of the male and the characters given in the keys and individual descriptions of each species.

Size. Total length: 28-35 mm; abdomen: 23-28 mm; hindwing: 18-23 mm.

Habitat. Small, shallow, clear water streams, fully exposed to sunlight with only moderate marginal vegetation.

Discussion. Gloyd (1958) elevated *A. nahuana* from a variation of *A. agrioides* to species status after carefully examining the type material and specimens from throughout its range, including Texas. Bick and Bick (1958) studied the Odonata at Cowan Creek, in southern Oklahoma, Marshall County. *Argia nahuana* was by far the most dominant species at this creek, where they observed and documented its oviposition behavior:

"Male and females perched in full sunlight on a blade of grass six inches from the margin of the creek where the water was one inch deep...The abdomen of the female was bent at a sharp angle and its tip touched the plant one half inch below the water surface where eggs were apparently

deposited. She probed for a few seconds with the tip of her abdomen, remained motionless for two and one half minutes, probed briefly and remained motionless for five minutes. The pair visited three more blades of grass where the female alternately probed and remained motionless but for only 30 seconds at each blade."

Hornuff (1968) described sperm location in this species during copulation and oviposition.

***Argia plana* Calvert**

Springwater Dancer

(Figs. 112-113, 135, Map 33)

Argia vivida var. *plana* Calvert, 1902: 96.

Argia plana Gloyd, 1958: 19.

Argia spegazzinii Navás, 1934: 69.

Type. Sierra de las Aguas, Escondidas, Guerrero, Mexico; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Nueces, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AZ, AR, CO, IL, IA, KS, MO, NE, NM, OK,

SD, TX, WI; MEXICO: CHS, CHI, COA, DFE, DGO, GRO, HGO, MEX, MCH, MOR, NLN, SLP, SIN; south to Guatemala.

Seasonal Distribution. Mar. 10 (TX) - Oct. 8 (OK).

Identification. The head of the male is blue, with a pair of postocular spots that are widely confluent with the compound eyes. These spots are connected by a pale occipital bar. The prothorax is black with blue lateral edges. The pale blue antehumeral stripe is bordered by a dark middorsal stripe of about the same width. The black humeral strip is unforked and about half the width of each of the above at its widest. It narrows considerably at about its middle and then widens again at its upper end. The pterothorax becomes paler laterally. The metapleural suture is marked with a narrow black line. The legs are blue with heavy black markings on the outer femoral and inner tibial surfaces. The tarsi are black and armed with black spurs. The wings are hyaline and have a dark brown pterostigma that subtends 1-1.5 cells. There are generally 4 and 3 postquadrangular cells in the fore- and hindwings, respectively.

The abdomen is bright blue. There is a small black basal spot dorsally and a lateral spot apically on segment 1. There is a basal black spot and a larger apical spot laterally on segment 2, that may be connected to form a bar. There is a dark subbasal spot on segments 3-6 that tapers apically on the posterior segments. There is also a dark apical spot on segments 3-6 that is confluent medially. Segment 7 is nearly all black, except for a pale apical ring and a middorsal line for half its length. Segments 8-10 are entirely pale blue. In lateral view, there is a short ventrally directed apical black tooth on the superior caudal appendages. The inferior appendages are bifid with the superior lobe serrated and

about twice as long as the inferior lobe. Some individuals from the Davis Mountains and Big Bend area of Texas and west have the blue of the pterothorax and abdomen replaced by violet, but markings are otherwise similar (see discussion below).

The female is pale brown in color. The head and thorax are similar to those of the male. The mesostigmal plate is broadly flattened and unnotched posteriorly (Fig. 135) and there are mesepisternal tubercles present. The legs are much paler than in the male with only limited black markings on the femora and tibiae. The tarsi are brown and the wings are as in the male. The abdominal color pattern closely approximates that of the male, but with black more extensive and the general pattern variable. There is a basal black spot dorsolaterally on segment 9.

Males of this common widespread species may be mistaken in the field for *Argia hinei*, *Argia fumipennis violacea*, *Argia nahuana* or *Argia munda*. The former two species can be separated from *Argia plana* by the presence of a black ventrolateral stripe on abdominal segments 8 through 10 (segments 8 through 10 are entirely blue in *Argia plana*). These species are also slightly smaller than *Argia plana*. Abdominal segments 8 through 10 of *Argia munda* are blue, like *Argia plana*, but whereas *Argia plana* has 4 postquadrangular cells, *Argia munda* has 5. *Argia nahuana*, along with *Argia hinei*, can be separated by the forked humeral stripe. This stripe is not forked in *Argia plana*. The females of these sympatric species are difficult to separate except by critical examination of the mesostigmal plates.

Size. Total length: 34-40 mm; abdomen: 26-33 mm; hindwing: 22-25 mm.

Habitat. Small shallow, canopied spring seepages with clay substrate.

Discussion. Gloyd (1958) raised the status of *Argia plana* from the variety of *Argia vivida* that Calvert described in 1902, largely on color, to species. These two species are closely related. Violet forms of *Argia plana* start appearing in western Texas, I have collected them in Brewster and Jeff Davis counties, and Gloyd (1958) reported them in the Big Bend region of Texas. In her study Gloyd (1958) reported that "all specimens taken in the region between the Mississippi River and the Rocky Mountains, some of which have been recorded in the literature by various authors as *vivida*, are actually a blue form of *plana*."

Bick and Bick (1965c) and Hornuff (1968) discussed sperm transfer in males. The former found that transfer took from 12-30 minutes. Bick and Bick (1958) described the oviposition behavior of a population of this species at Cowen Creek in Marshall County, Oklahoma. They observed seven pairs where the female clasped a small dead twig and the male was supported by only the female. The female curved her abdomen slightly and deposited eggs on or in the clay of this spring at a depth of no more than half an inch. The pairs remained motionless for 15 minutes with little probing. A female was also seen ovipositing in clay outside of the spring itself.

The reproductive behavior of this species was studied further by Bick and Bick (1972) at the same southern Oklahoma stream. They found that males seized females predominately at the water's edge as females approached. There was no courtship display of any kind by either sex. Copulation quickly followed sperm translocation at an average distance of 1.5 meters from the waters edge. Pairs did not change perch location, but were seen shifting during copulation, 2-7 times. They found copulation and oviposition

to last an average of 27 and 47 minutes, respectively. The observed females oviposited almost exclusively in *Nasturtium* (water cress) and debris.

***Argia rhoadsi* Calvert**

Golden-winged Dancer

(Figs. 114-115, 136, Map 34)

Argia rhoadsi Calvert, 1902: 92.

Type. Monterrey, Nuevo Leon, Mexico; BMNH.

Regional Distribution.

Biotic Province(s): Tamaulipas.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: HGO, NLN, PUE, SLP, TAM, VER.

Seasonal Distribution. March 19 (TAM)-Dec 18 (TAM)

Identification. This is a Mexican species that barely reaches our area and has been infrequently collected in extreme southern Texas, Cameron County. Despite its rarity in our area it is easily recognizable by its amber colored wings. The face of the male is blue. The labrum is darker and has a prominent pit in its center. There are two large post-ocular spots separated by a pale occipital bar. There is a pale blue spot anterolateral to each lateral ocellus and sometimes a black "T" is present anterior to the median ocellus.

The prothorax is black dorsally and blue laterally. A pale blue antehumeral stripe and a black middorsal stripe are equal in width on the pterothorax. The black humeral stripe is approximately $1/3$ the width of the antehumeral stripe and may be forked at its upper $1/3$. The lower fork is often faint and irregular. There is a short black stripe at the upper end of the interpleural suture that is contiguous with the black antealar carina. There is also an isolated black spot at the upper end of the metapleural suture. Occasionally there is a faint dark line continuing down this suture. The legs are pale blue with dark stripes on the outer femoral surfaces and inner tibial surfaces. The tarsi are brown armed with black spurs. The wings are flavescent or slightly amber with a nearly black pterostigma subtending a single cell. There are 4 and 3 postquadrangular cells in the fore- and hindwings, respectively.

Abdominal segment 1 is entirely blue. Segment 2 is blue with a dark dorsolateral stripe that widens posteriorly, but may not reach the apex of the segment. Segments 3-7 are largely black with a metallic reflection dorsally. Each segment above has a blue basal ring and a pale middorsal stripe that may not quite reach the apex. Segments 8 through 10 are entirely blue. The superior and inferior caudal appendages are both entire and not bifid. The former is no more than $2/3$ the length of the latter and possesses a ventrally directed anteapical tooth (Fig. 114).

The female is similarly patterned to the male, but tan replaces the blues and the black markings are less extensive. There is a narrow black middorsal stripe, approximately $1/7$ the width of the mesepisternum, and there are short dark stripes, posteriorly, on the interpleural and metapleural sutures. The mesostigmal plates are

mostly dark with pale, lateral edges. In dorsal view, there is a posteromedially directed lobe projecting over a shallow dark pit (Fig. 136). The mesepisternal tubercles are vestigial or absent entirely. The legs are tan with the black markings much less extensive, but armed with black spurs. The wings are smoky with a lighter pterostigma than in the male.

The abdomen is tan in color with an ill-defined pattern. Segment 2 has a dark stripe laterally that widens towards the apex of that segment. Segments 3-7 each have a narrow blue basal ring and a pale middorsal stripe, running there entire length. Segments 8 through 10 are entirely light tan and unmarked.

Size. Total length: 34-35 mm; abdomen: 27-28 mm; hindwing: 19-21 mm.

Habitat. Lagoons and pools formed at edges of streams and rivers.

Discussion. There is not much known about the biology of this Mexican species.

Westfall and May (1996) reported collections from a rain pond in San Luis Potosi, Mexico. Novelo (1992) described the larva from exuviae and terminal instars collected at Lguna de Azteca, in the Mexican state of Hidalgo. He found terminal instar larvae clinging to roots of water hyacinth, *Eichhornia* sp. at the edge of a lagoon. He also found laboratory emergences to occur in the late morning.

***Argia sedula* (Hagen)**

Blue-ringed Dancer

(Figs. 116-117, 137, Map 35)

Agrion sedulum Hagen, 1861: 94.

Argia sedula Selys, 1865: 411.

Type. Berkeley Springs, Virginia.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AZ, AR, CA, CO, DE, DC, FL, GA, IL, IN, KS, KY, LA, MD, MI, MS, MO, NE, NV, NM, NC, OH, OK, PA, SC, TN, TX, VT, VA, WV, WY; MEXICO: CHI, COA, DGO, NLN, PUE, SLP, SON, TAM, VER.

Seasonal Distribution. Mar. 19 (TX) - Nov. 14 (OK).

Identification. *Argia sedula* is sexually dimorphic, where males are blue and black and females have an olivaceous coloration. The top of the head of males is pale blue. There is a small black spot in the median depression of the labrum. The top of the head is largely black with two small blue spots anterior to the median ocellus and one anterior to the later ocelli. The pale postocular spots vary in size from small to large, sometimes contacting the compound eyes. The occipital bar separating the two may be either blue or black. The prothorax is mostly black with a pale blue, dorsolateral spot on each. The middorsal carina and wide middorsal stripe are both black. There is a wide black humeral stripe that is nearly twice as wide as the pale narrow antehumeral stripe. A black stripe

on the metapleural suture widens. The rest of the pterothorax is blue, becoming paler and almost yellow ventrally. The legs are largely black except for the medial surfaces of the femora and lateral surfaces of the tibiae and tarsi. The wings are slightly amber to clear with a light brown pterostigma that subtends one or fewer cells. There are 4 and 3 postquadrangular cells in the fore- and hindwings, respectively.

Abdominal segment 1 is blue with dark brown dorsobasally and laterally.

Abdominal segment 2 is black dorsally with a small pale blue spot basally or on each side of the midline. Segments 3 through 7 are black dorsally with a blue basal ring equal to as much as a sixth of the segment length. The ventrolateral areas of these segments are paler and confluent with the wings. Segments 8 through 10 are blue with a black ventrolateral stripe that extends to the apical portion of segment 10. The superior caudal appendage is straight, in lateral view, with a ventrally projecting tooth. The inferior appendages are bifid with the superior lobe rounded and directed dorsally. The inferior lobe is strongly serrated and projecting posteroventrally (Fig. 116). The tori are wider than long in dorsal view and separated by less than half their own width (Fig. 117).

The head of the female is largely a combination of pale brown and olivaceous markings. The pterothorax is brown dorsally, becoming paler ventrally. The middorsal and humeral stripes are reduced to thin black hairlines and often the latter is absent entirely. The legs are pale brown with dark stripes on the outer surfaces and armed with black spurs. The wings are smoky or amber to hyaline as in the male. The mesostigmal plates are long and strongly erect appearing almost perpendicular to the mesepisternum, when viewed laterally and the mesepisternal tubercles are very small or absent entirely.

The abdomen is pale brown dorsally segments 2 through 7. There are traces of darker brown where the male has black. The ventrolateral stripes and basal rings are often ill-defined, but with touches of blue or green. Segments 8 through 10 are pale and lack dark markings.

This species, like *Argia rhoadsi*, can be recognized by an amber tint to the wings. The wings of *A. rhoadsi*, however, are considerably darker and *A. sedula* is a common widespread species found throughout our area.

Size. Total length: 29-34 mm; abdomen: 22-28 mm; hindwing: 17-21 mm.

Habitat. Lakes, ditches, streams and rivers with gentle current and dense vegetation.

Discussion. Dunkle (1990) noted that this species is more prone to perching on vegetation, often in the shade, than most *Argia*. In Florida Dunkle reported adults living at least 16 days. Pairs require 10-15 minutes to mate and oviposition occurs in tandem, often in large numbers. Hornuff (1968) discussed the location of sperm during reproduction. Robinson *et al.* (1983) conducted a mark-recapture study on adult *Argia sedula* at a small creek on the campus of the University of Texas at Arlington. They found that males had a daily survivorship of 0.79 and that activity was closely correlated with bright sun.

***Argia tibialis* (Rambur)**

Blue-tipped Dancer

(Figs. 118-119, 138, Map 36)

Platycnemis tibialis Rambur, 1842: 241.

Trichocnemys tibialis, Sélys, 1857: 464.

Agrion fontium Hagen, 1861: 91

Agrion binotatum Walsh, 1862: 387.

Argia tibialis, Sélys, 1865: 413.

Type. "Amerique septentrionale"; IRSN?

Regional Distribution.

Biotic Province(s): Austroriparian, Kansan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Mississippi, Neches, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, DE, DC, FL, GA, IL, IN, IA, KS, KY, LA, MD, MI, MN, MS, MO, NE, NJ, NY, NC, OH, OK, PA, SC, TN, TX, VA, WV, WI.

Seasonal Distribution. Mar. 3 (LA) - Sep. 8 (TX).

Identification. This primarily eastern species ranges as far west in our region as the Red River in Wilbarger County, Texas. The front of the head in the male is pale blue to tan, extending laterally, to be continuous with the compound eyes, midway up the top of the head. The dorsal and posterior portions of the head are largely black, including a thick "T" anterior to the median ocellus. There is a pale spot anterolateral to each lateral ocellus. There are a pair of small postocular spots separated by an occipital bar in younger individuals. The violet antehumeral stripe is nearly twice as wide as the black

middorsal thoracic stripe. The thick black humeral stripe ranges from 1/2 to the entire width of the antehumeral stripe. The metapleuron and ventral side of the thorax are pale yellow, often becoming darker and covered with pruinosence in older males. There is a heavy black stripe along the metapleural suture. The coxae and base of the femora are pale yellow. The legs are largely black with a thin pale stripe on the outer surface of the femora and a broader pale stripe on the tibiae. The tarsi are black and armed with short spurs. The wings are hyaline with a slanted dark pterostigma subtending a single cell. There are 4 and 3 postquadrangular cells in the fore- and hindwings, respectively.

The abdomen is largely black dorsally with only a thin trace of a pale middorsal line on segments 1 through 7. Segments 3 through 7 have a narrow pale basal ring. The ventrolateral margins are pale for 3/4 of their length. Segment 8 is entirely black and segments 9 and 10 are blue or yellow dorsally with a wide ventrolateral black stripe. The superior caudal appendages are short, only 1/3 of the length of segment 10. These appendages are distinctly bifid in dorsal view (Fig. 119). The inferior appendages are also bifid with the superior lobe larger and projecting dorsoposteriorly. The inferior lobe generally doesn't extend beyond the superior lobe. The tori, when viewed dorsally, are not as wide as long and separated by less than each of their widths (Fig. 118).

The color of the female may be either light tan or pale blue. Both color forms have been collected in the Big Thicket Region of Texas, by the author. The head is colored much the same as in the male, but the pale areas are generally more extensive. The postocular spots are larger and sometimes partially confluent with the occipital bar. There are a pair of pale dorsal spots on the prothorax in addition to the larger lateral

spots. The pterothorax is much the same as in the male, but often the wide humeral stripe is forked at its upper end. The middorsal thoracic carina, when viewed dorsally, bifurcates obliquely, between the posterior medial corners of the mesostigmal plates appearing as "flat pear-shaped" pads. There are no posterior lobes on the mesostigmal plates (Fig. 138) and mesepisternal tubercles are lacking entirely. The tibiae are paler basally.

The abdominal color pattern is the same as for the male on segments 1 through 7. Abdominal segments 8 and 9 are black. Segment 9 generally has a pale middorsal, apical spot that may be confluent with pale lateral areas. Segment 10 is pale, sometimes with dark basal spots below.

The heavily bilobed superior caudal appendages of the male and the broadly triangular area between the diverging arms of the middorsal carina will separate this species from any of its congeners in our region.

Size. Total length: 30-38 mm; abdomen: 23-30 mm; hindwing: 18-24 mm.

Habitat. Streams and rivers of various flows and sloughs, swamps and ponds.

Discussion. Bick (1957) wrote that in Louisiana, the specimens he collected were "...from a wider range of habitats than any *Argia* in Louisiana." In the pinelands, *A. tibialis* occurred along swift creeks (73%), sluggish streams (9%), and near sloughs, swamps or ponds (5%).

This species usually perches on the ground, but does perch on vegetation and in shade more than most other *Argia*. Oviposition occurs in tandem and eggs are generally deposited in floating eelgrass or debris, but sometimes in wet wood above the water line.

It often occurs in large aggregations. Most of the above information was taken from Dunkle (1990).

This species has been documented as far west as Colorado (Westfall and May 1996), but Garrison (1994a), based on L.K. Gloyd's extensive distribution notes, reported that this record, based on a female in the "Austrian National Museum [NHMV?]" labeled from Colorado, may be mislabeled as to locality or it may be a stray.

Argia translata Hagen in Séllys

Dusky Dancer

(Figs. 120-121, 139, Map 37)

Argia translata Hagen in Séllys, 1865: 410.

Argia espinalensis Navás, 1935: 36.

Type. Puerto Cabello, Venezuela; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balcónian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Colorado, Guadalupe, Nueces, Ouachita, Red, Rio Grande, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AZ, AR, CT, DC, GA, IL, IN, KS, KY, MD, MA, MS, MO, NV, NJ, NM, NY, NC, OH, OK, PA, SC, TN, TX, VA, WV;
CANADA: Ont.; MEXICO: CHS, CHI, DGO, HGO, NLN, OAX, PUE, QRO, QTR,

SLP, SIN, TAB, TAM, VER, YUC; south to Argentina.

Seasonal Distribution. Mar. 17 (TX) - Nov. 7 (AR).

Identification. This is a widespread species, found throughout our area, except for Louisiana. It occurs abundantly along the eastern part of Mexico south through Central and South America (Garrison 1994). Males are easily recognized in the field because of their dark, nearly black coloration. The front of the head in the male is pale, becoming almost entirely black with age. The top of the head is largely black with pale postoccipital spots and an occipital bar that may become obscured with age. The head is remarkably setose. The prothorax is black with a pale dorsolateral spot on each side in younger individuals. There is a very wide black middorsal stripe and a pale yellow antehumeral stripe a third the width of the middorsal stripe. The dark humeral stripe may be almost completely divided longitudinally by a pale stripe in younger individuals. These two dark stripes become fused in older males. There is a black stripe on the metapleural suture. The rest of the pterothorax is pale yellow becoming densely pruinose in older individuals. The legs are black with a narrow pale stripe on their outer surface. The wings are hyaline or only slightly tinted, with a dark pterostigma subtending slightly more than a single cell. There are 5 and 4 postquadrangular cells in the fore- and hindwings, respectively.

Abdominal segment 1 is black with a large pale lateral spot on each side and a laterally elongated apical spot. Segment 2 is black with a pale middorsal stripe, that is often broken medially and a small pale apical spot laterally. Segments 3 through 7 are largely black with a pale yellow or blue basal ring and a pale ventrolateral stripe on each

side. Segment 8 is black with a strongly irregular blue ring, basally. This ring has exaggerated sides that extend posteriorly. The dorsum of segment 9 is blue for 1/4 or more of its length. The apical portion of the segment is black and is strongly sinuate dorsally and laterally. Segment 10 is black with a small pale spot laterally. The superior caudal appendages are strongly decurved toward the tip when viewed laterally. The inferior appendages are dark and bifid. The superior lobe is dorsally directed and rounded, while the longer inferior lobe is directed posteroventrally (Fig. 120). The tori, when viewed dorsally, are elongated and not wider than long (Fig. 121).

The female is very similar to the male. The pale area of the head encompasses the antennae. There are large pale postoccipital spots and an occipital bar. There is a large pale dorsolateral spot on each side of the prothorax, that may be continuous with the pale ventral areas. The posterior lobes of the mesostigmal plates are slightly constricted at their base, when viewed dorsally (Fig. 139). In lateral view the posterior lobe appears as a thin linear projection. The mesepisternal tubercles are well developed. The pale antehumeral stripe is 1/5 to 3/5 as wide as the black middorsal stripe. The humeral stripe is most often divided as in younger males.

Abdominal segment 2 is patterned as in younger males, with the pale middorsal stripe often divided into a basal stripe and an apical spot. Segments 3 through 7 each have pale basal rings that are contiguous with the pale ventrolateral stripe. There is a continuous pale middorsal stripe that is widest on the anterior segments. Segments 8 through 10 are pale. Each of these segments has a pale dorsal and lateral dark stripe.

Broughton (1928) and Geijskes (1946) both illustrated the larva of this species.

Size. Total length: 32-38 mm; abdomen: 25-33 mm; hindwing: 19-23 mm.

Habitat. Streams and rivers generally with a lot of exposure to sun and only moderate vegetation.

Discussion. Little has been published about the reproductive and oviposition behavior of this species (Walker 1941; Walker 1953; Donnelly 1961). This species has the widest distribution of any of its congeners occurring in the United States. Garrison (1994a) reported that this species is subject to a great amount of ontogenetic change as an early adult. This change is especially evident in the pterothoracic markings and those on abdominal segments 8 through 10.

Genus *Chromagrion* Needham

Aurora Damselfly

Chromagrion Needham, 1903.

This distinctive genus of damselflies is represented by a single species endemic to the eastern United States and Canada. The genus is closest to the Palearctic *Erythromma* (Walker 1953; Westfall and May 1996). The unique coloration and subforcipate caudal appendages of the male along with several distinct venational characteristics separate this genus from all others. Needham (1903) discussed the unique venation of this genus, including the following: the anterior side of the triangle in both wings is two to four times longer than the proximal side; the anterior side of the hindwing quadrangle is three

or more times longer than the proximal side; and the anal vein separates from the hind margin of both wings at the cubito-anal crossvein.

The larvae are also readily recognizable because of the acutely angulated hindmargins of the head, long legs and distinctly pointed gills. Westfall and May (1996) described nymphs as found typically climbing "on submerged vegetation or in litter in sheltered areas of clean streams, most often spring-fed, and some unpolluted lentic waters."

***Chromagrion conditum* (Hagen in Sélys)**

Aurora Damsel

(Figs. 146-149, Map 38)

Erythromma conditum Hagen in Sélys, 1876: 1305.

Chromagrion conditum, Needham, 1903: 246.

Type. Maryland; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Ouachita.

General Distribution. UNITED STATES: AL, AR, CT, DC, DE, GA, IL, IN, KY, ME, MD, MA, MI, MS, MO, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI;
CANADA: Man., N.B., N.S., Ont., P.E.I., Que.

Seasonal Distribution. May 18 (AR) - Jun. 7 (AR).

Identification. This rather conspicuous species just barely ranges southward into our region. It occurs only in northeastern Arkansas (Harp and Harp 1996). The head of the male is largely black dorsally, with pale blue only on the face. The dorsum of the prothorax is black with pale blue middorsally and on one or two small dorsolateral spots. The prothorax is blue laterally. The pterothorax is blue with a black middorsal stripe that widens posteriorly to the humeral suture. There is a black hairline humeral stripe extending the full length of the suture. The metepisternum is blue, becoming yellow anteriorly extending into the bright yellow metepimeron. The venter is white becoming pruinose with age. The wings are hyaline with a pterostigma subtending a single cell. There are 3 postquadrangular cells in both the fore- and hindwings. The long, largely black legs are pale yellow on the outer femoral and inner tibial surfaces.

The long, slender lestine-like abdomen is blue with black maculation. The first segment is blue with only a basal black spot. There is a black middorsal stripe on segment 2 that extends the full length of that segment, widening posteriorly. Segments 3 through 7 are black dorsally, with only a pale basal ring. The lateral areas of these segments are blue with black expanding apically from the dorsum. Segments 8 and 9 are blue with a thin black middorsal line that widens apically. There are a pair of black subapical spots on segment 8, laterally. The ventrolateral region of segments 8-9 and all of 10 is black. The decurved superior caudal appendages (Fig. 148) are black and distinctly forcipate, when viewed dorsally. The black inferior appendages are long, blunt and nearly straight.

The female is colored very similar to the male, with the blue of the male occasionally replaced by yellow-green, but the black basal stripe on the labrum is wider than in the male. The broad mesostigmal plates are triangular, with a prominent ridge along the posterior and medial borders (Fig. 149). The pale basal rings on abdominal segments 3 through 7 are generally less distinct. Segments 8 through 10 are entirely black, except for a pale ventrolateral stripe. The ovipositor is pale with darker styli.

Size. Total length: 31-39 mm; abdomen: 25-32 mm; hindwing: 20-26 mm.

Habitat. Sheltered, slow-moving spring-fed streams, brooks, and occasionally pools and bogs.

Discussion. Carpenter (1991) reported adult males of this species patrolling low over ditches of a cranberry bog, "an environment that would seem not particularly well-suited to aquatic life." This species may be confused in the field with *Lestes* because of their tendency to spread their wings when perched. This is a nearly unique characteristic among coenagrionid genera.

The reproductive and ovipositing behavior of a North Carolina population of *C. conditum* was studied by Bick *et al* (1976). They found that males would often vacate their perches without defensive activity when apparently not searching for females. There was no courtship activity displayed. Copulation averaged 36 minutes with an additional 67 minutes spent in tandem, and almost half of this time was spent in exploratory activity. Oviposition occurs in tandem. Walker (1953) reported numerous pairs ovipositing, in aquatic plants just beneath the surface of the water. Neither sex is ever completely submerged.

Genus *Enallagma* Sélys

Bluets

Enallagma Charpentier, 1840.

Aenallagma Sélys, 1875.

Thermagrion Förster, 1906.

Africallagma Kennedy, 1920.

Amphiallagma Kennedy, 1920.

Ischnallagma Kennedy, 1920.

Proischnura Kennedy, 1920.

Teleallagma Kennedy, 1920.

Libyagrion Fraser, 1928.

Sobobapteron Pierce, 1965.

This large group of damselflies comprises some 80 species worldwide and occurs everywhere but Australia and the Orient. They are among the most familiar damselflies to the casual observer and are the best represented genus of damselflies in North America. Nineteen species occur within the confines of our region. Our North American species are most similar to the genera *Ischnura* and *Coenagrion*, the latter of which does not occur in the south-central U.S. The genus *Acanthagrion*, represented by one species in our area, replaces *Enallagma* in the tropics of Central and South America.

There has been confusion over the correct author of this genus, but we follow

Cowley (1934) crediting Sélys (1875). A worldwide revision of this genus, based on wing venation and coloration, was done by Sélys (1876). Kennedy (1920) divided the genus into six separate genera based chiefly on subtle morphological differences in the male superior caudal appendages, but this classification has not been traditionally followed. Byers (1927a) provided the first key to the North American species. He divided the North American members of the genus into four groups based on the male caudal appendages and color patterns. Westfall and May (1996) recognized three groups within the genus and stated that each may deserve taxonomic recognition. Donnelly (1963) illustrated the penis of all North and Central American species and gave possible phylogenetic relationships among them. His conclusions are based on the assumption that the penis evolved from a complex structure that has become simple over time. He presented a tentative tree showing these phylogenetic relationships. Garrison (1984) revised both larvae and adults of this genus occurring West of the Rocky Mountains, including five species found in our area.

Most members of this genus are typically blue, others may be yellow, orange or red in coloration, but all are commonly called "bluets." They possess conspicuous postocular spots. The M_2 vein generally arises near the fifth and fourth postnodal crossveins in the fore- and hindwings respectively (at the fourth and third in *E. basidens*). The front row of tibial setae are less than twice the length of their intervening spaces. The penis of the male is distinct with lateral lobes on the terminus and rounded apically, never with long processes as in *Ischnura*. Females are generally present in two different color forms, i.e. dichromatic. The homochromatic forms are blue and black, and

heterochromatic forms are brown and black. They nearly always have a vulvar spine present.

The larvae are long and slender and often abundant in lentic bodies of water. Species in North America tend to segregate as larvae between lakes that do and do not support fish populations (Johnson & Crowley 1980; McPeck 1990a). The posterior margins of the head are rounded and there is often a conspicuous mosaic pattern to the eyes. There are 2-7 mental setae and 4-6 palpal setae. Larvae probably go through 10-12 instars with an emergence time of approximately 30 minutes (Garrison 1984). The larvae are very similar morphologically and often difficult to tell apart, especially to the inexperienced.

This genus of damselflies is as diverse ecologically as it is morphologically. Some species live in brackish waters (*E. durum*), while others are found in desert alkaline ponds (*E. clausum*). Many species commonly fly close to the water's surface often resulting in the collector having a wet net. Mature adults are commonly found around standing waters and are most active during midday. Garrison (1984) discussed the general behaviors of this genus. Recently emerged, teneral adults fly away from the water after 30 minutes. This is probably in an effort to avoid predation and contact with mature adults during this vulnerable time. These recently emerged adults go through a maturation period of one to three weeks during which they forage away from the water (Corbet 1983). Mature males will congregate around pools and ponds while the females tend to remain away from the water, only approaching to mate and oviposit. Adults typically perch on standing sedges, cattails and other riparian vegetation. Both sexes will

leave their perching sites near the water in late afternoon, probably to roost.

Courtship behavior has never been reported in this genus. Mating most often takes place during the active midday hours. Miller and Miller (1981) reported that males of this genus use their penises to remove sperm deposited by a previous male before depositing their own in the female spermatheca. This supports the hypothesis made by Waage (1979a). Pairs of males and females may copulate at or near the oviposition site. Females, by themselves or in tandem, commonly oviposit in living plant material, rotting wood, and algal mats. Females may submerge themselves for as much as an hour during oviposition (Garrison 1984). Most species oviposit at or near the surface of the water. The ubiquitous nature of many members of this genus has made them favored subjects for numerous studies (McPeck 1989, 1990a,b, 1994, 1995, 1997, 1998; Fincke 1994; McPeck *et al.* 1996; Chivers *et al.* 1996; Lombardo 1997)

KEY TO ADULT SPECIES OF *ENALLAGMA*

MALES

1. Black area on dorsum of abdominal segment 2 occupying nearly 1/2 the length of the segment or less, confined to the apical 1/2 or isolated near the center as a narrow, transverse band (ventrolateral stripes may extend further basally) . 2
- 1'. Black area on dorsum of abdominal segment 2 occupying from 2/3 to the entire length of the segment 9
- 2(1). Inferior caudal appendages shorter than, or subequal in length to the superior appendages 3

- 2'. Inferior caudal appendages distinctly longer than the superior appendages . . . 7
- 3(2). Apical 1/2 of paraprocts, when viewed laterally, turned sharply upward almost at right angle, and directed toward ventral margin of superior caudal appendages, or very short and directed dorsad almost from base; dominant color of abdominal segments 1-7 deep violet, purple or dark blue
- *novaehispaniae*
- 3'. Inferior caudal appendages, when viewed laterally, either straight or curving only gradually distad; dominant color of abdominal segments 1-7 pale or bright blue 4
- 4(3'). Superior caudal appendages, when viewed ventrolaterally, broadly emarginate and at least 2/3 the lateral length of abdominal segment 10 5
- 4'. Superior caudal appendages, when viewed ventrolaterally, not broadly and deeply emarginate, and usually about 1/2 the lateral length of abdominal segment 10 (in *civile* 2/3 or more) 6
- 5(4). Dorsum of abdominal segment 7 blue on apical 1/3 to 1/2; tips of superior caudal appendages, when viewed laterally, aslant posteroventrally
- *aspersum*
- 5'. Dorsum of abdominal segment 7 black apically; tips of superior caudal appendages, when viewed laterally straight *praevarum*
- 6(5). Upper arm of superior caudal appendage more prominent than lower arm, pale tubercle not surpassing tip of dorsal arm; medial surface of superior caudal appendages with strong, pointed recurved tooth at base of tubercle; black areas

- of abdominal segments 3-5 usually much less than 1/2 the length of their segments *civile*
- 6'. Upper and lower arms of superior caudal appendages nearly equal in prominence, pale tubercle extending beyond tips of dorsal arm; medial surface of cerci without a sharp, recurved tooth; black areas of abdominal segments 3-5 variable *doubledayi*
- 7(2'). Black marking on dorsum of abdominal segment 3 slightly greater than 1/2 the length of that segment; 4 or 5 postquadrangular cells; vein M₂ nearly always arising near the 6th postnodal crossvein in forewing *durum*
- 7'. Black marking on dorsum of segment 3 generally much less than 1/2 the length of that segment; 3 or 4 postquadrangular cells; M₂ generally arising near the 5th postnodal crossvein in the forewing 8
- 8(7'). Superior caudal appendages, when viewed laterally, not upturned apically; the pale tubercle of the superior appendages located on the medial margin near the apex *boreale*
- 8'. Superior caudal appendages, when viewed laterally, upturned apically; the pale tubercle of the superior appendages located at extreme tip (best seen dorsally) *cyathigerum*
- 9(1'). Ventrolateral black markings extending entire length of abdominal segments 8 and 9, and nearly entire length of segment 2 *geminatum*
- 9'. Abdominal segments 2, 8 and 9 lack dark ventrolateral stripes 10
- 10(9'). Black humeral stripe at midlength 1/2 to 1/5 the width of the blue antehumeral

- stripe 11
- 10'. Black humeral stripe at midlength much more than 1/2 the width of the antehumeral stripe, or if only 1/4 as wide, then antehumeral stripe orange or yellow (*vesperum*) 13
- 11(10). Superior caudal appendages nearly as long as abdominal segment 10 laterally and longer than inferior appendages; dorsum of segment 10, 1/2 to entirely black 12
- 11'. Superior caudal appendages nearly 1/2 the length of abdominal segment 10 laterally and equal to or shorter than inferior appendages; dorsum of segment 10 entirely blue *or* with a small, black basal spot *daeckii*
- 12(11). Superior caudal appendages, when viewed dorsally, with lower arms directed medially toward each other, their tips nearly touching; black marking on dorsum of abdominal segment 3 reaching base *traviatum westfalli*
- 12'. Superior caudal appendages, when viewed dorsally, with inferior arms directed posteriorly beneath dorsal arms, their tips widely separated; black marking on dorsum of segment 3 not reaching base *praevarum*
- 13(10'). Superior caudal appendages, when viewed laterally, bifid, or at least emarginate apically to produce dorsal and ventral arms, and distinctly shorter than abdominal segment 10 laterally; legs with distinct black markings; pale color of mature specimens mostly blue, violet or green 14
- 13'. Superior caudal appendages neither bifid nor emarginate apically as described above and nearly as long as or longer than abdominal segment 10; legs

- practically without black markings, except sometimes in distal 1/2 of femora; pale color of mature specimens orange or red 17
- 14(13). Vein M_2 arising near fourth and third postnodal crossveins in the fore- and hindwing respectively; abdominal segments 4-6 with dorsal pale blue marking on basal 1/3; black humeral stripe divided along mesopleural suture by a pale longitudinal stripe *basidens*
- 14'. Vein M_2 arising near fifth and fourth postnodal crossveins in the fore- and hindwings respectively; abdominal segments 4-6 with dorsal pale blue marking confined to basal 1/10; black humeral stripe usually entire 15
- 15(14'). Abdominal segment 8 predominately blue dorsally, nearly always with a small, basal, black triangular spot; black humeral stripe less than twice the width of the blue antehumeral stripe *divagans*
- 15'. Abdominal segment 8 entirely metallic black dorsally; black humeral stripe at least twice the width of the narrow pale antehumeral stripe, usually much more (except in *exsulans*) 16
- 16(15'). Upper and lower arms of superior caudal appendages long and widely divergent, the dorsal arm longer; face orange; abdominal segment 4 less than 3 times the length of segment 2 *antennatum*
- 16'. Upper and lower arms of superior caudal appendages short and not widely divergent, the ventral arm longer; face blue; abdominal segment 4 nearly 4 times the length of segment 2 *exsulans*
- 17(13'). Dorsum of abdominal segment 9 pale (blue, orange or yellow); black humeral

- stripe often narrower than pale antehumeral stripe along part of its length,
sometimes along entire length 18
- 17'. Dorsum of abdominal segment 9 black; black humeral stripe usually wider
than orange antehumeral along entire length 19
- 18(17). Black humeral stripe much narrower than pale antehumeral stripe; middorsal
stripe narrower than antehumeral stripe *vesperum*
- 18'. Black humeral stripe about as wide as pale antehumeral stripe; middorsal
stripe wider than antehumeral stripe *signatum*
- 19(17'). Black humeral stripe at most about twice the width of the pale antehumeral
stripe; larger, total length greater than 31 mm *concisum*
- 19'. Black humeral stripe 4 times the width of the pale antehumeral stripe; smaller,
total length less than 29 mm *dubium*

FEMALES

1. Dark humeral stripe wanting, or partly black, but interrupted or divided
longitudinally by light brown marking, or entirely light brown 2
- 1'. Dark humeral stripe entirely black and complete 8
- 2(1). A pale spot between the lateral ocelli; middle prothoracic lobe without distinct
dorsolateral pits; dorsum of abdominal segment 9 entirely pale or at most with
a very small basal black spot 3
- 2'. Area between lateral ocelli entirely black or if small pale spot is present,
middle prothoracic lobe with distinct dorsolateral pit on each side; dorsum of

- abdominal segment 9 at least 1/3 black 4
- 3(2). Black extending entire length of dorsum of abdominal segment 8;
mesostigmal plates with posterior margins not strongly elevated in lateral half,
so posterolateral corner is lower than anterolateral corner; abdomen usually
greater than 30 mm long *daeckii*
- 3'. Black extending at most 3/4 the distance from base to apex of dorsum of
abdominal segment 8; mesostigmal plates with posterior margins strongly
elevated in lateral half, so posterolateral corner is at least as high as
anterolateral corner; abdomen generally shorter than 27 mm
..... *traviatum westfalli*
- 4(2'). Middle prothoracic lobe with a dorsolateral pit on each side; thoracic color
usually predominantly yellow, green or orange *vesperum* (in part)
- 4'. Middle prothoracic lobe without dorsolateral pits; thoracic color
predominately grayish green, blue or light brown 5
- 5(4'). Forewing with 5 to 8 postnodal crossveins and M_2 arising near fourth
postnodal crossvein; light brown line dividing black humeral stripe very
distinct, full length, and less than half the width of the entire stripe; pale spots
anterior to lateral ocelli *basidens*
- 5'. Forewing usually with 9 to 12 postnodal crossveins and M_2 arising near fifth
postnodal; light brown line dividing black humeral stripe without sharply
defined edges, sometimes incomplete and varying in width from a hairline to
nearly the full width of the stripe; area anterior to lateral ocelli black 6

- 6(5'). A distinct, broad swelling present on mesepisternum posterior to each mesostigmal plate; mesostigmal plates each with a small, yellow tubercle at posteromedial corner; black humeral stripe usually divided by brown spot only at upper end; abdominal segment 9 in dorsal view black, but often with a median, pale spindle-shaped spot *antennatum*
- 6'. No distinct swellings on mesepisternum posterior to mesostigmal plates; mesostigmal plates usually without pale, posteromedial tubercles (*divagans* with distinct tubercles, usually black, but rarely pale); black humeral stripe usually divided by brown stripe for most of its length; abdominal segment 9 variable but never with a median, pale, spindle-shaped spot 7
- 7(6'). Mesostigmal plates each with distinct posteromedial tubercle; middorsal thoracic carina usually black *divagans*
- 7'. Mesostigmal plates without distinct posteromedial tubercles; middorsal thoracic carina pale *exsulans*
- 8(1'). Middle lobe of prothorax with pair of dorsal or dorsolateral pits, the edges of which are sharply defined 9
- 8'. Middle lobe of prothorax without dorsal or dorsolateral pits, although shallow depressions may be present 14
- 9(8). Abdominal segment 1 dorsally pale on the apical 1/3 to 1/2; mesostigmal plates without a high, pale tubercle at the posteromedial corner, nor with high mesepisternal tubercles posterior to mesostigmal plates 10
- 9'. Abdominal segment 1 dorsally wholly black except for narrow, pale apical

- annulus; mesostigmal plates each usually with a high pale tubercle at the posteromedial corner; if tubercles of mesostigmal plates are indistinct, then prominent mesepisternal tubercle present just posterior to each plate;
- abdominal segment 8 in dorsal view entirely black or nearly so 11.
- 10(9'). Abdominal segment 7 in dorsal view largely pale in basal 2/3 or more, except along midline; abdominal segment 1 usually with a small, round, lateral, apical black spot; abdominal segment 8 with pair of large blue, dorsolateral spots in basal half, usually separate or nearly so from pale ventrolateral areas *aspersum*
- 10'. Abdominal segment 7 in dorsal view mostly black basally; abdominal segment 1 with a vertically elongate, lateral, apical black spot; abdominal segment 8 with basal blue spots bordered laterally by a black stripe, therefore not confluent with ventrolateral pale area *geminatum*
- 11(9'). Dorsum of abdominal segment 10 almost entirely pale 12
- 11'. Dorsum of abdominal segment 10 almost entirely black 13
- 12(11). Black humeral stripe much less than half as wide as the pale antehumeral stripe *vesperum* (in part)
- 12'. Black humeral stripe more than half as wide as the pale antehumeral stripe *signatum*
- 13(11'). Distinct mesepisternal tubercles present; black humeral stripe at least 4 times as wide as the pale antehumeral stripe; prothoracic pits located near anterior margin of the middle lobe and not bordered by a pale spot *dubium*

- 13'. Mesepisternal tubercles absent or indistinct; black humeral stripe at most twice as wide as the pale antehumeral stripe; prothoracic pits located nearer the midsection of the middle lobe and usually bordered by a pale spot
 *concisum*
- 14(8'). Four or 5 postquadrangular cells in forewing; large, stocky, abdomen, at least 29 mm *durum*
- 14'. Two or 3 postquadrangular cells in forewing; smaller, slender, abdomen, generally no longer than 28 mm 15
- 15(14'). Black humeral stripe with an anterior projection extending toward and sometimes reaching posterior margin of mesostigmal plates; abdominal segment 8 nearly always with a ventrolateral black stripe, typically confluent with apical transverse stripe *novaehispaniae*
- 15'. Black humeral stripe without a black spot extending toward mesostigmal plates; abdominal segment 8 without a ventrolateral black stripe 16
- 16(15'). Hind lobe of pronotum with a pale, median tubercle bearing long setae; a broad, but distinct swelling present on mesepisternum posterior to each mesostigmal plate; face usually orange; abdominal segment 9 in dorsal view black, but often with a median, pale, spindle-shaped spot
 *antennatum*
- 16'. Hind lobe of pronotum without a pale, median tubercle OR if tubercle present, mesepisterna without distinct swellings; face green, grayish blue or tan; abdominal segment 9 in dorsal view either mostly pale OR black without a

- pale median spot 17
- 17(16'). Hind lobe of pronotum with a pale, median tubercle; abdominal segment 10 entirely pale or with a small, black dorsal spot apically, segment 9 generally with a small, basal, bilobed black spot, only rarely extending entire length of segment *divagans*
- 17'. Hind lobe of pronotum without a median tubercle; abdominal segment 10 usually with more extensive black markings, segment 9 usually with black from base to apex 18
- 18(17'). Mesostigmal plates with ridges forming medial margins narrow and very sharply defined, parallel or even slightly convex medially and continuous with similar ridges forming anteromedial corners and slightly broader ridges forming posteromeidal corners of each plate, thus delimiting a large, smooth, oval depression that occupies the entire medial half of the plate
..... *doubledayi*
- 18'. Mesostigmal plates with medial ridges different in shape, usually broader and less sharply defined, not delimiting such large, medial depressions 19
- 19(18'). Posterior border of each mesostigmal plate well defined by a narrow sulcus extending its entire length 20
- 19'. Posterior border of each mesostigmal plate indistinct over part of its length, the sulcus lacking *boreale*
- 20(19). Mesostigmal plates with medial borders usually at least slightly convergent forward, and each with a distinct, elongate depression confined to the

- anteromedial corner *cyathigerum*
- 20'. Mesostigmal plates with medial borders parallel or slightly divergent forward,
without such depressions 21
- 21(20'). Mesostigmal plates with medial ridges usually only slightly divergent
forward, each plate lateral to the medial ridge flat or elevated only along
anterolateral margin, forming a shallow depression running diagonally from
anteromedial to posterolateral portion of plate; black stripe on dorsum of
abdominal segment 1 generally almost reaching apex of segment and of
uniform width, black stripe on dorsum of segment 8 usually not markedly
constricted basally *civile*
- 21'. Mesostigmal plates with medial ridges strongly divergent forward and
thickened, each with a prominent diagonal ridge running from about middle of
posterior border to anterolateral corner of plate, these 2 ridges forming a
sharply defined depression between them in the middle of each plate; black
stripe on dorsum of abdominal segment 1 usually not nearly reaching apex of
segment or, if so, constricted apically, black stripe on dorsum of segment 8
usually constricted basally *praevarum*

Enallagma antennatum (Say)

Rainbow Dancer

(Fig. 150, 169-170, 207, Map 39)

Agrion antennatum Say, 1839: 39.

Protoneura antennata, Hagen, 1861: 73.

Enallagma fischeri Kellicott, 1895: 206.

Type. N. America.

Regional Distribution.

Biotic Province(s): Texan.

Watershed(s): Canadian, Cimarron.

General Distribution. UNITED STATES: CO, IL, IN, IA, KS, KY, MD, MI, MN, MO, MT, NE, NY, ND, OH, OK, PA, SD, WV, WI, WY; CANADA: Ont., Que.

Seasonal Distribution. Jun. 15 (OK).

Identification. This colorful species is not easily confused with the other *Enallagmas* in the south-central U.S. The initial impression in the field may actually be of an *Ischnura*. The male's face is bright orange. There is a prominent blue-green occipital bar and a pair of narrowed postocular spots that may be confluent with the bar. The eyes in life are brown dorsally fading to a green or yellow ventrally. The pronotum is largely black, bearing a blue transverse bar anteriorly. There is sometimes a median spot in addition to a pair of dorsolateral blue-green spots on the middle lobe. The hind lobe is marked with yellow, medially and laterally. There is a black middorsal stripe that is half the width of the mesepisterna. The antehumeral stripe is orange to greenish-yellow and the rest of the pterothorax is largely a pale blue-green, fading extensively to yellow-green ventrally. The wings are hyaline. The legs are a yellowish-orange with black markings.

The abdomen is largely marked with black dorsally, on segments 1-7. The above segments are green laterally, but with blue on segments 1-3 and 8-10. Segment 1 has a dark line dorsally that narrows medially only to expand into a thin subapical band, bordered by blue apically. Segments 2-6 have the black dorsal stripe extending the full length of the segment with a subapical expansion at each segment. Segment 7 is similar to 6 only sometimes with a narrow blue apical band. Segment 8 is entirely black dorsally, excepting a narrow blue apical band. Segment 9 is generally completely blue, with only occasionally a narrow black basal band, and segment 10 is black dorsally becoming blue or yellow ventrally. The deeply bifid superior caudal appendages are black and not more than $\frac{2}{3}$ the length of segment 10. The inferior appendages are nearly all pale, becoming dark apically. This dark apex curves dorsoanteriorly.

The female is colored and patterned much the same as the male on the head and thorax. The middorsal carina is generally more extensively pale. The mesostigmal plates are bordered posteriorly by a distinct sulcus, though a deep pit is lacking. These plates are more or less triangular with a pale tubercle at the posteromedial corners. Mesepisternal tubercles are lacking, but there is a transverse swelling medially behind each mesostigmal plate. The wings are as in the male.

The abdomen is marked as in the male on segments 1-6. Segments 7-9 are generally completely black, excepting a narrow apical band. Segment 9 generally has a median pale spot dorsally. Segment 10 has black narrowing apically, but often not actually extending the length of the segment.

Size. Total length: 27-33 mm; abdomen: 21-27 mm; hindwing: 15-21 mm.

Habitat. Slow streams, lakes, gravel and borrow pits.

Discussion. This northern species just ranges southward to just reach our northernmost boundary, occurring in Oklahoma. Kennedy (1919) and Donnelly (1963) consider this species to be one of the most primitive of the *Enallagmas*. It appears to be most closely related to *E. exsulans* and *E. divagans*. Walker (1953) described its habitat as the quiet reaches of streams where current is very slow and where dense vegetation is lacking. Westfall and May (1996) reported it also occurring in gravel pits. Little is known about the reproductive behavior of this species. Garman (1917) noted that *E. antennatum* females may submerge when ovipositing.

***Enallagma aspersum* (Hagen)**

Azure Bluet

(Fig. 151, 171-172, 208, Map 40)

Agrion aspersum Hagen, 1861: 97.

Enallagma aspersum, Sélys, 1876: 518.

Type. United States; NHMV.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Red, St. Francis.

General Distribution. UNITED STATES: AL, AR, CT, DE, GA, IL, IN, IA, KS, KY,

ME, MD, MA, MI, MS, MO, NE, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VA, WV, WI; CANADA: Ont., Que.

Seasonal Distribution. May 14 (TX)- Aug. 3 (TX).

Identification. This species might be easily confused with the more widespread *E. civile* in the field based on color pattern; however, *E. aspersum* is darker dorsally. The front of the head in the male is blue with a black line across the postclypeus. The top of the head is black except for a thin pale occipital bar that is only narrowly separated from a pair of large blue, oval postocular spots. The pronotum is black dorsally with a pair of medial blue spots. The distal margin of the posterior lobe is bordered by blue. The middorsal carina and stripe of the pterothorax are black with the latter approximately 1/2 the width of the mesepisterna. There is a blue antehumeral stripe that extends no more than 1/2 the width of the middorsal stripe. The black humeral stripe narrows posteriorly, often expanding anteriorly on the mesepimeron, but generally remaining narrower than antehumeral stripe. The rest of the pterothorax is pale blue, fading ventrally. The wings are hyaline with a dark pterostigma. Vein M_2 arises near the fifth postnodal crossvein in both wings. The legs are pale with dark stripes laterally and the tarsi are typically black with lighter tarsal claws.

The abdomen is blue above, fading laterally and ventrally. There is black basally on the dorsal 1/2 of segment 1 and there is a black spot on the apical 2/5 of segment 2 that is confluent with an apical ring. A narrow, dorsal black stripe starts at the basal 1/8 of the segment and widens for the full length of the segment. The entire dorsum of segments 4-6 is black except for a pale basal ring. Segment 7 is black for the basal 1/3 to 2/3 of the

segment and blue apically and laterally. Segments 8 and 9 are entirely blue. Segment 10 has a wide dorsal black stripe that narrows apically. The dark superior caudal appendages are distinctly bifid when viewed laterally. the upper arm of this appendage is much longer and more pronounced than the lower. The dark inferior appendages curve dorsally to reach the lower arm of the appendages above.

The head and thorax of the female are very similar to those of the male but with the pale blue colors generally replaced with green. The postocular spots are significantly smaller than in the male. There are a pair of kidney-shaped pits in the posterior 1/3 of the pronotum. The mesostigmal plates have a distinct posterior border and the wings are as in the male.

The abdomen is generally paler with more extensive yellow ventrolaterally. Segments 1 and 3-6 are generally as in the male. Segment 7 is nearly all black with an apical blue ring. Segment 8 is black with a narrow pale apical ring and a pair of pronounced blue spots at the basal 1/3 to 1/2 of the segment. Segments 9 and 10 are black dorsally with only a pale blue apical margin. The larva has been illustrated by Huggins and Brigham (1982).

Size. Total length: 27-34 mm; abdomen: 21-27 mm; hindwing: 15-20.

Habitat. Fishless lakes and semipermanent ponds and bogs.

Discussion. This infrequently seen species has been documented, in the north-central Texas area, from Collin, Dallas and Wise counties only. Its range in our area is restricted to the northern Austroriparian and Texan biotic provinces. It is generally restricted to fishless ponds and lakes (McPeck 1989), but Carpenter (1991) reported it occurring along

shallow grassy or boggy shorelines.

Bick and Hornuff (1966) and Bick (1972) studied its reproductive behavior, and found that unpaired males seldom perch or maintain a territory prior to mating. Females move away from the water between noon and 1300 hours each day, only to reappear in numbers between 1330 and 1430 hours. No courtship behavior takes place and emerging males will often seize ovipositing females from the water. Sperm transfer generally occurs while in tandem and perching on vegetation, quickly followed by copulation lasting an average of 14 minutes. Females most often oviposit completely submerged and unaccompanied (Jacobs 1955; Bick and Hornuff 1966).

Unlike most damselflies (Corbet 1963), female *E. aspersum* do not begin ovipositing above the water and back down, but rather determine an appropriate stem and immediately proceed down it, head first. The male separates upon contact with the water and perches nearby. Bick and Hornuff (1966) reported seeing a female submerge as low as 15 inches to oviposit at the base of the plant, apparently as an adaptation to avoid summer drought. Oviposition has not been recorded for more than 25 minutes (Morgan 1930; Jacobs 1955; Bick and Hornuff 1966).

Ingram and Jenner (1976) studied the life history of *E. aspersum*. Catling and Pratt (1997) noted that although it was formerly restricted to bog-marginated lakes, it seems to be expanding its habitat to include artificial ponds and calcareous and alkaline gravel pits in Ontario, Canada.

***Enallagma basidens* Calvert**

Double-striped Bluet

(Figs. 145, 152, 173-174, 209, Map 41)

Enallagma basidens Calvert, 1902: 114.**Type.** Texas, Corpus Christi Region?; ANSP - lost. See Garrison (1984) for discussion.**Regional Distribution.***Biotic Province(s):* Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.*Watershed(s):* Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.**General Distribution.** UNITED STATES: AL, AZ, AR, CA, CO, DE, FL, GA, IL, IN, IA, KS, KY, LA, MD, MI, MO, MS, NE, NM, NJ, NY, NC, OH, OK, PA, SC, TN, TX, VA, WV, WI; CANADA: Ont.; MEXICO: CHI, NLN, SLP, TAM.**Seasonal Distribution.** Feb. 18 (TX) - Nov. 6 (TX).**Identification.** The small size and divided humeral stripe generally allow for easy identification of this common, widespread species. The front of the head in the male is blue with a broad black stripe on the labrum and postclypeus. There is a broad black band extending between the compound eyes, including the ocelli, on the top of the head and a pale occipital bar that is generally confluent with the small postoccipital spots. Sometimes this bar is reduced only to lateral extensions of these spots.

The pronotum is black with a pair of pale dorsolateral spots on the middle lobe. The hind margin of the posterior lobe is blue. There is a pale blue middorsal carina running through a broad black middorsal stripe, that is approximately 1/2 the width of the mesepisterna. The blue humeral stripe is subequal in width to the antehumeral stripe, but narrowed basally, and divided for nearly its entire length by a pale blue line 1/4 to 1/3 of its width. This blue stripe is generally confluent at its upper end with the remainder of the blue pterothorax. There is often a narrow abbreviated black line on the upper end of the interpleural and occasionally metapleural sutures. The wings are hyaline with a light trapezoidal pterostigma. The M_2 arises near the fourth and third postnodal crossveins in the fore- and hindwings, respectively. The coxae and femora are pale blue or cream with a dark stripe on the outer surface. The tibiae and tarsi are generally pale and lack any dark markings.

The abdomen is largely bright blue, becoming paler ventrally. The entire dorsum of segment 1 is black except for a narrow blue apical band. There is a black stripe that runs the entire length of segments 2 and 3 dorsally, extending laterally in the distal 3/4-4/5 of each segment. There is a black hastate stripe on the apical 1/2-2/3 of segments 4-6, dorsally. The entire dorsum of segment 7 is black, except for pale basal and apical rings. Segments 8 and 9 are generally entirely blue and segment 10 has an irregular black stripe dorsally. The superior caudal appendages are black and extend for approximately half the length of segment 10. These appendages are sharply truncate, when viewed laterally and have a distinct basal ventrally directed lower lobe. The inferior appendages are pale becoming darker apically. They curve upwards and extend slightly more than 1/2 the

length of the superior appendage.

The head and thorax of the female closely resemble those of the male, but with the pale colors more extensive. Females occur in three different color forms, with the pale colors either blue, green or brown. There are generally small pale spots anterior to each ocellus. The pale stripe dividing the humeral stripe is most often confluent anteriorly and posteriorly with the rest of the pterothorax. There is a distinct anterior high ridge towards the middle of each depressed mesostigmal plate and these plates have a strong prominence at each posteromedial corner.

The abdominal segments are similar to those of the male, but with the dorsum of segments 3-6 entirely black except for a narrow, basal pale ring. Segment 8 is black dorsally with only a narrow apical pale ring. Segment 9 is black dorsally with a large blue spot in the basal 1/3-2/3 of the segment that narrows and is distinctly emarginate apically. This spot is sometimes divided into two separate triangles. The dorsum of segment 10 is entirely blue.

Size. Total length: 21-28 mm; abdomen: 17-22 mm; hindwing: 10-15 mm.

Habitat. Various permanent and semipermanent lentic bodies of water including ponds, lakes and reservoirs as well as slow reaches of streams and rivers.

Discussion. *Enallagma basidens*, originally described from Texas, has expanded its range westward. This expansion is probably a result of extensive irrigation affording new suitable breeding localities (Montgomery 1942, 1966; Paulson and Garrison 1977). It has also expanded its range eastward this century, now reaching as far as Florida (Dunkle 1990) and the Carolinas, north to New York and Michigan (O'Brien 1997). Cunnings

(1989) first reported it from Canada in southwestern Ontario collections taken in 1985.

Hornuff (1968) briefly summarized some of the reproductive behaviors, including sperm translocation. Females are often only observed around water while in tandem. Oviposition occurs in tandem where floating masses of filamentous algae and other vegetation are preferred (Bird 1933a). Dunkle (1990) reports that *Enallagma basidens* perches over water from 1000 to 1600 hours. The larva of this species was first described and illustrated by Bird (1931). Ferguson (1944) subsequently described it from a single exuviae taken near Dallas, Texas, and Huggins (1978a) redescribed the larva discussing its morphological similarities to *E. exsulans* and Walker's (1953) *Enallagma* Group II. He included a correction to the larval key for this group found in Walker (1953).

Enallagma boreale Sélys

Boreal Bluet

(Fig. 153, 175-176, 210, Map 42)

Aenallagma boreale Sélys, 1875: 242.

Enallagma cyathigerum race? *boreale* Sélys, 1876: 509.

Enallagma circulatum Sélys, 1883b: 133.

Enallagma calverti Morse, 1895: 208.

Enallagma yezoensis Asahina, 1949: 34.

Enallagma deserti boreale Jurzita, 1975: 39.

Type. White Bay, Newfoundland, Canada; lost.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AK, AZ, CA, CO, CT, ID, IL, IN, IA, ME, MA, MI, MN, MO, MT, NE, NV, NH, NM, NY, ND, OH, OR, PA, RI, SD, UT, VT, WA, WV, WI, WY; CANADA: Alb., B.C., Man., N.B., Nfld., N.S., N.W. Terr., Ont. P.E.I., Sask., Yuk.; MEXICO: DGO.

Seasonal Distribution. June (NM).

Identification. *Enallagma boreale* is a principally northern species whose males closely resemble those of *E. cyathigerum* in color. The face of the male is blue with a black bar across the top of the frons. The top of the head is broadly black with two pale more or less oval postocular spots that are not confluent with the compound eyes. There is a pale occipital bar that is thinly separated from each postocular spot.

The pronotum is black with a pair of elongated pale dorsolateral spots on the median lobe and the hind margin of the posterior lobe is pale as well as the entire lateral portions of the prothorax. The middorsal carina and stripe of the pterothorax are both black. The pale antehumeral stripe is 2/3 the width of the middorsal stripe. The jagged black humeral stripe is subequal in width to the antehumeral stripe of its upper and lower ends but is constricted towards the middle. The rest of the pterothorax is blue with an abbreviated black stripe on the upper 1/5-1/4 of the interpleural suture. The wings are hyaline with a dark pterostigma. Vein M_2 arises near the 6th and 5th postnodal crossveins

in the fore-and hindwings, respectively. The legs are pale with heavy dark stripes on the outer surface of the femora and tibiae and the tarsi are pale.

The first abdominal segment is nearly all blue with a small lateral black spot apically. Segment 2 is blue with a distinctive dorsal black crescent on its apical 2/3 and a black apical ring. Segments 3-5 are blue with a broad black apical ring for about 1/4 its length. On segments 6-7 the black band extends to 3/5 and 3/4 the segment length, respectively. Segments 8-9 are entirely blue and segment 10 is black dorsally and somewhat emarginated laterally. The superior caudal appendages are dark and somewhat rounded apically, extending to approximately 1/3 the length of segment 10. A distinct medial tubercle is visible when viewed dorsally. The inferior appendages are much longer, approximately 1.5 times the superior appendages and are curved slightly upwards.

The head and thorax of the female have a very similar color pattern to that of the male, with the pale areas more extensive. There are no distinct pits on the middle lobe of the pronotum. The hind margin of the mesostigmal plates is indistinct medially. The ridge along this medial margin is distinctly enlarged, forming a tuberculate swelling. The wings are as in the male.

The abdominal color pattern is similar to that of the male, but with a dark basal spot on the dorsum of segment 1. Segment 2 has a middorsal black stripe that extends the full length of the segment and is expanded distinctly in the apical 2/3 and only slightly basally. There is also a black apical ring on this segment. Segment 3 has a basally tapering middorsal stripe that is confluent with a broad apical ring extending approximately 1/4 of the segment. Segments 4-7 have a broad basally pointed dark stripe

on their dorsum. Segment 8 has a dark apical ring extending 1/3 the length of it and there is a narrow middorsal stripe that is broadly confluent with the ring. Segments 9 and 10 are entirely black.

Size. Total length: 28-36 mm; abdomen: 22-29 mm; hindwing: 17-22 mm.

Habitat. Fishless ponds, lakes, slow moving streams and occasionally saline waters.

Discussion. This species is very widespread, but only reaches New Mexico in the south-central U.S. The caudal appendages of *E. boreale* are so morphologically similar to its Palaerctic counterpart, *E. deserti*, that Juritza (1975) considered *E. boreale* a subspecies of the latter. Garrison (1984) and May (1997a) consider *E. boreale* to be a full species pending a more thorough study of other old world related forms.

Walker (1953) reported *E. boreale* occurring in a variety of lentic situations, but generally only when fish were lacking. The reproductive behavior of this species has been relatively well studied (Logan 1971; Furtado 1973; Paulson 1974). Various authors have commented on oviposition in this species (Walker 1953; Robert 1963; Logan 1971; Provonsha 1975, Lebus and Pilon 1976; Lebeuf and Pilon 1977). Pairing begins shortly after emergence and continues throughout the summer. The female sometimes oviposits unaccompanied by the male, but more often this is done in tandem. Emergent aquatic vegetation seems to be preferred and oviposition generally occurs just above water level.

The larval development and life history of *E. boreale* has been studied by Rivard *et al.* (1975), Lebeuf and Pilon (1977), and Baker and Clifford (1982). Wisenden *et al.* (1997) studied two Canadian populations of larval *E. boreale*. They found one occurring with the predatory fish the northern pike (*Esox lucius*) and a second that did not. The

population occurring with the pike adopted antipredator behavior in response to chemical stimuli from injured conspecifics and from chemical stimuli given off by the pike themselves. They found that individuals that were previously unexposed and unresponsive to stimuli from the pike learned to recognize these stimuli after a single exposure. McPeck (1997) studied selection and the subsequent adaptation by larvae to dragonfly predation.

***Enallagma civile* (Hagen)**

Familiar Bluet

(Fig. 154, 177-178, 211, Map 43)

Agrion civile Hagen, 1861: 88.

Enallagma civile, Sélys, 1876: 514.

Enallagma civile plebeium, Sélys, 1876: 515.

Enallagma civile race? *simile*, Sélys, 1876: 515.

Agrion canadense Provancher, 1876: 325.

Type. "Pecos River, Texas," actually New Mexico: Chaves County, near Roswell (see Needham and Cockerell 1903, Garrison 1994); MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado,

Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jose, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AZ, AR, CA, CO, CT, DE, DC, FL, GA, HA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, WV, WI, WY; MEXICO: AGS, BCA, CHS, CHI, COA, DFE, DGO, HGO, JAL, MEX, MCH, MOR, NAY, NLN, OAX, SLP, SIN, SON, TAM, TLX, VER; Cuba, Dom. Rep., Haiti, Jamaica, P. Rico, Bahamas; south to Columbia and Venezuela.

Seasonal Distribution. All year (TX).

Identification. This familiar blue damselfly is very likely the most widespread in North America and certainly within the south-central U.S. The front of the head in the male is blue with a black bar on the postclypeus. The top of the head is largely black except for blue anteriorly, a thin postoccipital bar (sometimes absent), and two small postocular spots. The pronotum is largely black with blue only on the anterior 1/2 of the anterior lobe two large dorsolateral spots and occasionally a small median spot on the middle lobe, and the hind margin of the posterior lobe. The middorsal carina is nearly always black with a wide middorsal stripe 1/2 the width of the mesepisterna. The blue antehumeral stripe is no more than 1/2 the width of this middorsal stripe. The dark humeral stripe widens anteriorly and is generally only 2/3 the width of the antehumeral stripe at that point. The rest of the pterothorax is pale to bright blue fading ventrally. The wings are hyaline with a dark pterostigma. Vein M_2 arises near the 5th postnodal crossvein in both wings. The legs are pale with broad black stripes on the outer surfaces,

but the distal portions of the tibiae and all the tarsi lack black stripes.

The abdomen is bright blue dorsally marked with black, becoming pale ventrolaterally. Segment 1 is entirely blue except for its basal $1/3$ to $1/2$ which is black dorsally. There is a large, irregular black spot that occupies the apical $1/2$ of segment 2 dorsally and is confluent with the apical ring. There is a similar spot dorsally on segments 3-5 that extends $1/4$ to $1/2$ the length of the segment and has a thin hairline extension middorsally, sometimes running the entire length of the segment. These dorsal stripes extend $1/2$ to $3/4$ or more the length of segments 6 and 7. Segments 8 and 9 are entirely blue and segment 10 is black dorsally, with slight emarginations on the sides. Each superior caudal appendage is uniformly black with a pale distal tubercle that extends beyond the lower arm of the appendage but that is clearly encompassed by the upper arm when viewed laterally. These appendages are approximately $3/4$ the length of segment 10. The inferior appendages are pale with dark tips and slightly curved upward.

The female may be either blue or tan. The head and thorax are similarly marked to those of the male. The middorsal carina may have a full length hairline stripe. The wings and legs are like those of the male. The middorsal lobe of the pronotum lacks any distinct pits. The mesostigmal plates are divergent anteriorly with the anterolateral corners elevated.

The abdomen is generally marked with more black. Segment 1 is almost entirely black dorsally with only a pale apical ring. There is a broad full length black stripe dorsally on segment 2. Segments 3-6 have a hastate black stripe that runs their entire length, or nearly so. Segment 7 is generally all black dorsally with only a pale apical and

sometimes basal ring. There is a full length black stripe running from segments 8 through 10 dorsally. This stripe is occasionally constricted basally on segment 8 and apically on segments 9 and 10. Needham and Cockerell (1903) first described the larva from Las Vegas, New Mexico, and Novelo and Gonzalez (1991) recently illustrated it.

Similar species include *E. aspersum*, *E. cyathigerum*, and *E. doubledayi*. The latter species and *E. civile* are often found together in eastern populations.

Size. Total length: 29-39 mm; abdomen: 22-34 mm; hindwing: 16-21 mm.

Habitat. Ephemeral or permanent lentic and slow flowing bodies of water, including ponds, lakes and streams, irregardless of salinity and vegetation.

Discussion. This generally distributed, southern species has extended its range dramatically, to now extend from as far south as Columbia and Venezuela north into southern Canada. It is only absent from the Pacific Northwest in the U.S. It has entered California only in the last 80 years (Garrison 1984) and more recently western Montana (Roemhild 1975), British Columbia (Scudder *et al.* 1976, Cannings and Stuart 1977), Oregon (Johnson and Paulson 1998), New York (Catling 1998) and southern Ontario (Caling 1996). It was accidently introduced into Oahu in 1936 and now occurs commonly on all of the major Hawaiian Islands (Zimmerman 1948; Polhemus and Asquith 1996). Its success is probably due in part to its ability to colonize temporary and newly created aquatic habitats (Voshell and Simmons 1978).

Prey of this species includes adult sweepotato whiteflies (Schaefer *et al.* 1996) and other small flies and insects. It is so commonly encountered that several authors have described its oviposition (Wilson 1920; Bird 1933a; Hornuff 1968; Bick 1972). Ferguson

(1940) made notes about a population observed at Sandpit Lake in Dallas Co., Texas, saying "...hundreds were in copulo, ovipositing on small plants just below the surface of the water." Moss (1992) studied oviposition site selection of *E. civile* and found that although aggregations reduced the risk of interference and may even lower predation risk, oviposition efficiency was also reduced. Its reproductive behavior has been studied extensively (Bick and Bick 1963, 1965; Bick 1963; Dunkle 1990). The peak activity is from midmorning into the afternoon. Males spend more days at the water (62%) than females (39%), but males mate on fewer of these days (14%) than females (79%) (Bick and Bick 1963). There is no courtship involved in mating and copulation may last as long as 45 minutes, but usually is over in 20 minutes. Oviposition occurs in tandem, with the male letting go to guard at a nearby perch before becoming completely submerged. Oviposition occurs in algae, roots, leaves and upright stems at the surface of the water. Underwater oviposition usually lasts an average of 12 minutes, but females may lay eggs for more than an hour below the surface, descending backwards (Dunkle 1990).

Johnson (1964a) studied polymorphic head color patterns in populations of *E. civile* and found that the majority (73-86%) of mature adult males lacked a postoccipital bar, while in the majority of females it was present. These females were split in having this postoccipital bar confluent (41-42%) and nonconfluent (50-52%) with the postoccipital spots.

Johnson (in Currie 1963) found *E. civile* males hiding underwater in a laboratory aquarium after the room temperature was accidentally left very low overnight. This was apparently an attempt to escape the cold temperature and as Dunkle (1990) pointed out

may suggest how damselflies escape cold weather in nature. Zehring *et al.* (1962) studied the eggs of *E. civile*.

***Enallagma concisum* Williamson**

Cherry Bluet

(Fig. 155, 179-180, 212, Map 44)

Enallagma concisum Williamson, 1922a: 117.

Type. Buckeye Homestead Pond, Enterprise, Florida; UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi.

General Distribution. UNITED STATES: AL, FL, GA, LA, MS, NC, SC.

Seasonal Distribution. Mar. 6 (LA) - Sep. 27 (LA).

Identification. This is a brilliant orange-red damselfly found only in the extreme eastern part of our area along the Mississippi Delta of Louisiana. The front of the head in the male is bright red-orange with only narrow black stripes along the frontal and fronto-clypeal sutures. The top of the head is black with small somewhat rounded, orange spots anterior to each ocellus. The base of each antenna is orange. The two transverse orange postocular spots are confluent with the occipital bar.

The pronotum is black with a broad red-orange stripe on the anterior margin of the

anterior lobe, a pair of dorsolateral-lateral spots on the medial lobe, and a narrow stripe on the hind margin of the posterior lobe. The lateral 1/2 of the posterior margin of the mesostigmal plates is orange. The middorsal carina and line are black, with the latter no more than 1/3 the width of the mesepisterna. The red-orange antehumeral stripe is nearly 1/2 the width of the middorsal stripe and more than 1/2 the width of the humeral stripe. There is an abbreviated black line on the interpleural suture and a slightly wider line on the metapleural suture. The remainder of the pterothorax is red-orange, quickly fading to a yellow or cream color. The wings are hyaline with a moderately pale pterostigma not quite subtending the full length of a cell. The vein M_2 arises nearest the 5th and 4th postnodal crossveins in the fore- and hindwings, respectively. The legs are entirely orange armed with dark spurs.

The abdomen is red-orange dorsally, becoming paler laterally, and marked with black. Except for the apical margin the entire dorsum of segment is black. There is a full length black stripe dorsally on segment 2 that is thin basally, widening considerably to a large spot over the apical 1/2 of the segment. A black stripe on the apical 1/3 to 4/5 of the dorsum of segment 3 that is truncated basally. The entire dorsum of segments 4-7 are black except for a broad, pale band basally. Segment 7 also has a narrow pale apical ring, dorsally. The entire dorsum of segments 8-10 are black except for pale narrow apical rings that are sometimes present. The superior caudal appendages are longer than segment 10 and orange or tan laterally, but distinctly white medially with dark tips. The pale inferior appendages are 1/2 to 2/3 the length of the superiors with the upper surface straight when viewed laterally.

The head of the female is similar to that of the male, but darker with black on the postclypeus. The pale areas are more yellow. There are distinct small pits medially on the middle lobe of the prothorax. The pterothoracic pattern is like that of the male with slightly wider humeral stripes and the pale areas yellow or yellow-green. The mesostigmal plates are generally triangular with a distinct pale tubercle on the posteromedial corners. The posterior and lateral borders are also pale. The wings are like those of the male. The legs are paler, more yellow or tan, and the femora have a dark stripe.

The pale areas of the abdomen are more yellow-green or tan. Segments 1-2 are like the male, but the black stripe on the latter is not as narrowed basally. The dorsum of segments 3-10 are nearly completely black, only interrupted by a pale ring on segments 7-10 and a basal ring on segments 3-7. There is a slight subapical expansion of this stripe on segments 3-6. The larva is undescribed, but Westfall and May (1996) included it in their key, modified here, based on reared material.

Females may be confused with those of *Enallagma dubium*, but *E. concisum* is larger and has red, not orange, antehumeral stripes.

Size. Total length: 27-32 mm; abdomen: 22-25 mm; hindwing: 13-17 mm.

Habitat. Sand-bottomed lakes and ponds, generally with ample emergent vegetation and lily pads.

Discussion. This species is closely related to *E. signatum*, but little is known of its reproductive behavior and ecology. It is usually seen on emergent vegetation and lily pads, where females curl their abdomens to oviposit on the underside of the latter's

leaves.

***Enallagma cyathigerum* (Charpentier)**

Northern Bluet

(Fig. 156, 181-182, 213, Map 45)

Agrion hastulatum Stephens, 1835: 74.

Agrion charpentieri Sélys, 1840: 214.

Agrion cyathigerum Charpentier, 1840: 163.

Agrion pulchrum Hagen, 1840: 80.

Agrion brunnea Evans, 1845: 15.

Agrion annexum Hagen, 1861: 87.

Aenallagma robustum Sélys, 1875: 243.

Enallagma cyathigerum, Sélys, 1876: 505.

Enallagma cyathigerum race? *annexum*, Sélys, 1876: 506.

Enallagma cyathigerum race? *robustum*, Sélys, 1876: 509.

Enallagma annexum, Kirby, 1890: 146.

Enallagma robustum, Kirby, 1890: 146.

Enallagma vernale Gloyd, 1943: 1.

Type. Europe; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AK, AZ, CA, CO, CT, ID, IN, IA, ME, MA, MI, MN, MT, NE, NV, NH, NJ, NM, NY, ND, OH, OR, PA, RI, SD, UT, VA, VT, WA, WV, WI, WY; CANADA: Alb., B.C., Man., N.B., Nfld., N.S., N.W.T., Ont., P.E.I., Que., Sask., Yuk.; MEXICO: BCA, BCS; also throughout most of the Holarctic region.

Seasonal Distribution. Jun. 26 (NM) - Aug. 7 (NM).

Identification. This very widespread species only occurs in the Guadalupe Mountains of southwestern New Mexico, within our area. It is very similar to the sympatric *E. boreale*. The face of the male is blue with black on the postclypeus. The top of the head is largely black with blue on the postfrons. There are two large blue, tear-drop shaped postocular spots that are generally not confluent with the pale occipital bar.

The pronotum is black with blue on the anterior margin of the anterior lobe and hind margin of the posterior lobe. There are also generally a pair of blue dorsolateral spots on the middle lobe and less frequently a small median spot. The middorsal carina of the pterothorax is generally blue, at least on the posterior half, surrounded by a black middorsal stripe approximately 1/2 the width of the mesepisterna. The pale blue antehumeral strip is slightly less than 1/2 of the width of the middorsal stripe and the black humeral stripe, narrowing considerably posteriorly to 1/2 as wide as the antehumeral stripe.

The rest of the pterothorax is blue, fading ventrally to a pale white or cream color. There is generally a small black spot on the metapleural fossa. The wings are hyaline

with a markedly dark pterostigma. The vein M_2 arises nearer the 6th and 5th postnodal crossveins in the fore- and hindwings, respectively. The legs vary from either blue or tan and have a black stripe on the outer femoral and inner tibial surfaces. The tarsi may be pale or dark.

The abdomen is mostly bright blue dorsally, fading laterally. The anterior 1/2 of the dorsum on segment 1 and poster 1/2 of segment 2 are black. There is an apical black spot on the dorsal 1/4 of segments 3-5. These spots often extend medially for half the length of the segment. The black dorsal stripe on segment 6 may extend from 1/2 to 3/4 of the segment apically. The entire dorsum of segment 7 is black with only a pale apical and wider basal ring. Segments 8 and 9 are blue and segment 10 is black dorsally. The superior caudal appendages are black and are no more than 1/2 the length of segment 10. The distal lower 1/2 of these appendages is upturned, when viewed laterally. When viewed dorsally, there is a distinct small pale apical tubercle just behind a subapical black tooth. The inferior appendages are approximately twice the length of the superior appendages. These pale appendages are distinctly darker apically and project nearly straight posteriorly.

The female may be blue, green or tan. The head is very similar to that of the male, with the only notable differences being smaller postocular spots. The thorax is like that of the male, but seldom with the humeral stripe wider than the antehumeral. The middle prothoracic lobe lacks any distinct pits. The mesostigmal plates are generally subquadrate. The posterior margin is entire and there is a distinct elongate depression along the anteromedial corner. The medial margins are concave or sinuate and generally

convergent anteriorly. The legs, especially the femora, are generally not as heavily marked with black as in the male.

Abdominal segment 1 is like that of the male and segment 2 has a dorsal black stripe extending the full length of the segment, and slightly expanded at about 3/4 its length apically. Segment 3-7 have broad black stripes that may either extend the full length of the segment or diminish anteriorly to only a hairline. Each stripe is widened considerably for the apical 1/4-1/5 of the segment. Segment 8 may vary from entirely black to entirely blue. Generally the dorsal black stripe is quadrate or somewhat triangulate. Segments 9 and 10 both have full length black stripes dorsally. The larva has been described by Lucas (1900) and Macneill (1950).

Size. Total length: 29-40 mm; abdomen: 23-32 mm; hindwing: 17-24 mm.

Habitat. Commonly found in quiet waters such as canals, marshes, ponds, lakes and bogs, sometimes heavily vegetated.

Discussion. *Enallagma cyathigerum* is a variable species that is truly Holarctic; it ranges throughout Europe and Asia to northern India (Fraser 1933) and throughout the New World. It is found from northern Mexico, Baja California, northward into Alaska. It is found in every state west of the Rocky Mountains (Garrison 1994) and is only absent from the Southeastern U.S. Confirmed records have never been reported from Oklahoma or Texas, but it is common westward.

The variability of *E. cyathigerum* has resulted in confusion surrounding the distinctness of this species from others, such as the old World *E. deserti*. Many Old World species have been described and subsequently synonymized. Gloyd (1943)

described the very similar *E. vernale* from Michigan, but Donnelly (1989) considered the differences between it and *E. cyathigerum* not to warrant specific status. The status of the former is still questionable because of geographic overlap in their ranges and an apparent distinction in habitats (Donnelly 1998). This is not always the case, however, as Pilon and Sylvestre (1989) showed with populations in Quebec. Juritza (1975) studied scanning electron micrographs of the mesostigmal plates of six species in the *cyathigerum-deserti* group. He made several conclusions about the taxonomic placement of these species, noting that *Enallagma cyathigerum* tends toward speciation in North America. A thorough taxonomic revision of the entire complex, including Palearctic species, is needed.

Differences in habitat preference of *E. cyathigerum* and *E. boreale* have been noted by different authors (Walker 1953; Garrison 1984). *Enallagma cyathigerum* is generally not found around the typical acidic ponds and bogs that *E. boreale* frequents. McPeck (1989), however, found both species commonly at several fishless lakes in Michigan. *Enallagma boreale* may have a slightly later emergence, but there is considerable overlap.

Enallagma cyathigerum has been the subject of numerous behavioral studies in both Europe and North America (Parr and Palmer 1971; Bell 1972; Glas and Verdonk 1972; Meulenbrock 1972; Macan 1974; Paulson 1974; Juritza 1978; Doerksen 1979). A complete bibliography of reproductive behavior up to 1980 has been given by Bick and Bick (1980). Garrison (1978) did a mark-recapture study of a California population of *E. cyathigerum* and found their average longevity to be 4.68 days. This compares well with

studies of other *Enallagma* spp. (Bick and Bick 1963; Johnson 1964; Logan 1971), but Parr (1976) found the average longevity to be substantially longer at 12.1 days. Koperski (1997) looked at changes in the feeding behavior of the larva in response to predator stimuli and Stoks and Bruyn (1996) found *E. cyathigerum* to be the chief prey of a European robberfly, *Eutolmus rufibarbis*.

***Enallagma daeckii* (Calvert)**

Attenuated Bluet

(Fig. 157, 183-184, 214, Map 46)

Telagrion daeckii Calvert, 1903: 36.

Enallagma daeckii Byers, 1927a: 391.

Type. Enterprise, Florida; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Red, Trinity.

General Distribution. UNITED STATES: AL, AR, DE, FL, GA, IN, LA, MD, MA, MS, NJ, NC, OK, PA, SC, TN, TX, VA.

Seasonal Distribution. Apr. 24 (LA) - Jun. (OK).

Identification. The entire head of the male, including the eyes in life, is pale blue with an intricate pattern of black. The black spots posterior to the antennae often don't reach

to the border of the postocular spots. There is a sinuate black line behind and often enveloping the median ocellus. The postocular spots are large and narrowly outlined by jagged, often incomplete black lines.

The prothorax is largely pale blue with a pair of dorsolateral spots on the hind margin of the anterior lobe that may be fused. There are also narrow black stripes along the notopleural suture and the front margin of the posterior lobe and a pair of dorsolateral crescent shaped stripes on the median lobe. Pterothorax is nearly entirely pale blue. There is a narrow black middorsal stripe reduced to thin lines on either side of the pale middorsal carina. The thin dark humeral stripe is also reduced often to three spots. There are smaller stripes along the mesopleural suture and the remainder of the pterothorax is pale blue fading to cream ventrally, with only an abbreviated black stripe at the posterior end of the interpleural suture. The wings are unique among the genus, as they are petiolate out nearly as far as the anal crossing (Ac) and CU_2 generally terminates much farther proximally than in other *Enallagmas*. The legs are pale blue basally, becoming cream-colored. Black stripes are present in varying degrees on the femora and tibiae and the tarsi are pale armed with black spurs.

The abdomen is pale blue laterally and black dorsally on segments 1-6. There is a dorsoapical blue ring on segment 1. The full length black stripe on segment 2 is expanded laterally at 3/4 its apical length. Segments 3-6 have lateral, apical expansions of the dorsal stripe and pale blue basal rings. Segment 7 is black dorsally with blue in the apical 1/4 of the segment and segments 8-10 are entirely blue with only very narrow black basal rings. The bifid superior caudal appendages are much shorter, approximately 1/3,

than the length of segment 10. When viewed laterally the appendages are brown, becoming darker apically, and have a broad truncate upper arm and more rounded lower arm. The inferior caudal appendages are upturned apically and only slightly longer than the superior appendages.

The female is pale blue, green or tan, but the head and thorax are very similar to those of the male with generally less black. The middle lobe of the pronotum lacks any prominent pits. The mesostigmal plates have a definite posterior margin. They are concave medially with the anterolateral margins expanded and somewhat raised.

The abdominal pattern is like that of the male on segments 1-6. Segments 7 and 8 are entirely black dorsally except for a narrow apical pale blue ring. Segments 9 and 10 are generally blue, but occasionally segment 9 has a small black spot, sometimes bilobed, extending 1/2 the segment length. The larva was described and illustrated by Huggins (1984).

Enallagma daeckii is easily recognizable in the field, because of its large slender shape. It has a noticeably elongated abdomen that makes it the longest coenagrionid in the south-central U.S. and all of North America. Its nearly all pale blue head and thorax are also excellent field characters. *Enallagma daeckii* is locally distributed throughout Texas, Louisiana, Oklahoma and Arkansas.

Size. Total length: 35-47 mm; abdomen: 30-40; hindwing: 19-25 mm.

Habitat. Swamp margins and shady, often heavily vegetated pond, lakes and stream backwaters.

Discussion. The large size and distinct wing venation of *E. daeckii* lead to its placement

in the monotypic genus *Teleallagma* in the past. Different authors (Byers 1927c; Donnelly 1964) have subsequently studied the relationship of *E. daeckii* with *E. traviatum* and *E. pallidum* and decided that it belongs in the genus *Enallagma*.

Populations of this infrequently collected species in the eastern Austroriparian province of the south-central U.S., seem to be locally restricted. In Texas, populations are only known from Dangerfield State Park in Morris County, Sam Houston National Forest in Montgomery and San Jacinto counties, and Boykin Springs Recreation area in the Angelina National Foest, Jasper County. Nothing is known about its reproductive behavior. It flutters in the shade like a "ghost" among the tangled vegetation of its habitat (Dunkle 1990), making it difficult to spot.

Enallagma divagans Sélys

Turquoise Bluet

(Fig. 158, 185-186, 215, Map 47)

Enallagma divagans Sélys, 1876: 521.

Type. Massachusetts.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Mississippi, Neches, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, ME, MD, MA, MI, MS, MO, NH, NJ, NY, NC, OH, OK, PA, SC, TN, TX, VA, WV.

Seasonal Distribution. Mar. 14 (LA) - Jun. 13 (OK).

Identification. This beautiful little turquoise *Enallagma* is widely distributed throughout the eastern half of this region. The males are recognizable in the field by the combination of turquoise-blue thoracic sides and a mostly black abdomen, with segments 8 and 9 blue. The thorax of the female is mostly blue with a brown humeral stripe outlined in black.

The front of the male head is blue with black on the labrum and postclypeus. The top of the head has a broad black stripe bordered anteriorly by blue on the postfrons and posteriorly by a pair of large, elongated, pale blue postocular spots. A pale blue occipital bar generally narrowly separates the latter. The prothorax is black dorsally with a blue stripe on the front margin of the anterior lobe, and a pair of pale dorsolateral spots on the middle lobe. Both the middorsal stripe and carina of the pterothorax are black. The former varies from $1/3$ to $1/2$ the width of the mesepisterna. The blue antehumeral stripe is no more than $1/2$ the width of the middorsal stripe. The black humeral stripe is approximately equal in width to the antehumeral stripe and is abruptly narrowed posteriorly. The rest of the pterothorax is turquoise-blue becoming cream ventrally. There is an abbreviated stripe on the upper end of the interpleural suture and a dark spot on the metapleural fossa. The wings are hyaline with a dark pterostigma generally not subtending an entire cell. Vein M_2 arises nearer the 5th and 4th postnodal crossveins in the fore- and hindwings, respectively. The legs may be blue or tan with black stripes on

the femora and tibiae. The tarsi are pale.

The abdomen is largely black dorsally, and bright blue laterally becoming paler ventrally. Segment 1 is black dorsally with only a pale apical ring. There are full-length black dorsal stripes on segments 2-7 with subapical expansions and a narrow blue basal ring on segments 3-7. Generally a small pale subapical spot is present on segment 7. Segments 8 and 9 are largely blue. Segment 8 has a wide basal triangle dorsally and often along with segment 9 a somewhat obscure lateral spot. The dorsum of segment 10 is black for 1/2 to its entire surface. The black caudal appendages are each approximately 1/2 the length of segment 10. The superior appendages are white medially and have a prominent dorsobasal lobe, when viewed laterally. The inferior appendages are widest basally and curve upwards.

The female is generally paler than the male. The general head and thoracic patterns are like those of the male with the following differences. The postocular spots are larger and the pale antehumeral stripe is generally wider. The black humeral stripe is divided longitudinally by brown for its entire length, sometimes completely replacing the black. The middle lobe of the pronotum lacks distinct pits. The hind margin of the posterior prothoracic lobe bears a prominent, pale, median tubercle with long setae. The mesostigmal plates are more or less triangular with a distinct posteromedial tubercle.

Abdominal segments 1-7 are as in the male, with the black dorsal stripes only slightly narrower. The black on the dorsum of segment 8 varies from the entire surface to 2/3 of the basal length. Segment 9 is blue with a basal black spot or stripe, emarginate medially, and extending up to 1/2 the length of the segment. Segment 10 is entirely blue,

with at most a basal black band. The larva was described and illustrated by Huggins (1978b).

Size. Total length: 26-36 mm; abdomen: 22-30 mm; hindwing: 17-22 mm.

Habitat. Shaded sluggish creeks and streams, sloughs or lakes.

Discussion. *Enallagma divagans* is not likely confused with any other species in this region. Its closest congeners are *E. exulans* and the eastern *E. weewa* (Westfall and May 1996). Males and females both rarely stray from water (Kellicott 1895). The flight of *E. divagans* is very deliberate and slow. Dunkle (1990) has recorded ovipositing females submerged for up to 30 minutes. Robinson (1981) reported further on the reproductive behavior of *E. divagans*.

Johnson *et al.* (1984) looked at the coexistence of a Tennessee population of *E. divagans* and *E. traviatum*. They found that *E. divagans* larvae experienced significantly greater survival and biomass increase than their congener. Through fecal pellet analyses they found considerable dietary overlap and little evidence of resource partitioning between the two species.

Enallagma doubledayi (Sélys)

Atlantic Bluet

(Fig. 159, 187-188, 216, Map 48)

Agrion doubledayi Sélys, 1850: 209.

Enallagma doubledayi Sélys, 1876: 502.

Type. St. John's Bluff, E. Florida; IRSN, MCZ.

Regional Distribution.

Biotic Province(s): Texan.

Watershed(s): Trinity.

General Distribution. UNITED STATES: AL, FL, GA, KY, MD, MA, MS, NJ, NY, NC, OH, PA, RI, SC, TX, VA; Cuba, Jamaica.

Seasonal Distribution. May (TX).

Identification. This eastern species is very similar to the widespread *E. civile* in our region. The two species are often found together, usually with the latter in greater numbers, but they may be easily confused in the field. The males, especially, are very similar to *E. civile*. The head is mostly blue with an anteriorly rounded black stripe on the postclypeus. The top of the head is largely black with blue on the frons. The pale blue postocular spots are very narrow and elongated. A pale occipital bar separates them, but is rarely confluent with them.

The prothorax is black with a blue stripe on the front and hind margins of the anterior and hind lobes, respectively. There are also a pair of pale dorsolateral blue spots on the middle lobe. The middorsal carina of the pterothorax is black with at most a hint of blue at its upper end. The black middorsal stripe is slightly less than 1/2 the width of the mesepisterna. Each blue antehumeral stripe is 1/2 -2/3 the width of the middorsal stripe and the black humeral stripe is nearly equal in width to the antehumeral stripe. The rest of the pterothorax is blue fading ventrally. There is only an abbreviated hairline

stripe on the interpleural suture and an elongated dark spot on the metapleural fossa. The wings are hyaline with fairly dark pterostigma subtending $3/4$ of a cell. Vein M_2 arises nearer the 5th, and 4th or 5th postnodal crossveins in the fore- and hindwings, respectively. The legs and coxae are largely pale blue to tan with broad black stripes on the femora and tibiae. The tarsi are tan with black spurs.

The abdomen is blue. Segment 1 has a basal black spot on the dorsum that extends posterolaterally. Segment 2 is black on the dorsoapical $1/2$ of the segment. This black apical band extends approximately $1/5$ the length of segments 3-5. This black stripe on segment 6, is more extensive tapering anteromedially to $3/4$ the length of the segment and segment 7 is black dorsally for its full length, except for narrow apical and sometimes basal pale ring. Segments 8 and 9 are blue with a small apical and basal spot on the dorsum of 8. The dorsum of segment 10 is black and strongly emarginated laterally. The superior caudal appendages are black and $1/2$ or more of the length of segment 10. Each has a distinct pale apical tubercle, when viewed laterally. When viewed dorsally, the upper arm is distinctly wider than tubercle. The inferior appendages are pale with black tips and extend $2/3$ - $3/4$ the length of the superiors. These appendages are broad basally terminating rather bluntly.

The female may be either pale brown, green, or blue. The general color pattern is very close to that of *E. civile*, but the abdomen is generally darker. The head is like that of the male. The prothorax has a broad pale stripe on the anterior lobe and the middle lobe of the prothorax lacks any distinct pits. The mesostigmal plates possess a distinct posterior border. The medial $1/3$ of each plate is bordered by a distinct narrow ridge.

The plates themselves are rather rectangular and possess an oval depression medially. The pterothorax, wings, and legs are all generally like those of the male.

The black stripes on the abdomen are more extensive. The stripe on segment 1 reaches apically for 3/4 the length of the segment. The remaining segments, 2-10, all have full length black stripes with pale medial rings and medially interrupted basal rings. Garman (1927) described the larva, including photographs of caudal gills.

Size. Total length: 28-37 mm; abdomen: 22-30 mm; hindwing: 16-21mm.

Habitat. Newly formed or ephemeral ponds and lakes, and occasionally sluggish streams.

Discussion. *Enallagma doubledayi* is known west of the Mississippi only by a single collection from Parkland Prairie in Collin County, Texas. It was noticed by S. Dunkle (pers. comm.) only after carefully examining a net full of *E. civile*. This appears to be a dramatic range extension based on previous collections, but very well may occur in isolated populations eastward to the Mississippi River and simply overlooked by collectors because of its similarity to the ubiquitous *E. civile*.

Enallagma doubledayi shows some tolerance to saline waters along the coast (Westfall and May 1996), but is most typically found in sandy-bottomed new or ephemeral ponds. Little is known of the details of its reproductive behavior, but Dunkle (1990) provided a brief overview. Males can generally be seen conspicuously perched on riparian vegetation at the water's edge. Pairs mate on emergent vegetation and oviposit in tandem. The female will remain underwater, ovipositing after pulling free from the male, for only a few minutes at a time. Males remain perched nearby, guarding the female.

Leafhoppers are a common prey of *E. doubledayi* (Dunkle 1990).

***Enallagma dubium* Root**

Burgundy Bluet

(Fig. 160, 189-190, 217, Map 49)

Enallagma dubium Root, 1924: 321.

Type. Lee County, Georgia.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Neches, Red, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, DE, FL, GA, LA, MD, MS, NC, OK, SC, TX, VA.

Seasonal Distribution. Apr. 9 (LA) - Sep. 23 (TX).

Identification. *Enallagma dubium* seems to be locally restricted, west of the Mississippi River, to the southeastern piney woods and Big Thicket Regions of eastern Texas and southeastern Oklahoma. It is infrequently encountered in these areas. This is another brilliant red and black species closely related to *E. concisum* and *E. signatum*.

The eyes of the male are a deep red in life becoming pale brown with age. The face is orange-red to violet and the rest of the head is black with metallic reflections. The

middorsal carina and stripe of the pterothorax are black with a metallic purple or blue-green shimmer. The latter is half the width of the mesepisterna. The antehumeral stripe is orange-red and no more than 1/4 the width of the middorsal stripe. The broad humeral stripe is black with metallic reflections and nearly equal in width to the middorsal stripe. At its upper end the humeral stripe is confluent with the short black stripe of the interpleural stripe. Occasionally there is a small isolated spot anterior to this stripe.

There is a black stripe, at its widest, equal in width to the antehumeral stripe covering the metapleural suture. The area between the humeral and metapleural stripes is orange. The rest of the pterothorax is lighter, fading to yellow ventrally. The wings are hyaline with a light pterostigma that doesn't quite subtend a single cell. The legs are orange-red, becoming paler distally. Occasionally a black stripe is evident on the femora. The tarsi are pale armed with black spurs.

The abdomen is orange-red and black. The entire dorsum is uniformly black with only a narrow apical ring on segment 1 and basal rings on segments 3-7. The lateral pale areas are orange-red basally, fading to yellow on the distal segments. Occasionally, thin pale apical rings are evident on segments 7-9. The superior caudal appendages are black laterally and pale medially. These appendages are generally as long as, if not slightly longer than, segment 10. There is a distinct ventrally projecting tooth at about midlength. The pale inferior appendages are no more than 1/2 the length of the superiors. They are dark apically and project slightly posteroventrally.

The female is paler, with more orange-yellow or tan and generally lacks any hint of metallic reflection in the black areas, as opposed to the male; otherwise, very similar in

pattern to the male. The middle lobe of the pronotum bears very large, distinctive pits near its anterior edge. The mesostigmal plates are noticeably triangular in shape, each having a prominent posteromedial tubercle. They are deeply depressed forming a distinct posterior border for most of their distance laterally. There is a prominent tubercle immediately posterior to each mesostigmal plate on the mesepisternum. The wings and legs are as in the male. The abdomen is the same as in the male, but pale apical rings on segments 7-9 are often lacking. The larva has not been described, but it is included in the larval key of Westfall and May (1996), based on reared material.

Size. Total length: 25-30 mm; abdomen: 20-25 mm; hindwing: 12-17 mm.

Habitat. Heavily vegetated black water ponds, lakes, oxbows, sloughs and slow reaches of streams, often associated with lily pads.

Discussion. Several authors have commented on the association *E. dubium* with lily pads and other floating vegetation (Root 1924; Westfall 1941; Dunkle 1990; Westfall and May 1996). I have observed this species in similar situations, as well, such as Turkey creek in the Big Thicket National Preserve. There were numerous ox-bows throughout this drainage. Many of the slow moving or standing water areas were packed with floating vegetation, including chiefly lily pads. There were also several smaller heavily vegetated islands whose margins seemed to be favorite patrolling areas of males. Dunkle (1990) noted the ability of *E. dubium* males to become amazingly inconspicuous, seemingly disappearing, as they entered shaded areas while patrolling. Mating pairs can be seen from midday into the afternoon on floating vegetation (Westfall 1941; Gloyd 1951). Pairs prefer to oviposit through holes in water lily leaves, where the female may

submerge her abdomen to deposit eggs in semicircular rows on the underside of the leaf; a process that can take up to 30 minutes (Dunkle 1990).

***Enallagma durum* (Hagen)**

Big Bluet

(Fig. 161, 191-192, 218, Map 50)

Agrion durum Hagen, 1861: 87.

Enallagma durum Sélys, 1876: 499.

Type. Schaum, Louisiana; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Tamaulipan, Texan.

Watershed(s): Brazos, Mississippi, Nueces, Rio Grande, Sabine, Trinity.

General Distribution. UNITED STATES: AL, CT, DE, DC, FL, GA, LA, MA, MD, MA, MS, NJ, NY, NC, PA, RI, TX, VA; MEXICO: TAM.

Seasonal Distribution. Mar. 6 (TX) - Sep. 27 (LA).

Identification. *Enallagma durum* is found all along the Gulf Coast of Tamaulipas, Mexico, Texas and Louisiana, northward along the Mississippi River. This rather large coastal species may at first be confused with *E. civile* in the field, but its larger size and examination of male caudal appendages in the hand will reliably separate the two.

The face of the male is largely blue. The top of the head is paler. There is a pale

blue crescent-shaped spot anterior to each lateral ocellus and sometimes two narrow diagonal stripes anterolateral to the median ocellus. These stripes, when present, form a black triangle anterior to the ocellus. The pale postocular spots are somewhat squared off and most often confluent with the occipital bar.

The pterothorax is blue ventrolaterally. The middorsal carina is broadly pale blue, running the entire length of the black middorsal stripe that is $1/2$ the width of the mesepisterna. The blue antehumeral stripe maybe $1/2$ - $3/4$ the width of the middorsal stripe. The black humeral stripe narrows posteriorly but is $1/3$ - $1/2$ the width of the antehumeral stripe at its widest. There is a black spot on the metapleural fossa. The rest of the pterothorax is blue, becoming much paler ventrally. The wings are hyaline with a tan pterostigma nearly subtending a single cell. The vein M_2 arises nearest the 6th and 4th postnodal crossveins in the fore- and hindwings, respectively. There are 4 or 5 postquadrangular cells in each wing. The legs are pale, either tan or blue, with a black stripe on the outer femoral and inner tibial surfaces and the tarsi are pale and armed with black spurs.

The abdomen is largely bright blue dorsally, fading to cream ventrally. the basal $1/2$ - $2/3$ of segment 1 is black and the apical $2/5$ - $1/2$ of segment 2 is black. Segments 3-6 have an apical hastate black spot, that narrows medially, extending up to $1/2$ the length of each segment. The entire dorsum of segment 7 is black, but the basal $1/5$ is highly emarginated so that the black is narrowly confluent with anterior segment margin. Segments 8 and 9 are blue and segment 10 is black dorsally. The superior caudal appendages are tan becoming dark dorsoapically. They are relatively short, extending to

no more than $\frac{1}{3}$ the length of segment 10. The superior caudal appendages, when viewed laterally, are truncated apically with a rounded posteroventral lobe. Dorsally, a pale internal tubercle is visible. The inferior appendages are pale with dark tips and extend slightly beyond the superior appendages. These appendages are straight or slightly upturned.

The female may be either blue or brown. The head is marked as in the male, but with the black less extensive. The middle lobe of the prothorax lacks any distinct pits. The mesostigmal plates are somewhat quadrate and deeply concave medially with a prominent posterior ridge. The pterothorax is similar to that of the male, but the humeral stripe is generally narrower than the pale antehumeral pale stripe. The legs are pale occasionally, with black stripes. The apices of the tarsi and tarsal claws are dark. The wings are as in the male.

The abdominal pattern is generally like that of the male. The first segment is black dorsally for its entire length, with only a pale apical band. Segment 2 is black dorsally for its full length with a slight lateral expansion apically at $\frac{3}{4}$ its length. Segments 3-7 are entirely black dorsally, but broadly emarginated basally. Segment 7 also has a pale apical ring. Segments 8-9 are black dorsally with an apical pale ring. Segment 10 is generally blue dorsally with a basal black spot extending rarely more than $\frac{1}{3}$ the length of the segment. Sometimes the larger segment is entirely pale dorsally. Garman (1927) provided a brief description of the larva with a photograph of its caudal gills.

Size. Total length: 34-44 mm; abdomen: 28-35 mm; hindwing: 17-25 mm.

Habitat. Along the shores of lakes and rivers, often with brackish water and emergent vegetation.

Discussion. This species frequently inhabits brackish waters and seldom ventures far from the coast line. It is considered to be one of the more primitive in the genus (Donnelly 1963) because of its distinct venation and genitalia. Little is known about the reproductive behavior of *E. durum*. Females oviposit head downward under water while males guard from perching sites above (Dunkle 1990). Dunkle (1990) suggested that the large size of *E. durum* may be an adaptation to high winds on open lakes and shore lines.

***Enallagma exsulans* (Hagen)**

Stream Bluet

(Fig. 162, 193-194, 219, Map 51)

Agrion exsulans Hagen, 1861: 82.

Enallagma exsulans, Hagen in Sélys, 1876: 522.

Type. Berkeley Springs, VA; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Guadalupe, Mississippi,

Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St.

Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DC, DE, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MS, MO, NE, NH, NJ, NY, NC, ND, OH, OK, PA, RI, SC, TN, TX, VA, WV, WI; CANADA: N.B., N.S., Ont., Que.; MEXICO: HGO, NLN, TAM.

Seasonal Distribution. Apr. 12 (LA) - Sep. 15 (TX).

Identification. This blue and black, somewhat delicate, species is found throughout the eastern United States west into Nuevo Leon and Tamaulipas states of Mexico. The face of the male is almost completely black. The top of the head is mostly black with a narrow strip of blue on the postfrons. There are two small tear drop-shaped pale postocular spots narrowly separated or confluent with a pale occipital bar.

The hind margin of the posterior pronodal lobe has a blue medial tubercle, bearing setae, and short stripes laterally. The lateral portions of the prothorax are pale blue. The middorsal carina and stripe of the pterothorax are both generally black. The former is sometimes tan posteriorly with the latter as much as 2/3 width of the mesepisterna. The pale blue antehumeral stripe is approximately 1/3 the width of the middorsal stripe. The broad black humeral stripe is equal to or as much as 3 times the width of the antehumeral stripe. There is an abbreviated black line on the interpleural suture that is confluent with the humeral suture. The rest of the thorax, aside from a dark spot on the metapleural fossa, is blue fading ventrally. The wings are hyaline or with only a slight smoky cast. Vein M_2 arises from nearest the 5th and 4th postnodal crossveins in the fore- and hindwings, respectively. The legs are pale with sometimes interrupted black stripes on the femora and tibiae and the tarsi are pale and armed with black spurs.

The abdomen is blue with a largely black dorsum. The entirety of the dorsum of

segment 1 is black with only a pale apical ring. There is a black stripe the full length of the dorsum on segment 2. Segments 3-6 each have a full length black stripe that narrows basally to interrupt pale blue ring. The apical 1/5 of each of these stripes is expanded somewhat laterally. Segment 7 is either as the previous segments or with the black extending over the entire dorsum. Segment 8 has a full length black dorsal stripe or sometimes only a basal triangle extending for more than 1/2 of the segment. Segment 9 is entirely blue with only a small basal black triangle. Segment 10 is entirely black dorsally and strongly emarginated laterally. Sometimes this emargination envelopes pale blue spots laterally. The dark superior caudal appendages are distinctly bifid, when viewed laterally. Both lobes are directed posteriorly, but the lower lobe is noticeably longer than the upper lobe, and is approximately 1/2 the length of segment 10. The pale inferior appendages are slightly shorter than the upper lobe of the superior and the dark apices are directed posterodorsally.

The female is generally more green than blue. The head pattern is like that of the male. The prothorax lacks any distinct pits on the middle lobe and the hind margin of the posterior lobe has a median tubercle bearing numerous setae. The middorsal carina is distinctly tan and bordered by a narrower black middorsal stripe generally not half as wide as the mesepisterna. The pale antehumeral stripe is 1/2 to 2/3 the width of the middorsal stripe. The black humeral stripe is generally less than twice the width of the antehumeral stripe and nearly always divided longitudinally; sometimes the brown replaces the black entirely. The metapleural stripe is not confluent with the humeral stripe. The rest of the pterothorax is as in the male. The mesostigmal plates are more or

less triangular and there is a distinct concavity just posterior to each plate.

The abdominal pattern is very similar to that of the male. Segments 1-7 are marked the same. Segment 8 has a narrow pale apical ring. Segment 9 has two confluent basal, black spots or triangles, emarginated with blue medially. Segment 10 may be entirely blue or occasionally have a small black dorsal triangle. Needham (1903) gave a full description of the larva.

Size. Total length: 31-37 mm; abdomen: 24-30 mm; hindwing: 17-21 mm.

Habitat. Common along shores of slow moving streams, rivers and occasionally lakes.

Discussion. *Enallagma exsulans* is widespread throughout central Texas but is much more frequently encountered to the east, where it can be quite abundant. They are often sparse in the earlier parts of the day but seem to become more numerous in the late afternoon as temperatures start to cool. Bick and Hornuff (1966) studied the reproductive behavior of an Indiana population of *E. exsulans*. They found that, as in most *Enallagma* and *Zygoptera*, sperm transfer occurred while in tandem, with the male grasping the female on the prothorax. Copulation quickly followed and lasted an average of 76 minutes but was witnessed to last as long as 2 hours. Females have the unusual behavior, among *Enallagma*, of submerging themselves to oviposit, sometimes while still in tandem with males and other times with the male breaking away after contact with the water. Females remain submerged for 15-31 minutes, while the longest recorded time for a male was 9 minutes. These observations agreed with previously published notes on the ovipositing behavior of *E. exsulans* by Calvert (1893). Eriksen (1960) found females to probe backwards down a filament of *Potamogeton* in a deliberate and repetitious manner,

depositing eggs. Williamson (1906a) described capturing a female to whose thorax was attached the last abdominal segments of the male; a true testimony to the secure coupling mechanism of *E. exsulans*!

***Enallagma geminatum* Kellicott**

Skimming Bluet

(Fig. 163, 195-196, 220, Map 52)

Enallagma geminatum Kellicott, 1895: 239.

Enallagma piscinarium Williamson, 1900b: 273.

Type. Ohio.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Brazos, Mississippi, Red, Sabine, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, ND, NE, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VA, WV, WI; CANADA: Ont.; Que.

Seasonal Distribution. Mar. 31 (LA) - Sep. 23 (TX).

Identification. This small eastern species is common, but it is restricted to the Texan and Austroriparian biotic provinces in our region. *Enallagma geminatum* is tied with *E.*

basidens for smallest *Enallagma* in our region. The distinctive color pattern will serve to separate them in the field from similar species described below. The head and thorax are blue and black as in most other members of the genus. The pale postocular spots are large and generally well separated with the absence of an occipital bar. The abdomen is almost entirely black except for the basal and apical segments. In both sexes the distinctive second segment is black dorsally, occasionally appearing as a diamond, and ventrolaterally as a broad irregular stripe with blue in between. This is diagnostic among species in our area. In the male segments 8-9 are pale blue and in the female there are a pair of large blue basal spots; these are occasionally fused but segment 9 is always black. The middle lobe of the female prothorax has a pair of shallow posterolateral pits. The larva was described by Needham (1903).

Similar species include male *E. divagans* which lacks the ventrolateral stripe on abdominal segment 2 and is generally larger. *Ischnura kellicotti* resembles *E. geminatum*, but the former has larger postocular spots, segment 2 has a large dorsal basal blue spot and apical band, and segment 9 in females is either blue or red. Female *Argia bipunctulata* may also be mistaken for this species, but abdominal segment 8 is blue dorsally. The more western *Enallagma novaehispaniae* females are similar, but these species are not sympatric, *E. novaehispaniae* lacks a black ventrolateral stripe, and segment 9 is largely black.

Size. Total length: 19-29 mm; abdomen: 14-22 mm; hindwing: 12-17 mm.

Habitat. Prefers open, muddy, heavily vegetated ponds and lakes with fish, and more rarely slow moving streams and swampy, small order streams.

Discussion. McPeck (1989) found this species exclusively in lakes containing fish and suggested that *E. geminatum* may be restricted to breeding in such situations to avoid predation by abundant Anisoptera larvae in fishless lakes. My observations agree with this, as large populations of *E. geminatum* have been studied in a heavily vegetated southern Oklahoma pond, with ample fish (including bass and *Lepomis* spp.) on a regular seasonal basis.

Dunkle (1990) briefly discussed the behavior of this damselfly. *Enallagma geminatum* is most active in the morning (Lutz and Pittman 1970), flying out over the water, perching on algae and other vegetation. Mating pairs aggregate on riparian branches and stems. The female oviposits unaccompanied by the male in algae and floating debris. This species appears to be a poor disperser, with adults generally returning to their home waters (McPeck 1989).

Enallagma novaehispaniae Calvert

Neotropical Bluet

(Fig. 164, 197-198, 221, Map 53)

Enallagma coecum Calvert, 1902: 112.

Enallagma coecum novaehispaniae, Calvert, 1907: 381.

Enallagma ypsilon Needham, 1942: 62.

Enallagma novaehispaniae, Donnelly, 1963: 117.

Type. Atoyac, Vera Cruz, Mexico; BMNH.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Tamaulipan.

Watershed(s): Colorado, Guadalupe, Nueces, Rio Grande, San Antonio.

General Distribution. UNITED STATES: TX; MEXICO: BCA, BCS, CHS, CAM, CHI, COL, GRO, HGO, MOR, NAY, OAX, PUE, QRO, QTR, SLP, SIN, SON, TAB, TAM, VER; south to Peru and Argentina.

Seasonal Distribution. Mar. 21 (TX) - Oct. 14 (TX).

Identification. *Enallagma novaehispaniae* is restricted to the Hill Country of Texas, southward throughout Central and South America. The unique color pattern and southwestern distribution of this species provide for easy field identification. It has large oval blue postocular spots that are usually not confluent with the occipital bar. The pterothorax is largely pale blue with thin black middorsal and humeral stripes. Both are generally wider in the female. The abdomen is largely black dorsally, with blue or violet on the basal and apical segments. Segments 8-9, in the male, are both pale dorsally with a black ventrolateral stripe. The former has a black apical band. Segment 10 is black and the strongly bifurcate appendages of the superior caudal appendages are apparent in hand. Segment 8 in the female is pale with an irregular black apical stripe. Segment 9-10 are both black with a large pale apical lateral spot. The larva is undescribed, but Westfall and May (1996) included it in their larval key based on reared specimens.

Size. Total length: 29-35 mm; abdomen: 23-29 mm; hindwing: 17-19 mm.

Habitat. Clear streams and rivers with a strong current.

Discussion. *Enallagma novaehispaniae*'s closest relative is the Antillean *E. coecum* (Donnelly 1963). Very little is known about the biology and reproductive behavior of this species (Bick and Bick 1980).

***Enallagma praevarum* (Hagen)**

Arroyo Bluet

(Fig. 165, 201-202, 222, Map 54)

Agrion praevarum Hagen, 1861: 88.

Enallagma praevarum, Sélys, 1876: 516.

Type. Trojes, Del Oro, Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Kansan, Tamaulipan.

Watershed(s): Brazos, Canadian, Colorado, Guadalupe, Nueces, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, KS, MT, NE, NV, NM, ND, OK, SD, TX, UT, WY; MEXICO: AGS, BCA, CHI, COA, DFE, DGO, GRO, HGO, JAL, MEX, MCH, MOR, NAY, NLN, OAX, PUE, QRO, SLP, SIN, SON, VER; southward to Guatemala and Belize.

Seasonal Distribution. Apr. 10 (TX) - Nov. 6 (TX).

Identification. This is a relatively common blue species found throughout the western biotic provinces of our region. Its face is blue with large tear-shaped postocular spots that

are separated by black from a pale occipital bar. The pterothorax is largely blue with a black middorsal stripe nearly 1/2 as wide as the mesepisterna. The middorsal carina is generally pale, especially in the female. The legs are pale, usually with distinctive black stripes. The abdomen, in the male, is mostly blue with black dorsally. Segments 8-9 are entirely blue and segment 10 has a large ventrolateral blue spot.

The female is generally like the male, but may be either tan or blue. The postocular spots are generally larger and confluent with the occipital bar. All abdominal segments have a black dorsal stripe. The male caudal appendages and female mesostigmal plates will readily differentiate this species from others in our area.

Garrison (1984) and Novelo and Gonzalez (1991) illustrated various aspects of the larva.

Size. Total length: 26-35 mm; abdomen: 20-27 mm; hindwing: 15-21 mm.

Habitat. Common in ponds and slow reaches of streams.

Discussion. *Enallagma praevarum* prefers high, rather dry regions (Donnelly 1968). It exhibits polymorphism in head color pattern where individuals range from lacking an occipital bar to having it confluent with postocular spots. Johnson (1964a) showed this variation along with a dimorphic prothoracic color pattern differs in frequency between the sexes.

Johnson (1964b) studied a population of *E. praevarum* in southeastern Arizona and found females were in greater abundance than males. The higher numbers of females is offset by a greater mating expectancy among males, suggesting that the sex ratio is a function of mating expectancies.

***Enallagma signatum* (Hagen)**

Orange Bluet

(Fig. 166, 201-202, 223, Map 55)

Agrion signatum Hagen, 1861: 84.*Agrion dentiferum* Walsh, 1863: 236.*Enallagma signatum*, Sélys, 1876: 525.**Type.** Louisiana; MCZ.**Regional Distribution.***Biotic Province(s)*: Austroriparian, Balconian, Kansan, Tamaulipan, Texan.*Watershed(s)*: Arkansas, Bayou Bartholomew, Brazos, Canadian, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.**General Distribution.** UNITED STATES: AL, AR, CT, DE, DC, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, NC, NE, NH, NJ, NY, OH, OK, PA, RI, SC, SD, TN, TX, VT, VA, WV, WI; CANADA: Ont., Que.**Seasonal Distribution.** All year (TX).**Identification.** *Enallagma signatum* is common and widely distributed throughout the central and eastern parts of our area, southward into the Texas Hill Country and lower Rio Grande Valley. This orange and black species is somewhat unusually colored for the genus. The face and sides of the thorax in mature individuals is orange. The majority of

the abdomen in the male is black with orange on segment 9. The superior caudal appendages are straight and extend noticeably beyond segment 10.

Females are typically marked as in the males, but are more yellow. The middle prothoracic lobe bears a pair of dark pits at the upper apical corner. There is a raised lobe on the posteromedial corner of each mesostigmal plate and a prominent raised bump posterior to each mesostigmal plate on the pterothorax. There is a more or less black triangular spot on the dorsum of abdominal segment 9 and segment 10 is orange. Teneral individuals of both sexes are blue, but become orange with age in a posterior progression. Needham (1903) illustrated the larva.

Teneral specimens of *E. vesperum* may be confused with *E. signatum*, but the black humeral stripe is either lacking or narrowly reduced. Its coloration and long slender abdomen will serve as good field characters.

Size. Total length: 28-37 mm; abdomen: 23-30 mm; hindwing: 15-21 mm.

Habitat. Various ponds and lakes as well as slow moving streams and rivers.

Discussion. Found in a variety of lentic and lotic situations, *E. signatum*, is unusual in that it is most active in the late afternoon. Lutz and Pittman (1970) found it never appeared before 2:30p. In this respect, it is similar to *E. vesperum*. Females stay some distance from the water and are often not encountered except in copula or tandem. Dunkle (1990) discussed three forms of the female. One remains blue throughout life, one becomes green and the third becomes orange.

Males are often seen hovering low to the water, occasionally perching on water lilies or other emergent vegetation. Tennessen (1975) studied the reproductive behavior

of *E. signatum*. He found females will posture their unwillingness to mate. The long straight caudal appendages of the male force him into a distinct 45° vertical position, when in tandem with the female (Borrer 1930; Koen 1937). After copulation, pairs will begin ovipositing in floating vegetation or debris, with the male often accompanying his partner underwater. Females will remain underwater, ovipositing in the traditional manner for up to 20 minutes at a time.

Enallagma traviatum Sélys

Slender Bluet

(Fig. 167, 203-203, 224, Map 56)

Enallagma traviatum Sélys, 1876: 519.

Enallagma westfalli Donnelly, 1964: 105.

Enallagma traviatum westfalli, Donnelly, 1973: 297.

Type. United States (*E. traviatum*); Cleveland, Liberty County, Texas; FSCA (*E. westfalli*).

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Mississippi, Red, Sabine, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, DC, GA, IL, IN, KS, KY, LA, MD, MA, MI, MS, MO, NJ, NY, NC, OH, OK, PA, SC, TN, TX, VA, WV, WI.

Seasonal Distribution. Apr. (LA) - Jul. 9 (OK).

Identification. This species is largely confined to the eastern Austroriparian biotic province of our area, but it is infrequently encountered in North-central Texas. The mostly pale blue head and large pale postocular spots are distinctive. The latter are thinly outlined by black and separated by an occipital bar. The pterothorax is pale blue with very little black. The middorsal stripe and carina are black and the former is usually confined to the latter. There is often a yellow-brown discoloration lateral to the above. The middorsal stripe may be incomplete and divided by this discoloration. The black humeral stripe is very narrow, often reduced to a hairline. The abdomen is largely black dorsally with segments 8-9 pale blue. Segment 8 usually has a small basal black triangular spot dorsally. The female is very similar to the male, but with segment 10 blue. Garman (1917) provided figures of the gills and Donnelly (1964) described the larva of *E. traviatum westfalli* from exuviae.

It is not likely confused with any other *Enallagma* within our area. The most similar species, in our area, *E. daeckii*, can be readily distinguished because of its relatively longer abdomen.

Size. Total length: 29-32 mm; abdomen: 24-26 mm; hindwing: 15-19 mm.

Habitat. Permanent ponds and lakes with from sparse to abundant emergent vegetation.

Discussion. *Enallagma traviatum* is widespread throughout the eastern U.S. The subspecies found in our area, *E. t. westfalli*, was described by Donnelly (1964) from a pond in east Texas near Cleveland, based on the relatively more robust posterodorsal arm of the male superior caudal appendages. The two subspecies, *E. t. westfalli* and the

nominate form, are apparently geographically separated by the Appalachian Mountains (Donnelly 1973), but because the distributions of the two subspecies are not well documented, we have listed the general distribution for this species, without respect to subspecific designation.

***Enallagma vesperum* Calvert**

Vesper Bluet

(Fig. 168, 205-206, 237, Map 57)

Enallagma vesperum Calvert, 1919: 380.

Enallagma laurenti Calvert, 1919: 379.

Type. Enterprise, Florida; ANSP.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Mississippi, Neches, Ouachita, Red, Sabine, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CO, CT, DE, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MO, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WV, WI.

Seasonal Distribution. Mar. 31 (LA) - Oct. 21 (TX).

Identification. This widely distributed eastern species is most common in the Piney woods of Texas and Austroriparian biotic province, but is found as far west as north-

central Texas. *Enallagma vesperum* is a delicate bright yellow and black species, with characteristic blue on the terminal abdominal segments. The face is mostly yellow with long postocular spots confluent with the occipital bar. The thorax is mostly yellow, but it may be pale blue in immature individuals. The black humeral stripe is usually present, but only as a narrow line. The abdomen is largely black dorsally, except for segment 9, which is blue in the male. Segment 10 may also be largely blue or entirely black dorsally. These segments in the female are blue or occasionally tan, marked with a basal black triangular spot that may extend to the full length of segment 9 dorsally. The male caudal appendages are distinctive among the species in our area. There are a pair of dorsolateral pits medially on the prothorax and a prominent knob on the posteromedial corner of each mesostigmal plate in the female. The larva was originally described and illustrated, as *E. pollutum*, by Walker (1913).

Females of *E. signatum* are similar, but the humeral stripe in *E. vesperum* is much narrower and the prothoracic pits in *E. signatum* are positioned more anteriorly.

Size. Total length: 29-37 mm; abdomen: 24-30 mm; hindwing: 15-21 mm.

Habitat. Most commonly found in heavily vegetated ponds and lakes, but occasionally in slow reaches of streams.

Discussion. *Enallagma vesperum* was reported in much of the early literature as *E. pollutum*, due to confusion with that species. *Enallagma vesperum* is another unusual species that is most active in the late evening, as its name implies, and it often does not appear over water until sunset. I have collected them at mercury vapor lights just after dusk. Their coloration and delicate shape allow them to easily take cover in vegetation

during the day; however, they may be seen sneaking about in the morning hours as well (Carpenter 1991).

Little has been published regarding the reproductive behavior of this species. Dunkle (1990) reported that pairs leave the water, for up to 20 minutes, to mate. Oviposition occurs in tandem, occasionally after dark (Robert 1939) in stems and other vegetation lying just below the surface.

Genus *Hesperagrion* Calvert

Painted Damsel

Hesperagrion Calvert, 1902.

This is a monotypic genus that may be closely related to *Ischnura* (Calvert 1902; Paulson and Cannings 1980), but beyond superficial affinities, adults share very few similarities with that group (Westfall and May 1996). Male *Hesperagrion* lack the dorsoapical prominence of segment 10 typical of *Ischnura* and the caudal appendages are sufficiently different. As its common name implies it is quite colorful, rivaling all other damselflies in our area in beauty. This group is found in lotic waters of the arid southwestern U.S. and Mexico. The larvae are rather slender with a wide head and the gills are distinctly rounded apically, unlike those of *Ischnura*.

Hesperagrion heterodoxum (Sélys)

Painted Damsel

(Figs. 225, 238, Map 58)

Agrion heterodoxum Sélys, 1868: 69.*Amphiagrion heterodoxum*, Sélys, 1876: 288.*Amphiagrion flavescens* Sélys, 1876: 289.*Hesperagrion heterodoxum*, Calvert, 1902: 103.**Type.** Vera Cruz, Mexico.**Regional Distribution.***Biotic Province(s):* Chihuahuan, Kansan, Tamaulipan.*Watershed(s):* Rio Grande.**General Distribution.** UNITED STATES: AZ, CO, NM, TX; MEXICO: CHI, DGO, HGO, MEX, MCH, MOR, NLN, OAX, PUE, SLP, VER.**Seasonal Distribution.** Apr. 9 (TX) - Nov. 11 (TX).**Identification.** Mature individuals are recognizable in the field by their striking red, blue and yellow color. The head is mostly black, except for 2 large bright red postocular spots. The thorax is largely black with the blue antehumeral stripe reduced to a distinctive anterior and posterior elongated spot. The rest of the thorax is blue fading below. The abdomen is largely black dorsally and blue-green laterally. In the male the apex of segment 7 and the majority of segments 8-10 are bright orange. In the female the

apical 3/4 of segment 7 is bright blue. Teneral individuals of both sexes are orange. Juveniles go through a number of intermediate color stages that may occur at different rates on the head, thorax and abdomen (Westfall and May 1996).

The superior caudal appendages of the male are bifid and *Ischnura*-like in appearance. The mesostigmal plates of the female are somewhat triangular with a strong posterolateral flange and a distinct small knob bearing a setal tuft on each posteromeidal corner. The larva was illustrated most recently by Novelo and Gonzalez (1991) and Westfall and May (1996).

Size. Total length: 28-35 mm; abdomen: 21-27 mm; hindwing: 16-21 mm.

Habitat. Permanent and ephemeral creeks and streams with moderate emergent vegetation.

Discussion. *Hesperagrion heterodoxum* is found commonly in the most western limits of our area. It is often openly perching on emergent vegetation in rather large numbers. It has been reported as an inhabitant of permanent streams, but I have observed it in ephemeral streams of the Davis Mountains in West Texas. Nothing has been published about its reproductive and oviposition behavior (Bick and Bick 1980).

Genus *Ischnura* Charpentier

Forktails

Ischnura Charpentier, 1840.

Micronympha Kirby, 1890.

Ischnosoma Wallengen, 1894.

Bedfordia Mumford, 1942.

These often brightly colored damselflies are among the smallest and most studied members of the suborder, within our area and in all of North America. Eleven of the 14 species found in the United States occur in the south-central region. The species in our area have distinctively eastern or western distributions, except for the northern *I. verticalis*. The common name, forktails, refers to the forked posterodorsal projection on the apex of abdominal segment 10 in most males. This projection, lacking in *I. kellicotti*, gives the characteristic appearance of the genus. Members of this genus may be quite abundant around the dense vegetation of their typical habitat, generally including ponds, lakes and marshes. Some species, however, prefer lotic habitats (Johnson 1966b). Despite the cosmopolitan distribution of many of our species, a testimony to their dispersal capabilities, they are relatively weak fliers (Westfall and May 1996).

Members of this genus are fairly distinct, but resemble other genera like *Enallagma*, *Hesperagrion* and *Coenagrion*, the latter of which does not occur in our area. The postocular spots are particularly well represented in some species and an occipital bar may be present in some females. The thoracic color pattern of the group always involves a black middorsal carina and stripe, and usually a black humeral stripe. The antehumeral stripes, when present, of some males are pale and may be reduced to anterior and posterior spots. The wings are hyaline, petiolate and generally characterized by the anal vein separating from the wing margin before the anal crossing. Vein M_2 arises nearer the

fourth and third postnodal crossveins in the fore- and hindwings, respectively, of most species (generally nearer the fifth and fourth in *I. prognata*). The pterostigma in most males is a different color and/or shape in the different wings. The abdomen of males is usually black dorsally, except in *I. hastata*, and pale laterally with blue on segments 8-9, except in *I. posita*.

A vulvar spine on abdominal segment 8 may or may not be present in females. Females are polymorphic (except *I. posita*), often occurring in 2 or 3 color forms, which may in turn change with age. The various color forms generally include an andromorph (homochromatic), that is similar to the male, and one or two heteromorphs (heterochromatic). Various explanations for the genetic basis of this balanced polymorphism in females have been proposed. Johnson (1964c, 1966b, 1975b) studied two of our western species, *I. demorsa* and *I. damula*. He found that the andromorphic state is recessive, less common than the heteromorphs, and because of their more conspicuous coloration preyed upon more heavily. The less colorful heteromorphs were also found to be at a disadvantage, however, because males frequently mated with the wrong species. Each color morph was determined to have an advantage in certain situations. Other studies on the North American species *I. ramburii* (Robertson 1985) and *I. denticollis* (Aguilar 1992), and two European species (Hinneking 1987; Cordero 1990) have shown that male interference of andromorphs during oviposition is reduced at high population densities, allowing more time for egg-laying. Andromorphs, however, are at a disadvantage at low population densities because of loss of mating opportunities when passed by males. At these low population densities the heteromorphs have an

easier time laying eggs, because they are not harassed by males. All of the available data suggest that polymorphism in *Ischnura* spp. is controlled by density-dependent factors (Cordero and Andres 1996). The mesostigmal plates of many of the females are very similar. This, combined with the polymorphism of females, makes them challenging to identify.

Members of this group typically have longer flight seasons, as compared to other coenagrionid genera, and multiple generations. The wide variation in size of many of the species is directly correlated to this. Larger specimens are predominately encountered in the spring, when larval durations are longer, and smaller individuals in the summer and fall months. Most females of this genus oviposit alone, not in tandem, in emergent plant stems. Exceptions in our area include *I. denticollis* and *I. damula*. Females typically mate in the early morning and often only once (Fincke 1987; Dunkle 1990; Robinson and Allgeyer 1996; Robinson and Novak 1997).

Robinson and Allgeyer (1996) divided the genus into three groups to explain variation in lifehistory traits, coloration patterns and reproductive behaviors. One group includes two U.S. species that are polyandrous and whose males tandem guard females and lack paired basal spines on their penes. The only member of this group occurring in our region is the western *I. denticollis*. A second group, containing several species, of which *I. damula* and *I. ramburii* occur in our area, is characterized by polyandry and the presence of paired basal penal spines. The last group is comprised of monandrous males and includes the remaining species in our region. Robinson and Allgeyer (1996) proposed that: (1) copulation serves only for sperm addition in monandrous species, (2)

for both sperm addition and displacement in polyandrous tandem guarding species, and (3) for contact guarding as well as sperm addition and displacement in polyandrous species that don't tandem guard. Robinson and Novak (1997) examined the penis morphology of seven species of this genus in relationship to mating systems.

Six subgenera have been recognized (Donnelly 1965; DeMarmels 1987) in North America, primarily on differences in wing venation and pterostigmata. The majority of the species occurring in our faunal limits and North America are placed in the nominate subgenus, regarded as a probable artificial assemblage (Westfall and May 1996).

The larvae of many *Ischnura* species closely resemble one another and certain members of the genus *Enallagma*, making them difficult to separate. They characteristically have long gills with acuminate tips, seven segmented antennae, a transversely elongated head with rounded posterior margins and eyes with a distinct horizontal banding pattern.

KEY TO SPECIES OF *ISCHNURA*

MALES

1. Dorsum of pterothorax solid black, with metallic lustre, but lacking pale antehumeral stripes *denticollis*
- 1'. Dorsum of pterothorax with pale antehumeral stripes present, sometimes only represented by a small anterior and posterior spot or stripe on each side ... 2
- 2(1'). Forewing pterostigma is separated from costa; abdomen mostly yellow dorsally; dorsoapical prominence on segment 10 is spinelike and

- approximately 1/2 as long as segment 9 *hastata*
- 2'. Forewing pterostigma not separated from costa; abdomen not yellow dorsally; dorsoapical prominence on segment 10 generally not spinelike (except in *prognata*) and much shorter 3
- 3(2)'. Antehumeral stripe widely separated into equal anterior and posterior spots *damula*
- 3'. Antehumeral stripes complete or narrowly divided, appearing as an exclamation mark, with anterior spot much longer than the posterior 4
- 4(3)'. Inferior caudal appendages deeply emarginate distally with ventral lobe curved mesially *demorsa*
- 4'. Inferior caudal appendage not emarginate 5
- 5(4)'. Superior caudal appendages bifid with lateral posteriorly directed process and medial ventrally directed process subequal in length 6
- 5'. Superior caudal appendages not bifid, but may be hooked downward 7
- 6(5)'. Upper and lower arms of superior caudal appendages long and thin; dorsoapical prominence on abdominal segment 10 appears as an elongated spine; dorsum of abdominal segments 8 and 9 are black and blue, respectively *prognata*
- 6'. Upper and lower arms of superior caudal appendages short and thick; dorsoapical prominence on abdominal segment 10 is short and not spinelike; dorsum of abdominal segments 8 and 9 are largely blue and black, respectively *ramburii* (p. 295)

- 7(5'). Dorsoapical prominence on abdominal segment 10 low and not bifid (Fig. 231); dorsum of abdominal segment 10 mostly blue *kellicotti*
- 7'. Dorsoapical prominence on abdominal segment 10 distinctly bifid; dorsum of abdominal segment 10 entirely black 8
- 8(7'). Abdominal segments 8 and 9 entirely blue or with black only dorsobasally on never laterally; superior caudal appendages rounded apically
..... *barberi*
- 8'. Abdominal segments 8 and 9 entirely black or at least with extensive black areas laterally; superior caudal appendages acute apically 9
- 9(8'). Abdominal segments 8 and 9 entirely black; inferior caudal appendages serrated, when viewed laterally; 2 postquadrangular cells in hindwing
..... *posita*
- 9'. Abdominal segments 8 and 9 blue dorsally, with black stripes ventrolaterally; inferior caudal appendages, not serrated, tapering to a blunt apical point; 3 postquadrangular cells in hindwing *verticalis*

FEMALES

1. Middle prothoracic lobe with distinct nipple-like process on each side, generally pale in color 2
- 1'. Middle prothoracic lobe without distinct nipple-like process on each sides ... 3
- 2(1). Prominent flange-like projection, dorsally, along posterior margin of mesostigmal plate; hindwing generally greater than 14 mm 3

- *damula*
- 2'. No prominent flange-like projection, dorsally, along posterior margin of mesostigmal plate, only low ridge; hindwing generally less than 14 mm
..... *denticollis*
- 3(1'). Abdomen usually longer than 28 mm; M_2 separates from $M_{1,2}$ near the fifth post nodal crossvein in the forewing *prognata*
- 3'. Abdomen usually less than 27 mm; M_2 separates from $M_{1,2}$ closer to the fourth postnodal crossvein in the forewing 4
- 4(3'). Mesostigmal plates with a prominent ridge or flange extending above surface of pterothorax 5
- 4'. Mesostigmal plates without a prominent ridge or flange extending above surface of pterothorax 7
- 5(4). Mesostigmal plates with prominent flange restricted to lateral 2/3 of their width and a distinct tubercle in the posteromedial corner *demorsa*
- 5'. Mesostigmal plates with prominent flange or ridge extending nearly their entire width 6
- 6(5'). Hind margin of prothorax with prominent fringe of hairs for its entire width
..... *verticalis*
- 6'. Hind margin of prothorax without a prominent fringe of hairs, although a few lateral hairs may be present *barberi*
- 7(4'). Vulvar spine on abdominal segment 8 absent; antehumeral stripe generally divided with a longer posterior stripe and a smaller anterior spot, resembling

- an exclamation mark, although often obscured with age *posita*
- 7'. Vulvar spine on abdominal segment 8 present, but may be small 8
- 8(7'). Postocular spots large and conspicuous; dorsum of abdominal segment
2 black with a blue or orange apical spot *kellicotti*
- 8'. Postocular spots small, often obscured in older individuals; dorsum of
abdominal segment 2 entirely black or entirely orange 9
- 9(8'). Hindwing generally no longer than 15 mm; middle prothoracic lobe with a
pair of distinct pits; mesostigmal plates with medial borders nearly straight
..... *hastata*
- 9'. Hindwing generally 16 mm or longer; middle prothoracic lobe without
distinct pits; mesostigmal plates with strongly concave medial border
..... *ramburii*

Ischnura barberi Currie

Desert Forktail

(Figs. 226, 239, Map 59)

Ischnura barberi Currie, 1903: 302.

Ischnura utahensis Muttkowski, 1910: 172.

Type. Hot Springs, Yavapai County, Arizona; USNM.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Kansan, Texan.

Watershed(s): Canadian, Cimarron, Red, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, KS, NE, NM, OK, TX, UT.

Seasonal Distribution. Jun. 5 (OK) - Sep. 14 (NM).

Identification. This species is infrequently encountered in the arid western areas of west Texas, the Kansan biotic province of Oklahoma and throughout New Mexico. *Ischnura barberi* is a blue-green species that closely resembles *I. ramburii*, but their ranges (Maps 59 & 68) apparently don't overlap. The face of the male is pale blue-green, heavily marked with black. There are two small pale blue postocular spots that are often confluent with a narrow occipital bar. The abdomen is blue-green on the first two segments and part of 3. The remainder of the abdomen is yellow-orange dorsally marked with black. The posterolateral portion of segment 7 and all of 8 and 9 are blue. Segment 10 is blue with a wide black dorsal stripe. The dorsoapical prominence on segment 10 is conspicuous, but does not extend posteriorly beyond segment 10. The superior caudal appendages are not bifid and are strongly directed downward. The inferior appendages are gently upturned or straight with apices upturned.

The mesostigmal plates of the female, when viewed dorsally, each bear a flange that extends posteromedially to the anterolateral corner. Homochromatic females are uncommon and nearly identical to males. Heterochromatic females are orange or tan often with a slight greenish cast to the abdomen. The abdomen is generally as above with a black basal triangle and subapical spot, dorsally on the pale segment 8. These spots are occasionally narrowly confluent. Segment 9 has a full-length black stripe and segment 10

bears a dorsal black triangle that extends the entire length of the segment. The larva has never been formally described but is included in the keys of Westfall and May (1996), based on reared specimens.

Size. Total length: 28-35 mm; abdomen: 22-27 mm; hindwing: 14-19 mm.

Habitat. Alkaline and saline, desert springs, pools, irrigation ditches and canals.

Discussion. Very little is known of this species' ecology and behavior (Bick and Bick 1980).

Ischnura damula Calvert

Plains Forktail

(Figs. 227, 240, Map 60)

Ischnura damula Calvert, 1902: 126.

Type. Zuni, New Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan.

Watershed(s): Canadian, Colorado, Rio Grande.

General Distribution. UNITED STATES: AZ, CO, KS, NE, NM, ND, OK, SD, TX, UT, WY.

Seasonal Distribution. May (TX) - Sep. (TX).

Identification. *Ischnura damula* is generally restricted to the eastern slope of the rockies

and Great Plains (Westfall and May 1996) and ranges as far south as extreme western Texas. It is also found throughout New Mexico and only the extreme western panhandle of Oklahoma. Males can be immediately distinguished from all others in our area by the reduction of the antehumeral stripes to a pair of small spots on each side. The abdomen is largely black with segments 8 and 9 blue except for an abbreviated basal lateral stripe. The caudal appendages are distinct with the superior appendages bearing a prominent posteroventral process and the inferiors upcurved with bluntly pointed apices.

The female is one of only two in our region that have a prominent nipple-like process on each side of the pronotum. It can be readily distinguished from the other species, *I. denticollis*, by its larger size and mesostigmal plates. Homochromatic females are common and nearly identical to males with a reduced antehumeral stripe.

Heterochromatic females have a complete antehumeral stripe and pale abdominal colors are orange or tan with occasional blue markings laterally on segments 1-2, apex of 7, and 8-10.

Size. Total length: 23-34 mm; abdomen: 18-27 mm; hindwing: 11-19 mm.

Habitat. Ponds, springs and slow moving streams with heavy marginal vegetation.

Discussion. Oviposition may occur unaccompanied by the male or in tandem (Provonsha 1975), usually in emergent vegetation or algal mats. Johnson (1965, 1966c) developed procedures for laboratory rearing and mating of both *I. damula* and *I. demorsa*. Johnson (1964c, 1975b) explored the genetic basis for the female polymorphism and its relationship to natural selection in this species. He found that the male-like homochromatic females were more vulnerable to predation, but offered increased

reproductive isolation, while the more cryptic heterochromatic females were provided with a great defense against predation, but engaged in interspecific mating that ultimately lowered their reproductive potential. These selective pressures explain the obscured higher frequencies of homochromatic females in populations.

***Ischnura demorsa* (Hagen)**

Mexican Forktail

(Figs. 228, 241, Map 61)

Agrion demorsum Hagen, 1861: 81.

Ischnura demorsa, Calvert, 1902: 128.

Type. Morelia, Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan.

Watershed(s): Canadian, Cimarron, Rio Grande.

General Distribution. UNITED STATES: AZ, CO, KS, NM, OK, TX, UT; MEXICO: AGS, CHI, COA, DFE, DGO, HGO, JAL, MEX, MCH, OAX, QRO, SLP, SIN, SON.

Seasonal Distribution. Apr. 9 (TX)- Nov. 11 (TX).

Identification. As its common name implies, *I. demorsa*, is primarily a Mexican species, but reaches as far north and east as Kansas. Its regional distribution is like that of *I. damula*, occurring throughout New Mexico and only in the extreme western biotic

provinces of Texas and Oklahoma. The coloration and caudal appendages of the male will help distinguish *I. demorsa* from other *Ischnuras* in the region. The head and thorax are blue-green, heavily marked with black. The antehumeral stripe is present and complete. Laterally, the abdomen is blue-green proximally, changing to a lighter yellow-green distally. Segments 8 and 9 are blue, each with a prominent lateral black stripe extending more distally on segment 8. There is also often a black dorsal stripe basally on 8. Segment 10 is black dorsally and blue laterally with the distinct dorsoapical prominence deeply bifurcated and extending well above the segment and easily viewed in the hand. The superior caudal appendages are strongly curved downward; the upper arm of the deeply bifurcated inferior appendages extends beyond both the lower arm and superior appendage.

The male-like, homochromatic females are uncommon and differ from males in having the entire dorsum of abdominal segment 10 blue. The more common heterochromatic females are pale orange or tan. The antehumeral stripe is sometimes reduced to a hairline. The abdomen is nearly all black dorsally, sometimes with segments 8-10 like that of the homochromatic form. The mesostigmal plates are rather quadrate in shape with only a moderate flange on the anterior border and a distal tubercle in the posteromeidal corner. Females may become heavily pruinose after only a few days (Johnson 1966b), but this seldom entirely obstructs the thoracic color pattern. The larva was fully described and illustrated by Novelo and Gonzalez (1991).

Size. Total length: 21-26 mm; abdomen: 17-21 mm; hindwing: 11-15 mm.

Habitat. Creeks, streams, springs and slow reaches of rivers with moderate vegetation.

Discussion. Johnson (1966b, 1975b) studied, in detail, the genetics of polymorphism in this species and found the same process of natural selection operating as previously discussed in *I. damula*. Heterochromatic forms generally live longer, but reduce reproductive isolation. Johnson (1965, 1966c) provided some details of its oviposition behavior.

Ischnura denticollis (Burmeister)

Black-fronted Forktail

(Figs. 229, 242, Map 62)

Agrion denticollis Burmeister, 1839: 819.

Ischnura exstriata Calvert, 1895: 493.

Ischnura denticollis, Calvert, 1902: 126.

Caelaenura denticollis, Kennedy, 1917: 500.

Type. Mexico.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Texan.

Watershed(s): Brazos, Canadian, Cimarron, Colorado, Red, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, ID, KS, NV, NM, OK, OR, TX, UT; MEXICO: BCA, BCS, CHS, CHI, DFE, DGO, HGO, JAL, MEX, MCH, NAY, OAX, PUE, QRO, SON, TLX, VER; south to Guatemala.

Seasonal Distribution. Mar. 10 (TX) - Aug. 30 (CHI).

Identification. Another western *Ischnura*, *I. denticollis*, is found only as far east as central Oklahoma. Males of this species are not easily confused with others in our area because of the solid metallic blue-black mesepisterna; the antehumeral stripe is absent. The abdomen is dark dorsally with a blue-green metallic lustre. Segment 8 and 9 are blue dorsally, the former with a narrow dark basal ring. The dorsoapical prominence on segment 10 is distinct but barely reaches above the height of segment 9, if at all. The tips of the superior caudal appendages are directed anteroventrally. The upper arms of the bifurcated inferior appendages are slightly denticulate at their upper end. The lower arms project nearly straight posteriorly.

Females are one of only two species in our region with distinct nipple-like processes immediately posterior to a deep pit on each side of the pronotum. *Ischnura denticollis* can be separated from the other, *I. damula*, by its smaller size and shorter posterior flange on the mesostigmal plates. The homochromatic form is rare and differs from the male in the occasional presence of the antehumeral stripes and a blue spot dorsally on segment 10. The heterochromatic form varies from pale blue to orange. Postocular spots are larger than in the male and they are separated by a pale occipital bar. The abdomen is patterned like the homochromatic form. Kennedy (1917) described the color variations in heterochromatic females and illustrated the larva. Garrison (1981) provided additional descriptions and a key to western California *Ischnura* larvae.

Size. Total length: 22-26 mm; abdomen: 17-21 mm; hindwing: 11-15 mm.

Habitat. Vegetated streams, creeks or ponds, often associated with springs, especially at

northern latitudes.

Discussion. *Ischnura denticollis* is more widely distributed than the previous three western species. Provonsha (1975) found *I. denticollis* in great abundance Utah, in most aquatic habitats between 1,400 and 2,500 m where there was sufficient vegetation and a high enough minimum temperature to support damselflies. Kennedy (1917) described *I. denticollis* as "undoubtedly the feeblest of all western Odonata..." Aguilar (1992, 1993) studied a Mexican population and reported further details of the reproductive behavior and polymorphism. He found that survivorship for both sexes was among the lowest rates in the Odonata and that their ability to disperse is low.

Kennedy (1917) observed and reported on various aspects of the ecology and reproductive behavior of *I. denticollis*. Unlike most *Ischnura*, females will oviposit in tandem, usually in emergent grasses or debris. The average copulation time is 20 minutes, the shortest of any *Ischnura* reported (Aguilar 1992).

Leong and Hafernik (1992a,b) studied seasonal variation and morphometric differentiation in sympatric populations of *I. denticollis* with the more western *I. gemina* (Kennedy) and found that hybridization does occur, but that the evidence shows hybrid unfitness. Kennedy (1917) placed both of the above species in the now unrecognized genus *Celaenura*, based on their lack of long internal spines on the penis head; a character only shared by them.

Ischnura hastata (Say)

Citrine Forktail

(Figs. 230, 243, Map 63)

Agrion hastatum Say, 1839: 38.

Agrion anomalum Rambur, 1842: 281.

Agrion venerinotata Haldemann, 1844: 55.

Anomalagrion hastatum, Sélys, 1876: 255.

Type. N. America.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkânsas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AZ, AR, CA, CO, CT, DE, FL, GA, IL, IN, IA, KS, KY, LA, MA, MD, ME, MO, MS, NC, NE, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, WV, WI; CANADA: Ont.; MEXICO: BCS, CHS, COL, GRO, JAL, MCH, MOR, NAY, NLN, OAX, PUE, QTR, SLP, SIN, TAB, TAM, VER, YUC; Bahamas, Bermuda, Cuba, Dom. Rep., Haiti, Jamaica, P. Rico; Central and South America.

Seasonal Distribution. All year (TX).

Identification. As the above wide distribution suggests this is a cosmopolitan species with the ability to readily adapt to its environment. *Ischnura hastata* is also easily dispersed by winds (Dunkle 1990). It is the smallest damselfly in the U.S. Males are

distinct because of the unique pterostigma, that is detached from the costa in the forewing. It is lighter in color and twice or more the size of its hindwing counterpart. No other damselfly in the world has this characteristic. The thorax of males is green and the abdomen is bright yellow. The dorsoapical projection on segment 10 is strongly notched and prominent. The superior caudal appendages project posteriorly and are rounded distally. There is a ventrally directed medial projection off of each. The inferior caudal appendages each have a short, rounded posteroventral lobe.

Female *I. hastata* may be confused with the similarly colored *I. posita*, but the latter is generally darker. *Ischnura hastata* females are red-orange with black stripes across the top of the head, middorsally on the pterothorax and dorsally on abdominal segments 6 through 8. In mature individuals a light pruinosity envelops the thorax and abdomen, but never completely obscures the pterothoracic pattern. Only heterochromatic forms are known in this species. A small vulvar spine may or may not be present on segment 8. The mesostigmal plates are distinct and somewhat elongate in shape. The larva, described by Needham (1903), is very similar to that of *I. posita*.

Size. Total length: 21-27 mm; abdomen: 16-22 mm; hindwing: 9-15 mm.

Habitat. Heavily vegetated marshes, bogs, ponds, lakes and other permanent or temporary bodies of water.

Discussion. The unique pterostigma of *I. hastata* has historically lead to its placement in a genus by itself, *Anomalagrion*, but most recently it has been recognized as a member of the *Ischnura*, and we follow this placement. *Ischnura hastata* is found throughout the New World, but remarkably little has been written about its reproductive behavior or

ecology. It is not unusual to find individuals far from water. They may be abundant in heavily vegetated areas with little or no water. Whether because of its small size or secretive behavior, *I. hastata*, is seldom seen mating. Dunkle (1990) reported an average mating time of 20 minutes and females ovipositing solo in submerged vegetation just under the surface. Other authors commenting on the reproductive and or oviposition behavior include Walker (1913) and Carpenter (1991) in its northern limits and Wilson (1911) in Jamaica.

***Ischnura kellicotti* Williamson**

Lilypad Forktail

(Figs. 231, 244, Map 64)

Ischnura kellicotti Williamson, 1898: 209.

Type. Round and Shriners Lakes, Indiana; UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Bayou Bartholomew, Mississippi, Ouachita, Red, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, AR, DE, FL, GA, IN, KY, LA, MA, ME, MD, MI, MS, NJ, NC, OH, OK, RI, SC, TX, VA, WI.

Seasonal Distribution. Apr. 1 (LA) - Oct. 1 (LA).

Identification. *Ischnura kellicottii* is strictly eastern in distribution. The Texan biotic province serves as its westernmost border. The bright blue or orange color of this species may result in its initial confusion with members of the genus *Enallagma* (e.g. *E. geminatum*). The postocular spots are unusually large and the pterothorax of males is bright blue with a broad black middorsal stripe and a pair of black humeral stripes. The abdomen is largely black with blue on parts of segments 1-2 and 7-10. The forewing pterostigma is larger than its tan hindwing counterpart and becomes bright blue anteriorly with maturity. Males also lack a notable dorsoapical projection on segment 10. The superior caudal appendages are rather distinctive, sloping ventrolaterally to form an acute apex. The inferior appendages are bifid with the lower appendages projecting posteroventrally.

Females exist in both a blue and a red-orange form. Each is patterned like the male, with pale colors replaced by the red-orange in the latter. The vulvar spine on segment 8 is small but usually present. The larvae are known to cling to the underside of waterlilies, but have never been described. Westfall and May (1996) included it in their key, based on reared specimens.

Size. Total length: 25-31 mm; abdomen: 19-24 mm; hindwing: 12-18 mm.

Habitat. Strongly associated with floating lily pads in bogs and lakes.

Discussion. This species is unique, among Nearctic odonates, in its obligatory relationship with water lilies (*Nuphar* and *Nymphaea*) in both larval and adult stages.

Williamson (1899b) was the first to report this little studied relationship. He stated that he, "...never saw one at rest on any other location than a flat-floating leaf of the white

water-lily. They were quarrelsome neighbors and frequently attacked *E. gemina* and *E. signatum*, though apparently without serious injury." Larvae cling to the bottom of the lily pads and emerge by crawling on top (Johnson and Westfall 1970). The adults are nearly always encountered perching or ovipositing on these plants. Dunkle (1990) described the unique posture, sometimes exhibited by this species; while perching on a pad the with abdomen curled downward, they will tilt back on the abdomen with the front legs in the air ready for an immediate getaway. Females, unaccompanied by males, take up to 20 minutes to oviposit. Calvert (1898b) made additional notes on habitat and Williamson's original description.

Robinson and Jordan (1996) studied color morphs in a north-central Texas population of this species. They found no evidence for dichromatic females, but rather that the color change was ontogenetic. Young teneral females are orange, but with the onset of reproductive maturity become blue. These authors state that females of netted copulating pairs were nearly always of an intermediate color form. The young orange color form, however, may be reproductively mature, as indicated by a photograph of a copulating pair in Westfall and May (1996). Interestingly, Robinson and Jordan (1997) found that although *I. kellicottii* are rarely harassed, females do not utilize an active copulation refusal display to thwart off nearby males, potentially explaining the photograph.

Ischnura perparva McLachlan in Selys

Western Forktail

(Figs. 232, 245, Map 65)

Ischnura perparva McLachlan in Sélys, 1876: 263.

Ischnura defixa Sélys, 1876: 261.

Type. IRSN.

Regional Distribution.

Biotic Province(s): Chihuahuan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, ID, KS, MT, NE, NV, NM, ND, OK, OR, SD, UT, WA, WY; CANADA: B.C., Man.

Seasonal Distribution. ?

Identification. This common northwestern species barely ranges to the western reaches of our area, extending into a northern and southwestern New Mexico and Westfall and May (1996) have recently reported it from Oklahoma. Male *I. perparva* most closely resemble *I. demorsa*, in our area, in coloration. The head and pterothorax are blue-green with considerable black markings. The black humeral stripe is as much as three times as wide as the antehumeral stripe. The abdomen is mostly yellow-green dorsally with blue on segments 1-2, base of 3, and all of 8-10. The bifurcated dorsoapical prominence on segment 10 extends 1/3-1/2 again as high as the segment. The superior caudal appendages gently curve downward, forming an acute process (Fig. 232). The inferior appendages are equally bifurcated and project posteriorly.

Females are orange becoming tan or olive with age and the thoracic pattern often become obscured. The head and thorax are like those of the male with the postoccipital spots becoming black dorsally with age. Only heterochromatic females are known.

Kennedy (1915b) discussed the color changes of females throughout maturity. Needham and Cockerell (1903) described the larva and Westfall and May (1996) noted its apparent affinity for mud.

Size. Total length: 23-30 mm; abdomen: 18-24 mm; hindwing: 11-17 mm.

Habitat. Ponds, lakes and slow moving streams with heavy vegetation and muddy substrate; often found in alkaline or saline situations.

Discussion. The range of this species barely enters our area, although it is common west of the Rocky Mountains. It is considered the most common damselfly in Utah (Provonsha 1975). Various aspects of its reproductive and oviposition behavior have been reported (Kennedy 1915; Paulson 1974; Provonsha 1975). Females usually oviposit in tandem, but may do so unaccompanied by the male.

***Ischnura posita* (Hagen)**

Fragile Forktail

(Figs. 233, 246, Map 67)

Argia positum Hagen, 1861: 77.

Nehalennia posita, Sélys, 1876: 1242.

Ischnura posita, Needham, 1903: 261.

Type. Savannah, Georgia; NHMV, MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, DC, FL, GA, HA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, NH, NJ, NY, NC, ND, OH, OK, PA, RI, SC, TN, TX, VT, VA, WV, WI; CANADA: Man., Nfld., N.S., Ont., Que.; MEXICO: HGO, QTR, SLP; south to Belize and Guatemala.

Seasonal Distribution. All year (TX).

Identification. *Ischnura posita* is a widely distributed species throughout the eastern U.S., finding its western border in the Kansan and Chihuahuan biotic provinces.

Ischnura posita males are marked with yellow-green and mature females are blue. The rest of the body is metallic black. They are unique among *Ischnura* in that the pterostigmata in all wings are similar and there are fewer postquadrangular antenodal cells. The dorsoapical projection of segment 10 is bifurcated, but short. The superior and inferior caudal appendages are short and subequal in length. Only homochromatic females are known, but with age they become dark blue with a heavy pruinosity. Females lack a vulvar spine on segment 8 and have subtriangular mesostigmal plates with raised lateral corners. Needham (1903) described the larva.

Both sexes are easily recognized in the field by the conspicuous division of the antehumeral stripes on the pterothorax into exclamation marks and the nearly all dark abdomen. *Ischnura damula* also has a divided antehumeral stripe, but the divisions are small subequal ovals and the abdominal segments 8 and 9 of males are blue. These species are not sympatric.

Size. Total length: 21-29 mm; abdomen: 16-22 mm; hindwing: 10-16 mm.

Habitat. Heavily vegetated ponds, marshes and slow moving waters.

Discussion. This common widespread species is found in every county in Arkansas (G. Harp pers. com.) and since Bick's (1957) report of the species from 36 of the 64 parishes in Louisiana, it has been collected in all but 8 (Mauffray 1997). It was introduced to Oahu in 1936 (Polhemus and Asquith 1996) and is now found on all but one of the major Hawaiian islands and as far north as Nova Scotia and south into Mexico. A southern subspecies *I. p. acicularis* Donnelly is found in Belize and Guatemala (Donnelly 1965).

Robinson *et al.* (1985) studied the roosting behavior of a north-central Texas population and found that unlike most odonates, both sexes were regularly encountered at ponds during the day. Both sexes roosted at night significantly higher on the same branches where they perched earlier in the day. At night the body was found to be at a right angle to the stem, possibly allowing for a quicker escape from predation and more efficiency in warming.

Bick and Bick (1958) studied a population of this species at a southern Oklahoma stream where it was easily one of the most abundant species. Patrick and Lutz (1969) reported brief life history information including data suggesting as many as two

generations per year. Robinson (1983) studied water mite parasitism on adults and there have been several studies on various aspects of the larvae of this species (Robinson *et al.* 1991; Shaffer and Robinson 1993).

***Ischnura prognata* (Hagen)**

Furtive Forktail

(Figs. 234, 247, Map 67)

Agrion prognatha Hagen, 1861: 83.

Ischnura prognata, Sélys, 1876: 249.

Type. Virginia; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Sabine, Trinity.

General Distribution. UNITED STATES: AL, FL, GA, IN, LA, MS, NY, NC, OH, PA, SC, TN, TX, VA, WV.

Seasonal Distribution. Feb. 15 (LA) - Sep. 9 (LA).

Identification. This eastern species is uncommon throughout its range and apparently finds its western most limit in the Sam Houston National Forest of east Texas. To the author's knowledge the only collections in Texas of *I. prognata* have been by Donnelly (1978). It is the longest of the *Ischnura* in the U.S. Its size combined with thoracic and

abdominal coloration will serve to separate *I. prognata* from similar species like *I. ramburii*.

Males are metallic black with only a thin green antehumeral stripe and pale blue on abdominal segment 9 and laterally on 10. The pterostigma in the forewing is twice the size as it is in the hindwing and is transparent in its outer half. The dorsoapical projection on segment 10 is bifurcate apically and readily visible in the hand. The superior caudal appendages of the male are sharply bifurcate with the upper branch projecting posteriorly and the lower ventrally (Fig. 234). The inferior appendages are stout and subequal to the upper branch of the superiors.

Only heterochromatic females are known. Juvenile forms have an orange-red thorax only interrupted by a black mid-dorsal stripe. The abdomen is orange to segment 4, but becomes black apically. Older females become less vibrant and almost brown. There is no vulvar spine on segment 8. The posterior margin of the pronotum has a distinct v-shaped emargination at its middle. The mesostigmal plates are subtriangular and have small tufts of hair at the posteromedial corners (Fig. 247). Huggins and Brigham (1982) described and illustrated the larva.

Size. Total length: 30-37 mm; abdomen: 24-31 mm; hindwing: 14-20 mm.

Habitat. Heavily shaded ponds, swamps and sloughs.

Discussion. Very little is known about the biology of this uncommon species. Dunkle (1990) discussed behavioral similarities to tropical damselflies. *Ischnura prognata* will fly ghost-like from one stem to another in the shady forest undergrowth, foraging at a height of 2 m or more.

Ischnura ramburii (Sélys)

Rambur's Forktail

(Figs. 235, 248, Map 68)

Agrion senegalensis in part Rambur, 1842: 277.*Agrion ramburii* Sélys, 1850: 186.*Agrion tuberculata* Sélys, 1857: 464.*Agrion credula* Hagen, 1861: 80.*Agrion defixum* Hagen, 1861: 80.*Agrion iners* Hagen, 1861: 75.*Ischnura ramburii*, Sélys, 1876: 272.**Type.** Unknown.**Regional Distribution.***Biotic Province(s)*: Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.*Watershed(s)*: Arkansas, Bayou Bartholomew, Brazos, Colorado, Guadalupe, Mississippi,

Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St.

Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AZ, AR, CT, DE, DC, FL, GA, HA, IL,

KY, LA, ME, MD, MA, MS, MO, NJ, NY, NC, OK, PA, RI, SC, TX, VA; MEXICO:

BCA, BCS, CAM, CHS, CHI, COL, DFE, GRO, JAL, MEX, MCH, NAY, NLN, OAX,

QTR, SLP, SIN, SON, TAB, TAM, VER, YUC; Bahamas, Bermuda, Cuba, Dom. Rep.,

Haiti, Jamaica, P. Rico; south to Chile.

Seasonal Distribution. All year (TX).

Identification. Males can be identified by the green thorax and blue on all of abdominal segment 8 and anterolaterally on 9. The dorsoapical projection on segment 10 is slight. The superior caudal appendages are short and blunt. The inferior appendages are twice as long as the later, unbifurcated and project posteriorly (Fig. 235).

Females are found in three color forms, including homochromatic, male-like forms. There is also an orange-red form, where the thorax and abdominal segments 1-2 are entirely orange-red except for a prominent black mid-basal stripe on the former. The rest of the abdomen is dark. A third, green form, is patterned like the orange-red form, but with pale colors olive-green. Because juveniles of the green form look like the red form, it is not certain whether a true genetically determined "red form" exists (Dunkle 1990). There is a prominent vulvar spine on segment 8 of all females. The mesostigmal plates are subtriangular and have a low, pale ridge forming a continuous posterior border (Fig. 248). The larva was described and illustrated as *Teleagrion daeckii* by Needham (1904).

This species is easily recognized in the field but may be confused with the very similar *I. barberi* at its westernmost localities. It can be distinguished by the continuous black stripe dorsally on the abdomen and the absence of blue dorsally on segment 9.

Size. Total length: 27-36 mm; abdomen: 21-29 mm; hindwing: 15-19 mm.

Habitat. Heavily vegetated ponds, lakes, marshes and slow reaches of streams exposed to sunlight including brackish waters.

Discussion. Considered the most widespread *Ischnura* of the New World (Westfall and May 1996), *I. ramburii* ranges as far north as Maine, southward through the U.S., Mexico, Central and South America. It occurs year round in the southern parts of its range. It is another species that reaches its western border within our limits. The most western record the authors have documented is in Ward Co., Texas. It also inhabits the Hawaiian Islands, where it was introduced in 1973 (Polhemus and Asquith 1996), with possible subsequent introductions (Hilton 1989).

As widespread as this species is, surprisingly little has been written about its biology. Robertson (1985) reported on the reproductive behavior, Wilson (1911) on oviposition and Dunkle (1990) summarized its natural history. Both sexes will remain close to the water and although males are not territorial, females are known to be highly predaceous and often cannibalistic (Garcia-Diaz 1938). Males often do not release females from the wheel position for several hours, and sometimes as many as seven, to secure their genetic contribution. Red females will sometimes attack males, but more often curl their abdomen downward while fluttering their wings in a refusal display.

Females often oviposit late in the afternoon, unattended by males, on the underside of floating vegetation or debris, by curling the abdomens. Dunkle (1990) discussed the lack of color preference by males and the selective advantages and disadvantages of various color forms in populations.

Ischnura verticalis (Say)

Eastern Forktail

(Figs. 236, 249, Map 69)

Agrion verticalis Say, 1839: 37.

Ischnura verticalis, Sélys, 1876: 265.

Type. United States.

Regional Distribution.

Biotic Province(s): Austroriparian, Kansan, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Cimarron, Red, St. Francis, White.

General Distribution. UNITED STATES: AL, AR, CO, CT, DE, DC, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MO, MT, NE, NH, NJ, NM, NY, NC, ND, OH, OK, PA, RI, SC, SD, TN, TX, VT, VA, WV, WI, WY; CANADA: Man., N.B., Nfld., N.S., Ont., P.E.I., Que.

Seasonal Distribution. Apr. 21 (AR) - Sept. 12 (TX).

Identification. One of the most common damselflies in the northeastern U.S., and throughout Oklahoma, this species is uncommon south of the Red River. Males are dark with a narrow green antehumeral stripe and yellow-green thorax laterally. The antehumeral stripe is often narrowed at about 2/3 its length. The abdomen is largely black with segments 8-9 bright blue dorsally. The dorsoapical projection on segment 10 is blunt and bifurcated for about 1/2 its length. It projects more dorsally than posteriorly, not extending beyond the hind margin of segment 10. The superior caudal appendages slant downward in lateral view, terminating to an acute apex. The inferior appendages

have an abrupt dorsobasal process followed by a lower posteriorly projecting process that curves upward (Fig. 237).

The less common homochromatic, male-like female has the postocular spots larger and confluent with the rear of the head. The blue on abdominal segments 8-9 is variable and often restricted to the apical 1/2 of the segment. The more common heterochromatic females are orange marked with black. The abdomen is largely black dorsally, especially from segments 4-10. Both color forms become dark and heavily pruinose with age. The mesostigmal plates are distinctly triangular, generally with a prominent posterior ridge or flange (Fig. 249). There is a well developed vulvar spine on abdominal segment 8. The larva was described and illustrated by Needham (1903).

Size. Total length: 20-33 mm; abdomen: 15-26 mm; hindwing: 11-19 mm.

Habitat. Ponds, lakes, slow moving streams and marshes.

Discussion. *Ischnura verticalis* has been variously reported from Louisiana (Calvert 1893; Foster 1915; Bick 1957), but the validity of these records remains questionable. Mauffray (1997) reported no modern records in the state but did not rule out its occurrence in the northern part of the state. In much of its range it is one of the first damselflies seen in the spring and last seen in the fall (Carpenter 1991; Westfall and May 1996). Various aspects of the ubiquitous species have been well studied. Mitchell (1962) suggested that strong winds may be the principal cause of its dispersal. Grieve (1937) studied the biology and reproductive behavior of this species in detail. He found that mating took place as early as four days after emergence and that oviposition began a few hours after mating. The well-documented behavior of *I. verticalis* females flexing the

abdomen ventrally and rapidly beating their wings was determined to be a successful threat display, warding off intruders (Bick 1966). Calvert (1915) discussed color dimorphism in *I. verticalis*.

Richardson and Baker (1997) found that food intake was an important determinant of number of eggs laid in *I. verticalis* and that adult body size was relatively unimportant. Failure to find food on any one day had consequences not only for clutches laid the next day, but also for subsequent clutches. Unlike most damselflies, *I. verticalis* females tend to be monogamous, mating only once (Fincke 1987). A single female may fertilize over a thousand eggs using the sperm from a single-male encounter without a drop in fertility (Grieve 1937; Fincke 1987).

The various instars and larval development were studied in detail by Pilon and Franchini (1984). Richardson and Baker (1996) hypothesized that abdominal wave actions in larvae may function to loosen the exoskeleton prior to molting and/or release of metabolites. Baker and Smith (1997) studied differences in antipredator and antiparasite behavior in larvae.

Genus *Nehalennia* Sélys

Sprites

Nehalennia Sélys, 1850.

Argiallagma Calvert, 1907.

Trichocnemis Sélys, 1857 (in part).

This small genus of six species world-wide is largely confined to the New World with only a single Palearctic species. The group is comprised of small beautifully metallic green or black damselflies characterized by a sharply angulate frons and widely separated eyes. All members lack postocular spots, but often have a visible occipital bar. The second antennal segment has a characteristic white ring. All of the above characters will readily separate this group from the closely related *Ischnura*. The legs are relatively short with variable sized tibial spurs. The wings are hyaline and characterized by 7-12 and 6-11 postnodal crossveins in the fore- and hindwings, respectively. The abdomen is either black or metallic green, becoming cream or tan ventrally. The male caudal appendages are distinct, but short and often difficult to see. The mesostigmal plates of the females are readily distinguished by their heavy sculpturing.

A revision of the genus was completed by DeMarmels (1984). He provided detailed descriptions and figures for all adults including a proposed phylogenetic tree of the group. This group occupies a specific ecological niche characterized by lentic habitats or slow moving streams with variably dense low emergent vegetation where adults fly (DeMarmels and Schies 1977; DeMarmels 1984). The biology of most species is poorly known. Hilton (1983), however, studied recognition between two North American species not occurring in the region, *N. gracilis* Morse and *N. irene* (Hagen).

***Nehalennia integricollis* Calvert**

Southern Sprite

(Figs. 250, 254, Map 70)

Nehalennia integricollis Calvert, 1913a: 312.

Type. Enterprise, Florida; ANSP.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Red, Sabine, Trinity.

General Distribution. UNITED STATES: AL, FL, GA, LA, MD, MS, NJ, NY, NC, OK, PA, RI, SC, TX, VA.

Seasonal Distribution. Apr. 15 (TX) - Sep. 10 (LA).

Identification. This species is uncommon in the southwesternmost reaches of its range. This species will not likely be confused with others in our area because of its small size and metallic green coloration and blue abdominal segment 10. The superior caudal appendages are short, 1/4 of the length of segment 10 and have a posteroventral apical tooth that may only be visible when viewed posteriorly. The serrated inferior caudal appendages are slightly longer than the superior appendages and have two to three acute teeth along the posterior margin (Fig. 254). Females appear like males in coloration. The mesostigmal plates are subtriangular with a rounded posteromedial corner (Fig. 250). Females lack a vulvar spin on abdominal segment 8.

Size. Total length: 20-25 mm; abdomen: 16-20 mm; hindwing: 11-14 mm.

Habitat. Ponds, lakes, bogs and slow reaches of streams with moderately dense vegetation.

Discussion. One of the smallest and least studied *Nehalennia* occurring the in U.S., this species has been reported from a diversity of habitats, including sand hill lakes in Florida and sphagnum bogs in New Jersey (Westfall and May 1996). The most recent collections in our area have coincidentally been in Sam Houston State Park (Calcasieu Parish, Louisiana) and San Houston National Forest (San Jacinto Co., Texas). It has been reported only from the southern extremities in Louisiana, where Mauffray (1997) believed additional collecting will result in additional populations. *Nehalennia integricollis* is generally close to the ground perching in thick clusters of sedges and grasses. Its reproductive behavior and biology are unknown. Calvert (1913b) clarified his earlier description of this species.

Genus *Neoerythromma* Kennedy

Caribbean Yellowface

Neoerythromma Kennedy, 1920.

This is a small tropical genus comprised of only two species, one of which ranges north to our southern extremity. The other species, *N. gladiolatum*, is found in western Mexico. Males of both species are recognizable by their bright yellow faces.

The placement of these two species has been uncertain because of possible affinities with both *Enallagma* and *Ischnura*. The species are distinct, however, and can be characterized by origination of vein M_2 near the fourth and third postnodal crossveins

in the fore- and hindwings, respectively. The pterostigma is relatively long. Females lack a vulvar spine on segment 8 and the ovipositor is short, not extending past the terminal abdominal segment. Both sexes have characteristic yellow subapical bands on the femora.

The biology and reproductive behavior of this species is virtually unknown. The larvae closely resemble those of the "*signatum*" group of *Enallagma*, differing in the arrangement of setae on the abdominal venter and the lateral carinae of the caudal segments (Westfall and May 1996).

***Neoerythromma cultellatum* (Sélys)**

Caribbean Yellowface

(Figs. 251, 255-256, Map 71)

Enallagma cultellatum Hagen in Sélys, 1876: 524.

Neoerythromma cultellatum, Kennedy, 1920: 86.

Type. Cuba; MCZ.

Regional Distribution.

Biotic Province(s): Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: FL, TX; MEXICO: CAM, CHS, COL, OAX, QTR, TAM, VER, YUC; Cuba, Dom. Rep. Haiti, Jamaica, P. Rico; south to Venezuela.

Seasonal Distribution. Apr. 28 (TX) - May 13 (TX).

Identification. This species was only recently discovered in Texas (Abbott & Stewart 1998; Nikula 1998). It has only been found along the Rio Grande of extreme southern Texas, within our area. It is also found, however, from Florida and Mexico southward through Central America. As its common name implies it has a distinctive bright yellow face. This combined with bright blue on the thorax and abdomen will readily distinguish it from all other species in our area. Males in addition to the yellow face have a prominent bright yellow antehumeral stripe and a pair of bright blue postocular spots. The pterothorax is bright blue laterally along with parts of abdominal segments 1 and 2 and all of segments 8 and 9. The superior caudal appendages are long and black with distinctly white dorsolateral-medial surfaces (Fig. 256). The inferior appendages are much shorter and strongly upturned to an apical process (Fig. 257).

The face in females is blue-green rather than yellow and the abdomen is black with blue spots on segments 8-10. The mesostigmal plates are subtriangular in shape, but nearly flat and unsculptured (Fig. 251). The absence of a vulvar spine on segment 8 will separate it from any potentially confusing *Enallagma* species. The larva was described and illustrated by Garcia-Diaz (1938).

Size. Total length: 27-31 mm; abdomen: 22-25 mm; hindwing: 13-16 mm.

Habitat. Ponds and slow reaches of streams or rivers with abundant floating debris.

Discussion. Virtually nothing is known about the life-history of this tropical species. Juveniles mature some distance from water in forests (Dunkle 1990; Westfall and May 1996). Adults are quite elusive, remaining some distance from the shoreline. They are

often associated with floating debris or vegetation where females may oviposit, accompanied by males. I collected these from a boat dock along the southern Rio Grande River with considerable effort. Individuals were flying very low, along with *Neoneura amelia*, 1-5 meters from the shore line amongst debris and floating algae. They were only captured after waiting for one to approach the shoreline and slapping a net over them in the water. Their elusiveness, and difficulty in seeing them from shore without binoculars, has no doubt contributed to their only recently having been discovered in Texas.

Genus *Telebasis* Sélys

Firetails

Telebasis Sélys, 1865.

Erythragrion Sélys, 1876.

This is a large species rich group containing 37 species, extending from Argentina to the southern U.S. and becoming most diverse in the tropics. Males of this group are easily distinguished by their nearly unmarked bright red abdomens. Most species lack postoccipital spots, including the two in our area. The wings are hyaline and characterized by the origination of M_2 near the 5th and 4th postnodal crossveins in the fore- and hindwings, respectively. Vein M_{1A} extends the length of four to five cells. Females never have a vulvar spine on segment 8. Careful examination of the male caudal appendages and female mesostigmal plates is required for accurate determinations.

The genus was recently revised and eight new species were described (Bick and Bick 1995). All species were diagnosed, illustrated and included in a key. Members of this group are often found associated with emergent or floating vegetation, but life-histories and behaviors of most species remain completely unknown. The larvae are often stocky and green in color with the posterolateral margins of the head distinctly rounded. The gills are broad and noticeably petiolate.

KEY TO ADULT SPECIES OF *TELEBASIS*

1. Superior caudal appendages of male with 2 black subequal medial teeth; hind prothoracic lobe of female armed with prominent horns *salva*
- 1'. Superior caudal appendages of male without distinct teeth, but with blunt apical medial projections; hind prothoracic lobe of female without prominent horns *byersi*

Telebasis byersi Westfall

Duckweed Firetail

(Figs. 252, 257-258, Map 72)

Telebasis byersi Westfall, 1957: 20.

Type. Florida; FSCA.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Bayou Bartholomew, Mississippi, Red, Sabine, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, IL, LA, NC, SC, TX, VA.

Seasonal Distribution. Jun. 14 (AR) - Jun. 22 (TX).

Identification. Another eastern species that finds the western limits of its range within our area. Males are bright red, including the eyes. The unique black middorsal stripe is widened abruptly at its posterior end and then narrowed again, so that combined they give the appearance of a posteriorly directed arrow. The majority of the remaining pterothorax and all of the abdomen are bright red. The superior caudal appendages are no more than $\frac{2}{3}$ the length of segment 10 and nearly uniform in height throughout its length. There are two black subapical medial teeth on each appendage, of which only the lower may be readily visible. The inferior appendages are about a fourth again as long as the superior appendages and with black apices.

Females are marked like males, but tan in color. Abdominal segments 8 and 9 are black dorsally. The mesostigmal plates are subtriangular and only slightly sculptured.

The larva was described and illustrated by Westfall (1957).

The ranges of *T. byersi* and *T. salva* don't overlap in our area and will help to differentiate the closely related species. Close examination of the male caudal appendages is necessary for reliable determinations.

Size. Total length: 25-31 mm; abdomen: 20-24 mm; hindwing: 13-17 mm.

Habitat. Swampy, partially shaded areas with abundant floating duckweed.

Discussion. Although locally common in the southeast, it is rarely seen west of the

Mississippi. The only collection of this species in Texas was by Donnelly (1978) within the confines of Sam Houston National Forest. Mauffray (1997) reports it from eastern Louisiana based on an early instar larva and Vidrine *et al.* (1992a) reported sight records from three additional parishes. Harp and Harp (1996) recently reported it from southern Arkansas.

This species, restricted to the southeastern U.S., is so similar to the more western *Telebasis salva*, that it was known for years, before being distinguished, as a separate species (Westfall 1957). Adults apparently mature in forests some distance from aquatic habitat where they may be surprisingly inconspicuously perched on shady matted plants (Dunkle 1990). Lounibos *et al.* (1990) described the life history of this species and its close association with duckweed, where the larvae live on the underside.

Telebasis salva (Hagen)

Desert Firetail

(Figs. 253, 259-260, Map 73)

Agrion salvum Hagen, 1861: 85.

Erythragrion salvum, Sélys, 1876: 962.

Telebasis boucardi Sélys, 1868: 70.

Telebasis salva, Calvert, 1902:119.

Type. not stated; MCZ?.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: AZ, CA, KS, NV, NM, OK, TX, UT;
MEXICO: BCA, BCS, CAM, CHS, CHI, COL, DFE, DGO, GRO, HGO, JAL, MCH,
MOR, NAY, NLN, OAX, PUE, QRO, QTR, SLP, SIN, SON, TAB, TAM, VER, YUC;
south to Venezuela.

U.S. Temporal Distribution. Mar. 10 (CA) - Nov. 6 (TX).

Seasonal Distribution. Mar. 10 (TX) - Nov. 6 (TX).

Identification. Much more widely distributed than *T. byersi*, *T. salva* is found throughout the Texan biotic province westward and southward through Central America to Venezuela. Only close examination of the male caudal appendages will serve to reliably distinguish *T. salva* and *T. byersi*.

Males and females are nearly identical in coloration to *T. byersi*. The male superior caudal appendages are slightly longer than in *T. byersi*, reaching 2/3-3/4 the length of segment 10. The dorsal surface of each appendage is straight for 1/4 of its length, when viewed laterally, then abruptly turns downward. Each appendage bears two separate, subapical, medial black teeth. The inferior appendages are 1/2 again as long as the superior appendages and slightly more upturned than in *T. byersi*. The mesostigmal plates of the female are subtriangular with little sculpturing, closely resembling those of *T. byersi*. The larva was described and illustrated by Needham (1904).

Size. Total length: 24-29 mm; abdomen: 19-22 mm; hindwing: 12-16 mm.

Habitat. Ponds, lakes, pools, springs and slow reaches of streams with open sunlight and abundant emergent vegetation.

Discussion. This species is widespread throughout the southwestern U.S., southward into Central America. Several notes (Needham and Heywood 1929; Smith and Pritchard 1956) have been made about the species' habit of flying low over the water in and out of vegetation, literally taunting a prospective predator or collector.

Robinson and Frye (1985) studied a north-central Texas population and reported on the life history of this species. They found that copulation lasted for an average of 80 min, followed by oviposition of the female, accompanied by the male, lasting 25 minutes, in stems, algal mats and floating sticks. Females likely oviposit at different localities on different days, improving survival of their eggs. Interestingly, males abandoned their initial site if a female was not obtained on the first day.

CHAPTER 8

PETALURIDAE

Petaltails

These large, prehistoric looking dragonflies represent some of the oldest living members of this order. Fossil evidence indicates this group flourished during the late Jurassic (Rohdendorf 1991; Carpenter 1992), and was once much more widespread than it is today. Today the family is represented by only nine widely disjunct extant species, including four in Australia and New Zealand. The two species found in North America are uncommon and somewhat locally distributed. One, *Tanypteryx hageni*, is endemic to the mountains of the Pacific Northwest and British Columbia and the other, *Tachopteryx thoreyi*, is found along the Atlantic seaboard west to Texas.

The family is distinctive, with a mosaic of characters seen in other families. They are clear-winged and distinctively primitive in appearance. The eyes are widely separated on top of the head, much like the Gomphidae, with a rounded occipital crest and a median cleft dividing the tip of the labium, as in the Cordulegastridae. The thorax and abdomen are compact and stout giving the family a very robust, primitive, appearance. The last two abdominal segments lack a club and are subequal in length, but much shorter than those preceding them.

The accessory genitalia of segment two in the male are not prominent. The caudal appendages, however, are broad and strong, appearing petal-like in most exotic species.

The ovipositor of the female is well-developed and strongly upcurved resembling that of aeshnid females, but smaller. The venation in this family is somewhat variable in detail. There are usually two thickened antenodal crossveins, an extremely long, thin pterostigma surmounting five to nine cells, and a variously developed bracevein. The triangles are similar in the fore- and hindwings and equally distant from the arculus in the North American species. Males generally have a strongly developed three-celled anal triangle. Kennedy (1917) gave the only detailed discussion of both North American species, illustrating and discussing differences in habitat, morphology and distribution.

The larvae are found in bogs and spring seeps. They are easily recognized by their short antennae, shorter than the head, and short labrum which lacks both raptorial setae and teeth. There is a single prominent movable hook located laterally on the squared lateral lobes. The subcylindrical body is reminiscent of the cordulegastrid body.

Genus *Tachopteryx* Uhler in Sélys

Tachopteryx Uhler in Sélys, 1859b.

This genus is represented by a single large gray and black eastern species. It is easily recognized by its large size and coloration. Kennedy (1917) stated that "*Tachopteryx* is, perhaps, the most primitive genus of living anisopterous dragonflies in North America." In his paper he erected a new genus, *Tanypteryx*, redefining *Tachopteryx*, and restricting it to a single species, *thoreyi*. The larvae are subcylindrical,

and like most members of the family, inhabit slow-moving, permanent bogs, seepages and springs.

***Tachopteryx thoreyi* (Hagen in Sélys)**

Gray Petaltail

(Fig. 31, Map 74)

Petalura (Uropetala) thoreyi Hagen in Sélys, 1858: 633.

Tachopteryx thoreyi, Uhler in Sélys, 1859b: 551.

Petalura thoreyi, Hagen, 1861: 117.

Type. United States; BMHH.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Mississippi, Neches, Ouachita, Red, Sabine, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, FL, GA, IL, IN, KY, LA, MD, MA, MI, MS, MO, NH, NJ, NY, NC, OH, OK, PA, SC, TN, TX, VA, WV.

Seasonal Distribution. May 20 (TX) - Jun. 24 (TX).

Identification. This species is the only gray-black dragonfly of its size in our area, and could not easily be confused with other species. The distinct behavior of perching on tree trunks, discussed below, is a good field character. The eyes are widely separated and the

face is pale with black crossbands. The pterothorax is grayish with black lateral stripes. The legs are entirely black. The venation is somewhat variable, but generally with a well-developed bracevein under a noticeably long, black pterostigma. The anal triangle in the male usually has 3 cells, but may contain as many as 5. The abdomen is long and tapering. There are two distinct tufts of long white hairs dorsolaterally on segment 1. Females have an ovipositor with blades, resembling those of aeshnids. Williamson (1901) described and illustrated the larvae.

Measurements. Total length: 71-82 mm; abdomen: 50-61 mm; hindwing: 45-56 mm.

Habitat. Permanent springs and seepages of hardwood forests.

Discussion. This species, although sometimes locally abundant, is uncommon throughout the eastern parts of our area. It is a rather bold species that doesn't shy from people, even landing on them when motionless. They have a distinctive behavior of lighting on sunlit areas of tree trunks and cypress knees, where they can be somewhat cryptic. Although easily approachable they are strong fliers that can be evasive. Individuals are occasionally seen lower to the ground or even on stones. Williamson (1900a), Fisher (1940) and Barlow (1991) have each made brief notes on this species, but Dunkle (1981) gave a complete description of its ecology and behavior. He found that they were predaceous on various sized insects, including large dragonflies. Males are often seen searching tree trunks for females or waiting nearby perched in sunlit areas. Copulation occurs high in the forest canopy and females oviposit among roots in dense grasses and fallen leaves, or mud.

CHAPTER 9

AESHNIDAE

Darners

This family of often brilliantly colored blue, green and brown dragonflies are among the largest Odonata flying today. They have large heads, with eyes comprising the greatest portion and meeting broadly on top. The resulting anterior vertex and posterior occiput are reduced in size, to a small mound and a triangular space, respectively. They have long slender abdomens that have lead many to compare them with darning needles, from which the common name "darners" is derived. They are found world-wide and are among the strongest dragonflies in flight. The males are so strong that they often leave scars on the eyes of the females they have held during mating (Dunkle 1979).

The legs are long and used commonly for perching vertically on twigs or trunks of trees. The thorax is robust and the wings are nearly always hyaline, only occasionally becoming smoky in some species. Many similarities in wing venation nicely characterize the family. The fore- and hindwing triangles are similar in shape and are equal distance from the arculus. The pterostigma is of normal length with a proximal brace vein. The subtriangles are only weakly developed. Vein M_2 is always strongly up-arched and does not parallel the radial sector (Rs) as in other families. Both radial and medial planates are strongly developed. There is generally a compact two-celled anal loop in the hindwing and an anal triangle in males that comprises 2 or more cells.

The long, slender abdomen is only interrupted by the swollen basal segments, and a noticeably constricted third segment. Females have a long ovipositor with blades, resembling those of damselflies, that they use for ovipositing in vegetation. There is a variously armed plate projecting posteriorly from segment 10.

The larvae are active predators that are commonly found climbing in tangles and mats of vegetation and other submerged objects. They are often strikingly patterned and almost always found in permanent waters. The labium is long, flat, and devoid of raptorial setae. There are several genera in our region that are represented by a single species. Dunkle (1983) discussed polychromatism in North American females and the effects of different preservation methods on colors in this family.

KEY TO ADULT GENERA OF AESHNIDAE

1. Midbasal space with crossveins *Boyeria vinosa*
- 1'. Midbasal space without crossveins 2
- 2(1'). Wing bases with brown spots extending out to level of first antenodal crossvein in both wings; 2 white stripes on side of thorax; smaller species, 50-67 mm; *Basiaeschna janata*
- 2'. Wing bases without brown spots ; with or without thoracic stripes, but if present, usually not white; size variable 3
- 3(2'). Sectors of the arculus arise well beyond its middle; thorax uniform green
..... *Anax*
- 3'. Sectors of the arculus arise near or below the middle; thorax usually brown

- marked with blue, green or yellow 4
- 4(3'). Radial sector (Rs) not forked *Gomphaeschna*
- 4'. Radial sector forked 5
- 5(4'). Stalk of Rs originates under middle of pterostigma; two rows of cells in fork .
..... *Coryphaeschna*
- 5'. Stalk of Rs originates proximal to pterostigma; usually more than 2 rows of
cells in fork 6
- 6(5'). Stalk of Rs straight and fork is symmetrical 7
- 6'. Stalk of Rs arched upward and fork is asymmetrical 8
- 7(6). Radial planate subtends a single row of cells
..... *Nasiaeschna pentacantha*
- 7'. Radial planate subtends more than a single row of cells
..... *Epiaeschna heros*
- 8(6'). Supertriangle not distinctly longer than midbasal space
..... *Aeshna*
- 8'. Supertriangle distinctly longer than midbasal space
..... *Gynacantha nervosa*

Genus *Aeshna* Fabricius

Darners

Members of the genus are primarily Holarctic and are the dominant North American group in this family with 20 species. The five species occurring in our region are all quite similar in appearance. The eyes adjoin on top of the head for a distance at least as long as the occiput, and generally longer. There is usually a distinct black "T" on the upper surface of the frons and the thorax is usually brown with two pale blue, green or yellow middorsal and lateral stripes.

The wings are hyaline with the radial sector arching unsymmetrically and forking well before the pterostigma. The triangles usually comprise four or more cells, but almost always have two basal cells. The distinct color patterns and caudal appendages of males are the most useful characters for identification. The abdomen is usually spotted with blue or green in some females and is strongly constricted just beyond the basal segments. The larvae are long and narrow with the posterolateral corners of the head rounded.

Sternberg (1996) compared intraabdominal temperatures of variously colored European species of this genus. He found that different diurnal activity patterns in females and conspecific males are mainly caused by their body colors and color patterns. Abdominal heat gain was high in dull and dark colored abdominal segments due to high light absorption and low under Tyndall-blue spots due to high light reflection. Walker (1912) studied the North American members of this genus in detail.

KEY TO ADULT SPECIES OF *AESHNA*

1. Distinct midventral tubercle on segment 1; bare middorsal tubercle on

- abdominal segment 10 in males 2
- 1'. Midventral tubercle on segment 1 absent; middorsal tubercle on abdominal segment 10 in males absent 5
- 3(2). Male with superior caudal appendages simply carinate; top of frons, in female, with yellow continuous down its sides and middorsal thoracic stripes long, reaching almost up to crest *psilus*
- 3'. Male with superior caudal appendages with inferior carina prolonged downward into anteapical tooth; top of frons, in female, with yellow forming two isolated spots and middorsal thoracic stripes short, less than 3 mm long . 4
- 4(3'). Anal loop with 2 paranal cells; male superior caudal appendages strongly bifurcated *multicolor*
- 4'. Anal loop with 3 paranal cells; male superior caudal appendages not bifurcated *dugesi*
- 5(1'). Rear of head marked with yellow or brown; row of pale blue spots on both sides of segments 4-6 or 7, inside lateral carina *umbrosa*
- 5'. Rear of head black; spots on segments 4-6 absent *constricta*

Aeshna constricta Say

Lance-tipped Darner

(Fig. 261, Map 75)

Aeschna constricta, Hagen, 1861: 123.

Aeschna constrictor, Burnham, 1900: 32.

Type. Rhode Island (neotype); MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas.

General Distribution. UNITED STATES: AR, CA, CO, CT, IA, ID, IL, IN, KS, MA, MD, ME, MI, MN, MO, ND, NE, NH, NJ, NV, NY, OH, OR, PA, RI, SD, TN, UT, VA, VT, WA, WI; CANADA: Alb., B.C., Man., N.B., N.S., Ont., P.E.I., Que., Sask.

Seasonal. May (AR).

Identification. This is a robust widely distributed species of the eastern U.S. that has only been taken in central Arkansas within our region. It is most similar to *A. umbrosa* when comparing the male caudal appendages, but the two can be distinguished in the hand by the color of the back of the head, which is pale in *A. umbrosa* and black in *A. constricta*. The thorax is reddish-brown with yellowish stripes. The second lateral stripe is distinctly broader than the first. The wings are hyaline and there are generally six paranal cells in the hindwing, including three within the anal loop. The abdomen is brown with bluish-green spots. The male superior caudal appendages have a prominent posteroventrally projecting spine.

Size. Total length: 65-72 mm; abdomen: 45-57 mm; hindwing: 42-47 mm.

Habitat. Open sunlit ponds, slow streams and marshes with emergent vegetation.

Discussion. Harp and Rickett (1977) reported the only record of this species in our region. It is a common eastern species that is active during sunny days, but like most *Aeshnas* it is also active at dusk. Walker (1958) summarized what is known about the biology of this species. Oviposition requires a relatively longer period of time than in other species and takes place in aquatic plants, up to 1 m above the waterline.

***Aeshna dugesi* Calvert**

Arroyo Darner

(Fig. 262, Map 76)

Aeshna dugesi Calvert, 1905: 184.

Type. MEXICO; USNM.

Regional Distribution.

Biotic Province(s): Chihuahuan, Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, NM, TX; MEXICO: BCS, DGO, GTO, NLN, OAX, VER.

Seasonal Distribution. Jun. 9 (NLN) - Sep. 3 (TX).

Identification. This large, western species is uncommonly encountered in southern New Mexico and western Texas, south to the lower Rio Grande Valley. It is very similar to the much more common *A. multicolor* but is more robust. Males can be easily distinguished

in the hand by the strongly bifurcated superior caudal appendages in *A. multicolor* and the presence of three paranal cells, rarely two. It has blue eyes and a distinctly blue face. The black T on top of the frons is pronounced with an exceptionally broad stem. The first blue lateral thoracic stripe widens downward while the second widens upward. The wings are hyaline, occasionally becoming tinged, and the pterostigma is somewhat abbreviated, usually surmounting no more than two crossveins. The abdomen is dark brown with pale blue spots. Abdominal segment 10 is usually darker than the preceding segments and has a distinct middorsal tubercle, bordered laterally by a pair of large yellow spots. Novel and Gonzalez (1991) described and illustrated the larva.

Size. Total length: 70-75 mm; abdomen: 49-55 mm; hindwing: 48-53 mm.

Habitat. Slow flowing permanent streams, rivulets, and arroyos.

Discussion. This is an uncommon species of the Chihuahuan and Tamaulipan biotic provinces. It can be a frequent visitor to arroyos and springs in open areas. Nothing has been published about its biology.

Aeshna multicolor Hagen

Blue-eyed Darner

(Fig. 263, Map 77)

Aeschna multicolor Hagen, 1861: 121.

Aeshna multicolor, Calvert, 1905: 183.

Aeschna furcifera Karsch, 1891: 310.

Type. unknown; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Texan.

Watershed(s): Brazos, Canadian, Cimarron, Colorado, Red, Rio Grande, San Antonio, San Jacinto.

General Distribution. UNITED STATES: AZ, CA, CO, IA, ID, KS, MO, MT, NE, NM, NV, OK, OR, SD, TX, UT, WA, WY; CANADA: Alb., B.C.; MEXICO: AGS, BCA, BCS, DFE, DGO, HGO, JAL, MEX, MCH, MOR, TLX; south to Panama.

Seasonal Distribution. May 8 (NM) - Sep. 13 (TX).

Identification. This is a common, predominately blue western species that is very similar to *A. dugesi*. *Aeshna multicolor* is less robust and the male has a distinctly bifurcated superior caudal appendages, when viewed laterally. Abdominal segment 10 is also largely black dorsally, with an indistinct middorsal tubercle bordered by pale blue spots on each side, not yellow as in *A. dugesi*. There are also generally two paranal cells in the anal loop instead of three. The face and more so the eyes are brilliant blue. The black T on top of the frons widens basally. The thorax has two pale blue lateral stripes that are nearly the same width for their entire length. The wings are hyaline with a somewhat abbreviated pterostigma surmounting 2-3 crossveins. The abdomen is long and strongly constricted behind segment 3. There are the usual pale blue spots throughout its length and segment 10 and the male superior caudal appendages are as described above.

Size. Total length: 67-74 mm; abdomen: 45-52 mm; hindwing: 42-47 mm.

Habitat. Open sunlit areas of slow-flowing streams, sloughs, lakes and ponds, including alkaline ones, with moderate vegetation

Discussion. This species is certainly the most common darner found around still waters during the summer, in the extreme western limits of our region. They tend to haunt almost any kind of standing water. I observed them so numerous around a Nebraska slough that I counted 21 individuals perched on a single twig. Kennedy (1917) once commented on its abundance near civilization, writing in Sacramento, California, "This species was observed catching insects on the market street of the city at twilight, they flew among the wagons and buggies, entirely indifferent to numerous passers-by. This habit of familiarity with man's haunts is very noticeable in *multicolor*. It is the most domestic of all the western Odonata." Williamson (1908a) clarified differences among *A. multicolor* and two other closely related species not found in our region.

Aeshna psilus Calvert

Turquoise-tipped Darner

(Fig. 264, Map 78)

Aeshna dominicana Hagen, 1861: 126.

Aeshna cornigera (in part) Ris, 1918: 157.

Aeshna cornigera, Klots, 1932: 18.

Aeshna cornigera, Garcia, 1938: 55.

Aeshna psilus Calvert, 1947: 4.

Type. Cachi, Costa Rica; ANSP.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan.

Watershed(s): Guadalupe, Rio Grande.

General Distribution. UNITED STATES: AZ, TX; MEXICO: AGS, CHS, HGO, JAL, MOR, NAY, PUE, QTR, SLP, SIN, TAM, VER, YUC; Cuba, Dominican Republic, Jamaica, Puerto Rico; south to Ecuador and Peru.

Seasonal Distribution. Mar. 10 (TX) - Oct. 19 (TX).

Identification. This is the smallest of the *Aeshnas* in our region. It is a Neotropical species that makes it into the southern Hill Country of Texas. It is slender with a blue face and a brown T spot on top of the frons. The stem of the T is nearly parallel-sided. The eyes adjoin on top of the head for an unusually long distance. Both middorsal and lateral, green or blue, thoracic stripes are present. The wings are hyaline, with six to seven paranal cells in the hindwing, including three encompassed by the anal loop. The pterostigma is short. The abdomen is brown, strongly constricted behind the proximal swollen segments and has the typical blue spots down its length. The superior caudal appendages of the male are distinctly shorter than in the female. They are nearly parallel throughout their distance, but slope gently upward.

Size. Total length: 58-62 mm; abdomen: 41-51 mm; hindwing: 36-43 mm.

Habitat. Slow-flowing, open sunlit streams and ponds.

Discussion. Nothing has been published about the biology of this species. Abbott (1996)

reported, it for the first time in the U.S. from two previously collected male specimens. One was from Landa Park in New Braunfels and the other from Brownsville, Texas. These were most likely northern strays of this species, but it has also been found in Arizona (Behrstock pers. comm., 1998).

***Aeshna umbrosa* Walker**

Shadow Darner

(Fig. 265, Map 79)

Aeschna constricta Scudder, 1866: 212.

Aeshna umbrosa Walker, 1908: 380, 390, 450.

Aeshna constricta, (in part) Calvert, 1905: 185.

Aeshna "z" Williamson, 1907a: 145.

Type. De Grassi Point, Ontario; USNM.

Regional Distribution.

Biotic Province(s): Austroriparian, Kansan, Navahonian, Texan.

Watershed(s): Bayou Bartholomew, Canadian, Ouachita, Red, Rio Grande, St. Francis.

General Distribution. UNITED STATES: AL, AR, CA, CO, CT, DC, ID, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, UT, VT, VA, WA, WI, WV, WY; CANADA: Alb., B.C., Man., N.B., Nfld., NW Terr., N.S., Ont., P.E.I., Que., Sask., Yukon.

Seasonal Distribution. Aug. 18 (AR).

Identification. This is a rather common widespread midsummer species found within our northern limits. It is most similar to *A. constricta*, but the back of the head is black, not pale. It has a greenish-brown face and the black T on top of the frons is constricted slightly medially. The pterothorax is brown with yellow-green parallel thoracic stripes both dorsally and laterally. The wings are hyaline and there are generally 7 paranal cells in the hindwing, including 3 in the anal loop. The abdomen is strongly constricted beyond the proximal segments. The pale areas are blue or green and generally there are pale blue spots visible ventrally on segments 4-6 and sometimes 7. This is distinctive of this species.

Size. Total length: 68-76 mm; abdomen: 49-59 mm; hindwing: 42-48 mm.

Habitat. Partly shaded, slow-flowing streams and ditches.

Discussion. Two forms of this species have been recognized, the typical "*umbrosa*," found in our area, and a Pacific-Northwestern form, "*occidentalis*." This species is somewhat unique in the group, in tending to prefer shaded habitats. Females oviposit in wet decaying wood and aquatic plants. Pritchard (1964) found prey consisted of mainly small flies.

Genus *Anax* Leach

Green Darners

This is a cosmopolitan group of large dragonflies with an unmarked green thorax. Males are unusual amongst the darners in that they lack auricles on abdominal segment two and the basal margin of the hindwing is rounded. All four North American species occur within our limits. The wings are hyaline with a long pterostigma and there is no anal triangle in males, due to the rounded wing margins. There is a supplementary lateral carina on the posterior abdominal segments. The inferior caudal appendages of males are truncate. The larvae are long, slender active predators in submerged vegetation. Byers (1927b) described the larvae of the four North American species. Calvert (1934) studied rates of larval growth and development in this genus.

KEY TO ADULT SPECIES OF ANAX

1. Large species, greater than 88 mm long; abdomen very long, 1.3X the length of the wings *walsinghami* (p. 335)
- 1'. Species not as large, less than 88 mm long; abdomen not noticeably long, about as long as length of wings 2
- 2(1'). No dark spots on top of frons; occiput dark; hind femora unusually long, as long as the distance from the nodus to end of pterostigma in forewing
..... *longipes* (p. 334)
- 2'. Dark spot on top of frons; occiput pale yellow; hind femora not unusually long; abdomen not brick red 3
- 3(2'). Frons with round black spot encircled anteriorly by black or blue
..... *junius* (p. 332)

- 3'. Frons with a triangular dark spot with a dark triangle on either side almost meeting anteriorly to it *amazili* (p. 330)

***Anax amazili* (Burmeister)**

Amazon Darner

(Map 80)

Aeshna amazili Burmeister, 1839: 841.

Anax maculatus Rambur, 1842: 188.

Anax amazili, Hagen, 1861: 119.

Type. South America; lost.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Texan.

Watershed(s): Brazos, Guadalupe, Mississippi, Nueces, Rio Grande.

General Distribution. UNITED STATES: FL, LA, TX; MEXICO: CAM, CHS, COL, HGO, MEX, NAY, SIN, VER; Cuba, Puerto Rico, south to Argentina.

Seasonal Distribution. Jun. 8 (TX) - Aug. (TX).

Identification. This tropical vagrant is quite similar to the common darner, *A. junius*. The dark mark on top of the frons, however, is triangular rather than circular and the abdomen looks distinctly ringed rather than striped as in *A. junius*. The face is green lightly marked with black. The wings are hyaline with a brown pterostigma and a

somewhat greenish costa. The abdomen is mostly brown with green on segments 1-2.

There are large green basal spots, blue in juveniles, on segments 3-6, giving the abdomen a ringed appearance. Byers (1927b) described and illustrated the larva.

Size. Total length: 70-74 mm; abdomen: 48-54 mm; hindwing: 48-52 mm.

Habitat. Tropical ponds and lakes with weeds.

Discussion. Breeding populations of this species have never been found in the U.S., making it an occasional vagrant. Curt Williams (pers. comm.) recently, August 1998, photographed a purple martin feeding a single female *A. amazili* to her young nestlings in his back yard in Marlin, Texas. Dunkle (1989) reported that this species actively feeds up until dark. Females oviposit in vegetation submerged or a short distance above the water.

Anax junius (Drury)

Common Green Darner

(Map 81)

Libellula junia Drury, 1770: 112.

Aeschna junia, Burmeister, 1838: 841.

Anax spiniferus Rambur, 1842: 186.

Anax junius, Sélys in Sagra, 1850: 328.

Type. Kentucky (lectotype); MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AK, AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NE, NC, ND, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY; CANADA: Alb., B.C., Man. N.B., N.S., Ont., P.E.I., Que., Sask.; MEXICO: BCA, BCS, CHI, COA, DFE, DGO, HGO, JAL, MCH, MOR, OAX, SIN, TAM, VER, YUC; West Indies; Guatemala & Belize south to Costa Rica; western coast of Asia.

Seasonal Distribution. All year (TX).

Identification. This widespread species is found throughout North America, including all 50 U.S. states. It is certainly one of the most common and widespread species in our area. The face is pale green with a distinct black spot on the top of the frons bordered anteriorly by a blue semicircle. *Anax amazili* has a triangular spot. The thorax is green with brown only lightly represented on the lateral sutures. The wings are hyaline with a yellow costa. The abdomen is mostly blue, with green on segment 1 in males and greenish-brown throughout in females. The brown superior caudal appendages in the male are long, about the length of segments 9-10 combined. Byers (1927b) described and illustrated the larva.

Size. Total length: 68-84 mm; abdomen: 46-60 mm; hindwing: 45-58 mm.

Habitat. Permanent and temporary ponds, lakes, bays and slow-flowing streams with emergent vegetation.

Discussion. This species is probably one of the most familiar dragonflies in all of North America. It is one of the few North American dragonflies that migrates and is therefore most common in the spring and fall. It is a vicious predator which commonly takes wasps, butterflies, mosquitoes (Edman and Haeger 1974), and other dragonflies on the wing. It has even been reported to attack hummingbirds (Dunkle 1989) and can be cannibalistic (Donnelly 1993). It is not uncommon to walk through an open field of tall grass in the early morning and have *A. junius* flying up from their perches low to the ground, an unusual behavior amongst darners. Pairs in copulo may fall out of the air to the ground or be seen hanging in bushes or trees. This is the only darner in our region where females will oviposit in tandem. Individuals darken considerably in response to cold temperatures but regain their original color upon warming up. Various aspects of its life cycle have been well studied (Kriegsman and Lutz 1965; Trottier 1966, 1971; Young 1967). There is evidence that its migratory movements are strongly dictated by seasonal warm fronts (Butler *et al.* 1975; Orr 1998). Jordan and McCreary 1996 explored foraging efficiency of the larvae in complex habitats and Calvert (1929) looked at growth rates in *A. junius*. May (1995a,b) has studied thermoregulation in this species.

Anax longipes Hagen

Comet Darner

(Map 82)

Anax longipes Hagen, 1861: 118.

Type. Georgia; Zürich Mus.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Brazos, Colorado, Mississippi, Ouachita, Red, Rio Grande, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, IL, IN, KS, KY, LA, MA, MD, MI, MO, MS, NC, NJ, NY, OH, OK, PA, SC, TN, TX, VA, WI, WV; CANADA: N.B., Ont..

Seasonal Distribution. May 23 (LA) - Aug. 30 (LA).

Identification. This distinct darner has the typical green thorax of the genus, but the abdomen is brilliant red. The face is yellow-green, but unlike in other *Anax* species the top of the frons is unmarked. The legs are unusually long and the femora are red except distally where they become black. The wings are hyaline, however, occasionally they may be tinted and have a greenish costa. The male abdomen is bright red beyond the basal green segments. Females are similar, but with greenish-brown spots, and with blue in juveniles on the middle and posterior segments.

Size. Total length: 75-87 mm; abdomen: 50-61 mm; hindwing: 46-56 mm.

Habitat. Primarily fishless temporary and semi-permanent grassy ponds and pools.

Discussion. This is an uncommon species, widely distributed throughout the eastern parts of our region. Its interactions with *A. junius* are unclear. *Anax longipes* has been reported both outnumbering (Beatty 1945) and being outcompeted (Johnson and Crowley 1980) by *A. junius* in semipermanent artificial ponds. Kielb and O'Brien (1996) discussed the relationship of these sympatric species. Individuals are not active as late in the day as *A. junius*. Females oviposit in submerged vegetation.

Anax walsinghami McLachlan

Giant Darner

(Map 83)

Anax validus (*nomen nudum*) Hagen, 1875: 32.

Anax walsinghami McLachlan, 1883: 127.

Type. North California; BMNH.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian, Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, CA, NM, NV, TX, UT; MEXICO: BCA, BCS, DGO, GRO, NAY, NLN; south to Guatemala & Honduras.

Seasonal Distribution. Jun. 26 (NM) - Sep. 1 (TX).

Identification. This is the largest dragonfly in our region and all of North America. It is

only found in the western extremes of our region and, due to its size, it is not likely to be confused with other species. The face is green and the top of the frons is marked with a dark spot surrounded anteriorly by a semicircle of blue. The thorax is green with legs dark brown becoming black at 2/3 the length of the femur. The wings are hyaline with a yellow costa. The abdomen is largely brown, heavily marked with blue in males and green in females. The prominent caudal appendages of the male are brown. The superior appendages are about twice as long as the inferiors. Byers (1927b) and more recently Novelo and Gonzales (1991) described and illustrated the larva.

Size. Total length: 88-116 mm; abdomen: 67-90 mm; hindwing: 56-67 mm.

Habitat. Slow-flowing open, streams, ponds and pools.

Discussion. This species may be locally abundant and, despite its size, easier to catch than other *Anax*. Males consistently patrol low over the water. Nothing has been published about the biology of this distinctive western species.

Genus *Basiaeschna* Sélys

Springtime Darner

Basiaeschna Sélys, 1883a.

This monotypic genus includes a distinctive small brown eastern species. The eyes are smaller than in other genera and there is a pair of pale yellow stripes on each side of the pterothorax, with a general color pattern similar to that of *Aeshna*. The pterostigma

is noticeably narrow and both the triangles and supertriangles usually have two crossveins. The caudal appendages in both males and females are no longer than abdominal segments 9-10 combined. This dragonfly frequents small forest streams. The larvae are slender and resemble *Boyeria*, but the narrow inferior caudal appendage is distinctive.

***Basiaeshna janata* (Say)**

Springtime Darner

(Fig. 34, Map 84)

Aeschna janata Say, 1839: 13.

Aeschna minor Rambur, 1842: 207.

Basiaeschna janata, Sélys, 1883a: 735.

Type. United States; Boston Mus.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, FL, GA, IA, IL, IN, KY, KS, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX,

VA, VT, WI, WV; CANADA: Man., N.B., N.S., Ont., Que.

Seasonal Distribution. Mar. 19 (TX) - May 26 (AR).

Identification. This species may be confused with *Boyeria vinosa*, but the pale yellow thoracic markings are stripes rather than spots and *B. janata* emerges earlier in the spring. *Basiaeschna janata* is brown marked with blue-green with distinctive pale yellow or cream-colored lateral thoracic stripes. There are two pale middorsal thoracic stripes that become obscure with age. The wings are hyaline with a small basal brown spot extending out to the first antenodal crossvein in each wing. The abdomen is brown with pale blue spots that become obscured in preserved specimens.

Size. Total length: 50-67 mm; abdomen: 38-51 mm; hindwing: 32-42 mm.

Habitat. Small forest streams and lakes.

Discussion. This common species is much like *Boyeria vinosa* in its habits. It is found earlier in the spring in many of the same locations that the former will visit later in the summer. They are active during the day, sometimes well into the evening. They patrol streams and lake shores with greater speed and at greater heights than *Boyeria* (Walker 1958). Several accounts of oviposition have been reported (Needham 1901; Needham & Westfall 1955; Walker 1958). Females oviposit below the water surface in live plants and dead leaves or cattails.

Genus *Boyeria* McLachlan

Spotted Darners

Boyeria McLachlan, 1896a.

Fonscolombia Sélys, 1883a.

This genus includes four distinctive species, two occurring in the Old World and two occurring in the eastern U.S. All have two prominent pale spots on each side of the pterothorax. They are inhabitants of woodland streams much like *Basiaeschna*. The thorax and abdomen are finely covered with hairs. In addition to the distinctive thoracic markings, no other North American dragonfly has crossveins in the midbasal space of the wings.

Members of this group are often abundant about forest edges and lake shores where their characteristic butterfly-like flight pattern often makes them easier to capture than other darners. Although they fly during the day in shaded areas they are quite active at dusk and into the evening. The larvae are dark brown or black and often have a characteristic pale spot dorsally on abdominal segment 8. Wright (1949) clarified differences between the larvae of both U.S. species.

***Boyeria vinosa* (Say)**

Fawn Darner

(Map 85)

Aeshna vinosa Say, 1839: 12.

Aeshna quadriguttata Burmeister, 1839: 837.

Fonscolombia vinosa, Kirby, 1890: 93.

Boyeria vinosa, Williamson, 1900b: 300.

Type. North America; Boston Mus.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Mississippi, Neches, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DC, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV; CANADA: N.B., N.S., Ont., Que., P.E.I.

Seasonal Distribution. May 3 (LA) - Nov. 15 (LA).

Identification. This is a common species found throughout the eastern half of our region. It may be confused with the earlier emerging *Basiaeschna janata*, but differences given under that species will serve to separate the two. *Boyeria vinosa* has a large head and somewhat green face. The wings each have a dark basal spot and become strongly tinged with age. The pterothorax has two distinctive pale yellow or cream colored spots laterally and there are rows of pale spots on the abdomen. The larva was first described by Needham (1901), and then illustrated by Needham and Hart (1901).

Size. Total length: 60-71 mm; abdomen: 45-56 mm; hindwing: 39-46 mm.

Habitat. Forest streams, rivers and lake shores with sufficient shade.

Discussion. This species could be considered crepuscular, with its chief activity

occurring well into the evening. Williamson (1932a) reported that it often competes with bats for prey around lake edges. It is not uncommon, however, to see males patrolling along shaded areas of streams or lake shores earlier in the day.

Williamson (1932a) remarked that it is "by all odds the most abundant and most widely distributed of the lotic Anisoptera east of the Great Plains." I have found them so abundant in some areas as to be overflowing collection heads of a malaise trap.

Williamson also commented on the discriminating nature of this dragonfly's feeding; occasionally rejecting some prey after seizing it.

Genus *Coryphaeschna* Williamson

Pilot Darners

Coryphaeschna Williamson, 1903.

This is a genus of very large, primarily Neotropical, dragonflies. Four species occur in the U.S., including three in the east and a single western species. One of the former occurs in our region. These dragonflies are very high swift fliers. The large eyes comprise a major portion of the head and meet dorsally for a long distance, reducing the occiput to a small triangle. The thorax is largely green with brown lateral thoracic stripes. The legs are shorter than in other members of the family. The wings are hyaline in males, but the wings of the female change tinted areas with age. Younger individuals have basally tinted wings and older individuals have this portion hyaline and are tinted distally.

The triangles are long and the Rs forks under the pterostigma. The abdomen is brown, long and narrow beyond the first few swollen segments. The caudal appendages are unusually long. They are often broken off in older females. The larvae are long and slender with a distinctly flattened head that is squared off posteriorly.

Coryphaeschna ingens (Rambur)

Regal Darner

(Map 86)

Aeschna ingens Rambur, 1842: 192.

Aeschna abboti Hagen, 1863: 373.

Coryphaeschna ingens, Williamson, 1903: 8.

Type. not stated; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian, Tamaulipan, Texan.

Watershed(s): Bayou Bartholomew, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, LA, MS, NC, SC, TX, VA; Cuba & Bahamas.

Seasonal Distribution. Apr. 17 (TX) - Oct. 3 (LA).

Identification. This large coastal species, may be confused with the equally large

Epiaeschna heros. The latter however, has a brown pterothorax with green stripes, while *C. ingens* is green with brown stripes. The eyes are green in juvenile individuals and males, but become deep blue in older females. The wings are hyaline, except in females which change with age as described for the genus. The abdomen is brown with narrow green markings. The basal segments are swollen and there is no noticeable constriction following them. Needham and Westfall (1955) presented larval keys to all but one North American species.

Size. Total length: 82-100 mm; abdomen: 64-78 mm; hindwing: 54-60 mm.

Habitat. Lakes and slow flowing streams with heavy vegetation.

Discussion. This species is unusual in that males don't defend or patrol territories (Dunkle 1989a). They are strong fliers that rarely perch. Like several other darners they may be rather abundant feeding on swarms of flying insects at dusk.

Genus *Epiaeschna* Hagen

Swamp Darner

Epiaeschna Hagen, 1875.

This is a monotypic genus that is common throughout the Midwest and eastern United States. As its common name implies, it haunts swamps and bogs. The single large species is similar in coloration to *Nasiaeschna*. The compound eyes are large and occupy much of the head. The thorax and abdomen are robust. The wings are hyaline in young

individuals but become heavily tinted with age. The outer side of the triangle is sinuous and the small anal loop is generally comprised of five cells in two rows. The caudal appendages are long and noticeably hairy in the male and somewhat flattened in the female. The larvae are dark and slender, but with a strong middorsal ridge on the posterior abdominal segments.

***Epiaeschna heros* Fabricius**

Swamp Darner

(Map 87)

Aeshna heros Fabricius, 1798: 285.

Aeshna multicolor Say, 1839: 9.

Aeschna heros, Hagen, 1861: 128.

Epiaeschna heros, Cabot, 1881: 39.

Type. United States; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY,

LA, ME, MD, MA, MI, MS, MO, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VA, WI, WV; CANADA: N.B., Ont., Que.; Mexico, Panama.

Seasonal Distribution. Feb. 25 (LA) - Oct. 28 (LA).

Identification. This species is equally large but more widespread than the similar *Coryphaeschna ingens*. *Epiaeschna heros* has blue eyes and a brown thorax with two green lateral stripes, while that of *C. ingens* is green striped with brown. The only other brown and green darner it could be confused with is *Nasiaeschna pentacantha*, but the latter is smaller and has a fairly uninterrupted green longitudinal stripe laterally on the abdomen. The wings are often heavily tinged, moreso laterally. The abdomen is brown, long and nearly parallel sided posteriorly. The caudal appendages are long in both sexes. The male appendages are complex and distinctly hairy. The female appendages are flattened appearing petiolate. The larva was described and illustrated by Cabot (1881).

Size. Total length: 80-94 mm; abdomen: 63-72 mm; hindwing: 52-60 mm;

Habitat. Heavily wooded ponds, streams and ox-bows including ephemeral pools and ponds.

Discussion. This species is certainly among the largest in North America. It is unusual, in that like *C. ingens*, males don't defend territories or patrol. They are, however, often seen swarming in large numbers (Mundt 1882), feeding on flying insects at dusk, both high in the air or lower to the ground, such as over culverts. This species seems to enter open windows and buildings with some frequency (Ferguson 1940; Walker 1958), perhaps owing to a similarity to its naturally shaded haunts. Schaefer *et al.* (1996) reported incidental captures of *E. heros* in traps designed for arboreal beetles, in which

the trap opening was slightly smaller than the wingspan of the victims. Females oviposit in mud or vegetation, often some distance above the water line.

Genus *Gomphaeschna* Sélys

Pygmy Darners

Gomphaeschna Sélys, 1871.

This is a group of two small North American species that both occur within the eastern limits of our area. They are largely dark darners with a greenish-gray face and green eyes at maturity. The wings are hyaline with relatively reduced venation. There is generally a single crossvein distal to the bracevein under the pterostigma. The two-celled anal loop is preceded by 2-3 paranal cells and the triangle is usually only two-celled. The male caudal appendages are long and the inferior appendages are distinctly bifurcated, unlike in other aeshnids. The female ovipositor is short, somewhat truncate, but bearing a pair of long, slender palps. The larvae are found in sphagnum bogs and the species can be difficult to distinguish from one another. Dunkle (1977a) gave characters for distinguishing both species.

KEY TO ADULT SPECIES OF *GOMPHAESCHNA*

1. Single bridge crossvein in both wings; hindwing at level of nodus as wide as or wider than distance in forewing from nodus to pterostigma; distance

- between bases of superior appendages in male, when viewed dorsally, about as wide as one of them *antilope* (p. 347)
- 1'. More than one bridge crossvein in both wings; hindwing at level of nodus not wider than distance in forewing from nodus to pterostigma; distance between bases of superior appendages in male, when viewed dorsally, about twice as wide as one of them *furcillata* (p. 349)

***Gomphaeschna antilope* (Hagen)**

Taper-tailed Darner

(Fig. 266, Map 88)

Aeschna antilope Hagen, 1874: 354.

Gomphaeschna antilope, Kirby 1890: 92.

Gomphaeschna furcillata antilope Calvert, 1893: 247.

Type. Baltimore, Maryland; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Red.

General Distribution. UNITED STATES: AL, DC, DE, CT, FL, GA, LA, MA, MD, MS, NC, NJ, NY, OH, PA, SC, TN, VA.

Seasonal Distribution. Apr. 11 (LA) - Jun. 2 (LA).

Identification. This species is easily confused with *G. furcillata*, of which it is still considered to be a subspecies by some (Steinmann 1997). *Gomphaeschna furcillata* tends to be darker and specific characters are given for each species. This small dark aeshnid has brilliant green eyes in life and the costal margin of the wings are yellow. The first and third or fourth antenodal crossveins are usually thickened and there is a single bridge crossvein. The middle half of the female forewing is generally tinted. The posterior abdominal segments in the male have green spots and the middle abdominal segments in the female have white spots laterally and brown-orange spots dorsally. The superior caudal appendages in the male flatten abruptly at about 1/3 their length, forming a distinct inferior angle (Fig. 266) not present in *G. furcillata*.

Size. Total length: 53-60 mm; abdomen: 38-46 mm; hindwing: 30-37 mm.

Habitat. Shallow sphagnum bogs and swamps.

Discussion. Very little has been published or is known on the biology and behavior of this uncommon species. Dunkle (1989a) commented on male behavior and noted that females oviposit in wet wood just above the water line. Gloyd (1940) studied both species of *Gomphaeschna* and determined that *G. antilope* was a distinct species. She presented numerous characters helpful in separating the two. The key given above is modified from her work.

Gomphaeschna furcillata (Say)

Harlequin Darner

(Fig. 267, Map 89)

Aeschna furcillata Say, 1839: 14.

Gynacantha quadrifida Rambur, 1842: 209.

Gomphaeschna furcillata, Sélys, 1871a: 413.

Gomphaeschna furcillata furcillata, Calvert, 1893: 247.

Type. Massachusetts; Boston Mus.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Bayou Bartholomew, Mississippi, Ouachita, Red, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, KY, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ, NY, OH, PA, RI, SC, TN, TX, VA, VT;
CANADA: N.B., N.S., Ont.

Seasonal Distribution. Feb. 3 (LA) - Apr. 4 (TX).

Identification. This is the only *Gomphaeschna* to be taken in Texas. It is very similar to *G. antilope*, but generally it is darker. The face is greenish-brown as is the thorax which is covered with numerous gray-white hairs. The abdomen is dark with pale marks as in *G. antilope*. The superior caudal appendages of the male are smoothly curved to their tip, lacking a distinct inferior angle as seen in *G. antilope*. The larva was described through the third instar by Kennedy (1936).

Size. Total length: 52-60 mm; abdomen: 39-46 mm; hindwing: 29-36 mm.

Habitat. Shallow sphagnum bogs and swamps.

Discussion. *Gomphaeschna furcillata* emerges in the early spring, well before *G. antilope*. Williams (1979a) reported *G. furcillata* from Big Creek in Sam Houston National Forest for the first time in Texas. Very little has been documented about its biology; however, Kennedy (1936) noted certain behaviors and Dunkle (1989a) gave a brief description of its known biology, including the following. Males are unusual in often patrolling over land and are commonly seen flying on windy days.

***Gynacantha* Rambur**

Two-spined Darners

Gynacantha Rambur, 1842.

Acanthagyna Kirby, 1890.

Selsiophlebia Förster, 1904.

This is a large tropical genus represented by a single species in the U.S. and in our region. These are mostly greenish or brown darners with hyaline or tinted wings. The triangles are quite long and the radial sector is forked well before the pterostigma in the hindwing and usually in the forewing. The abdomen is slender and tapers posteriorly. There are two spines on the ventral process of abdominal segment 10, for which the genus is named, that females use as a fulcrum during oviposition. This group is most active just after sunrise and before sunset. Williamson (1923a) studied the neotropical members of this large group.

A *Gynacantha* has been seen and photographed, by R.A. Behrstock, in the lower Rio Grande Valley of Texas. It is unclear from the photograph whether the species is *G. nervosa*, thus far unreported from Texas, or *G. mexicana*, which would represent a new U.S. record.

***Gynacantha nervosa* Rambur**

Twilight Darner

(Map 90)

Gynacantha nervosa Rambur, 1842: 213.

Acanthagyna nervosa, Kirby, 1890: 94.

Type. Santa Cruz, Bolivia; MNHN.

Regional Distribution.

Biotic Province(s): Austroriparian, Tamaulipan.

Watershed(s): Arkansas, Rio Grande.

General Distribution. UNITED STATES: AL, FL, GA, OK, SC; MEXICO: CAM, CHS, GRO, JAL, OAX, QTR, SLP, SIN, TAM, VER, YUC; West Indies; Guatemala, Belize; south to Brazil.

Seasonal Distribution. Mar. 23 (TAM) - Sep. 15 (OK).

Identification. This is a largely brown dragonfly marked with pale green. The eyes are large and change from brown to green with maturity. The pterothorax is greenish brown

with four small dark stripes laterally. The wings become heavily tinted in older individuals. The long caudal appendages are often broken off in older females. Williams (1937) described and illustrated the larva.

Size. Total length: 75-80 mm; abdomen: 50-57 mm; hindwing: 47-56 mm.

Habitat. Fishless, ephemeral ponds with sufficient emergent vegetation and shade.

Discussion. Kormondy (1960) reported a single male from Ouachita National Forest, northwest of Page in Leflore County, Oklahoma. To my knowledge this species has not been confirmed in the south-central U.S. since. It has also been taken at Victoria in the Mexican state of Tamaulipas. This species as with other members of the genus, may not be seen all day, but will show itself in large numbers just after sunrise or before sunset in large feeding swarms. O'Donnell (1996) discussed the possible importance of prey selection in visually acute predators, like *G. nervosa*, favoring the evolution of resemblance to eusocial wasps. Williams (1937) described in excellent detail its natural history.

Genus *Nasiaeschna* Sélys in Förster

Cyrano Darner

Nasiaeschna Sélys in Förster, 1900.

This is another monotypic genus found widespread in the eastern portion of our region. The genus is named for the uniquely protruding frons of its single species. The

eyes are blue and the vertex is bilobed. The body is brown marked with green stripes and the wings are hyaline. The abdomen is long and parallel-sided, not constricted behind the proximal abdominal segments. The caudal appendages in both sexes are distinctly short. The larvae are dark and rather typical in appearance except for two pairs of prominent tubercles on top of the head and a series of low middorsal abdominal hooks.

Nasiaeschna pentacantha (Rambur)

Cyrano Darner

(Map 91)

Aeschna pentacantha Rambur, 1842: 208.

Nasiaeschna pentacantha, Sélys in Förster, 1900: 93.

Nasiaeschna menthacantha (misprint), Muttkowski, 1910: 116.

Type. New Orleans, Louisiana; MNHN.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IS, IL, IN, KS, KY, LA, MA, MD, MI, MO, MS, NH, NY, NC, OH, OK, PA, SC, TN, TX, VA, WI,

WV; CANADA: N.B., N.S., Ont., Que.

Seasonal Distribution. Mar. 30 (LA) - Oct. 12 (LA).

Identification. A smaller brown and green darner, this species may be confused with *Epiaeschna*. In addition to its smaller size, the pronounced frons and greenish lateral abdominal stripes will separate the two. The distinctive frons is unique among North American dragonflies. Its common name is derived on the comparison of this feature with literature's Cyrano de Bergerac. The eyes and top of frons are blue, the later lacking a distinct black "T" spot. The wings are hyaline and the radial planate subtends a single row of cells. The triangle has two crossveins.

The abdomen tapers somewhat posteriorly in the male, but is parallel throughout its length in the female. In both sexes there are three greenish longitudinal stripes, a medial stripe and two lateral stripes. These stripes are generally somewhat interrupted throughout their length. The caudal appendages of the female are short, scarcely longer than segment 10, and the male's are about twice that. The larva was described and illustrated by Needham (1901).

Size. Total length: 62-73 mm; abdomen: 47-55 mm; hindwing: 45-50 mm.

Habitat. Sheltered forest ponds, streams and lake coves.

Discussion. This species never seems to stray far from the protection of wooded areas. It is often seen perching or flying along forest or path edges. Dunkle (1985a) reported on growth changes in larvae of this species.

CHAPTER 10

GOMPHIDAE

Clubtails

This is the second largest Anisopteran family and is comprised of medium-sized distinctive greenish-yellow and brown dragonflies. They have widely separated eyes as in the Petaluridae and a distinct, club-like widening of the posterior abdominal segments that is usually more prominent in males. The wings are generally hyaline and lacking both medial and radial planates, but with a bracevein present under the pterostigma. The legs vary in length and there are usually numerous short spines on the femora. The caudal appendages are distinctive in most species and male inferior appendages are usually forked. In the tribe Gomphini, including our genera, *Arigomphus*, *Dromogomphus* and *Gomphus*, the superior caudal appendages are fused to the abdomen (Dunkle 1988). Females lack an ovipositor and are not accompanied by males during oviposition.

These dragonflies will generally not be as obvious as other families to the general observer. Most are found around streams and rivers and don't spend a great deal of time in flight. Most species are found resting on the ground, a rock, leaf or occasionally the ends of twigs. They are often seen raising their abdomen when perched, a behavior known as obelisking. Larvae of this family are usually flattened, with an elongate abdomen. The head is small with four-segmented antennae. Carle (1986) revised the classification of this family and I have largely followed his system. Garrison (1994b)

gave a very informative table summarizing the distributions of New World gomphid species. Paulson (1983) discussed the limited pruinosity seen in members of this family.

KEY TO ADULT GENERA OF GOMPHIDAE

1. Hind femora bearing 4-7 long ventral spines intermingled with numerous smaller ones *Dromogomphus*
- 1'. Hind femora without long ventral spines intermingled with the usual numerous smaller ones 2
- 2(1'). Triangles with 1 or more crossveins 3
- 2'. Triangles without crossveins 6
- 3(2). Basal subcostal crossvein absent; subtriangles without crossveins; generally greater than 73 mm in length *Hagenius brevistylus*
- 3'. Basal subcostal crossvein present; subtriangles of at least forewings with crossveins; generally less than 70 mm in length 4
- 4(3'). Supertriangles with 1 or more crossveins 5
- 4'. Supertriangles without crossveins *Progomphus*
- 5(4). Hindwing subtriangle with 2 or more cells; anal loop of 3-5 cells formed by convergence of veins A_1 and A_2 ; apical most spine on hind femora twice as long as preceding ones *Phyllogomphoides*
- 5'. Hindwing subtriangle usually 1-celled.; anal loop is absent; apical spine on hind femora no longer, or only slightly so, than preceding ones
..... *Aphylla*

- 6(2'). Hind wing with semicircular anal loop usually of 3 cells
 *Ophiogomphus westfalli*
- 6'. Hind wing without semicircular anal loop or of only 1-2 weakly bordered cells
 7
- 7(6'). Pterostigma of forewing short and thick, twice as long as wide, at its widest;
 hind wing with 5 paranal cells *Erpetogomphus*
- 7'. Pterostigma of forewing usually more elongate, 3 times as long as wide;
 hindwing with 4-5 paranal cells 8
- 8(7'). Pterostigma less than 4 times as long as wide, more than 2 times as wide as
 the space behind its middle; small, usually less than 40 mm long
 *Stylogomphus albistylus*
- 8'. Pterostigma rarely less than 4 times as long as wide, less than 2 times as wide
 as the space behind its middle; larger, usually greater than 40 mm long 9
- 9(8'). Dark stripes on each side of pale middorsal thoracic carina faint or absent;
 thoracic stripes on side reduced *Arigomphus*
- 9'. Dark stripes on each side of middorsal carina conspicuous; at least some
 thoracic stripes on side fully developed 10
- 10(9'). Top of frons 4 times as wide as long; long slender species *Stylurus*
- 10'. Top of frons only 3 times as wide as long; form varied, but often more stocky
 *Gomphus*

Genus *Aphylla* Sélys

Forceptails

Aphylla Sélys, 1854.

This small, primarily Neotropical genus is represented by three U.S. species, all of which occur in the south-central U.S. These are large dragonflies with relatively short legs and clear wings, that superficially resemble those of *Phyllogomphoides*. In *Aphylla* the nodus is well beyond the midpoint of the forewing and the hindwing subtriangle is generally comprised of a single cell. The thorax and abdomen are red-brown marked with greenish yellow stripes. The males have forceps-like superior caudal appendages, as the common name implies. The inferior appendages are reduced, appearing nearly absent, a situation not seen in any other North American dragonflies. The larvae are easily recognized by the distinctly elongate abdominal segment 10. Garrison (1996) clarified differences in two of the three U.S. species.

KEY TO ADULT SPECIES OF *APHYLLA*

1. Sides of thorax with two wide brown bands formed by the fusion of the humeral and antehumeral stripes and the second and third lateral stripes, so that there are two pale yellow-green stripes laterally (occasionally females may have a small pale stripe between these) *williamsoni*
- 1'. Sides of thorax with three wide brown bands, with a pale yellow-green stripe

- between each. 2
- 2(1'). Greatest width of lateral foliate margin of abdominal segment 8 at least 0.80 mm in males and 0.50 mm in females; thoracic stripes all approximately the same width; apical mesal margin of male superior caudal appendage with no overlapping ridge extending over basal third of appendage *protracta*
- 2'. Greatest width of lateral foliate margin of abdominal segment 8 less than 0.60 mm in males and 0.30 mm in females; third lateral thoracic stripe often narrower than others; apical mesal margin of male superior caudal appendage forms overlapping ridge extending over basal third of appendage *angustifolia*

***Aphylla angustifolia* Garrison**

Brown-striped Forceptail

(Figs. 30, 268, 271, 274, Map 92)

Cyclophylla protracta, Kirby, 1890: 74.

Gomphoides protracta, Calvert, 1905: 157.

Gomphoides sp., Calvert, 1914: 454.

Aphylla protracta, Needham, 1940: 372.

Aphylla angustifolia Garrison, 1986: 938.

Type. Lago Catemaco, Veracruz, Mexico; NMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Tamaulipan, Texan.

Watershed(s): Brazos, Colorado, Guadalupe, Mississippi, Neches, Nueces, Red, Rio Grande, San Antonio.

General Distribution. UNITED STATES: LA, TX; MEXICO: NLN, OAX, QTR, SLP, TAB, TAM, VER; south to Belize and Guatemala.

Seasonal Distribution. May 11 (TX) - Sept. 18 (TX).

Identification. This species occurs within the southern limits of this region may be easily confused with *A. protracta*. The thoracic stripes of the later are typically all about the same width. In *A. angustifolia*, the dark third lateral stripe is narrower and the lateral expanse of abdominal segment 8 is not as wide. The thorax is greenish-yellow with dark brown stripes. The middorsal stripes are triangular. The humeral and antehumeral stripes are equally broad. The midlateral thoracic stripe is broader than the humeral and third lateral stripes. The wings are hyaline with a relatively long brown pterostigma. The abdomen is long, slender and brown marked with yellowish stripes. Segment 8 is widely expanded laterally, more so in males than females. The apical mesal margin of the male superior caudal appendages form a ridge overlapping the appendage dorsally. The posterior margin of segment 10 is narrowly emarginate. The larva was first briefly described from an exuviae collected from Williams Lake in Matagorda County, Texas, by Calvert (1914) and then by Needham (1940).

Size. Total length: 62-68 mm; abdomen: 47-50 mm; hindwing: 36-40 mm.

Habitat. Lakes, ponds and pools of intermittent streams with muddy bottoms.

Discussion. Confusion between this species and the closely related *A. protracta* was clarified with its description by Garrison (1986). He discussed the taxonomic history of this species and gave characters to distinguish the two species. The key above is based, in part, on Garrison's (1986) work. The description given in Needham and Westfall (1955) for *A. protracta* was actually of *A. angustifolia*. These two species are sympatric in at least two localities, and probably others. Garrison (1986) reported them both at Lago Catemaco in Veracruz, Mexico, and they have both been taken at Falcon Dam in the lower Rio Grande Valley of Texas. *Aphylla angustifolia* is much more common in the south-central U.S. than *A. protracta*. Early records of the latter should be suspect until they can be verified.

Aphylla protracta (Hagen in Sélys)

Narrow-striped Forceptail

(Figs. 269, 272, 275, Map 93)

Cyclophylla protracta Hagen in Sélys, 1859b: 546.

Gomphoides protracta, Hagen, 1861: 113.

Gomphoides ambigua Sélys, 1873b: 505.

Neogomphoides ambigua, Muttkowski, 1910a: 81.

Aphylla ambigua, Needham, 1940: 364.

Aphylla protracta, Needham & Westfall, 1955: 111.

Type. Matamoros, Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Tamaulipan, Texan.

Watershed(s): Brazos, Guadalupe, Neches, Rio Grande, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: TX; MEXICO: COA, COL, JAL, MOR, SLP, SIN, TAM, VER; Guatemala, Belize, Nicaragua, south to Costa Rica.

Seasonal Distribution. Apr. 27 (TX) - Nov. 15 (TX).

Identification. This Mexican species is less common than *A. angustifolia* and has a wider lateral margin on abdominal segment 8. Other characters to separate these species are given under the description of *A. angustifolia*. The face is greenish-yellow and the thorax is very similar to that of *A. angustifolia*. The dark third lateral thoracic stripe is generally as broad as the humeral and midlateral stripes. The wings are hyaline and typical of the genus. Segment 10 of the long, slender abdomen is deeply notched dorsally. The male superior caudal appendages lack an overlapping ridge on their mesal margin dorsoapically.

Size. Total length: 64-66 mm; abdomen: 42-50 mm; hindwing: 35-49 mm.

Habitat. Lakes, ponds and pools of intermittent streams with muddy bottoms.

Discussion. This species has long been referred to in the literature as *A. ambigua*. The broader lateral margin of the terminal abdominal segments will distinguish even poorly preserved specimens (Garrison 1986). Nothing has been published about its biology.

Aphylla williamsoni (Gloyd)

Two-striped Forceptail

(Figs. 270, 273, 276, Map 94)

Neogomphoides ambigua, Byers, 1930: 46, 244.

Gomphoides williamsoni Gloyd, 1936: 9.

Aphylla williamsoni, Needham, 1940: 371.

Type. Logan Lake, Madison Co., Florida; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Neches, Red, Sabine, Trinity.

General Distribution. UNITED STATES: AL, GA, FL, LA, MS, NC, SC, TX, VA;
MEXICO: QTR.

Seasonal Distribution. Apr. 14 (LA) - Nov. 2 (LA).

Identification. This is the most distinctive of our species in the genus. *Aphylla williamsoni* generally has two lateral yellow thoracic stripes. Occasionally, some females will have a thin pale stripe between the two, but the brown humeral and antehumeral stripes are always fused together. These stripes have a narrow yellow stripe between them in the other two *Aphylla* in our region. The wide lateral flange on abdominal segment 8 is yellow-orange.

Size. Total length: 71-76 mm; abdomen: 52-62 mm; hindwing: 37-43 mm.

Habitat. Ponds, lakes, borrow pits and sluggish streams.

Discussion. Although long suspected to occur there, this species has only recently been seen in Texas. Bob Honig and Bob Behrstock have separately photographed this species in the piney woods of southeast Texas (Abbott and Stewart 1998). These are the only two records of this species I am aware of in the state. Future collecting efforts will undoubtedly reveal additional records. This is the best known of the three species in our region. Bick and Aycock (1950) and Hornuff (1951) studied the life history and larval growth rates of this species. Dunkle (1989a) summarized its behavior as generally foraging in tree tops.

Genus *Arigomphus* Needham

Pond Clubtails

Arigomphus Needham, 1897a.

Orcus Needham, 1897a.

This is a distinctively pale eastern group of seven North American species, four of which occur in the south-central U.S. The brown middorsal and lateral thoracic stripes are somewhat to entirely obscured on the greenish-gray thorax in this genus. The hind femora in males are often clothed with many fine hairs. The wings are hyaline with somewhat reduced venation. The gaff is generally more than half as long as the inner side of the hindwing triangle. The terminal abdominal segments are only slightly enlarged

laterally in both sexes and the superior caudal appendages in the male are often forked apically. Females in this group are the only North American clubtails with an ovipositor. The posterior abdominal segments of the larvae are noticeably elongate and there is a low middorsal ridge ending in a vestigial hook on segment 9. This group is unique among gomphids in regularly ovipositing in semipermanent and artificial ponds and lakes.

KEY TO ADULT SPECIES OF *ARIGOMPHUS*

- 1. Middle of occiput with sharp elevation or spine and usually edged by black . . .
 *villosipes*
- 1'. Middle of occiput without sharp elevation or spine, usually not edged in black
 2
- 2(1'). Lateral thoracic stripes well-developed; small species, hindwing about 28-32
 mm *maxwelli*
- 2'. Lateral thoracic stripes not well-developed; larger species, hindwing generally
 greater than 30 mm 3
- 3(2'). Antehumeral and humeral dark stripes subequal in width *lentulus*
- 3'. Humeral stripe reduced to a line, much narrower than antehumeral stripe
 *submedianus*

Arigomphus lentulus (Needham)

Stillwater Clubtail

(Fig. 277, Map 95)

Gomphus lentulus Needham, 1902: 275.

Gomphus subapicalis Williamson, 1914: 54.

Arigomphus lentulus, Davies & Tobin, 1985: 24.

Type. Little Wabash River, Illinois; INHS.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Colorado, Mississippi, Red, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AR, IL, IN, KS, KY, MO, OK, TX.

Seasonal Distribution. Apr. 25 (TX) - Jul. 17 (OK).

Identification. This is a smaller pale greenish-gray species with the thorax faintly marked in a similar fashion to that of *A. submedianus*. The humeral and antehumeral stripes are generally subequal, however, in *A. lentulus*. The middorsal thoracic stripe is completely divided by the pale carina and may be very faint. The brownish humeral and antehumeral stripes are usually subequal in width, as stated above, but with the former generally more developed and always separated from the latter by a thin stripe of greenish-yellow. The lateral thoracic stripes are wanting, only visible at their ends. The abdomen is rufous-brown with a pale middorsal stripe hardly visible. Segments 7 and 8 are black dorsally and 9 is pale brown. Segment 10 and the caudal appendages are yellowish.

Size. Total length: 48-57 mm; abdomen: 34-41 mm; hindwing: 30-37 mm.

Habitat. Semi-permanent and artificial ponds, lakes and slow-areas of streams with muddy bottoms.

Discussion. Although listed in Needham and Westfall (1955) and by Vidrine *et al.* (1992a,b) via sight records, as occurring Louisiana, Mauffray (1997) reported that there are no confirmed records for this species in that state. It should occur in the western portion of that state, however. Nothing has been published about its biology.

Arigomphus maxwelli (Ferguson)

Bayou Clubtail

(Fig. 278, Map 96)

Gomphus maxwelli Ferguson, 1950: 93.

Arigomphus maxwelli, Davies & Tobin, 1985: 24.

Type. Hardin Co., Texas; CU.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Bayou Bartholomew, Mississippi, Neches, Ouachita, Red, Sabine, Trinity.

General Distribution. UNITED STATES: AR, AL, FL, IL, LA, MS, TN, TX.

Seasonal Distribution. May 2 (LA) - Jun. 20 (TX).

Identification. This species is the most well-marked of our four *Arigomphus*, with brown stripes laterally on the thorax. It is uncommon and only occasionally taken in

southeastern Texas and Louisiana. It is most similar to *A. villosipes* but is smaller and the occiput lacks a sharp elevation or spine. The face is yellowish and thorax olive green. The middorsal thoracic stripe is entirely divided by the pale carina into a pair of brown widely separated stripes, each narrowing anteriorly. The antehumeral and humeral stripes are present and well developed. The former is slightly wider than the somewhat sinuate latter. The mid- and third lateral stripes are generally present, but not well developed, and only visible at their ends. The legs are pale basally becoming black at tibiae. The wings are hyaline with a yellow costa and pale pterostigma. The abdomen is olive-green, but darker than the thorax. The middle segments have brown basal and apical rings. Segments 8-9 are reddish-brown and segment 10 and the caudal appendages are yellow.

Size. Total length: 50-54 mm; abdomen: 35-40 mm; hindwing: 28-32 mm.

Habitat. Ditches, bayous and semi-permanent lakes and ponds with muddy bottoms.

Discussion. This species was originally described from four males taken in Hardin County, in the Big Thicket area of southeastern Texas. It has since been taken in several other southeastern states. Nothing has been published on its biology or behavior.

Arigomphus submedianus (Hagen)

Jade Clubtail

(Fig. 279, Map 97)

Gomphus submedianus Williamson, 1914: 54.

Arigomphus submedianus, Davies & Tobin, 1985: 24.

Type. Bay City, Matagorda Co., Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Colorado, Guadalupe, Mississippi, Ouachita, Red, Rio Grande, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, IA, IL, IN, LA, KS, KY, MI, MO, MS, NE, OK, TN, TX, WI.

Seasonal Distribution. April 4 (TX) - Aug. 5 (TX).

Identification. This is another unusually pale species, quite similar to *A. lentulus*, and widely distributed throughout the eastern portion of our area. The face and thorax are olivaceous. The brown middorsal stripe is entirely divided by the carina and rather inconspicuous. The humeral and antehumeral brown stripes are both present, but the former is usually less developed. The mid- and third lateral thoracic stripes are only evident at their ends. The abdomen is greenish-yellow with brown basal and apical rings. Segments 7-9 are entirely rufous-brown. Segment 10 and the caudal appendages are pale yellow. The superior caudal appendages are shorter and more compact than in *A.*

lentulus.

Size. Total length: 51-55 mm; abdomen: 37-41 mm; hindwing: 34-36 mm.

Habitat. Semi-permanent and artificial ponds, lakes and slow-areas of streams with muddy bottoms.

Discussion. This species is sometimes locally abundant along the shores of ponds, small

lakes and borrow pits. It doesn't usually venture far from the water, resting along the ground at pond's edge. Nothing has been published about its biology.

Arigomphus villosipes (Sélys)

Unicorn Clubtail

(Fig. 280, Map 98)

Gomphus villosipes Sélys, 1854: 53.

Aeschna villosipes, Kirby, 1890: 64.

Arigomphus villosipes, Davies & Tobin, 1985: 24.

Type. United States; NHMV.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Ouachita.

General Distribution. UNITED STATES: AL, AR, CT, IL, IN, KY, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, PA, RI, TN, VA, VT, WI, WV; CANADA: Ont.

Seasonal Distribution. Jun. 10 (AR).

Identification. A slightly larger darker species, most similar to *A. maxwelli*, in our area, but with the lateral thoracic stripes not as well-developed and with a prominent sharp elevation or spine in the middle of the occiput that is usually edged by black. It is green with a relatively well-marked thorax and predominately dark abdomen. The dark brown

middorsal thoracic stripe is divided by the pale carina, except at its upper end. The humeral and antehumeral stripes are both present and well-developed, separated by a green stripe of about equal width. The humeral stripe is abbreviated and free at its upper end. The remaining mid- and third lateral stripes are only visible at their ends. The hind femora of the male are densely clothed with a series of hairs. The abdomen is largely black, especially distally. A pale greenish middorsal stripe is interrupted on segments 3-7. Segments 8-9 are nearly all black and 10 and the caudal appendages are yellowish-brown. The larva was described by Needham (1901).

Size. Total length: 50-58 mm; abdomen: 37-41 mm; hindwing: 29-36 mm.

Habitat. Semi-permanent and artificial ponds, lakes and slow-areas of streams with muddy bottoms.

Discussion. A single record of this eastern species exists in our region (Harp 1983b). It commonly rests on wet, pond edges, rock and logs, where it can be extremely difficult to approach. It is apparently proficient at taking and feeding on smaller dragonflies. The figures of the male caudal appendages and female subgenital plate were switched with those of *A. furcifer*, in Needham and Heywood (1929).

Genus *Dromogomphus* Sélys

Spinylegs

Dromogomphus Sélys, 1854.

This is a small genus of three North American species that are easily recognized by a row of 4-8 extremely long spines on the hind femora. All three species occur within our region; however *D. armatus*, has only been collected as a larva in eastern Louisiana. The face of these dragonflies is yellowish-green. The dark antehumeral and humeral stripes are variable but always prominent and often somewhat confluent. The remaining lateral thoracic stripes are variously present. The wings are hyaline with the costa yellow to dark brown. The abdomen is long and tapering with a prominent club, more pronounced in males, and it is yellowish-green variously marked with brown or black. The larvae are elongate with an acute middorsal ridge on abdominal segment 9 terminating in a sharp spine. Wright (1946b) reported on differences in the larvae. Westfall and Tennessen (1979) clarified taxonomic differences among the three species and included an updated key to the adults and larvae.

KEY TO ADULT SPECIES OF *DROMOGOMPHUS*

1. Humeral and antehumeral dark stripes wide and confluent for at least most of their length, pale stripe between them, a hairline at most; midlateral thoracic stripe vestigial or absent; costa and caudal appendages black *spinosus*
- 1'. Humeral and antehumeral dark stripes not wider than intervening pale stripe and not confluent throughout their length; midlateral thoracic stripe usually well-marked; costa and caudal appendages yellow or brown 2
- 2(1'). Dark markings on abdominal segments 3-6 discontinuous dorsolaterally; caudal appendages yellow *spoliatus*

- 2'. Dark markings on abdominal segments 3-6 continuous dorsolaterally; caudal appendages brown or black *armatus*

Dromogomphus armatus Sélys

Southeastern Spinyleg

(Map 99)

Dromogomphus armatus Sélys, 1854: 59.

Gomphus armatus, Sélys, 1858, 122.

Type. N. America; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi.

General Distribution. UNITED STATES: AL, FL, GA, LA, MS, NC, SC.

Seasonal Distribution. Dec. 15 - Jan. 26 (LA, larval records).

Identification. This species just enters the easternmost edge of our area, where it is very uncommon. It is slightly larger than the other two species in the genus. The face is green with a prominent dark cross-stripe. The top of the frons is yellowish and the vertex is black. The thorax is green with the brown antehumeral and humeral stripes widely separated by a green stripe at least as wide as each of them. The mid- and third lateral thoracic stripes are both present and well developed. The wings are hyaline with a

yellowish- brown costa. The abdomen is greenish with an uninterrupted dark stripe dorsolaterally on segments 3-6 and segments 7-9 are orange-brown and expanded laterally..

Size. Total length: 60-68 mm; abdomen: 46-52 mm; hindwing: 36-42 mm.

Habitat. Small sluggish coastal streams with relatively low turbidity, mucky bottoms and emergent vegetation.

Discussion. Eastern Louisiana appears to be the western limit for this coastal species. Westfall and Tennesen (1979) and Louton (1982) each reported a single larva from Iberia and Saint Tammany parishes, respectively. These are the only records of this species in our area.

Dromogomphus spinosus Sélys

Black-shouldered Spinyleg

(Map 100)

Dromogomphus spinosus Sélys, 1854: 59.

Gomphus spinosus, Sélys, 1857, 120.

Type. Georgia; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Guadalupe, Mississippi,

Neches, Nueces, Ouachita, Red, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV; CANADA: N.B., N.S., Ont., Que.,

Seasonal Distribution. May 25 (TX) - Nov. 11 (LA).

Identification. This species is distinctive from the other two in having the antehumeral and humeral stripes fused for nearly their entire length. At most there is a thin pale green stripe between the two. The face is greenish and usually unmarked, but some individuals may have a dark cross-stripe. The top of the frons is green and the vertex is black, with a pair of distinct black spines, in the female. The midlateral stripe is generally reduced to a short stalk at its lower end. The third lateral stripe is reduced to a thin line on the suture. The legs are black and the wings are hyaline with a dark costa. The abdomen is mostly black with an interrupted greenish middorsal stripe. Segments 7-9 are dark brown to black and expanded laterally. The caudal appendages are black.

Size. Total length: 54-67 mm; abdomen: 42-45 mm; hindwing: 34-36 mm.

Habitat. Small to large streams and oxbows with slow to rapid flow and sandy or muddy bottoms.

Discussion. Several authors (Kellicott 1899; Dunkle 1989a) have noted the distinctive ovipositing behavior of this species. Females fly quickly over the water, tapping the abdomen at regular intervals, depositing eggs. Pairs may stay in copula for some time high in trees. I have seen this species abundant, perched on the ground and bridge

guardrails near streams. Mahato and Johnson (1991) documented the invasion of this species into a Tennessee lake that resulted in a dietary shift in coexisting larval *Epitheca*.

***Dromogomphus spoliatus* (Hagen in Sélys)**

Flag-tailed Spinyleg

(Map 101)

Gomphus spoliatus Hagen in Sélys, 1857: 409.

Dromogomphus spoliatus, Sélys, 1859b: 543.

Type. Texas.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, FL, IA, IL, IN, KS, KY, LA, MO, OH, OK, SC, TN, TX, WI; MEXICO: NLN, TAM.

Seasonal Distribution. May 20 (TX) - Sep. 29 (TX).

Identification. This species is lighter in color than the preceding; *D. spinosus*, and is more similar to *D. armatus*, with distinct dark antehumeral and humeral stripes. The face is yellow and never marked with a black cross-stripe. The vertex is dark brown and

females lack spines. The thorax is yellowish-green. The middorsal thoracic stripe parallels the anterior collar, so that it nearly contacts the antehumeral stripe at its lower end. The dark antehumeral and humeral stripes are separated by a pale yellowish-green stripe of equal or greater width and the midlateral stripe is more developed than in *D. spinosus*, but not reaching far beyond the spiracle. The third lateral stripe is hardly wider than the suture itself. The wings are hyaline and the costa is yellow. The abdomen is brownish-green with an interrupted dark dorsolateral stripe on segments 3-6. Segments 7-9 are expanded greatly in males, more so than in the other two species, and are orange-brown.

Size. Total length: 60-61 mm; abdomen: 43-46 mm; hindwing: 35-38 mm.

Habitat. Small, clear sandy or mud bottomed streams with a regular current.

Discussion. Mauffray (1997) reported that the six Louisiana parish records, cited in Bick (1957), were based on larval identifications and may be invalid. Those parishes (Bossier, East Feliciana, Saint Tammany, Tangipahoa, Washington and Webster) have therefore not been included in the distribution of this species (Map 101). Nothing has been published about the biology of this species, but it appears to be very similar to *D. spinosus*.

Genus *Erpetogomphus* Hagen in Sélys

Ringtails

Erpetogomphus Hagen in Sélys, 1858.

Herpetogomphus Walsh, 1862.

This is a large group of 21 mainly Neotropical species of which six occur primarily in the western portions of our area. They are medium-sized green dragonflies marked with brown or black. They have short legs and hyaline wings. The middorsal thoracic stripe, when present, is brown and widened anteriorly to form a triangle in our species. It is usually divided by the pale middorsal carina. The thorax is variously marked with brown lateral stripes. The abdomen is distinctly ringed and the terminal segments are expanded to form a well-developed club. The caudal appendages and general maculation are the most useful characters for identifying males, and the vertex and occiput are somewhat distinctive in females. The superior appendages in the male are variable, but never longer than segments 9-10 combined.

Garrison (1994b) revised the genus and divided it into five groups. All of our species, except *E. eutainia*, belong to the *E. crotalinus* group and are characterized by the upper surface of the male superior caudal appendages being angulate (except in *E. compositus*) and the anterior hamule divided distally. The larvae have divergent wing pads and somewhat depressed bodies, with lateral spines on segments 6-9. Needham and Westfall (1955) gave keys for the larvae of three species.

KEY TO ADULT SPECIES OF *ERPETOGOMPHUS*

1. Middorsal stripe absent; hind tibiae either entirely yellow externally or yellow with median longitudinal black line *crotalinus* (p. 384)
- 1'. Middorsal stripe present; hind tibiae entirely brown or black externally, lacking any yellow 2

2(1').	Males	3
2'.	Females	7
3(2).	Dorsal surface of superior caudal appendage distinctly angulate in lateral view	4
3'.	Dorsal surface of superior caudal appendage smoothly curved	6
4(3).	Sides of thorax almost entirely green, with only a small, ill-defined dark humeral stripe; second lateral thoracic stripe incomplete, dark only below metathoracic spiracle or not at all; third lateral stripe present only on upper third of suture	<i>heterodon</i> (p. 389)
4'.	Sides of thorax green with usual compliment of dark thoracic stripes; second lateral stripe may be incomplete, but humeral and third lateral stripes always present	5
5(4').	Tip of superior caudal appendage strongly acuminate; dark antehumeral stripe not connected to collar; base of wings flavescens; median area of occiput with a strongly raised tubercle	<i>designatus</i> (p. 385)
5'.	Tip of superior caudal appendage blunt, not acuminate; dark antehumeral stripe usually connected to humeral stripe; base of wings hyaline, median area of occiput only slightly raised	<i>lampropeltis</i> (p. 391)
6(3').	Superior caudal appendages not uniform in color, with ventral carina at base of appendage black; this carina usually denticulate; thorax blue-green in life; sides of posterior hamules parallel, linear; Texas Hill Country	<i>eutainia</i> (p. 387)

- 6'. Superior caudal appendages uniform in pale color, including ventral carina at base of appendage; this carina smooth; thorax pale green in life; side of posterior hamules converging toward tip, not linear *compositus* (p. 382)
- 7(2)'. Vulvar lamina followed on segment 9 by distinct and prominent semicircular ridge, never with a posteriorly directed arm; Texas Hill Country
. *eutainia* (p. 387)
- 7'. Vulvar lamina followed on segment 9 by a Y-shaped ridge 8
- 8(7)'. Median surface of occiput with a strongly raised tubercle
. *designatus* (p. 385)
- 8'. Median surface of occiput planar or at most slightly raised 9
- 9(8)'. Thorax with a second complete dark lateral stripe 10
- 9'. Thorax without a second complete dark lateral stripe, or at most stripe extending from base to just above metathoracic spiracle . . *heterodon* (p. 389)
- 10(9)'. Occiput in dorsal view narrow, its width less than width between median ocellus and occiput; base of wings with flavescent infusion between Sc and R at least up to first antenodal crossvein and cubitoanal area; top of abdomen with light areas of ivory or with a tinge of orange not differing from white on sides *compositus* (p. 382)
- 10'. Occiput in dorsal view wide, its width almost equal to width between median ocellus and occiput; base of wings hyaline; top of abdomen with light areas much darker than white on sides *lampropeltis* (p. 391)

Erpetogomphus compositus Hagen in Sélys

White-belted Ringtail

(Figs. 281, 287, Map 102)

Erpetogomphus compositus Hagen in Sélys, 1858: 600.*Gomphus compositus*, Hagen, 1861: 99.*Herpetogomphus compositus*, Hagen, 1874b: 597.*Erpetogomphus coluber* Williamson & Williamson, 1930: 17.**Type.** Roswell, Chaves Co., New Mexico; MCZ.**Regional Distribution.***Biotic Province(s):* Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.*Watershed(s):* Colorado, Rio Grande, Trinity.**General Distribution.** UNITED STATES: AZ, CA, ID, NV, NM, OR, TX, UT, WA, WY; MEXICO: BCA, BCS, NLN, SON.**Seasonal Distribution.** Apr. 18 (TX) - Sep. 25 (TX).**Identification.** This is one of the more distinctive of our six *Erpetogomphus* species. The face is nearly white with only a few dark markings. The vertex is dark brown, often with a pale median spot extending posteriorly from the median ocellus. The thorax is pale green, moreso in front. The brown middorsal stripe is well-defined and widens anteriorly to the collar. The antehumeral stripe widens early on and is connected basally but is free at its upper end. The humeral stripe extends posteroventrally for some

distance, but not as far as to connect with the midlateral stripe. The pale areas between these stripes are so pale as to often appear white. The hind femora are light pale green with the outer surfaces black and the tibiae are mostly black. The wings are hyaline with only a very slight wash of yellow at their bases. The abdomen is pale gray, almost appearing white, for much of its length (segments 1-6) and is strongly marked with black rings on the middle segments. In males segment 7 is white dorsally on the anterior half becoming yellowish posteriorly. The remaining segments are yellowish brown and generally darker in females. This is the only species in our region where the male superior caudal appendages are not strongly angulate. The larva was described by Hagen (1885) and included in Needham and Westfall's (1955) key.

Size. Total length: 46-55 mm; abdomen: 31-39 mm; hindwing: 26-32 mm.

Habitat. Desert streams, creeks and irrigation ditches with wide sandy or rocky margins.

Discussion. This species is not usually common in this region, which is on the eastern edge of its range. Garrison (1994b), however, stated that "This species and *Progomphus borealis* McLachlan in Sélys are the two most conspicuous gomphid elements along most desert streams and irrigation ditches in the southwestern United States." Although currently restricted to desert-like streams of the southwest this species was once taken by Hagen (1875) as far east as Dallas, Texas. Although often seen perched on sandbars of streams, it is readily found in shady, more protected areas in the late afternoon. Females oviposit while hovering motionless over water and tapping their abdomens to the water surface.

Erpetogomphus crotalinus Hagen in Sélys

Yellow-legged Ringtail

(Figs. 282, 288, Map 103)

Ophiogomphus crotalinus Hagen in Sélys, 1854: 40.

Erpetogomphus crotalinus, Hagen in Sélys, 1858: 332.

Herpetogomphus crotalinus, Hagen, 1875: 43.

Type. Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, NM; MEXICO: CHI, DGO, GRO, HGO, JAL, MEX, MCH, MOR, PUE.

Seasonal Distribution. May - Oct.

Identification. This species which has been taken contemporaneously with three others in our region, *E. designatus*, *E. heterodon*, and *E. lampropeltis* is restricted to the higher altitudinal areas of central and western Mexico. It can be distinguished from the above species, and all other *Erpetogomphus*, in having the outer surfaces of the tibiae yellow. It is also the only species in our region nearly lacking any sign of brown on the pale yellow thorax. The abdomen is pale yellow with interrupted dorsolateral black stripes. The male superior caudal appendages are moderately to strongly angulate. The female is similar to

the males, but with a pair of pits anterolaterally on the frons and a medial notch in the occipital crest. Novelo and Gonzales (1991) described and illustrated the larva.

Size. Total length: 45-49 mm; abdomen: 33-37 mm; hindwing: 29-35 mm.

Habitat. Higher altitude seasonal and permanent streams and creeks with wide sandy or rocky margins.

Discussion. This species can be quite common in certain habitats (Garrison 1994b; Novelo and Gonzales 1991), but appears to be restricted, as mentioned above, primarily to central and western Mexico. Evans (1995) reported it from three counties in southern New Mexico, including Eddy, bordering Texas. This species has not however, been found in Texas. The above records along with reared specimens from Arizona constitute all known U.S. records.

Erpetogomphus designatus Hagen in Sélys

Eastern Ringtail

(Figs. 283, 289, Map 104)

Erpetogomphus designatus Hagen in Sélys, 1858: 661.

Gomphus designatus, Hagen, 1861: 99.

Herpetogomphus designatus, Walsh, 1862: 389.

Type. Roswell, Chaves Co., New Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Nueces, Ouachita, Red, Rio Grande, San Antonio, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AZ, AR, CO, FL, GA, IL, IN, KS, KY, LA, MD, MO, MS, MT, NC, NM, NV, OH, OK, SC, SD, TN, TX, VA, WV; MEXICO: CHI, COA, DGO, NLN.

Seasonal Distribution. May 2 (TX) - Sep. 15 (TX).

Identification. This is the most widely distributed of our species. It can be distinguished from other species by a combination of characters including diffuse yellow or brown in the quadrangles of all wings, a dark brown pterostigma and a medially swollen occiput in both sexes. The face of this yellowish-green species is pale green and the vertex is dark brown. The green occiput is swollen medially in both species. The middorsal thoracic stripe widens anteriorly toward the collar. The brown antehumeral stripe tapers distally and is free at both ends. The brown humeral stripe is complete and well-developed, but not extending considerably posteroventrally. The midlateral stripe is weakly developed and interrupted, often wanting at its upper end. The third lateral stripe is narrow, but complete. The femora are pale green becoming darker distally. The tibiae are dark brown armed with black spines. The wings are hyaline with the above-mentioned distinctive basal wash of yellow. The abdomen is pale green marked with reddish-brown rings and an interrupted dorsolateral stripe on segments 3-6. The remaining segments in

males are light yellowish-brown and in females segments 7-8 are darker dorsally. The larva was first described and illustrated by Cabot (1872).

Size. Total length: 49-55 mm; abdomen: 34-37 mm; hindwing: 28-32 mm.

Habitat. Clear streams and rivers of deciduous forests with moderate current.

Discussion. This is the best known and most widely distributed of species in this group. Various authors (Montgomery 1925, 1937; Williamson 1932; Ahrens 1938; LaRivers 1938) have commented on its behavior in the field. It may be abundant, perched along the ground. Emergent rocks surrounded by swift current along the stream margin are also favored perches. Females fly swiftly, occasionally hovering over the water, tapping their abdomens on the surface. Garrison (1994) described *E. designatus* as partially sympatric with *E. compositus* and having taken it with *E. eutainia* in the Texas Hill Country.

Erpetogomphus eutainia Calvert

Blue-faced Ringtail

(Figs. 284, 290, Map 105)

Herpetogomphus menetriesii Sélys, 1878: 429.

Erpetogomphus eutainia Calvert, 1905: 162.

Erpetogomphus diadophis Calvert, 1905: 167.

Herpetogomphus diadophis, Byers, 1928: 5.

Erpetogomphus (Calogomphus) eutainia, Carle, 1992: 148.

Type. Rio Papagayo, Guerrero, Mexico; BMNH.

Regional Distribution.

Biotic Province(s): Tamaulipan, Texan.

Watershed(s): Guadalupe, Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: CHS, GRO, MCH, MOR, OAX, PUE, SLP, TAM, VER; Belize, Guatemala, Honduras, El Salvador, Costa Rica.

Seasonal Distribution. Aug. 3 (TX) - Sep. 17 (TX).

Identification. This species is found southeast of the Edwards Plateau in the Texas Hill Country and in northern and central Mexico. It is a smaller, pale species that may be found with the larger *E. designatus*, but it lacks the diffuse brown basal marks in the wings of the later. The face is greenish-gray to brown with a centrally-located green spot. The frons is pale green and the vertex is brown. The occiput is slightly swollen medially. The green thorax is well marked with brown middorsal and lateral stripes, the former widening toward the collar. The antehumeral stripe is linear and free at its upper end and the humeral stripe is long and complete. The mid- and third lateral stripes are present and well developed. The femora are dark brown to black, except for pale yellow, midventrally. The tibiae are black. The wings are hyaline with a black pterostigma. The abdomen is pale green with a dorsolateral interrupted brown stripe on segments 3-6 to appear as basal and distal rings on each segment. Segment 7 is pale bluish-green proximally and orange brown distally. Segments 8-10 are reddish-brown in males and darker in females. The larva is undescribed.

Size. Total length: 47-51 mm; abdomen: 29-33 mm; hindwing: 23-28 mm.

Habitat. Small rivulets and streams of the Texas Hill Country, with swift current and cobble bottoms.

Discussion. This species is found perching on bushes and grasses adjacent to streams they patrol. Garrison (1994b) described its behavior as "more like a damselfly, for they never flew far, rested on tips of stubble or bars of barbed-wire fences, and were always easy to take with a net."

***Erpetogomphus heterodon* Garrison**

Dashed Ringtail

(Figs. 285, 291, Map 106)

Erpetogomphus heterodon Garrison, 1994b: 230.

Type. Tularosa River, Catron Co., New Mexico; USNM.

Regional Distribution.

Biotic Province(s): Chihuahuan, Navahonian.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, NM, TX; MEXICO: CHI.

Seasonal Distribution. Jun. 23 (TX) - Aug. 27 (CHI).

Identification. This western species is most similar to *E. crotalinus*, but it is relatively well marked with dark stripes on the thorax and the outer surfaces of the tibiae are black, not yellow. The face and occiput are pale green, the latter with only a slight medial

swelling. The thorax is pale green with a brown middorsal stripe that widens anteriorly. There is an abbreviated antehumeral stripe that is free at both ends. The humeral stripe is narrow, becoming moreso at its lower end. The mid- and third lateral stripes are only thinly visible at their lower and upper ends, respectively. The femora are pale green with the outer surfaces black and the tibiae are black. The wings are hyaline with a light brown pterostigma. The abdomen is pale green with a dark brown or black dorsolateral stripe interrupted anteriorly on segments 3-7. Segments 8-10 are predominantly orange-yellow. The caudal appendages in the male are yellowish and strongly angulated. The larva is undescribed.

Size. Total length: 50-53 mm; abdomen: 37-40 mm; hindwing: 33-36 mm.

Habitat. Higher altitude rivers and streams with swift current and rocky or cobble bottoms.

Discussion. I have taken this species with *E. lampropeltis* in southwestern New Mexico and Garrison (1994b) reported taking it with *E. crotalinus* in Rio Pacheco, in the Mexican state of Chihuahua. Females oviposit as do many other species in this group, by hovering over the water and tapping the abdomen to the water's surface. Males often perch on rocks where they face the stream.

Erpetogomphus lampropeltis Kennedy

Serpent Ringtail

(Figs. 286, 292, Map 107)

Erpetogomphus lampropeltis Kennedy, 1918: 297.

Herpetogomphus lampropeltis, Byers, 1928: 5.

Erpetogomphus natrix Williamson & Williamson, 1930: 19.

Erpetogomphus lampropeltis lampropeltis, Tsuda, 1991: 95.

Erpetogomphus lampropeltis natrix, Garrison, 1994b: 226.

Type. Sespe Cr., Fillimore, Ventura Co., California; USNM.

Regional Distribution.

Biotic Province(s): Chihuahuan, Navahonian.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, CA, NM, TX; MEXICO: BCS, CHI, DGO, SON.

Seasonal Distribution. Aug. 4 (NM) - Oct. 8 (TX).

Identification. This southwestern species is most similar to *E. compositus* but is darker, without white abdominal rings, and differs in the male having the superior caudal appendages distinctly angulated. The face has a slight blue cast with a pale brown cross-stripe. The occiput is dark brown and the thorax is darkly marked with brown. The middorsal stripe widens substantially towards the collar. The antehumeral stripe is long and parallel-sided for its entire length, but free at its upper end or only nearly joining the humeral stripe. The humeral stripe is long, well developed and connected to the antehumeral stripe at its lower end and runs posteroventrally a short distance. The midlateral stripe runs irregularly so as to nearly contact the third lateral stripe at its upper

end. The legs are pale basally, with the outer surface of the femora and the entire tibiae black. The wings are hyaline with a dark pterostigma. The abdomen is pale green marked with dark brown. The brown dorsolateral stripe on segment 3 is interrupted medially and anteriorly. Segments 4-6 are only interrupted anteriorly by a pale greenish-yellow band. Segments 7-10 are largely rufous brown, becoming darker dorsally. Novelo and Gonzales (1991) fully illustrated and described the larva.

Size. Total length: 49-53 mm; abdomen: 35-38 mm; hindwing: 27-31 mm.

Habitat. Rivers and streams with swift current and rocky or cobble bottoms.

Discussion. There are two subspecies recognized. The nominate form is restricted to four southern California counties. The subspecies found in our area, *E. l. natrix*, is greener and widely distributed throughout the southwestern U.S. and Mexico. Abbott and Stewart (1998) erroneously reported the nominate subspecies from New Mexico and Texas. This species has been taken with *E. crotalinus* in central Mexico (Garrison 1994b) and I have taken it with *E. heterodon* in western New Mexico, where it perched on exposed rocks in the Gila River. It has also apparently been taken with *E. compositus* on occasion. Females oviposit by flying rapidly over the water, periodically tapping the abdomen to the surface. *Erpetogomphus eutainia* and this species seem to emerge later in the summer than our other species.

Genus *Gomphus* Leach

Common Clubtails

Gomphus Leach, 1815.

This is a large Holarctic complex of 38 North American species, badly in need of revision, but currently placed together by a combination of characters. There are 11 largely eastern species found in the south-central U.S. The genera *Stylurus* and *Arigomphus* have historically been considered subgenera of *Gomphus*. Needham (1948) suggested raising them to generic level, but they were retained as subgenera in Needham and Westfall (1955). I follow Garrison (1997) in giving them generic status. Carle (1986) made several changes to this group that I do not follow here although an appendix defending these changes was given in May and Carle (1996). I do not recognize the subgenera *Phanogomphus* or *Stenogomphurus* and I don't accept the elevation of *Gomphurus* to generic status. The subgenus *Hylogomphus* is probably not an available name (Bridges 1994) and I therefore don't use it. Walker (1957) studied the genitalia and affinities of this group.

The face in *Gomphus* species is usually greenish yellow and may or may not have dark cross stripes. The thorax is typically greenish or brown and well marked with dark brown or black stripes. The spines on the hind legs of females are oddly longer and more pronounced than those in males. These apparently help the females with more efficient foraging. The abdomen is usually darker than the thorax, either brown or black, and striped with pale yellowish-green longitudinal stripes. I have included a single key to our 11 species. Many of our species look very similar and it will often be necessary with this group to critically examine collected individuals before making a determination, based on

the key and relevant figures.

KEY TO ADULT SPECIES OF *GOMPHUS*

1. Vein A1 in hindwing runs straight or in an open curve from gaff to wing margin; front side of the forewing triangle at least as long as the inner side (subgenus *Gomphus*) 2
- 1'. Vein A1 in hindwing angulated or kinked at outer end of gaff; front side of the forewing triangle no longer than the inner side (subgenus *Gomphurus*) 6
- 2(1). Gaff at least as long as inner side of triangle; short and stocky species; eastern *apomyius*
- 2'. Gaff is shorter than inner side of triangle 3
- 3(2'). Middorsal thoracic dark stripe parallel-sided 4
- 3'. Middorsal thoracic stripe widened downward, forming a triangle of brown 5
- 4(3). Tibia with yellow line ending at tarsus *graslinellus*
- 4'. Tibia with yellow line running down on tarsus *oklahomensis*
- 5(3'). Caudal appendages yellow; peduncle of penis warty externally *militaris*
- 5'. Caudal appendages brown or black; peduncle smooth externally *lividus*
- 6(1'). Face yellow- or gray-green, without black horizontal stripe 7

- 6'. Face with prominent black horizontal stripe 10
- 7(6). Dorsum of segment 9 with area of pale yellow, may be obscured in female . . . 8
- 7'. Dorsum of segment 9 black, with little if any yellow *hybridus*
- 8(7). Tibiae with yellow on their external surface; female with slender yellow spine laterally on postocellar ridge *externus*
- 8'. Tibiae wholly brown or black, without yellow on their external surfaces; female without spine laterally on postocellar ridge 9
- 9(8'). Superior caudal appendages of male strongly divergent; occipital crest of female straight to convex; no spine on postocellar ridge; South Texas & Mexico *gonzalezi*
- 9'. Superior caudal appendages of male little divergent if at all; occipital crest of female slightly biconvex; vestigial spine on postocellar ridge between lateral ocellus and compound eye in female; Arkansas & Oklahoma; *ozarkensis*
- 10(6'). Humeral and antehumeral stripes separated their full lengths by long yellow stripe 2/3 or greater the width of the former *modestus*
- 10'. Humeral and antehumeral stripes in contact near their upper ends, or separated only by a very narrow yellow line *vastus*

Subgenus *Gomphurus* Needham

Gomphus (*Gomphurus*) Needham, 1901.

Six of our 11 species fall into this group. They are of moderate to large size and more robust than the nominate group. The thorax is always well marked with middorsal and lateral dark stripes. The wings are hyaline with the front side of the forewing triangle no longer than the inner side. Vein A1 in the hindwing is angulated or kinked at the outer end of the gaff, before running to the wing margin. The abdomen is robust with segments 7-9 greatly expanded laterally in both sexes. Each of these segments is progressively smaller than the former and segment 10 is generally only half the length of segment 9. The caudal appendages in the male tend to be more slender than those of *Gomphus s. str.* and the larvae are generally broader in form. Needham and Westfall (1955) provided a key to larvae of all our species except *G. modestus* and *G. ozarkensis*.

***Gomphus (Gomphurus) externus* Hagen in Sélys**

Plains Clubtail

(Figs. 293-294, Map 108)

Gomphus externus Hagen in Sélys, 1858: 411.

Gomphus consobrinus Walsh, 1863: 242.

Gomphus fraternus, Walsh, 1863: 246.

Aeschna externa, Kirby, 1890: 66.

Gomphus (Gomphurus) externus, Needham & Heywood, 1929: 90.

Gomphurus externus, Davies & Tobin, 1985: 28.

Type. Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Red, Rio Grande, Sabine, San Antonio, St. Francis, Trinity.

General Distribution. UNITED STATES: AR, CO, IA, ID, IL, IN, KS, KY, MN, MO, MS, ND, NE, NM, OK, SD, TX, UT, WI, WY; CANADA: Man.

Seasonal Distribution. Mar. (TX) - July 26 (OK).

Identification. This is a central U.S. species widely distributed throughout our area, but not as yet reported from Louisiana. It is a medium-sized robust yellowish species most similar to *G. gonzalezi*, but generally larger and darker with wider brown thoracic stripes and erect yellow spines at each end of the postocellar ridge in the female. The face is pale yellowish and devoid of any dark marks. The thorax is pale yellowish-green and the dark brown middorsal stripe is widened slightly, to appear nearly parallel. It is thinly divided by the pale middorsal carina. The antehumeral stripe is narrowly confluent with the humeral stripe at its upper end. There is a pale yellowish stripe between the two, no more than 1/2 their width. The mid- and third lateral stripes are present and well-developed, only narrowly confluent at their lower ends. A paler yellow stripe separates the two, but this may become obscured in older individuals. The legs are dark brown or black with a yellow stripe on the outer surface of the tibiae. The wings are hyaline with a brown

pterostigma. The abdomen is black with interrupted pale middorsal and lateral stripes. Segments 7-9 are widely expanded with a middorsal stripe appearing as spearheads on segments 7-8. In females, segment 8 generally has only a pale basal spot. Segment 9 has a broad yellow stripe dorsally and segment 10 is yellow. The superior caudal appendages of the male are parallel, not divergent, when viewed dorsally.

Size. Total length: 52-60 mm; abdomen: 36-43 mm; hindwing: 30-35 mm.

Habitat. Large muddy bottomed rivers and streams with moderate flow.

Discussion. Females fly low over streams tapping their abdomen to the water surface. Adults emerge late at night and early in the morning on vegetation, logs and artificial structures only a few feet above the water. Calvert (1901) compared this species to its two closest relatives.

Gomphus (Gomphurus) gonzalezi Dunkle

Tamaulipan Clubtail

(Figs. 295-296, Map 109)

Gomphus (Gomphurus) gonzalezi Dunkle, 1992b: 79.

Type. Nacimiento del Rio Coy, San Luis Potosi, Mexico; UNAM.

Regional Distribution.

Biotic Province(s): Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: SLP.

Seasonal Distribution. Apr. 11 (TX) - May 8 (TX).

Identification. This recently described species is uncommon and found only in far south Texas and Mexico. It is similar to *G. externus*, but smaller and paler with narrower brown thoracic stripes. The face is pale grayish-green with a green or brown vertex, lacking spines in females. The thorax is pale green. The middorsal stripe is parallel-sided. The antehumeral stripe is free at its upper end and widely separated from the humeral stripe by a pale area at least as wide as each dark stripe. The midlateral stripe is present and strongly developed. The third lateral stripe is long and confluent at its lower end with a fourth lateral stripe on the rear edge of the thorax. The legs are brown and the wings hyaline with a dark brown pterostigma. The abdomen is pale brown marked with grayish-green on segments 1-6 and pale yellow on 7-10. It is marked very similarly to *G. externus*, but with more yellow dorsally on 8 in males. The male caudal appendages are brown and only slightly divergent dorsally, nearly parallel, with less of a ventral keel at $2/3$ their length, than in *G. externus*. The larva is unknown.

Size. Total length: 47-50 mm; abdomen: 34-37 mm; hindwing: 27-31 mm.

Habitat. Muddy canal-like channels and clear, spring fed deep rivers.

Discussion. This is an early spring emerger. Dunkle (1992b) in his description, reported what little biology of this species we know. Males apparently wait for females during the middle of the day on overhanging vegetation or rock outcrops.

Gomphus (Gomphurus) hybridus Williamson

Cocoa Clubtail

(Figs. 297-298, Map 110)

Gomphus hybridus Williamson, 1902: 47.*Gomphus (Gomphurus) hybridus*, Needham & Heywood, 1929: 90.*Gomphurus hybridus*, Davies & Tobin, 1985: 28.**Type.** Cumberland R., Nashville, Tennessee; MCZ.**Regional Distribution.***Biotic Province(s):* Austroriparian, Texan.*Watershed(s):* Arkansas, Bayou Bartholomew, Mississippi, Neches, Red, Sabine.**General Distribution.** UNITED STATES: AL, AR, FL, GA, IL, IN, KY, LA, MD?, MS, SC, TN, TX.**Seasonal Distribution.** Mar. 30 (LA) - Oct. 27 (AR).**Identification.** This is an uncommon *Gomphus* found in the eastern portion of our region. It is similar to *G. externus*, but with no or very little yellow dorsally on abdominal segment 9. It can be distinguished from *G. vastus* by the partially confluent thoracic stripes. The face and thorax are greenish. Females have a short erect spine at the end of each postocellar ridge. The dark middorsal stripe widens towards the collar only slightly and is divided by the pale carina. The antehumeral stripe is wide, often contacting the humeral stripe in one or more places, but becoming free at its upper end.

The midlateral stripe is present but often interrupted above the spiracle, while the third lateral stripe is present and well-developed. The legs are black with only a pale yellow line on the outer surface of the tibiae. The wings are hyaline with a dark pterostigma. The abdomen is dark brown or black with an interrupted middorsal stripe. The basal segments are yellowish-green lateral. Segments 7-9 are widened laterally and darker than the preceding ones, often lacking any yellow dorsally on segment 9. Segment 10 either has a round yellow spot dorsally or is entirely black. The male superior caudal appendages are divergent when viewed dorsally.

Size. Total length: 48-53 mm; abdomen: 34-38 mm; hindwing: 27-32 mm.

Habitat. Large turbid rivers with moderate current and sandy bottoms.

Discussion. Vidrine *et al.* (1992a,b) reported *G. vastus* from Louisiana, but Mauffray (1997) suggested that these were most likely *G. hybridus*. Nothing has been published about the biology of this uncommon species.

Gomphus (Gomphurus) modestus Needham

Gulf Coast Clubtail

(Figs. 299-300, Map 111)

Gomphus (Gomphurus) modestus Needham, 1942: 72.

Gomphurus modestus, Davies & Tobin, 1985: 28.

Type. Lucedale, Mississippi; CU.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Brazos, Mississippi, Ouachita, Red, Sabine, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, AR, LA, MS, TX.

Seasonal Distribution. May 8 (TX) - June 6 (LA).

Identification. This southeastern U.S. species is the largest of our *Gomphurus*. It is closest to *G. vastus* among our species, but it is paler with more complete lateral thoracic stripes. The face is pale green, handsomely striped with black. The thorax is green with the dark brown middorsal stripe widening anteriorly and divided medially by the pale carina. The antehumeral stripe is wide and separated from the humeral stripe by a wide greenish-yellow stripe, but still narrowly contacting the middorsal stripe at its upper end. The midlateral stripe is well-developed and strongly confluent with the humeral stripe at its lower end, appearing as a "U." The third lateral stripe is present and well-developed. The wings are hyaline, sometimes with a hint of flavescence basally. The legs are black. The abdomen is black, except laterally on the basal segments. Segments 1-7 each have a pale hastate stripe middorsally that becomes shorter on the posterior segments. Segment 8 has a small basal yellow spot dorsally and segments 9-10 are black dorsally. The wide expansion of segments 7-9 in the male are yellow basolaterally. Westfall (1974) described and illustrated the larva.

Size. Total length: 55-63 mm; abdomen: 43-47 mm; hindwing: 34-38 mm.

Habitat. Medium-sized coastal streams and rivers with mud or sand bottoms.

Discussion. Westfall (1974) critically studied this species, comparing it with *G. vastus*.

Males of this species often perch on the ground, facing the stream. Nothing has been published about its biology.

***Gomphus (Gomphurus) ozarkensis* Westfall**

Ozark Clubtail

(Figs. 301-302, Map 112)

Gomphus ozarkensis Westfall, 1975: 91.

Gomphurus ozarkensis, Davies & Tobin, 1985: 28.

Type. Devil's Den State Park, Washington Co, Arkansas; FSCA.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Ouachita, Red, White.

General Distribution. UNITED STATES: AR, KS, MO, OK.

Seasonal Distribution. Apr. 26 (TX) - June 14 (AR).

Identification. This uncommon species is largely restricted to the Interior Highlands of Arkansas and Oklahoma. The eyes are greenish in teneral, turning yellow with maturity. The body is green and reddish brown in young individuals, becoming yellow and darker brown with age. It is very similar to *G. externus*, but without yellow on the outer surface of the tibiae and with the humeral and antehumeral stripes, and mid- and third lateral thoracic stripes largely fused to form two broad dark stripes. The face is pale yellowish-

green and lacks any black stripes. The vertex is brown and in females bears a very small spine at each end of the postocellar ridge. The thorax is greenish with a dark middorsal stripe that widens only slightly anteriorly. The lateral thoracic stripes are as stated above, at most separated by a thin interrupted pale line. The wings are hyaline becoming tinged in older individuals. The abdomen is mostly dark brown with an interrupted pale middorsal stripe. The basal segments are pale greenish laterally. Segments 7-9 are widely expanded with yellow dorsally and laterally. The yellow on the dorsum of segment 9 may be obscured in older individuals. Segment 10 has a small yellow spot dorsally. The male superior caudal appendages are nearly parallel as in *G. externus*. The larva was described and illustrated by Huggins and Harp (1985).

Size. Total length: 50-52 mm; abdomen: 35-37 mm; hindwing: 29-31 mm.

Habitat. Upland Interior Highland streams with moderate current.

Discussion. Bick (1983) classified this species as rare because of its restricted range, little known life history, and the threat that tourism poses to its Ozark upland stream habitats. Susanke and Harp (1991) studied various aspects of the biology of this species. They found that it has a short synchronous emergence period in the early spring. Maturation takes 18 and 25 days for males and females, respectively.

***Gomphus (Gomphurus) vastus* Walsh**

Cobra Clubtail

(Figs. 303-304, Map 113)

Gomphus vastus Walsh, 1862: 391.

Aeschna vasta, Kirby, 1890: 66.

Gomphurus vastus, Davies & Tobin, 1985: 28.

Type. United States; types lost.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Guadalupe, Nueces, Ouachita, Red, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DC, FL, GA, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, PA, SC, TN, TX, VA, WI, WV; CANADA: Ont., Que.

Seasonal Distribution. May 26 (TX) - Aug. 2 (TX).

Identification. This eastern species is widespread throughout the Austroriparian biotic province, except in Louisiana. It is most similar to the paler *G. modestus*. The pale green face is broadly striped with black and the humeral and middorsal thoracic stripes are generally confluent at their upper ends, leaving the antehumeral stripe free at its upper end. The thorax is yellowish-green with a thin midlateral stripe often interrupted above the spiracle. The third lateral stripe may be present, but it is usually wanting. The abdomen is black except for a thin interrupted pale yellow middorsal stripe and laterally on the basal segments. Segments 7-9 are broadly expanded with only a small basal yellow spot laterally on 8 and a broad irregular lateral stripe on 9. The larva was first

described and illustrated by Cabot (1872) and more recently was compared to *G. modestus* by Westfall (1974).

Size. Total length: 46-57 mm; abdomen: 33-42 mm; hindwing: 27-35 mm.

Habitat. Medium-sized rivers or lakes with areas of alternating sand and gravel.

Discussion. The *G. vastus* in Texas are larger and more brown in color than typical northeastern U.S. individuals. Westfall (1974) discussed this cline in color and the possible reasons for it. *Gomphus vastus* is unusual among most gomphids, in that it is commonly found in both lakes and streams. It will perch on rocks along the margin of the rivers or lakes they inhabit. Wilson (1909) noted "...alternating reaches of sand and gravel seemed particularly attractive to these dragonflies." Kellicott (1899) observed "...females fly far out over the [lake] waves, dipping the abdomen in the water as they fly to wash off the eggs." Vidrine (1992a,b) listed sight records for this species in Louisiana, which Mauffray (1997) felt were probably *G. hybridus*. This species should, however, occur in Louisiana.

Subgenus *Gomphus* Leach

Gomphus Leach, 1815.

This group includes the remaining five species in our region. They are more slender than those in *Gomphurus* and males generally show much less expansion laterally of abdominal segments 7-9; females often show none. The face is pale yellowish or green

and lacks black cross stripes. The abdomen and thorax are generally duller in color, often brownish-green, but with complete middorsal and lateral thoracic stripes. The wings are hyaline with the front side of the forewing triangle at least as long as the inner side. Vein A1 in the hindwing runs straight or in an open curve from the gaff to the wing margin and the male caudal appendages are stockier on average than in *Gomphurus*. The larvae are usually distinctly lanceolate, with the abdomen regularly tapering posteriorly.

***Gomphus (Gomphus) apomyius* Donnelly**

Banner Clubtail

(Figs. 305-306, Map 114)

Gomphus apomyius Donnelly, 1966: 102.

Type. Big Creek, San Jacinto Co, Texas; FSCA.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Ouachita, Trinity, White.

General Distribution. UNITED STATES: AL, AR, GA, LA, MS, NC, NJ, TX, VA.

Seasonal Distribution. Mar. 9 (TX) - May 24 (AR).

Identification. This is a small uncommon species, originally described from the Sam Houston National Forest in Southeast Texas. It can be separated from our other gomphids by a combination of characters including its small size. Vein A1 in the

hindwing is straight, not kinked at the outer end of the gaff, and the gaff is nearly as long as the inner side of the forewing triangle. The face and occiput are yellowish and the vertex is black. The thorax is pale yellow with a dark middorsal stripe that is nearly parallel sided. The dark antehumeral stripe is wide and connects to the middorsal stripe at its upper end. The humeral stripe is widest at its top where it is confluent with the antehumeral stripe. It also may come into contact with it at about $3/4$ its length. The thin pale stripe between them is often cut off at its upper end to form a rounded triangular spot. The midlateral stripe is complete but thin and the third lateral stripe is wanting. The legs are black, except for the front and mid femora which are bright or obscurely yellow.

The wings are hyaline with the above-mentioned venational characters. The abdomen is dark brown with yellow middorsally and laterally on segments 1-3. The spots are narrowed apically on segments 4-7. The lateral expansion of segments 7-9 are yellow. The male superior caudal appendages are black. The larva has yet to be described.

Size. Total length: 34-37 mm; abdomen: 26-29 mm; hindwing: 23-27 mm.

Habitat. Small, shaded streams with loose flowing sand.

Discussion. To my knowledge this species has not been taken in Texas, except from the type locality at Big Creek near Shepherd, in San Jacinto Co., part of the Sam Houston National Forest. Little is known about the biology of this species. It was described from mostly reared specimens and the adult is rarely seen. Strangely it has not been found in southwest Louisiana.

***Gomphus (Gomphus) graslinellus* (Walsh)**

Pronghorn Clubtail

(Figs. 307-308, Map 115)

Gomphus graslinellus Walsh, 1862: 394.*Aeschna graslinella*, Kirby, 1890: 66.**Type.** Illinois; types lost.**Regional Distribution.***Biotic Province(s):* Austroriparian, Balconian, Texan.*Watershed(s):* Arkansas, Brazos, Canadian, Colorado, Guadalupe, Mississippi, Ouachita, Red, Rio Grande, St. Francis, White.**General Distribution.** UNITED STATES: AR, CO, ID, IL, IN, IA, KS, KY, MI, MN, MO, MT, ND, NE, OH, OK, SD, TX, WA, WI; CANADA: Alb., B.C., Man., Ont.**Seasonal Distribution.** Mar. 15 (TX) - July 13(OK).**Identification.** This is a species of typically northern distribution. It is medium-sized, greenish-yellow and can be distinguished from *G. militaris* by the largely fused antehumeral and humeral stripes. It has a wide stripe of yellow on abdominal segment 9 that is not present in *G. lividus*, and unlike *G. oklahomensis*, the mid- and third lateral stripes are well defined. The face is greenish-yellow only scarcely marked with brown. The thorax is green with well-defined dorsal and lateral stripes. The middorsal thoracic stripe is parallel-sided. The antehumeral stripe is largely fused with the humeral stripe,

but it does diverge at its upper end becoming free. There is only a thin pale line separating these two medially. The remaining thoracic stripes are present and well separated. The legs are brown, becoming black distally, with a yellow stripe externally on the tibiae. The abdomen is dark brown or black with a pronounced club. The yellow middorsal stripe is interrupted to appear as large spearheads on segments 1-7. Segment 8 has very little yellow dorsally, but a wide stripe is present on segments 9-10. Laterally, segments 8-10 are all brightly marked with yellow. The male caudal appendages are dark brown. Hagen (1885) first described the larva.

Size. Total length: 44-54 mm; abdomen: 32-40 mm; hindwing: 28-35 mm.

Habitat. Ponds, lakes and slow-reaches of small and large streams.

Discussion. Adults rest on rocks or bushes near the water. Females oviposit by flying low over the water and touching the abdomen to the surface every few feet. Needham and Hart (1901) reported that this species emerges between daybreak and sunrise. Whitehouse (1941) has observed females dipping and rising in a series of concave loops over the water.

Gomphus (Gomphus) lividus (Sélys)

Ashy Clubtail

(Figs. 309-310, Map 116)

Gomphus lividus Sélys, 1854: 53.

Gomphus sordidus Hagen in Sélys, 1854: 35.

Aeschna livida, Kirby, 1890: 64.

Gomphus umbratus Needham, 1897a: 184.

Gomphus williamsoni Muttkowski, 1910a: 98.

Type. United States; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Bayou Bartholomew, Brazos, Mississippi, Neches, Ouachita, Red, Sabine, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IN, KY, LA, MA, MD, ME, MI, MS, MO, NJ, NY, NC, OH, PA, SC, TX, VA, WI; CANADA: Ont., Que.

Seasonal Distribution. Mar. 4 (TX) - June 6 (LA).

Identification. This is another early spring species found in the eastern part of our region. It is darker than the other species, with very little color on the abdomen. The face is pale green without dark stripes. The vertex is brown. The thorax is grayish-green with a parallel-sided middorsal thoracic stripe. The antehumeral and humeral stripes are fused, with the former sometimes free at its upper end. Occasionally, a thin, interrupted yellowish line is visible between them. The mid- and third lateral stripes are confluent and a very faint brown lateral stripe is often present at the rear edge of the thorax. The legs are brownish throughout with a yellow line externally on the tibiae. The abdomen is largely black, with a thin pale yellow middorsal line nearly continuous on the middle segments. Segments 8 and 9 are only slightly enlarged in the male. These segments have

relatively little yellow dorsally. Segment 10 is brownish-yellow and the male caudal appendages are black. Needham (1901) first described the larva (as *G. sordidus*) and Louton (1982) more recently illustrated it.

Size. Total length: 46-57 mm; abdomen: 35-41 mm; hindwing: 28-35 mm.

Habitat. Sand or mud-bottomed streams and rivers with moderate current; sheltered inlets and bays of lakes.

Discussion. This can be the most common gomphid in the early spring in the Big Thicket area of southeast Texas. Larvae generally do not venture more than a few inches from the water, early in the morning, to emerge. Walker (1958) reported females flying in a series of "concave loops" on sunny days.

***Gomphus (Gomphus) militaris* Hagen in Sélys**

Sulphur-tipped Clubtail

(Figs. 311-312, Map 117)

Gomphus militaris Hagen in Sélys, 1858: 416.

Aeschna militaris, Kirby, 1890: 65.

Type. Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Neches, Nueces, Red, Rio Grande, Sabine, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: CO, IA, KS, MO, NE, NM, OK, SD, TX; MEXICO: NLN.

Seasonal Distribution. Apr. 1 (TX) - Aug. 14 (NM).

Identification. This is the most widespread *Gomphus* in our region, although it is conspicuously absent in both Arkansas and Louisiana. It is marked with the most yellow and is the brightest colored of our species. The face is yellow with no evidence of dark stripes. Females have a pair of minute spines present on the vertex. The front of the thorax is distinctly yellower than the darker sides. The brown middorsal stripe is narrow and widens slightly toward the collar. The antehumeral stripe is well separated from the humeral stripe and is free at its upper end. The pale stripe between them is 1/2-2/3 their width at their widest. The humeral stripe narrows at its lower end. The midlateral stripe is thin and always present, but generally interrupted above the spiracle. The third lateral stripe is also thin, but well-developed. The legs have more yellow on them than do those in other species. The otherwise black femora and tibiae both have yellow stripes on their outer surfaces. The black abdomen is conspicuously narrowed medially. The pale yellow middorsal stripe is wide and nearly continuous on the middle segments. Segments 7-9 are expanded laterally, less so in females, and segments 8-10 are diffusely yellow with the caudal appendages brownish-yellow. Males are distinctive because of an enlarged, distinctly warty peduncle. Bird (1934) described and illustrated the larva.

Size. Total length: 47-54 mm; abdomen: 34-41 mm; hindwing: 28-35 mm.

Habitat. Ponds, lakes, streams and creeks with muddy bottoms.

Discussion. This species is found in a variety of habitats, often perching on the ground or on rocks surrounding the water. It can be equally as common away from the water, in open fields.

***Gomphus (Gomphus) oklahomensis* Pritchard**

Oklahoma Clubtail

(Figs. 313-314, Map 118)

Gomphus oklahomensis Pritchard, 1935: 1.

Type. Fourche Maline Creek, N of Wilburton, Oklahoma; UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Neches, Ouachita, Red, Sabine, San Jacinto, Trinity.

General Distribution. UNITED STATES: AR, LA, OK, TX.

Seasonal Distribution. Mar. 23 (LA) - Aug. 31 (TX).

Identification. This species has a rather restricted range, found only in the south-central U.S. It is most similar to *G. graslinellus* and *G. lividus*, but it can be separated from the former by its smaller size and paler legs. The latter has the antehumeral and humeral stripes fused, and in *G. oklahomensis*, they are narrowly separated by a pale stripe. The

face is pale green and the vertex is dark brown. The thorax is grayish-green with a dark middorsal stripe that widens as it approaches the collar. The antehumeral and humeral stripes are narrowly separated by a pale stripe no more than 1/5 their width, except at their extreme lower ends where they are confluent. The mid- and third lateral stripes are present and diffusely joined together. The legs are brown, pale on the under side of the femora with a yellowish-white stripe on the outer surface of the tibiae, extending down onto the tarsi. The abdomen is largely black, with a broad yellowish stripe ventrolaterally in females. The pale middorsal stripe is nearly continuous in females and tapers to a point on each segment in males. Segments 7-9 are only slightly expanded laterally in the male and not at all in the female. The middorsal stripe is reduced to a small basal spot on segment 8, there may be a disconnected thin line distally in females, and a broad stripe on segment 9. Segment 10 has a conspicuous pale spot. Segments 8-9 are yellow laterally. The male caudal appendages are brown. Pritchard (1935) described the larva from exuviae at the time of the above description.

Size. Total length: 44-49 mm; abdomen: 33-36 mm; hindwing: 24-30 mm.

Habitat. Small creeks and streams with moderate current and sand or mud bottoms.

Discussion. Females usually don't venture far from the bank, ovipositing 1-2 feet above the water, by touching the abdomen to the surface and quickly rising again. Several dips are usually made before moving to a new location.

Genus *Hagenius* Sélys

Dragonhunter

Hagenius Sélys, 1854.

This primitive looking monotypic genus includes the largest North American clubtail dragonfly. It is a widely distributed, common, voracious predator along many streams, but it is somewhat of a relic. Its closest relatives are Palearctic and Oriental in distribution. As its common name implies, it is a routine predator of small and medium sized insects, including other dragonflies. The black thorax is robust and striped with yellow. The legs are long and the tibiae are armed with a row of strong spines that aid them in catching prey. The wings are hyaline with a long, somewhat narrow pterostigma. The abdomen is long, robust and with hardly any indication of a club in either sex. The individual abdominal segments decrease in length from 6 on. The black caudal appendages are stout and somewhat shortened. The larva is probably the most distinctive of all Anisoptera in North America. It is large, about the size of a half-dollar, and incredibly flattened with a row of prominent middorsal abdominal hooks.

Hagenius brevistylus Sélys

Dragonhunter

(Map 119)

Hagenius brevistylus Sélys, 1854: 82.

Type. North America; Hope Mus., Oxford.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Guadalupe, Mississippi, Neches, Ouachita, Red, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, PA, SC, TN, TX, VA, VT, WI, WV; CANADA: Man., N.B., N.S., Ont., Que.

Seasonal Distribution. May 26 (LA) - Sep. (TX).

Identification. This large, showy dragonfly is not likely confused with any other gomphid in our region. Its eyes are completely separated unlike in *Cordulegaster*. The face is yellowish-green cross striped with black. The thorax and abdomen are largely black. The thorax has a pair of brilliant yellow stripes middorsally and laterally. The legs are long and black. The wings are hyaline with black veins and may become tinted in older individuals. The abdomen is black with a thin interrupted yellow middorsal and ventrolateral stripe to segment 8. The terminal segments are only slightly expanded, do not appear clubbed, and are characteristically tucked under during flight. The larva was first described and illustrated by Cabot (1872).

Size. Total length: 76-91 mm; abdomen: 53-65 mm; hindwing: 47-59 mm.

Habitat. Streams, rivers and creeks with moderate to fast current and undercut banks.

Discussion. This species is often seen taking prey the size of medium dragonflies and large Swallowtail butterflies. Erickson (1989) reported that the presence of this species

resulted in ceased feeding and wing clapping in aggregations of *Calopteryx maculata*. When not foraging, this species will often perch on limbs of trees near water. The males can be remarkably bold, not easily scared off by human intruders, when patrolling streams. Females usually oviposit by regularly dropping down from a perch to water's edge and dipping their abdomen to the surface, but they will also fly back and forth in a small area periodically, tapping the abdomen to the water.

Genus *Ophiogomphus* Sélys

Snaketails

Ophiogomphus Sélys, 1854.

This is a relatively large group of 19 North American medium-sized species, including a single Ozark species just entering the northeastern part of our region. In most species, the midlateral stripe is wanting. The legs are short and armed with stout spines. The wings are hyaline and have a distinct semicircular anal loop. The pale abdomen is usually stout and heavily maculated. The superior caudal appendages are short and stocky, generally only as long as segment 10. Females usually have two pairs of spines on the vertex, however Paulson (1998a) discussed the varying presence or absence of these spines in 8 of the 19 species. Carle (1981) provided a key to the eastern U.S. species, but because of several recent new species to the group this was updated by Cooke and Daigle (1985). Carle (1992) gave adult and larval keys for all North American

species. The larvae are short and stout with divergent wingpads and tibial hooks used in burrowing. They are typically found in streams and rivers. Dunkle (1984a) noted severe head damage to females of this group during mating. Dunkle said of the damage, "it is nearly the maximum possible to imagine and still allow the female to live."

Ophiogomphus westfalli Cook & Daigle

Westfall's Snaketail

(Map 120)

Ophiogomphus westfalli Cook and Daigle, 1985: 90.

Type. Caddo River, Montgomery Co., Arkansas; FSCA.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Ouachita, White.

General Distribution. UNITED STATES: AR, KS, MO.

Seasonal Distribution. May 9 (AR) - July 18 (AR).

Identification. This single *Ophiogomphus* clubtail occurs in the Interior Highlands of the Arkansas Ozarks and Ouachita Mountains. It was only recently described by Cook and Daigle (1985). This species is green with a conspicuous absence of dark thoracic markings. Only a faint brown middorsal stripe is present. The female has prominent occipital spines and occasionally vestigial postoccipital spines. The wings have the basal

1/3 flavescent and a yellow costa. The pterostigma is black. The abdomen is pale yellow dorsally, with an interrupted dark brown dorsolateral stripe on segments 1-6. Segments 7-9 are yellow dorsally with black apically and a reddish-brown full length dorsolateral stripe. Segment 10 is mostly yellow. Cook and Daigle also described and illustrated the larva.

Size. Total length: 48-50 mm; abdomen: 31-35 mm; hindwing: 29-31 mm.

Habitat. Clear forest mountain streams with strong riffles and cobble substrate.

Discussion. Harp and Rickett (1977) reported *O. rupinsulensis* from Arkansas before this species was described. Those specimens have all been reexamined and found to be *O. westfalli* (Cooke and Daigle 1985). Males come out to patrol around noon.

Genus *Phyllogomphoides* Belle

Leafetails

Phyllogomphoides Belle, 1970.

This is another primarily Neotropical group with two representatives in the southwestern U.S. They are large gomphids, with long thin abdomens and short legs, reminiscent of *Aphylla*. They are greenish-yellow in color, striped with brown. The face is pale yellowish with brown cross stripes. The thorax is yellowish-green with four or five brown or black lateral stripes. The legs are pale basically with dark outer surfaces, becoming entirely black distally. The spines of the hind femora are relatively stout, with

the apical one twice as long as any other. The wings are hyaline with a yellow to black costa and dark pterostigma. The anal loop is generally well developed. The abdomen is largely brown with wide yellowish pale rings and segments 8-10 are greatly expanded laterally. The male superior caudal appendages are forcipate.

The larvae of our species are similar to those of *Dromogomphus*, but they have larger burrowing hooks on the forelegs, segment 10 is longer than 9, and the middorsal spinelike process on segment 9 is uplifted. Needham and Westfall (1955) provided larval keys to our species. Belle (1970) established the genus from the strictly South American *Gomphoides* and Gloyd (1973, 1974) and Donnelly (1979) further characterized the group.

KEY TO ADULT SPECIES OF *PHYLLOGOMPHOIDES*

1. Third and fourth lateral stripes confluent at their lower ends; abdominal segments 8 and 9 in female greatly expanded laterally, to same width as male
 *albrighti*
- 1'. Third and fourth lateral stripes not confluent, but distinctly separate, at their lower ends; abdominal segments 8 and 9 in female expanded only slightly, if at all *stigmatus*

Phyllogomphoides albrighti (Needham)

Five-striped Leaf-tail

(Map 121)

Gomphoides albrighti Needham, 1950: 1.

Phyllogomphoides albrighti, Gloyd, 1973: 6.

Type. San Antonio River, Bexar Co., Texas; CU.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Navahonian, Tamaulipan, Texan.

Watershed(s): Brazos, Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio, Trinity.

General Distribution. UNITED STATES: NM, TX; MEXICO: NLN, SLP, TAM.

Seasonal Distribution. May 19 (TX) - Sep. 18 (TX).

Identification. This species is very similar to *P. stigmatus* and our *Aphylla* species, but it can be distinguished by the presence of a fourth lateral stripe at the rear margin of the thorax. The face is pale and thorax yellowish-green. The dark middorsal stripe is widest at its lower end, but not running onto the collar. The dark antehumeral stripe may be free at both ends or thinly confluent with the humeral stripe. The midlateral stripe is generally wider than the others and usually confluent at least with the lower end of the humeral stripe. The third and fourth lateral stripes are broadly confluent at their lower ends. The wings are hyaline with a dark pterostigma. The abdomen is blackish, becoming darker in older individuals, with broad yellowish anterior rings. Segments 8-10 are expanded considerably laterally in both sexes. The caudal appendages are yellow.

Size. Total length: 60-65 mm; abdomen: 45-49 mm; hindwing: 37-41 mm.

Habitat. Streams and rivers with swift current and cobble or muddy bottoms, emarginated by vegetation.

Discussion. This species was described from the San Antonio River near Berg's Mill in Bexar County, Texas, from specimens collected by Paul Albright, who stated, "They were quite wary, and were captured only by creeping up on them very slowly, and without any quick motions. They are not ordinarily very fast in flight," (Needham 1950). This species inhabits streams and rivers and is generally not found with *P. stigmatus*.

Phyllogomphoides stigmatus (Say)

Four-striped Leaf-tail

(Map 122)

Aeschna stigmatus Say, 1839: 17.

Progomphus stigmatus, Sélys, 1854: 72.

Neogomphoides stigmata, Muttkowski, 1910a: 81.

Gomphoides stigmatus, Needham, 1940: 368.

Phyllogomphoides stigmatus, Gloyd, 1973: 6.

Type. Texas; lost.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Tamaulipan, Texan.

Watershed(s): Brazos, Cimarron, Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: AZ, NM, OK, TX: MEXICO: NLN, TAM.

Seasonal Distribution. Jun. 11 (TX) - Sep. 14 (TX).

Identification. This species is similar to our *Aphylla* but the hind femur has a stout apical spine, longer than the preceding ones, in both sexes. It is larger than *P. albrighti* and lacks a fourth lateral thoracic stripe. The face and thorax are pale yellowish-green. The thorax is like that of *P. albrighti* except in the lateral thoracic stripes, which are narrower. The third lateral stripe ends ventrally and is never confluent with the midlateral stripe. The wings and abdomen are similar to those of *P. albrighti*, except in females, which have a nearly cylindrical abdomen, with only weak expansion of the posterior segments laterally. Needham (1904) described and illustrated the larva.

Size. Total length: 65-70 mm; abdomen: 49-56 mm; hindwing: 39-44 mm.

Habitat. Ponds and slow reaches of streams with muddy bottom and heavy vegetation.

Discussion. This species seems to be more widely distributed than the preceding one and is commonly found at livestock and artificial ponds, where males will perch high on grasses, facing the water. They are quite flighty, never staying perched for very long, but often returning to their original perch. Adults mature in open pastures of tall grass some distance from water. Our two *Phyllogomphoides* species are generally not taken together, but this species has been found with *P. albrighti* at Dolan Falls on the Devils River in southwest Texas.

Genus *Progomphus* Selys

Sanddragons

Gomphus (*Progomphus*) Selys, 1854.

Progomphus, Selys & Hagen, 1858.

This large New World genus is represented by four North American species, including two in the south-central U.S. They are smaller clubtails, with short legs and are generally grayish-green to yellow marked with brown or black. The thorax is variously marked and the wings have a basal touch of color in our species. There is a basal subcostal crossvein in all wings but no anal loop. The anal triangle in males is comprised of three cells and doesn't extend to the hind margin of the wings as in *Aphylla* and *Phyllogomphoides*. The superior caudal appendages are yellow in our species and there is only a slight swelling of abdominal segments 8-10. The larvae are generally quite pale and very slender, tapering posteriorly. They are found in loose sandy-bottomed substrate of streams. Byers (1939) and Bell (1973) studied the taxonomy and distribution of this group and Needham (1941) studied various components of their life history. Tennessen (1993) gave a key to the North American larvae and Dunkle (1984b) reported on several novel features of reproduction in U.S. members of this genus.

KEY TO ADULT SPECIES OF *PROGOMPHUS*

1. Mid-lateral thoracic stripe absent above spiracle; thorax generally gray; larger

- species, greater than 56 mm in length *borealis*
1. Mid-lateral thoracic stripe complete above spiracle; thorax not gray; smaller species, less than 55 mm in length *obscurus*

***Progomphus borealis* McLachlan in Sélys**

Gray Sanddragon

(Map 123)

Progomphus borealis McLachlan in Sélys, 1873: 764

Progomphus obscurus borealis, Muttkowski, 1910a: 79.

Type. Oregon, U.S.; BMNH.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Kansan, Navahonian.

Watershed(s): Colorado, Red, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, NM, OR, TX, UT; MEXICO: BCS, CHI, DGO, JAL, MCH, SON.

Seasonal Distribution. May 30 (TX) - Sep. 13 (TX).

Identification. This is the only western species of this genus in the U.S. It is easily distinguished from the eastern species by its larger size and the absence of a midlateral stripe. It is dull grayish-green. The thorax is yellow in the front and grayish-green laterally. The antehumeral stripe is so angled at its upper end that it nearly becomes

confluent with the middorsal stripe. It is confluent with the humeral stripe at its lower end and again at about 2/3 its length, but the latter is free at its upper end. The midlateral stripe is wanting and entirely absent above the spiracle. The third lateral stripe is present and well-developed. The wings are hyaline with only a wash of brown at the extreme bases. The abdomen is largely black, ringed with yellow. Segments 8-10 are expanded slightly laterally and the superior caudal appendages are yellow. In males the inferior appendages are black. Novelo and Gonzales (1991) described and illustrated the larva.

Size. Total length: 56-62 mm; abdomen: 42-45 mm; hindwing: 33-36 mm.

Habitat. Shallow desert, sandy-bottomed streams.

Discussion. I have taken this species in Palo Duro Canyon State Park, Texas, on the Prairie Dog Town Fork of the Red River. This is apparently the eastern-most locality for this species, where it is found flying with *P. obscurus*. This and Caprock Canyons State Park are the only localities I know of where these two species are sympatric.

Progomphus borealis flies along stream margins with heavy vegetation occasionally resting on exposed sand banks in relative shade, where it can be quite inconspicuous. This species is often seen with its abdomen directed upward, in an obelisk position, so as to almost appear like it is standing on its head. Females oviposit while flying erratically, low over the water and tapping their abdomens to the surface. Both sexes of this species have a straight smooth, erect spine middorsally at the rear edge of the first abdominal tergite that is apparently a persistent larval dorsal hook (Dunkle 1984b).

***Progomphus obscurus* (Rambur)**

Common Sanddragon

(Map 124)

Diastatomma (Neaprogomphus) obscurum Rambur, 1842: 170.*Gomphoides obscura*, Sélys, 1850: 360.*Gomphus (Progomphus) obscurus*, Sélys, 1854: 55.*Progomphus obscurus*, Sélys & Hagen, 1858: 461.*Progomphus meridionalis* Hagen, 1885: 52.*Progomphus (Neoprogomphus) obscurus*, Carle, 1986: 322.**Type.** Amerique septentrionale; IRSN.**Regional Distribution.***Biotic Province(s):* Austroriparian, Balconian, Kansan, Navahonian, Tamaulipan, Texan.*Watershed(s):* Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity.**General Distribution.** UNITED STATES: AL, AR, CO, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, NE, NJ, NH, NM, NY, OH, OK, PA, SC, TN, TX, VA, VT, WI, WV.**Seasonal Distribution.** Apr. 11 (LA) - Sep. 9 (TX).**Identification.** This species is much more widely distributed throughout its range, than

the former. It is slightly smaller with a complete midlateral thoracic stripe and a strong patch of brown basally in each wing. The thorax is pale yellow with the dark middorsal stripe widening anteriorly toward the collar and isolated from the antehumeral stripe at its upper end. The humeral and antehumeral stripes are normally confluent at both ends with a thin pale stripe between them. The mid- and third lateral stripes are both present and well developed. The legs are short and darker than in *P. borealis*. The basal brown spot in each wing extends out generally to the first antenodal crossvein. They can be distinguished from *E. designatus*, in this respect, by the distinctly yellow superior and black inferior caudal appendages in the male and the general maculation of the abdomen, which is similar to that of *P. borealis*. Needham (1941) described and illustrated the larva.

Size. Total length: 51-55 mm; abdomen: 39-43 mm; hindwing: 31-35 mm.

Habitat. Shallow streams and lakes with a sandy bottoms.

Discussion. Tinkham (1934) erroneously reported this eastern species from Presidio County (see Byers 1939), when referring to *P. borealis*. This is the most abundant clubtail species, found as larvae in many sandy-bottomed streams of east Texas. Adults can be somewhat uncommon, taking refuge in wooded areas surrounding the streams they emerge from. It is not a strong flier and when seen is usually not difficult to catch. It is often found obelisking, as in *P. borealis*. Females oviposit by quickly flying low over the water and tapping their abdomens to the surface. They however, also hover over a riffle and drop eggs (Dunkle 1984b). This is the only North American gomphid where males guard females during oviposition. Dunkle (1984b) reported sperm removal during

copulation in this species, the first known instance in this family. Numerous authors have commented on the behavior of this species in the field (Brimley 1903; Wilson 1912; Howe 1917; Kennedy 1917; Williamson 1920, 1932; Montgomery 1925, 1933; Byers 1925, 1930, 1939; Dunkle 1989a).

Genus *Stylogomphus* Fraser

Least Clubtail

Stylogomphus Fraser, 1922.

This is a small oriental group of gomphids with a single disjunct eastern U.S. species. This U.S. representative has long been placed in the eastern U.S. genus, *Lanthus*, but Chao (1954) referred it to *Stylogomphus*. Carle (1980) gave a brief taxonomic history of this genus. It includes the smallest clubtail in the U.S. It is a group of dark green gomphids with hyaline wings and an exceptionally slender abdomen in the male. The larva is distinctly stocky with a depressed abdomen and most noticeably a broadly ovate third antennal segment. Carle (1980) gave adult and larval keys to all U.S. Octogomphines and in 1984 discussed the phylogeny and biogeography of the tribe Octogomphini, including *Stylogomphus*.

***Stylogomphus albistylus* (Hagen in Sélys)**

Least Clubtail

(Map 125)

Gomphus albistylus Hagen in Sélys, 1878: 460.

Gomphus naevius Harvey, 1898: 63,85.

Aeschna albistyla, Kirby, 1890: 66.

Lanthus albistylus, Needham, 1901: 443.

Lanthus naevius, Muttkowski, 1910: 88.

Stylogomphus albistylus, Chao, 1954: 65.

Type. Maine; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Ouachita, Red, St. Francis, White.

General Distribution. UNITED STATES: AL, AR, CT, GA, KY, MA, MD, ME, MI, MO, NC, NH, NJ, NY, OH, OK, PA, SC, TN, VA, VT, WI, WV; CANADA: N.B., N.S., Ont., Que.

Seasonal Distribution. Jun. 21 (AR) - Jun. 26 (OK).

Identification. This species is the smallest gomphid in our region and is found in forest streams in eastern Oklahoma and western Arkansas. It is dark green with distinct black cross stripes on the face. The thorax is green with the front appearing black except for a thin pale middorsal carinae, two lateral pale stripes and the anterior collar. The humeral and midlateral stripes are all dark and well developed. The third lateral stripe is usually

present, but may be wanting in some individuals. The wings are hyaline with a dark brown pterostigma and sometimes a hint of flavescence basally. The abdomen is black, with narrow pale yellowish-green basal rings. The caudal appendages are pale distally.

Size. Total length: 31-36 mm; abdomen: 21-26 mm; hindwing: 20-23 mm.

Habitat. Shallow forest streams with moderate current.

Discussion. The larva of this species is much easier to come by than the wary adults. Males will perch on emergent rocks and gravel bars in the sun, surrounded by swift current and are quick to rapid flight if disturbed. Williamson (1932a) described them as "wary and nervous, their flight impossible to follow." Females oviposit in the afternoon by flying low to the water in a figure eight or similar pattern, tapping their abdomen and releasing eggs in areas of moderate riffle. Leonard (1940) and Kielb *et al.* (1996) discussed the habitat of this species in Michigan in detail and Blust (1980) studied its life history. Phillips (1996) found *S. albistylus* larvae had a significant preference for the interstitial spaces at the edge of riffles in Ozark streams.

Genus *Stylurus* Needham

Hangingtails

Stylurus Needham, 1897a.

This group of 11 North American species is represented in our region by two eastern and one western species. Species are usually found perched on bushes or grasses,

rarely on the ground. They are moderately sized yellowish to green dragonflies. The eyes in tenerals are gray, olive green or brown and become bright blue or green in adults. The top of the frons is distinctly narrow. The dark middorsal thoracic stripe is generally widened so much that it leaves only a narrow isolated pale stripe on each side above the collar. The legs are relatively short and the wings are hyaline, with the front side of the forewing triangle distinctly longer than the inner side. The abdomen is long and slender and males generally lack a strong club. The larvae are distinctly elongate with small tibial hooks for burrowing. Walker (1928) gave a key to the larvae.

KEY TO ADULT SPECIES OF *STYLURUS*

- 1. Lateral thoracic stripes vestigial or absent; western species *intricatus*
- 1'. Lateral thoracic stripes well-developed; eastern species 2
- 2(1'). Sides of thorax yellowish; vertex entirely black; area between lateral thoracic stripes grayish *laurae*
- 2'. Sides of thorax olivaceous; posterior half of vertex olivaceous green; area between thoracic stripes is olivaceous *plagiatus*

Stylurus intricatus (Hagen in Sélys)

Brimstone Clubtail

(Figs. 315-316, Map 126)

Gomphus intricatus Hagen in Sélys, 1857: 418.

Aeschna intricata, Kirby, 1890: 65.

Gomphus (Stylurus) intricatus, Needham & Heywood, 1929: 99.

Stylurus intricatus, Davies & Tobin, 1985: 37.

Type. Texas; ?.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, KS, MO, NE, NM, NV, SD, TX, UT, WY; CANADA: Alb., Sask.

Seasonal Distribution. Jun. 8 (TX) - Oct. 4 (TX).

Identification. This is the only western *Stylurus* in the region. It is pale yellow-green with little very dark maculation on the head. The thorax is pale green with the dark brown middorsal stripe interrupted medially by the pale carina. The narrow antehumeral stripe becomes exceedingly pale at its lower end. The remaining lateral stripes are obsolete or nearly so. The femora are yellow except distally where they become darker running into the black tibiae and tarsi. The abdomen is yellow green with brown triangular lateral spots confluent dorsally. The caudal appendages are yellow edged with black in the male. Walker (1928) described and illustrated the larva.

Size. Total length: 41-55 mm; abdomen: 32-43 mm; hindwing: 26-32 mm.

Habitat. Slow flowing, open, desert streams and rivers.

Discussion. Kennedy (1917) described the behavior of this desert species, that "...spends

much of its time seated on some bush or piece of driftwood, rarely alighting on the ground. However, when it is on the wing it is very energetic, and the males fly rapidly back and forth in short beats, about 6 inches above the surface of the water. The females oviposit while flying in the same quick, nervous manner...In copulation the male picks the female up either from over the water or from some bush, and after a very short nuptial flight settles for a very long period in copulation." Harp and Rickett (1977) reported this species from Arkansas, but later Harp (1983) determined the record was based on misidentified material.

Stylurus laurae (Williamson)

Laura's Clubtail

(Figs. 317-318, Map 127)

Stylurus laurae Williamson, 1932b: 3.

Gomphus (Stylurus) laurae, Needham & Westfall, 1955: 240.

Type. North Saluda River, Greenville Co., South Carolina; UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Ouachita, Red, Sabine, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, IN, KY, LA, MD, MI, MS, NC, OH, SC, TN, TX, VA.

Seasonal Distribution. Apr. 6 (LA) - Jul. 28 (LA).

Identification. This is the less common of the two eastern *Stylurus* species in our region.

It is greenish-yellow with a distinct black cross stripe on the face. The dark middorsal thoracic stripe widens anteriorly isolating a pale, smoothly rounded, stripe, that is nearly, but not confluent with the pale collar. The antehumeral and humeral stripes are separated by a thin, often interrupted, pale line between them. The rest of the thorax is yellowish green with the remaining lateral stripes present and complete, although the midlateral stripe may be somewhat wanting at its lower end. The legs are pale basally becoming black distally and on the tibiae and tarsi. The wings are hyaline and there is a nearly complete yellow middorsal stripe on abdominal segments 1-7.

Size. Total length: 61-65 mm; abdomen: 42-48 mm; hindwing: 36-43 mm.

Habitat. Shallow, well shaded, rivers and streams with cobble, sand or mud substrate.

Discussion. Williamson (1932a) said that this species "almost invariably rested on leaves, 1-10 feet above the water. Two alighted on logs projecting from the water, but remained there only a few seconds. On leaves they were not wary and were easily approached and captured." This species was only known in Texas from larval collections (Donnelly 1978) taken in the Sam Houston National Forest, until Bob Behrstock photographed a single adult female at Big Creek Scenic Area in June of 1998.

Stylurus plagiatus (Sélys)

Russet-tipped Clubtail

(Figs. 319-320, Map 128)

Gomphus (Gomphus) plagiatus Sélys, 1854: 57.

Gomphus (Gomphus) elongatus Sélys, 1854: 58.

Aeschna plagiata, Kirby, 1890: 65.

Stylurus plagiatus, Needham, 1897a: 167.

Gomphus (Stylurus) plagiatus, Needham & Heywood, 1929: 101.

Type. United States; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Guadalupe, Mississippi, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, AZ, CA, FL, GA, IA, IL, IN, KS, KY, LA, MD, MI, MO, MS, NC, NJ, NM, NV, NY, OH, OK, SC, TN, TX, VA, WI, WV; CANADA: Ont.; MEXICO: NLN.

Seasonal Distribution. May 25 (TX) - Nov. 7 (TX).

Identification. This is the most widespread of our three *Stylurus* species. It is darker than *S. laurae*, has widely separated humeral and antehumeral stripes, and the posterior 1/2 of the vertex is green, not black. The eyes are brilliant blue in mature adults. The brown middorsal stripe on this dark green species widens anteriorly, becoming confluent at both ends with the antehumeral stripe. The dark humeral and antehumeral stripes are

widely separated by an olivaceous green stripe as stated above. The midlateral stripe is thin, 1/2 the width of the humeral stripe and somewhat sinuate or interrupted at its upper end. The third lateral stripe is less well developed and often interrupted in its lower 1/2. The wings are hyaline, but may become amber in older females. The legs are, as in *S. laurae*, pale basally becoming black on the tibiae and tarsi. The pale abdominal middorsal stripe is nearly obsolete on the tawny brown abdomen. Segments 7-10 are expanded laterally and are orange-brown, as are the caudal appendages. Walker (1928) and Byers (1930) described and illustrated the larva.

Size. Total length: 53-66 mm; abdomen: 38-50 mm; hindwing: 20-41 mm.

Habitat. Weedy rivers, streams and lakes with moderate to little current.

Discussion. Pairs will often fly into the trees or bushes surrounding the streams during copulation. Females oviposit in a fast, low, irregular flight, touching the water at intervals of several meters, or they may rest, perching between these flights (Dunkle 1989a). This species has been seen in copula with *Dromogomphus*. Williamson (1932a) reported capturing a female in copula with *Dromogomphus spinosus*, and later male in copula with a female *Dromogomphus armatus*. There is an apparent geographical variation in the eye color of this species, with most individuals, in our area, changing from gray or green to blue with age, but in Florida they remain primarily green (Dunkle pers. comm.).

CHAPTER 11

CORDULEGASTRIDAE

Spiketails

This family is represented by a single genus in the United States. Two of nine North American species occur in the eastern limits of our area. These dragonflies are similar to the petalurids in their large primitive appearance, but are generally black and yellow in coloration. The eyes meet at only a single point on the top of the head or they may be barely separated. There is a medial cleft in the labrum.

The legs are short, with the hind femora barely reaching the abdomen. The wings are hyaline and the anal triangle of the male is 3-4 cells. The anal loop is rather short and quite variable in the number of cells and the abdomen is distinctly cylindrical, lacking both dorsal and lateral carinae.

The larvae are very hairy, with eyes elevated above the head. The labium is large and spoon shaped with pronounced irregular jagged teeth. They are found in small forest streams.

Genus *Cordulegaster* Leach

Spiketails

Cordulegaster Leach, 1815.

Thecaphora Charpentier, 1840.

Taeniogaster Sélys, 1854.

Thecagaster Sélys, 1854.

Zoraena Kirby, 1890.

Kuldanagaster Yousuf & Yunus, 1974.

Archaeogaster Lohmann, 1992.

Kalyptogaster Lohmann, 1992.

Lauragaster Lohmann, 1992.

Panaeagaster Lohmann, 1992.

Sonjagaster Lohmann, 1992.

These large dark brown-black dragonflies have distinctly brilliant green or blue eyes and are vividly marked with yellow lateral thoracic stripes on the pterothorax and spots on the abdomen. The hyaline wings lack a brace vein and the triangles are usually two celled. The well-developed anal loop is never foot-shaped and comprises 2-10 cells. The abdomen is variably marked with yellow.

Females have a spine-like ovipositor for depositing eggs in the substrate of shallow streams. The caudal appendages of the male are short, usually shorter than segment 10. The larvae are noticeably hairy and subcylindric in general shape, with the abdomen tapering to a distinct point. The larvae can be locally abundant in narrow, gently-flowing sandy or mucked bottomed streams of hardwood forests.

The taxonomy in this family has long been debated. Carle (1983) recognized two

new genera amongst the U.S. species and most recently Lohmann (1992) performed a cladistic analysis on the family that resulted in splitting our eight U.S. species into six genera. I do not recognize these genera but rather follow Garrison (1997) in maintaining all U.S. species belong in a single genus. An undescribed species taken in Clark and Montgomery counties, Arkansas, is currently being described by Ken Tennessen.

KEY TO SPECIES OF *CORDULEGASTER*

1. Dorsal abdominal spots spear-shaped on middle abdominal segments, 2-7;
occiput raised in a conical eminence *obliqua*
- 1'. Dorsal abdominal spots not spear-shaped on middle abdominal segments, 2-7;
occiput not raised into a conical eminence *maculata*

Cordulegaster maculata Sélys

Twin-spotted Spiketail

(Map 129)

Cordulegaster maculatus Sélys, 1854: 105.

Pangaegaster maculata, Lohmann, 1992: 10.

Type. Georgia; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Neches, Ouachita, Red, Sabine, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, CT, FL, GA, IN, KY, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ, NY, OH, PA, SC, TN, TX, VA, VT, WI, WV; CANADA: N.B., N.S., Ont., P.E.I., Que.

Temporal Distribution. Mar. 2 (LA) - Apr. 18 (TX).

Identification. This species is confined to the eastern Austroriparian biotic province of our area, where it may be confused with several species in the field. *Boyeria vinosa* can be distinguished in the field by two lateral thoracic spots, rather than stripes. *Basiaeshna janata* has basal brown spots in both wings and blue on the abdomen. The cruisers, *Didymops* and *Macromia*, both have a single lateral thoracic stripe.

In *C. maculata* the eyes are brilliant blue or green in life. The pterothorax is dark brown, becoming paler below where there are numerous gray hairs around the legs. There are two broad pale stripes laterally. The wings are hyaline, sometimes becoming smoky. The abdomen is dark brown with a paired row of pale yellow spots. The larva was described by Needham (1901).

Measurements. Total length: 65-76 mm; abdomen: 47-58 mm; hindwing: 38-50 mm.

Habitat. Small, rapidly flowing spring-fed forest streams and seepages with sandy or muck bottoms.

Discussion. This early spring species is widely distributed throughout the eastern half of the U.S. and Canada. Little has been published about its biology. Johnson (1982) found that mayflies make up the majority (69%) of the larval diet and Dunkle (1989a) briefly discussed details of copulation, which lasts an average of 50 min, and oviposition.

***Cordulegaster obliqua* (Say)**

Arrowhead Spiketail

(Map 130)

Aeschna obliqua Say, 1839: 15.*Cordulegaster fasciatus*, Rambur, 1842: 178.*Cordulegaster (Taeniogaster) obliquus*, Selys, 1854: 89.*Taeniogaster fasciata*, Kirby, 1890: 81.*Taeniogaster obliqua*, Davies & Tobin, 1985: 61.*Cordulegaster obliqua*, Garrison, 1997: 565.**Type.** North America; IRSN.**Regional Distribution.***Biotic Province(s)*: Austroriparian, Texan.*Watershed(s)*: Arkansas, Bayou Bartholomew, Brazos, Mississippi, Neches, Ouachita, Red, Sabine, St. Francis, Trinity.**General Distribution.** UNITED STATES: AL, AR, CT, FL, GA, IA, IL, IN, KY, KS, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, PA, SC, TN, TX, VA, WI, WV; CANADA: Ont., Que.**Temporal Distribution.** Apr. 17 (AR) - Jun. 7 (AR).**Identification.** Like, *C. maculata*, this species is restricted to the eastern limits of our area. In addition to a later emergence period, it can be separated from the former by a

row of spear-shaped dorsal pale yellow markings on the abdomen. It can be distinguished from other similar species by the characters given under the description of *C. maculata*.

Cordulegaster obliqua is darker than *C. maculata*, often appearing nearly black. It has aqua-blue eyes and two broad pale yellow stripes laterally on the pterothorax. The wings are hyaline and rarely become smoky. The abdomen is dark red-brown with yellow spear-shaped marks on segments 2-7.

Two subspecies, both of which occur in our area, are recognized. The nominate subspecies, *C. o. obliqua*, is found in Texas and is generally smaller, 72-80 mm. The forewing triangle is usually comprised of 2-cells and the anal triangle of the male is 3-celled. *C. o. fasciata* is found in Arkansas and Louisiana and is generally larger, 82-88 mm. The forewing triangle is generally 3-celled and the anal triangle in males is comprised of 4-cells. Needham (1905) described the larvae.

Measurements. Total length: 72-88 mm; abdomen: 48- 72 mm; hindwing: 41-60.

Habitat. Small, rapidly flowing spring-fed forest streams and seepages with sandy or muck bottoms.

Discussion. This species emerges later and has a longer flight period than *C. maculata*, but is less likely to be encountered. It is uncommon and somewhat elusive throughout its range (Needham 1905; Walker 1958). Nothing has been published about its behavior, but as far as is known, it similar to *C. maculata*. Needham (1905) gave a detailed description of the larval behavior.

CHAPTER 12

CORDULIIDAE

Cruisers & Emeralds

This family includes two distinct groups regarded as subfamilies here and described in greater detail below. Collectively, these dragonflies are medium-sized to large and often somewhat metallic in coloration. The compound eyes meet broadly on top of the head and generally bear a low tubercle on their rear margin. The thorax is often marked with pale stripes. The legs vary in length, but are generally long and may or may not have pronounced keels on the tibiae. The wings are generally hyaline or marked with brown, but with no bracevein under the pterostigma. The triangles in the forewing are twice, or more, as far from the arculus as those in the hindwing, and they are generally elongated transversely. The anal loop can take one of these forms: foot-shaped, with little or no development of the toe; or semicircular. Males have an auricle on each side of abdominal segment 2. The larvae of this group are broad with a spoon-shaped labium and can be quite difficult to separate from those of the family Libellulidae. The taxonomic affinities of this group were discussed by May (1995a).

KEY TO ADULT GENERA OF CORDULIIDAE

1. Anal loop nearly as broad as long, without a midrib; triangle of hind wing remote from arculus Macromiinae 2

- 1'. Anal loop, if present, long and narrow, with 2 rows of cells divided by a midrib, appearing somewhat foot-shaped; triangle of hind wing opposite the arculus *Corduliinae* 3
- 2(1). Nodus of forewing about midway between base and apex of wing; vertex simple, rounded, smaller than occiput; coloration light brown and yellow
..... *Didymops transversa*
- 2'. Nodus of forewing distinctly beyond middle of wing; vertex bilobed, longer than occiput; coloration dark, with metallic luster and yellow
..... *Macromia*
- 3(1'). Veins M_4 and Cu_1 in forewing diverging towards wing margin
..... *Neurocordulia*
- 3'. Veins M_4 and Cu_1 in forewing converge towards wing margin, generally appearing parallel for most of their distance 4
- 4(3'). Wings with large brown spots at nodus and wing tips and a large basal spot in hindwing *Epitheca* (subgenus *Epicordulia*)
- 4'. Wings hyaline or never with spots at nodus or wing tip, generally only a trace of color basally in the hindwing 5
- 5(4'). Two cubito-anal crossveins in hindwing; body may or may not have a metallic green or blue lustre 6
- 5'. Generally only a single cubito-anal crossvein in the hindwing; body generally lacks any metallic lustre *Epitheca* (subgenus *Tetragoneuria*)

- 6(5'). Hindwing with basal dark spots and occasionally spots on some antenodal crossveins *Helocordulia*
- 6'. Hindwing hyaline, lacking any spots *Somatochlora*

MACROMIINAE

Cruisers

This subfamily contains a small U.S. group of fairly large individuals that fly swiftly along the margins of rivers and streams. They are primarily brown or black and prominently marked with a yellow stripe encircling the thorax, like a belt. The dark thorax often appears to have a metallic lustre. The eyes meet on top of the head for some distance, clearly separating the occiput and vertex. The legs are long and heavily spined. Males have a keel on the tibiae. The wings are narrow and venationally distinct. The hindwing triangle is remote from the arculus. The anal loop is as broad as long, appearing simicircular, and lacking a midrib. There is generally no radial or medial planate. The dark brown to black abdomen lacks a ventrolateral carina. Females lack an ovipositor and release eggs by dragging their abdomens through the water while in flight. The larvae are distinct with a prominent erect frontal horn and exceedingly long legs. Gloyd (1959) critically studied this subfamily.

Genus *Didymops* Rambur

Cruisers

Didymops Rambur, 1842.

This is a group of two eastern North American species that are light or dull brown, lacking any metallic lustre, and marked with yellow. A single widespread species occurs in the south-central U.S., the other is restricted to Florida. The eyes become brilliant green at maturity and contact each other on top of the head, for a relatively short distance, compared to that of *Macromia*. The front of the thorax lacks any stripes, but the side has the normal oblique lateral stripe. The wings are hyaline with the costal margin paler than the rest. The abdomen has pale rings on the middle segments. Larvae are distinguished from *Macromia* by the prominent lateral spines on abdominal segment 9 extending back to the tip of the inferior appendages.

Didymops transversa (Say)

Stream Cruiser

(Map 131)

Libellula transversa Say, 1839: 19.

Epoptalmia cinnamomea Burmeister, 1839: 845.

Didymops servillei Rambur, 1842: 142.

Didymops transversa, Hagen 1861: 135.

Macromia (Macromia) transversa, Sélys, 1871b: 111.

Type. Georgia; Boston Mus.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV; CANADA: N.B., N.S., Ont., Que.

Seasonal Distribution. Mar. 12 (LA) - May 26 (AR).

Identification. This widely distributed species is distinctive among our Macromiinae. The body is dull brown. The thorax is covered with whitish hairs and a single pale yellowish stripe laterally. The wings are clear with only a hint of brown basally. The abdomen has pale spots on segments 1-8 and is somewhat clubbed. The caudal appendages are yellowish. Cabot (1890) and Needham (1901) have described and illustrated the larva.

Size. Total length: 56-60 mm; abdomen: 34-43 mm; hindwing: 34-48 mm.

Habitat. Medium to large streams and rivers.

Discussion. This is an early spring species that commonly perches obliquely on grasses and bushes. Younger individuals are often seen flying low, quite some distance from water, in open fields and along paths. Returning males patrol for long distances along the shore line. Females may oviposit over a long distance by tapping their abdomens to the

water surface intermittently or choose to confine their egg laying to a smaller area.

Genus *Macromia* Rambur

Threadtails

Macromia Rambur, 1842.

Phyllomacromia Sélys, 1878b.

Pseudogomphus Kirby, 1889.

Ceratopyga Nunney, 1895.

Hylaeschna Sjöstedt, 1900.

This is a large genus represented in North America by seven species, all but two of which occur in the south-central U.S. This group represents the larger members of the family. They are dark, generally with a metallic luster, and usually marked with yellow. The eyes are brilliant green and the vertex is distinctly bilobed and variously marked with yellow. The thorax and abdomen are dark brown or black. The former may or may not be marked dorsally with yellow, but always with a pale lateral stripe. The wings are hyaline, but may be heavily tinted in younger individuals. The legs are black and the abdomen is long and robust, sometimes appearing club-shaped.

Members of this genus are often found inconspicuously hanging high in branches of trees. The larvae have long legs and a prominent frontal horn, like *Didymops*, but the lateral spines on abdominal segment 9 do not extend to the tips of the inferior

appendages. Williamson (1909) studied the North American members of this genus and Williams (1978) discussed the larval behavior of four species. May (1997) discussed the relationships of male secondary genitalia and caudal appendages in *Macromia*.

KEY TO ADULT SPECIES OF *MACROMIA*

1. Vertex dark, not marked with yellow 2
- 1'. Vertex pale, marked with yellow 4
- 2(1). Yellow antehumeral stripe present and well developed, basally; yellow, when present, on abdominal segment 7 interrupted laterally 3
- 2'. Yellow antehumeral stripe if present, vestigial; yellow on abdominal segment 7 encircling that segment *alleganiensis*
- 3(2). Yellow ring on abdominal segment 2 widely interrupted middorsally; wings often flavescent in females *taeniolata*
- 3'. Yellow ring on abdominal segment 2 not interrupted, or only narrowly, middorsally; wings generally not flavescent in females *illinoensis*
- 4(1'). Vertex all pale; yellow spots on abdominal segments 3-6 entire or not completely divided by middorsal stripe; western species *annulata*
- 4'. Vertex with pale restricted to marks on double cone-like summit; yellow spots on abdominal segments 3-6 narrowly interrupted by thin black middorsal stripe; eastern species *pacifica*

***Macromia alleghaniensis* Williamson**

Allegheny River Cruiser

(Map 132)

Macromia alleghaniensis Williamson, 1909: 376.

Type. Pennsylvania; UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Ouachita.

General Distribution. UNITED STATES: AL, AR, FL, GA, IL, KY, MD, MS, NC, NJ, OH, SC, TN, VA, WV.

Regional Seasonal Distribution. Jun. 19 (AR).

Identification. This species is distinct in our region, with its wholly dark vertex, short tibial keels and vestigial pale antehumeral stripe. The face is yellowish-brown, becoming black dorsally on the frons with two small yellow spots. The wings are hyaline with a dark costa and pterostigma. The keel on the middle tibia is $1/7$ - $1/5$ as long as the tibia itself. The yellow ring on abdominal segment 2 is interrupted middorsally. Segments 3-6 bear a pair of spots dorsally. Segments 7-8 have a pale basal middorsal spot, which may be absent in females. The yellow on segment 7 encircles the abdomen, so that segments 7-9 have the inferior basal margin of each segment yellow. Louton (1982) described and illustrated the larva and Donnelly and Tennesen (1994) compared it to *M. illinoensis*.

Size. Total length: 65-72 mm; abdomen: 51-56 mm; hindwing: 45-50 mm.

Habitat. Cool, upland streams.

Discussion. This species was reported by Harp and Harp (1996) from southwestern Arkansas. Nothing has been published about the behavior of this species. Williamson (1909) in his original description wrote, "...I recall nothing striking in its habits of life."

***Macromia annulata* Hagen**

Bronzed River Cruiser

(Map 133)

Macromia annulata Hagen, 1861: 133.

Macromia caderita Needham, 1950: 10.

Type. Texas; MCZ;

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Brazos, Colorado, Guadalupe, Nueces, Rio Grande, San Antonio.

General Distribution. UNITED STATES: NM, TX; MEXICO: NLN, SLP.

Seasonal Distribution. Apr. 19 (TX) - Sep. 14 (TX).

Identification. This is a southwestern species, the only one with a whitish-yellow vertex and uninterrupted middorsal abdominal spots. The top of the frons is broadly marked with yellow, with only a pale narrow brown line medially on the sulcus. The thorax is

dull to dark brown with long well-developed antehumeral stripes. These stripes lack touching the alar crest by a distance equal to their width. The wings are hyaline with a yellow costa and a hint of brown basally in females. The legs are brown, becoming black distally. The first abdominal segment bears a yellow streak laterally, unique among North American species. There is a wide uninterrupted yellow ring on segment 2. The row of pale dorsal spots is uninterrupted middorsally on segments 3-8. The larva has not been described.

Size. Total length: 68-75 mm; abdomen: 52-57 mm; hindwing: 45-52 mm.

Habitat. Large rivers and streams.

Discussion. This is our only western distributed species. Nothing has been published about its biology, but it seems to be typical for the genus. Older individuals become moderately to heavily pruinose.

***Macromia illinoensis* Walsh**

Illinois River Cruiser

(Map 134)

Macromia illinoensis Walsh, 1862: 397.

Epophthalmis georgina Sélys, 1878: 197.

Macromia georgina, Martin, 1906: 64.

Macromia australensis, Williamson, 1909: 381.

Type. Illinois; ?.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, DE, FL, GA, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, MT, NC, NH, NJ, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV; CANADA: Man., N.B., N.S., Ont., Que.

Seasonal Distribution. Apr. 27 (LA) - Sep. 28 (TX).

Identification. This is perhaps our most widespread and frequently encountered *Macromia* species. It would only be confused in our region with *M. alleghaniensis*, but the yellow on abdominal segment 7 does not completely encircle that segment. The top of the frons is dark with two dorsal and two lateral pale spots. The vertex is wholly black. The antehumeral stripes on the dark thorax extend up $1/3$ - $1/2$ the distance of the front of the thorax. The wings are hyaline, with at most a hint of brown basally in females. The legs are black and long. There is an uninterrupted yellow ring on abdominal segment 2. Segments 3-6 each have a dorsal spot that may be thinly interrupted. Segments 7-8 each have a pale ring interrupted ventrolaterally, broadly so on 7. Cabot (1890) first described the larva. More recently Louton (1982) and Donnelly and Tennessen (1994) have illustrated it.

Size. Total length: 65-79 mm; abdomen: 47-56 mm; hindwing: 40-53 mm.

Habitat. Moderate to large rivers and streams.

Discussion. This species is often seen flying along roads and forest paths. It is most active in the morning, when males patrol low above the water (Dunkle 1989a). Donnelly and Tennessen (1994) recognized two subspecies. The nominate form is found north and west of the Appalachians. The subspecies occurring in our area, *M. i. georgina*, until recently recognized as a distinct species, is distributed along the coastal plains and Mississippi Valley. Females oviposit flying low over stream riffles, tapping their abdomens to the surface every few meters. Copulating pairs may be found high in trees or lower to the ground in bushes or shrubs. This species is occasionally seen flying high in mixed feeding swarms.

***Macromia pacifica* Hagen**

Gilded River Cruiser

(Map 135)

Macromia pacifica Hagen, 1861: 134.

Macromia flavipennis Walsh, 1862: 398.

Type. Texas: MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Guadalupe, Nueces, Ouachita, Red.

General Distribution. UNITED STATES: AR, IA, IL, IN, KS, MN, MO, OH, OK, TN, TX, WV.

Seasonal Distribution. May (TX) - Sep. 26 (TX).

Identification. Though uncommon, this is our brightest and most-vividly marked species. It can be identified from our other species by the yellow vertex and narrowly interrupted pale abdominal spots. The frons is yellow on top except for a broad medial dark stripe on the sulcus. The thorax is dark brown with well-developed full-length antehumeral stripes. The wings are hyaline, although sometimes tinged with yellow, and have distinct basal brown spots. The legs are dark brown or black. The abdomen is dark brown or black, strikingly marked with yellow on segments 2-9. These spots are often thinly interrupted middorsally on segments 3-6. The larva is undescribed.

Size. Total length: 62-70 mm; abdomen: 45-51 mm; hindwing: 40-46 mm.

Habitat. Moderate-sized streams and rivers with pools and areas of slow flow.

Discussion. Williams (1979b) found that individuals in the southern part of this species' range were on average smaller than more northern individuals. Williamson (1909) stated "The flight of *pacifica* is generally less swift than that of *taeniolata* and...[it] ranges less widely, patrolling possibly only one pool, while others return to the same point only after longer intervals."

***Macromia taeniolata* Rambur**

Royal River Cruiser

(Map 136)

Macromia taeniolata Rambur, 1842: 139.

Macromia (Epopthalmia) taeniolata, Sélys, 1871b: 90.

Epopthalmia taeniolata, Kirby, 1890: 54.

Type. United States; unknown.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, DE, FL, GA, IA, IL, IN, KS, KY, LA, MD, MI, MN, MO, NC, OH, SC, TN, TX, VA, WI, WV; CANADA: Ont.

Seasonal Distribution. May 7 (LA) - Sep. (TX).

Identification. This is our largest, most robust, *Macromia*. It is easily recognized by its size and metallic blue face and top of frons and vertex. The thorax is dark brown with pale yellow antehumeral stripes extending for half of its length. The wings are hyaline but may be deeply tinted amber in younger individuals. The legs are black. The abdomen is black and not as vividly marked as in our other species. There is a yellow ring, narrowly interrupted dorsally, on segment 2. The pale spots on segments 3-6 are small and often obscured. Segment 7 generally has a larger pale middorsal spot and there is a small basal dorsolateral spot on segment 8. The remaining segments and caudal appendages are black. Cabot (1890) and more recently Louton (1982) described and

illustrated the larva.

Size. Total length: 77-92 mm; abdomen: 53-68 mm; hindwing: 46-62 mm.

Habitat. Rivers, streams and lakes.

Discussion. Young individuals of this species, as with others, are often seen hanging obliquely from branches high in trees. Males patrol in a similar fashion to other species, but generally fly higher. Dunkle (1989a) found females oviposit for about 2 minutes, mostly in the afternoon.

CORDULINAE

Emeralds

This subfamily contains mostly medium-sized, slender dragonflies, generally found in streams or lakes with high oxygen content. Many are found in distinctive habitats and only fly early in the morning or late in the evening, making them less conspicuous to the casual observer. Most are metallicly colored and have brilliant iridescent green eyes at maturity. The eyes are prominent and confluent for a long distance on top of the head. There is a tubercle present on the rear margin, although it is generally not as prominent as in the Macromiinae. The wings are either hyaline, or with a spot of brown basally that may extend variably out to the nodus. The anal loop is usually in the form of a foot, or boot, but with little development of the toe region. In most there is a single bridge crossvein. The abdomen is generally longer than in the Libellulidae and there is a longitudinal ventrolateral carina on the middle segments in both sexes. The larvae are similar to those of the Macromiinae, but with shorter legs and the head

generally lacks a prominent frontal horn. Needham (1908) and Williamson (1908b) have both revised this subfamily.

Genus *Epitheca*

Baskettails

Epitheca Burmeister, 1839.

Tetragoneuria Hagen, 1861.

Epicordulia Sélys, 1871b.

This is a large group of very similar medium-sized to large brown non-metallic dragonflies. The face is either yellow or brown. The eyes meet on top of the head for about the length of the occiput. The thorax is often thinly to diffusely covered with short black or white hairs, but usually a small yellow spot is visible laterally. The legs are long and the tibiae are keeled. The abdomen is dark brown or black and distinctly widened in some and constricted basally in others, usually not as much so in females. In both sexes there is a pale yellow lateral abdominal stripe.

Females in this group carry a large string of eggs with them that appears as a pale yellow or orange ball at the end of the abdomen. This egg mass is then released on a partially submerged piece of vegetation or debris where it unravels. Dunkle (1989a) noted that this is advantageous, both so females expose themselves only once to aquatic predators and because eggs placed near the water surface are exposed to higher oxygen

concentrations and temperatures, speeding up embryological development. The larvae are somewhat distinct with broadly flattened bodies, prominent middorsal hooks and long lateral spines on abdominal segments 8 and 9.

Our U.S. species include two groups that historically have been recognized as separate genera (*Epicordulia* and *Tetragoneuria*), but Walker (1966) united them with the Old World genus *Epitheca*. I am considering the above as subgenera here and briefly discuss each below, in particular the difficulties associated with identifying members of *Tetragoneuria*.

KEY TO ADULT SPECIES OF *EPITHECA*

1. Wings with large brown spots basally, at nodus and at wing tips
 (subgenus *Epicordulia*) ***princeps***
- 1'. Wings hyaline or never with spots at nodus or wing tip, generally only a trace
 of color basally in the hindwing (subgenus *Tetragoneuria*) 2
- 2(1'). Male superior caudal appendages with sharp anteapical tooth at top of
 terminal declivity ***spinosa***
- 2'. Male superior caudal appendages without anteapical tooth 3
- 3(2'). Middle abdominal segments wider than long; hindwing with brown extending
 outward to halfway between last antenodal crossvein and nodus
 ***semiaquea***
- 3'. Middle abdominal segments narrow, longer than wide; hindwing with brown
 less extensive, at most reaching last antenodal crossvein 4

- 4(3'). Abdomen strongly constricted behind segment 3; superior appendages of male in dorsal view nearly parallel; female caudal appendages as long or longer than abdominal segments 9 and 10 together; hindwing with basal brown spot not extending out to cover 1st antenodal crossvein *costalis*
- 4'. Abdomen not strongly constricted behind segment 3; superior appendages of male in dorsal view divergent; female caudal appendages shorter, not as long as segments 9 and 10 together 5
- 5(4'). Pterostigma long, 3mm; hindwing with basal brown spot not extending out to cover 1st antenodal crossvein *stella*
- 5'. Pterostigma shorter, 2mm or less; hindwing with basal brown spot extending out to cover 1st antenodal crossvein 6
- 6(5'). Both fore- and hindwings with small transverse brown spot on nodus; hindwings with smaller spots on antenodal crossveins; abdomen of male slender with parallel sides *petechialis*
- 6'. Brown spot on nodus absent in both fore- and hindwings; hindwing without smaller spots on antenodal crossveins; abdomen of males broad and flat *cynosura*

Subgenus *Epicordulia* Sélys

Epitheca (*Epicordulia*) Sélys, 1871b.

This subgenus contains a single distinctive eastern U.S. species and is our largest corduliid. The wings are built for strong flight and are marked with brown at the base, nodus and apex. The larvae are rather distinctive as well, with long legs and a pair of mound-like tubercles on top of the head.

***Epitheca (Epicordulia) princeps* Hagen**

Prince Baskettail

(Map 137)

Epitheca princeps Hagen, 1861: 134.

Cordulia (Cordulia) princeps, Sélys, 1871b: 41.

Cordulia (Cordulia) regina Sélys, 1871b: 45.

Epicordulia princeps, Kirby, 1890: 51.

Type. Texas.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NY, OH, OK, PA, RI, SC, TN,

TX, VA, VT, WI, WV; CANADA: N.B., N.S., Ont., Que.

Seasonal Distribution. Mar. 31 (TX) - Sep. 1 (TX).

Identification. This is our most widespread and probably easiest corduliid to recognize.

It is the only *Epitheca* with brown wing tips. It may be confused with *L. pulchella*, which has wings similarly patterned, but there are no yellow lateral thoracic stripes in *E.*

princeps. The thorax and abdomen are brown, the latter with an obscured row of pale spots on the sides. The wings are variably marked with brown basally, at the nodus and apically. The larva was described and illustrated by Cabot (1890).

Size. Total length: 58-68 mm; abdomen: 42-49 mm; hindwing: 38-43 mm.

Habitat. Quiet reaches of streams, rivers, ponds and lakes.

Discussion. This species may be mistaken for a patrolling aeshnid because of its size and similar behavior. The more northern individuals are smaller and tend to have the brown markings on the wings more reduced. It flies high, often over the tree line, and may be seen mixed in with other species in feeding swarms. The males generally patrol long areas of shoreline and fly at heights of one to two meters above the water. They are, however, agile fliers and can be quite challenging to catch. Females oviposit in a similar manner to other members of this genus by depositing the egg mass on leaves or debris at the water surface. Adults may congregate in large numbers on the leeward side of bushes on windy days (Robert 1963). Larvae emerge no more than a few centimeters above the water line on emergent vegetation.

Subgenus *Tetragoneuria* Hagen

Epitheca (Tetragoneuria) Hagen, 1861.

This is a taxonomically difficult group of medium-sized brown species that are all quite similar. All have at least a hint of brown basally in the wings and this may extend out to the level of the nodus in some. Five species occur in the south-central U.S. Despite four revisions (Davis 1933; Kormondy 1959; Muttkowski 1911, 1915; Tennessen 1973), identifying these species is problematic at best. Donnelly (1992b) and May (1995b) have most recently discussed some of the problems in this group. Many names have been synonymized, and still others probably should be. I have not studied this group in detail and realize that the key and characters below will not be adequate to separate our species in many cases. Ken Tennessen (pers. comm.) is currently undertaking a molecular analysis of this group which will hopefully shed light on the group. The larvae are similar to that *E. (Epicordulia) princeps* but lack tubercles on the top of the head.

***Epitheca costalis* (Sélys)**

Stripe-winged Baskettail

(Map 138)

Cordulia (Cordulia) costalis Sélys, 1871b: 29.

Tetragoneuria costalis, Kirby, 1890: 50.

Tetragoneuria williamsoni Muttkowski, 1911: 122.

Tetragoneuria cynosura costalis, Muttkowski, 1910a: 126.

Epiheca costalis, Garrison, 1997: 565.

Type. Georgia; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan, Kansan.

Watershed(s): Arkansas, Canadian, Colorado, Mississippi, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, CO, DE, FL, GA, IL, KS, KY, LA, MD, MO, MS, NC, NE, NJ, OH, OK, PA, SC, TN, TX, VA.

Seasonal Distribution. Mar. 25 (LA) - Jun. 27 (AR).

Identification. This is a brown dragonfly, typical of the subgenus, with a hairy thorax and a spot of yellow on the side. The abdomen has a lateral yellow stripe. The wings are marked with a basal spot of brown, or in some females there may be a brown stripe across the front edge of the wings. Males have a slender abdomen and long superior caudal appendages (greater than 3.4 mm). These appendages are similar to those of *E. cynosura*, but lack a ventral keel. The abdomen of the male is often strongly constricted behind segment 3. The female caudal appendages are long, as long as segments 9 and 10 together. The larva was described by Tennessen (1977).

Size. Total length: 42-45 mm; abdomen: 28-32 mm; hindwing: 25-28 mm.

Habitat. Lakes, ponds and slow reaches of streams and rivers.

Discussion. Little has been published on the behavior of this species, but it is apparently much like that of other *Tetragoneuria*. It may be seen in feeding swarms or perched on twigs and bushes in large numbers. Males patrol along shore lines for long distances. Copulating pairs perch on stems at the waters edge. Tennessen (1979) reported larvae of this species and *E. (T.) cynosura* emerging on pine trees at unusually long distances and heights from the water. Exuvia were found 10.5 m from the water and at maximum heights of 5.5 m.

Epitheca cynosura (Say)

Common Baskettail

(Map 139)

Libellula tomentosa (?*nomen oblitum*) Fabricius, 1775: 423.

Libellula cynosura Say, 1839: 30.

Epophthalmia lateralis Burmeister, 1839: 247.

Cordulia complanata Rambur, 1842: 145.

Cordulia lateralis, Hagen, 1861: 139.

Cordulia basiguttata Sélys, 1871b: 37.

Cordulia cynosura cynosura, Sélys, 1871b: 36.

Cordulia diffinis Sélys, 1871b: 270.

Cordulia tomentosa, Sélys, 1871b: 34.

Somatochlora tomentosa, Kirby, 1890: 49.

Tetragoneuria basiguttata, Kirby, 1890: 51.

Tetragoneuria cynosura, Kirby, 1890: 51.

Tetragoneuria lateralis, Calvert, 1898: 58.

Paracordulia tomentosa, Martin, 1906: 34.

Tetragoneuria cynosura simulans Muttkowski, 1911: 95.

Tetragoneuria morio Muttkowski, 1911: 125.

Tetragoneuria tomentosa, Steinmann, 1997: 275.

Tetragoneuria cyanosura basiguttata, Steinmann, 1997: 274.

Epitheca cynosura, Garrison, 1997: 565.

Type. United States; Boston Mus.

Regional Distribution.

Biotic Province(s): Austroriparian, Kansan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Mississippi, Neches, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CO, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NY, OH, OK, PA, SC, SD, TN, TX, VA, VT, WI, WV; CANADA: N.B., N.S., Ont., Que.

Seasonal Distribution. Feb. 17 (TX) - Jun. 18 (AR).

Identification. This species is very similar to *E. costalis*. Some individuals have a basal triangular spot extending to the 3rd antenodal crossvein in the hindwing. Others have only a basal spot of brown in each wing. The abdomen is broad and flattened in the

middle segments. It is not constricted, or only slightly so, behind the third abdominal segment. The male caudal appendages, when viewed laterally, have a ventral keel extending posteriorly from the ventral angle. The female caudal appendages are not longer than 2.25 mm. Cabot (1890) described the larva.

Size. Total length: 36-44 mm; abdomen: 25-34 mm; hindwing: 26-30 mm.

Habitat. Almost any permanent or temporary, quiet water, including ponds, lakes, marshes, streams and rivers, with submerged and emergent vegetation.

Discussion. The taxonomic history listed above tells the story of this variable species. It can be one of the most abundant early spring, mid-summer species. Larvae emerge on nearly any structure, natural or artificial, on which they can climb 1-3 m above the water, although they may emerge at distances much farther from the water (see discussion under previous species). Tennessen and Murray (1978) studied the hatching of eggs in this species under natural and controlled conditions. Adults may venture some distance from water, commonly being found along forest clearings and roads. Kormondy (1959) studied this species in detail. He recognized four types of flight: (1) a patrolling flight, consisting of extended periods of hovering, (2) a feeding flight seen away from water and generally occurring during midmorning or early afternoon, (3) a copulatory flight, where both sexes mate in flight with no hovering and usually in a linear direction, often covering 1,300 m or more, and (4) a swarming flight, involving both sexes and nearly always an additional species of *Tetragoneuria*. Johnson (1986) studied the life history of a Tennessee population and Johnson *et al.* (1985) studied competition among this and other larval dragonflies. Females oviposit in the usual fashion for this group; releasing a

large string of eggs on partially submerged vegetation or debris. Claus-Walker *et al.* (1997) studied larval activity and development in this species.

***Epitheca petechialis* (Muttkowski)**

Dot-winged Baskettail

(Map 140)

Tetragoneuria petechialis Muttkowski, 1911: 101.

Epitheca petechialis, Garrison, 1997: 565.

Type. United States; unknown.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Navahonian, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio, San Jacinto.

General Distribution. UNITED STATES: KS, NM, OK, TX.

Seasonal Distribution. Mar. 14 (TX) - Oct. 20 (TX).

Identification. This is a southern species with a relatively slender abdomen. Some individuals have a distinct row of brown spots on the antenodal crossveins in the hindwing, extending out to the nodus. These individuals are easy to identify. In others, these spots may not be as prominent. The slender abdomen is slightly constricted behind the 3rd segment in males. The male caudal appendages are slightly divergent and lack a

sharp angulation downward, when viewed laterally. The caudal appendages of the female are approximately 2 mm long. Needham and Westfall (1955) included this species in their larval key.

Size. Total length: 41-43 mm; abdomen: 30-34 mm; hindwing: 27-31mm.

Habitat. Lakes, ponds and slow reaches of streams and rivers.

Discussion. This species hangs around later in the year than our other species. It is considered by many scientists to be a synonym of *E. (T.) costalis*. I don't feel that it is productive at this point, for future studies, to lump the two species here.

***Epitheca semiaquea* (Burmeister)**

Mantled Baskettail

(Map 141)

Libellula semiaquea Burmeister, 1839: 858.

Tetragoneuria diffinis (*nomen nudum*) Hagen, 1861: 141.

Tetragoneuria semiaquea, Hagen, 1861: 140.

Cordulia (*Cordulia*) *semiaquea*, Sélys, 1871b: 38.

Tetragoneuria cynosura race *semiaquea* Martin, 1906: 42.

Tetragoneuria semiaquea calverti Muttkowski, 1915: 58.

Epitheca semiaquea, Garrison, 1997: 565.

Type. Savannah, Georgia; NHMV.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Neches, Red, San Jacinto, Trinity.

General Distribution. UNITED STATES: FL, GA, MA, MD, NC, NJ, NY, OK, SC, TX, VA.

Seasonal Distribution. Mar. 25 (TX) - May 30 (TX).

Identification. This species has a broad abdomen, never constricted behind segment 3, but rather regularly tapering after segment 6. The hindwings are often broadly colored with brown out past the 4th antenodal crossvein, often to the level of the nodus. This maculation is somewhat variable in our region, however, and can be confused with maculated individuals of *E. cynosura*. Eastern forms of this species apparently have the brown markings extending much farther out in the hindwing. This species has the widest and shortest abdomen of our *Epitheca*. Segments, 4-6 are wider than long. The male superior caudal appendages are widely divergent dorsally and the female caudal appendages are short, between 1.2 to 1.5 mm long. The larva was questionably included in the Needham and Westfall's (1955) key.

Size. Total length: 34-38 mm; abdomen: 24-30 mm; hindwing: 24-31 mm.

Habitat. Lakes and ponds with submerged and emergent vegetation.

Discussion. Abbott (1996) published the first records for this species in Oklahoma. Nothing has been published on the behavior of this species, but it is presumably similar to that of other members in the genus.

***Epitheca spinosa* (Hagen in Selys)**

Robust Baskettail

(Map 142)

Cordulia spinosa Hagen in Selys, 1878b: 188.

Tetragoneuria spinosa, Kirby, 1890: 50.

Epitheca spinosa, Garrison, 1997: 565.

Type. Georgia; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Mississippi, Ouachita.

General Distribution. UNITED STATES: AL, AR, FL, GA, LA, MD, NC, NJ, OK, SC, VA.

Seasonal Distribution. May 10 (AR).

Identification. This is a southern coastal species in which males have distinctive caudal appendages. The thorax is diffusely covered with white hairs. The hindwings may be variously marked with brown basally. There is a sharp dorsally projecting spine just before the superior caudal appendage declines downward. The female caudal appendages are 2 mm long.

Size. Total length: 42-45 mm; abdomen: 32-35 mm; hindwing: 29-33 mm.

Habitat. Lakes, ponds and wooded swamps with little flow.

Discussion. This species is uncommon in our region and only sporadically reported. Sid Dunkle (pers. comm.) has a single female in his collection from Washington Parish, Louisiana. A single male each was reported by Harp and Harp (1996) from Clark County, Arkansas, and by Bick and Bick (1957) from Latimer County, Oklahoma (previously reported by Bird (1932s) as *T. canis*).

***Epitheca stella* (Williamson in Muttkowski)**

Florida Baskettail

(Map 143)

Tetragoneuria stella Williamson in Muttkowski, 1911: 96.

Type. U.S. ?.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Bayou Bartholomew.

General Distribution. UNITED STATES: FL, GA, LA, MS.

Seasonal Distribution. Apr. 14 (LA).

Identification. This species is very similar to *E. cynosura*, but generally larger. The frons is yellow, covered with numerous short black hairs above and white below. The pterothorax is densely clothed with white hairs. The lateral thoracic stripes are irregular, but the 1st and 3rd stripes are visible at their lower ends and confluent above the spiracle.

The wings are clear with a touch of brown basally. The pterostigma is long. The abdomen is slender, regularly tapering beyond swollen segment 3. Segments 1-3 are largely yellow. Pale lateral markings regularly diminish posteriorly and segment 10 and the caudal appendages are black. The caudal appendages are similar to those of *E. cynosura*, but generally with the basal 3rd straight, or nearly so.

Size. Total length: 44-47 mm; abdomen: 32-36 mm; hindwing: 27-32 mm.

Habitat. Lakes and ponds.

Discussion. Dunkle (1989a) reported this species as endemic to Florida, but it has been infrequently taken in Georgia and Mississippi. A single male was reported from Louisiana in our region by Mulhern (1971). The specimen was taken in Ouachita Parish near Monroe, Louisiana. Little has been reported on its behavior, which is apparently similar to that of *E. cynosura*, although Paulson (1973) did give some brief notes.

Genus *Helocordulia* Needham

Sundragons

Helocordulia Needham, 1901.

This is a small group of two uncommon eastern U.S. species that are very similar to *Epitheca*. They differ in the structure of the male accessory genitalia and caudal appendages. The wings are hyaline with a basal spot of brown and in some individuals with spots on the antenodal crossveins. The venation in the genus is fairly plastic. The

male abdomen gradually widens after the basal constriction behind segment 3 and does not taper again after the middle segments.

They have short flight seasons in the early spring and are often seen along forest edges and roadsides. Females don't deposit eggs in a long gelatinous string as in *Epitheca*. There has been some confusion in the past with identifying these species because figures of the male caudal appendages in Needham and Westfall (1955) were reversed. The larvae have been studied by Kennedy (1924) and Wright (1946c), the latter giving a key to the two species.

KEY TO ADULT SPECIES OF *HELOCORDULIA*

1. Hindwing with golden yellow spot in midst of basal brown spot; subgenital plate of female deeply bifid and greater than 1/2 as long as segment 9 *uhleri*
- 1'. Hindwing without yellow spot in midst of basal brown spot; subgenital plate of female emarginate and less than 1/3 as long as segment 9 *selysii*

Helocordulia selysii (Hagen in Sélys)

Sélys' Sundragon

(Map 144)

Cordulia selysii Hagen in Sélys, 1878b: 189.

Neurocordulia selysii, Kirby, 1890: 50.

Helocordulia selysii, Needham, 1901: 496.

Type. Georgia; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Ouachita, Red, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, FL, GA, LA, MD, MS, NC, SC, TX, VA.

Seasonal Distribution. Mar. 8 (TX) - Apr. 10 (LA).

Identification. This is an uncommon dark species with clear wings. The face is pale yellow and the top of the frons has a deep medial depression. The thorax is brown and thickly clothed with silky hairs. The legs are black. The wings have a basal uniform dark spot and the abdomen is dark with pale spots laterally on the middle segments.

Size. Total length: 38-41 mm; abdomen: 29-31 mm; hindwing: 26-28 mm.

Habitat. Small, cool forest streams with sandy bottoms.

Discussion. Needham and Westfall (1955) reported that adults of this species prefer open sunny glades in woods and are much less common than *H. uhleri*, but at the western edge of their distribution, *H. selysii* seems more widespread and commonly encountered.

Nothing has been published on the biology of this species. Harp and Harp (1996) recently reported it from the Salado Creek in Independence County, Arkansas.

***Helocordulia uhleri* Sélys**

Uhler's Sundragon

(Map 145)

Cordulia (Cordulia) uhleri Sélys, 1871b: 40.

Neurocordulia uhleri, Kirby, 1890: 50.

Helocordulia uhleri, Needham, 1901: 496.

Type. Maine; Boston Mus.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Ouachita, Red, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, GA, KY, MA, MD, ME, MO, NC, NH, NJ, NY, OH, OK, PA, RI, TN, VA, VT, WV; CANADA: N.B., N.S., Ont., Que.

Seasonal Distribution. Apr. 12 (OK).

Identification. This uncommon species is very similar to the preceding one, but without a clear or golden yellow area in the midst of the basal brown wing spot. Its range is more restricted in our area.

Size. Total length: 41-46 mm; abdomen: 28-33 mm; hindwing: 25-30 mm.

Habitat. Small, rapid forest streams, often with impeded flow, and occasionally lakes.

Discussion. Walker (1975), reported this species "...is inconspicuous and flies with great

speed, within two or three feet of the water, following the shore line closely." Bick and Bick (1957) reported a single male from the Mountain Fork River in Mochatown, Oklahoma, while Harp and Rickett (1977) and Harp (1985) have reported it from Arkansas. *Helocordulia uhleri* was reported from Louisiana by Needham and Westfall (1955), but as Mauffray (1997) explained, all specimens examined have been *H. selysii*, and the Louisiana records can probably be attributed to the past confusion in separating these two species.

Genus *Neurocordulia* Sélys

Shadowdragons

Neurocordulia Sélys, 1871b.

Platycordulia Williamson, 1908b.

This is an inconspicuous group of six medium-sized, brown U.S. species. All but one, the more northern *N. yamaskanensis*, occur in the south-central U.S. Their common name, shadowdragons, is derived from the fact that individuals of this group are seldom seen during the day, when they cryptically perch on twigs or bushes in the shade. They are typically only active for a short time at dusk and dawn (crepuscular).

They are brownish without iridescent eyes or metallic coloration. The wings are generally marked with brown spots, often occurring on the antenodal crossveins, and sometimes becoming quite diffuse. The frons is distinctly rounded. The erect, shelf-like

vertex often obstructs the view of the middle ocellus from the top. There is a faint stripe or spot of yellow laterally on the thorax around the spiracle. The legs are not especially long, but generally pale. These are the only corduliids in our region with the veins M_4 and Cu_1 divergent to the wing margin. The abdomen is swollen basally but becomes depressed in the middle segments. The larvae are stocky with a prominent transverse frontal ridge, a pair of tubercles located on the vertex and short lateral spines on abdominal segments 8 and 9. Davis (1929) made notes on a few species and Byers (1937) revised the genus. Louton (1982) described and illustrated most of the larvae in our region.

KEY TO ADULT SPECIES OF *NEUROCORDULIA*

1. Midbasal space of all wings with a single crossvein *obsoleta*
- 1'. Midbasal space of some, but not all, wings with a crossvein 2
- 2(1'). Two rows of cells between toe of anal loop and wing margin ... *xanthosoma*
- 2'. One row of cells between toe of anal loop and wing margin 3
- 3(2'). Metathoracic trochanter, in males, with conspicuous truncate process on inner side, as long as segment is wide; caudal appendages of female long, 2.3 mm or greater *molesta*
- 3'. Metathoracic trochanter, in males, lacking conspicuous truncate process on inner side; caudal appendages of female normal length, less than 2.1 mm
..... 4
- 4(3'). Foretibia of male with keel longer than width of tibia at its widest; caudal

- appendages of female, shorter, less than 1.8 mm *alabamensis*
- 4'. Foretibia of male without keel or at most vestigial; caudal appendages of
female 1.9-2.1 mm *virginiensis*

***Neurocordulia alabamensis* Hodges in Needham & Westfall**

Alabama Shadowdragon

(Map 146)

Neurocordulia alabamensis Hodges in Needham & Westfall, 1955: 356.

Type. unknown.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Ouachita, Trinity.

General Distribution. UNITED STATES: AL, FL, GA, LA, MS, NC, SC, TX, WY.

Seasonal Distribution. May 17 (TX) - Jun. 19 (LA).

Identification. This is a coastal species only rarely seen as far west as Louisiana and Texas. It is pale brown with the yellow on the sides of the thorax diffuse, appearing lighter than the front. The wings are clear or uniformly tinted with a row of brown spots along the entire costal margin of the wing. The legs are pale and in the male the trochanter of the middle legs lacks a distinct truncate process on its inner side. There is a distinct keel on the foretibia, approximately as long as the tibia is wide. The abdomen is

pale brown and the caudal appendages are pale yellowish-brown. The female caudal appendages are short, approximately 1.6 mm.

Size. Total length: 41-46 mm; abdomen: 29-32 mm; hindwing: 28-33 mm.

Habitat. Small to medium-sized slow flowing or spring-fed forest streams, frequently tannin stained.

Discussion. All Louisiana records of this species are based on larvae (Mauffray 1997). The only Texas records (Donnelly 1978) were taken from Hickman Branch, 3.2 km south of Coldspring in San Jacinto County, Texas, part of the Sam Houston National Forest. Dunkle (1989a) called this one of the most elusive dragonflies in Florida, because of its crepuscular behavior and habits. Females oviposit during a rapid crisscrossing flight in pools or areas of slow flow.

Neurocordulia molesta (Walsh)

Smoky Shadowdragon

(Map 147)

Cordulia molesta Walsh, 1863: 254.

Neurocordulia obsoleta clara Muttkowski, 1910b: 174.

Neurocordulia molesta, Needham & Westfall, 1955: 357.

Type. New Orleans, LA; destroyed.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Canadian, Mississippi, Ouachita, Red, San Jacinto, St. Francis.

General Distribution. UNITED STATES: AL, AR, FL, GA, IA, IL, KS, KY, LA, MI, MO, MS, NC, NE, OH, OK, SC, SD, TN, TX, WI.

Seasonal Distribution. May 21 (AR) - Jul. 23 (OK).

Identification. This is a larger species, second only to *N. xanthosoma*, and widely distributed in the southeast. The face is olivaceous or brown. The thorax is brown on front, with only a pale yellowish middorsal carina. The thorax becomes noticeably paler laterally. The midlateral stripe is diffuse yellow to the level of the spiracle and then becomes obsolete except for a small yellowish spot. The legs are pale and the middle trochanter of the male has a conspicuous truncate process on the inner side. The wings are lightly tinted amber and have brown spots on the antenodal crossveins and a larger spot on the nodus. The spots on the antenodal crossveins are darkest on either side of the crossveins themselves. The abdomen is brown and the caudal appendages yellowish. The female appendages are long, approximately 2.4 mm.

Size. Total length: 45-53 mm; abdomen: 35-38 mm; hindwing: 33-38 mm.

Habitat. Rivers and medium-sized streams with strong current.

Discussion. This uncommon species has been reported in Texas by Louton (1982), who took a single male at the Little Brazos River in Brazos County. Nothing has been published about its biology or behavior.

Neurocordulia obsoleta (Say)

Umber Shadowdragon

(Map 148)

Libellula obsoleta Say, 1839: 29.*Libellula polysticta* Burmeister, 1839: 856.*Didymops obsoleta*, Hagen, 1861: 29.*Cordulia (Epitheca) obsoleta*, Sélys, 1871b: 45.*Neurocordulia obsoleta*, Kirby, 1890: 50.**Type.** United States; ANSP.**Regional Distribution.***Biotic Province(s):* Austroriparian.*Watershed(s):* Sabine.**General Distribution.** UNITED STATES: AL, FL, GA, IA, IL, IN, KY, LA, MA, MD, ME, MS, NC, NH, NJ, NY, OH, PA, SC, TN, VA.**Seasonal Distribution.** Jul. 1 (LA).**Identification.** This species is medium-sized and brown, similar to the others. The thorax is darkest on the front, but divided as usual by the pale middorsal carina. The wings are clear or lightly tinted with distinct maculation. There is a large basal black spot present in each wing, but generally larger in the hindwings. There is a row of smaller brown spots on the antenodal crossveins and a larger spot at the nodus. This is our only

species with a crossvein present in the midbasal space of all wings. The legs are pale and the abdomen is brown with dark caudal appendages.

Size. Total length: 43-48 mm; abdomen: 33-35 mm; hindwing: 30-33 mm.

Habitat. Rivers and lakes.

Discussion. Mauffray (1997) reported a single male from Beauregard Parish on the Texas Louisiana border. Harp and Rickett (1977) reported it from Arkansas, but later Harp (1983) determined these records were misidentified. Nothing has been published about the behavior of this uncommon species.

Neurocordulia virginiensis Davis

Cinnamon Shadowdragon

(Map 149)

Neurocordulia virginiensis Davis, 1927: 156.

Type. Virginia; Unknown.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Mississippi, Ouachita, Red.

General Distribution. UNITED STATES: AL, AR, FL, GA, LA, MD, MO, MS, NC, OK, SC, TN, VA.

Seasonal Distribution. May 21 (AR) - Jun. 18 (OK).

Identification. This is another medium-sized brown species, but its wings are the least marked of our species. The thorax is darker in front and divided by a pale middorsal carina. The sides of the thorax are paler and there is a diffuse yellow-spot surrounding the spiracle. There are dark spots on the antenodal crossveins before the triangles only. The legs are pale and the fore-tibiae in males have only a vestigial keel. There is no truncate process on the innerside of the middle trochanter. The abdomen is brown, and segments have a dark transverse carina. The caudal appendages are yellowish-brown. The female appendages are approximately 2 mm long.

Size. Total length: 42-48mm; abdomen: 32-35 mm; hindwing: 29-32 mm.

Habitat. Medium-sized rivers with riffles.

Discussion. This species may fly well after sunset or through forest understories during the day. Dunkle (1989a) described two stages of flight in this species. The first involves an erratic flight 1-2 m above the water. The second stage involves males frequently skirmishing, followed by a lower flight 15 cm above the water. Anadu *et al.* (1996) looked at acute toxicity of an insect larvicide on this species.

Neurocordulia xanthosoma (Williamson)

Orange Shadowdragon

(Map 150)

Platycordulia xanthosoma Williamson, 1908b: 432.

Neurocordulia xanthosoma, Needham & Westfall, 1955: 360.

Type. Oklahoma; UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Ouachita, Red, Rio Grande, San Antonio, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AR, IA, IL, KS, MN, MO, NM, OK, TX.

Seasonal Distribution. May 28 (AR) - Jul. 30 (TX).

Identification. This is our largest, most common and widely distributed *Neurocordulia*.

It is also the most distinctive. The thorax is pale yellowish brown, interrupted middorsally by the pale carina. There is only a hint of yellow laterally around the spiracle. The wings are lightly to strongly spotted along the entire costal margin. There is a darker black spot at the base of the hindwing. The tips are generally darkened and the entire wing may become amber in males. The legs are pale. The abdomen is dark brown, with the carinae outlined in black. The caudal appendages are pale and the male superior caudal appendages bear a ventrally projecting tooth, when viewed laterally. Williams and Dunkle (1976) described the larva.

Size. Total length: 48-51 mm; abdomen: 37-41 mm; hindwing: 36-42 mm.

Habitat. Medium-sized turbid rivers and streams with strong current.

Discussion. This species comes out at dusk or dawn, often in large numbers, to feed on smaller flying insects. Their pale color makes them very difficult to see against the sky, as they swarm 1.5 to 2.5 m off the ground. Mating pairs hang from branches or twigs in

the shade. Oviposition generally occurs 30 minutes to 1 hour after the flight. Females oviposit alone, and unguarded by males, by rapidly flying low over the water, occasionally pausing to release eggs at the surface. Harwell (1951) reported a female ovipositing, "while attended by the male." Williams (1976) described the behavior of this species in Texas and redescribed the female. Bird (1932b) described oviposition. Williams (1979c) described the behavior of the larvae, including their habit of feigning death. Clark (1979) reported it from the Black River in New Mexico, the westernmost record for this species.

Genus *Somatochlora* Sélys

Emeralds

Somatochlora Sélys, 1871b.

Chlorosoma Charpentier, 1840.

This northern Holarctic genus is the largest of the corduliids and includes 26 North American species. They are medium-sized, metallic brown dragonflies that are often very locally distributed and uncommon. Many fly at great heights, rarely coming low enough to view critically. Six species occur in the south-central U.S. The eyes become brilliant iridescent green in older adults. The front of the thorax is unmarked, but most have two variously shaped pale lateral stripes. The wings are hyaline with a single bridge crossvein and generally a single crossvein in the triangles. A keel is present on the

fore- and hind tibiae of males. The abdomen is generally dark with a narrow pale ring and spots apically. The male caudal appendages are generally quite distinctive and the females have a distinct spout-like ovipositor. The larvae are sprawlers and more or less hairy, with wide heads. Daigle (1991) gave a key to the North American larvae and amended it in 1994. Walker (1925) revised the North American members of this genus.

KEY TO ADULT SPECIES OF *SOMATOCHLORA*

1. Tibiae with yellow on their outer surface; coloration not so metallic; lateral thoracic stripes long and wide *georgiana*
- 1'. Tibiae without yellow on their outer surfaces, but entirely black; coloration strongly metallic; lateral thoracic stripes variable 2
- 2(1'). Lateral thoracic stripes pale or absent *linearis*
- 2'. Pale lateral thoracic stripes present 3
- 3(2'). Abdominal segment 2 with a single large spot of yellow, laterally, before auricle; coloration generally pale *tenebrosa*
- 3'. Abdominal segment 2 with more than 1 spot of yellow, laterally, before auricle; coloration generally more vivid 4
- 4(3'). First lateral thoracic stripe narrower than second, and angulated or interrupted at middle *filosa*
- 4'. First lateral thoracic stripe running straight and uninterrupted for its length, generally not distinctly narrower than second 5
- 5(4'). Obscure pale basal markings present on abdominal segments 4-8.

- *margarita*
5. Obscure pale basal markings on abdominal segments 4-8 absent
- *ozarkensis*

***Somatochlora filosa* Hagen**

Fine-lined Emerald

(Map 151)

Cordulia filosa Hagen, 1861: 136.

Cordulia (Epiteca) filosa, Sélys, 1871b: 53.

Somatochlora filosa, Kirby, 1890: 48.

Type. Georgia; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Neches, Ouachita, Red, St. Francis.

General Distribution. UNITED STATES: AL, AR, FL, GA, IL, KY, LA, MD, MO, MS, NC, NJ, PA, SC, TN, TX, VA.

Seasonal Distribution. Jul 8 (LA) - Sep. 24(LA).

Identification. This is an uncommon species with brilliant iridescent green eyes. The brown thorax is vividly marked metallic green on the sides with two pale lateral stripes. This is the only species in our region with the first stripe interrupted or distinctly

angulated medially. The second stripe is wider. The face is pale in front and metallic blue on top. The wings in young females often become amber apically. The legs are wholly black. The abdomen is dark metallic brown with the basal segments marked with 3 pale stripes laterally. The caudal appendages of the male are distinct and the female has the typical grooved ovipositor. Dunkle (1977b) described and illustrated the larva.

Size. Total length: 52-69 mm; abdomen: 41-54 mm; hindwing: 35-46 mm.

Habitat. Spring-fed seeps and forest streams.

Discussion. This species has been reported from a limited number of counties in Louisiana and Arkansas (Barr 1981; Mauffray 1997). Abbott and Stewart (1998) reported a single female, collected by B. Mauffray, in east Texas. This species is typical of the genus, usually seen flying high over paths, trails, and roads in the early morning and late afternoon and evening.

Somatochlora georgiana Walker

Coppery Emerald

(Map 152)

Somatochlora georgiana Walker, 1925: 98.

Type. Georgia; unknown.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Red.

General Distribution. UNITED STATES: AL, FL, GA, LA, MA, MS, NC, NH, NJ, SC, TX, VA.

Seasonal Distribution. Jun. (TX) - Aug. 6 (LA).

Identification. This southeastern species has only rarely been reported from as far west as Louisiana and Texas. It is distinctive among our local congeners by having yellow on the outer surface of the otherwise brown tibiae. It is not as metallic as other species in general coloration. The thorax is brown with two well-developed pale lateral stripes, the latter much wider than the former. The wings are hyaline. The abdomen is dark brown, with the usual yellow basal stripes. The female ovipositor is short, somewhat triangular and directed ventrally. Daigle (1994) described the larva.

Size. Total length: 47-50 mm; abdomen: 34-38 mm; hindwing: 32-34 mm.

Habitat. Pools and slow flowing tannin-stained forest streams.

Discussion. This species has been reported from a single parish/county in each Louisiana and Texas (Daigle 1994). Both specimens were collected in the early 1950's and are in the G.H. Beatty collection at the Pennsylvania State University. No additional collections of this species have been made in our region. Daigle (1994) summarized what little is known about the biology of this species. Adults are generally encountered in the early or late afternoon, feeding 10-20 cm above dirt roads and forest clearings. They perch on branches of trees. Oviposition usually occurs at midstream, with females flying erratically less than a 1 m above the water.

***Somatochlora linearis* (Hagen)**

Mocha Emerald

(Map 153)

Cordulia linearis Hagen, 1861: 137.*Cordulia (Epiheca) linearis*, Sélys, 1871b: 52.*Cordulia (Epiheca) procera* Sélys, 1871b: 51.*Somatochlora linearis*, Kirby, 1890: 47.*Neurocordulia lateralis (lapsus)* Needham, 1901: 501.**Type.** St. Louis, MO; MCZ.**Regional Distribution.***Biotic Province(s):* Austroriparian, Texan.*Watershed(s):* Arkansas, Bayou Bartholomew, Brazos, Mississippi, Neches, Ouachita, Red, Sabine, St. Francis, Trinity, White.**General Distribution.** UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, MI, MO, MS, NC, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, WV; CANADA: Que.**Seasonal Distribution.** Jun. 12 (LA) - Sep. 20 (TX).**Identification.** This distinctive species is the most widespread and probably most frequently encountered of our *Somatochlora*. It is the only one in our region lacking lateral pale yellow thoracic stripes. The face is pale brown and the top of the head is

metallic blue. The eyes become iridescent green in older individuals. The thorax is brown and metallic green, unmarked with pale stripes, as stated above. The wings are hyaline but may be tinted amber. The legs are wholly black. The abdomen is dark brown with metallic reflections. Segment 2 has a large pale spot basally. The male caudal appendages are bifurcate apically and the female has a triangular-shaped ventrally-projecting ovipositor. Walker (1925) described and illustrated the larva.

Size. Total length: 56-70 mm; abdomen: 42-56 mm; hindwing: 38-50 mm.

Habitat. Permanent and temporary forest streams.

Discussion. This species is most often seen flying in the early morning and late afternoon high over trees. It only occasionally comes low to the ground. Adults perch on twigs in full shade between those times. Males patrol low to the water, at heights of 1 m or less, making frequent hovering stops. Females oviposit in sand or mud at the water's edge by stabbing the ovipositor into the substrate. Dunkle (1989a) and Williamson (1922a) have briefly reported on oviposition and other behaviors of this species.

Somatochlora margarita Donnelly

Texas Emerald

(Map 154)

Somatochlora margarita Donnelly, 1963: 235.

Type. San Jacinto Co., Texas; FSCA.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Neches, Red, Sabine, Trinity.

General Distribution. UNITED STATES: LA, TX.

Seasonal Distribution. May 27 (TX) - July 2 (TX).

Identification. This uncommon species is closest to *S. ozarkensis* and *S. filosa*, but with obscure pale basal spots present on abdominal segments 4-8. The face is largely pale and the top of the head is metallic blue. The eyes become brilliant iridescent green in older individuals. The brown thorax has bluish-green reflections with two well-developed pale lateral stripes. The first is slightly narrower than the latter. The legs are wholly black and the wings are hyaline. The abdomen is dark brown with metallic reflections. The basal segments are marked with pale yellow. Segment 3 has a conspicuous pale triangular spot anterolaterally. Segments 4-8 have obscure pale spots anterolaterally. I am currently describing the larva from reared material given to me by Sid Dunkle.

Size. Total length: 50-54 mm; abdomen: 32-41 mm; hindwing: 32-37 mm.

Habitat. Small, sandy forest streams, with moderate current.

Discussion. This species is endemic to the long-leaf and loblolly pine forests of southeastern Texas. It is very uncommon and until recently hadn't been collected more than a few km from its type locality, in the Sam Houston National Forest. Price *et al.* (1989) expanded this initial range to a now estimated 16,000 km area in east Texas and western Louisiana. I reported it from Louisiana in 1996 and expanded its range north and west with a single female taken at Engeling Wildlife Management Area in Anderson

County, Texas. Little is known and nothing apart from the original description is published on the behavior of this species. It is found flying high at tree top level, along dirt roads. Females occasionally come down into open fields of forest clearings to feed. They fly in the early morning and late afternoon to dusk, as is usual for the genus.

***Somatochlora ozarkensis* Bird**

Ozark Emerald

(Map 155)

Somatochlora ozarkensis Bird, 1933b: 1.

Type. United States; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Ouachita, White.

General Distribution. UNITED STATES: AR, KS, MO, OK.

Seasonal Distribution. Jun. 10 (OK) - Sep. 7 (AR).

Identification. This species is apparently endemic to the Interior Highlands of Arkansas Oklahoma and Missouri. It has a pale face. The top of the head is metallic greenish-blue. The eyes become iridescent green in older individuals. The thorax is brown with metallic reflections and two well-developed pale stripes laterally. The posterior stripe is slightly wider than the anterior one. The wings are hyaline, occasionally becoming amber. The

legs are largely black and the abdomen is dark brown. The basal segments are marked with pale yellow, including a subtriangular spot, dorsolaterally on segment 3. There are no basal spots on segments 4-8. Pritchard (1936) described and illustrated the larva.

Size. Total length: 50-56 mm; abdomen: 37-44 mm; hindwing: 33-40 mm.

Habitat. Forest streams with moderate riffles.

Discussion. This species was described from Cunneotubby Creek near Wilburton in Latimer County, Oklahoma. Pritchard (1936) made a few notes on its behavior near the type locality several other localities in eastern Oklahoma. Pritchard considered the flight of *S. ozarkensis* "quite irregular," but not as extensive as *S. inearis*, which was flying commonly with it. *Somatochlora ozarkensis* flies from just after daybreak to early morning or during the late evening, but is rarely seen during the day.

Somatochlora tenebrosa (Say)

Clamp-tipped Emerald

(Map 156)

Libellula tenebrosa Say, 1839: 19.

Cordulia tenebrosa, Hagen, 1861: 137.

Cordulia tenebrica (*nomen nudum*), Hagen, 1861: 138.

Cordulia (*Epitheca*) *tenebrosa*, Sélys, 1871b: 55.

Somatochlora tenebrosa, Kirby, 1890: 49.

Type. Indiana; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Ouachita, St. Francis.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IA, IL, IN, KS, KY, MA, MD, ME, MN, MO, MS, NC, NH, NJ, NY, OH, OK, PA, RI, SC, TN, UT, VA, WI, WV; CANADA: N.B., N.S., Ont., Que..

Seasonal Distribution. Jul. 17 (AR).

Identification. This common eastern U.S. species has been seen rarely as far west as Arkansas and Oklahoma. It is distinct, among our species, in having a single large circular pale spot laterally on abdominal segment 2. The face is orangish-yellow and the top of the head is deep metallic blue or black. The thorax is brown and metallic green with well-developed pale stripes laterally. The wings are hyaline, occasionally becoming lightly amber tinted. The legs are wholly black. The abdomen is brown with metallic reflections. Segment 2 is as above. Segment 3 has a short dorsolateral spot and a larger ventral spot. The large angulate caudal appendages of the male are distinctive. The female has a long, compressed ventrally projecting ovipositor. Walker (1925) described the larva.

Size. Total length: 48-65 mm; abdomen: 33-46 mm; hindwing: 33-42 mm.

Habitat. Small forested streams with intermittent riffles and pools.

Discussion. This species is typical of the genus, flying in the early morning or late afternoon and evening. Walker and Corbet (1975) noted this species' preference for shade. Wilson (1912) observed this species "...patrolling back and forth just after sunset in one corner of an old pasture near a small brook at the foot of the mountains. They were strong and rapid fliers..."

CHAPTER 13

LIBELLULIDAE

Skimmers

This is the largest family of Odonata and includes nearly a third of the species in the south-central U.S. Members of the family are world-wide in distribution and among some of the most common and recognizable species. They are generally inhabitants of ponds, lakes and marshes, where they are often seen flying or perched atop twigs and bushes. Many are vividly colored and have distinctive wing markings. In most species the males accompany the females during oviposition.

The eyes are large and meet on top of the head for a considerable distance. They lack the tubercles on the hind margin of the eyes found in the Corduliidae. The triangles in the fore- and hindwings are different shapes, and males lack an anal triangle, so that the wings in both sexes are rounded basally. The radial and median planates are well-developed. The anal loop is distinctly shaped as a foot with a well-developed ankle and toe region. The abdomen is generally shorter and more depressed than in the Corduliidae and males lack auricles on abdominal segment 2.

The larvae are very similar to those of the Corduliidae, so much so that individual genera are often easier to recognize than the family to which they belong. Adult characters are clear in separating these families, however, larval characters are much more plastic and often result in frustration for both the experienced and inexperienced

identifier. Larval keys that accomodate these ambiguities are needed. They generally have shallower crenations in the palpal lobes, however. Various authors (Kirby 1889; Ris 1909-1916; Borror 1945) have studied this family in detail. Needham and Fischer (1936) and Westfall and Tennessen (1996) have given larval keys to the genera in this family.

KEY TO ADULT GENERA OF LIBELLULIDAE

1. Antenodal crossveins of both wings with row of roundish brown to black spots *Pseudoleon superbus*
- 1'. Antenodal crossveins of both wings without row of roundish brown to black spots 2
- 2(1'). Vein M₂ waved (only slightly so in *Brechmorhoga* and *Macrothemis*) 3
- 2'. Vein M₂ smoothly curved 10
- 3(2). Hindwing with 2 cubito-anal crossveins and vein Cu1 arising from outer side of triangle; hindwing narrow at base; south Texas & Mexico
..... *Cannaphila insularis*
- 3'. Hindwing without 2 cubito-anal crossveins and vein Cu1 not arising from outer side of triangle; hindwing wider at base 4
- 4(3'). Wings with more than 1 crossvein (many *Libellula semifasciata* have a single crossvein, but with large spots at nodus and pterostigma *Libellula*
- 4'. Wings with a single bridge crossvein 5
- 5(4'). Pterostigma extremely long, surmounting 5-6 crossveins *Orthemis*

- 5'. Pterostigma moderately long, surmounting no more than 4 crossveins 6
- 6(5'). Hindwing with 2 cubito-anal crossveins *Pantala*
- 6'. Hindwing with a single cubito-anal crossvein 7
- 7(6'). Forewing with 2 rows of cells beyond triangle 8
7. Forewing with 3 rows of cells beyond triangle 9
- 8(7). Forewing subtriangle with 1-2 cells; median planate absent in forewing
. *Macrothemis*
- 8'. Forewing subtriangle with 3 cells; median planate present in forewing
. *Brechmorhoga mendax*
- 9(7'). 2 to 4 parallel rows of cells between vein A_2 and marginal row at hind
angle of hindwing *Dythemis*
- 9'. 4 to 5 very irregular rows of cells between vein A_2 and marginal row at
hind angle of hindwing *Paltothemis*
- 10(2'). Midrib of anal loop nearly straight or only slightly kinked at ankle; reverse
vein, postnodal crossveins of 2nd series, and 1st crossvein under pterostigma
generally strongly aslant 11
- 10'. Midrib of anal loop angulated; reverse vein and postnodal crossveins slanted
only slightly if at all 13
- 11(10). Forewing triangle of 2-4 cells, usually with 3-4 cells beyond in trigonal
interspace; radial planate often subtends 2 rows of cells *Celithemis*
- 11'. Forewing triangle of 1 cell, with 2 rows of cells beyond trigonal interspace;
radial planate subtends a single row of cells 12

- 12(11'). Forewing triangle with inner side about as long as front side; more than a single bridge crossvein *Perithemis*
- 12'. Forewing triangle with inner side much longer than front side; generally only a single bridge crossvein *Macrodiplax balteata*
- 13(10'). Wings with more than a single bridge crossvein *Micrathyria*
- 13'. Wings with a single bridge crossvein 14
- 14(13'). Wings with a triple-length vacant space before single crossvein that is either under distal end of pterostigma or just beyond it
..... *Pachydiplax longipennis*
- 14'. Wings with one or more crossveins under pterostigma and without a triple-length vacant space 15
- 15(14'). Wings with a single crossvein under pterostigma; without a dark band across entire base of hindwing *Sympetrum*
- 15'. Wings generally with 2 or more crossveins under pterostigma; often with a dark band across entire base of hindwing 16
- 16(15'). Hindwing with 2 paranal cells before anal loop *Brachymesia*
- 16'. Hindwing with 3 paranal cells before anal loop 17
- 17(16'). Wings with trapezoidal pterostigma, front side distinctly longer than rear; some double-length cells above apical planate, reach from planate to M_1 18
- 17'. Wings with pterostigma not trapezoidal, front and rear sides equal in length; apical planate poorly developed and with no double-length cells reaching to

- M₁ 20
- 18(17). All cells above apical planate double-length and in a single row; one crossvein under pterostigma *Miathyria marcella*
- 18'. Half of the cells above apical planate in a single row, followed by a double row; 2 crossveins under pterostigma 19
- 19(18'). Forewing with 3 rows of cells in trigonal interspace *Tauriphila azteca*
- 19'. Forewing with 4 rows of cells in trigonal interspace *Tramea*
- 20(17'). Spines on outer angle of hind femur gradually increasing in length distally; forewing with 5 paranal cells before subtriangle *Erythrodiplax*
- 20'. Spines on basal half or 2/3 of outer angle of hind femur short and of nearly equal length, with 2-4 large spines on distal 1/2-1/3 *Erythemis*

Genus *Brachymesia* Kirby

Tropical Pennants

Brachymesia Kirby, 1889.

Cannacria Kirby, 1889.

This is a small genus of three species, including two Neotropical ones. All three species occur in the south-central U.S. They are medium-sized with a brown thorax and red, brown or black abdomen. The wings are hyaline, smoky or with a large dark spot beyond the nodus. The apical planate subtends 2-3 rows of cells. The abdomen is

swollen basally and strongly compressed to the end. They are found around lakes, ponds, marshes and ditches, often perched high on the riparian vegetation. The larvae generally lack hairs and are often patterned with lateral spines on the abdomen increasing in length to rearward. Byers (1936) discussed the taxonomy of this group.

KEY TO ADULT SPECIES OF *BRACHYMESIA*

1. Hindwing with 6 antenodal crossveins; median planate subtends a single row of cells *furcata*
- 1'. Hindwing with 7-8 antenodal crossveins; median planate subtends 2 rows of cells 2
- 2(1'). Face black with light markings; forewing with 3 rows of cells in trigonal interspace to level of middle fork, then 4 rows; pterostigma white *gravida*
- 2'. Face light; forewing with 3 rows of cells in trigonal interspace to level of nodus, then 4 rows; pterostigma buff colored *herbida*

Brachymesia furcata (Hagen)

Red-tailed Pennant

(Map 157)

Erythemis furcata Hagen, 1861: 169.

Brachymesia australis Kirby, 1889: 330.

Cannacria smithii Kirby, 1894: 266.

Cannacria furcata, Calvert, 1907: 325.

Brachymesia furcata, Muttkowski, 1910a: 170.

Type. Cuba; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Tamaulipan, Texan.

Watershed(s): Colorado, Guadalupe, Nueces, Rio Grande, San Jacinto.

General Distribution. UNITED STATES: AZ, CA, FL, MO, TX; MEXICO: BCS, CAM, COA, HGO, MOR, QTR, SIN, TAM, VER, YUC; West Indies; Central America; south to Argentina & Chile.

Seasonal Distribution. May 13 (TX) - Sep. 12 (TX).

Identification. This species is found in the southern portions of Texas and is distinctive from the other two species in this genus because of a relatively short abdomen, distinctly shorter than the wings, that becomes brilliant red in mature individuals. The face is yellow or red and the prothorax is bilobed and covered by a dense fringe of long hairs. The pterothorax is brown, unmarked and densely clothed with short hairs. The wings are hyaline with a hint of yellow basally in the forewing and a larger spot in the hindwing. The legs are brown becoming black distally. The abdomen is swollen basally and strongly compressed, tapering towards the tip. It is bright red in older males and some females, but usually yellowish-brown in the latter. Garcia (1938) described and illustrated the larva.

Size. Total length: 38-46 mm; abdomen: 23-30 mm; hindwing: 30-36 mm.

Habitat. Ponds, lakes and ditches with permanent or semipermanent water including brackish waters.

Discussion. This species frequently forages from atop bushes and tall grasses. Males when not patrolling perch on twigs or other vegetation extending out over the water.

Dunkle (1989a) has published the only notes on the behavior of this species. Pairs mate for a short period of 15 seconds, then the male guards the female as she dips the eggs in the water along the shoreline.

***Brachymesia gravida* (Calvert)**

Four-spotted Pennant

(Map 158)

Leptemis gravida Calvert, 1890: 35.

Cannacria gravida, Calvert, 1895: 547.

Brachymesia gravida, Muttkowski, 1910a: 170.

Type. unknown locality; ANSP.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, Trinity,

White.

General Distribution. UNITED STATES: AL, AR, DE, FL, GA, LA, MD, MS, NC, NE, NJ, NM, OK, SC, TN, TX, VA.

Seasonal Distribution. Apr. 27 (LA) - Oct. 24 (LA).

Identification. This is the most widespread and commonly encountered member of this genus in our region. It has a much longer abdomen that is parallel-sided, not tapered, as in *B. furcata*. Young individuals are similar to those of *B. herbida*, but the latter have a tan pterostigmata and lack the prominent wing spots described below. The face is black and white, becoming wholly black, along with the top of the head, in older individuals. The thorax is brown, becoming dark bluish-black with age, but less so in females. The wings have a distinct white pterostigma. Males and mature females develop a dark brown spot between the nodus and pterostigma in all wings. The legs are black. The abdomen is brown with an interrupted longitudinal dark stripe in teneral and females, but it becomes wholly black in males. It is swollen basally, and somewhat compressed for a short distance thereafter, but never tapering to the end. The larva was described by Byers (1936) and Needham and Fisher (1936) separately.

Size. Total length: 47-55 mm; abdomen: 30-40 mm; hindwing: 32-42 mm.

Habitat. Ponds, lakes and roadside ditches, including brackish waters.

Discussion. This species is typical of the genus, often perching high on twigs, stems and bush tops. It may be abundant on fence wire and telephone lines. After a brief mating, females oviposit in a similar fashion to *B. furcata*, dipping eggs into the water, sometimes guarded by the male.

***Brachymesia herbida* (Gundlach)**

Tawny Pennant

(Map 159)

Libellula herbida Gundlach, 1888: 261.*Cannacria batesi* Kirby, 1889: 341.*Cannacria fumipennis* Currie, 1901: 387.*Brachymesia herbida*, Ris, 1912: 736.**Type.** Cuba; Zool. Inst., Havana.**Regional Distribution.***Biotic Province(s):* Austroriparian, Balconian, Texan.*Watershed(s):* Colorado, Guadalupe, Neches, Rio Grande.**General Distribution.** UNITED STATES: FL, TX; MEXICO: CAM, GRO, NAY, SIN, SLP, TAB, TAM, VER, YUC; West Indies, Central America south to Argentina.**Seasonal Distribution.** May 19 (TX) - Aug. 21 (TX).**Identification.** This species is rare in our area, but may be confused with teneral individuals of *B. gravida*. The pterostigma is tan, not white, and the wings lack a dark spot, although they may be smoky. The face is tan or brown. The thorax is brown and unmarked. The wings may be amber or smoky, especially along the front border, but never with a dark spot beyond the nodus. The abdomen is black dorsally and yellow

laterally.

Size. Total length: 43-48 mm; abdomen: 32-36 mm; hindwing: 33-38 mm.

Habitat. Ponds, lakes, marshes and roadside ditches including brackish waters.

Discussion. Nothing has been published on the biology of this tropical species, but it is presumed similar to our other two species. It occurs year round farther south in its established range.

Genus *Brechmorhoga* Kirby

Clubskimmer

Brechmorhoga Kirby, 1894.

Nothemis Navás, 1915.

This is a moderate sized genus of Neotropical species. A single species occurs in the western part of our area (*B. pertinax* (Hagen) occurs in Arizona). Most species are blue-gray in color. The wings are hyaline, or smoky in some females, generally with 2 crossveins in the forewing triangle and lacking an apical planate. The combination of their color and the slightly expanded terminal abdominal segments may lead to the illusion of a clubtail dragonfly. The larvae are compact and generally lack hairs.

***Brechmorhoga mendax* (Hagen)**

Pale-faced Clubskimmer

(Map 160)

Dythemis mendax Hagen, 1861: 164.

Brechmorhoga mendax, Calvert, 1898b: 313.

Type. Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Brazos, Canadian, Cimarron, Colorado, Guadalupe, Nueces, Ouachita, Red, Rio Grande, San Antonio.

General Distribution. UNITED STATES: AR, AZ, CA, KS, NM, NV, OK, SD, TX, UT; MEXICO: BCS, GRO, NLN, SLP, SON, TAM, VER.

Seasonal Distribution. Mar. 17 (TX) - Nov. 6 (TX).

Identification. This species is widespread throughout the western portion of our region. Its stout shape, with a clubbed tail, color and markings may lead to misidentifications as a gomphid, but the eyes are in contact on top of the head. The face is pale. The thorax is bluish-gray. There are two broadly confluent stripes middorsally on the thorax for 2/3 to 3/4 its length. There is a broad brown humeral stripe and two additional lateral stripes that are confluent above. The wings, sometimes becoming amber in females, have a dark basal spot, more prominent in the hindwing. The legs are brown becoming darker distally. The abdomen is largely black with pale basal segments. It is slender basally,

then slightly expanded at segments 7-9 in males. There are paired bluish-gray spots dorsally on segments 3-6, but these quickly become obscured with age. Segment 7 has a pair of large pale dorsal spots that are broad and never obscured. Needham and Westfall (1955) described the larva.

Size. Total length: 52-64 mm; abdomen: 34-46 mm; hindwing: 32-44 mm.

Habitat. Sand and cobble streams and rivers.

Discussion. Males of this species typically have small territories that they patrol low over the water, less than 1 m, and can be quite elusive. Kennedy (1917) described this species as "...the most graceful on the wing of any odonate with which I am familiar." Females oviposit by making short straight or figure eight runs low over the water and dipping eggs at the surface. Adults are active all day, but may retreat to shaded areas of the stream in the heat of the day. They are often abundant at dusk in clearings near streams where they feed on emerging mayflies and caddisflies (C.R. Nelson pers. comm.).

Genus *Cannaphila* Kirby

Narrow-winged Skimmer

Cannaphila Kirby, 1889.

This is a small Neotropical genus of three species, a single one of which occurs as far north as southern Texas. They are rather non-descript as a group, except for having the hindwings only slightly wider than the forewings, basally. The toe of the anal loop is

poorly developed for a libellulid. There are 2 cubito-anal crossveins and vein Cu1 arises from the outer side of the hindwing triangle.

***Cannaphila insularis* Kirby**

Narrow-winged Skimmer

(Map 161)

Cannaphila insularis Kirby, 1889: 341.

Misagria insularis funerea Carpenter, 1897: 434.

Cannaphila angustipennis insularis Muttkowski, 1910a: 144.

Cannaphila funerea, Needham & Westfall, 1955: 468.

Type. Haiti; BMNH.

Regional Distribution.

Biotic Province(s): Tamaulipan, Texan.

Watershed(s): Guadalupe, Rio Grande, San Antonio.

General Distribution. UNITED STATES: TX; MEXICO: CAM, CHS, JAL, NAY, NLN, QTR, SLP, TAB, VER, YUC; West Indies; Central America south to Panama.

Seasonal Distribution. Jun. 27 (TX) - Sep. 4 (TX).

Identification. This is an uncommon non-descript species only rarely reported from Texas. The best diagnosing character is the unusually narrow base of the hindwing. The body is brown with a pale yellow face. The top of the head becomes metallic green in

older males. The thorax is brown, darker in front, with streaks of yellow that become obscured with age. The wings are unusually narrow, as described above, and hyaline with a brown pterostigma. The legs are brown, turning to black distally. The abdomen is brown edged by a black carina, with some pale yellow dorsally and basally. The larva is unknown.

Size. Total length: 36-39 mm; abdomen: 24-26 mm; hindwing: 29-32 mm.

Habitat. Ponds and lakes.

Discussion. Nothing has been published on the biology or behavior of this species.

Genus *Celithemis* Hagen

Pennants

Celithemis Hagen, 1861.

This is a genus of eight usually colorful eastern North American species. All but a single northern species occur in the south-central U.S. Members of this group are commonly seen perching on grass, bushes or tall twigs in open fields or around ponds, lakes and marshes. The face is pale yellow often turning brilliant red in older individuals. The thorax is pale with dark stripes that become obscured with age. The humeral and antehumeral stripes generally form a single broad dark shoulder stripe. The wings are generally colorful and variously marked, with at least a basal bicolored spot in the hindwing. The color pattern of the wings is the easiest character for identification. The

legs are usually black with a touch of pale color on the underside of the femora. The midrib of the anal loop is nearly straight. The abdomen is slender and only slightly compressed along the middle segments. The larvae are often green and strikingly patterned, with eyes that narrow from front to back, but extend some distance laterally.

Needham and Westfall (1955) included a key to the larvae of all of our species.

Williamson (1922b) updated this genus, describing two new species.

KEY TO ADULT SPECIES OF *CELITHEMIS*

- | | | |
|--------|---|---------------|
| 1. | Wings clear or with only a touch of color basally | 2 |
| 1'. | Wings with large dark spots at or near the nodus | 4 |
| 2(1). | Radial planate usually subtends 2 rows of cells | <i>verna</i> |
| 2'. | Radial planate usually subtends a single row of cells | 3 |
| 3(2'). | Anal loop with 2 or 3 ankle cells; generally a single crossvein under
pterostigma | <i>amanda</i> |
| 3'. | Anal loop with a single ankle cell; generally 2 crossveins under pterostigma | 4 |
| 4(3'). | Cross-venation yellow, brown or black, in basal hyaline portion of wing;
trigonal interspace of forewing generally with rows of no fewer than 3 cells . .
. | <i>ornata</i> |
| 4'. | Cross-venation bright red in basal hyaline portion of wing in male; trigonal
interspace of forewing generally with 2 rows reduced to 1-3 cells | <i>bertha</i> |
| 5(1'). | Wings with median planate subtending 2 rows of cells; wing membrane | |

- yellow to orange *eponina*
- 5'. Wings with median planate subtending a single row of cells; wing membrane clear or at most with a yellow tinge 5
- 6(5'). Wings with basal dark spot touching nodus; round spot between nodus and pterostigma large, touching costa *fasciata*
- 6'. Wings with basal dark spot not touching nodus; round spot between nodus and pterostigma small, not touching costa *elisa*

***Celithemis amanda* (Hagen)**

Amanda's Pennant

(Map 162)

Libellula pulchella (Burmeister (*nec* Drury, 1770), 1839)

Diplax amanda Hagen, 1861: 183.

Leucorrhinia amanda, Brauer, 1868: 719.

Celithemis amanda, Kirby, 1890: 11.

Type. Georgia; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Neches, Ouachita, Red, Sabine, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, LA, MS, NC, SC, TX.

Seasonal Distribution. Jun. 17 (LA) - Sep. 9 (LA).

Identification. This is a small uncommon species in our area that can be recognized by the extent of the wing markings and the unmarked thorax. It has a yellow face that becomes brown or red in older males. The thorax is yellow, turning brown with age, and largely unmarked. The forewings are unmarked with red veins. The hindwings have a large basal amber or brown spot, extending approximately 1/4 the length of the wing. This spot generally contains 2 anterior and a single posterior black stripe. The abdomen is largely dark brown or black. There are pale dorsal spots on segments 1-7. Segment 3 and the basal portion of 4 are pale. These pale areas are yellow, turning red in older individuals.

Size. Total length: 24-31 mm; abdomen: 16-22 mm; hindwing: 21-27 mm.

Habitat. Calm lakes, ponds, and marshes with emergent vegetation.

Discussion. This species is uncommon west of the Mississippi. As is typical of the genus, it is often seen perching on tall grasses or bushes around the water. Pairs mate while perched on emergent vegetation. Females, thereafter oviposit, along the shore accompanied by the male.

Celithemis bertha Williamson

Red-veined Pennant

(Map 163)

Celithemis bertha leonora Westfall, 1952: 112.

Type. Florida, UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Red.

General Distribution. UNITED STATES: AL, FL, GA, LA, MS, NC, SC.

Seasonal Distribution. May 28 (LA) - Sep. 23 (LA).

Identification. This is another smaller uncommon species that has only been reported in Louisiana west of the Mississippi. Males become bright red, including the wing veins, with age. This species can be distinguished from others in the genus by the thoracic markings and relative lack of maculation on the wings. There is only a small basal amber or black spot in the hindwing. The face, thorax and pale abdominal markings are all yellow in younger individuals but become red with age. There is a wide black humeral and third lateral stripe. The midlateral stripe is broad and fully developed below the spiracle. The face, thorax and wing veins remain yellow in females. The abdomen is slender and mostly black with pale basal markings laterally. Pale dorsal spots are present on segments 3-7.

Size. Total length: 26-37 mm; abdomen: 16-23 mm; hindwing: 23-28 mm.

Habitat. Lakes, ponds, pools, roadside ditches and borrow pits with emergent vegetation.

Discussion. This species was erroneously reported from the Jones State Forest in

Montgomery County, Texas by Price *et al.* (1989). The species was actually *C. ornata* (R. Orr pers. comm.). *Celithemis bertha* does not appear to range as far west as the eastern Piney Woods region of Texas. This species is very similar to *C. amanda* in its habits and behavior. Females oviposit accompanied by males and Dunkle (1989a) reported this species' preference for pine trees as roosting sites.

***Celithemis elisa* (Hagen)**

Calico Pennant

(Map 164)

Diplax elisa Hagen, 1861: 182.

Celithemis elisa, Walsh, 1862: 400.

Leucorrhinia elisa, Brauer, 1868: 719.

Type. New Jersey; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, FL, GA, IL, IN, KY, KS, MA, MD, ME, MI, MN, MO, MS, NE, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, WI;

CANADA: N.B., N.S., Ont., Que.

Seasonal Distribution. Mar. 9 (LA) - Sep. 25 (LA).

Identification. This is one of the more common and widespread *Celithemis*, only second to *C. eponina*. It is easily distinguished by the wing markings, which include a brown spot basally, beyond the nodus and at the tips. The basal spot in the hindwing is large, occupying 1/4 or more of the wing and usually bicolored, encompassing a central amber area. The face is yellow, but as usual, becomes bright red in older males. The thorax is yellowish-brown, with the typical dark middorsal stripe and diffuse brown stripes laterally on each suture. The wings are as above with a yellow pterostigma that becomes red with age. The abdomen is dark brown or black with basal pale markings laterally on segments 1-4 and dorsally on segments 3-7.

Size. Total length: 24-34 mm; abdomen: 16-22 mm; hindwing: 25-30 mm.

Habitat. Lakes, Ponds and borrow pits with emergent vegetation and calm, clear waters.

Discussion. This species perches on top of tall grasses and weeds in open fields and surrounding water. Waage (1986) described much of the behavior of this species. Males are not territorial and perch facing away from the water to apparently intercept females as they approach the water (Dunkle 1989a). Mating takes place accompanied by the male or single, and lasts an average of five minutes, with oviposition requiring 3-5 minutes .

Celithemis eponina (Drury)

Halloween Pennant

(Map 165)

Libellula eponina Drury, 1773: 47.

Libellula camilla Rambur, 1842: 46.

Libellula lucilla Rambur, 1842: 46.

Celithemis eponina, Hagen, 1861: 147.

Type. North America; unknown.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CO, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV; CANADA: Ont., Que.; Cuba and Bahamas.

Seasonal Distribution. May 16 (OK) - Oct. 15 (TX).

Identification. This is our largest, most widely distributed, and perhaps most colorful *Celithemis* species. Its common name is very descriptive of its distinctive orange and brown or black wings. The face is yellowish or olivaceous, becoming darker with age and red in males. The thorax is yellowish-green with a dark middorsal stripe and narrow lateral stripes on each suture. The midlateral stripe is usually not continuous after the spiracle. This is the only species with completely yellowish-orange wings marked with

broad dark brown or black stripes and a red pterostigma. The abdomen is slender with pale yellow dorsal spots that become red, with age, on segments 3-7.

Size. Total length: 30-42 mm; abdomen: 20-30 mm; hindwing: 27-35 mm.

Habitat. Lakes, ponds, borrow pits and marshes with emergent vegetation.

Discussion. This species may be quite abundant. It forages from atop tall grasses, weeds and stems in open fields some distance from the water. It perches, somewhat uniquely, with the fore- and hindwings in different planes. The forewings are held somewhat vertically and the hindwings horizontally. Most activity takes place in the early to midmorning hours. Females oviposit similarly to other species, accompanied by males. Its fluttering flight has been compared to that of a butterfly (Needham 1901; Dunkle 1989a). Miller (1982) studied the reproductive behavior of this species in Florida and Whedon (1914) observed this species in Minnesota.

Celithemis fasciata Kirby

Banded Pennant

(Map 166)

Celithemis fasciata Kirby, 1889: 326.

Celithemis monomelaena Williamson, 1910: 155.

Celithemis fasciata monomelaena, Davies & Tobin, 1985: 91.

Type. Georgia; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Antonio, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, MI, MO, MS, NC, NJ, NY, OH, OK, RI, SC, TN, TX, VA, WV .

Seasonal Distribution. May 17 (LA) - Sep. 18 (TX).

Identification. This is another larger member of this group that is easily identified by its dark color and clear wings with large black spots. The face and body of this species are bright yellow, but quickly become black or dark blue in males. The thorax is yellow, striped with black on the humeral, midlateral and third lateral sutures, but becomes wholly black at maturity. The wings are clear with a large basal black spot extending out to the nodus and encompassing an amber area centrally in the hindwing. There is also a dark spot in the outer half of the wing and the wing tips are black. The abdomen is black with pale yellowish dorsal markings on segments 5-7 that quickly become obscured in older individuals. Leonard (1934) described the larva as *C. monomelaena*.

Size. Total length: 28-38 mm; abdomen: 17-26 mm; hindwing: 24-32 mm.

Habitat. Lakes, ponds and borrow pits with emergent vegetation.

Discussion. *Celithemis fasciata* prefers protected areas of ponds and lakes with thick growths of trees or bushes. They forage, as do other species in this group, from tall grasses or stems. They often perch, in a similar fashion to *C. eponina*, with the forewings

elevated above the hindwings. Females oviposit accompanied by males or alone.

***Celithemis ornata* (Rambur)**

Faded Pennant

(Map 167)

Libellula pulchella Burmeister, 1839: 849.

Libellula ornata Rambur, 1842: 96.

Diplax ornata, Hagen, 1861: 182.

Leucorrhinia ornata, Brauer, 1868: 719.

Celithemis ornata, Muttkowski, 1910a: 168.

Type. United States; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Mississippi, Red, Sabine, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, FL, GA, LA, MD, MS, NC, NJ, SC, TX, VA.

Seasonal Distribution. Mar. 12 (LA) - Sep. 9 (LA).

Identification. This is a small reddish species similar to *C. amanda*, but it has a larger spot in the hindwing and an un-marked thorax. In *C. ornata* the basal 1/5 of the hindwing is amber or brown. The face and thorax are pale olivaceous. There are wide brown

middorsal stripe and a broad humeral, midlateral and third lateral stripe on the sides. The last two of these stripes are confluent above. There is a basal amber spot in the hindwing, as described above, that is variously striped with dark brown or black. The abdomen is black with pale yellow spots dorsally on segments 1-7 that become red in older males.

Size. Total length: 31-36 mm; abdomen: 21-26 mm; hindwing: 21-28 mm.

Habitat. Lakes, ponds, pools, with calm waters and slow reaches of streams, all with emergent vegetation.

Discussion. This is a dainty species that behaves similarly to other members of the genus. It may be seen perched high on tall grasses and stems when foraging in open fields. It is more common in the eastern portion of its range. Females oviposit accompanied by males, along the shorelines of ponds, lakes and marshes.

Celithemis verna Pritchard

Double-ringed Pennant

(Map 168)

Celithemis verna Pritchard, 1935: 6.

Type. Oklahoma; UMMZ.

Regional Distribution.

Biotic Province(s): Austroriparian.

Watershed(s): Arkansas, Bayou Bartholomew, Mississippi, Ouachita, Red, St. Francis,

Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, IL, IN, KS, KY, LA, MD, MO, MS, NC, NJ, OK, SC, TN, TX, VA.

Seasonal Distribution. Apr. 12 (LA) - Jun. 12 (LA).

Identification. This species is different from the others in the genus, because it lacks pale spots dorsally on abdominal segments 5-7, and the hindwing has only a small black basal spot. The face and thorax are yellowish becoming black in older males. The black middorsal and humeral stripes are confluent at their lower ends. The mid- and third lateral stripes are present, but interrupted and irregular. The wings are clear with only a small black basal spot. The abdomen is black except for pale basal segments in teneral and females.

Size. Total length: 31-36 mm; abdomen: 20-24 mm; hindwing: 25-29 mm.

Habitat. Newly formed lakes and ponds with emergent vegetation.

Discussion. Pritchard (1935) described this species from Quinton, Oklahoma. He stated that he "...had very little success...in finding *verna* in the day time. At daybreak, however, ...numbers were found emerging among water lilies. During the day, several teneral specimens which were flushed from the vegetation bordering the lake fluttered to the tree tops." A female oviposits accompanied by the male, dipping the abdomen in the water, around the margin, at frequent intervals.

Genus *Dythemis* Hagen

Setwings

Dythemis Hagen, 1861.

This genus includes seven New World species, four of which occur within our range. Members of this group are commonly seen perching on top of grasses and other vegetation with both wings depressed downward and the abdomen raised above the rest of the body. These "setwings" are often found near streams and rivers of moderate current and lakes and ponds with emergent vegetation. They are medium-sized grayish-blue to yellow or red, with some species becoming heavily pruinose dark blue with age. The wings may have large basal spots or only a hint of color. The anal loop in the hind wing is a well-developed foot and is strongly angulate at the ankle. There are generally 2-4 parallel rows of cells between vein A₂ and the hindwing margin. The larvae are stout with middorsal spines on segments 3-9 and short lateral spines on segments 8-9. Needham and Westfall (1955) included two of our species in their larval key.

KEY TO ADULT SPECIES OF *DYTHEMIS*

1. Wings with wide basal crossband of red or brown out to hindwing triangle . . 2
- 1'. Wings without wide basal crossband of color out to hindwing triangle 3
- 2(1). Thorax and abdomen bright red; basal color of wings orange-red *maya*
- 2'. Thorax and abdomen brown or black; basal color of wings dark brown
 *fugax*
- 3(1'). Top of frons metallic purple; usually 4 cell rows between A₂ and hindwing

- margin in female *nigrescens*
- 3'. Top of frons not metallic; usually 3 rows of cells between A₂ and hindwing
margin in female *velox*

***Dythemis fugax* Hagen**

Checkered Setwing

(Map 169)

Dythemis fugax Hagen, 1861: 163.

Type. Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Nueces, Red, Rio Grande, Sabine, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: AR, AZ, IL, KS, NM, OK, TX; MEXICO: TAM.

Seasonal Distribution. Apr. 25 (TX) - Oct. 25 (TX).

Identification. This is a primarily southwestern species that is easily recognized by its dark color and the large basal brown spots that extend out to not quite 1/4 the length of the wings. It is the only dark *Dythemis* in our region, with strongly spotted wings. The

face is olivaceous, but becomes bright red in older males. The brown middorsal and antehumeral stripes are broadly confluent above, exposing only a small isolated pale area. The side of the thorax is bluish-gray or olivaceous with four brown diffuse lateral stripes. The legs are black and the wings are as above with a smaller spot of brown at the nodus and generally with dark wingtips. The abdomen is bluish-gray to yellow basally and dark brown to black for most of its length. There are pale spots laterally on segments 4-9 and middorsally on 4-7, becoming large and most conspicuous on 7. The remaining segments and caudal appendages are dark brown or black. Needham (1904) described and illustrated the larva from Roswell, New Mexico.

Size. Total length: 42-51 mm; abdomen: 30-35 mm; hindwing: 35-40 mm.

Habitat. Ponds and lakes with emergent vegetation.

Discussion. This species may be abundant, perching on tall vegetation surrounding ponds and lakes or in open fields away from water. Males perch at the tips of vegetation and along fence lines with the both pairs of wings depressed downward. When disturbed they usually don't fly far, returning quickly to their perch. Harp and Harp (1996) recently reported it from Arkansas for the first time.

Dythemis maya Calvert

Mayan Setwing

(Map 170)

Type. Mexico; ANSP.

Regional Distribution.

Biotic Province(s): Chihuahuan, Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: CHI, GRO, JAL, MOR, NAY, NLN, OAX, SIN, TAM, VER; Guatemala & El Salvador.

Seasonal Distribution. Jul. 5 (NLN) - Aug. 28 (TX).

Identification. This is an uncommon brilliant red species only known from isolated localities in the far southwestern portions of our area. It is the only red setwing in our area, but it may be confused with other red skimmers that it flies with. *Paltothemis lineatipes* is profusely marked with black on the thorax and abdomen, unlike *D. maya*. *Libellula croceipennis* and *L. saturata* are larger and have more extensive color in the wings. The face, thorax and abdomen of *D. maya*, are unmarked and all red, brilliantly so in males. Both wings have a broad basal crossband of deep amber for 1/4 of their length. The legs are brown with black tarsi. The abdomen is noticeably wider than in our other setwing species. The larva is unknown.

Size. Total length: 37-41 mm; abdomen: 23-26 mm; hindwing: 30-33 mm.

Habitat. Small streams with moderate to swift current.

Discussion. This species was first collected in the U.S. by C. Riley Nelson in Big Bend Ranch State Natural Area in Presidio County, Texas (Abbott 1996). I returned to this locality in August of 1997 and found it abundant at several streams (Fig. 11) within the

Natural Area. They were flying with *Libellula saturata*, *L. croceipennis* and *Paltothemis lineatipes*, which are all red species and similar in appearance, but can be separated with characters given above. *Dythemis maya* was flying from midmorning well into the afternoon. Males patrol short territories of scarcely more than 10 m, with regular attentiveness. When not patrolling they perch on vegetation overhanging the stream.

***Dythemis nigrescens* Calvert**

Black Setwing

(Map 171)

Dythemis nigrescens Calvert, 1899: 390.

Type. Mexico; CAS.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Tamaulipan, Texan.

Watershed(s): Brazos, Colorado, Guadalupe, Nueces, Rio Grande, San Antonio.

General Distribution. UNITED STATES: AZ, TX; MEXICO: CAM, GRO, HGO, MOR, NAY, NLN, OAX, PUE, SIN, SLP, SON, TAM, VER.

Seasonal Distribution. Apr. 10 (TAM) - Sep. 23 (TX).

Identification. This is a dark Mexican species found in the southwestern part of our area. It is very similar to *D. velox*. The top of the frons is metallic purple and older individuals become wholly pruinose dark blue. In teneral and females the face and

thorax are olivaceous, the latter has a dark, broad middorsal stripe that covers nearly the entire front of the thorax, and diffuse lateral stripes. All of these areas become obscured by a dark blue pruinosity in older individuals. The wings are clear with at most a slight spot of dark brown at the extreme base of both wings and generally at the extreme tips. The wings become amber throughout with age. There are generally 4 rows of cells between vein A2 and the hindwing margin. The legs are brown basally, becoming black on the tarsi and tibiae. The abdomen in the male is very slender after the swollen, pale basal segments. There are paired, pale, middorsal spots on segments 4-7, with those on 7 conspicuously enlarged. The remaining segments and caudal appendages are dark. The larva is unknown.

Size. Total length: 42-50 mm; abdomen: 26-32 mm; hindwing: 31-34 mm.

Habitat. Creeks, streams and rivers with moderate current.

Discussion. The biology of this species appears similar to *D. velox*.

***Dythemis velox* Hagen**

Swift Setwing

(Map 172)

Dythemis velox Hagen, 1861: 163.

Dythemis tabida, Hagen, 1861: 317.

Dythemis broadwayi Kirby, 1894b: 227.

Dythemis nigra Martin, 1897: 590.

Dythemis velox var. *tabida*, Calvert, 1898b: 310.

Type. Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, AZ, FL, GA, IL, KS, LA, MS, NC, NM, OK, SC, TN, TX, VA; MEXICO: BCA, CHI, NLN, TAM; Cuba.

Seasonal Distribution. Mar. 17 (TX) - Oct. 14 (TX).

Identification. This is another largely clear winged species that is very similar to *D. nigrescens*, but the top of the frons is dull, never metallic, older males generally lack heavy pruinescence, the wing tips are generally darker and there are usually 3 rows of cells between vein A2 and the hindwing margin. The face is olivaceous in teneral and females and dark brown in older males. The thorax and abdominal markings are as described for *D. nigrescens*, but generally with less diffuse pruinosity. The wings become amber in older individuals and have a spot of brown at the extreme base in both wings. The tips are dark brown, more so than in *D. nigrescens*. The legs are black. The larva was described from the Sand River in San Marcos, Texas, by Needham (1904).

Size. Total length: 42-50 mm; abdomen: 25-32 mm; hindwing: 30-36 mm.

Habitat. Lakes, ponds and borrow pits as well as creeks, streams and rivers with

moderate current.

Discussion. This is the most widespread of the North American species and is apparently continuing to expand its range. Bick (1957) didn't find it in Louisiana, but Mauffray (1997), forty years later, reported that it was common in the northern part of the state, west of Baton Rouge. It is often found along ponds, borrow pits, streams, creeks and rivers where it perches high on tall grasses and weeds with the wings depressed downward and the abdomen held above the rest of the body, sometimes considerably. Males patrol small areas along the stream and creek edges where they may be somewhat flighty.

Genus *Erythemis* Hagen

Pondhawk

Erythemis Hagen, 1861.

Leptthemis Hagen, 1861.

Mesothemis Hagen, 1861.

This is a Neotropical genus of 10 medium-sized species. Four largely clear-winged species that are green, blue or black occur in the south-central U.S. Members of this group often change considerably in color with age. These are somewhat stocky species with long legs well-armed with black spines. The wings are clear or with color only basally. The abdomen is narrowed at its middle segments and distinctly triangular in

cross-section. The larvae are stocky with the inferior caudal appendages strongly decurved downward. Williamson (1923b) reported on various species in the genus and Kennedy (1923a) studied the phylogeny and distribution of members of this group.

KEY TO ADULT SPECIES OF *ERYTHEMIS*

1. Radial planate subtends 2 rows of cells; base of midrib of anal loop 4 times as far from triangle as from vein A_2 *vesiculosa*
- 1'. Radial planate subtends single row of cells; base of midrib 3 times as far from triangle as from vein A_2 2
- 2(1). Thorax black or brown; mature males black, not pruinose blue; wings generally with basal brown spot; abdomen slender *plebeja*
- 2'. Thorax green, marked with brown; mature males become wholly pruinose blue; wings clear throughout 3
- 3(2'). Face all green; caudal appendages yellow *simplicicollis*
- 3'. Face with black across frons; caudal appendages blackish *collocata*

Erythemis collocata (Hagen)

Western Pondhawk

(Map 173)

Mesothemis collocata Hagen, 1861: 171.

Mesothemis simplicicollis var. *collocata*, Calvert, 1895: 552.

Erythemis collocata, Williamson, 1907b: 150.

Erythemis simplicicollis collocata, Muttkowski, 1910a: 158.

Type. Texas; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian.

Watershed(s): Canadian, Colorado, Red, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, ID, NM, NV, OR, TX, UT, WA, WY; CANADA: B.C.; MEXICO: BCS, CHI, CHS, COA, DFE, DGO, JAL, MCH, TLX.

Seasonal Distribution. May 26 (TX) - Oct. 4 (TX).

Identification. This common, widespread, green, western species is very similar to its eastern counterpart, *E. simplicicollis*. The darker *E. collocata* has a black midorsal abdominal stripe that is irregular in outline, however, and has black caudal appendages, even in teneral individuals. The middle abdominal segments of *E. collocata* are also wider than in *E. simplicicollis*. *Erythemis vesiculosa* is much larger, and has complete black stripes or bands dorsally on abdominal segments 4-6, rather than spots. Older pruinose males of *Libellula deplanata* may look similar, but they have distinct dark stripes in both wings basally. The face and thorax of *E. collocata* are bright green in tenerals and females, but the latter along with the abdomen, becomes completely powder blue or black in older males. The wings are clear. The abdomen is mostly black with green dorsolateral rectangular spots on segments 4-6. The remaining segments are black,

including the caudal appendages. The female has a "scoop-like" ovipositor, typical of the genus, projecting ventrally.

Size. Total length: 39-42 mm; abdomen: 23-30 mm; hindwing: 30-33 mm.

Habitat. Ponds, lakes and slow flowing waters of streams and creeks.

Discussion. This species was long considered a variant or subspecies of the eastern *E. simplicicollis*, until Gloyd (1958) distinguished the two adequately. It is common in the extreme parts of the western Texas panhandle where it occurs with *E. simplicicollis*. Nothing has been written on what mechanisms may serve to identify these species to each other where they are sympatric. *Erythemis collocata* are often seen perching on the ground similar to clubtails, for which they may be mistaken, due to their green color. They are very capable and fierce predators in the air, taking small to large prey at will.

Erythemis plebeja (Burmeister)

Pin-tailed Pondhawk

(Map 174)

Libellula plebeja Burmeister, 1839: 856.

Lepthemis verbenata Hagen, 1861: 162.

Lepthemis plebeja, Kirby, 1890: 39.

Libellula verbenata, Kirby, 1890: 40 (incorrect synonymy with *attala* Sélys, 1857).

Mesothemis verbenata, Kirby, 1899: 366.

Erythemis plebeja, Ris, 1911b: 603.

Type. Brazil; Halle.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan, Texan.

Watershed(s): Colorado, Guadalupe, Rio Grande, San Antonio.

General Distribution. UNITED STATES: FL, TX; MEXICO: CAM, CHS, COL, DFE, GRO, JAL, MOR, NAY, OAX, PUE, SIN, SLP, TAB, TAM, VER, YUC; West Indies; Central America; south to Argentina.

Seasonal Distribution. Apr. 11 (TX) - Sep. 10 (TX).

Identification. This is our only black pondhawk. It can easily be distinguished from other dragonflies by a combination of its dark color, a small basal black spot in the hindwing and an extremely thin abdomen. The similar *Macrodiplax balteata* is larger, with more black basally in the hindwing, and the abdomen is not noticeably narrowed. The face and thorax of *E. plebeja* are brownish in juveniles and females and black in older males. The dark abdomen is swollen basally and then extremely narrowed to the end, with light brown rings on abdominal segments 4-7, that become obscured in older males. The female has a ventrally projecting spout-like ovipositor on segment 9. Calvert (1927) described the larva.

Size. Total length: 41-49 mm; abdomen: 30-39 mm; hindwing: 30-37 mm.

Habitat. Ponds, lakes, ditches and slow reaches of rivers and streams.

Discussion. This species is an extremely active, aggressive flier. Males perch on vegetation low over the water. This species only occurs as far north as southern Texas

and northeastern Mexico. Dunkle (1989a) reported that copulation takes on average 40 seconds. Other aspects of its reproduction are presumed similar to that of the better known *E. simplicicollis*. It may very well be found all year round in extreme southern Texas.

Erythemis simplicicollis (Say)

Eastern Pondhawk

(Map 175)

Libellula simplicicollis Say, 1839: 28.

Libellula imbuta Say, 1839: 32.

Libellula caerulans Rambur, 1842: 64.

Libellula maculiventris Rambur, 1842: 87.

Mesothemis gundlachii Scudder, 1866: 195.

Erythemis simplicicollis, Calvert, 1905: 42.

Type. North America; Boston Mus.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, AZ, CA, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV; CANADA: Ont., Que.: MEXICO: CAM, COL, DFE, JAL, NLN, SLP, TAM, VER, YUC; West Indies; Belize, El Salvador, Honduras, Nicaragua, Costa Rica.

Seasonal Distribution. Year round.

Identification. This is one of the most widely distributed species in our region and in all of the eastern U.S. It is very similar to the darker, western *E. collocata*, with differences emphasized under that species. Other species for which it may be confused are also diagnosed under *E. collocata*. It is bright green in teneral individuals and females, becoming powder blue in older males, starting basally on the abdomen and on the front of the thorax. The abdomen, before becoming obscured in older males, is black with green dorsolateral spots on abdominal segments 4-6 and yellow or pale superior caudal appendages. Females have the usual ventrally projecting spout-like ovipositor below segment 9. The last instar has been described by various authors (Needham 1901; Calvert 1927; Garman 1927; Byers 1930) and Bick (1941) reared this species from an egg, describing each larval instar in detail.

Size. Total length: 36-48 mm; abdomen: 24-30 mm; hindwing: 30-34 mm.

Habitat. Ponds, lakes, ditches, and slow moving creeks, streams and rivers.

Discussion. This widespread species occurs as far south as Costa Rica, north as Quebec, Canada and is common throughout the central and eastern U.S. It has been taken in every county and parish in Arkansas and Louisiana. Its green color and common habit of

resting on the ground, trash, logs or other objects, may result in its initial confusion with clubtails, but the eyes are widely joined on top of the head. Various authors (Bell and Whitcomb 1961; Dunkle 1989a; Sanborn 1996) have commented on this species' ability to prey on a variety of small and large insects, up to and including its own species.

Although this species inhabits almost any slow moving body of water, they are often found around plants on the water surface, such as water lilies, lotus and duckweed, where males patrol their territories. Males of this species display a unique "leap frogging" behavior when defending territories (Williamson 1900b; Dunkle 1989a). A male chasing another male will suddenly move under or over the male in front. This swapping of positions will often occur repeatedly. McVey (1985) found that the change from female-like green coloration to the pruinose blue over the entire thorax and first 7 abdominal segments occurs through a predictable progression of color patterns. He described 17 different color patterns that this species undergoes over a period of 2-3 weeks. The rate of color change significantly decreased with both decreasing food consumption and air temperature. Waage (1986) and McVey and Smittle (1984) looked at sperm displacement and reproductive behavior of this species. Both found that sperm from the most recent mating competes for fertilizations with sperm stored from previous matings only if the female oviposits on the following day without remating. Sperm mixing in the bursa of females took 24 to 48 hours, at which time the last male to mate had replaced an average of more than 57-75% of the sperm stored by females from previous matings. McVey (1981, 1988) studied additional aspects of sexual selection and the reproductive tactics of this species. Harrison and Lighton (1998) studied the oxygen-limitation of flight muscle

in this species.

Erythemis vesiculosa (Fabricius)

Great Pondhawk

(Map 176)

Libellula vesiculosa Fabricius, 1775: 421.

Libellula acuta Say, 1839: 24.

Leptemis vesiculosa, Hagen, 1861: 160.

Erythemis vesiculosa, Davies & Tobin, 1985: 113.

Type. Mexico.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Brazos, Canadian, Cimarron, Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: AZ, FL, KS, NM, OK, TX; MEXICO: CAM, CHS, COL, DFE, DGO, JAL, MEX, MOR, NAY, OAX, SIN, SLP, SON, TAM, VER, YUC; West Indies; throughout Central America south to Argentina.

Seasonal Distribution. Apr. (TX) - Sep. 20 (TX).

Identification. This species is called the Great Pond Hawk because of its large size. It occurs from Kansas south through the central part of our area to Argentina. Its size and

the dark wide bands on abdominal segments 4-7 will distinguish it from other species, including the smaller *E. simplicicollis* and *E. collocata*, which have interrupted rings or spots on abdominal segments 4-7. The face and thorax are bright green and unmarked. The wings are hyaline with a green pterostigma in juveniles and the abdomen is green, marked as described above, with segments 8-10 black. The caudal appendages are pale yellow. The legs are greenish basally, but black for most of their length, with large prominent femoral and tibial spines. Klots (1932) described and illustrated the larva.

Size. Total length: 55-65 mm; abdomen: 40-48 mm; hindwing: 38-45 mm.

Habitat. Ponds, lakes, ditches, and slow moving creeks, streams and rivers.

Discussion. Like other members of this genus, this species is a strong flyer and skillfull hunter, taking other flying insects such as horseflies, butterflies and other dragonflies up to its size. It commonly rests on the ground or just above on objects or vegetation. Despite its strong flight capabilities, *E. vesicouloso* is generally wary, often staying just out of net's reach. Mating occurs while perched and females will oviposit in nearly any standing or slow moving body of water.

Genus *Erythrodiplax* Brauer

Dragonlets

Erythrodiplax Brauer, 1868.

Nadiplax Navás, 1917.

This is another large, primarily Neotropical genus that includes six North American species, all of which occur in the south-central U.S. Our species are all brown, blue or black with either minimal basal wing markings or wide bands of black in the outer half of the wings. Members of this group may change considerably in color with age and females of some species occur in different color forms. Our species are generally somewhat pale as teneral, but the face and top of the head may become metallic blue, black or red in older males. The abdomen is generally robust and often gently tapered beyond the compressed basal segments. Females and teneral often have pale dorsolateral spots on segments 3-7 that are almost always obscured in older males. The larvae have broadly rounded eyes and short lateral spines on the posterior abdominal segments. They are found climbing on submerged vegetation. Borror (1942) made a thorough and complete revision of this group. Mola (1996) studied the cytogenetics of two of our species (*E. fusca* and *E. umbrata*).

KEY TO ADULT SPECIES OF *ERYTHRODIPLAX*

- | | | |
|--------|---|-----------------|
| 1. | Radial planate subtends 2 rows of cells | 2 |
| 1'. | Radial planate subtends a single row of cells | 3 |
| 2(1). | Median planate generally subtends 2 rows of cells | <i>funerea</i> |
| 2'. | Median planate generally subtends a single row of cells | <i>umbrata</i> |
| 3(1'). | Vein Cu1 in hindwing arises from anal angle of triangle | 4 |
| 3'. | Vein Cu1 in hindwing distinctly separated from anal angle of triangle | <i>berenice</i> |

- 4(3). Frons bluish black; basal spot in hindwing variable, usually dark brown, but never red or reddish brown 5
- 4'. Frons red or reddish brown; basal spot in hindwing dark red or reddish brown *fusca*
- 5(4). Hindwing less than 21 mm; basal spot in hindwing small, extending at most to cubital crossvein *minuscula*
- 5'. Hindwing 21 mm or greater; basal spot in hindwing larger, often extending to base of A₂ or beyond *connata*

***Erythrodiplax berenice* (Drury)**

Seaside Dragonlet

(Map 177)

Libellula berenice Drury, 1770: 48.

Libellula histrio Burmeister, 1839: 849.

Dythemis naeva Hagen, 1861: 167.

Diplax berenice, Hagen, 1861: 178.

Macrothemis naeva, Kirby, 1890: 33.

Trithemis berenice, Kirby, 1890: 19.

Micrathyria berenice, Calvert, 1893: 260.

Erythrodiplax berenice berenice, Calvert, 1906: 269.

Type. United States.

Regional Distribution.

Biotic Province(s): Austroriparian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Mississippi, Neches, Red, Rio Grande, Sabine, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, CO, CT, DE, FL, GA, LA, MA, MD, ME, MS, NC, NJ, NM, NY, PA, RI, SC, TX, VA, VT; CANADA: N.S., Que.; MEXICO: BCA, BCS, CAM, OAX, QTR, SIN, YUC.; West Indies; Guatemala, Belize, Panama; Columbia, Venezuela, Trinidad.

Seasonal Distribution. Jan. 16 (TX) - Nov. 4 (LA).

Identification. This is a small, common, distinctly coastal species. It is similar to *Pachydiplax longipennis*, which has an unmarked face and basal wing markings. Juveniles and females have a pale face with broad black stripes. The thorax is pale yellowish, heavily striped with black in the front and sides. These dark stripes are broadly confluent at their lower ends. The face and thorax quickly become entirely dark blue or black in males and nearly so in females. The top of the frons becomes metallic blue. The wings are clear, although there may be hints of amber basally and at the nodus in females. The legs are black. The abdomen is largely black with broad orange or yellow spots dorsally on segments 1-7. These spots quickly become obscured in males and more slowly in females. Females are quite variable during this transition time, in some individuals the thorax becomes black before the abdomen. In others the abdomen

turns black before the thorax and there may or may not be an amber spot near the nodus in each wing. The female has a triangular shaped, scooped-out, ovipositor projecting ventrally from segment 9. Calvert (1904) described the larva.

Size. Total length: 28-35 mm; abdomen: 15-23 mm; hindwing: 18-26 mm.

Habitat. Salt marshes, estuaries, bays and occasionally inland lakes high in salinity.

Discussion. *Erythrodiplax berenice* is the closest thing we have to a marine dragonfly, capable of breeding in sea water, in North America. It is limited to salt marshes and estuaries along the coast and certain inland saline lakes. They may be locally abundant perched in great numbers on bushes, stems or on the ground. Populations of males are often found defending relatively small territories around isolated pools. The female oviposits accompanied by the male in these pools by dipping her abdomen numerous times while hovering in place. The nominate subspecies occurs in our region, but the *naeva* form occurs in the Antilles south to Columbia. This species probably occurs year around in the southern limits of our area. Dunson (1980) discussed adaptations of the larva to a saline environment.

Erythrodiplax connata (Burmeister)

Plateau Dragonlet

(Map 178)

Libellula connata Burmeister, 1839: 855.

Libellula communis Rambur, 1842: 93.

Libellula (Diplax) chlorpleura Brauer, 1865: 504.

Diplax abjecta Scudder, 1866: 196.

Libellula leontina Brauer, 1865: 505.

Diplax fraterna Hagen, 1873: 375.

Diplacodes portoricana Kolbe, 1888: 168.

Erythrodiplax connata, Kirby, 1890: 21.

Trithemis fraterna, Kirby, 1890: 20.

Erythrodiplax ponderosa Karsch, 1891: 113.

Trithemis basifusca, Calvert, 1895: 536.

Micrathyria pallida Needham, 1904: 710.

Erythrodiplax fraterna, Calvert, 1906: 253.

Erythrodiplax connata connata, Ris, 1911a: 499.

Type. Peru: MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, NM, TX; MEXICO: BCA, BCS, CHI, DGO, GRO, JAL, MCH, MOR, NAY, OAX, PUE, SIN, SON, VER; West Indies; Costa Rica, Panama; south to Argentina & Chile.

Seasonal Distribution. Jul. 13 (TX) - Oct. 22 (TX).

Identification. This is a small brown southwestern species. It is one of three closely

related species in our area. *Erythrodiplax fusca* is red, including the face, and often has a large basal spot of amber in the hindwing. *Erythrodiplax minuscula* is smaller with pale caudal appendages and is largely found in the eastern half of our area. *Erythrodiplax connata* is an olivaceous or brownish species that quickly becomes dark blue or black in older males. The top of the head changes to metallic blue or black in these individuals. The thorax is largely unmarked, but is darker brown in front and more olivaceous on the sides before pruinescence sets in. The legs are brown with black externally in females and completely black in males. The wings of individuals in our area are clear or have at most a dark amber spot, basally on the front portion of the hindwing, that extends no further than the first antenodal crossvein. The abdomen is stout with swollen basal segments and flattened medially. It is brown in the female and teneral and bluish-black in older mature males. The carinae and appendages are black.

Size. Total length: 26-30 mm; abdomen: 18-24 mm; hindwing: 21-26 mm.

Habitat. Marshy creeks, streams and ponds.

Discussion. Males of this dragonfly vigorously defend their relatively small territories, chasing away even slightly larger dragonflies. They perch low on vegetation surrounding ponds or low on stems overhanging the water. They often perch in a similar fashion to setwings with both wings moderately depressed. Pairs may mate on the wing or perched and males generally guard females as they oviposit.

***Erythrodiplax funerea* (Hagen)**

Black-winged Dragonlet

(Map 179)

Libellula funerea Hagen, 1861: 158.

Neurothemis affinis Kirby, 1889: 323.

Trithemis funerea, Calvert, 1889: 398.

Belonia funerea, Kirby, 1890: 29.

Trithemis tyleri Kirby, 1899: 364.

Erythrodiplax funerea, Calvert, 1906: 249.

Type. Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Tamaulipan.

Watershed(s): Rio Grande, San Antonio.

General Distribution. UNITED STATES: AZ, CA?, TX; MEXICO: CHS, COA, COL, DFE, GRO, JAL, MCH, MOR, NAY, NLN, OAX, PUE, SIN, SON, VER; Central America; south to Columbia & Ecuador.

Seasonal Distribution. Jun. 15 (NLN).

Identification. This species is a rare stray into the south-central U.S. from Mexico and Central America. It is a large, dark species with wings variable, but generally extensively marked with brown or black, in mature males and homochromatic females, extending basally out beyond the nodus halfway to the pterostigma and beyond in both wings.

Teneral individuals and heterochromatic females are most similar to *E. umbrata*, with

either a basal spot or a wide isolated dark band in the middle of the wing. Separating teneral and heterochromatic forms of these two species requires careful examination of the genitalia. The face is black. The thorax is brownish in teneral individuals, but well-marked with black stripes that become diffuse with age, so that the entire thorax becomes black in males. The thorax in mature female *E. funerea* is generally violet, while that of *E. umbrata* is more olivaceous or yellowish-green.

Size. Total length: 38-42 mm; abdomen: 20-33 mm; hindwing: 25-34 mm.

Habitat. Open temporary pools and ponds.

Discussion. This tropical species' range just barely reaches northward into the United States. It is primarily found along the Pacific coast, while its similar counterpart, *E. umbrata*, is found along the Atlantic seaboard. Needham and Westfall (1955) reported this species from Texas with no further information and Beatty and Beatty reported it from Bexar county, Texas, in an unpublished manuscript. These records were more than likely based on the same apparently lost specimen. The only other records near our area are from Mesa, Arizona, and Allende, Nuevo Leon, Mexico.

This species apparently aestivates, as adults, in forests before rains, where it then turns black within 3 days moving to open ponds and pools. Males and pairs in copula perch on vegetation around these ponds, while females oviposit, occasionally dipping their abdomens among the emergent vegetation. The above notes on the behavior of this species were provided by Sid Dunkle.

***Erythrodiplax fusca* (Rambur)**

Red-faced Dragonlet

(Map 180)

Libellula fusca Rambur, 1842: 78.*Libellula incompta* Rambur, 1842: 119.*Diplax fusca*, Hagen, 1861: 318.*Erythrodiplax fusca*, Brauer, 1868: 723.*Trithemis fusca*, Kirby, 1890: 20.*Trithemis pulla* Kirby, 1899: 363.*Erythrodiplax connata*, Calvert, 1906: 249.*Erythrodiplax connata fusca*, Ris, 1911a: 481.**Type.** Cayenne, Brazil; IRSN.**Regional Distribution.***Biotic Province(s):* Balconian, Tamaulipan.*Watershed(s):* Guadalupe, Nueces, Rio Grande.**General Distribution.** UNITED STATES: TX; MEXICO: CAM, CHS, COL, HGO, MOR, OAX, PUE, SLP, TAB, TAM, VER, YUC; Central America; south to Argentina.**Seasonal Distribution.** Jun. 26 (TAM) - Nov. 29 (TAM).**Identification.** This is a small species closely related to *E. connata* and *E. minuscula*, but it can generally be distinguished from these in the field by its predominantly reddish

color, including the head, thorax and basal wing spot. This basal wing spot is more prominent in males than in females and generally varies from a faint yellowish wash to a distinct dark reddish spot extending out to the triangle in the hindwing. Teneral individuals are yellowish-brown with a dark antehumeral stripe on the thorax and a brown lateral stripe on the abdomen. This yellowish color quickly becomes bright red or brownish in both sexes with age. The abdomen, especially in older males, becomes dark with light powder blue pruinescence.

Size. Total length: 24-28 mm; abdomen: 16-22 mm; hindwing: 19-28 mm.

Habitat. Marshy swamps, pools, lakes and streams with moderate current and periodic pools.

Discussion. This species is uncommon in the southern parts of Texas. It was collected in Blanco, Texas, along a small marsh, less than 10 m in diameter, adjacent to a spring-fed stream (Dunkle pers. comm.). This species may be seen foraging in open fields. Males perch low on stems overhanging the water.

Erythrodiplax minuscula (Rambur)

Little Blue Dragonlet

(Map 181)

Libellula minuscula Rambur, 1842: 115.

Diplax minuscula, Hagen, 1861: 183.

Diplacodes minuscula, Kirby, 1889: 308.

Trithemis minuscula, Castle & Laurent, 1896: 302.

Erythrodiplax minuscula, Calvert, 1906: 249.

Erythrodiplax connata minuscula, Borror, 1942: 169.

Sympetrum minusculum, Williamson, 1899: 325.

Type. United States; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Mississippi, Neches, Ouachita, Red, Sabine, San Antonio, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, IL, IN, KY, LA, MD, MS, NC, NJ, NV, OH, OK, PA, SC, TN, TX, VA, WV.

Seasonal Distribution. Apr. 3 (LA) - Dec. 9 (LA).

Identification. This is a widespread *Erythrodiplax* species. It is a small species, very similar to its southwestern counterparts, *E. connata* and *E. fusca*, once considered a subspecies of the former. It can generally be readily distinguished in the field from either of these by its eastern distribution and the distinctive powder blue pruinose appearance of older individuals. Other specific differences are given under each of the previous two species. Teneral and female individuals are greenish-brown. The front of the thorax is devoid of stripes and darker than the sides. The wings are hyaline or with only a small basal spot in the hindwing. There is a black middorsal and a pair of interrupted lateral stripes on the abdomen. Mature individuals develop a powder blue pruinose appearance

that envelopes the body from the thorax posteriorly and terminal abdominal segments anteriorly. Abdominal segments 7-10 become wholly black. The caudal appendages are pale and the female has a short but distinct, triangular, spout-like ovipositor, below segment 9. Needham (1904) described and illustrated the larva.

Size. Total length: 22-27 mm; abdomen: 14-17 mm; hindwing: 15-21 mm.

Habitat. Marshy ponds, pools, lakes and slow moving streams.

Discussion. This species may be quite common perched low on grasses or other ground cover. They generally don't travel far, even when disturbed. Males patrol and defend small territories close to the water's edge where competition is minimal and they have an easier time escaping larger dragonflies. Mating occurs quickly, generally less than 20 seconds, followed by females ovipositing, unaccompanied, but guarded by males, among emergent plants.

Erythrodiplax umbrata (Linnaeus)

Band-winged Dragonlet

(Map 182)

Libellula umbrata Linnaeus, 1758: 545.

Libellula unifasciata DeGeer, 1773: 557.

Libellula fallax Burmeister, 1839: 855.

Libellula ruralis Burmeister, 1839: 856.

Libellula subfasciata Burmeister, 1839: 855.

Libellula tripartita Burmeister, 1839: 855.

Libellula flavicans Rambur, 1842: 87.

Libellula fuscofasciata Blanchard, 1845: 217.

Trithemis umbrata, Kirby, 1890: 20.

Trithemis montezuma Calvert, 1899: 397.

Erythrodiplax umbrata, Calvert, 1906: 251.

Type. Surinam; BMNH.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Red, Rio Grande, San Antonio, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, KS, LA, IN, OH, OK, TX; MEXICO: CAM, CHS, GRO, HGO, MOR, NAY, NLN, OAX, PUE, QTR, SLP, TAB, TAM; West Indies; throughout Central America south to Argentina.

Seasonal Distribution. year round south.

Identification. This is a larger species in the genus, second only to the similar *E. funerea*. Diagnostic differences are given under that species. Other similar species include *Pseudoleon superbus*, which has wings with much heavier maculation and *Erythemis vesiculosa*, which may be confused with teneral and female individuals with unmarked wings. *Erythemis vesiculosa*, however, is a bright green species with the

abdomen well marked with black. The face and thorax of *E. umbrata* are olivaceous or greenish-brown in teneral males and most commonly in females. In these females the wings are clear with only a wash of amber or flavescence through the wing. Males become black with age, as does the uncommon heterochromatic form of the female. Both have a large dark spot that becomes a broad black band in the outer half of each wing. Calvert (1928) described the larva.

Size. Total length: 38-47 mm; abdomen: 23-34 mm; hindwing: 25-34 mm.

Habitat. Permanent and temporary marshy ponds, pools and lakes.

Discussion. This species will occasionally roost in large numbers on the branches of trees with their wings characteristically depressed below the body. Males don't guard females during oviposition like other members of this genus.

Genus *Libellula* Linnaeus

King Skimmers

Libellula Linnaeus, 1758.

Leptetrum Newman, 1833.

Platetrum Newman, 1833.

Plathemis Hagen, 1861.

Pigiphila Buchecker, 1876.

Holotania Kirby, 1889.

Ladona Needham, 1897b.

Belonia Kennedy, 1922b.

Eolibellula Kennedy, 1922b.

Eurothemis Kennedy, 1922b.

Neotetrum Kennedy, 1922b.

Syntetrum Kennedy, 1922b.

This is a large Holarctic group of cosmopolitan species that generally represent the dominant dragonflies around ponds, pools and lakes. The genus is well represented in our area with 19 of the 24 North American species occurring in the south-central U.S. They are often brightly colored and have distinct wing maculation that is useful for field indentifications. These are generally stocky dragonflies with a robust thorax that is usually unmarked and densely clothed with hair. The wings are usually conspicuously colored with stripes or spots, sometimes with white. The arculus is closer to the second antenodal crossvein than to the first. The forewing triangle may comprise 2-5 cells, but generally no more than 3-4, while the hindwing triangle nearly always comprises only 2 cells. Vein R_3 is usually strongly undulate or wavy. The robust and broad abdomen is shorter than the wings and regularly tapers rearward, but in some females segment 8 is widened laterally. This expansion is used to throw water along with eggs onto the shore, where they may experience less competition and thus mortality.

The larvae are found in pools, ponds, lakes or nearly any standing body of water, including watering troughs. They are generally hairy with the eyes prominently fixed anterolaterally on the head. Abdominal dorsal hooks are variably present, but never on

segment 9.

This is a relatively well-known group, but there are some differences in opinion on whether to include *Plathemis* and *Ladona* in this group. I follow Garrison (1997) in using the name in its broader sense. Ris (1910b) and Kennedy (1922a,b) studied the adults of this group in detail. Byers (1927c) constructed a key to the larvae known at that time, and Needham & Westfall (1955) included all but 2 of our species in their laval key.

KEY TO ADULT SPECIES OF *LIBELLULA*

- | | | |
|--------|--|------------------|
| 1. | Forewing triangle of 2 cells | <i>deplanata</i> |
| 1'. | Forewing triangle of 3 or more cells | 2 |
| 2(1'). | Arculus midway between 1st and 2nd antenodal crossveins; first abdominal sternite of male bearing a pair of large, conspicuous processes; abdomen of female with side margins of middle abdominal segments parallel; wing patterns of male and female differently marked | 3 |
| 2'. | Arculus at or very near 2nd antenodal crossvein; first abdominal sternite of male lacking prominent processes; abdomen of female slowly tapered rearward on lateral margins of middle segments; wing patterns of male and female similar | 4 |
| 3(2). | Median crossband of wings of male uniform dark brown; wing tips of female brown; male ventral tubercle on abdominal segment 1 deeply bifurcate and "U" shaped; widespread | <i>lydia</i> |
| 3'. | Median crossband of wings of male divided by strip of pale color; wing tips of | |

- female hyaline; male ventral tubercle on abdominal segment 1 emarginate or only modestly bifurcate, appearing as a "V;" western *subornata*
- 4(2'). Basal third of both fore- and hindwings covered full width by blackish band; wing tips clear *luctuosa*
- 4'. Basal third of wings without black markings or if present, not completely covering basal third of wing 5
- 5(4'). Anterior 1/4 of fore- and hindwings covered full length by diffuse brownish band strongly tinged with amber yellow; pterostigma white, heavily margined by black; wing tips of female generally black; sides of thorax creamy white crossed by narrow midlateral brown stripe *flavida*
- 5'. Anterior 1/4 of wings not covered by diffuse brownish band; pterostigma variable 6
- 6(5'). Wings throughout their membrane yellow, orange, or red, but with no dark marking in definite color pattern 7
- 6'. Wings hyaline or with more or less definite pattern in brown 10
- 7(6). Wings dark red; western 8
- 7'. Wings lighter, yellow to orange-red; eastern 9
- 8(7). Wings with reddish color extending outward to pterostigma; hindwing with baso-cubital space, triangle and supertriangle all dark red-brown; usually a single cubito-anal crossvein present *saturata*
- 8'. Wings with reddish color extending outward to nodus only; baso-cubital space, triangle and supertriangle in hindwing all not dark red-brown; usually 2

- cubito-anal crossveins present *croceipennis*
- 9(7'). Hind tibiae light brown, with black spines; costa bicolored, darker before
nodus, yellow beyond; hindwing generally with 4 paranal cells before anal
loop; found along coast *needhami*
- 9'. Hind tibiae black, with black spines; costa not bicolored, uniform light brown;
hindwing generally with 3 paranal cells before anal loop; found more inland .
..... *auripennis*
- 10(6'). Costa distinctly white out to pterostigma; short band of yellow across wing
bases; western *composita*
- 10'. Costa not white; no band of yellow across wing bases 11
- 11(10'). Pterostigma bicolored, brown and yellow-white 12
- 11'. Pterostigma uniformly colored 13
- 12(11). Face white; hindwing greater than 35 mm; western *comanche*
- 12'. Face dark blue; hindwing less than 35 mm; eastern *cyanea*
- 13(11'). Wings with wide crossband of brown at nodus 14
- 13'. Wings without wide crossband of brown at nodus 16
- 14(13). Hindwing less than 37 mm; wings with light brown spots bordered with
yellow *semifasciata*
- 14'. Hindwing greater than 37 mm; wings with dark brown or black spots, not
bordered with yellow 15
- 15(14'). Wing tips entirely brown beyond pterostigma *pulchella*
- 15'. Wing tips largely hyaline beyond pterostigma *forensis*

- 16(13'). Hindwing with large brown basal spot, traversed by white crossveins and connected by streak of yellow in membrane to small brown spot at nodus;
western *quadrimaculata*
- 16'. Hindwing without large brown basal spot transversed by white crossveins and connected by streak of yellow in membrane to small brown spot at nodus . . 17
- 17(16'). Trigonal interspace of forewings generally with 4 rows of cells; both fore- and hindwings with conspicuous basal black spots reaching out to triangles;
western *nodisticta*
- 17'. Trigonal interspace of forewings generally with 3 rows of cells; markings in fore- and hindwings not so extensive 18
- 18(17'). Face white; sides of thorax pale without a brown triangular basal mark near forewing *vibrans*
- 18'. Face not white, most brown or black; sides of thorax with a brown triangle near base of forewing 19
- 19(18'). Both sexes with a basal black streak in each wing; frons of female with a sharply defined black triangle; labrum black; female generally with one double cell in at least one hindwing in the median planate *axilena*
- 19'. Males and usually females without a basal black streak in each wing; frons of female brown to diffusely black; labrum pale; female generally lacking double cells in the medial planate *incesta*

***Libellula auripennis* Burmeister**

Golden-winged Skimmer

(Map 183)

Libellula auripennis Burmeister, 1839: 861.*Libellula costalis*, Rambur, 1842: 59.*Holotania auripennis*, Kirby, 1890: 28.**Type.** Savannah, GA; MCZ.**Regional Distribution.***Biotic Province(s):* Austroriparian, Tamaulipan, Texan.*Watershed(s):* Arkansas, Bayou Bartholomew, Brazos, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Jacinto, Trinity.**General Distribution.** UNITED STATES: AL, AR, CT, FL, GA, IA, KY, LA, MA, MD, MO, MS, NC, NJ, OH, OK, PA, RI, SC, TN, TX; MEXICO: TAM.**Seasonal Distribution.** Jun. 4 (LA) - Sep. 9 (LA).**Identification.** This is a relatively large, beautiful, red species found throughout the eastern portions of our area. It is very similar to the coastal species *L. needhami*, but it has red veins throughout, whereas *L. needhami* has black veins over most of its wings. The hind tibiae of *L. auripennis* are reddish-brown, never bicolored. Teneral individuals of *Libellula flavida* are also easily confused, but the costa is generally dark out at least to the nodus, the front 1/4 to 1/5 of all wings is heavily tinged with amber or yellow and the

thorax is more robust and has a prominent pale middorsal stripe. The face is brown in juvenile and female *L. auripennis*, becoming bright red in older males. The thorax is brown with 2 diffuse pale stripes laterally. The wings have a yellow pterostigma and the abdomen is yellow with a black middorsal stripe. In mature males the front of the thorax becomes rusty red, and the pterostigma and abdomen become bright red. The wing veins are reddish-orange throughout.

Size. Total length: 45-58 mm; abdomen: 32-40 mm; hindwing: 35-45 mm.

Habitat. Ponds, pools, ditches, lakes and occasionally slow flowing streams.

Discussion. This species is common around open ponds and lakes where males actively defend their territories. This species becomes much less common as it approaches coastal waters, where it is replaced by *L. needhami*. These two species, which can be difficult to distinguish in the field, were long confused with one another and literature records like those of Wright (1943a,b) published before Westfall's (1943) clarification of the two species should be considered to consist of mixed records. Males may be exceedingly wary of intruders, but often return to the top of a favored twig or branch on which they were perched. Females perch high in trees or lower to the ground on vegetation some distance from water. They lack flanges on abdominal segment 8 and therefore oviposit by dipping the abdomen to the water's surface, usually doing so while guarded by the male. As with other skimmers, this species is a voracious predator, taking damselflies, horseflies, butterflies and other small insects readily. They are also victims of other predatory insects, however, like robberflies (Paulson 1966).

***Libellula axilena* Westwood**

Bar-winged Skimmer

(Map 184)

Libellula axilena Westwood, 1837: 47.*Libellula leda*, Say, 1839: 22.*Holotania axilena*, Kirby, 1889: 261.**Type.** Unknown.**Regional Distribution.***Biotic Province(s):* Austroriparian.*Watershed(s):* Mississippi, Sabine, St. Francis.**General Distribution.** UNITED STATES: AR, AL, CT, FL, GA, KY, LA, MA, MS, NC, NJ, NY, OK?, PA, RI, SC, VA.**Seasonal Distribution.** May 23 (LA) - Sep. 9 (LA).**Identification.** This is a large species very similar to *L. incesta* and *L. vibrans*. Its range extends westward to Beauregard Parish in Louisiana, bordering Texas. The face is pale but darkens with age to black with a metallic purple luster dorsally. The pterothorax is brown and yellow in females and juvenile males, appearing very similar to that of *L. incesta*. They are generally larger however, and the lateral margins of the face remain pale. Mature males become dark, with a pale gray pruinose appearance starting at the front of the thorax, between the wings and moving progressively posteriorly. The wings

are generally clear with a touch of white basally in the hindwings and a dark bar basally, in the outer half, and at the tip, along the front margin of each wing.

Size. Total length: 50-62 mm; abdomen: 37-42 mm; hindwing: 41-49 mm.

Habitat. Forest ponds and ditches.

Discussion. This species, which is easily confused with *L. incesta* and *L. vibrans*, has variously and doubtfully been reported from Louisiana (Wright 1939; Barr 1979), but Mauffray (1997) confirmed records from Beauregard, St. Tammany and Washington parishes. The former is the westernmost locality for this species, right on the border of Texas. It has not been taken in that state, as of yet, but is to be expected. The reproductive behavior of this species is very similar to that of *L. incesta*. Pairs mate while perched on stems or vegetation and females oviposit guarded, but unaccompanied by the male.

Libellula comanche Calvert

Comanche Skimmer

(Map 185)

Libellula comanche Calvert, 1907: 201.

Libellula flavida Calvert (*nec* Rambur 1842), 1907: 201.

Type. Montana; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Brazos, Canadian, Cimarron, Colorado, Guadalupe, Nueces, Red, Rio Grande, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: AZ, CA, ID, KS, MT, NM, NV, OK, OR, UT; MEXICO: CHI, NLN, SON.

Seasonal Distribution. May 31 (TX) - Sep. 13 (TX).

Identification. This is a handsome southwestern species commonly found from the Texan biotic province westward. It is one of two dragonflies in our region with a distinctly bicolored pterostigma, half white-half brown. The other, *L. cyanea*, is a smaller eastern species with a black face. The face in *L. comanche* is white with a dark stripe across the labrum. The thorax is brown in front, divided by a broad pale middorsal stripe. The sides are pale or cream colored with a distinct brown stripe on the third lateral suture that is connected by a line above and below to the front of the thorax. The line below is divergent to cover the spiracle and encompass a pale spot below it. The wings are hyaline, with at most a yellowish patch of color in the costal and subcostal regions, and brown at the extreme wing tips. The pterostigma is pale yellow-white proximally and black in the distal half. The legs are black. The abdomen is broad, never narrowed basally, but gradually tapered to rearward. It is brownish with brown middorsal and lateral stripes. The thorax and abdomen in mature males become covered with a dark blue pruinescence, so that only the inferior caudal appendages remain pale.

Size. Total length: 45-57 mm; abdomen: 30-36 mm; hindwing: 35-46 mm.

Habitat. Ponds, lakes and sluggish streams.

Discussion. This species is an active flier around its usual weedy pond and lake haunts. It perches atop grasses, bent stems and other vegetation near or overhanging the water. It is replaced in the southeastern U.S. by the similar *L. cyanea*. Calvert (1907), in his original description, described differences between *L. comanche* and two related species, *L. cyanea* and *L. flavida*.

***Libellula composita* (Hagen)**

Bleached Skimmer

(Map 186)

Mesothemis composita Hagen, 1873: 728.

Libellula composita, Hagen, 1874b: 587

Leptetrum compositum, Kirby, 1890: 26.

Type. Yellowstone N.P.; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian, Texan.

Watershed(s): Red, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, KS, OR, NM, NV, TX, UT, WY.

Seasonal Distribution. Jun. 11 (NM) - Aug. 27 (NM).

Identification. This western desert species is uncommon in our region. It is distinct in

life, with its white face and uniquely white eyes. The top of the vertex and occiput are also white, so that the head is predominately pale in color. The thorax is brown in front with a broad pale middorsal stripe. The sides are pale white or olivaceous with two black stripes on the humeral and third lateral sutures. These stripes are thinly connected above on the alar crest and by an irregular line below. The legs are distinctly pale basally, becoming black beyond. The wings are marked with brown basally, extending out to the arculus, and a smaller spot on the nodus. The costa is bright yellow, while the other veins are black. The abdomen is dark with broad middorsal and lateral stripes and a black band posteriorly on each segment giving the appearance of large quadrate spots, each becoming smaller on subsequent segments. The latter half of the abdomen in the male is wholly black. There is a slight expansion laterally on segment 8 in females. Musser (1962) described the larva and pointed out discrepancies (a single premental seta and sharply serrate margins of the palpal lobes) in Needham and Westfall's (1955) description which was apparently of *L. subornata*.

Size. Total length: 42-48 mm; abdomen: 28-33 mm; hindwing: 33-37 mm.

Habitat. Desert alkaline ponds and lakes, often associated with underground springs.

Discussion. This species is uncommon, largely restricted to habitats with alkaline waters. Some of the species often associated with *L. composita* include *L. subornata*, *L. forensis*, *L. saturata* and *Sympetrum corruptum*. Nothing has been published about its reproductive behavior.

Libellula croceipennis Sélys

Neon Skimmer

(Map 187)

Libellula croceipennis Sélys, 1868: 67.*Belonia uniformis* Kirby, 1889: 333.*Libellula saturata aliasignata* Muttkowski, 1910a: 140.*Libellula saturata croceipennis*, Muttkowski, 1910: 140.**Type.** Mexico: IRSN.**Regional Distribution.***Biotic Province(s):* Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.*Watershed(s):* Brazos, Canadian, Colorado, Guadalupe, Neches, Nueces, Red, Rio Grande, San Antonio, San Jacinto, Trinity.**General Distribution.** UNITED STATES: AZ, CA, NM, OK, TX; MEXICO: BCS, CHS, COL, GRO, HGO, MOR, NAY, NLN, OAX, PUE, SIN, SLP, TAM, VER; Central America south to Columbia.**Seasonal Distribution.** May 25 (TX) - Oct. 18 (TX).**Identification.** This is a brilliant bright red species. It is robust and very similar to *L. saturata* but with the orangish-amber color of the wings less extensive, reaching only as far as the nodus. The face, front of the thorax and entire abdomen including the caudal appendages are brilliant deep red. The sides of the thorax are reddish-brown and

unmarked. The amber-yellow color of the wings is diffuse basally out to the triangle where it narrows towards the costal margin, terminating near the nodus. The pterostigma is brown and generally longer (6 mm) than in *L. saturata* (less than 5 mm). The legs are brown and armed with black spines. Abdominal segment 8 in females is distinctly expanded laterally.

Size. Total length: 54-59 mm; abdomen: 32-39 mm; hindwing: 35-47 mm.

Habitat. Ponds, lakes and sluggish streams.

Discussion. This is one of the most noticeable visitors to lakes and ponds in central Texas. Its bright red color and erratic movements rarely let it go unnoticed. Males may be seen perched on top of tall grasses and weeds, but when females are present, they are generally seen chasing them in attempts to mate. Their courtship behavior, generally not seen in dragonflies, was described in this species by Williams (1977). Males typically only approach females when they are ovipositing. Males approach females with their abdomen raised and clearly visible to females. The female then leaves or the male makes sudden quick advances toward her until she flees, whereupon he attempts to seize her. Males apparently also exhibit threat displays to other males by lowering the abdomen. Copulation typically occurs while perched on limbs or twigs near the water, but it may take place in flight. The entire process usually does not take longer than 30 seconds. Females then oviposit guarded by the male only for an initial short time. Females oviposit, typically at midday, by swiftly flying forward, dipping the abdomen in the water and subsequently throwing eggs with droplets of water on shore. They fly up and back again, repeating this several times.

***Libellula cyanea* Fabricius**

Spangled Skimmer

(Map 188)

Libellula cyanea Fabricius, 1775: 424.*Libellula quadrupla* Say, 1839: 23.*Libellula bistigma* Uhler, 1857: 87.*Leptetrum cyaneum*, Kirby, 1890: 26.**Type.** Unknown.**Regional Distribution.***Biotic Province(s)*: Austroriparian, Balconian, Kansan, Texan.*Watershed(s)*: Arkansas, Bayou Bartholomew, Brazos, Mississippi, Neches, Ouachita, Red, Sabine, San Antonio, St. Francis, Trinity, White.**General Distribution.** UNITED STATES: AL, AR, CT, DE, GA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV.**Seasonal Distribution.** May 3 (LA) - Jul. 28 (LA).**Identification.** This eastern species is very similar to *L. comanche* with a bicolored pterostigma, but it is smaller and has a dark face. Another species that it may be confused with is the larger *L. flavida*, which lacks a distinct bicolored pterostigma, although the extreme posterior portion may be dark brown. The front of the thorax in *L. cyanea* is

brown with a broad pale yellow or white middorsal stripe. The sides are pale with a distinct brown third lateral stripe isolating two large pale areas. The wings are clear with a bicolored pterostigma (white and brown), a distinct dark stripe on the costal area that doesn't extend beyond the triangle, and dark colored wing tips. The front area of the wings beyond the nodus is tinged amber or yellow, particularly in juvenile and female individuals. The legs are brown basally, becoming black beyond. The abdomen is short, broad, and pale yellow with distinct dark middorsal and lateral stripes. Segment 8 of the female is only slightly expanded laterally. The entire thorax and abdomen, including the caudal appendages, become pruinose dark steel blue in mature males.

Size. Total length: 40-48 mm; abdomen: 29-34 mm; hindwing: 31-37 mm.

Habitat. Marshy ponds, pools and lakes.

Discussion. Common around farm stock ponds and waters dammed by beavers. Calvert (1907) gave a table outlining the differences between this species and *L. comanche* and *L. flavida*, with which it is sometimes confused. Adults perch on top of grasses surrounding their usually marshy habitat. Aspects of their reproductive behavior and biology that I have witnessed do not appear especially different from those of other members in the genus. Females oviposit alone, but guarded by the male.

***Libellula deplanata* Rambur**

Blue Corporal

(Map 189)

Libellula deplanata Rambur, 1842: 75.

Ladona deplanata, Needham, 1897b: 144.

Ladona exusta deplanata, Muttkowski, 1910a: 134.

Type. United States; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Mississippi, Neches, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, MO, MS, NC, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA.

Seasonal Distribution. Feb. 25 (TX) - May 21 (AR).

Identification. This is a brown moderate-sized southeastern species with a notable clear streak running through the basal brown spot in all wings. The face is light tan and darkens with age. The vertex is black, shallowly emarginate and punctate. The thorax is brown with two distinct white stripes in the front, from which part of its common name is derived. The wings are clear, with only a basal brown area as described above, and a brown pterostigma. The legs are brown. The strongly depressed abdomen is brown with a black middorsal stripe and carinae outlined in black. The front of the thorax and the abdomen develop a pruinose appearance, becoming steel blue, in mature males.

Needham (1897b) and Needham and Westfall (1955) described the larva, stating that it lacked premental setae, but Cross (1951) and Paulson (1966) each observed these setae

on specimens they examined.

Size. Total length: 31-35 mm; abdomen: 19-24 mm; hindwing: 22-26 mm.

Habitat. Sloughs, ponds, lakes, borrow pits and open areas of slow streams often with sandy bottoms.

Discussion. This species is one of three in the U.S. considered historically (and presently by some) worthy of their own genus (*Ladona*). Bennefield (1965) studied the taxonomic differences and May (1992) discussed morphological and ecological differences between the species in this group. This is one of the few skimmers that may be commonly seen perching on the ground with the wings depressed. They will also perch vertically on trees exposed to sunlight in the late afternoon, probably using the depressed abdomen as a heat collector. This and other behaviors make it similar to *L. lydia* in habit. It emerges in the early spring for a relatively short time. Males patrol the edges of ponds and lakes, sometimes resting on floating debris or low on vegetation. They have a low fluttering flight occasionally interrupted by hovering. Mating occurs on the wing and females oviposit immediately after while guarded by the male. They oviposit by short dips of the abdomen to the water. Females are not often encountered near the water except to mate or oviposit. This species is unusual among most libellulids in the south in that it overwinters as a final instar larva.

***Libellula flavida* Rambur**

Yellow-sided Skimmer

(Map 190)

Libellula flavida Rambur, 1842: 58.

Libellula plumbea Uhler, 1857: 87.

Belonia plumbea, Kirby, 1890: 28.

Holotania flavida, Kirby, 1890: 29.

Type. not given; IRSN.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Texan.

Watershed(s): Arkansas, Brazos, Guadalupe, Mississippi, Neches, Ouachita, Red, Sabine, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, KS, KY, LA, MD, MO, MS, NC, NE, NJ, NY, OK, PA, SC, TX, VA, WV.

Seasonal Distribution. Apr. 24 (TX) - Sep. 6 (LA).

Identification. This is moderately-sized, widespread, but fairly uncommon species of the southeastern U.S. It may be confused with juvenile individuals of *L. cyanea*, but it is larger and the pterostigma is pale tan with at most the posterior 1/4 darkened. The face is pale, quickly becoming black in males. The thorax is brown in front with a pale cream-colored middorsal stripe. This area becomes pruinose blue in mature males. The sides are cream colored and divided by a brown stripe on the third lateral suture. The wings are deeply tinged with amber, especially towards their tips and there is a darker brown stripe on either side of the midbasal space. The legs are brown basally and black beyond. The

abdomen is brown with a dark middorsal stripe and strongly depressed at its middle segments. The abdomen becomes dark, with a powder blue covering dorsally, at maturity. Needham (1903) described an early instar of the larva.

Size. Total length: 47-52 mm; abdomen: 31-36 mm; hindwing: 36-42 mm.

Habitat. Marshy ponds, lakes, borrow pits and slow flowing streams.

Discussion. This species was considered a variation of *L. cyanea* until Calvert (1907) outlined detailed morphological differences between the two species. Little has been published on its behavior. It is a wary species. Males are typically not found patrolling in large numbers around ponds and borrow pits. Often only one or two individuals will be present around what would seem suitable habitat.

Libellula forensis Hagen

Eight-spotted Skimmer

(Map 191)

Libellula forensis Hagen, 1861: 154.

Leptetrum forensis, Kirby, 1890: 26.

Libellula forensis, Muttkowski, 1910a: 137.

Neotetrum forensis, Kennedy, 1922b: 111.

Type. California; MNB.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, ID, MT, NE, NM, NV, OR, SD, UT, WA; CANADA: B.C.

Seasonal Distribution. Jun. 28 (NM).

Identification. This is a western species very similar to the more widely distributed *L. pulchella*. It can be distinguished from the former by the absence of dark wing tips. The face is pale yellow and there are two pale spots on the side and on the top of the frons. The thorax is brown with a pair of lateral yellow stripes, one on each side of the spiracle. There is a dark brown spot basally in each wing, broadly extending out to the triangle, and a second more diffuse spot extending from the nodus towards the pterostigma, but not reaching it. As in *L. pulchella*, mature males develop white opaque spots in between these darker areas. The legs are black. The stout abdomen is dark brown with a pale yellow lateral stripe interrupted along the posterior segments, resulting in a series of spots. Segment 8 of females is slightly expanded laterally. In older individuals the abdomen develops a gray-pruinose appearance. Musser (1962) and Walker and Corbet (1975), both described the larva in detail, giving characters to separate it from *L. pulchella*.

Size. Total length: 44-50 mm; abdomen: 27-32 mm; hindwing: 35-41 mm.

Habitat. Muck-bottomed ponds, lakes and sloughs.

Discussion. This species barely enters our area to the west, with a few collections in southeastern New Mexico. It is often seen flying alongside the similar *L. pulchella* and

they may be indistinguishable in flight. Females oviposit, unattended by the male, by tapping their abdomens to the water's surface along the shoreline.

***Libellula incesta* Hagen**

Slaty Skimmer

(Map 192)

Libellula incesta Hagen, 1861: 155.

Holotania incesta, Kirby, 1890: 29.

Libellula vibrans incesta, Ris, 1910b: 270.

Type. Carolina; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, NJ, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV; CANADA: N.B., N.S., Ont.

Seasonal Distribution. Jun. 17 (LA) - Sep. 25 (LA).

Identification. This is a large common pond species found throughout the eastern U.S.

Juvenile individuals may be easily confused with *L. flavida*, but the wings are clear with a black pterostigma and, at most, dark wingtips. Another similar species is the larger *L. vibrans*. Juvenile *L. incesa* individuals, however have a brown face, not white as in that species, and a brown triangular spot at the base of the forewing on the thorax that is absent in *L. vibrans*. The eyes of *L. incesa*, in life, are brown. The face quickly darkens and the top of the head becomes metallic black in both sexes. The front of the thorax is brown, lacking a definite middorsal stripe. The sides of the thorax lack defined lateral stripes with only a short dark triangular spot below the forewing, as mentioned above, and the upper part of the third lateral suture outlined in brown. The wings are clear with dark wing tips and an occasional small dark spot on the nodus. The legs are black with brown only at their extreme bases. The abdomen is slender, slightly depressed and regularly tapers rearward, with usual dark lateral and middorsal stripes in teneral. Segment 8 in the female is widened laterally. The thorax and entire abdomen develop a deep pruinescence, becoming blue or black in both sexes. Byers (1927c) described the larva.

Size. Total length: 45-56 mm; abdomen: 30-36 mm; hindwing: 35-43 mm.

Habitat. Marshy ponds, lakes and slow flowing forest streams with muck bottoms.

Discussion. Dunkle (1985b) clarified the long taxonomic confusion between this species, *L. vibrans* and a third (*L. axilena*) that doesn't occur in our region, giving critical keys to separate them. This species may be one of the most common dragonflies at a forest pond or other quiet waters. Its dark color and ubiquity have resulted in comparisons to a crow (Dunkle 1989a). Like many skimmers, males perch on top of tall grasses and weeds in

sun lit areas. Females are seldom seen around water except to mate, which takes an average of 30 seconds, and to oviposit. Females deposit their eggs alone, but guarded by males. They use their abdomens to throw the eggs, along with water droplets, to the shoreline or to open water. Females can apparently oviposit while still showing their pale juvenile coloration (Dunkle 1989a).

***Libellula luctuosa* Burmeister**

Widow Skimmer

(Map 193)

Libellula luctuosa Burmeister, 1839: 861.

Libellula basalis Say (*nec* Stephens, 1835), 1839: 23.

Libellula odiosa Hagen, 1861: 152.

Belonia luctuosa, Kirby, 1890: 29.

Type. Pennsylvania.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, AZ, CA, CO, CT, DE, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NM, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, VA, VT, WA, WI, WV; CANADA: N.S., Ont., Que.; MEXICO: CHI.

Seasonal Distribution. May 10 (LA) - Sep. 13 (TX).

Identification. This is certainly a widespread and easily recognized dragonfly. It has large black wing bands in both sexes extending from the base out to the nodus. The face is pale yellow or brown in juveniles and females, but darkens, to black along with top of the head in mature males. The pterothorax is dark brown with a pale yellow middorsal stripe that extends onto the prothorax. This area becomes an obscure brown color in females and black in mature males, ultimately turning powder blue. The sides are pale yellow with a somewhat ill-defined dark stripe on the third lateral suture. This area becomes obscured in females and turns a dark brassy brown in older males. The wings are distinctly marked as above, with occasional darkening of the wing tips, especially in females and more western-distributed individuals. Mature males develop a white area beyond the basal dark stripe that extends to the wing apex. The legs are black. The abdomen is only moderately depressed and tapers rearward. It is pale yellow with broad black middorsal and lateral stripes. The yellow is interrupted only by the black carinae. Segment 8 in females is but slightly expanded laterally. The caudal appendages are black. The color of the abdomen darkens in both sexes and becomes a powder pruinose blue in males.

Size. Total length: 38-50 mm; abdomen: 24-32 mm; hindwing: 33-41 mm.

Habitat. Still bodies of water, including marshy ponds, lakes and borrow pits.

Discussion. This widespread species is found nearly everywhere in the U.S. except the along the gulf of the southeastern U.S. and the Great Basin. It is an active flier around nearly any still body of water, or creeks and streams, where males may be seen regularly combatting over territories. Females rhythmically dip their abdomens to the water while flying just above the surface, and unaccompanied, but occasionally guarded by the male. Ferguson (1940) briefly described the oviposition behavior and appearance of the eggs. Garrison (1976) examined three different variations of this species, including the paler *odiosa* form that intergrades with the darker nominate form in the Hill Country of Texas. Discriminate analysis revealed distinctions between these two forms as not warranting separate taxonomic rankings. The density of males increases dramatically during the breeding season, with two or more males simultaneously defending territories (Moore 1987). Moore (1989, 1990) and Campanella (1975) studied various aspects of this species' behavior and ecology.

***Libellula lydia* Drury**

Common Whitetail

(Map 195)

Libellula lydia Drury, 1770: 112.

Libellula trimaculata DeGeer, 1773: 556.

Libellula serva Fabricius, 1793: 378.

Platthemis trimaculata, Hagen, 1861: 149.

Platthemis lydia, Kirby, 1889: 288.

Type. Unknown.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CA, CO, CT, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, ME, MI, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY; CANADA: B.C., N.B., N.S., Ont. P.E.I., Que.; MEXICO: NLN.

Seasonal Distribution. Mar. 3 (LA) - Nov. 24 (LA).

Identification. This is another ubiquitous dragonfly, commonly seen at almost any standing body of water during the summer. It is found throughout most of the U.S. and southern Canada. It is a moderate-sized stout species that displays a distinct dimorphism between the sexes. The male has large broad brown or black bands in the outer portion of each wing, while the female's wings are less maculated, with three spots, basally, at the nodus and apically, appearing as a smaller version of *L. pulchella*. The face is yellowish-brown initially, but becomes noticeably darker in both sexes. The top of the head is a

deep brown. The robust thorax is brown, unmarked in the front and with two yellowish lateral stripes giving way to white at their upper ends. The wings in the male are as above with a small white spot below the basal dark area in the hindwing. The legs are brown. The abdomen is quite wide and appears triangular in cross-section as it tapers apically in males. In females the abdomen is strongly depressed. In both sexes the abdomen is brown with an interrupted white line laterally, appearing as individual stripes. In mature males the thorax becomes darker and the lateral stripes obscured. The most noticeable change, however, is the total envelopment of the male abdomen by a white pruinescence. Needham (1901) originally described the larva and Levine (1957) later studied and described it in further detail.

Size. Total length: 38-48 mm; abdomen: 23-29 mm; hindwing: 29-35 mm.

Habitat. Nearly any pool, pond, lake or quiet stream.

Discussion. This is certainly one of the most familiar dragonflies to the casual observer and one of the most studied (Jacobs 1955; Campanella and Wolf 1974; Dickerson *et al.* 1982; Waltz 1982; McMillan 1984; Koenig and Albano 1987a,b, 1985; Koenig 1990). It has been collected in every county in Arkansas (Harp pers. comm.). The distinct white abdomen of mature males is used in displays to threaten other males. They elevate the abdomen above the rest of the body and fly towards an intruder. Males patrol moderate-sized habitats of 15-30 m around the shores of ponds, lakes and occasionally streams. They will often venture some distance from their breeding sites and may commonly be seen along roadsides and path margins perching on the ground, logs or low vegetation. Adults mature after an average of two weeks, after which they return to bodies of water to

breed. Males are aggressive, often stealing females from other males. Mating is quick, occurring as the pair hovers over the water, usually no longer than three seconds. Males will often attempt to guard more than one female as they oviposit, some 1,000 eggs, by tapping the tip of the abdomen to the water in regular intervals. This species is found alongside the similar, but larger *L. pulchella*, which may add to their confusion. Although this species is widespread, Savard and Girard (1996) reported that its distribution is limited to the north where more than 1,660 degree-days of growth (at a threshold of 5.6°C) are afforded. Valley (1998) recently reported several male specimens in Oregon that have dark wing tips. All the males I have seen from our area have had clear wing tips. Koenig (1991) studied levels of female choice in this species.

***Libellula needhami* Westfall**

Needham's Skimmer

(Map 195)

Libellula (Holotania) needhami Westfall, 1943: 22.

Type. Florida: CU.

Regional Distribution.

Biotic Province(s): Austroriparian, Tamaulipan, Texan.

Watershed(s): Bayou Bartholomew, Brazos, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, LA, MA, MD, MS, NC, NH, NJ, NY, RI, SC, TX, VA; MEXICO: JAL, QTR, TAM; Cuba.

Seasonal Distribution. Apr. 24 (LA) - Sep. 10 (LA).

Identification. This largely coastal species is very similar to *L. auripennis*. Differences between the two are given under the latter. The face, thorax and abdomen are all yellowish-brown in teneral and female individuals, with all but the sides of the thorax becoming vivid red as in *L. auripennis*. The absence of thoracic stripes, will distinguish it from teneral individuals of *L. flavida*. The legs are brown with no black except on the spines. The wings are amber or orange in the front half with a yellow orange pterostigma and black veins in the posterior 2/3 of the wing. The costa is somewhat bicolored, being dark basally to the nodus and lighter beyond to the pterostigma. There is a black middorsal stripe on the abdomen.

Size. Total length: 45-57 mm; abdomen: 32-39 mm; hindwing: 35-45 mm.

Habitat. Marshy ponds and lakes including brackish waters.

Discussion. This species, although reported as far inland as just north of the Arkansas-Louisiana border (Harp and Rickett 1977) is much more common along the coastal areas where it replaces *L. auripennis*. It may be one of the most abundant species, along with *Brachymesia gravida* and *Erythrodiplax berenice*, along brackish waters where it typically perches low on vegetation surrounding or overhanging the water. Females are often only encountered some distance from the water when mating. Pairs mate while perched and females oviposit, guarded or not by males, by vigorously tapping their abdomens to the water's surface.

***Libellula nodisticta* Hagen**

Hoary Skimmer

(Map 196)

Libellula nodisticta Hagen, 1861: 151.*Leptetrum nodistictum*, Kirby, 1890: 26.**Type.** Mexico; MCZ.**Regional Distribution.***Biotic Province(s):* Navahonian.*Watershed(s):* Canadian, Rio Grande.**General Distribution.** UNITED STATES: AZ, CA, CO, ID, MT, NM, NV, OK, OR, UT, WY; MEXICO: DFE, DGO, JAL, MCH, MEX, TLX.**Seasonal Distribution.** Jun. 9 (NM) - Jul. (NM).**Identification.** This is a distinct, common, western species that just enters the south-central U.S., from the west. The face is yellow with a black stripe and the top of the frons is furrowed and black. The thorax is brown with a pale middorsal stripe that becomes obscured with age. The lateral sutures on the sides of the thorax are outlined in black. The wings have a basal brown stripe extending out to the level of the triangle, and a smaller spot on the nodus. The area behind and below the basal stripe becomes pruinose with age. The veins and pterostigma are black. The legs are black. The abdomen is brown or black becoming darker posteriorly, and with a lateral interrupted pale stripe.

The caudal appendages are black. Males develop a pruinescence over the front of the thorax and entire abdomen with age.

Size. Total length: 46-52 mm; abdomen: 32-35 mm; hindwing: 37-42 mm.

Habitat. Ponds, lakes and streams with little flow.

Discussion. This species is not found east of the Navahonian biotic province. Despite its relative abundance in certain western localities, very little has been documented about its behavior and habits. Kennedy (1917) wrote about the species, they are "Common on the town drain. In the morning individuals of this species were easily captured while seated on brush and weeds in the sunny openings along the stream. Copulation was as usual among *Libellula*. A female observed ovipositing flew about 2 feet above the water and made several quick swings downward, tapping the water with her abdomen just once for each swing."

Libellula pulchella Drury

Twelve-spotted Skimmer

(Map 197)

Libellula pulchella Drury, 1773: 48.

Libellula versicolor Fabricius, 1775: 423.

Libellula bifasciata Fabricius, 1775: 421.

Libellula confusa Uhler, 1857: 87.

Plathemis pulchella, Kirby, 1890: 28.

Type. Unknown.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Mississippi, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, AZ, CA, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NE, NC, ND, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA; CANADA: Alb., B.C., Man., N.B., N.S., Ont., Que., Sask.

Seasonal Distribution. Mar. 28 (LA) - Nov. 7 (LA).

Identification. This is a large, handsome, brown skimmer found in all 48 contiguous United States. Its distinct wing pattern of dark brown or black wing spots, basally, at the nodus and at the wing tips, will readily distinguish it from most dragonflies in our region. Individuals of the similar *L. forensis* lack dark wing tips. Female *L. lydia* are very similar, but they are smaller and have pale legs. The face of *L. pulchella* is dull yellowish-brown. The thorax is brown and lacks a middorsal stripe. Each side has a pair of pale yellowish-stripes. The wings are spotted with dark brown or black, as mentioned above. Mature males develop two white spots in each forewing and three in each hindwing, giving them their traditional common name "ten spot." It has more recently

been given the name "twelve spot" to represent the more conspicuous brown spots of each wing. The legs are brown at their extreme bases and black beyond for the remainder of their length. The abdomen is brown with a broad pale yellow uninterrupted stripe on each side and a narrower one along the middorsal carina. The caudal appendages are brown, darkening with age. Females have a slight lateral expansion of abdominal segment 8. Musser (1962) described and illustrated the larva.

Size. Total length: 51-58 mm; abdomen: 32-36 mm; hindwing: 42-48 mm.

Habitat. Shallow ponds, lakes, marshes and slow streams.

Discussion. *Libellula pulchella* tends to prefer open pond and lake shores well exposed to sunlight. It is an aggressive, strong flier entering into numerous skirmishes with other males and intruders, rarely being displaced, which often makes it difficult to catch. Territories are established in areas over the water that are free of surface vegetation. Mature males seldom perch, but when they do, they can be found on top of tall grasses and bushes surrounding the water. The female deposits eggs along the shoreline of shoals and bays by regularly tapping her abdomen to the water surface, unattended by the male. The similar *L. forensis* is almost always found alongside *L. pulchella*, where their ranges overlap. Pezalla (1979) discussed the behavioral ecology of this species. Fitzhugh and Marden (1997) and Marden (1995) studied behavioral and thermoregulatory changes that occur in this species during adult maturation as they pertain to flight muscles and flight performance.

***Libellula quadrimaculata* Linnaeus**

Four-spotted Skimmer

(Map 198)

Libellula quadrimaculata Linnaeus, 1758: 543.*Libellula quadripunctata*, Fabricius, 1781: 520.*Libellula maculata* Harris, 1782: 46.*Libellula praenubila* Newman, 1833: 420.*Leptetrum quadrimaculata*, Newman, 1833: 511.*Libellula ternaria* Say [in part], 1839: 21.*Libellula (Orthetrum) basilinea* McLachlan, 1894: 430.**Type.** Sweden; BMNH.**Regional Distribution.***Biotic Province(s):* Chihuahuan, Navahonian.*Watershed(s):* Rio Grande.**General Distribution.** UNITED STATES: AK, AR, AZ, CA, CO, CT, IA, ID, KS, IL, IN, MA, MD, ME, MI, MN, MT, ND, NE, NH, NJ, NM, NV, NY, OH, OR, PA, RI, SD, UT, VA, VT, WA, WI, WV, WY; CANADA: Alb., B.C., Man., N.B., Nfld., N.S., N.W.T., Ont., P.E.I., Que., Sask.; Northeastern Europe & Asia.**Seasonal Distribution.** Jul. 12 (NM).**Identification.**

Size. Total length: 41-45 mm; abdomen: 25-30 mm; hindwing: 31-38 mm.

Habitat. Marshy bogs, ponds and lakes, especially peaty waters.

Discussion. Walker and Corbet (1975) stated this species is the most common libellulid in Canada. In the south-central U.S. it has been reported by Muttkowski (1910a) from Arkansas with no further information and Evans (1995) reported it from several northcentral New Mexico counties. Because of its more northern distribution, the casual observer in our area is unlikely to come across this species. In much of its typical northern range, however, it is one of the earliest dragonflies to emerge in the spring. It is commonly seen in open fields and along forest margins where it perches low on vegetation or the ground, similar to *L. lydia*. This species is known to form large aggregations and migrate (Burton 1996; Walker and Corbet 1975). As males mature they vigorously patrol their territories around nearly any standing body of water. They readily take other dragonflies their size and smaller as prey (Whitehouse 1941). Mating takes place in flight, generally lasting only a few seconds, but sometimes as long as a minute (Schiemenz 1953). Females deposit eggs unaccompanied, but guarded by the male, by regularly dipping her abdomen to the waters surface. Convey (1990) studied territorial and satellite behavior (males adopting a form of wandering which may not necessarily influence their reproductive success verses several males defending the same territory consecutively) in this species in detail.

Libellula saturata Uhler

Flame Skimmer

(Map 199)

Libellula saturata Uhler, 1857: 88.

Belonia saturata, Kirby, 1890: 28.

Type. Mexico; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Brazos, Canadian, Colorado, Nueces, Red, Rio Grande, Sabine, San Antonio, San Jacinto.

General Distribution. UNITED STATES: AZ, CA, CO, ID, KS, MO, MT, NM, NV, OK, OR, SD, TX, UT, WY; MEXICO: BCS, CHI, COA, DFE, DGO, GTO, HGO, JAL, MCH, MOR, NLN, OAX, PUE, SON, VER.

Seasonal Distribution. Apr. 29 (TX) - Sep. 27 (TX).

Identification. This is a brilliant red southwestern species that is very similar to *L. croceipennis*, but with the amber coloration in the wings more extensive extending out to the pterostigma and with a darker brown stripe covering the midbasal space in the hindwing. The face is light brown in teneral individuals, but it quickly becomes bright red. The stocky thorax and abdomen are brick red and lack stripes. The wings have red veins and a flavescence that extends out to the pterostigma, but deepens basally, with darker brown stripes midbasally in the hindwing. The legs are red with black spurs. The

caudal appendages are red and the segment 8 of the female is expanded laterally.

Needham (1904) described and illustrated the larva.

Size. Total length: 52-60 mm; abdomen: 32-40 mm; hindwing: 41-45 mm.

Habitat. Ponds, lakes and slow streams, including artificial ponds.

Discussion. This conspicuous dragonfly commands the notice of even the most casual observer. Its mating and reproductive behavior have been well studied (Alcock 1989a; DeBano 1993, 1996). Males are found searching long stretches of streams for potential mates or they are seen perched on tall vegetation near the ponds and pools used by females for oviposition. Males will warn off intruders by flying towards and then along with them in an ascending flight with only one male returning to the perch. Females oviposit in a similar manner to that of *L. croceipennis*, by throwing water along with the eggs towards the shore. Males will guard females from a perch for only a short time after mating in flight. Males are more abundant streamside during times of female receptivity and when the receptive females are most common. Males tend to aggregate at areas along streams where receptive females are likely to visit, both seasonally and during the course of the day. Both of these observations indicate male mate-searching patterns in this species are sexually selected. The small disjunct population in Houston, Harris Co., Texas, represents the easternmost record for this species, which was most likely accidentally introduced as larvae with aquatic plants (Honig pers. comm.).

***Libellula semifasciata* Burmeister**

Painted Skimmer

(Map 200)

Libellula bifasciata (*nomen oblitum*) Fabricius, 1775: 421.

Libellula semifasciata Burmeister, 1839: 862.

Libellula ternaria Say [in part], 1839: 21.

Libellula maculata Rambur, 1842: 55.

Libellula hersilia Blanchard, 1861: 21.

Leptetrum semifasciata, Kirby, 1890: 27.

Eolibellula semifasciata, Kennedy, 1922: 111.

Type. United States; Halle.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Mississippi, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WV; CANADA: N.B., Ont.

Seasonal Distribution. Feb. 24 (LA) - Aug. 25 (LA).

Identification. This is a moderately-sized yellow and brown species found in the eastern Austroriparian biotic province of our area. Its wings are distinctive with a basal yellow wash of color that extends along the costal area to the nodus. There is a dark brown

stripe beyond the midbasal space in the forewing and below in the hindwing, as well as a brown spot on the nodus and apically in both wings. The face is olivaceous turning red in mature males. The thorax is tawny brown thinly beset with short brown hairs and without a middorsal stripe. The sides each have an oblique yellowish-white stripe behind the first and third lateral stripes. The legs are pale brown basally and black beyond. The abdomen is brown and tapers strongly posteriorly. It is pale yellowish-brown basally, often appearing translucent until segment 6. There is a pale lateral stripe on each side. Segments 7-10 and the caudal appendages are black dorsally. The lateral margins of segment 8 are only narrowly expanded laterally. The larva was described by Bick (1951a) from Louisiana.

Size. Total length: 39-48 mm; abdomen: 25-31 mm; hindwing: 31-38 mm.

Habitat. Marshy forest seepages, ponds and slow streams.

Discussion. This species can be somewhat inconspicuous flying casually around the forest ponds it patrols. It seldom occurs in large numbers. Its flight is usually swift and with sweeping curves.

Libellula subornata (Hagen)

Desert Whitetail

(Map 201)

Plathemis subornata Hagen, 1861: 149.

Libellula subornata, Ris, 1916: 1049.

Libellula lydia subornata, La Rivers, 1946: 216.

Type. Texas; Agassiz Mus.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian.

Watershed(s): Canadian, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, ID, KS, MT, NE, NM, NV, OK, OR, TX, UT, WA, WY; CANADA: B.C.; MEXICO: CHI, JAL, SON.

Seasonal Distribution. Jul. 25 (TX) - Aug. 5 (OK).

Identification. This western desert species is very similar to the paler *L. lydia*. Females are easily distinguished by the lack of color apically in the wings. Males typically have a more pronounced clear streak through the dark midbasal area of all wings, but this becomes somewhat obscured in older males. The area between the dark spots becomes entirely pruinose in *L. subornata* and the ventral tubercle on the first abdominal segment is shallowly bifurcate, appearing "V" shaped. The face is yellowish with a black median stripe that becomes obscured as the face darkens with age. The thorax is dark brown with two pale yellow oblique lateral stripes that are obscured with age. The wings in both sexes have a dark basal area, as described above, extending out to the triangle, and a second broad stripe in the outer half of the wing that is significantly lighter in its middle third, sometimes appearing clear. The stout abdomen is dark brown with a series of interrupted yellow stripes laterally. Segment 8 is not expanded laterally in females.

Levine (1957) thoroughly described and illustrated the larva.

Size. Total length: 41-52 mm; abdomen: 22-31 mm; hindwing: 31-38 mm.

Habitat. Desert pools, ponds and slow streams with thick emergent vegetation and mud bottoms.

Discussion. This species is strictly western, found in semi- and full desert environments, often along side *L. lydia*. Williamson (1906b) and Gloyd (1958) have both clarified differences in the adults of these two similar species, often placed in the genus *Plathemis*. Little has been documented about the behavior of this species. Needham and Westfall (1955) noted that the larvae often transform just above the water on thick clusters or reeds and grasses. LaRivers (1946) found this species to be among the most common in alkaline lakes and ponds of Nevada, "...where it was seemingly restricted to the pond areas, where it beat over the water in regular circuits..." LaRivers found that this species along with *Erythemis simplicicollis* and *Sympetrum corruptum* were the only inhabitants of the smaller springs, often consisting of only muddy seeps. Cannings (1983) reported this desert species from Nanaimo, British Columbia, constituting a considerable range extension northward.

***Libellula vibrans* Fabricius**

Great Blue Skimmer

(Map 202)

Libellula vibrans Fabricius, 1798: 280.

Holotania vibrans, Kirby, 1890: 29.

Type. Unknown.

Regional Distribution.

Biotic Province(s): Austroriparian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Guadalupe, Mississippi, Neches, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, FL, GA, IL, IN, KS, KY, LA, MA, MD, MI, MO, MS, NC, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, WI;
CANADA: Ont.

Seasonal Distribution. Mar. 26 (LA) - Sep. 25 (LA).

Identification. This is our largest skimmer, found throughout the eastern Texan and Austroriparian Biotic Provinces in our area. It may be confused with juvenile individuals of *L. incesta*, but the face is white, not black. The thorax is brown with a narrow white middorsal stripe and the sides are pale grayish-white with a dark stripe along the third lateral suture that is obsolete at its lower end. The wings are clear with a narrow dark stripe basally, a small spot at the nodus and dark wing tips. The femora are pale over the basal half, with the remaining length, tibiae and tarsi black. The abdomen is yellow with a black middorsal stripe. Mature pruinose males become pale blue first on the front of the thorax then the abdomen. In mature females the yellow on the abdomen becomes brown. Segment 8 of females is considerably expanded laterally.

Size. Total length: 50-63 mm; abdomen: 37-43 mm; hindwing: 46-52 mm.

Habitat. Swampy ponds, lakes and slow forest streams.

Discussion. This large handsome dragonfly is common around forest ponds and sloughs during the summer, where it perches for lengthy periods. It is remarkably approachable from its shady perches. Mating occurs while pairs are perched and generally takes less than 30 sec. Females then oviposit in the traditional *Libellula* fashion by tossing eggs along with water onto the shoreline. Dunkle (1989a) noted that males may mate before they are fully pruinose. Dunkle (1985) clarified taxonomic differences between this and two closely related species, including *L. incesta*.

Genus *Macrodiplax* Brauer

Marl Pennant

Macrodiplax Brauer, 1868.

This is a small tropical genus of two species, one found in the Old World (*M. cora*) and a single species found in the southern limits of our area. The group is recognizable by the deeply notched frons and broad hind wings. In the forewings there are large paranal cells with smaller marginal cells adjacent to them. The forewing triangle is unusually broad and typically devoid of crossveins. There is a radial planate that encompasses five cells in both fore- and hindwings. The single New World species is found in the southern U.S. and is generally associated with large ponds and lakes, often with brackish water.

***Macrodiplax balteata* (Hagen)**

Marl Pennant

(Map 203)

Tetragoneuria balteata Hagen, 1861: 140.*Tramea balteata*, Hagen, 1875: 66.*Miathyria balteata*, Kirby, 1890: 4.*Celithemis balteata*, Hagen, 1890: 383.*Macrodiplax balteata*, Muttkowski, 1910a: 183.**Type.** Texas; ANSP.**Regional Distribution.***Biotic Province(s):* Austroriparian, Balconian, Chihuahuan, Kansan, Tamaulipan, Texan.*Watershed(s):* Colorado, Mississippi, Red, Rio Grande, Sabine, San Antonio, San Jacinto, Trinity.**General Distribution.** UNITED STATES: AL, AZ, CA, FL, GA, LA, MS, NC, NM, SC, TX; MEXICO: BCA, QTR, SIN, VER, YUC; West Indies; Belize, Venezuela.**Seasonal Distribution.** May 7 (TX) - Aug. 4 (TX).**Identification.** This widely distributed species is recognizable by a large black spot at the base of the hindwing and a much smaller, but similar, spot in the forewing. Mature males are similar to *Erythemis plebeja*, but they have a larger spot in the hindwing, extending out to the hind margin of the triangle, and they lack the unusually slender

abdomen of that species. A few species of *Celithemis* are similar, but all are much smaller. The face and thorax in juvenile and female individuals are white and gray, respectively. There is no middorsal stripe on the latter, only a darkly outlined carina. The lateral sutures on the side of thorax are irregularly outlined by black and connected below, to appear as a "W." The wings are as described above with a narrow brown pterostigma. The legs are pale at their bases and black throughout the rest of their length. The abdomen is pale yellow outlined laterally, middorsally and on the carinae by black. Segments 8-10 are entirely black. The mature male darkens extensively, with the face and entire body turning black. Needham and Fisher (1936) described and illustrated the larva.

Size. Total length: 35-42 mm; abdomen: 25-30 mm; hindwing: 31-35 mm.

Habitat. Large brackish ponds and lakes.

Discussion. This species is widely distributed, found across the southern half of our area. It is usually found associated with large brackish bodies or water, but not always. It is apparently restricted to the southeastern St. Tammany Parish in Louisiana (Mauffray 1997). Both males and females of this species are found in equal abundance around the water. They will perch on the tips of vegetation at varying heights, with both wings and abdomen elevated. *Macrodiplax balteata* will occasionally be found in large feeding swarms with *Miathyria*, *Pantala* and *Tramea*. Males patrol for some distance over open water and along the shoreline. Mating takes place in flight and generally over the open water of ponds and lakes. Males accompany females during oviposition which takes place in open waters or along the shoreline by tapping the abdomen to the surface during

long regular approaches to the water. This species is found year around throughout most of its range.

Genus *Macrothemis* Hagen

Sylphs

Macrothemis Hagen, 1868.

Cendra Navás, 1917.

This is a large Neotropical genus with three species that occur in North America, all of which are found in the southern limits or our area. The species in this group are slender with small heads, delicate thoraxes and narrowed abdomens. A unique characteristic of all but two species (*M. inequiunguis* and *M. urimaculata*) is the unusually elongated inner tooth of the tarsal claw. The species in our area are brown or black with pale cream-colored thoracic stripes and clear wings. The frons and vertex are a metallic color in males. Calvert (1898b) studied the members of this group known at that time and Donnelly (1984) clarified differences between *Macrodiplox* and the closely related *Brechmorhoga*. May (1998a) presented a key to males of the genus. Larval keys have not been published for our species.

KEY TO ADULT SPECIES OF *MACROTHEMIS*

1. Tarsi with normal claws, each claw having an inferior small tooth remote from

- tip *inequiunguis*
- 1'. Tarsi with modified tarsal claws, each claw with inferior tooth enlarged and
extending outward to level of claw 2
- 2(1)'. Abdominal segments 7-10 dilated *imitans*
- 2'. Abdominal segments 7-10 not dilated, but parallel *inacuta*

***Macrothemis imitans* Karsch**

Ivory-striped Sylph

(Map 204)

Macrothemis imitans Karsch, 1890: 367.

Macrothemis imitans leucozona Ris, 1913a: 887.

Type. Brazil.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan, Texan.

Watershed(s): Guadalupe, Nueces, Rio Grande, San Antonio.

General Distribution. UNITED STATES: TX; MEXICO: CHS, NLN, TAM, VER;

Central America south to Argentina.

Seasonal Distribution. Jul. 1 (TX) - Sep. 7 (NLN).

Identification. This is one of the two smaller *Macrothemis* species which occur in our area. The top of the head is distinctively metallic blue in males and brown in females. In

life the eyes of the male are a deep aqua blue. The thorax is dark brown or black with a pair of abbreviated pale middorsal stripes and whitish green lateral stripes. The middorsal stripes are scant or entirely absent in females. The wings are hyaline with a touch of yellow flavescence throughout. The pale middorsal stripe on the abdomen is interrupted and segments 7-9 are broadly expanded in the male. The male superior caudal appendages are upturned to appear as a high-heel shoe, when viewed laterally.

The similar *M. inequiunguis* can be distinguished by its nearly complete middorsal thoracic stripes and broader lateral stripes.

Size. Total length: 35-37 mm; abdomen: 25-27 mm; hindwing: 25-29 mm.

Habitat. Rocky streams and rivers.

Discussion. This species feeds in sustained flights and males fly back and forth low over shallow riffles (Dunkle pers. comm.).

Macrothemis inacuta Calvert

Straw-colored Sylph

(Map 205)

Macrothemis inacuta Calvert, 1898b: 328.

Macrothemis rochai Navás, 1918: 1.

Type. Mexico: CAS.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan.

Watershed(s): Nueces, Rio Grande.

General Distribution. UNITED STATES: AZ, TX; MEXICO: CAM, CHS, MOR, NAY, NLN, OAX, SIN, SLP, TAM, VER; Central America south to Brazil & Venezuela.

Seasonal Distribution. Jun. 16 (TAM) - Sep. 18 (TX).

Identification. This species is the largest of the three occurring in the south-central U.S. The pale thoracic stripes are not as prominent in this species as in our other two. The face is hairy and olivaceous and becomes metallic blue along with the top of the head in mature males. The thorax is brown with a pale cream stripe on the front of the thorax on either side of the middorsal carina. The lateral sutures are thinly outlined in black. There are two pale oblique stripes on each side, the first of which is thin and somewhat interrupted medially. The second, posterior to the third lateral suture, is isolated as a conspicuous round spot on the rear margin of the thorax. The wings are clear but often develop a wash of amber, and each has a basal brown spot that may extend out as far as the triangle in the hindwing. The venation is somewhat variable between the sexes. The legs are brown. The abdomen is brown, long and slender. The carinae are all black. The larvae was described and illustrated by Novelo and Ramirez (1998).

Size. Total length: 39-42 mm; abdomen: 25-29 mm; hindwing: 27-31 mm.

Habitat. Clear rocky streams and rivers.

Discussion. This species perches obliquely on branches high in trees. Calvert (1899) made a few notes on the behavior of this species.

***Macrothemis inequiunguis* Calvert**

Jade-striped Sylph

(Map 206)

Macrothemis inequiunguis Calvert, 1895: 533.*Macrothemis vulgipes* Calvert, 1898b: 320.*Brechmorhoga inequiunguis*, Calvert, 1906: 246.*Macrothemis tessellata inequiunguis*, Ris, 1913a: 870.**Type.** Panama, CAS.**Regional Distribution.***Biotic Province(s):* Balconian.*Watershed(s):* Guadalupe, Rio Grande, San Antonio.**General Distribution.** UNITED STATES: TX; MEXICO: BCS, CHS, GRO, NAY, NLN, SLP, TAB, VER; Central America south to Venezuela.**Seasonal Distribution.** Jun. 25 (NLN).**Identification.** This is a smaller brown species with a pair of broad cream-colored, oblique stripes on the sides of the thorax. The face is brown in juveniles and females but becomes metallic green in mature males. The thorax is brown with a pale middorsal carina and a greenish-white stripe on either side of the carina that is convergent at the top. The first is nearly complete and the posterior one is broken into 2-3 ill-defined spots along the hind margin. The abdomen is brown, darker on top, with a lateral interrupted

pale stripe. The femora are brownish, becoming black distally along with the remainder of the leg. The wings are clear or with a wash of amber throughout the membrane. There is a dark spot basally in each wing.

Size. Total length: 32-36 mm; abdomen: 25-28 mm; hindwing: 24-30 mm.

Habitat. Rocky streams and rivers.

Discussion. Nothing has been published on the behavior of this species.

Genus *Miathyria* Kirby

Gliders

Miathyria Kirby, 1889.

Nothifixis, Navás, 1916.

This Neotropical genus contains two species that are associated with water hyacinth (*Eichhornia*) and water lettuce (*Pistia*). Only one of these is found in our area and it primarily occurs along the southern coastal regions of our area. They are brownish, moderately-sized species with distinctly broad hindwings that taper apically. The hindwings are marked with a long narrow basal stripe similar to that in our species of *Tramea*. There are few antenodal crossveins in the hindwing, generally four in our species, and the apical planate subtends a single row of double-height cells. The abdomen in this group narrows apically after the swollen basal segments. The caudal appendages of the male are distinctly sigmoid when viewed laterally. This group is of

evolutionary significance because it contains species that exophytically oviposit by recognizing and choosing individual plant species, although success of the larvae is not dependent upon the selection (Paulson 1966).

***Miathyria marcella* (Sélys in Sagra)**

Hyacinth Glider

(Map 207)

Libellula marcella Sélys in Sagra, 1857: 452.

Tramea simplex Hagen, 1861: 146.

Tramea marcella, Hagen, 1867: 227.

Miathyria marcella, Kirby, 1889: 258.

Type. Brazil.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Colorado, Guadalupe, Mississippi, Neches, Nueces, Red, Rio Grande, Sabine, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, FL, GA, LA, TX, VA; MEXICO: CAM, CHS, DFE, HGO, JAL, MOR, NAY, NLN, OAX, QRO, SLP, SIN, SON, TAB, TAM, VER, YUC; West Indies; Central America south to Argentina.

Seasonal Distribution. Apr. 13 (LA) - Nov. 24 (LA).

Identification. This beautiful brown species is found all along the coastal areas of southern Texas and Louisiana as well as some distance inland. It is similar to members of the genus *Tramea*, but *Tramea* are all larger with the black on the abdomen restricted to segments 8-10, and all but *T. calverti* lack thoracic stripes. The face of *M. marcella* is pale, with the top of the frons becoming metallic violet in older males. The thorax is tawny brown with a pair of oblique cream-colored lateral stripes. These may become obscured with age in males as the thorax progressively becomes darker violet in color, starting with the front and the area between the wings. The wings themselves are clear with light brown or reddish veins and a dark basal band in each hindwing. There are relatively few antenodal crossveins compared to other dragonflies this size, with 7 and 4 in the fore- and hindwings, respectively. The legs are dark brown with paler bases. The abdomen is orangish-brown with a black middorsal stripe. The larva was described and illustrated by Bick (1953) and Westfall (1953).

Size. Total length: 35-41 mm; abdomen: 21-27 mm; hindwing: 27-34 mm.

Habitat. Marshy ponds and lakes, including brackish waters, with water hyacinth.

Discussion. This species, found throughout Mexico, Central and South America, was not reported from the U.S. until Bick *et al.* (1950). It has since been found northward in Arkansas and Virginia. Its spread is certainly correlated with the introduction and spread of water hyacinth (*Eichhornia*) into this country. Individuals are commonly seen in large feeding swarms away from water, often along roadsides. Paulson (1966) stated that "adults swarm in flocks with more coherence than any other odonates familiar to me (except the closely related *Tauriphila*)." They are active fliers, rarely resting. However,

when at rest they perch vertically on twigs, stems or other vegetation low to the ground, with their abdomens pointed downward (in a similar fashion to the darners). Males patrol territories low over the water, often hovering extensively. Dunkle (1989) reported territories in this species are established by display of the orange abdomen by one male to intruding males. Mating occurs in flight. The male may accompany the female as she oviposits eggs or she may do this alone or guarded by the male. Eggs are deposited at the base of water hyacinth (*Eichhornia*), water lettuce (*Pistia*) and other floating aquatic vegetation by rapid descents from 1-2 m above the water. Needham (1933) erroneously described the larva of *Brachymesia gravida* from southern Florida as *M. marcella*.

Genus *Micrathyria* Kirby

Dashers

Micrathyria Kirby, 1889.

This is another large group of Neotropical species, represented only sparsely in the U.S. Three species occur in southern Texas. They are all small dark dragonflies with predominantly pale faces, a greenish thorax and spotted abdomens. The hind lobe of the prothorax is distinctly enlarged and bilobed in some species, with a fringe of long hairs. The wings are clear and highly variable in venation, but always with 2 or 3 bridge crossveins. The abdomen is generally swollen both basally and distally with slender middle segments. Abdominal segment 10 is considerably shortened. Several authors

have studied various aspects of this genus, including oviposition (Paulson 1969), life histories (Needham 1943) and reproductive behavior and thermoregulation (May 1977, 1980). Needham 1943 gave a key separating the larvae of a few species, including all three occurring in our area.

KEY TO ADULT SPECIES OF *MICRATHYRIA*

- 1. Total length less than 32 mm; hindwing less than 25 mm *aequalis*
- 1'. Total length greater than 33 mm; hindwing greater than 25 mm; 2
- 2(1). Thorax with 3 unbranched lateral stripes; trigonal interspace of hindwing with no full-length cells *didyma*
- 2'. Thorax with midlateral stripe forked at upper end; trigonal interspace of hindwing with 1-2 full-length cells *hagenii*

Micrathyria aequalis (Hagen)

Spot-tailed Dasher

(Map 208)

Dythemis aequalis Hagen, 1861: 167.

Micrathyria septima Sélys, 1900: 265.

Type. Cuba; MCZ.

Regional Distribution.

Biotic Province(s): Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: FL, TX; MEXICO: BCS, CAM, CHS, COL, JAL, MOR, NAY, NLN, OAX, PUE, QTR, SLP, SIN, TAB, TAM, VER; West Indies; Central America south to Ecuador.

Seasonal Distribution. May 7 (TX) - Sep. 13 (TX).

Identification. This small species has been collected in the lower Rio Grande Valley of southernmost Texas. The face is nearly white with grey eyes. The eyes become brilliant green and the top of the head metallic green in mature males. The thorax is a pale yellowish-green in juveniles and females. The front of the thorax has a pair of yellowish stripes and each side has 3 diffuse brown stripes along the lateral sutures, confluent below to form a "WII" pattern. The wings are clear and the legs are black. The slender abdomen is brown with a pair of interrupted pale stripes dorsally, ending on segment 7 or 8. Older males become heavily pruinose, obscuring the thorax and abdominal pattern with gray. Females usually retain the pattern, but the colors may dull and the wing tips darken.

Similar species include *Pachydiplax longipennis*, *M. didyma* and *M. hagenii*, but all have 3 distinct straight black stripes laterally on the thorax. Females of *Erythrodiplax berenice* are similar, but they are easily distinguished by the prominent ventrally projecting ovipositor.

Size. Total length: 26-34 mm; abdomen: 15-24 mm; hindwing: 20-26 mm.

Habitat. Permanent and temporary ponds, sloughs and lakes.

Discussion. This species' northern range barely extends into the southern tip of Texas

where it is only occasionally encountered. It is common throughout most of its range, however. Needham (1943) reported this species as the most common "Libellulinae dragonfly" in Soledad, Cuba. Individuals may fly furiously along the edges of their pond habitats. Males will perch at varying heights up to 2 m over the water on twigs and branches, usually exposed to sunlight. Females tend to remain farther back when not mating or ovipositing. On warmer days both sexes will adopt a typical obelisk position. Females oviposit alone, but often interrupted by males. Females land on floating leaves into which they invert the end of the abdomen to deposit eggs on the underside. Needham (1943) described this action; "She swings her body from side to side, plastering her eggs to the leaf in rather irregular rows and in a single layer..." An estimated 2,000 eggs may be deposited in a square inch area. May (1977, 1980) studied thermoregulation, temporal and reproductive activity in this species.

Micrathyria didyma (Sélys)

Three-striped Dasher

(Map 209)

Libellula phyna Rambur, 1842: 121.

Libellula didyma Sélys, 1857: 453 .

Dythemis dicrota Hagen, 1861: 166.

Mesothemis poeyi Scudder, 1866: 194.

Micrathyria didyma, Kirby, 1889: 303.

Micrathyria pruinosa Kirby, 1894a: 267.

Type. Cuba; IRSN.

Regional Distribution.

Biotic Province(s): Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: FL, TX; MEXICO: BCS, CAM, CHS, HGO, JAL, MOR, NAY, OAX, QTR, SIN, SLP, TAB, TAM, VER, YUC; West Indies, Central America south to Ecuador.

Seasonal Distribution. year round (Mexico).

Identification. Like *M. aequalis*, *M. didyma* just enters the lower Rio Grande Valley of Texas. The face is white with top of the head becoming metallic green in mature males and staying brown in females. The green thorax is marked with brown in the front and with three oblique dark stripes laterally. The wings are clear, generally with two cells instead of one in the forewing triangle. The legs are black. The abdomen is slender and black with pale green trapezoidal spots on segments 2-7, the most prominent of which is on segment 7. Segments 8-10 and the caudal appendages are black. Needham (1943) described the larva.

Micrathyria didyma, is slightly larger than the other two species. *Micrathyria aequalis* has a pattern of stripes that appears as "WII" on the sides of the thorax, while older males of *M. hagenii* become heavily pruinose and the midlateral stripe is forked at its upper end. It differs from *Pachydiplax longipennis*, which has dorsal spots on

abdominal segment 8, and from female *Erythrodiplax berenice* by the ventrally projecting ovipositor.

Size. Total length: 32-40 mm; abdomen: 22-28 mm; hindwing: 25-32 mm.

Habitat. Weedy pools, ponds, brooks and ditches in the shade.

Discussion. The only record of this species in Texas is a single male taken at Bentsen State Park in Hidalgo County (Abbott 1996). This species is typically found along forest clearings where it feeds. Little has been written on its biology or behavior. Needham (1943) described the habitat where he collected larvae as a "little, weedy, spring-fed brook." It is found year round throughout most if not all of its range.

***Micrathyria hagenii* Kirby**

Thornbush Dasher

(Map 210)

Dythemis didyma, Hagen, 1861: 165.

Micrathyria hagenii Kirby, 1890: 41.

Type. Unknown.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Colorado, Rio Grande, San Antonio, St. Francis.

General Distribution. UNITED STATES: AR, TX; MEXICO: BCS, CAM, CHS, GRO,

NAY, NLN, OAX, PUE, QTR, SIN, SLP, TAM, VER, YUC; West Indies, Belize, Honduras, Costa Rica & Panama.

Seasonal Distribution. May. 7 (TX) - Nov. 4 (TX).

Identification. This is our most widespread *Micrathyria* species. The face is pale yellow. The top of the frons is brown in juveniles and females, but it becomes metallic blue in mature males. The front of the thorax is brown, with two pale green stripes, that don't reach the alar carina. The sides are green with three brown oblique stripes. The middle one is usually forked at its upper end, often joining with the stripes on either side. The underside of the front femur is green in juveniles and females with the rest of the leg black. The wings are hyaline, with only a flavescent tinge basally and a small brown basal spot in the hindwing. The black abdomen is slender but widens slightly at segments 7-9. There is a row of greenish spots dorsolaterally on segments 1-7, with those on segment 7 most pronounced. The remaining abdominal segments and caudal appendages are black. Mature males develop a pruinose grayish color on the thorax and abdomen. Females are similar to males but lack the pruinosity, and the abdominal spots are larger throughout. Needham (1943) described and illustrated the larva.

It differs from the smaller *M. aequalis* in having three distinct lateral thoracic stripes and from *M. didyma* and *Pachydiplax longipennis* in having the middle stripe branched at its upper end. As with the other two species, it can be distinguished from *Erythrodiplax berencie* females by the ventrally projecting ovipositor of that species.

Size. Total length: 30-36 mm; abdomen: 18-25 mm; hindwing: 24-30 mm.

Habitat. Heavily vegetated ponds and lakes.

Discussion. This species has been reported as far north as Franklin County, Arkansas (Harp and Rickett 1977). Although it is widely distributed it is certainly not common within our limits. Paulson (1969) described ovipositing females near Oaxaca, Mexico. They hover low over the water, 0.25 m, extrude egg masses approximately 2 mm in diameter and flick their abdomen upwards to release them. They will also extrude eggs on floating vegetation. This species is often found perched on thick vegetation surrounding the ponds it haunts. This species is found year round throughout much of its range, and the limited seasonal distribution stated above may not be completely representative.

Genus *Orthemis* Hagen

Roseate Simmers

Orthemis Hagen, 1861.

Neocysta Kirby, 1889.

This is a moderately diverse Neotropical genus of some 18 species, two of which extend northward into our area. They are large, robust dragonflies similar in size to those of the genus *Libellula*, but males are predominantly brown in color with red or purple abdomens. The top of the frons becomes metallic violet in mature males. The wings are clear with a long brown pterostigma that surmounts 5-6 crossveins. The abdomen strongly tapers rearward and appears triangular in cross section. Abdominal segment 8 is

pronounced and expanded laterally in females. The larvae are similar to those of *Libellula* but the broad eyes are raised considerably above the rest of the head.

KEY TO ADULT SPECIES OF *ORTHEMIS*

1. Second lateral thoracic stripe distinct, dark on lower part of mesepimeron; distinct pale yellow stripe along ventral suture; distinct dark markings on ventrolateral portion of metepisternum; two halves of vulvar lamina, in female, meet evenly forming a wide "U" *ferruginea*
- 1'. Second lateral thoracic stripe nearly absent; some specimens with indistinct pale yellow stripe along ventral suture; no dark markings on venter of thorax; two halves of vulvar lamina, in female, meet at a slight angle, forming a shallow "V" *discolor*

Orthemis discolor (Burmeister)

Orange-bellied Skimmer

(Map 211)

Libellula discolor Burmeister, 1839: 856.

Orthemis discolor, Davies & Tobin, 1985: 101.

Type. Brazil.

Regional Distribution.

Biotic Province(s): Tamaulipan, Texan.

Watershed(s): Brazos, Guadalupe, Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: TAM.

Seasonal Distribution. Jun. 25 (TAM) - Oct. 20 (TX).

Identification. This species has a red face and orange labrum. Juveniles are brown with an unmarked thorax that is orange-yellow ventrally. The top of the head turns a dark metallic violet in mature males and the thorax and abdomen become reddish with a uniform purple pruinose overcast in both sexes. The wings are clear with dark wing veins. The wide lateral flange on segment 8 in females is generally dark and the black vulvar lamina meet at a very slight angle, forming a shallow V.

The only species likely to be confused with *O. discolor* is the very similar and much more widespread *O. ferruginea*. In that species the ventral side of the thorax is grayish-yellow often with distinct dark markings on the ventrolateral portion of the metepisternum that are generally not present in *O. discolor*. The sides of the thorax in *O. ferruginea* have a distinct pale yellow stripe along the ventral suture. The wing veins are more orange and the lateral flange of abdominal segment 8 in females is pale. The vulvar lamina in *O. ferruginea* meet straight forming a wide, short-armed U.

Size. Total length: 47-56 mm; abdomen: 33-39 mm; hindwing: 35-44 mm.

Habitat. Temporary and permanent ponds, lakes, ditches and slow streams.

Discussion. This species was considered a southern form and synonym of the very similar *O. ferruginea*. It has only been reported from two counties in south Texas, but it is likely much more widespread. DeMarmels (1988) and Donnelly (1995) both illustrated

differences in color between these two sister species, but neither was able to distinguish structural characters that differentiated the two species. Paulson (1998b) however, found differences in the vulvar lamina outlined above. Donnelly (1995) discussed the biogeography and invasion of this species into Central America. Both *Orthemis* species in our area are known to occur together in areas of Mexico and Central America; however no discernable behavioral differences have been detected. Novelo's (1981) behavioral study of *O. ferruginea*, may have very well included both species. The early and late dates listed above for *O. discolor* are reflective only of three collections of this species in our area. It is found year round throughout most of its range. Paulson (1998b) and Dunkle (1998) each have reported a single male in their collections from Texas. The locations are a stream near Round Top in Fayette County, and Palmetto State Park in Gonzales County, Texas, respectively.

Orthemis ferruginea (Fabricius)

Roseate Skimmer

(Map 212)

Libellula ferruginea Fabricius, 1775: 423.

Libellula macrostigma Rambur, 1842: 57.

Orthemis ferruginea, Kirby, 1889: 286.

Type. Amazonas, Halle.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, Trinity.

General Distribution. UNITED STATES: AL, AR, AZ, CA, FL, GA, HI, KS, LA, MS, NC, NM, NV, OK, SC, TX; MEXICO: AGS, BCS, CAM, CHI, CHS, COA, COL, DFE, DGO, GRO, HGO, JAL, MIC, MOR, NAY, NLN, OAX, PUE, QRO, QTR, SIN, SLP, SOR, TAB, TAM, VER, YUC; West Indies, Central America south to Chile.

Seasonal Distribution. Apr. 27 (LA) - Dec. 1 (LA).

Identification. This handsome and widespread, common species is found throughout all parts of our area. It is brown initially in both sexes with pale stripes on the thorax forming an irregular "HII" pattern. The abdomen is uniform brown in juveniles. Mature adults develop a pale bluish thorax and a bright pinkish or purple abdomen. The wings are clear with orangish veins. The lateral flanges of abdominal segment 8 in females are generally pale.

Other characteristics and specific differences between *O. ferruginea* and *O. discolor* are given under the description of the latter.

Size. Total length: 46-55 mm; abdomen: 33-39 mm; hindwing: 35-44 mm.

Habitat. Temporary and permanent ponds, lakes, ditches and slow streams.

Discussion. This is a widespread species that seems to invade new habitats and readily expand its range. It is found throughout the New World tropics, including the Bahamas,

West Indies and Hawaii. Its ubiquity has made it the subject of numerous behavioral studies (Harvey and Hubbard 1987; Novelo and Gonzalez 1984; Novelo 1981; Young 1980). It behaves similarly to many *Libellula* species, foraging from the top of tall vegetation. It is an aggressive predator taking insects only slightly smaller than itself. Males will regularly and vigorously patrol territories averaging 10 m. Males use their abdomens to ward off intruding males by bending the tip downwards. They pursue females in flight, where mating takes place for an average of 10 sec. Oviposition by females takes an average of 1-3 minutes and is done by flicking the eggs along with water droplets towards the shoreline. The male guards the female during this time, often hovering close to her and bending the abdomen down, almost at a right angle, when numerous competing males are present. Mauffray (1997) reported two emergence peaks in Louisiana; one in the spring and a second one in the late summer to early fall.

Genus *Pachydiplax* Brauer

Blue Dasher

Pachydiplax Brauer, 1868.

This genus includes a single species of variably-sized individuals found throughout the U.S. and southward to Belize and the Bahamas. It is recognizable by the striped thorax and blue pruinose abdomens of mature males and older females. The wings have only a single crossvein under the pterostigma, with a long vacant space

anterior to it. The abdomen is depressed and short, especially in females. The larvae are smooth, often strikingly patterned, and lack dorsal abdominal hooks, but have pronounced long lateral spines on abdominal segment 9.

***Pachydiplax longipennis* (Burmeister)**

Blue Dasher

(Map 213)

Libellula longipennis Burmeister, 1839: 850.

Libellula socia Rambur, 1842: 96.

Mesothemis longipennis, Hagen, 1861: 173.

Pachydiplax longipennis, Brauer, 1868: 722.

Type. Mexico; Halle.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio. San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, AZ, CA, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NE, NC, NH, NJ, NM,

NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY;
CANADA: B.C., Man., N.B., Ont.; MEXICO: BCS, COA, DFE, DGO, JAL, MIC, NAY,
SIN, SON, TAM, VER; Bermuda, Bahamas & Belize.

Seasonal Distribution. Year round (TX).

Identification. This rather distinctive species is found throughout our area. It has a white face, and the top of the frons is metallic blue in mature individuals of both sexes. The eyes are brilliant blue or green in males and reddish-brown in females. The front of the thorax is brown with a thin pale carina medially and a wider pale stripe on either side. The sides are pale green with three full length brown stripes. The wings are typically clear but may be flavescent and with a dark brown stripe on either side of the midbasal space in males. The legs are black and heavily armed. The abdomen is black with a pair of pale yellow stripes dorsally that are interrupted on segments 3-8 to appear as dashes. Segment 9 and the caudal appendages are black, while 10 is pale. The abdomen is considerably shorter in females. Older males develop a pale pruinose blue color dorsally and more slowly laterally on the thorax and over the entire abdomen. Females become pruinose, but much more slowly than males. The larva was described by Needham (1901) and most recently illustrated by Musser (1962).

This species is similar to mature males of *Erythemis simplicicollis*, which have an unmarked green or blue thorax. Females of *Erythrodiplax berenice* have a prominent ventrally projecting ovipositor. Species of *Micrathyria* are similar and characters are given under those species to help separate them.

Size. Total length: 28-45 mm; abdomen: 23-35 mm; hindwing: 30-43 mm.

Habitat. Ponds, lakes, marshes, ditches, slow streams and other quiet bodies of water.

Discussion. This ubiquitous species is found around nearly any standing body of water.

It has been called the most common and abundant species by numerous authors (Bick 1950, 1957; Byers 1930; Needham 1946; Penn 1951; Root 1924; Wright 1943b). Harp (pers. comm.) reported it from every county in Arkansas and Mauffray (1997) from every parish in Louisiana. As a result it certainly ranks as one of the most well studied dragonflies in North America. Studies on this species include food intake and foraging behavior (Fried and May 1983; May 1984; Baird and May 1997) and territoriality and reproductive behavior (Johnson 1962c; Robey 1975; Sherman 1983; Mackinnon and May 1994). *Pachydiplax longipennis* is often seen perched vertically on twigs and branches at a variety of heights from just above ground level to tree tops with the wings depressed downward. On warmer days individuals will raise the abdomen in an obelisk position, reducing heat absorbance. They are aggressive predators, regularly taking over 10% of their body weight in prey daily. Adults roost in trees and are occasionally attracted to lights at night (Paulson 1966; Frost 1971). This species will defend favored feeding sites for several days in a row. Breeding territories are established along the shoreline, where males will investigate all intruders, and defend and chase other males out by raising their pruinose blue abdomen. Multiple territories may be established in a single day. Mating takes place while in flight or perched and may last from 1/2 to 2 minutes. The male will guard the female from a nearby perch while she deposits eggs by flying low over the water and repeatedly tapping the abdomen to the surface, but never bobbing the entire body up and down. She may lay 300-700 eggs in only 35 seconds, usually in a heavily

vegetated pond margin. Females remain farther back from the water when not ovipositing or mating.

The tremendous variation in size within this species is generally correlated with larger individuals during the spring months and progressively smaller ones occurring in the summer and fall. Penn (1951) studied size variation of species in the southeastern Gulf States. Wellborn and Robinson (1987) found that larvae of this species had a strong preference for the leaf axil area of the aquatic plants they were associated with. This provides them protection and makes them less susceptible to fish predation.

Genus *Paltothemis* Karsch

Red Rock Skimmers

Paltothemis Karsch, 1890.

Until recently, when Garrison (1982b) added a Mexican species, this genus contained a single species found in the southwestern U.S. southward to Venezuela. The group is closely related to *Dythemis* but differ in several points. Individuals have broad wings with a narrow, black and relatively short pterostigma. The forewing triangle points inward and the cubital vein is strongly angulated. The anal area in the hindwing contains 4 or 5 irregular double rows of cells. The larvae are glabrous in appearance with middorsal hooks on abdominal segments 2-6 and short, posteriorly-directed lateral spines on abdominal segments 8-9.

Paltothemis lineatipes Karsch

Red Rock Skimmer

(Map 214)

Paltothemis lineatipes Karsch, 1890: 33.*Dythemis russata* Calvert, 1895: 526.**Type.** Brazil; MNB.**Regional Distribution.***Biotic Province(s):* Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.*Watershed(s):* Colorado, Red, Rio Grande.**General Distribution.** UNITED STATES: AZ, CA, NM, OK, TX, UT; MEXICO: BCS, CHI, CHS, COA, DGO, GRO, JAL, MEX, MOR, NLN, OAX, QRO, SLP, SIN, SOR, VER; Central America south to Costa Rica.**Seasonal Distribution.** Apr. 23 (TX) - Oct. 13 (NM).**Identification.** This is a moderate dragonfly found throughout the southwestern parts of our area. In juveniles and females the face is pale, but it becomes bright red along with the vertex in males. The thorax and abdomen are brownish-gray heavily marked with black. The front of the thorax has a dark rectangle anteriorly. There are two large dark spots, one in front and one below the humeral suture, visible from the side. The mid- and third lateral sutures, along with the rear margin of the pterothorax, are each marked with a heavy, but irregular, black stripe. The wings have a broad area of flavescence basally that

is more pronounced in males, and a darker stripe on either side of the midbasal space. The legs are pale externally and dark on the inside. The abdomen is marked with black on the carinae and irregularly so on the rest of each segment. In mature males the front of the thorax and the entire abdomen become red. Needham (1904) and Musser (1962) have described the larva.

This species may be confused with several other red species with which it is sympatric in some areas. *Paltothemis lineatipes*, however, is darker and more heavily striped. *Dythemis maya*, *Libellula croceipennis* and *L. saturata* all have an unmarked thorax and abdomen.

Size. Total length: 44-53 mm; abdomen: 29-36 mm; hindwing: 41-46 mm.

Habitat. Small, sunlit, rocky bushland and forest streams.

Discussion. The habits of this common species were not described until Dunkle (1978). It is unique among libellulids in combining the broad hindwing of glider dragonflies (*Pantala* and *Tramea*) with the behavior of perchers and fliers. Adults make a habit of gliding during both feeding and patrolling flights. When perched, they nearly always do so horizontally on rocks or vertically on bridge pillars. Males patrol small 15 m sections of streams where the water trickles through the rocks, early in the morning, rarely being seen after midday. Mating takes place in flight and subsequent oviposition by females occurs alone or guarded by the male. Females rapidly drop to the water from a height of 12 cm, dipping the abdomen in regular 1 sec. intervals.

Alcock (1989b) found that males, in the absence of intraspecific competition, defended territories more than twice as large as those defended during a high-density

year, as defined by a high rate of male-male interactions, and regular raiding of neighboring territories to steal females. Alcock (1987b, 1990) further studied male reproductive tactics, territoriality and oviposition resources in this species. Males engage in meandering searching flights to locate potential oviposition sites in their territories. This is followed by an inspection flight, indicative of a suitable place that will be displayed to the female after capturing her. Dunkle (1978) described the eggs and emergence of this species.

Genus *Pantala* Hagen

Rainpool Gliders

Pantala Hagen, 1861.

This genus contains two medium-sized brownish-yellow dragonflies. They have pale faces that become red with maturity and large wings that are broad basally, allowing them sustained flight. Both species in this genus are found widespread throughout the U.S. including the south-central states, where they are often seen soaring for hours in open fields. One of our species, *P. flavescens*, is a well-known migratory species, with a circumtropical distribution. The larvae are very similar in appearance to those of *Tramea*, lacking middorsal hooks but having unusually long and stout lateral spines on segments 8-9 and the caudal appendages. This group is among the first of the dragonflies to colonize a newly formed habitat, which may include nearly any standing body of water

such as temporary ponds, pools and watering troughs. This group gets its name because adults have the unusual behavior of breeding in these temporary pools where the larvae are fast growing.

KEY TO ADULT SPECIES OF *PANTALA*

1. Hindwing with large round brown spot in anal area *hymenaea*
 1'. Hindwing without brown spot in anal area, but some yellow flavescence may
 be present *flavescens*

Pantala flavescens (Fabricius)

Wandering Glider

(Map 215)

Libellula flavescens Fabricius, 1798: 285.

Libellula viridula Beauvois, 1805: 69.

Libellula sparshallii Curtis, 1829 (Dale MS): 162.

Libellula analis Burmeister, 1839: 852.

Libellula terminalis Burmeister, 1839: 852.

Pantala flavescens, Hagen, 1861: 141.

Sympetrum tandicola Singh, 1955: 171.

Type. India; ZMUC.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, TN, TX, UT, VA, WA, WI, WV; CANADA: Man., N.B., Nfld., N.S., Ont., Que.; MEXICO: BCS, CAM, CHI, CHS, COA, COL, DFE, DGO, GRO, HGO, JAL, MEX, MOR, NAY, NLN, OAX, PUE, QTR, SIN, SLP, SOR, TAB, TAM, VER, YUC; West Indies, Central America south to Chile & Argentina; found on all continents but Europe.

Seasonal Distribution. Year round (TX).

Identification. This is probably the most widespread and cosmopolitan of all dragonflies. It is commonly encountered throughout our area. It is distinctive with its predominantly yellow color. The face is pale yellow becoming reddish in older males. The thorax is olivaceous brown and largely unmarked. The wings are clear, with males developing brown apices. The legs are pale basally, becoming black for most of their length. The stout tapered abdomen is yellow with black stripes laterally on the swollen basal segments. The thin dark middorsal stripe widens and becomes noticeably darker on segments 8-10. The pale caudal appendages are more or less bicolored in males,

darkening in their outer half. Cabot (1890) first described the larva and more recently Musser (1962) illustrated it.

Similar species include *P. hymenaea*, which has a brown spot basally in the wings and *Sympetrum* spp. which have normal shaped wings and parallel-sided abdomens. Our species of *Tramea* all have wide crossbands in the hindwings.

Size. Total length: 44-51 mm; abdomen: 25-34 mm; hindwing: 35-42 mm.

Habitat. Permanent and temporary ponds, pools and other water bodies, including brackish ones.

Discussion. This species' common name may be the most appropriate of any of our species. It is a strong flier, with a circumtropical distribution. It is found in nearly every contiguous state, extreme southern Canada (Trottier 1967), southward throughout Central and South America, the Bahamas, West Indies, Hawaii and throughout the Eastern Hemisphere, except for Europe. It is a strong flier that is regularly encountered by ocean freighters (McLachlan 1896b). It is certainly the best known migratory species (Wakana 1959; Corbet 1963; Reichholf 1973). Because of its ability to drift with the wind, feeding on aerial plankton, until it finally encounters a rain pool in which it breeds, Dunkle (1989a) has called this "...the world's most evolved dragonfly." It is generally more abundant in the fall when offspring from earlier in the spring migrate southward. They are often encountered in large mixed feeding swarms, along with *Tramea* spp., where they prey upon small flying insects. Males patrol territories of varying lengths 1-2 m above the water. Mating takes place in flight and lasts from 30 sec to an unusually long 5 min. Females oviposit in temporary ponds or rainpools by tapping their abdomen to the

water surface, alone or accompanied by the male. It takes as little as five weeks for the larva to complete its cycle. It is not unusual, however to see females attempting to oviposit on automobile roof tops, asphalt roads or other shiny structures that they mistake for water. They usually perch vertically on low stems and twigs, but sometimes they will perch horizontally with the abdomen depressed below the rest of the body. Svihla (1961) studied oviposition in this species and found egg laying restricted to lentic situations and oviposition generally occurring while in tandem flying straight over the water. Feeding swarms consist of both males and females in equal numbers over land and can occur at anytime from dawn to dusk. Warren (1915) made extensive studies of the larval feeding habits of this species, which can be cannibalistic. Chowdhury and Rahman (1996) described the anatomy and histology of the alimentary canal and malpighian tubules of the final instar larva.

Pantala hymenaea (Say)

Spot-winged Glider

(Map 216)

Libellula hymenaea Say, 1839: 19.

Pantala hymenaea, Hagen, 1861: 142.

Tramea huanacina Förster, 1909: 229.

Type. Indiana; lost.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, AZ, CA, CO, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MO, MS, NC, NE, NH, NJ, NM, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, UT, VA, WA, WI, WV; CANADA: B.C., Man., N.B., N.S., Ont., Que.; MEXICO: BCA, BCS, CAM, COA, DFE, DGO, GRO, MOR, NAY, NLN, QTR, SIN, SON, TAM, VER, YUC; West Indies, Central America south to Argentina & Chile.

Seasonal Distribution. Year round (TX).

Identification. This species is very similar to *P. flavescens* and equally cosmopolitan in the south-central U.S. The face and thorax are essentially as in that species. Each hindwing, however, has a distinct round dark spot basally. The abdomen is dark and mottled. Kennedy (1923b) and Musser (1962) have described and illustrated the larva.

This species can be distinguished from *P. flavescens* by the presence of the dark basal hindwing spot and darker abdomen. Other species (*Tramea*) that are similar and with which *P. hymenaea* may fly either lack the basal wing spot or have this spot differently shaped.

Size. Total length: 43-51 mm; abdomen: 29-35 mm; hindwing: 39-45 mm.

Habitat. Open, temporary and artificial ponds and pools, including brackish waters.

Discussion. This species, although not found globally, is as widely distributed throughout the U.S. as *P. flavescens*. The behavior of this species is much the same as that of *P. flavescens*. It is a strong flier, generally only taking a perch to roost at night. It is an early colonizer of temporary and artificial ponds where it breeds. Males patrol larger more linear territories than do *P. flavescens* (Dunkle 1989a). Females oviposit by tapping the abdomen to the water while flying quickly over the water or while hovering, and either accompanied by the male or alone. This species, like *P. flavescens*, has been slow to colonize along the coastal states of the western U.S., but Paulson and Garrison (1977) have reported an apparent increase over much of the region. Cannings (1988) first reported this species from British Columbia, Canada. Bick (1951b) found larvae of this species in Oklahoma could complete development in less than five weeks during the summer months.

Genus *Perithemis* Hagen

Amberwings

Perithemis Hagen, 1861.

This primarily Neotropical genus contains a few species of small, robust brown and yellow dragonflies. Two of the four North American species are found within our limits. Both are readily recognized by their small size and the solid amber wings of the

male and spotted wings of the female. Many members of this genus have complex courtship displays. The thorax is olivaceous green-brown with the abdomen narrowed at both ends in each sex. The abdomen is shorter than the wings. The forewing triangle is unusual with the inner and anterior sides equal, or nearly so, in length. The anal loop forms a foot that is hardly bent, if at all, at the ankle. *Perithemis tenera* is the only species widely distributed across the U.S. Ris (1930) revised the genus. The larvae are rather broad with depressed abdomens, small spines of equal length on segments 8 and 9 and cultriform hooks middorsally on segments 3-9. Needham and Westfall (1955) gave a key to separate the larvae of both of our species.

KEY TO ADULT SPECIES OF *PERITHEMIS*

1. Pale dorsal markings on abdomen take form of chevrons; generally triangles and subtriangles without crossveins *tenera*
- 1'. Pale dorsal markings on abdomen form a straight line; generally some triangles or subtriangles divided by crossveins *domitia*

Perithemis domitia (Drury)

Slough Amberwing

(Map 217)

Libellula domitia Drury, 1773: 45.

Libellula metella Sélys, 1857: 451.

Perithemis domitia, Hagen, 1861: 185.

Perithemis pocahontas Kirby, 1889: 232 .

Perithemis iris Kirby, 1890: 10.

Type. Santa Cruz, CA.

Regional Distribution.

Biotic Province(s): Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: AZ, TX; MEXICO: CHI, CHS, COL, HGO, JAL, NAY, NLN, OAX, PUE, QTR, SIN, SLP, SOR, TAB, VER, YUC; West Indies, Central America south to Ecuador & Brazil.

Seasonal Distribution. May 9 (TX) - Jul. 2 (NLN).

Identification. This is a Mexican and Central American species that just ranges into southwestern Arizona and Texas. It is very similar in appearance and size to the more widespread *P. tenera*. It is a greenish-brown species. The face is yellow with the vertex and occiput brown. The thorax is brown with two wide olivaceous stripes that become obscured with age. In the male the wings are amber with dark red venation and pterostigma. In the female the wings are amber out to the nodus, with dark brown spots. The legs are brown with black joints. The brown abdomen is short with a narrow waste basally widening medially and narrowing again apically, so as to appear spindle shaped. There is a series of pale stripes forming an interrupted, but straight, line on either side of the midline.

This species could easily be confused with the similar *P. tenera*. Careful examination will reveal that males of that species generally develop brown spots above the triangles in each wing and the pale line on the abdomen appears more as a row of separated chevrons. *P. domitia* also tends to prefer shady areas rather than open sunny fields and meadows like *P. tenera*.

Size. Total length: 21-25 mm; abdomen: 12-16 mm; hindwing: 16-20 mm.

Habitat. Shaded sloughs, ponds, pools, roadside ditches and other still waters.

Discussion. Though widespread farther south, this species has only been found from Hidalgo and Brewster counties in Texas. It is not a vagrant, as there are breeding populations in Big Bend National Park, Brewster County (Dunkle pers. comm.). Little has been documented about the behavior of this species. Needham and Westfall (1955) reported that "Adults fly low over water, never departing far from it. They dart about very swiftly and perch frequently on emergent twigs or grass stems. Males on meeting face to face in flight may dart upward to considerable heights, threatening each other, but return at once to low-level perches."

Perithemis tenera (Say)

Eastern Amberwing

(Map 218)

Libellula tenera Say, 1839: 31.

Libellula tenuicincta Say, 1839: 31.

Libellula chlora Rambur, 1842: 125.

Perithemis tenera, Kirby, 1890: 10.

Perithemis domitia seminole Calvert, 1907: 314.

Perithemis domitia tenera, Muttkowski, 1910a: 146.

Perithemis tenuicincta, Muttkowski, 1910a: 146.

Perithemis seminole, Ris, 1930: 17.

Type. United States.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, AZ, CO, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, MI, MO, MS, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, WI, WV; CANADA: Ont.; MEXICO: COA, DGO, NLN, TAM.

Seasonal Distribution. Feb. 1 (LA) - Nov. 21 (LA).

Identification. This species is very similar to *P. domitia*, but it is much more widespread throughout the U.S. and our area. It is a small brown species. *Perithemis tenera*, males have orange or amber wings that usually develop a brown spot above the triangles in our

area. Females have variously shaped brown spots or stripes through the amber areas.

Needham (1901) described and illustrated the larva. Differences between this species and *P. domitia* are given under that species.

Size. Total length: 19-25 mm; abdomen: 12-16 mm; hindwing: 16-21 mm.

Habitat. Open sloughs, ponds, pools, roadside ditches and other still waters.

Discussion. This small dragonfly has been well studied. It has an elaborate courtship behavior. Males come to the water's edge early in the morning in search of a territory. They then patrol and defend these territories, as potential oviposition sites, where they regularly perch on emergent sticks or twigs. These small territories, less than 5 square m, are only accepted by the male, if he is not disturbed and there is no competition from other males. Females appear and are courted by the male. He will fly out to her and lead her back to his prospective oviposition site, hovering with his abdomen turned up. Upon acceptance by the female, signaled by a slower wing beat, the pair perch on a twig and mate, taking 20-30 sec. Females then oviposit either accompanied by the male or alone and guarded. Females tap the abdomen against sticks or twigs, within the oviposition area, attaching to it a gelatinous mass just above the waterline. Montgomery (1937) described this process in detail. The mass then explodes into individual eggs as it hits the water.

Both sexes of this group mimic wasps by perching at the ends of grasses or weeds and, while beating its wings, pumps the abdomen up and down. Females also fly with the hindwings held together vertically with the abdomen bent up (Dunkle (1989a). Hardy (1966) studied the effects of temperature and sunlight on *Perithemis tenera*, which will

assume an obelisk position to reduce its body temperature. Jacobs (1955) studied in detail the reproductive behavior of this species and found that females with more darkly pigmented wings tend to select the more favorable oviposition sites such as logs or sticks, and the lighter pigmented females select less favorable patches of floating vegetation. Shiffer (1968) reported the occasional appearance of homochromatic females, with diffusely amber wings. Switzer (1977a,b) has studied factors affecting site fidelity in this species and found that males that were prevented from mating were much more likely to change potential oviposition sites the following day than males that were allowed to mate, possibly implying that males use their reproductive success to determine the quality of oviposition sites.

Genus *Pseudoleon* Kirby

Filigree Skimmer

Pseudoleon Kirby, 1889.

This genus contains a single unmistakable black, ornately patterned, species found in the southwestern U.S. southward through Mexico to Costa Rica. The eyes are strikingly patterned with long stripes that often remain after preservation. The wings are variably and ornately patterned with black. The foot in the hindwing is broad, usually with several ankle cells. The forewing triangle is unusually narrow, and in the hindwing, concave on its outer side. The larvae are readily recognized by brown spots on the lateral

lobes of the labium.

***Pseudoleon superbus* (Hagen)**

Filigree Skimmer

(Map 219)

Celithemis superbus Hagen, 1861: 148.

Erythrodiplax superbus, Brauer, 1868: 723.

Pseudoleon superbus, Kirby, 1889: 274.

Type. Mexico.

Regional Distribution.

Biotic Province(s): Balconian, Chihuahuan, Navahonian, Tamaulipan.

Watershed(s): Nueces, Rio Grande, San Antonio.

General Distribution. UNITED STATES: AZ, NM, TX; MEXICO: BCS, CHS, DFE, DGO, GRO, JAL, MOR, NAY, NLN, OAX, PUE, QRO, SIN, SLP, TAM; Guatemala, El Salvador, Honduras, Nicaragua & Costa Rica.

Seasonal Distribution. Jun. 11 (TX) - Jul. 17 (TX).

Identification. This species is found throughout the southwestern parts of Texas and New Mexico. It is a dark species with a pale face in teneral individuals that quickly becomes black with age. The eyes are light with dark longitudinal stripes. The thorax is initially tan with numerous darker brown stripes, becoming diffusely black with age. The

wings are variably patterned with black, but always with a wide dark band at the nodus. Males usually have more black in the wings, often with the hindwing becoming entirely black except for a clear apical tip. The legs are brown but darken with age. The abdomen is brown, marked with a series of "V" marks outlined internally by a thinner pale line on segments 3-7. This pattern becomes obscured by an almost iridescent black in males.

Needham (1937) described and illustrated the larva.

Size. Total length: 34-45 mm; abdomen: 21-29 mm; hindwing: 30-36 mm.

Habitat. Desert ponds and slow streams.

Discussion. This species generally perches on the ground or on rocks with the wings characteristically depressed below the rest of the body. They can be quite wary however, and can rapidly take flight from this position, especially on hot days. Needham and Westfall (1955) described the behavior of this species. Males are very territorial with numerous midair skirmishes. Females are commonly seen fluttering low around grasses and roots floating in ponds. They oviposit by hovering over the water and then "thrusting" the abdomen into algal mats floating on the surface. Females are commonly interrupted by pursuing males during oviposition, whereupon they immediately stop and flee the area.

Genus *Sympetrum* Newman

Meadowhawk

Sympetrum Newman, 1833.

Diplax Burmeister, 1839.

Thecadiplax Sélys, 1883b.

Tarnetrum Needham & Fisher, 1936.

Kalosympetrum Carle, 1993.

This is a widely distributed group of nearly 60 species found predominantly in the Northern Hemisphere. Fifteen species occur in North America and of those seven are found in the south-central U.S. Two are widespread within that region, one is predominantly eastern and the other four are western species. They are small to medium-sized yellow or red species that are generally seen flying in meadows and swamps. They are weak fliers, usually abundant in the fall, resting on the tips of twigs, branches or tall grasses, although on cooler days some species will rest on the ground or rocks for maximum sun exposure. The head is rounded with a low frons and well developed furrow. The thorax is usually moderately hairy. The wings generally have some degree of flavescence. Because of certain differing characters in the genitalia and wing venation, including two rows of cells above the radial planate, two of our species have historically been placed in a separate genus, *Tarnetrum*. Various authors have disagreed with this separation (Corbet and Walker 1975; Garrison 1997; Gloyd and Wright 1959; Kormondy 1958, 1960) and I follow them in not acknowledging *Tarnetrum*. The abdomen is slender, compressed vertically on the basal segments, especially in the male, and more parallel-sided beyond. They mate for relatively lengthy periods, up to 30 min in some cases. The larvae are slender, often mottled in coloration and variably exhibit middorsal

hooks and lateral spines. Carle (1993) provided a key to the adults of all the Nearctic species and Walker (1917) provided keys for all North American larvae known at that time.

KEY TO ADULT SPECIES OF *SYMPETRUM*

1. Radial planate subtends 2 rows of cells 2
- 1'. Radial planate subtends a single row of cells 3
- 2(1). Wings hyaline, with at most a faint wash of yellow basally; legs mostly black; hindwing with 5 antenodal crossveins *corruptum*
- 2'. Wings with brown streaks in basal subcostal and cubital spaces, surrounded by a yellow area that covers most of the basal half of wing; legs mostly yellow; hindwing with 6 antenodal crossveins *illotum*
- 3(1'). Face white; thorax with green cast *ambiguum*
- 3'. Face not white; thorax yellow-brown 4
- 4(3'). Superior caudal appendages of male with a prominent inferior tooth; subgenital plate of female deeply bifid; tibiae black externally *internum*
- 4'. Superior caudal appendages of male without a prominent inferior tooth, at most a row of denticles may be present; subgenital plate of female entire or only slightly emarginate; tibiae variable 5
- 5(4'). Wings tinged with yellow over basal half, extending just beyond nodus in both wings and often deepening in color *occidentale*

- 5'. Wings clear or with yellow only present on costal strip or extreme basal portion of wing 6
- 6(5'). Tibiae entirely yellow *vicinum*
6. Tibiae striped with black on sides *costiferum*

Sympetrum ambiguum (Rambur)

Blue-faced Meadowhawk

(Map 220)

Libellula ambiguum Rambur, 1842: 106.

Libellula albifrons Charpentier (*nec* Burmeister, 1839), 1840: 81.

Diplax albifrons, Hagen, 1861: 177.

Diplax ambigua, Walsh, 1862: 400.

Sympetrum ambigua, Muttkowski, 1910a: 160.

Sympetrum ambiguum, Ris, 1911b: 689.

Type. Georgia; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Kansan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Mississippi, Neches, Ouachita, Red, Sabine, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, DE, FL, GA, IA, IL, IN, KS, KY,

LA, MA, MD, ME, MN, MO, MS, NC, NE, NJ, OH, OK, PA, SC, TN, TX, VA;

CANADA: Ont.

Seasonal Distribution. Jun. 13 (AR) - Nov. 27 (LA).

Identification. This is our only predominantly eastern distributed species. Its face is white in front and bluish above. The thorax is grayish-brown or olivaceous with the lateral sutures outlined by thin brown stripes. The wings are clear, with only a small spot of flavescence at the extreme base of each wing tip. The costa is yellow and the pterostigma is brown with yellow around its outer edges. The legs are pale brown but darken at the joints. The abdomen is brown with diffuse black rings apically around segments 4-9, in juveniles and females. The abdomen turns red in mature males. Wright (1946d) described and illustrated the larva. This upper part of the face is bluish-green, while the lower part is white. The face along with the pale legs and male genitalia make this species distinct in our region.

Size. Total length: 31-38 mm; abdomen: 22-25 mm; hindwing: 26-28 mm.

Habitat. Partially shaded temporary and permanent ponds, pools, marshes, swamps and sloughs.

Discussion. This species is particularly partial to shaded areas and forest edges. It is typical of the group, as it perches at the tips of twigs, stems and grasses, but it often do so at greater heights than other species. It will sometimes perch with its abdomen raised above the rest of the body in an obelisk position, like many other *Sympetrum*. Males bring females down low to weeds, stems and other perches and are even occasionally seen mating on the ground. The female oviposits alone, but guarded by the male, as she

extrudes eggs along the shore or over a dry pond or pool where they remain undeveloped until the pond fills again.

***Sympetrum corruptum* (Hagen)**

Variegated Meadowhawk

(Map 221)

Mesothemis corrupta Hagen, 1861: 171.

Diplax corrupta, Sélys, 1884: 43.

Sympetrum corruptum, Kirby, 1890: 17.

Type. Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity.

General Distribution. UNITED STATES: AL, AR, AZ, CA, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, LA, MA, ME, MI, MN, MO, MS, MT, NE, NC, ND, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, WA, WI; CANADA: Alb., B.C., Man., Ont., N.S., P.E.I., Que., Sask.; MEXICO: AGS, BCN, BCS, CHI, COA, DFE,

DGO, HGO, JAL, MEX, MIC, MOR, NAY, SON, TAM, VER; Belize & Honduras.

Seasonal Distribution. All year (TX).

Identification. This is certainly our most widespread *Sympetrum* species. It is largely tan or gray. The face is pale or tan in juveniles and females but becomes red in mature males. The thorax has two oblique lateral white stripes, each with a distinct round yellow spot at the lower end. The yellow always remains visible, but the white becomes obscured in mature males. The wings are clear with yellow veins in the costal and subcostal areas and have a tan pterostigma, bordered by yellow and red. The legs are dark brown except on their outer surfaces. The abdomen is grayish with a yellowish orange middorsal stripe and orange rings apically on segments 3-7. There is a row of white spots laterally on segments 2-8 and segment 8 and 9 each have a large black spot dorsally. The orange color of the abdomen turns red in older males. Needham (1901) and more recently Musser (1962) have described and illustrated the larva. Cannings (1982) described differences between the larva of this species and others in the *Tarnetrum* group.

Size. Total length: 33-43 mm; abdomen: 23-29 mm; hindwing: 27-33 mm.

Habitat. Ponds and slow streams, preferably with sandy or cobble bottoms, but occasionally including brackish waters.

Discussion. This species may be seen on the ground more than other *Sympetrum*. It will also readily perch on the tips of grass stems and tree branches, however. It can be numerous flying over roads, lawns, meadows, marshes and ponds. They are definitely more abundant in the early spring and late fall months, but they have been taken every month in Texas. Kennedy (1915a) described *S. corruptum* as very adaptable, "...found in

a greater variety of environments than any other." Mating occurs while perched on twigs, stems or other vegetation. Females oviposit accompanied by males in the open water of ponds and lakes.

***Sympetrum costiferum* (Hagen)**

Saffron-wing Meadowhawk

(Map 222)

Diplax costifera Hagen, 1861: 175.

Diplax atripes Hagen, 1873: 588.

Sympetrum costiferum, Kirby, 1890: 17.

Type. Massachusetts; MCZ.

Regional Distribution.

Biotic Province(s): Kansan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: CA, CO, CT, IA, ID, IL, IN, KS, MA, ME, MI, MN, MO, MT, ND, NE, NH, NJ, NM, NV, NY, OH, OR, PA, RI, SD, UT, VT, WA, WI, WY; CANADA: Alb., B.C., Man., N.B., Nfld., N.S., N.W.T., Ont., P.E.I., Que., Sask.

Seasonal Distribution. ?.

Identification. This more northern reddish species has been reported as far south as

southeastern New Mexico. Teneral individuals and females are yellow. The face is hairy and pale white or olivaceous with a darker green labrum. The thorax is brownish red in older males. The dark markings seen, on the sutures of juveniles, become obscured. Juveniles and females with a golden yellow color along the costal margin of each wing, covering red veins. This color lessens or disappears in mature males, but may become diffuse covering nearly all of the hindwing in females. The legs are pale yellow externally and dark internally. The abdomen is distinctly spindle-shaped, narrowed basally then widening slightly at segments 5 and 6 and narrowing again distally. The abdomen is red in mature adults, with a prominent black stripe on each lateral carina. Segment 8 and 9 are black dorsally. Needham (1901) and Musser (1962) described and illustrated the larva.

Size. Total length: 31-37 mm; abdomen: 22-26 mm; hindwing: 25-28 mm.

Habitat. Shallow marshes, bay and lagoons of lakes and reservoirs, including saline ones. **Discussion.** This is a late fall species. Evans (1995) reported it from Eddy County, New Mexico. This is the only record of this species from the south-central U.S. It is apparently more tolerant of saline waters than other *Sympetrum* species (Walker and Corbet 1975). This species is another one that commonly perches on the ground. Females generally oviposit accompanied by the male. Kennedy (1915b) reported seeing thousands of this species perched on telephone wires and I have seen the same behavior in other *Sympetrum* species (*S. occidentale* and *S. obtrusum*). Walker (1917) described specific ecological differences between *S. costiferum*, *S. pallipes* and *S. obtrusum*, all of which are very similar.

***Sympetrum illotum* (Hagen)**

Cardinal Meadowhawk

(Map 223)

Mesothemis illotum Hagen, 1861: 172.*Libellula gilva* Hagen, 1861: 172.*Mesothemis gilva*, Hagen, 1875: 78.*Diplax illota*, Sélys, 1884: 43.*Sympetrum illotum*, Kirby, 1890: 17.*Tarnetrum illotum*, Needham & Fisher, 1936: 114.**Type.** California; MCZ.**Regional Distribution.***Biotic Province(s)*: Chihuahuan, Navahonian.*Watershed(s)*: Rio Grande.**General Distribution.** UNITED STATES: AZ, CA, ID, MT?, NM, NV, OR, TX, WA, WY?; CANADA: B.C.; MEXICO: BCS, CAM, DFE, DGO, GRO, HGO, JAL, MEX, MIC, MOR, NAY, OAX, PUE, TLX, VER; West Indies, Central America south to Chile & Argentina.**Seasonal Distribution.** May 22 (TX).**Identification.** This species is found throughout the western U.S. and ranges southward into Chile and Argentina. It and *S. corruptum*, are the only two species in our region of

the *Tarnetrum* group. The face is pale brown but becomes bright red in front and on top in mature males. The thorax is brown with two oblique, somewhat abbreviated or interrupted, white stripes laterally. In mature adults only the rounded lower end of these spots remain conspicuous. The wings are diffusely yellow out to the level of the nodus and there are one or two darker brown streaks extending at least to the first antenodal crossvein in the subcostal and or cubital areas of the wings. The legs are reddish brown. The abdomen is dark brownish red and parallel-sided, for most of its length. The caudal appendages are red. The subgenital plate of the female is emarginate and extends beyond the posterior margin of segment 8 by half the length of that segment. Needham (1901) described and illustrated the larva and Cannings (1982) differentiated it from the closely related *S. corruptum*. Wright (1946) further keyed and described the larvae of the *Tarnetrum* group.

This species is unlike our typical *Sympetrum* species because it has a broader parallel-sided abdomen. *Sympetrum corruptum* is superficially similar but has clear wings.

Size. Total length: 36-40 mm; abdomen: 23-26 mm; hindwing: 26-29 mm.

Habitat. Small ponds and slow streams.

Discussion. Within our area this species has been reported from southern New Mexico by Evans (1995) and I (Abbott 1996) reported it from Texas for the first time from collections made by C.R. Nelson at Limpia Spring in the Davis Mountains, Jeff Davis County. This species perches on the tips of twigs, grasses and other vegetation with its wings depressed below the abdomen. Kennedy (1917) has given the most detailed

description of behavior for this species. Mating initiates in flight or on a twig or branch and requires 30 sec. The male then generally accompanies the female as she oviposits by making numerous dips to the surface with the abdomen.

Sympetrum internum Montgomery

Cherry-faced Meadowhawk

(Map 224)

Sympetrum internum, Montgomery, 1943: 57.

Type. United States.

Regional Distribution.

Biotic Province(s): Navahonian, Texan.

Watershed(s): Canadian, Cimarron.

General Distribution. UNITED STATES: AK, CA, CO, CT, DE, IA, ID, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MT, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SD, UT, VT, WA, WY; CANADA: Alb., B.C., Man., N.B., Nfld., N.S., N.W.T., Ont., P.E.I., Que., Sask., Yuk.

Seasonal Distribution. Oct. 8 (OK).

Identification. This species is only found as far south as north-central Oklahoma. It is a handsome species with a cherry red face at maturity. The thorax is reddish-brown, thickly clothed with hairs of the same color, but unmarked both in front and on the sides.

The wings are clear, with only a hint of yellow flavescence at the extreme base. The femur is pale beneath with the rest of the leg black. The abdomen is cherry red with large black subequal triangles laterally on segments 4-8 or 9. Segment 10 and the caudal appendages are yellow with black apically on the superior appendages.

Size. Total length: 27-34 mm; abdomen: 20-23 mm; hindwing: 25-27 mm.

Habitat. Ponds, pools and slow shady streams.

Discussion. This species is very similar to the larger and more northern *S. rubicundulum*. Montgomery (1943) clarified the long taxonomic history and confusion surrounding this species. Williamson (1983) discussed the status of this species (as *S. decisum*). Bick and Bick (1957) have reported this species from Cleveland and Payne Counties in Oklahoma, representing the most southern extent of its range. Needham and Westfall (1955) listed this species from Arkansas and Texas, but these records are undoubtedly in error.

Sympetrum occidentale Bartenef

Western Meadowhawk

(Map 225)

Sympetrum semicinctum Bartenef, 1915: 1.

Sympetrum occidentale, Walker, 1951: 156.

Type. North America.

Regional Distribution.

Biotic Province(s): Chihuahuan, Kansan, Navahonian.

Watershed(s): Canadian, Cimarron, Red, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, CO, IA, ID, KS, MN, MT, ND, NE, NM, NV, OK, OR, SD, UT, WA, WY; CANADA: Alb., B.C.

Seasonal Distribution. Aug. 1 (NM) - Oct. 21 (NM)..

Identification. This is a brownish western species very similar to *S. semicinatum*, which does not occur in the south-central U.S. The face is pale yellow. The thorax is darker olivaceous in front and pale yellowish-green laterally with distinct black stripes, usually confluent at their lower end. In older individuals the pale color becomes a dull greenish or gray color, with the dark stripes becoming obscured. The oblique black stripe anterior to the spiracle always remains visible, however. The wings of *S. occidentale* are distinctive among our species, with a broad yellow flavescence extending out to the nodus and a darker brown band covering the outer half of that stripe. The legs are black. The abdomen is yellowish dorsally with a black ventrolateral stripe on either side. Segments 8 and 9 are black dorsally and the caudal appendages are yellow. Musser (1962) described and illustrated the larva.

Size. Total length: 30-38 mm; abdomen: 18-24 mm; hindwing: 23-27 mm.

Habitat. Spring fed, muddy bottomed ponds, sloughs and swamps.

Discussion. Considerable confusion has existed in the past between *S. occidentale* and *S. semicinatum*. Some scientists consider *S. occidentale* to be a synonym of that species. Walker (1951) described three geographic groups as subspecies of *S. occidentale*, including *S. o. fasciatum*, which occurs in our area. Walker illustrated the differences

between the three subspecies and *S. semicinctum*. I have seen this species perched on fence and telephone lines by the thousands.

***Sympetrum vicinum* (Hagen)**

Yellow-legged Meadowhawk

(Map 227)

Diplax vicina Hagen, 1861: 175.

Sympetrum vicinum, Kirby, 1890: 16.

Type. Bergen Hill; unknown.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Kansan, Navahonian, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Colorado, Guadalupe, Nueces, Ouachita, Red, Rio Grande, San Antonio, San Jacinto, St. Francis.

General Distribution. UNITED STATES: AL, AR, CA, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NM, NY, OH, OK, OR, PA, RI, SC, TN, TX, VA, VT, WA, WI, WV; CANADA: B.C., N.B., N.S., Ont., P.E.I., Que.

Seasonal Distribution. Jun. 11 (TX) - Nov. 9 (OK).

Identification. This is a smaller, delicate, but widely distributed *Sympetrum*. The face is yellowish, but becomes red in older males. The thorax is darker in front and greenish

brown laterally with no markings. The wings are hyaline with a slight hint of amber at the extreme base in each wing. The legs are pale brown. The abdomen is uniform brown but becomes red along with the front of the thorax in mature males. The female has a ventrally projecting scoop-shaped subgenital plate that becomes more pronounced after oviposition.

This species is distinct amongst our *Sympetrum*, with a pale face and legs, and clear wings. The abdomen of *S. ambiguum* is marked with black and the face remains white in older males.

Size. Total length: 26-35 mm; abdomen: 18-23 mm; hindwing: 20-25 mm.

Habitat. Permanent ponds and slow flowing streams.

Discussion. This thin-legged species flies in the late summer and early fall. It has been reported throughout our area. Carle (1993) included Louisiana in his distribution for the species, but could not recall the source of his data. Although it is to be expected in the northern part of that state, Mauffray (1997) listed it as doubtful from Louisiana.

Individuals of *S. vicinum* tend to perch higher up on vegetation, such as bushes and grasses, than many of our other *Sympetrum*. This species tends to only breed in permanent waters, including slow streams and ponds. Females oviposit, in tandem, along the bank by tapping the abdomen alternately against the water and then the bank. Calvert (1926) made further notes on the ecology of this species and May (1998b) studied body temperature regulation.

Genus *Tauriphila* Kirby

Pasture Gliders

Tauriphila Kirby, 1889.

This is a group of five Neotropical species, two of which range into the U.S. *Tauriphila australis* is found in Florida and *T. azteca* ranges into southern Texas. The group is similar in appearance to the genus *Tramea*. They are generally smaller than members of that genus, however, and are unique in several venational characters. The forewing triangle is composed of two cells and the pterostigma is of equal length in the fore- and hindwing (in *Tramea* the forewing pterostigma is distinctly longer). The radial planate subtends a single row of cells. The caudal appendages are of normal length and don't appear unusually long as in *Tramea*.

***Tauriphila azteca* Calvert**

Aztec Glider

(Map 227)

Tauriphila azteca Calvert, 1906: 298.

Type. Mexico.

Regional Distribution.

Biotic Province(s): Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: TX; MEXICO: CAM, COL, JAL, NAY, QTR, SLP, TAB, VER; West Indies, Guatemala & Costa Rica.

Seasonal Distribution. Jun. 8 (TX).

Identification. The yellow abdomen marked with distinct bands at each segment along with the dark basal marking in each hindwing will readily distinguish this species. The face is brown with a metallic violet lustre in males. The thorax is brown and largely unmarked. Abdominal segments 8-10 have a black middorsal stripe and the caudal appendages are black. The larva is unknown.

Size. Total length: 40-44 mm; abdomen: 29-35 mm; hindwing: 34-38 mm.

Habitat. Slow, calm waters with emergent or floating vegetation.

Discussion. The only record of this species in our region is a single male specimen in the Florida State Collection of Arthropods collected in Kingsville, Texas (Abbott 1996). As its common name implies this species has a distinct gliding flight, ranging widely when feeding. Males patrol territories over floating plants, where females oviposit eggs at their bases (Dunkle pers. comm.).

Genus *Tholymis* Hagen

Evening Skimmer

Tholymis Hagen, 1867.

This is a tropical genus of few species, with a single inhabitant in the New World. It is a vagrant in southern Florida and Texas. Members of this genus have a broadly rounded heel in the anal loop and an open toe, with veins A1 and A2 ending at the hindwing margin. Also characteristic of this genus is a second row of cells inserted medially in the radial and median planates. Our species has amber spots below the nodus. Males have a row of denticles on the underside of the superior caudal appendages.

***Tholymis citrina* Hagen**

Evening Skimmer

(Map 228)

Tholymis citrina Hagen, 1867: 218.

Type. Cuba; MCZ.

Regional Distribution.

Biotic Province(s): Tamaulipan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: FL, TX; MEXICO: CAM, CHS, DFE, GRO, NAY, QTR, SLP, TAB, VER; West Indies, Central America south to Brazil & Chile.

Seasonal Distribution. Sep. 16 (TX).

Identification. This is a large species capable of efficient strong flight. The face is pale yellow but darkens with age and becomes metallic blue along with the top of the frons and vertex in mature males. The thorax is olivaceous brown and unmarked, but the front and sides become bluish black in older males. The wings have a spot of amber below the nodus, brown crossveins and a tawny pterostigma. The dark spot is ill-defined and more diffuse in the forewing. There are generally three paranal cells before the anal loop. The legs are pale and armed with dark spines. The abdomen is pale brown with a middorsal stripe that is darkest on segment 9. The caudal appendages and segment 10 are pale in juvenile, but darken with age in both sexes. The larva is undescribed.

Size. Total length: 48-53 mm; abdomen: 32-40 mm; hindwing: 36-39 mm.

Habitat. Ponds and lakes.

Discussion. This species has only been reported within the U.S. limits on two occasions. Barber and Elia (1994) photographed this species on the southern tip of Florida. The second record of it in the U.S. is a single female collected by Smith and Hodges from the lower Texas Rio Grande Valley (Hidalgo Co.), in 1950, now housed in the Florida State Collection of Arthropods. This species' normal distribution is southern Mexico southward to Brazil. It is a crepuscular flier which may, explained in part the paucity of records.

Genus *Tramea* Hagen

Saddlebags

Tramea Hagen, 1861.

Trapezostigma Hagen, 1849.

This is a globally distributed group of moderate to large dragonflies. Five of the seven North American species occur in the south-central U.S. They are typically red, brown or black with large heads and a long eye seam. They have a broad saddle-bag-like crossband basally in the hindwing, giving them their characteristic appearance and common name. They have broad hindwings that taper to a point permitting them to remain in flight for extended periods of time. The pterostigma is trapezoidal and distinctly longer in the forewing than in the hindwing. The broad basal wing bands are used to shade the depressed abdomen from the sun on hot days. The forewing triangle is generally 2-3 cells. The apical planate subtends two rows of cells for most of its length. The inside of the foot in the anal loop is composed of numerous branching veins, making it difficult to follow. The abdomen is long and slender. The larval abdomen is smooth, lacking middorsal hooks, but with prominent lateral spines on segments 8 and 9.

Members of this group have an unusual oviposition behavior in which the male and female start out in tandem, the male releases the female while she drops to the water and dips her abdomen to the surface, and she then returns and is grasped by the male as they travel to another ovipositing site. The eggs, are in thin sticky strings that attach to submerged vegetation. This genus is similar to *Pantala* in its habit of continual sustained flight, only occasionally perching horizontally on the tips of tall grasses or other vegetation. Gloyd (1972) discussed the history of the generic names *Tramea* and

Trapezostigma, under which these species have been variously placed..

KEY TO ADULT SPECIES OF *TRAMEA*

1. Base of hindwing with narrow crossband of dark color extending outward to level of anal crossing 2
- 1'. Base of hindwing with broad crossband of dark color extending to distal angle of triangle 3
- 2(1). Sides of thorax with two wide oblique yellow stripes *calverti*
- 2'. Sides of thorax without these wide yellow stripes *insularis*
- 3(1'). Basal color of hindwing red or brown; abdomen olivaceous to red, and lacking yellow spots dorsally 4
- 3'. Basal color of hindwing bluish-black ; abdomen black with paired, broad dorsal yellow spots, becoming most prominent on segments 7-8
..... *lacerata*
- 4(3). Top of frons metallic violet; male hamules only as long or very slightly longer than lateral lobes of abdominal segment 2; female vulvar lamina 2/3 the length of segment 9 *carolina*
- 4'. Top of frons variable, but never metallic violet; male hamules about 1/3 longer than lateral lobes of abdominal segment 2; female vulvar lamina subequal in length to segment 9 *onusta*

***Tramea calverti* Muttkowski**

Striped Saddlebags

(Map 229)

Tramea calverti Muttkowski, 1910: 179.

Type. California.

Regional Distribution.

Biotic Province(s): Balconian, Tamaulipan, Texan.

Watershed(s): Brazos, Colorado, Guadalupe, Nueces, Rio Grande.

General Distribution. UNITED STATES: AZ, CA, FL, IA, MA, MD, MO, NC, NJ, NY, SC, TN, TX; MEXICO: BCS, CAM, CHS, DFE, DGO, JAL, NAY, QTR, SIN, SLP, TAB, VER, YUK; West Indies, Central America south to Argentina.

Seasonal Distribution. Apr. (TX) - Aug. 4 (TX).

Identification. This tropical species has expanded its northern range into Texas and up the eastern seaboard. Its face is pale yellow turning red in mature males and the vertex is metallic violet. The thorax is brown with 2 oblique pale stripes laterally. The wings are clear with a broad basal brown stripe in the hindwing. The legs are pale basally and darker beyond. The abdomen is yellowish in females and red in mature males. Segments 8-10 are black dorsally.

This is our only *Tramea* with a striped thorax. It is most similar to the smaller *Miathyria marcella*, but it lacks the complete middorsal black stripe of that species.

Size. Total length: 44-49 mm; abdomen: 30-33 mm; hindwing: 37-42 mm.

Habitat. Temporary and permanent ponds and slow streams.

Discussion. This species has been found as far north as New York and Massachusetts. It is widely distributed in Texas, but is most commonly encountered in the southern portions of the state. It is typical of the genus in having a strong steady, high flight, often not coming below two meters. They will perch horizontally at the tips of tall grasses and branches with a clear view of intruders in open fields and around ponds. The female oviposits in a manner typical of the genus, as previously described.

***Tramea carolina* (Linnaeus)**

Carolina Saddlebags

(Map 230)

Libellula carolina Linnaeus, 1763: 28.

Tramea carolina, Hagen, 1861: 143.

Trapezostigma carolina, Cowley, 1935: 283.

Type. Carolina.

Regional Distribution.

Biotic Province(s): Austroriparian, Chihuahuan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Cimarron, Mississippi, Neches, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, ME, MI, MO, MS, NC, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, WI; CANADA: N.S., Ont.

Seasonal Distribution. Year round.

Identification. This is a large handsome red species found predominantly throughout the eastern portion of our area and the U.S. The face is initially pale but it becomes red and the top of the head, including the vertex, turn metallic violet. The thorax is reddish-brown and unmarked. The wings have red veins along the front margin. In the hindwing there is a nearly solid dark reddish-brown band that extends out to the outer side of the anal loop. The veins in this area are red. The legs are brown basally and turn darker for most of the rest of their length. The abdomen is brownish-red, becoming bright red in mature males. Segments 8 and 9 are largely black. Cabot (1890) described the larva.

This species is similar to *T. onusta*, especially in flight, but that species lacks the violet color on top of the head. Segments 8 and 9 are black dorsally in *T. onusta* and the crossband in the hindwing is smaller and generally interrupted by a larger clear stripe medially. Gloyd (1958) provided further distinctions between these two species.

Size. Total length: 45-54 mm; abdomen: 30-36 mm; hindwing: 41-46 mm.

Habitat. Ponds, lakes and slow streams with thick emergent vegetation.

Discussion. This species is generally not seen in the large feeding swarms in which *T. onusta* and *T. lacerata* take part. Males fly feeding and patrolling territories nearly all day. They will perch, as usual, horizontally on the tops of tall vegetation, giving them a clear view of their territory. Pairs mate while perched in vegetation or high in trees and

many remain there for sometime. Females typically oviposit the manner described for the genus (Carpenter 1991; Davis 1898), but they may also oviposit alone. Females ovipositing alone do so at a rate nearly ten times faster than those in tandem (Dunkle 1989a). Sherman (1983) briefly discussed post-copulatory mate guarding behavior in this species.

***Tramea insularis* Hagen**

Antillean Saddlebags

(Map 231)

Tramea insularis Hagen, 1861: 146.

Type. Cuba; MCZ.

Regional Distribution.

Biotic Province(s): Chihuahuan.

Watershed(s): Rio Grande.

General Distribution. UNITED STATES: FL, TX; MEXICO: CAM, VER; Bahamas; Greater Antiles.

Seasonal Distribution. May 23 (TX).

Identification. This species is predominantly found in the Bahamas and Greater Antiles but is fairly common in southeastern Florida and ranges into Mexico and Texas. The face is brown in juveniles and females but becomes black in mature males. The top of the

head is metallic violet. The thorax is brown and unmarked. The wings have predominantly red veins anteriorly and the hindwings each have a brown basal crossband. The legs are black except at their extreme bases. The abdomen is red, except segments 8, 9 and sometimes 10, which are black dorsally.

Size. Total length: 41-48 mm; abdomen: 26-31 mm; hindwing: 36-40 mm.

Habitat. Ponds, lakes and slow streams.

Discussion. This species is only known from Big Bend National Park in the south-central U.S. (Abbott 1996). The population there is breeding in ponds (Dunkle pers. comm.), and therefore this species is not a vagrant in our region. Nothing has been published about the behavior or biology of this species.

***Tramea lacerata* Hagen**

Black Saddlebags

(Map 232)

Tramea lacerata Hagen, 1861: 145.

Type. Texas; MCZ.

Regional Distribution.

Biotic Province(s): Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.

Watershed(s): Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado,

Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.

General Distribution. UNITED STATES: AL, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, TN, TX, UT, VA, WA, WI, WV; CANADA: B.C., Que.; MEXICO: BCS, QTR, TAM, VER, YUC.

Seasonal Distribution. Mar. 30 (LA) - Nov. 5 (LA).

Identification. This is our only black *Tramea*. It is large with a yellowish face in teneral and females that becomes entirely black in mature males. The top of the head, including the vertex, is deep metallic violet. The thorax is brown with black iridescence on the sides. The wings are clear with a broad black crossband covering the basal 1/4 of the hindwing. There is a large prominent clear spot medially in this area, extending to the inner wing margin. The legs are black. The abdomen is black with a pair of yellowish spots dorsally on the middle segments which becomes obscured except on segment 7. Bick (1951) described the early instar of the larva from New Orleans, Louisiana, and Musser (1962) described the final instar larva.

Size. Total length: 47-55 mm; abdomen: 31-38 mm; hindwing: 40-48 mm.

Habitat. Marshy ponds, lakes, ditches and slow streams.

Discussion. This species migrates northward in the spring (Beatty 1946; Borror 1953). Males are often seen in large feeding swarms throughout the day. Females oviposit as described for the genus, but may do so alone or without being released from the males grasps. This species probably occurs year round in the southern areas of its range.

***Tramea onusta* Hagen**

Red-mantled Saddlebags

(Map 233)

Tramea onusta Hagen, 1861: 144.**Type.** Texas; MCZ.**Regional Distribution.***Biotic Province(s):* Austroriparian, Balconian, Chihuahuan, Kansan, Navahonian, Tamaulipan, Texan.*Watershed(s):* Arkansas, Bayou Bartholomew, Brazos, Canadian, Cimarron, Colorado, Guadalupe, Mississippi, Neches, Nueces, Ouachita, Red, Rio Grande, Sabine, San Antonio, San Jacinto, St. Francis, Trinity, White.**General Distribution.** UNITED STATES: AL, AR, AZ, CA, CO, DE, FL, GA, IA, IL, IN, KS, KY, LA, MD, MN, MS, MO, NC, NE, NJ, NM, NV, OH, OK, SC, SD, TN, TX, UT, VA; CANADA: B.C., Ont.; MEXICO: BCN, BCS, CHS, COL, DFE, GRO, HGO, JAL, MOR, NAY, NLN, OAX, PUE, QTR, SIN, SLP, SOR, TAB, TAM, VER, YUC; West Indies, Central America south to Venezuela.**Seasonal Distribution.** Feb. 20 (TX) - Nov. (TX).**Identification.** This is another red species that is widely distributed, both across our area and the entire U.S. The face is pale brown initially but turns red in mature males. The thorax is brown and unmarked. The wings have reddish-brown veins anteriorly and the

hindwing has a large basal brown crossband that doesn't generally extend beyond the midrib of the anal loop. There is a large central clear spot in this crossband. The legs are pale turning black more distally. The abdomen is yellowish-brown in juveniles and females, but turns red in mature males. Segments 8-10 are black dorsally. Byers (1927b) described the larva.

This species is very similar to *T. carolina*, and they can be very difficult to separate, especially in flight. Distinguishing characteristics are given under the former species.

Size. Total length: 41-48 mm; abdomen: 28-34 mm; hindwing: 37-42 mm.

Habitat. Permanent and temporary ponds, lakes and slow streams.

Discussion. This species is commonly seen throughout our area feeding over large fields, meadows and roadways. Males patrol large territories, often flying at great heights. Mating occurs while perched high in bushes and trees. Oviposition, typical for this genus, was described in detail by Needham and Heywood (1929). Females will oviposit alone or in tandem and generally deposit eggs on algal mats at the water surface.

Table 1. Distribution of the 233 species of Odonata currently known from the south-central Nearctic Region. Arkansas (AR), Austroriparian (AUST), Balconian (BALC), Chihuahua (CHI), Chihuahuan (CHIH), Coahuila (COA), Kansan (KANS), Louisiana (LA), Navahonian (NAVA), New Mexico (NM), Nuevo Leon (NLN), Oklahoma (OK), Tamaulipan (TAMA), Tamaulipas (TAM), Texan (TEXA) and Texas (TX); (*) = new state record.

	United States					Mexico				Biotic Provinces						
	AR	LA	NM	OK	TX	CHI	COA	NLN	TAM	AUST	BALC	CHIH	KANS	NAVA	TAMA	TEXA
ZYGOPTERA (73)																
Calopterygidae (5)																
<i>Calopteryx dimidiata</i>		X			X					X						
<i>C. maculata</i>	X	X		X	X					X			X			X
<i>Hetaerina americana</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>H. titia</i>	X	X		X	X			X	X	X	X	X	X	X	X	X
<i>H. vulnerata</i>			X			X	X	X	X			X		X		X
Lestidae (9)																
<i>Archilestes grandis</i>	X		X	X	X	X		X	X	X	X	X	X	X		X
<i>Lestes alacer</i>			X	X	X		X	X	X	X	X	X	X	X	X	X
<i>L. disjunctus</i>	X	X	X	X	X					X	X	X	X	X	X	X
<i>L. forficula</i>					X				X		X			X	X	
<i>L. inaequalis</i>	X	X		X	X					X						
<i>L. rectangularis</i>	X			X						X						X
<i>L. sigma</i>				X	X			X	X					X	X	
<i>L. unguiculatus</i>	X			X	*					X			X			X
<i>L. vigilax</i>	X	X		X	X					X						
Protoneuridae (3)																
<i>Neoneura aaroni</i>					X			X			X				X	
<i>N. amelia</i>					X										X	
<i>Protoneura cara</i>					X			X		X					X	
Coenagrionidae (56)																
<i>Acanthagrion quadratum</i>					X			X	X	X					X	
<i>Amphiagrion abbreviatum</i>			X	X							X		X			X
<i>Argia alberta</i>			X	X									X			X
<i>A. apicalis</i>	X	X	X	X	X			X		X	X	X	X	X	X	X
<i>A. barretti</i>					X			X	X	X	X				X	X

Table 1. Continued.

	United States					Mexico				Biotic Provinces						
	A R	L A	N M	O K	T X	C H I	C O A	N L N	T A M	A U S T	B A L C	C H I H	K A N S	N A V A	T A M A	T E X A
<i>Argia bipunctulata</i>	X	X		X	X					X						X
<i>A. cuprea</i>					X			X			X				X	
<i>A. fumipennis</i>	X	X	X	X	X			X		X	X	X	X	X	X	X
<i>A. hinei</i>			X		X		X				X	X	X			
<i>A. immunda</i>	X		X	X	X	X		X	X	X	X	X			X	X
<i>A. leonorae</i>					X			X			X	X			X	X
<i>A. lugens</i>			X	X	X	X					X	X		X		
<i>A. moesta</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>A. munda</i>			X		X	X						X				
<i>A. nahuanà</i>			X	X	X	X		X		X	X	X	X	X	X	X
<i>A. plana</i>	X		X	X	X	X	X	X		X	X	X	X	X	X	X
<i>A. rhoadsi</i>					X			X	X						X	
<i>A. sedula</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>A. tibialis</i>	X	X		X	X					X		X				X
<i>A. translata</i>	X		X	X	X	X		X	X	X	X	X	X	X	X	X
<i>Chromagrion conditum</i>	X									X						
<i>Enallagma antematum</i>				X												X
<i>E. aspersum</i>	X			X	X					X						X
<i>E. basidens</i>	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
<i>E. boreale</i>			X								X	X	X			
<i>E. civile</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>E. concisum</i>		X								X						
<i>E. cvathigerum</i>			X								X	X	X			
<i>E. daeckii</i>	X	X		X	X					X						
<i>E. divagans</i>	X	X		X	X					X						X
<i>E. doubledayi</i>					X											X
<i>E. dubium</i>		X		X	X					X						
<i>E. durum</i>		X			X				X	X				X	X	
<i>E. exsulans</i>	X	X		X	X			X	X	X	X	X		X	X	
<i>E. geminatum</i>	X	X		X	X					X						X

Table 1. Continued.

	United States					Mexico				Biotic Provinces						
	A R	L A	N M	O K	T X	C H I	C O A	N L N	T A M	A U S T	B A L C	C H I H	K A N S	N A V A	T A M A	T E X A
<i>Enallagma novaehispaniae</i>					X			X	X		X	X			X	
<i>E. praevarum</i>			X	X	X	X	X	X			X	X	X	X	X	
<i>E. signatum</i>	X	X		X	X					X	X		X		X	X
<i>E. traviatum westfalli</i>	X	X		X	X					X						X
<i>E. vesperum</i>	X	X		X	X					X						X
<i>Hesperagrion heterodoxum</i>			X		X	X	X	X				X	X	X	X	
<i>Ischnura barberi</i>			X	X	X						X	X	X	X		X
<i>I. damula</i>			X	X	X							X	X	X		
<i>I. demorsa</i>			X	X	X	X	X					X	X	X		
<i>I. denticollis</i>			X	X	X	X						X	X	X		X
<i>I. hastata</i>	X	X	X	X	X			X	X	X	X	X	X	X	X	X
<i>I. kellicotti</i>	X	X		X	X					X						
<i>I. perparva</i>			X	X								X	X	X		
<i>I. posita</i>	X	X		X	X					X	X	X	X		X	X
<i>I. prognata</i>		X			X					X						
<i>I. ramburii</i>	X	X		X	X	X		X	X	X	X	X			X	X
<i>I. verticalis</i>	X		X	X	X					X		X	X			X
<i>Nehalennia integricollis</i>		X		X	X					X						
<i>Neorhythomma cultellatum</i>					X				X						X	
<i>Telebasis byersi</i>	X	X			X					X						
<i>T. salva</i>			X	X	X	X		X	X	X	X	X	X	X	X	X
ANISOPTERA (160)																
Petaluridae (1)																
<i>Tachopteryx thoreyi</i>	X	X		X	X					X						X
Aeshnidae (17)																
<i>Aeshna constricta</i>	X									X						
<i>A. dugesi</i>			X		X		X				X				X	
<i>A. multicolor</i>			X	X	X					X	X	X	X	X		X
<i>A. psilus</i>					X			X			X				X	
<i>A. umbrosa</i>	X		X	X						X		X	X			X

Table 1. Continued.

	United States					Mexico				Biotic Provinces						
	A R	L A	N M	O K	T X	C H I	C O A	N L N	T A M	A U S T	B A L C	C H I H	K A N S	N A V A	T A M A	T E X A
<i>Anax amazili</i>					X						X	X				
<i>A. junius</i>	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
<i>A. longipes</i>	X	X		X	X					X	X					X
<i>A. walsinghami</i>			X		X			X				X	X	X	X	
<i>Basiaeschna janata</i>	X	X		X	X					X	X		X			X
<i>Boyeria vinosa</i>	X	X		X	X					X	X					X
<i>Coryphaeschna ingens</i>	X	X			X					X				X	X	
<i>Epiaeschna heros</i>	X	X		X	X					X	X		X		X	X
<i>Gomphaeschna antilope</i>		X								X						
<i>G. furcillata</i>	X	X			X					X						
<i>Gynacantha nervosa</i>				X					X	X					X	
<i>Nasiaeschna pentacantha</i>	X	X		X	X					X	X		X		X	X
Gomphidae (37)																
<i>Aphylla angustifolia</i>		X			X			X	X	X	X				X	X
<i>A. protracta</i>					X		X		X	X	X				X	X
<i>A. williamsoni</i>		X			X					X						
<i>Arigomphus leniulus</i>	X			X	X					X						X
<i>A. maxwelli</i>	X	X			X					X						
<i>A. submedianus</i>	X	X		X	X					X						X
<i>A. villosipes</i>	X									X						
<i>Dromogomphus armatus</i>		X								X						
<i>D. spinosus</i>	X	X		X	X					X	X					X
<i>D. spoliatus</i>	X	X		X	X			X	X	X	X			X	X	
<i>Erpetogomphus compositus</i>			X		X			X			X	X	X	X	X	X
<i>E. crotalinus</i>			X			X					X	X	X			
<i>E. designatus</i>	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
<i>E. eutainia</i>					X				X						X	X
<i>E. heterodon</i>			X		X	X				X			X			
<i>E. lampropeltis</i>			X		X	X				X			X			
<i>Gomphus (Gomphurus) externus</i>	X		X	X	X					X	X	X	X	X	X	X

Table 1. Continued.

	United States					Mexico				Biotic Provinces						
	A R	L A	N M	O K	T X	C H I	C O A	N L N	T A M	A U S T	B A L C	C H I H	K A N S	N A V A	T A M A	T E X A
<i>Gomphus (G.) gonzalezi</i>					X										X	
<i>G. (G.) hybridus</i>	X	X			X					X						X
<i>G. (G.) modestus</i>	X	X			X					X						X
<i>G. (G.) ozarkensis</i>	X			X						X						
<i>G. (G.) vastus</i>	X			X	X					X	X				X	X
<i>Gomphus (Gomphus) apomyius</i>	X	X			X					X						
<i>G. graslinellus</i>	X			X	X					X	X					X
<i>G. lividus</i>	X	X			X					X						X
<i>G. militaris</i>			X	X	X			X		X	X	X	X	X	X	X
<i>G. oklahomensis</i>	X	X		X	X					X						X
<i>Hagenius brevistylus</i>	X	X		X	X					X	X					X
<i>Ophiogomphus westfalli</i>	X									X						
<i>Phyllogomphoides albrighti</i>			X		X			X	X	X	X		X	X	X	X
<i>P. stigmatus</i>			X	X	X			X			X	X			X	X
<i>Progomphus borealis</i>			X		X	X	X				X	X	X	X		
<i>P. obscurus</i>	X	X		X	X					X	X		X	X	X	X
<i>Stylogomphus albistylus</i>	X			X						X						
<i>Stylurus intricatus</i>			X		X							X	X	X		
<i>S. laurae</i>	X	X			X					X						
<i>S. plagiatus</i>	X	X		X	X			X		X	X			X	X	
Cordulegastridae (2)																
<i>Cordulegaster maculata</i>	X	X			X											
<i>C. obliqua obliqua</i>	X	X		X	X					X						X
Corduliidae (25)																
Macromiinae (6)																
<i>Didymops transversa</i>	X	X		X	X					X	X		X			X
<i>Macromia alleghaniensis</i>	X									X						
<i>M. annulata</i>			X		X			X		X	X	X		X	X	
<i>M. illinoensis</i>	X	X		X	X					X	X			X	X	
<i>M. pacifica</i>	X			X	X					X	X				X	X
<i>M. taeniolata</i>	X	X		X	X					X						X

Table 1. Continued.

	United States					Mexico				Biotic Provinces						
	A R	L A	N M	O K	T X	C H I	C O A	N L N	T A M	A U S T	B A L C	C H I H	K A N S	N A V A	T A M A	T E X A
Corduliinae (20)																
<i>Epitheca (Epicordulia) princeps</i>	X	X		X	X					X	X		X		X	X
<i>E. (Tetragoneuria) costalis</i>	X	X		X	X					X	X		X			X
<i>E. (T.) cynosura</i>	X	X		X	X					X		X				X
<i>E. (T.) petechialis</i>			X	X	X					X	X		X	X		X
<i>E. (T.) semiaquea</i>				X	X					X						X
<i>E. (T.) spinosa</i>	X	X		X						X						
<i>E. (T.) stella</i>		X								X						
<i>Helocordulia selysii</i>	X	X			X					X						
<i>H. uhleri</i>	X			X						X						
<i>Neurocordulia alabamensis</i>		X			X					X						
<i>N. molesta</i>	X	X		X	X					X						X
<i>N. obsoleta</i>		X								X						
<i>N. virginensis</i>	X			X						X						
<i>N. xanthosoma</i>	X		X	X	X					X	X					X
<i>Somatochlora filosa</i>	X	X			X					X						
<i>S. georgiana</i>		X			X					X						
<i>S. linearis</i>	X	X		X	X					X						X
<i>S. margarita</i>		X			X					X						
<i>S. ozarkensis</i>	X			X						X						
<i>S. tenebrosa</i>	X			X						X						
Libellulidae (77)																
<i>Brachymesia furcata</i>					X		X	X	X	X	X	X			X	X
<i>B. gravida</i>	X	X	X	X	X					X	X		X		X	X
<i>B. herbida</i>					X			X		X	X					X
<i>Brechmorhoga mendax</i>	X		X	X	X		X	X		X	X	X	X	X	X	X
<i>Cannaphila insularis</i>					X		X							X	X	
<i>Celithemis amanda</i>	X	X			X					X						
<i>C. berthia</i>		X								X						
<i>C. elisa</i>	X	X		X	X					X	X					X
<i>C. eponina</i>	X	X	X	X	X		X			X	X	X	X	X	X	X

Table 1. Continued.

	United States					Mexico				Biotic Provinces						
	A R	L A	N M	O K	T X	C H I	C O A	N L N	T A M	A U S T	B A L C	C H I H	K A N S	N A V A	T A M A	T E X A
<i>Celithemis fasciata</i>	X	X		X	X					X	X					X
<i>C. ornata</i>		X			X					X						
<i>C. verna</i>	X	X		X	X					X						
<i>Dythemis fugax</i>	X		X	X	X				X	X	X	X	X	X	X	X
<i>D. maya</i>					X	X		X	X			X			X	
<i>D. nigrescens</i>					X			X	X		X	X			X	X
<i>D. velox</i>	X	X	X	X	X	X		X	X	X	X	X		X	X	X
<i>Erythemis collocata</i>			X		X	X	X					X	X	X		
<i>E. plebeja</i>					X				X		X				X	X
<i>E. simplicicollis</i>	X	X	X	X	X			X	X	X	X	X	X	X	X	X
<i>E. vesiculosa</i>			X	X	X				X	X	X		X	X	X	X
<i>Erythrodiplax berenice</i>		X	X		X					X		X	X	X	X	X
<i>E. connata</i>			X		X						X					
<i>E. funerea</i>					X		X	X			X	X			X	
<i>E. fusca</i>					X				X		X				X	
<i>E. minuscula</i>	X	X		X	X					X	X					X
<i>E. umbrata</i>	X	X		X	X			X	X	X	X	X		X	X	X
<i>Libellula auripennis</i>	X	X		X	X				X	X				X	X	
<i>L. axilena</i>	X	X								X						
<i>L. comanche</i>			X	X	X	X		X				X	X	X	X	X
<i>L. composita</i>			X		X							X	X	X		X
<i>L. croceipennis</i>			X	X	X			X	X	X	X	X		X	X	X
<i>L. cyanea</i>	X	X		X	X					X	X					X
<i>L. deplanata</i>	X	X		X	X					X						X
<i>L. flavida</i>	X	X		X	X					X	X					X
<i>L. forensis</i>			X								X	X	X			
<i>L. incesta</i>	X	X		X	X					X	X					X
<i>L. luctuosa</i>	X	X	X	X	X	X				X	X	X	X	X	X	X
<i>L. lydia</i>	X	X	X	X	X			X		X	X	X	X	X	X	X
<i>L. needhami</i>	X	X			X				X	X				X	X	
<i>L. nodisticta</i>			X	X									X			

Table 1. Continued.

	United States					Mexico				Biotic Provinces						
	A R	L A	N M	O K	T X	C H I	C O A	N L N	T A M	A U S T	B A L C	C H I H	K A N S	N A V A	T A M A	T E X A
<i>Libellula pulchella</i>	X	X	X	X	X					X	X	X	X	X	X	X
<i>L. quadrimaculata</i>	X		X									X		X		
<i>L. saturata</i>			X	X	X	X	X	X		X	X	X	X	X	X	X
<i>L. semifasciata</i>	X	X		X	X					X						X
<i>L. subornata</i>			X	X	X	X						X	X	X		
<i>L. vibrans</i>	X	X		X	X					X						X
<i>Macrodiplax balteata</i>		X	X		X					X	X	X			X	X
<i>Macrothemis imitans</i>					X			X	X		X				X	X
<i>M. inacuta</i>					X			X	X		X				X	
<i>M. inequiunguis</i>					X			X			X					
<i>Miathyria marcella</i>	X	X			X			X	X	X	X				X	X
<i>Micrathyria aequalis</i>					X			X	X						X	
<i>M. didyma</i>					X				X						X	
<i>M. hagenii</i>	X				X			X	X	X	X				X	X
<i>Orthemis discolor</i>					X				X						X	X
<i>O. ferruginea</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Pachydiplax longipennis</i>	X	X	X	X	X		X		X	X	X	X	X	X	X	X
<i>Paltothemis lineatipes</i>			X		X	X		X			X	X	X	X	X	X
<i>Pantala flavescens</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>P. hymenaea</i>	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
<i>Perithemis domitia</i>					X	X		X							X	
<i>P. tenera</i>	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
<i>Pseudoleon superbus</i>			X		X			X	X		X		X	X		
<i>Sympetrum ambiguum</i>	X	X		X	X					X		X				X
<i>S. corruptum</i>	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
<i>S. costiferum</i>			X									X				
<i>S. illotum</i>			X		X								X			
<i>S. internum</i>			X	X									X			X
<i>S. occidentale</i>			X	X								X	X	X		
<i>S. vicinum</i>	X		X	X	X					X	X		X	X		X

Table 1. Continued.

	United States					Mexico				Biotic Provinces						
	A R	L A	N M	O K	T X	C H I	C O A	N L N	T A M	A U S T	B A L C	C H I H	K A N S	N A V A	T A M A	T E X A
<i>Tauriphila azteca</i>					X										X	
<i>Tholymis citrina</i>					X										X	
<i>Tramea calverti</i>					X						X				X	X
<i>T. carolina</i>	X	X		X	X					X		X				X
<i>T. insularis</i>					X							X				
<i>T. lacerata</i>	X	X	X	X	X				X	X	X	X	X	X	X	X
<i>T. onusta</i>	X	X	X	X	X			X	X	X	X	X	X	X	X	X
Totals	126	114	88	133	197	37	25	68	63	161	109	92	95	78	107	141

Table 2. Species richness among 10 Odonata families represented in the south-central U.S. and northeastern Mexico.

Families	Genera	Species
Zygoptera		
Calopterygidae (broad-winged damselfs)	2	5
Lestidae (spreadwings)	2	9
Protoneuridae (threadtails)	2	3
Coenagrionidae (pond damselfs)	10	56
Anisoptera		
Petaluridae (petaltails)	1	1
Aeshnidae (darners)	9	17
Gomphidae (clubtails)	11	37
Cordulegastridae (spiketails)	1	2
Corduliidae (emeralds & cruisers)	6	26
Libellulidae (skimmers)	22	77
	Totals	66
		233

Table 3. Continued.

Species	J	F	M	A	M	J	J	A	S	O	N	D
<i>Ischnura verticalis</i>				—	—	—	—	—				
<i>Nehalennia integricollis</i>				—	—	—	—	—				
<i>Neoerythromma cinctellatum</i>				—								
<i>Telebasis byersi</i>						—						
<i>T. salva</i>				—	—	—	—	—	—	—	—	—
<i>Tachopteryx thoreyi</i>						—						
<i>Aeshna constricta</i>					—							
<i>A. dugesi</i>						—	—	—	—			
<i>A. multicolor</i>						—	—	—	—			
<i>A. psilus</i>				—	—	—	—	—	—	—	—	—
<i>A. umbrosa</i>								—	—			
<i>Anax amazili</i>						—	—	—				
<i>A. junius</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. longipes</i>						—	—	—	—			
<i>A. walsinghami</i>							—	—	—			
<i>Basiaeschna janata</i>				—	—							
<i>Boyeria vinosa</i>				—	—	—	—	—	—	—	—	—
<i>Coryphaeschna ingens</i>				—	—	—	—	—	—			
<i>Epiaeschna heros</i>				—	—	—	—	—	—			
<i>Gomphaeschna antilope</i>					—							
<i>G. fuscillata</i>	—	—										
<i>Gynacantha nervosa</i>				—	—	—	—	—	—	—	—	—
<i>Nasiaeschna pentacantha</i>				—	—	—	—	—	—			
<i>Aphylla angustifolia</i>						—	—	—	—			
<i>A. protracta</i>						—	—	—	—	—	—	—
<i>A. williamsoni</i>						—	—	—	—	—	—	—
<i>Arigomphus lentulus</i>						—	—	—				
<i>A. maxwelli</i>						—						
<i>A. submedianus</i>				—	—	—	—	—				
<i>A. villosipes</i>						—						
<i>Dromogomphus armatus</i>
<i>D. spinosus</i>						—	—	—	—	—	—	—
<i>D. spoliatus</i>						—	—	—				

Table 3. Continued.

Species	J	F	M	A	M	J	J	A	S	O	N	D
<i>Macromia taeniolata</i>						██████████	██████████	██████████	██████████			
<i>Epitheca (Epicordulia) princeps</i>				██████████	██████████	██████████	██████████	██████████	██████████			
<i>E. (Tetragoneuria) costalis</i>				██████████	██████████	██████████						
<i>E. (T.) cynosura</i>		██████████	██████████	██████████	██████████	██████████						
<i>E. (T.) petechialis</i>				██████████	██████████	██████████	██████████	██████████	██████████	██████████		
<i>E. (T.) semiaquea</i>				██████████	██████████	██████████						
<i>E. (T.) spinosa</i>					██████████	██████████						
<i>E. (T.) stella</i>				██████████	██████████							
<i>Helocordulia selysii</i>				██████████	██████████							
<i>H. uhleri</i>				██████████	██████████							
<i>Neurocordulia alabamensis</i>						██████████	██████████					
<i>N. molesta</i>						██████████	██████████					
<i>N. obsoleta</i>							██████████	██████████				
<i>N. virginiensis</i>						██████████	██████████					
<i>N. xanthosoma</i>						██████████	██████████					
<i>Somatochlora filosa</i>								██████████	██████████	██████████		
<i>S. georgiana</i>								██████████	██████████	██████████		
<i>S. linearis</i>								██████████	██████████	██████████		
<i>S. margarita</i>								██████████	██████████	██████████		
<i>S. ozarkensis</i>								██████████	██████████	██████████		
<i>S. tenebrosa</i>									██████████			
<i>Brachymesia furcata</i>									██████████	██████████		
<i>B. gravida</i>									██████████	██████████	██████████	
<i>B. herbida</i>									██████████	██████████		
<i>Brechmorhoga mendax</i>									██████████	██████████	██████████	
<i>Cannaphila insularis</i>									██████████			
<i>Celithemis amanda</i>									██████████	██████████		
<i>C. bertha</i>									██████████	██████████		
<i>C. elisa</i>									██████████	██████████	██████████	
<i>C. eponina</i>									██████████	██████████	██████████	
<i>C. fasciata</i>									██████████	██████████	██████████	
<i>C. ornata</i>									██████████	██████████	██████████	
<i>C. verna</i>									██████████			
<i>Dythemis fugax</i>									██████████	██████████	██████████	

Table 3. Continued.

Species	J	F	M	A	M	J	J	A	S	O	N	D
<i>Dythemis maya</i>							—					
<i>D. nigrescens</i>				—	—	—	—	—				
<i>D. velox</i>			—	—	—	—	—	—				
<i>Erythemis collocata</i>						—	—	—				
<i>E. plebeja</i>				—	—	—	—	—				
<i>E. simplicicollis</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>E. vesiculosa</i>				—	—	—	—	—				
<i>Erythrodiplax berenice</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>E. connata</i>							—	—				
<i>E. funerea</i>						—	—	—				
<i>E. fusca</i>							—	—	—	—	—	—
<i>E. minuscula</i>				—	—	—	—	—				
<i>E. umbrata</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>Libellula auripennis</i>						—	—	—				
<i>L. axilena</i>				—	—	—	—	—				
<i>L. comanche</i>				—	—	—	—	—				
<i>L. composita</i>						—	—	—				
<i>L. croceipennis</i>						—	—	—				
<i>L. cyanea</i>						—	—	—				
<i>L. deplanata</i>	—	—	—	—	—	—	—	—				
<i>L. flavida</i>				—	—	—	—	—				
<i>L. forensis</i>						—	—	—				
<i>L. incesta</i>						—	—	—				
<i>L. luctuosa</i>						—	—	—				
<i>L. lydia</i>				—	—	—	—	—				
<i>L. needhami</i>				—	—	—	—	—				
<i>L. nodisticta</i>						—	—	—				
<i>L. pulchella</i>				—	—	—	—	—				
<i>L. quadrimaculata</i>						—	—	—				
<i>L. saturata</i>				—	—	—	—	—				
<i>L. semifasciata</i>	—	—	—	—	—	—	—	—				
<i>L. subornata</i>						—	—	—				
<i>L. vibrans</i>				—	—	—	—	—				
<i>Macrodiplax balteata</i>						—	—	—				
<i>Macrothemis imitans</i>						—	—	—				
<i>M. inacuta</i>						—	—	—				

Table 4. Odonata species richness, number of species found in a single biotic province within the region (Single Province Species), and percent total (N) for each of the seven biotic provinces depicted in Figure 1.

	Single-Province Species N=59		Species Richness N=233	
	Total	%	Total	%
Austroriparian	41	69	161	69
Balconian	1	2	109	47
Chihuahuan	4	7	92	39
Kansan	1	2	95	41
Navahonian	1	2	78	33
Tamaulipan	9	15	107	46
Texan	2	3	141	61

Table 5. Number and percent similarity of the south-central U.S. Odonata species (N=233) shared with other regions in North America, Mexico and the Neotropics.

Region	Zygoptera Species	Anisoptera Species	Total	%
Northern U.S. and Canada	29	55	84	36
Eastern U.S. (East of the Mississippi)	46	104	150	64
Western U.S. (West of the Rocky Mtns.)	35	54	89	38
Southern Mexico & Latin America	42	67	109	47
South America	10	23	33	14

Table 6. The number of recorded species of Odonata and breeding birds for each contiguous U.S. state (after Robins & Opler 1997).

State	Breeding Birds ^a	Odonata Spp.	Major Source for Odonata
Alabama	145	173	Tennesen <i>et al.</i> (1995)
Arizona	246	110	Garrison (unpublished)
Arkansas	130	133	Harp & Harp (1996)
California	286	102	Paulson & Garrison (1977)
Colorado	235	101	Evans (1988)
Connecticut	158	115	Garman (1927)
Delaware	160	110	White (pers. comm.) ^d
Florida	160	162	Dunkle (1992a)
Georgia	160	165	Mauffray (WWW) ^d
Idaho	?	64	Logan (1967); Paulson (WWW) ^b
Illinois	160	115	Brigham (WWW)
Indiana	151	144	Lawrence (1967)
Iowa	154	79	Loudon (1933) ^d
Kansas	175	121	Beckemeyer & Huggins (1997, 1998)
Kentucky	153	140	Heady & Cook (1981)
Louisiana	158	124	Mauffray (1997)
Maine	176	117	Borror (1944, 1951)
Maryland	192	162	Orr (WWW)
Massachusetts	177	138	Leahy & Forster (WWW)
Michigan	202	155	O'Brien (1997)
Minnesota	224	97	Hamrun <i>et al.</i> (1971) ^c
Mississippi	130	119	Bick (1950); Stanford & Lago (1981) ^{c,d}
Missouri	175	68	Williamson (1932a) ^d
Montana	224	82	Miller & Gustafson (1996)
Nebraska	194	90	Pruess (1967) ^d
Nevada	224	75	Simpkin (WWW) ^{c,d}
New Hampshire	175	133	White & Morse (1973)
New Jersey	181	172	May & Carle (1996)
New Mexico	247	97	Evans (1995)
New York	220	175	Donnelly (1992a)
North Carolina	178	170	Westfall & May (1996); Needham & Westfall (1955) ^d
North Dakota	171	53	Bick <i>et al.</i> (1977) ^d
Ohio	180	158	Glotzhofer (1995)
Oklahoma	180	133	Bick & Bick (1957)
Oregon	232	62	Paulson & Garrison (1977)
Pennsylvania	185	170	Beatty & Beatty (1971)
Rhode Island	141	74	Westfall & May (1996); Needham & Westfall (1955) ^d
South Carolina	152	159	White <i>et al.</i> (1980, 1983)
South Dakota	207	65	Bick <i>et al.</i> (1977) ^d
Tennessee	160	127	Goodwin (1968) ^d
Texas	300	197	Abbott & Stewart (1998)
Utah	220	89	Musser (1962); Provonsha (1975)
Vermont	175	62	Westfall & May (1996); Needham & Westfall (1955) ^d
Virginia	179	184	Roble <i>et al.</i> (1997)
Washington	235	75	Paulson (1997)
West Virginia	156	74	Cruden (1962) ^d
Wisconsin	203	148	Smith <i>et al.</i> (1993) ^c
Wyoming	222	77	Molnar & Lavigne (1979)

^aTaken from Peterson (1963); ^bWorld Wide Web; ^cSupplemented with personal data; ^dIncomplete data.

Table 7. Abbreviations used in text for museums with type specimens.

ANSP	Academy of Natural Sciences, Philadelphia, PA
BMNH	British Museum (Natural History)
CAS	California Academy of Sciences, San Francisco, CA
CU	Cornell University Collectioin, Ithaca, NY
FSCA	Florida State Collection of Arthropods, Gainesville, FL
Halle.	Zoologisches Museum, Martin-Luther Universitat, Halle-Wittenberg
INHS	Illinois Natural History Survey, Urbana, IL
IORI	International Odonate Research Institute, Gainesville, FL
IRSN	Institut Royal de Sciences Naturelles, Brussels
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, MA
MNB	Museum für Naturkunde an der Humboldt-Universitat, Berlin
MNHN	Museum Nationale d'Histoire Naturelle, Paris
NHMV	Naturhistorisches Museum, Vienna
UMMZ	University of Michigan Museum of Zoology, Ann Arbor, MI
UNAM	Instituto de Biologia, Universidad Nacional Autonoma de Mexico
USNM	United States National Museum, Smithsonian Institution, Washington DC
ZMHB	Zoologische Museum der Humboldt Universitat, Berlin
ZMUC	Zoologisk Museum, Universitets Copenhagen

Table 8. U.S. and Mexican State, and Canadian Provincial abbreviations used throughout the text.

U.S. STATES

AL	Alabama	KY	Kentucky	NY	New York
AK	Alaska	LA	Louisiana	OH	Ohio
AR	Arkansas	MA	Massachusetts	OK	Oklahoma
AZ	Arizona	MD	Maryland	OR	Oregon
CA	California	ME	Maine	PA	Pennsylvania
CO	Colorado	MI	Michigan	RI	Rhode Island
CT	Connecticut	MN	Minnesota	SC	South Carolina
DC	District of Columbia	MO	Missouri	SD	South Dakota
DE	Delaware	MS	Mississippi	TN	Tennessee
FL	Florida	MT	Montana	TX	Texas
GA	Georgia	NE	Nebraska	UT	Utah
HI	Hawaii	NC	North Carolina	VA	Virginia
IA	Iowa	ND	North Dakota	VT	Vermont
ID	Idaho	NH	New Hampshire	WA	Washington
IL	Illinois	NJ	New Jersey	WI	Wisconsin
IN	Indiana	NM	New Mexico	WV	West Virginia
KS	Kansas	NV	Nevada	WY	Wyoming

CANADIAN PROVINCES

Alb.	Alberta	N.S.	Nova Scotia
B.C.	British Columbia	Ont.	Ontario
Man.	Manitoba	P.E.I.	Prince Edward Island
N.B.	New Brunswick	Que.	Quebec
Nfld.	Newfoundland	Sask.	Saskatchewan
N.W.T.	North West Territory	Yuk.	Yukon

MEXICAN STATES

AGS	Aguascalientes	GRO	Guerrero	QTR	Quintana Roo
BCA	Baja California	HGO	Hidalgo	SLP	San Luis Potosi
BCS	Baja California Sur	JAL	Jalisco	SIN	Sinaloa
CAM	Campeche	MEX	Mexico	SON	Sonora
CHS	Chiapas	MCH	Michoacan	TAB	Tabasco
CHI	Chihuahua	MOR	Morelos	TAM	Tamaulipas
COA	Coahuila	NAY	Nayarit	TLX	Tlaxcala
COL	Colima	NLN	Nuevo Leon	VER	Veracruz
DFE	Distrito Federal	OAX	Oaxaca	YUC	Yucatan
DGO	Durango	PUE	Puebla	ZAC	Zacatecas
GTO	Guanajuato	QRO	Queretaro		

Fig. 1. The seven natural biotic provinces of the south-central U.S. and northeastern Mexico (modified from Blair 1950; Dice 1943; Blair & Hubbell 1938).

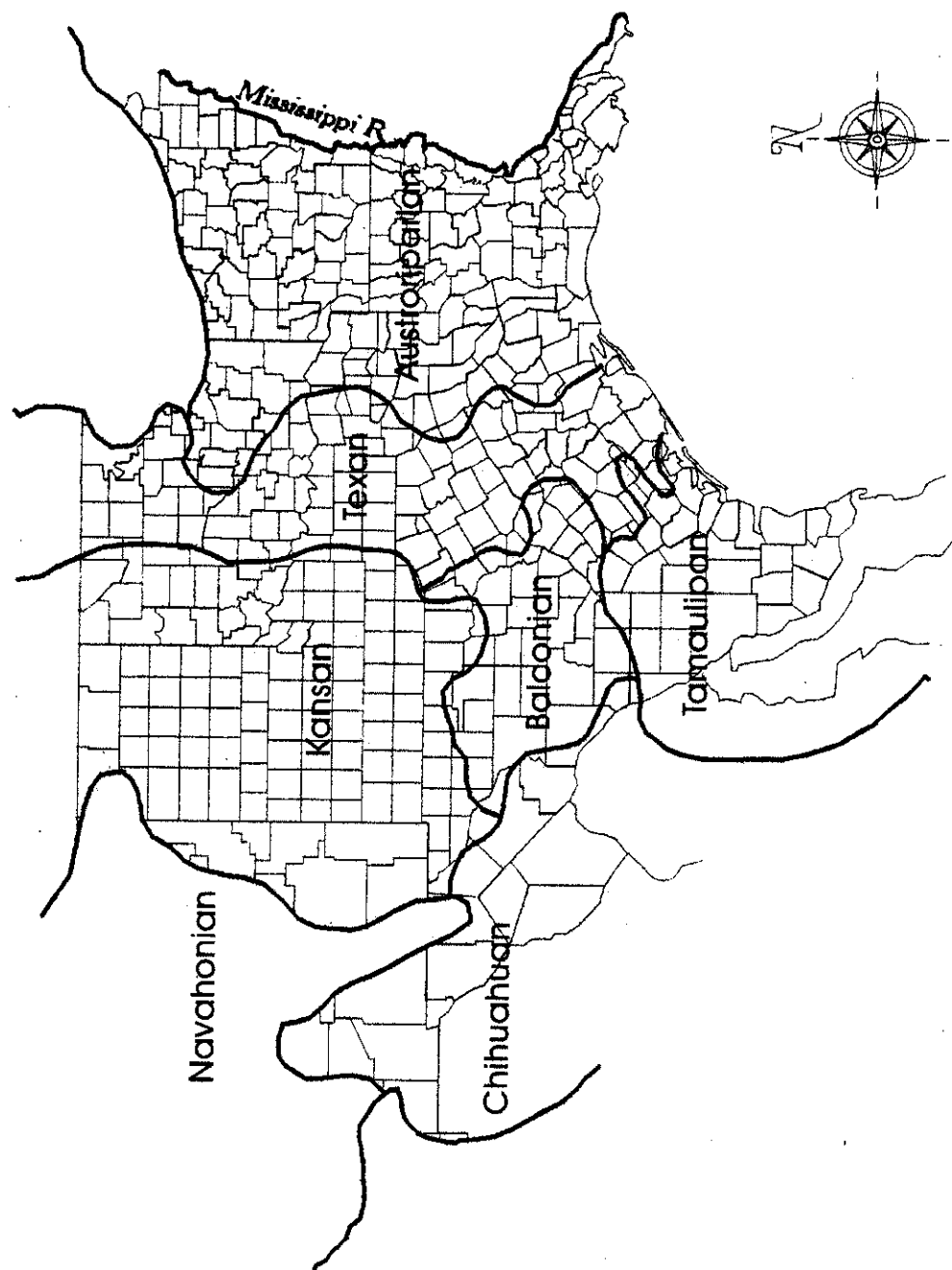
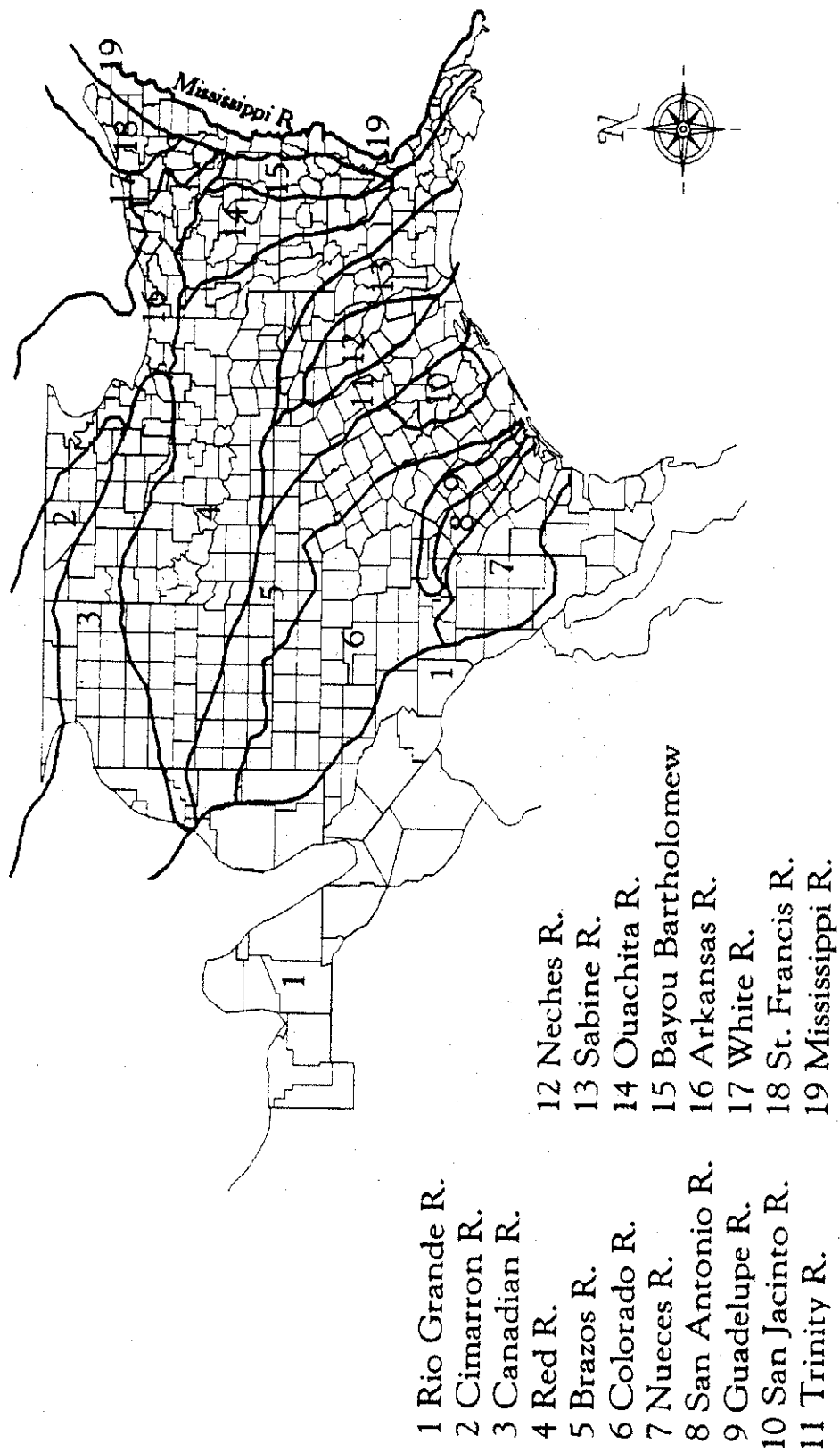
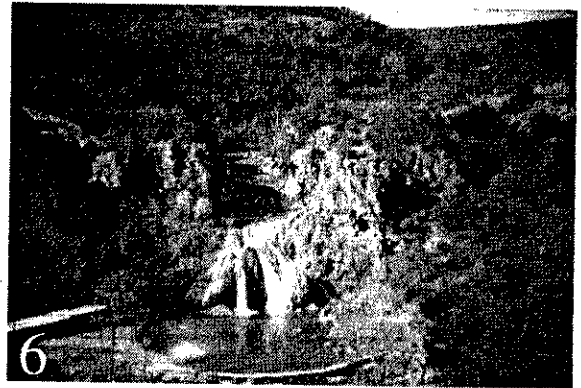
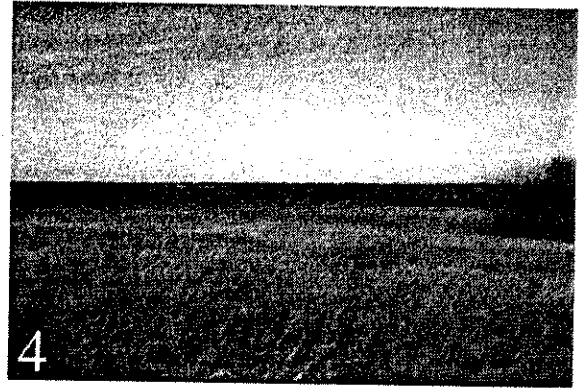
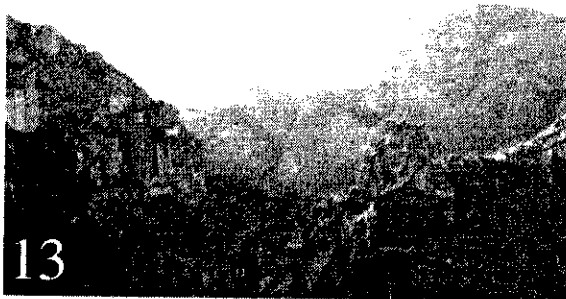


Fig. 2. Natural watershed subdivisions of the south-central U.S. and northeastern Mexico.





Figs. 3-8. Aquatic and terrestrial habitats of the south-central U.S. 3. Turkey Creek, in the Austroriparian Province, Tyler Co., TX. 4. Tall Grass Prairie, in the Texan Province, Collin Co., TX. 5. Brazos River, in the Texan Province, Palo Pinto Co., TX. 6. Turner Falls, in Arbuckle Mts., Murray Co., OK. 7. Palo Duro Canyon, in Kansan Province, Randall Co., TX. 8. Guadalupe River, Kerr Co., TX.



Figs. 9-14. Aquatic and terrestrial habitats of the south-central U.S. 9. Nueces River, Real Co., TX. 10. Rio Grande River, Starr Co., TX. 11. Limpia Creek, Jeff Davis Co., TX. 12. Las Cuevas, Big Bend State Natural Area, Presidio Co., TX. 13. McKittrick Canyon, Guadalupe Mtns. Natl. Park, Culberson Co., TX. 14. McKittrick Creek, Guadalupe Mtns. Natl. Park, Culberson Co., TX.

Fig. 15. Number of Odonata species from states occupying the south-central U.S. and the primary literature.

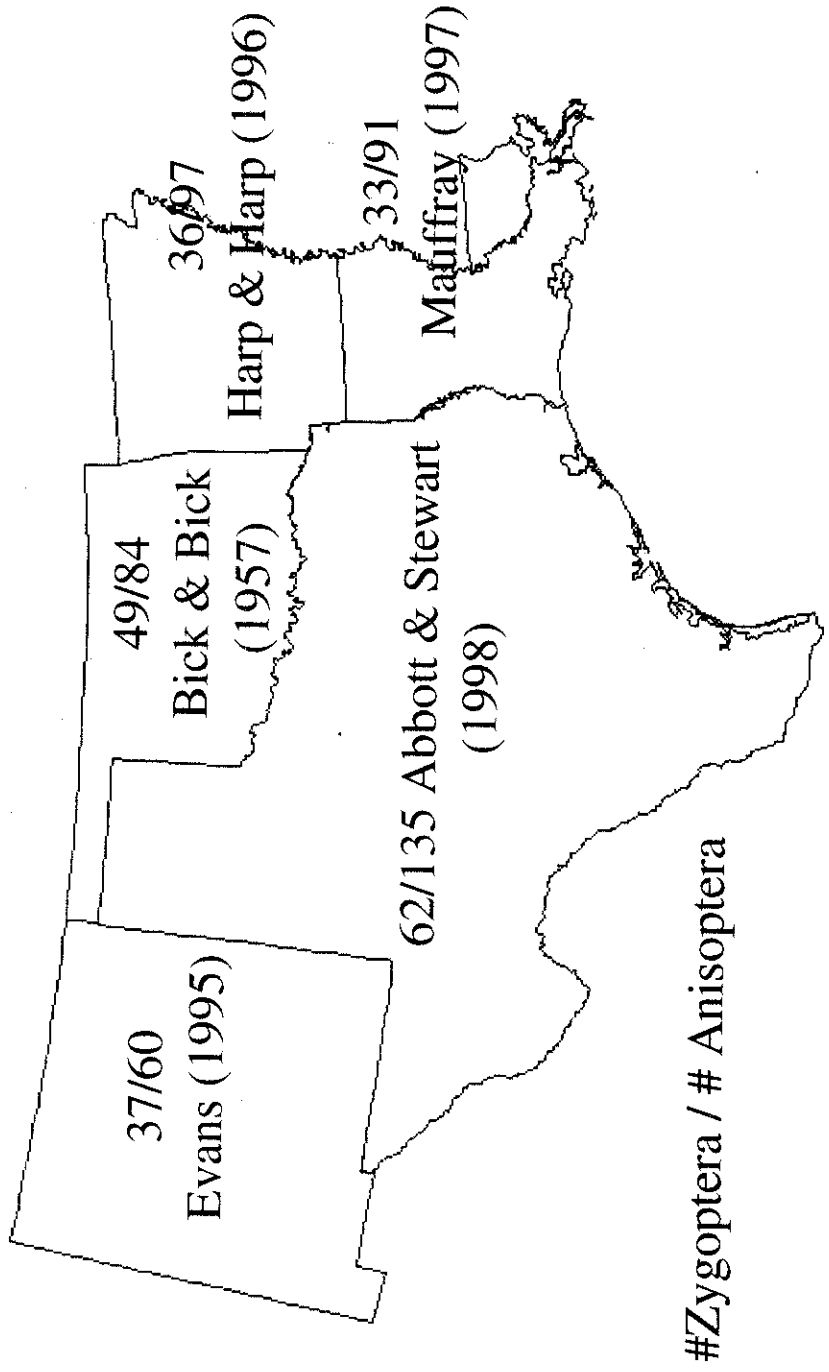


Fig. 16. Counties of Arkansas, Louisiana, New Mexico, Oklahoma and Texas.

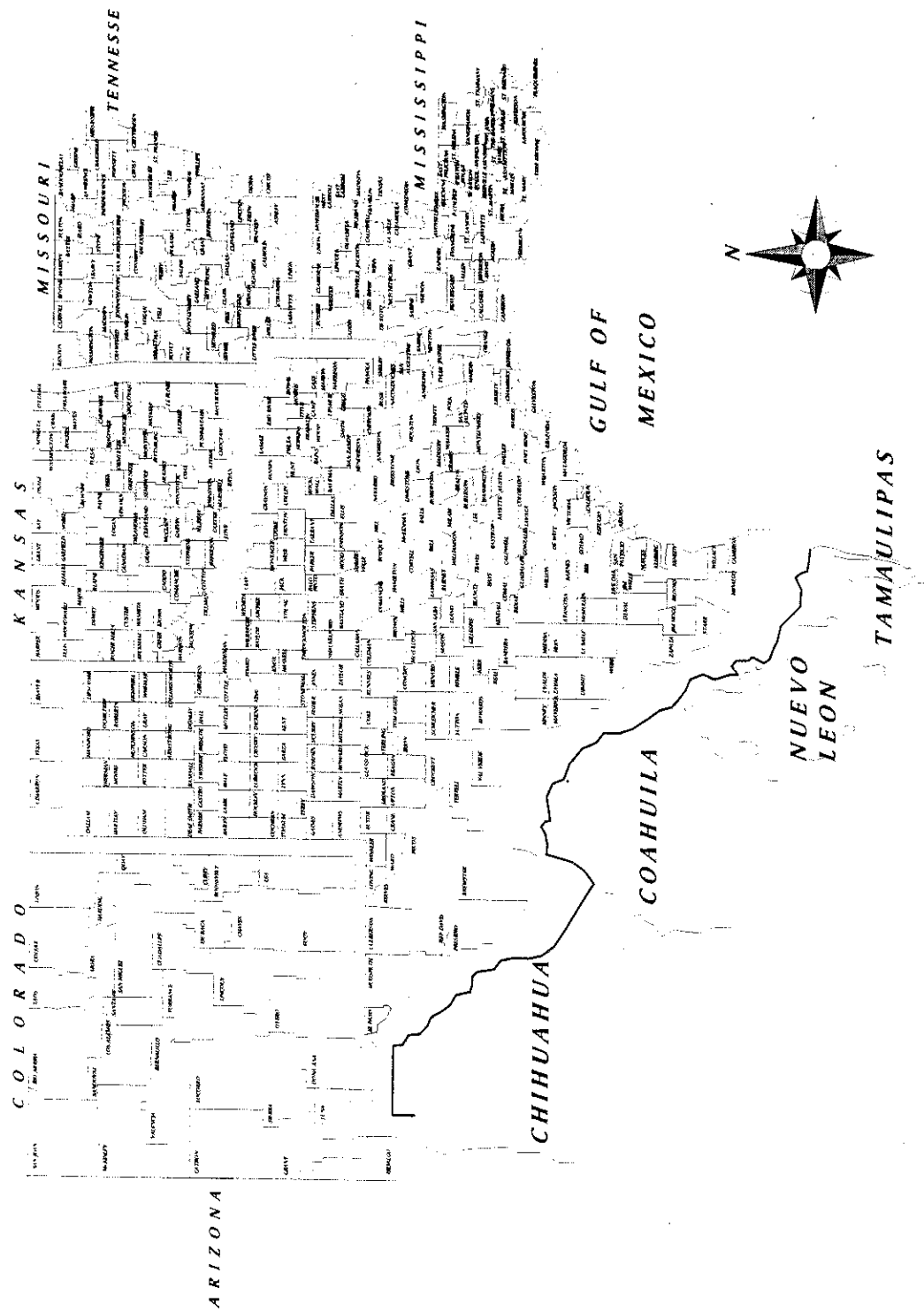


Fig. 17. Collection records of *Odonata* for 408 counties in the south-central U.S.

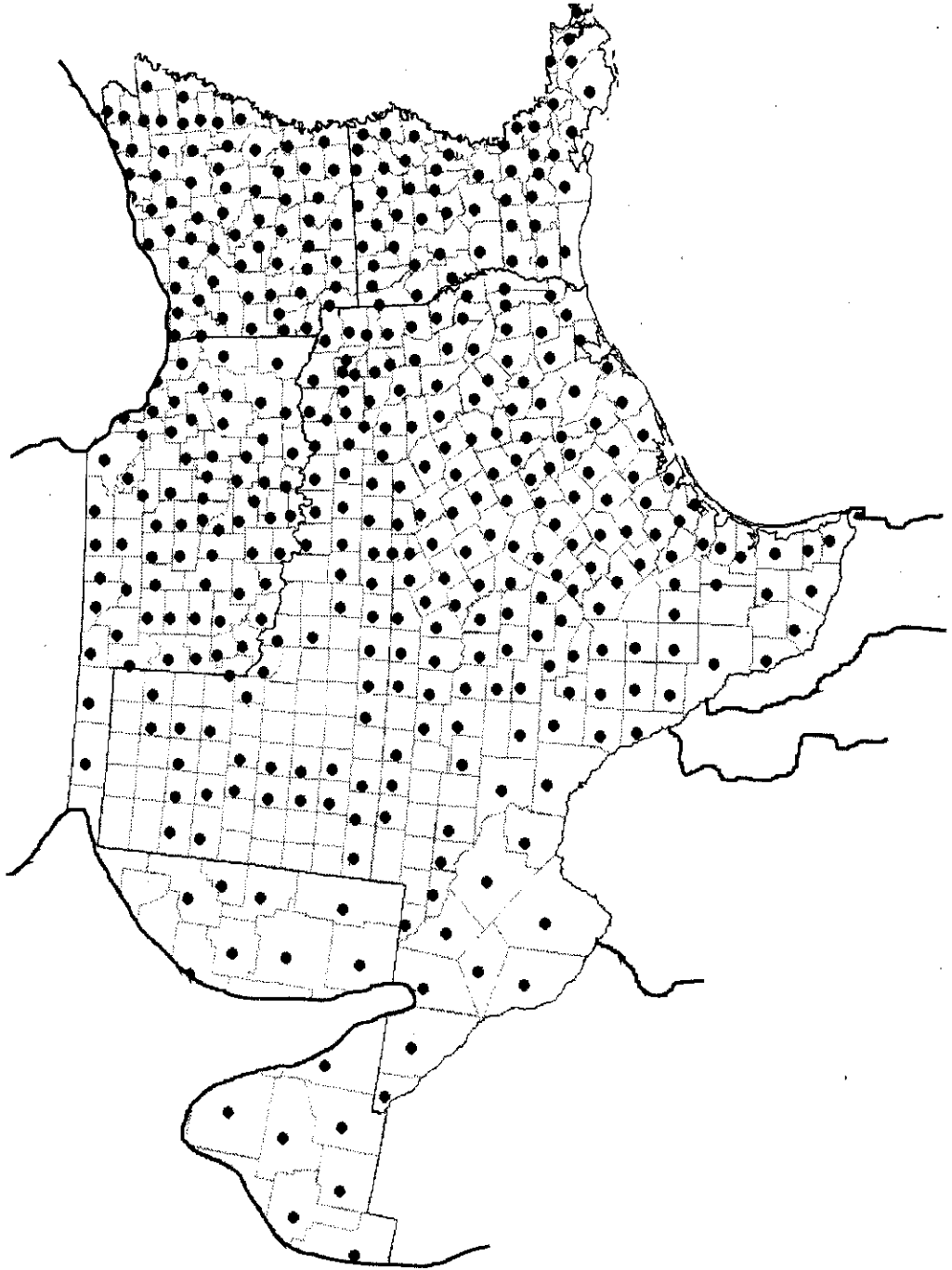


Fig. 18. Plot of species richness versus the area for each of the seven biotic provinces shown in Figure 1.

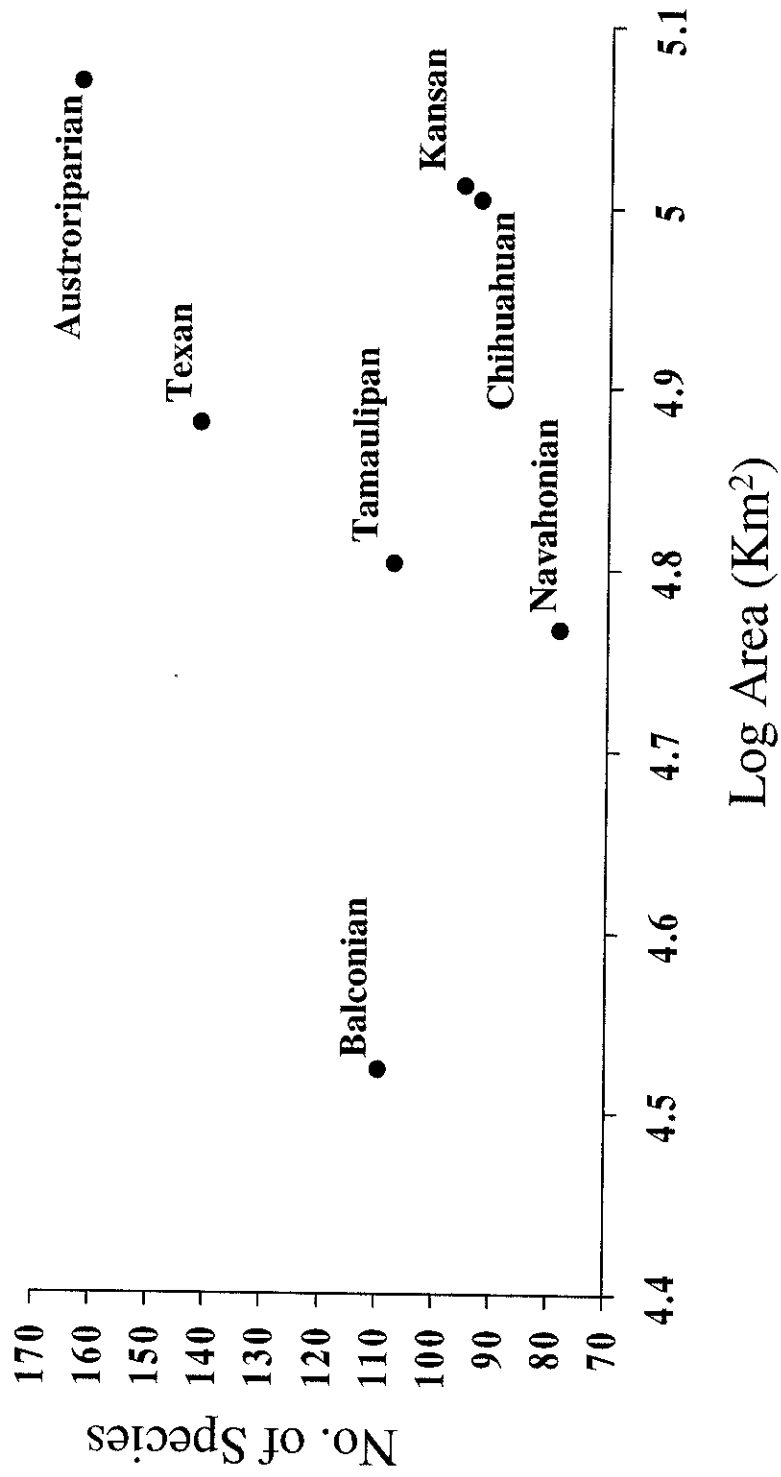


Fig. 19. Percent species richness of Odonata, Trichoptera and Butterflies in each of the seven biotic provinces shown in Figure 1.

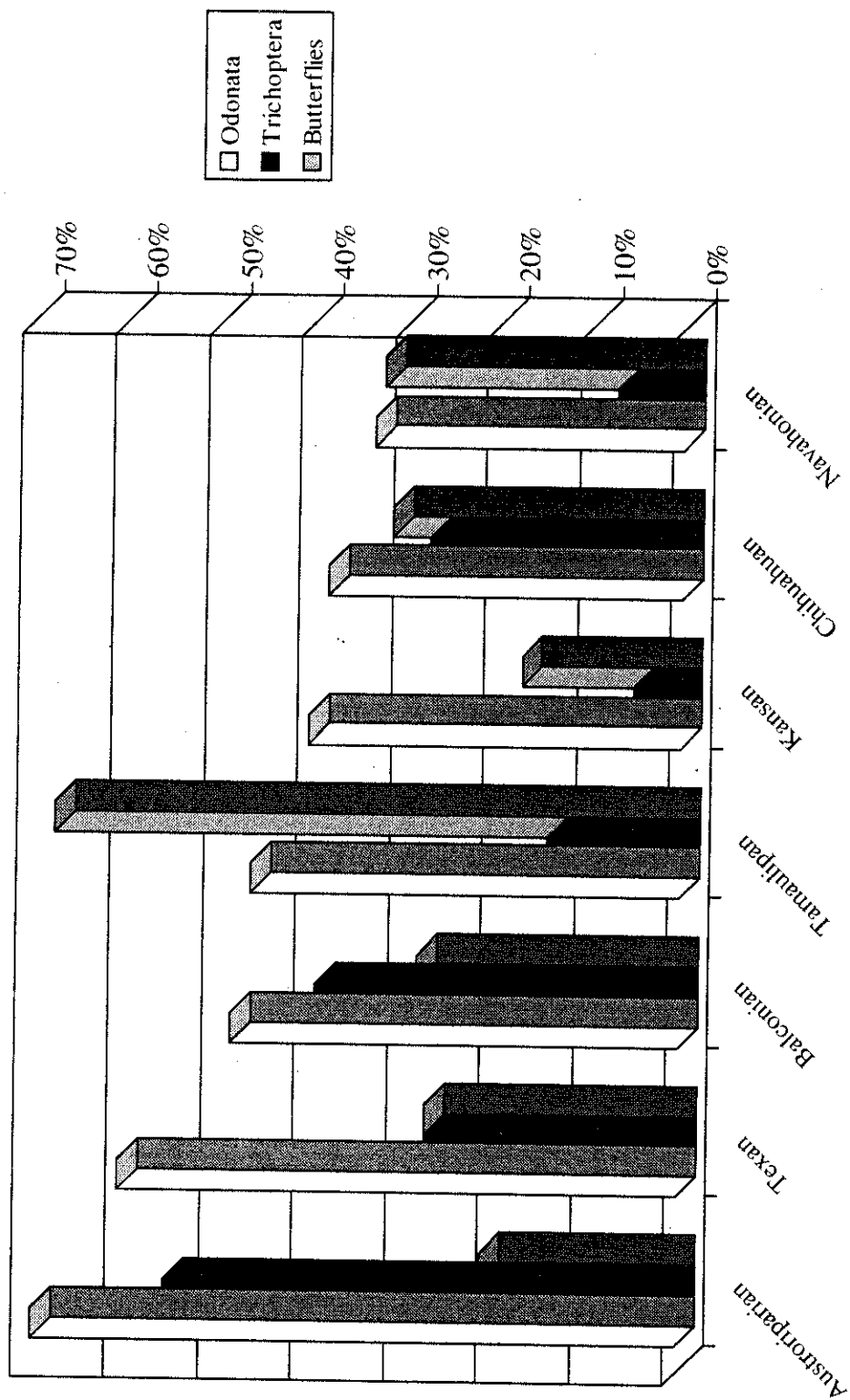


Fig. 20. Species richness, by county, of Odonata within the South-central U.S.

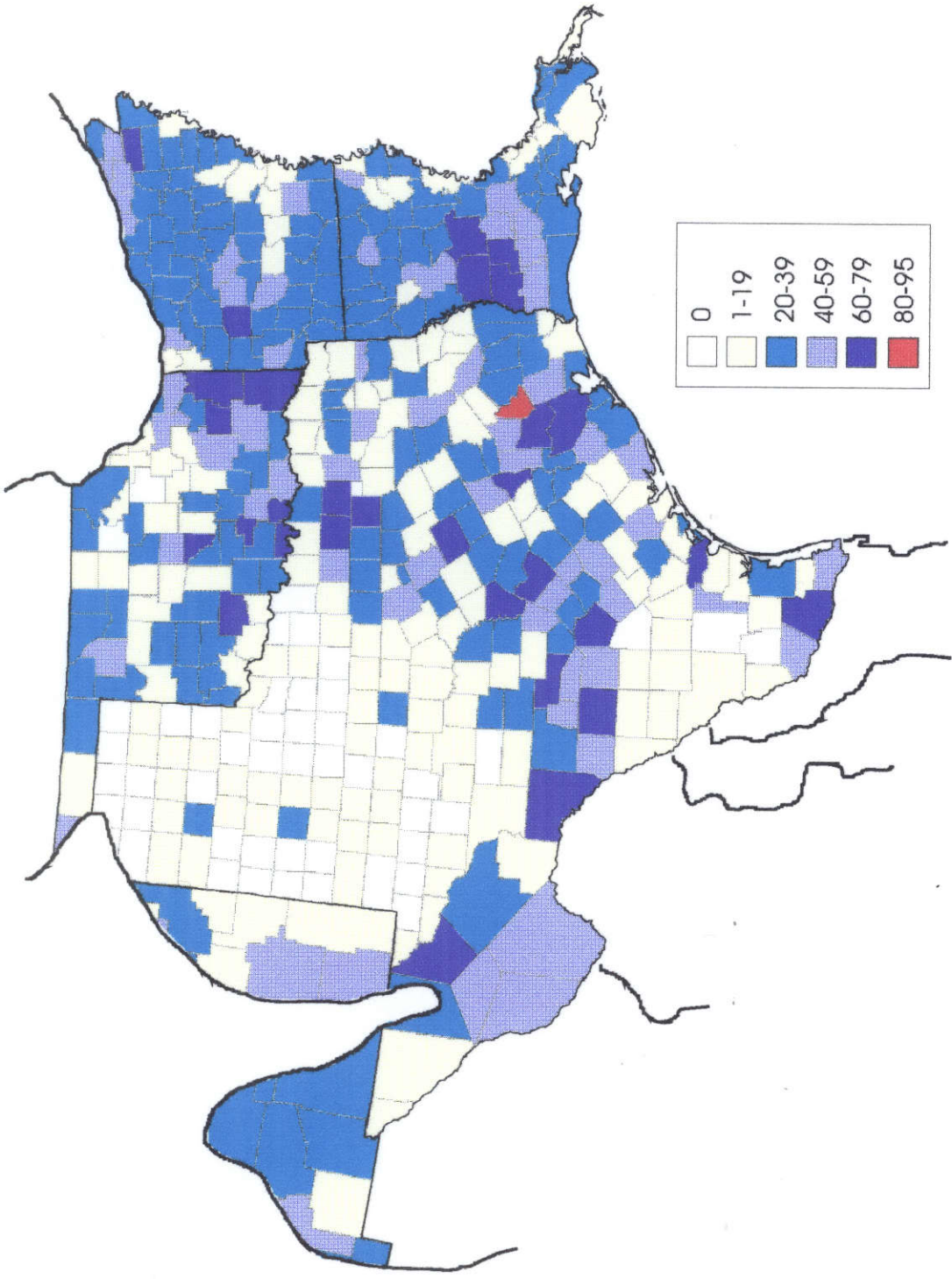


Fig. 21. Map of south-central U.S. showing the location of two transects along which species diversity was analyzed. Transect A stretches from Boise City to Brownsville; Transect B, from Animas to New Orleans.

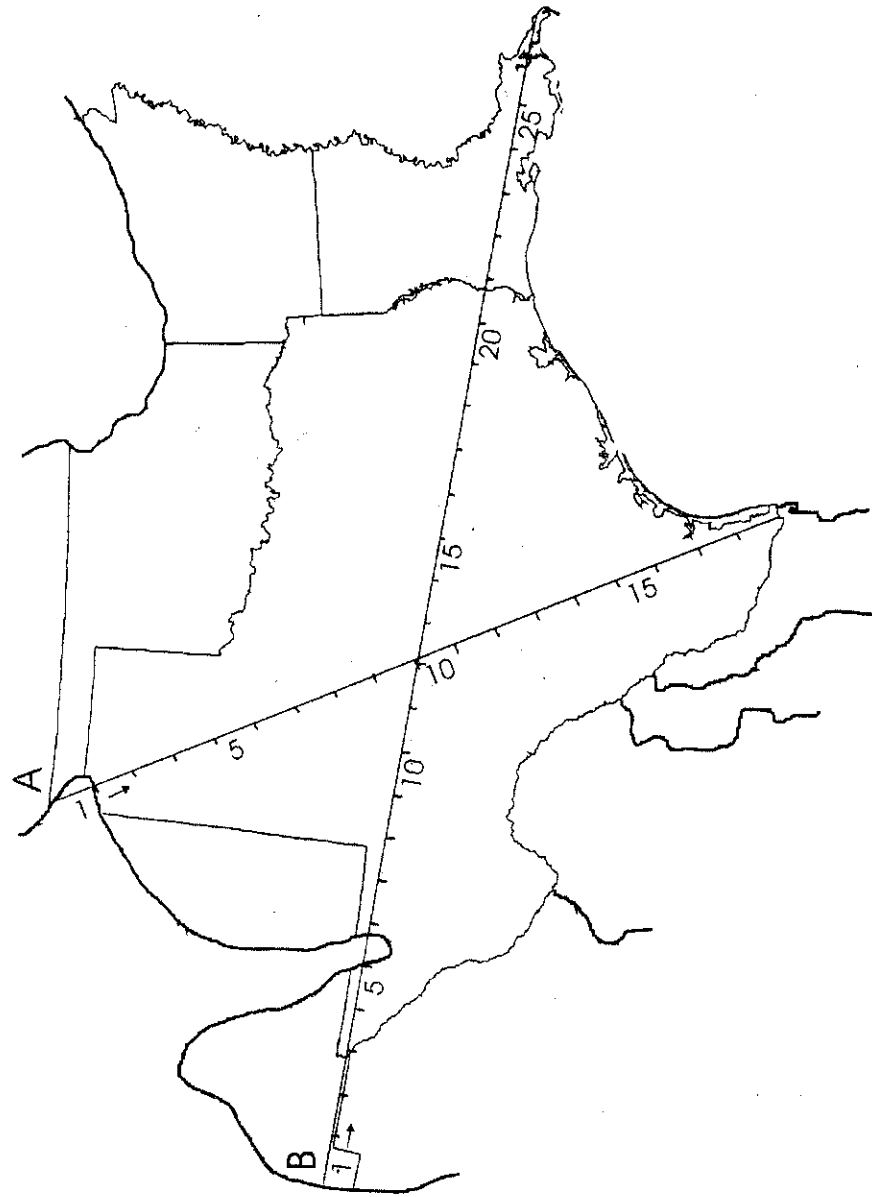
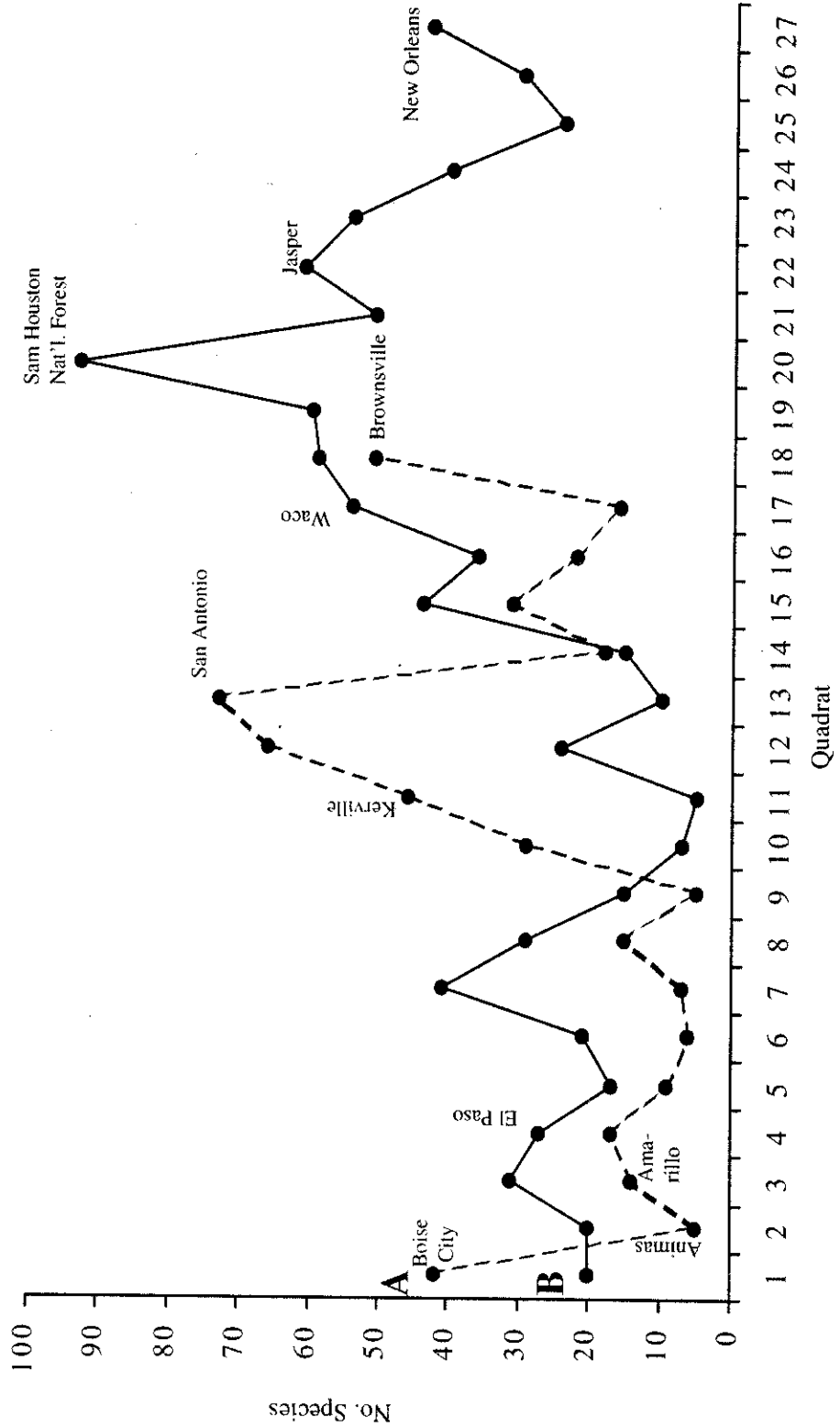


Fig. 22. Species diversity plots for the quadrats along the two transects (A and B) shown in Figure 21.



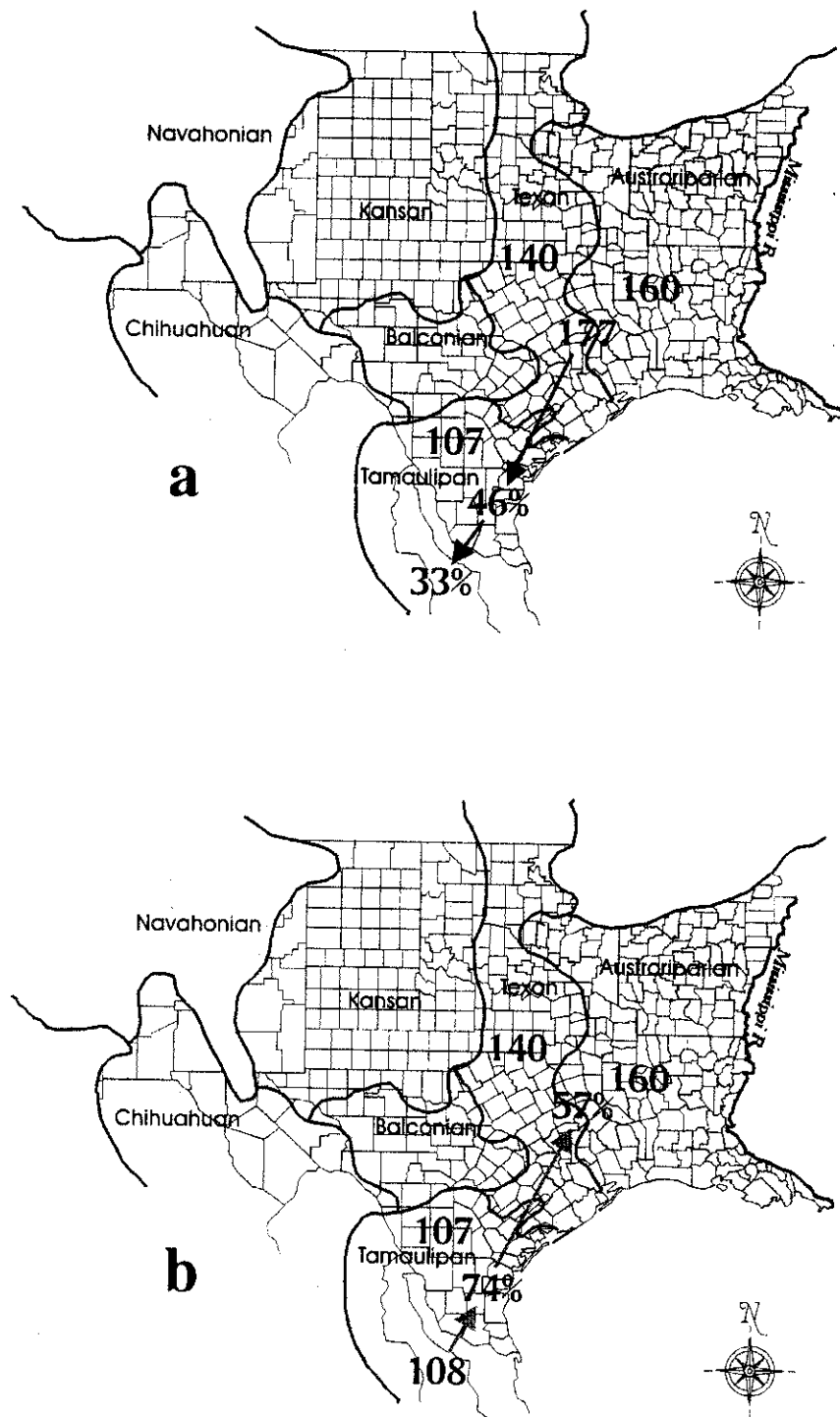


Fig. 23. Mixing zones and short distance dispersal corridors between temperate and subtropical Odonata faunas.

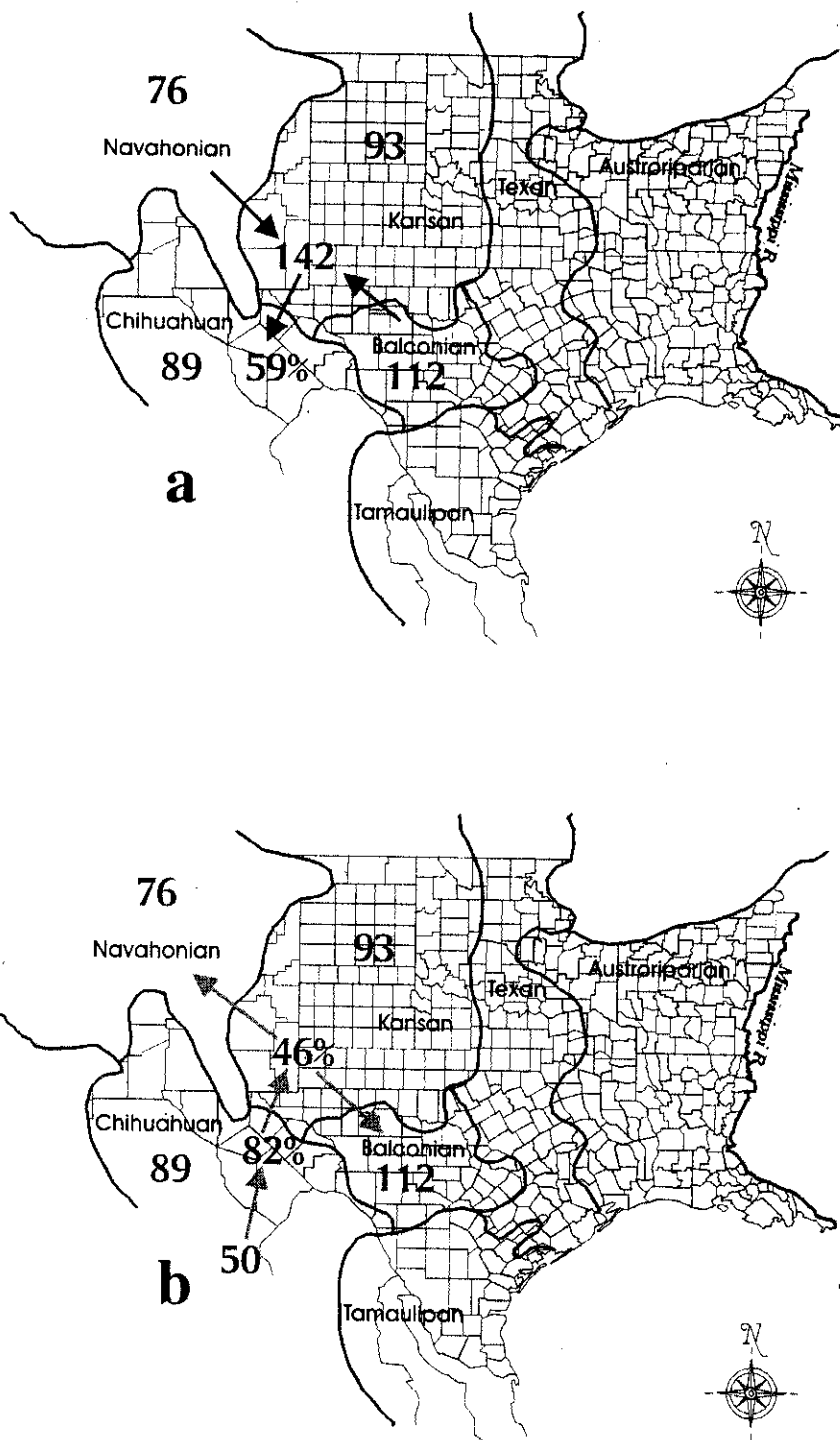
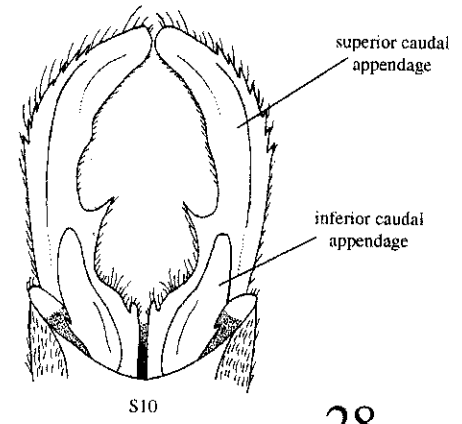
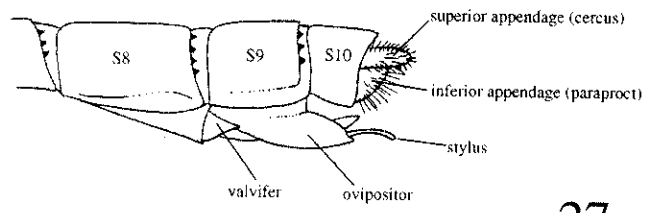
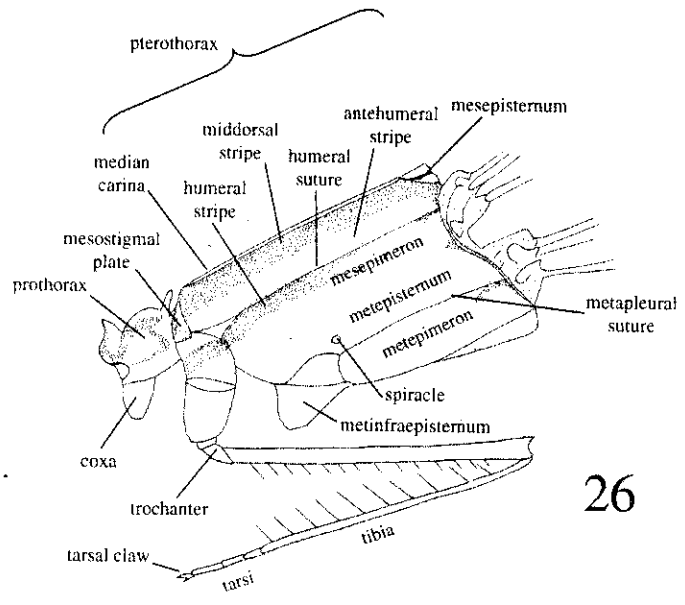
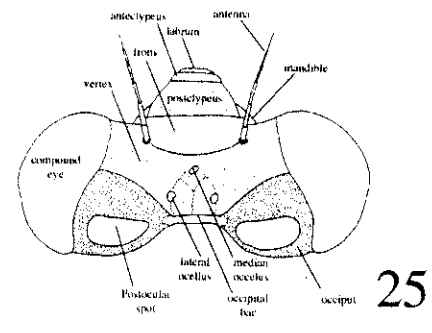
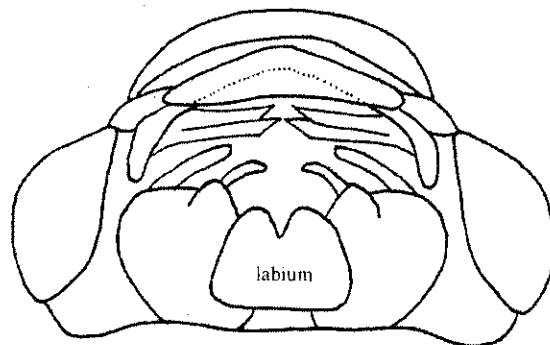
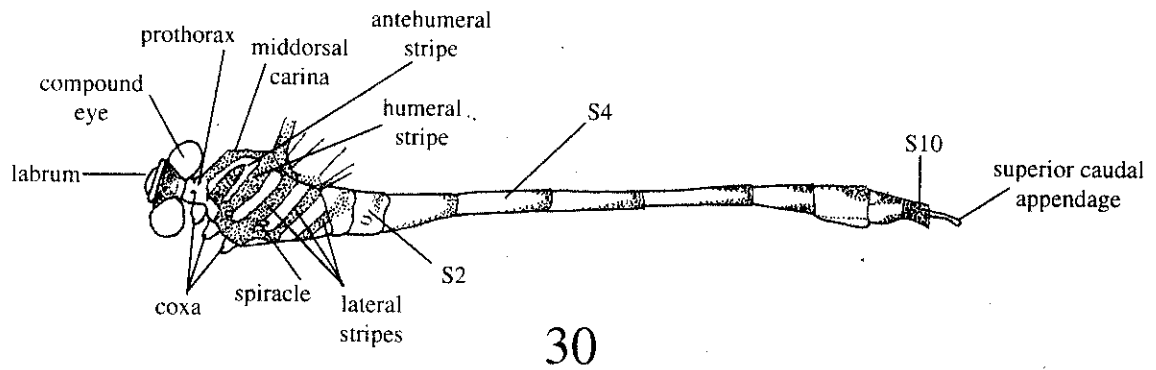
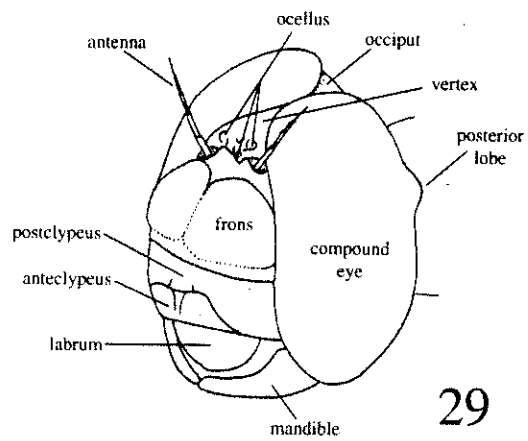


Fig. 24. Mixing zones and short distance dispersal corridors between more northern Kansan/Navahonian/Balconian provinces and the southern Chihuahuan province.

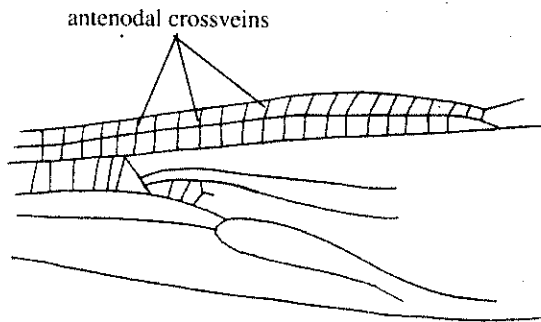


Figs. 25-28. Morphology of an adult damselfly. **25.** Damselfly head, dorsal view. **26.** Damselfly thorax, *Argia fumipennis violacea*, lateral. **27.** Terminal abdominal segments of female *Lestes vigilax*, lateral view. **28.** Terminal abdominal segments of male *Archilestes grandis*, ventral view.

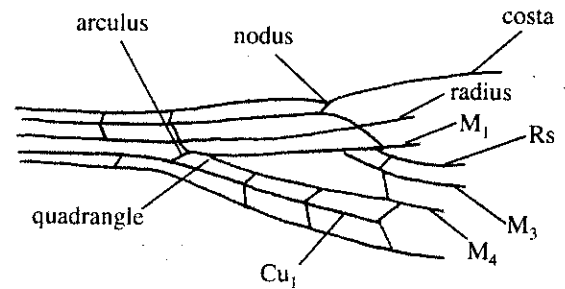


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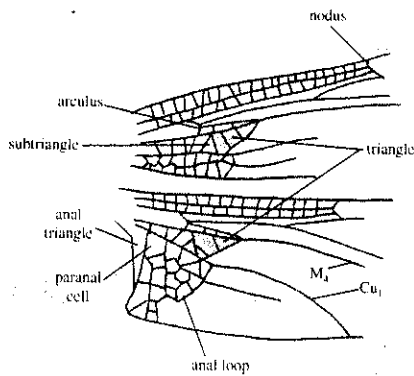
Figs. 29-31. Morphology of adult dragonfly. **29.** *Epitheca* head. **30.** *Aphylla angustifolia*, lateral view. **31.** *Tachopteryx thoreyi* head, ventral view.



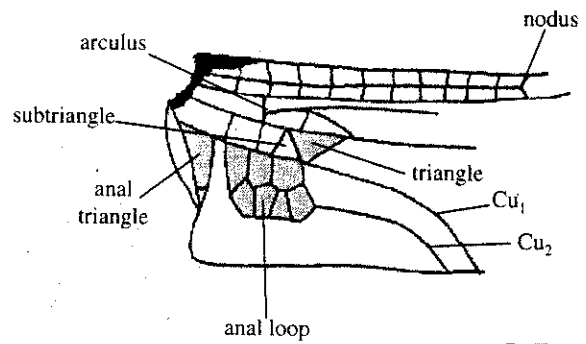
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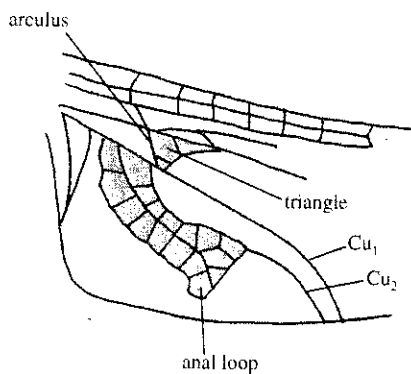
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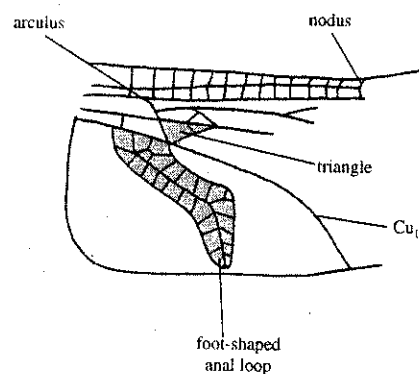
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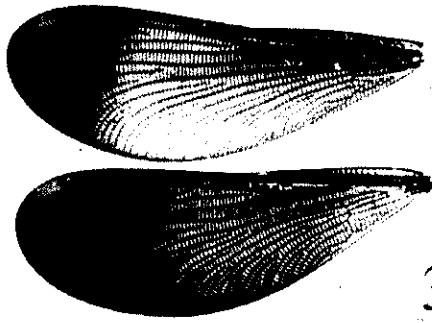


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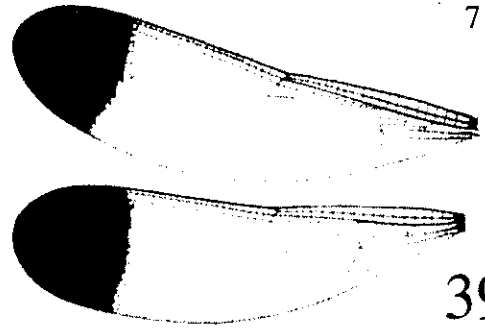


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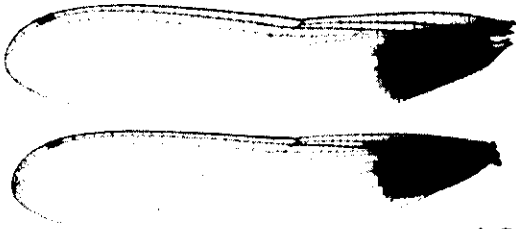
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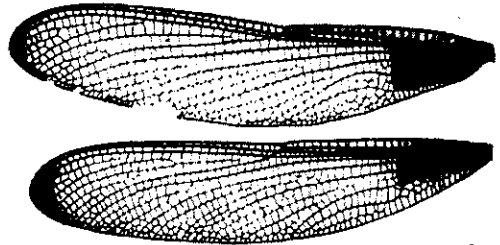
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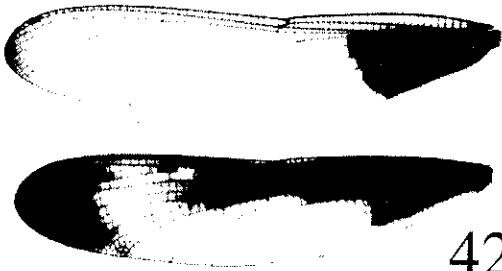
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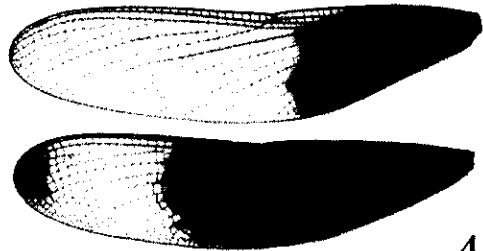
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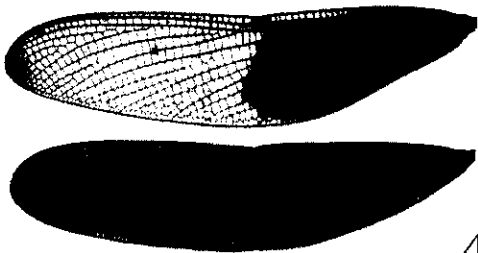
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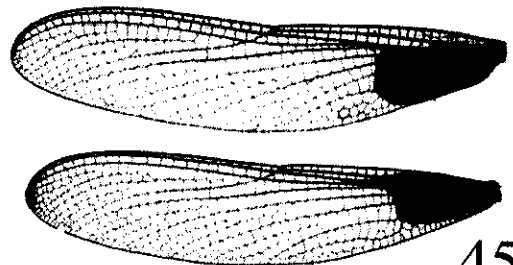
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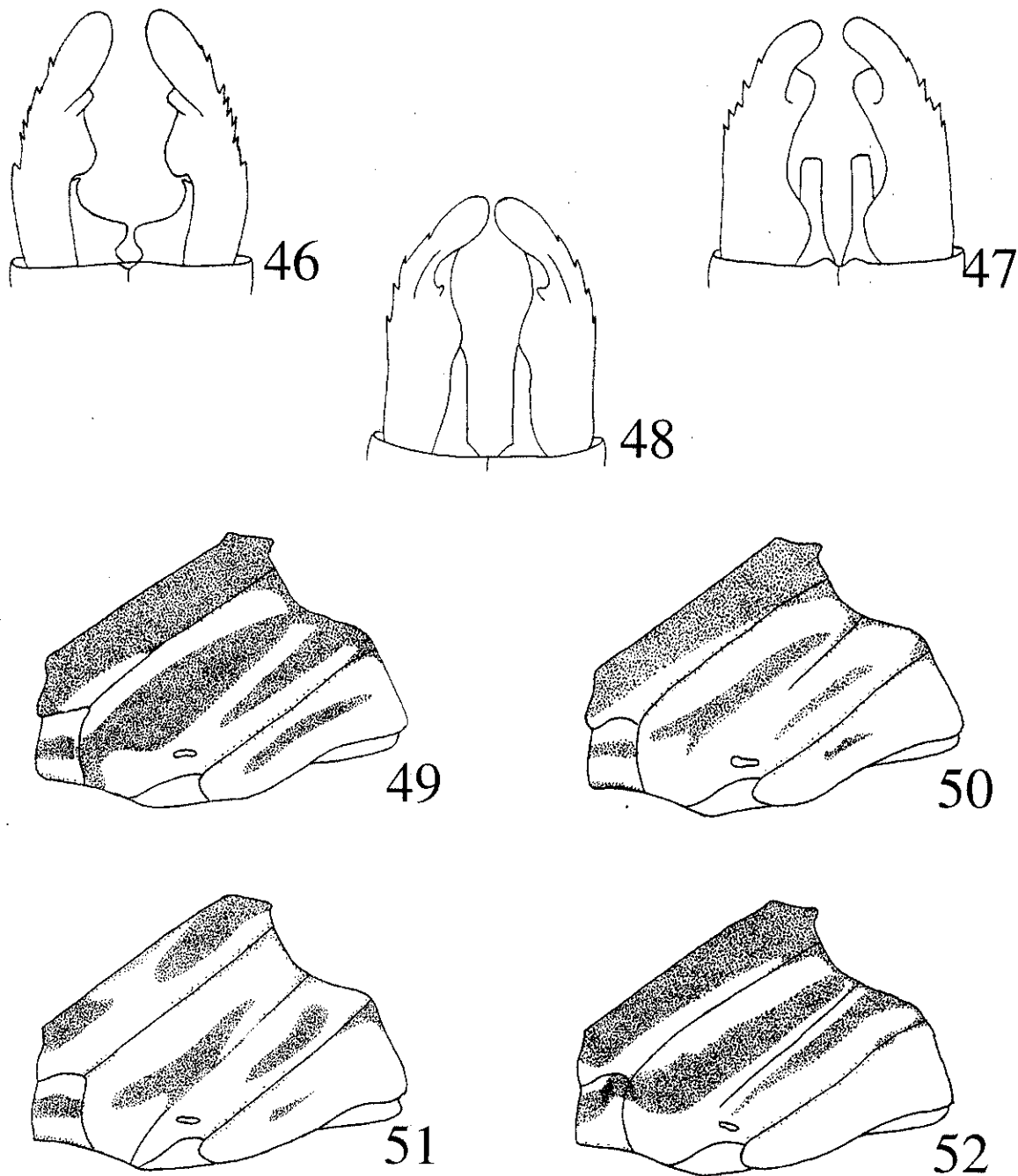


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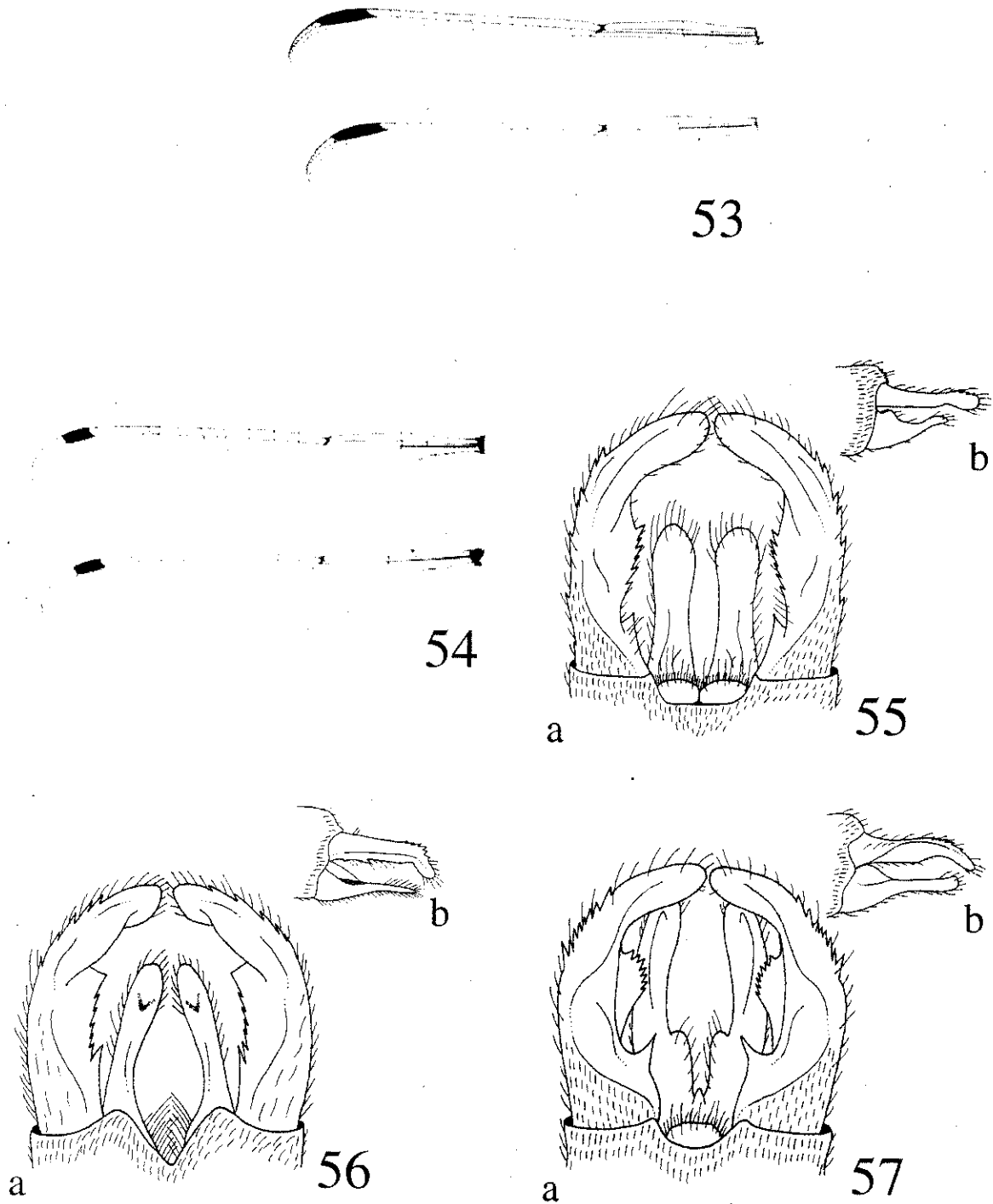


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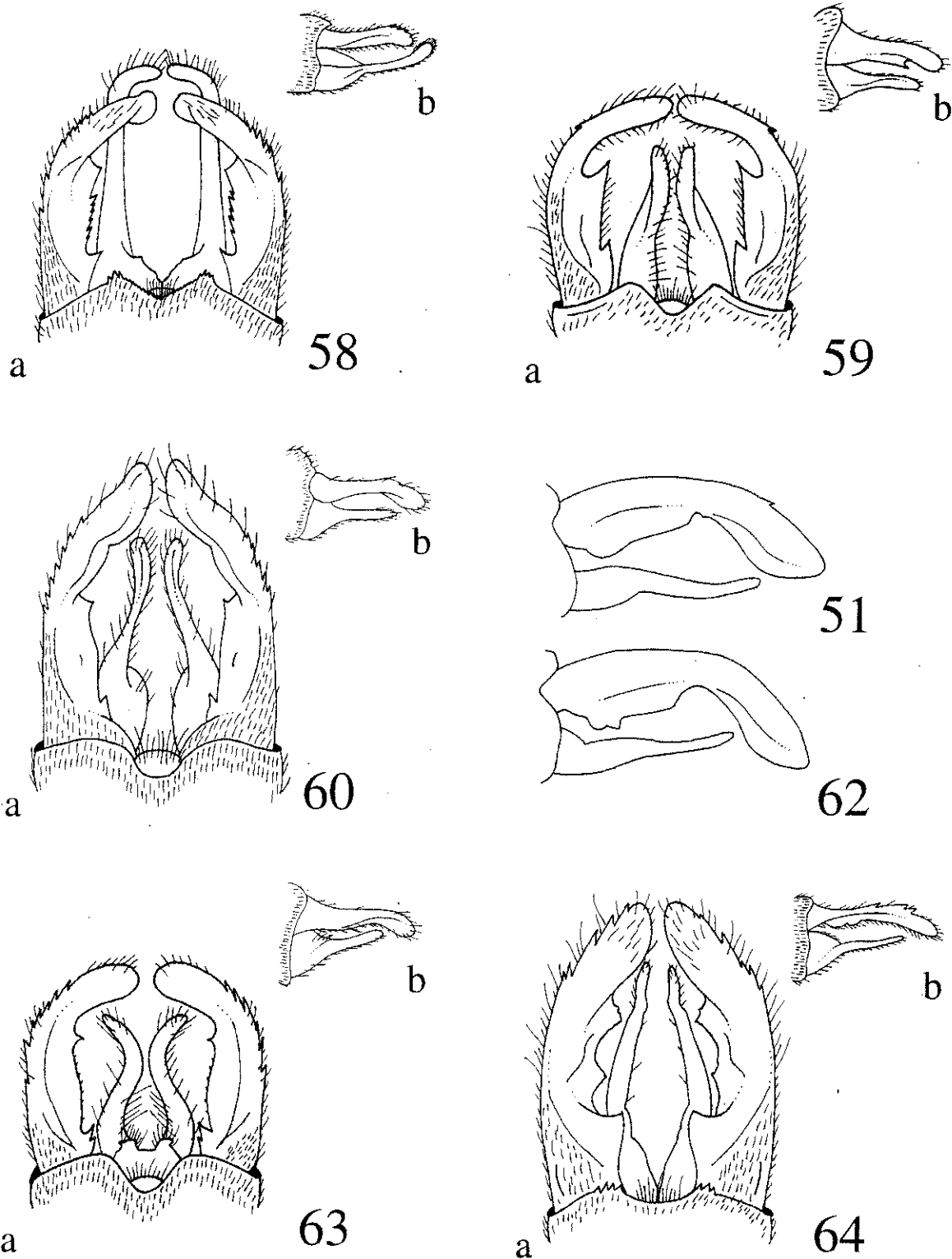
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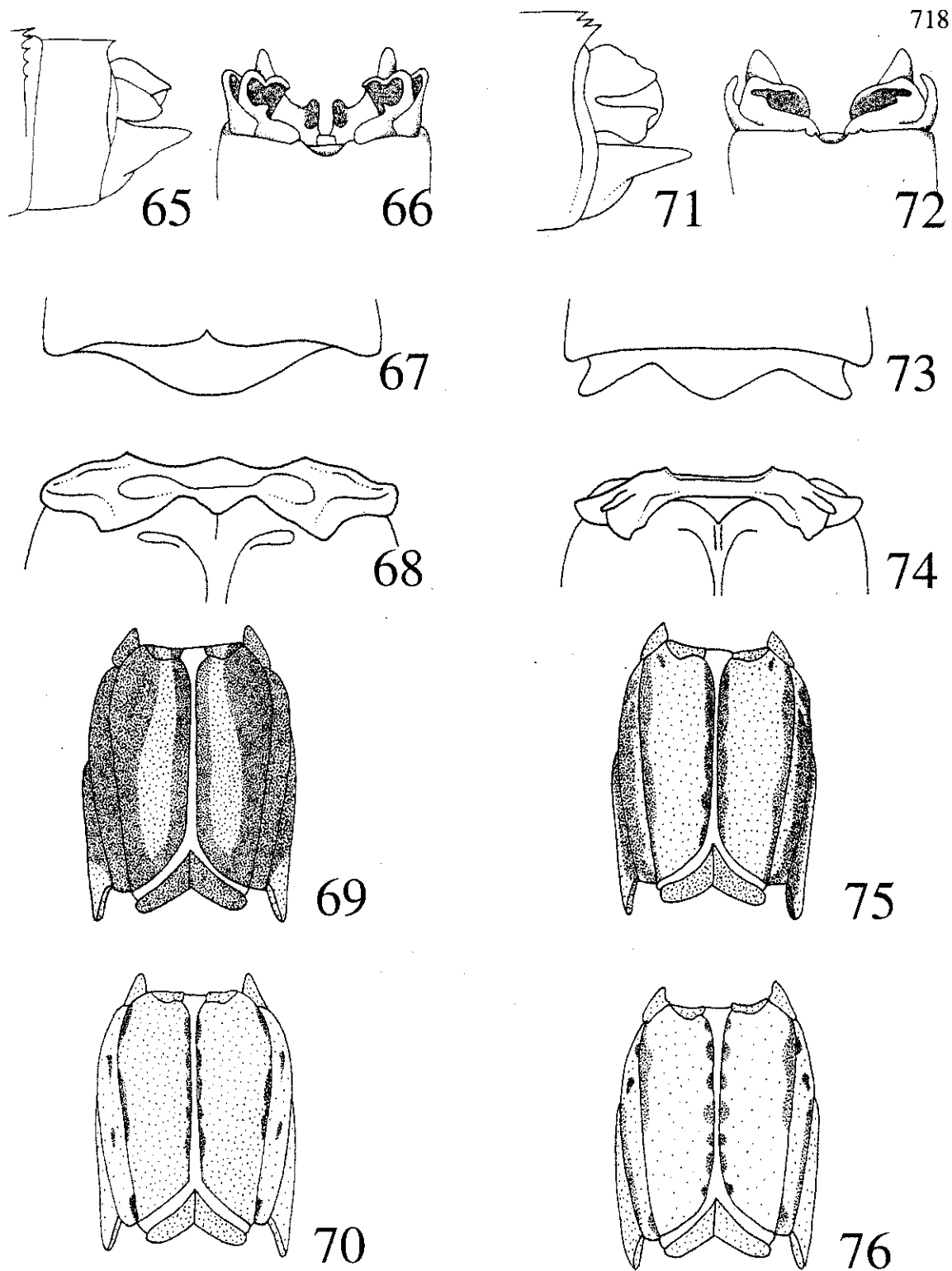
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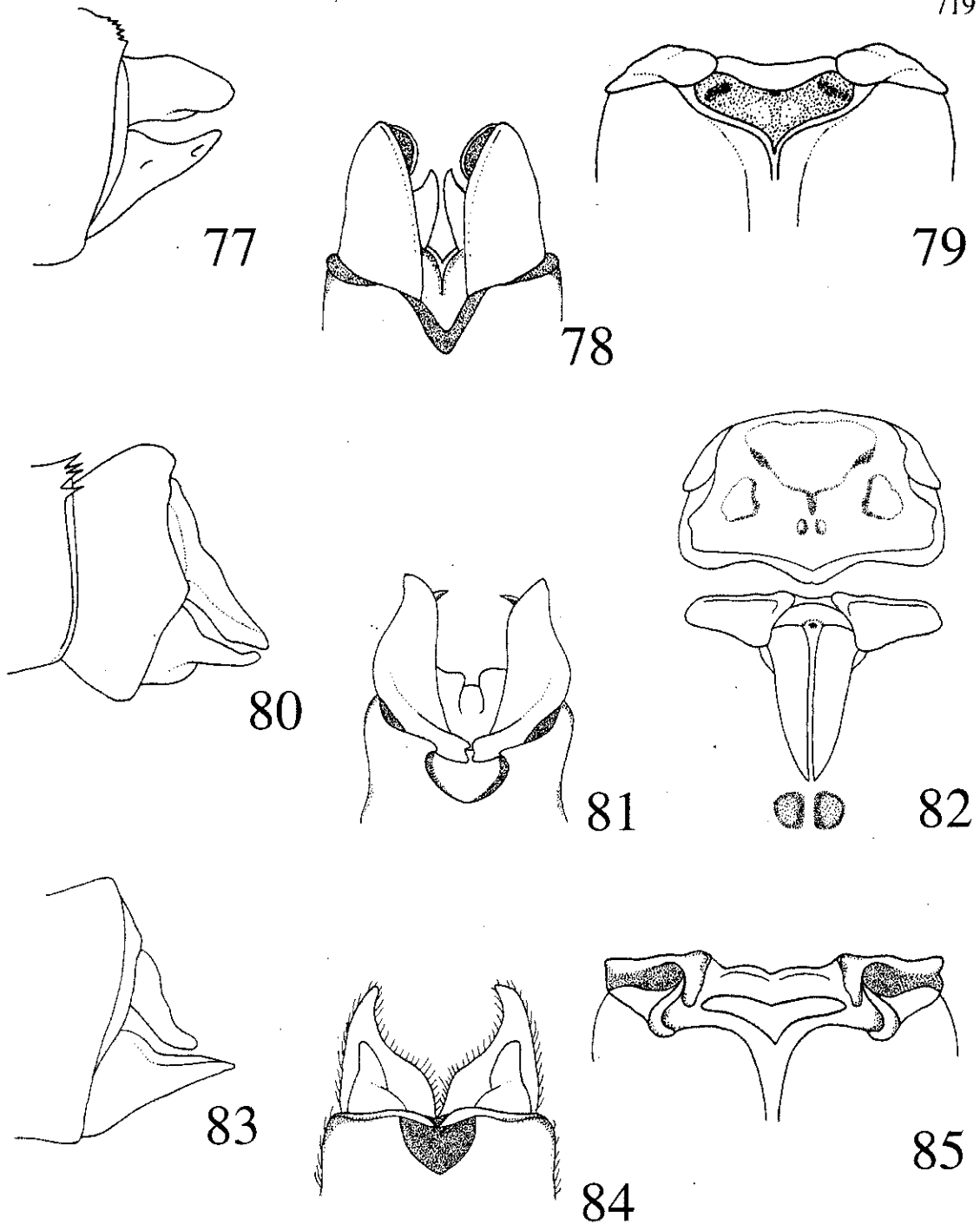
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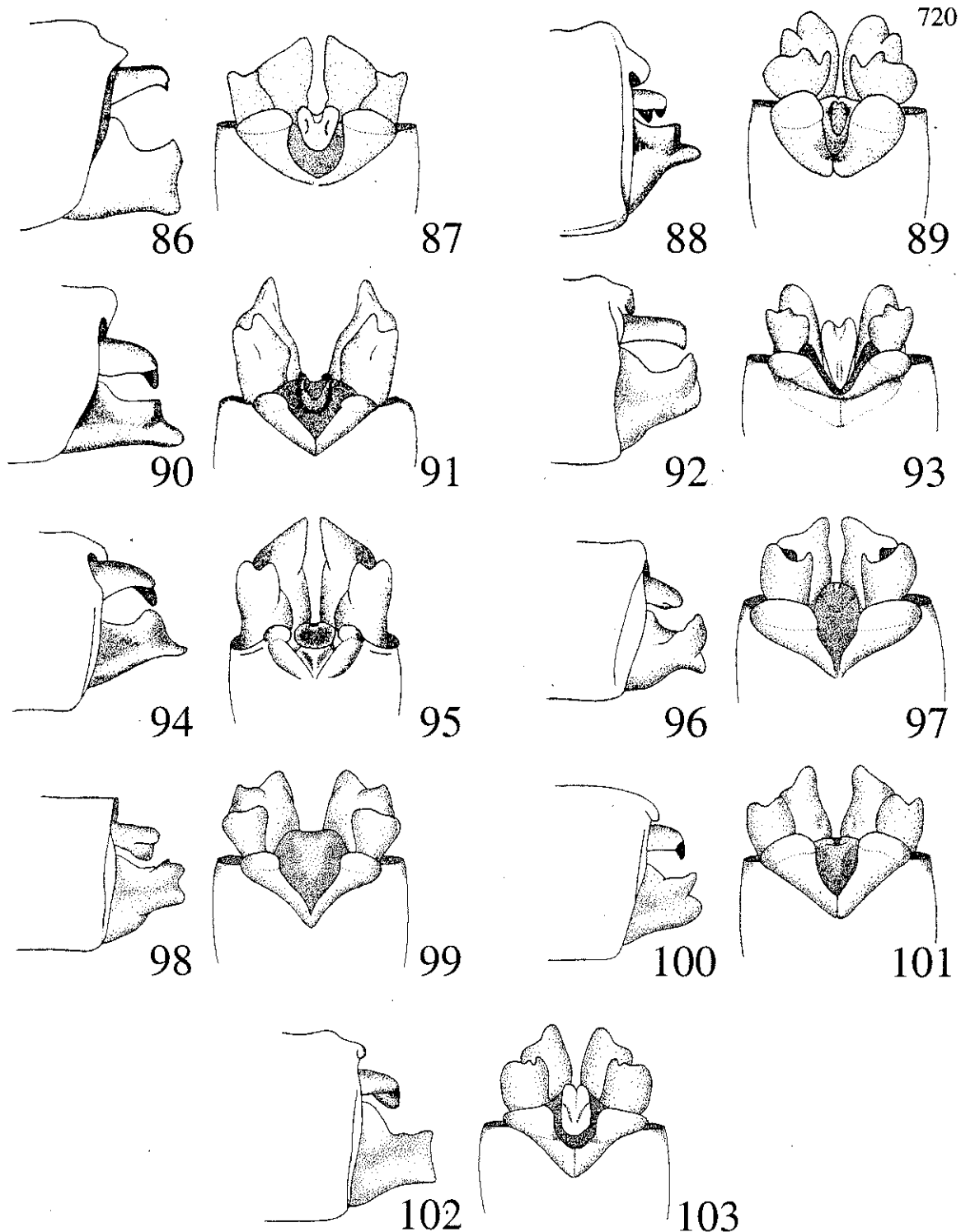
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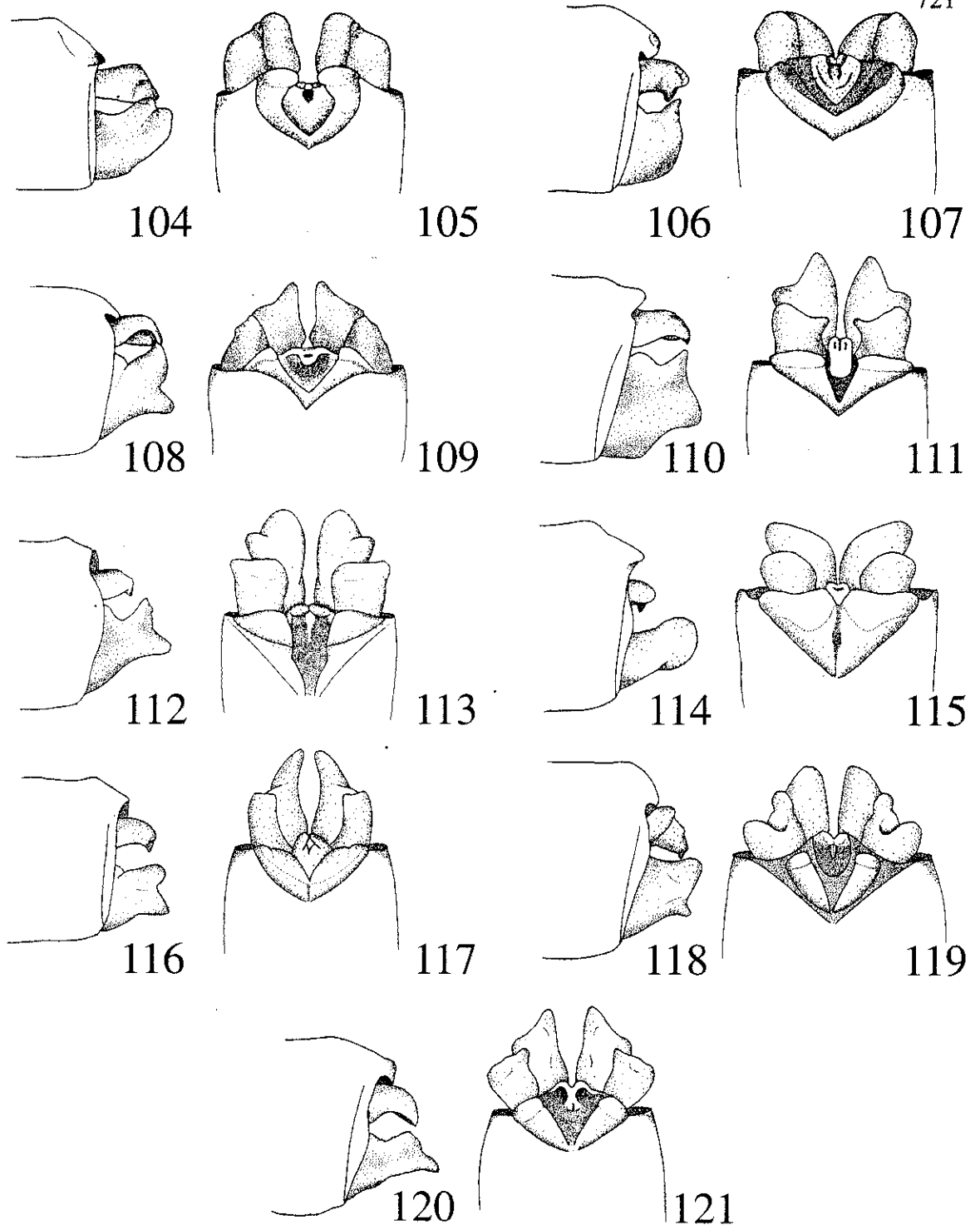
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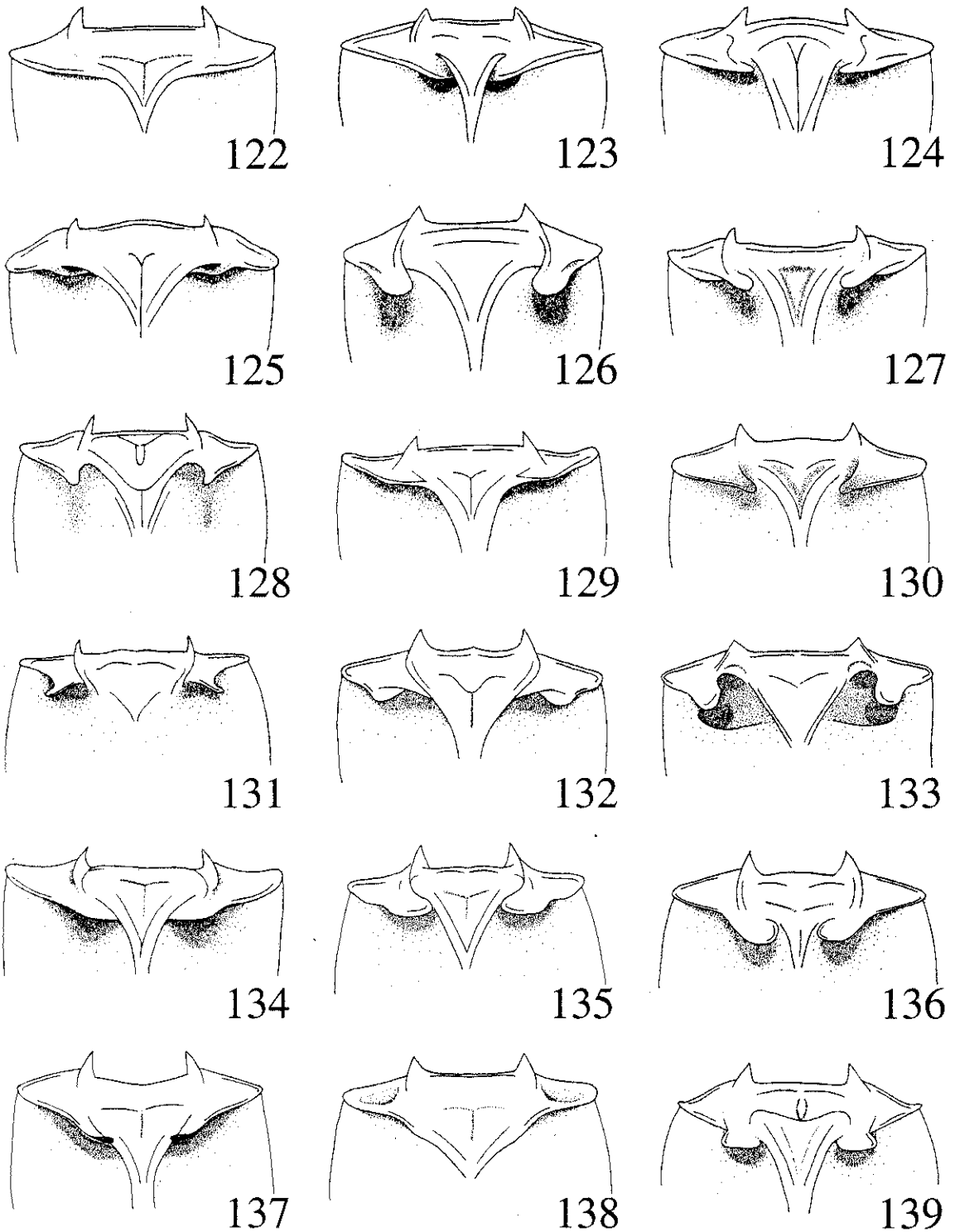
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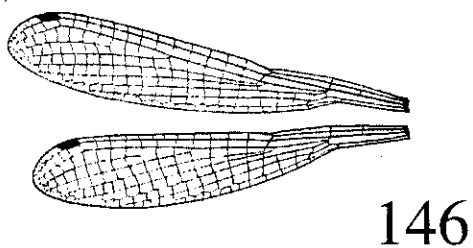
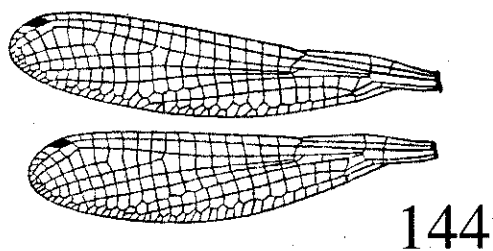
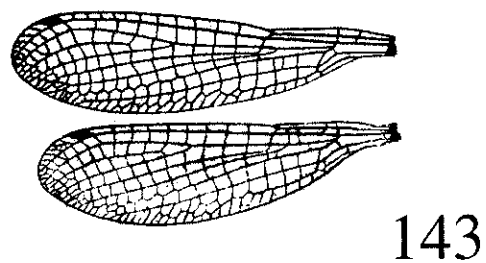
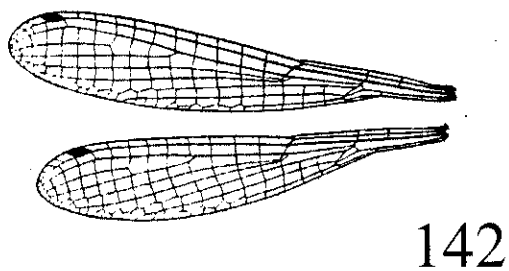
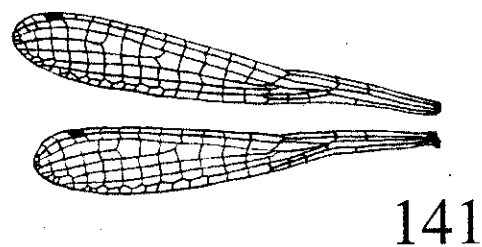
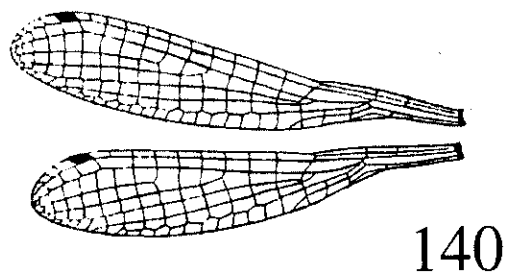
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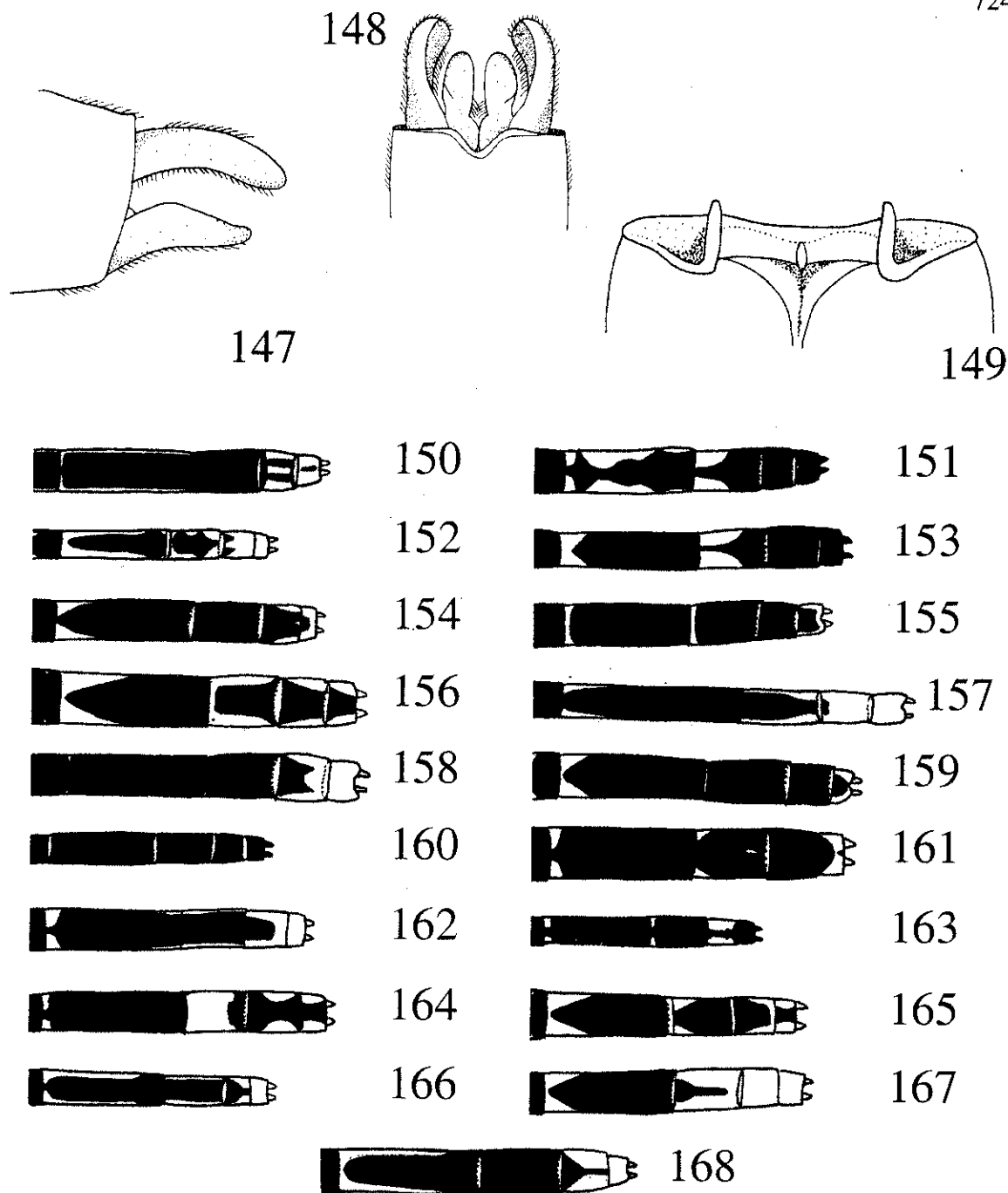
Figs. 104-121. Caudal appendages of male *Argia*. **104.** *A. lugens*, lateral. **105.** *A. lugens*, dorsal. **106.** *A. moesta*, lateral. **107.** *A. moesta*, dorsal. **108.** *A. munda*, lateral. **109.** *A. munda*, dorsal. **110.** *A. nahuana*, lateral. **111.** *A. nahuana*, dorsal. **112.** *A. plana*, lateral. **113.** *A. plana*, dorsal. **114.** *A. rhoadsi*, lateral. **115.** *A. rhoadsi*, dorsal. **116.** *A. sedula*, lateral. **117.** *A. sedula*, dorsal. **118.** *A. tibialis*, lateral. **119.** *A. tibialis*, dorsal. **120.** *A. translata*, lateral. **121.** *A. translata*, dorsal.



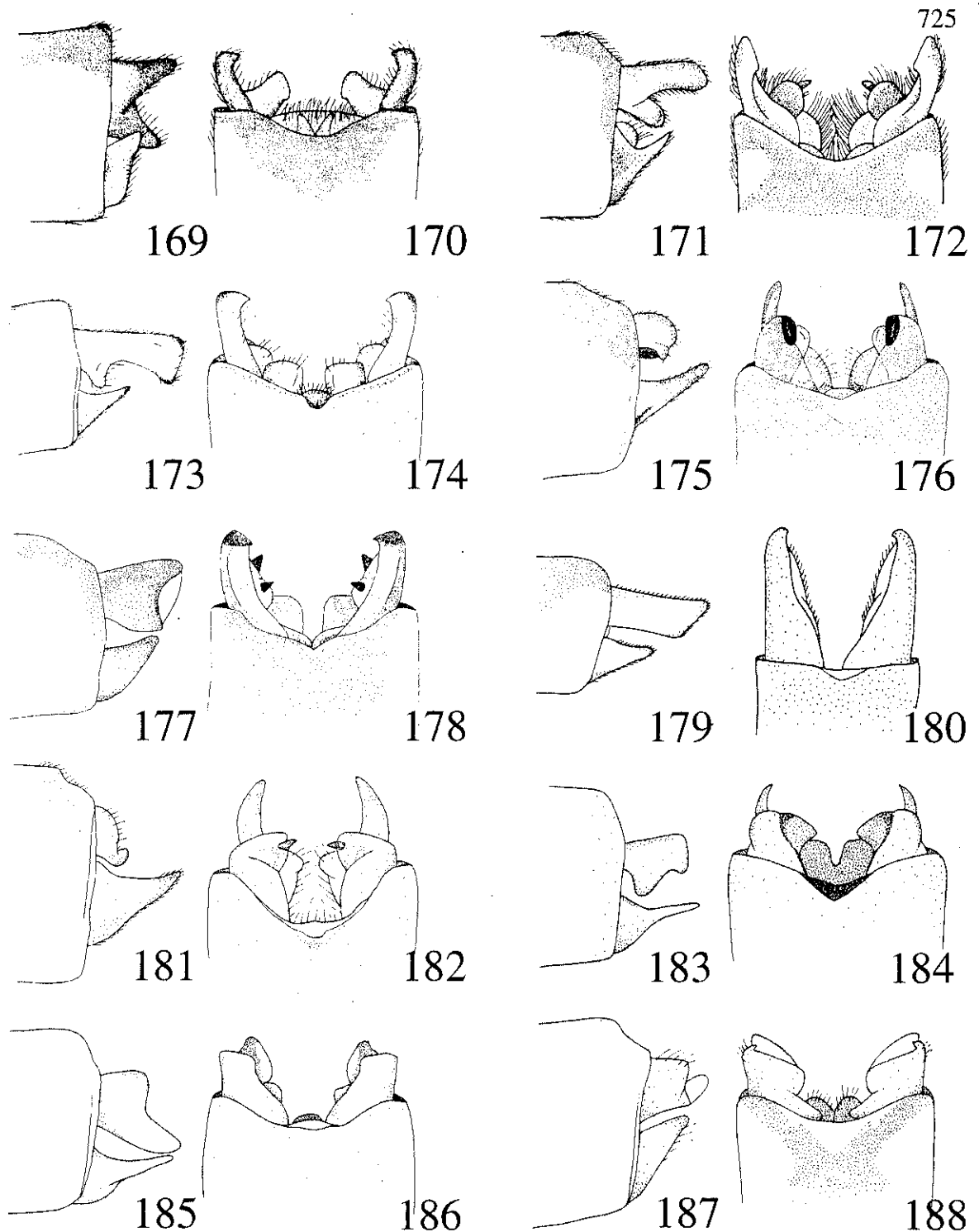
Figs. 122-139. Female *Argia* mesostigmal plates. **122.** *A. alberta*. **123.** *A. apicalis*. **124.** *A. barretti*. **125.** *A. bipunctulata*. **126.** *A. cuprea*. **127.** *A. fumipennis violacea*. **128.** *A. hinei*. **129.** *A. immunda*. **130.** *A. leonora*. **131.** *A. lugens*. **132.** *A. moesta*. **133.** *A. munda*. **134.** *A. nahuana*. **135.** *A. plana*. **136.** *A. rhoadsi*. **137.** *A. sedula*. **138.** *A. tibialis*. **139.** *A. translata*.



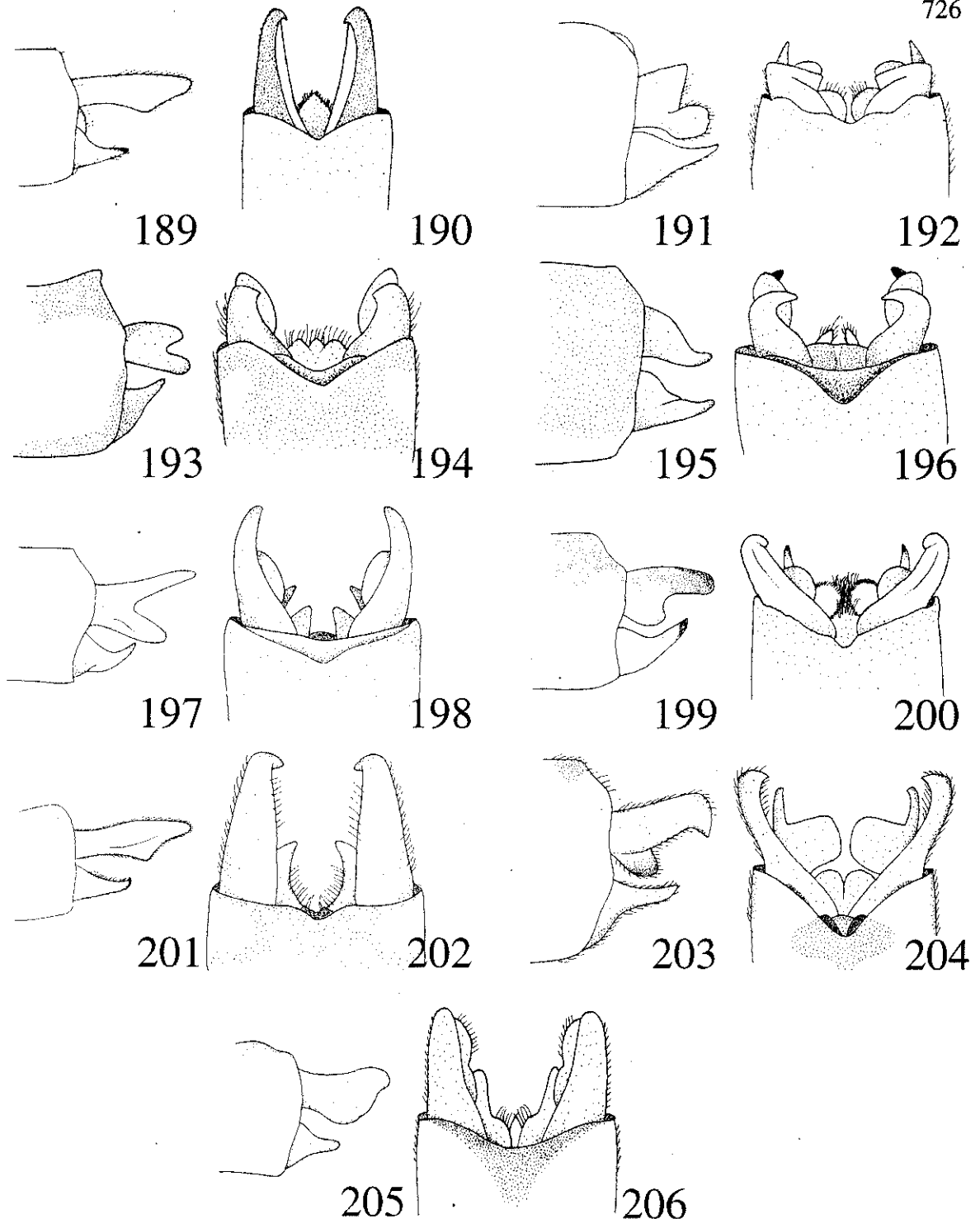
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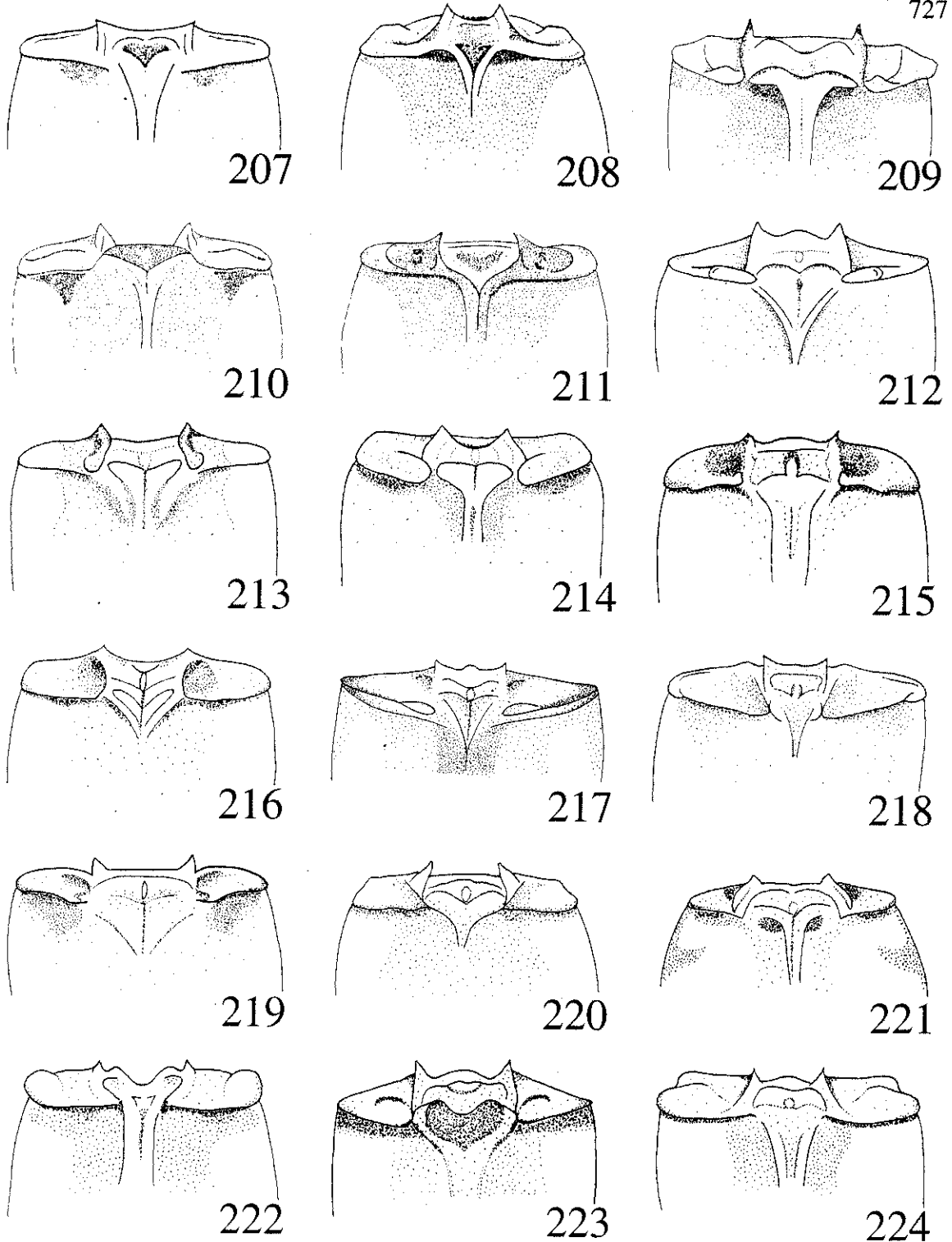
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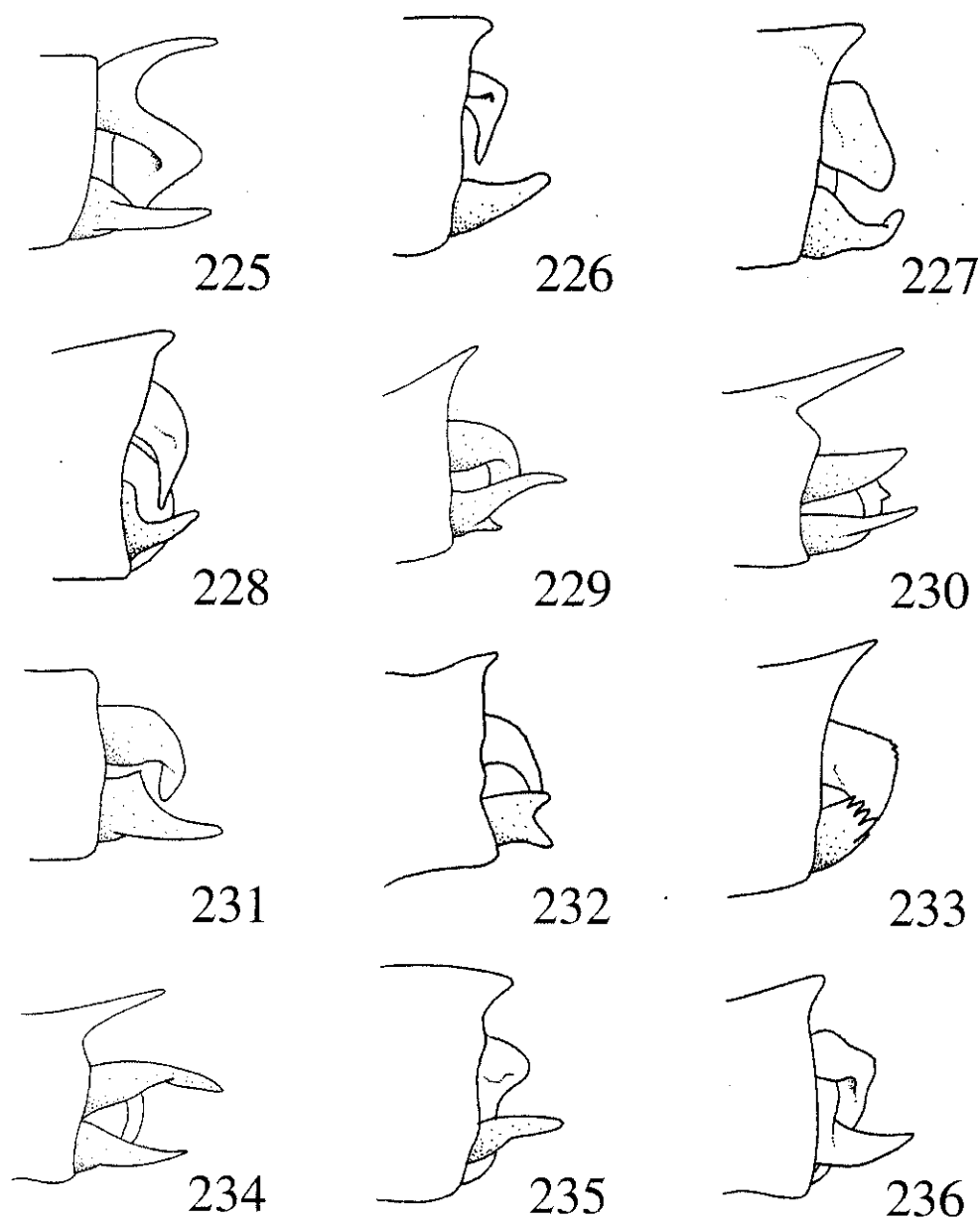
Figs. 169-188. Caudal appendages of male *Enallagma*. 169. *E. antennatum*, lateral. 170. *E. antennatum*, dorsal. 171. *E. aspersum*, lateral. 172. *E. aspersum*, dorsal. 173. *E. basidens*, lateral. 174. *E. basidens*, dorsal. 175. *E. boreale*, lateral. 176. *E. boreale*, dorsal. 177. *E. civile*, lateral. 178. *E. civile*, dorsal. 179. *E. concisum*, lateral. 180. *E. concisum*, dorsal. 181. *E. cyathigerum*, lateral. 182. *E. cyathigerum*, dorsal. 183. *E. daeckii*, lateral. 184. *E. daeckii*, dorsal. 185. *E. divagans*, lateral. 186. *E. divagans*, dorsal. 187. *E. doubledayi*, lateral. 188. *E. doubledayi*, dorsal.



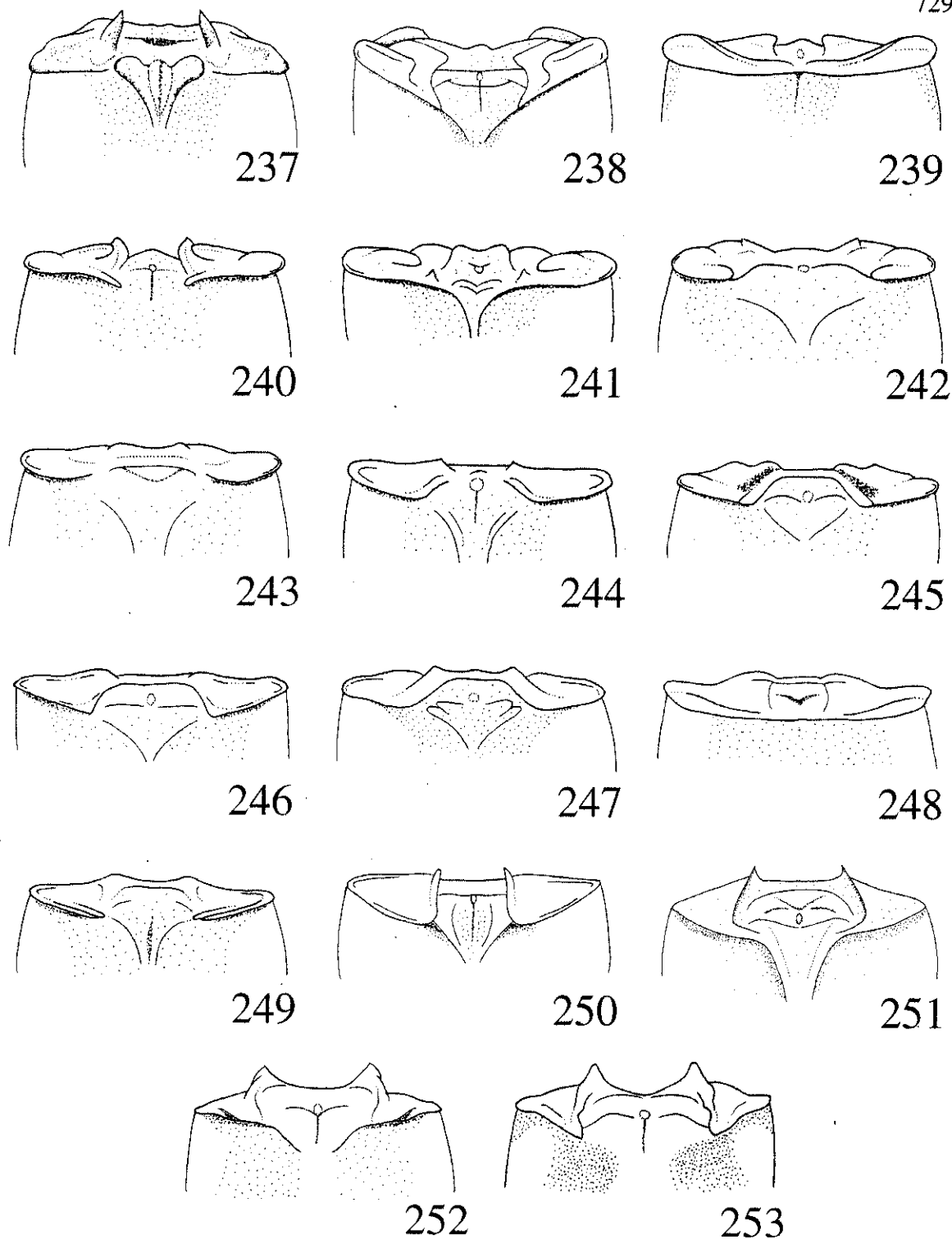
Figs. 189-206. Caudal appendages of male *Enallagma*. **189.** *E. dubium*, lateral. **190.** *E. dubium*, dorsal. **191.** *E. durum*, lateral. **192.** *E. durum*, dorsal. **193.** *E. exsulans*, lateral. **194.** *E. exsulans*, dorsal. **195.** *E. geminatum*, lateral. **196.** *E. geminatum*, dorsal. **197.** *E. novaehispaniae*, lateral. **198.** *E. novaehispaniae*, dorsal. **199.** *E. praevarum*, lateral. **200.** *E. praevarum*, dorsal. **201.** *E. signatum*, lateral. **202.** *E. signatum*, dorsal. **203.** *E. traviatum westfalli*, lateral. **204.** *E. traviatum westfalli*, dorsal. **205.** *E. vesperum*, lateral. **206.** *E. vesperum*, dorsal.



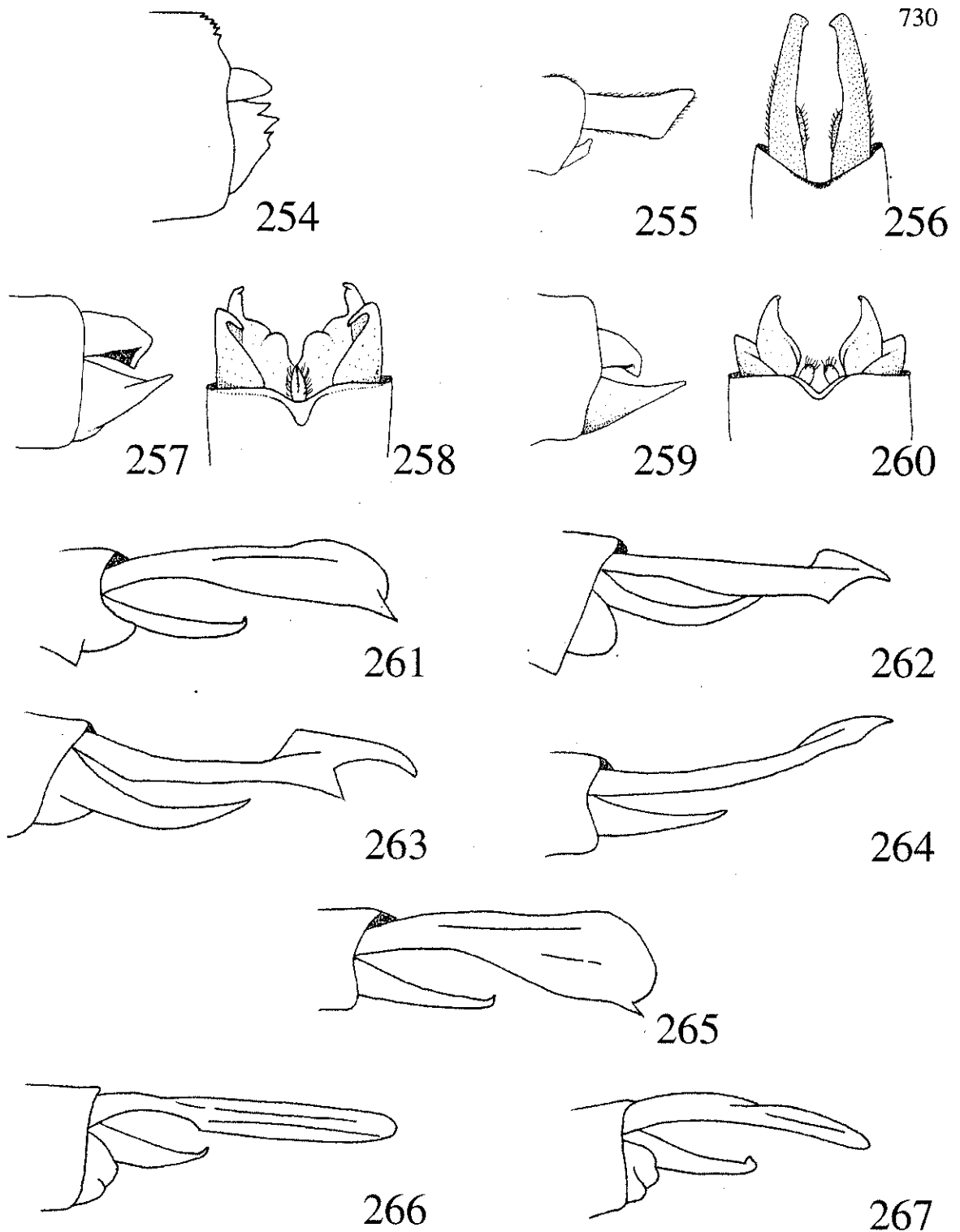
Figs. 207-224. Female *Enallagma* mesostigmal plates. 207. *E. antennatum*. 208. *E. aspersum*. 209. *E. basidens*. 210. *E. boreale*. 211. *E. civile*. 212. *E. concisum*. 213. *E. cyathigerum*. 214. *E. daeckii*. 215. *E. divagans*. 216. *E. doubledayi*. 217. *E. dubium*. 218. *E. durum*. 219. *E. exsulans*. 220. *E. geminatum*. 221. *E. novaehispaniae*. 222. *E. praevarum*. 223. *E. signatum*. 224. *E. traviatum westfalli*.



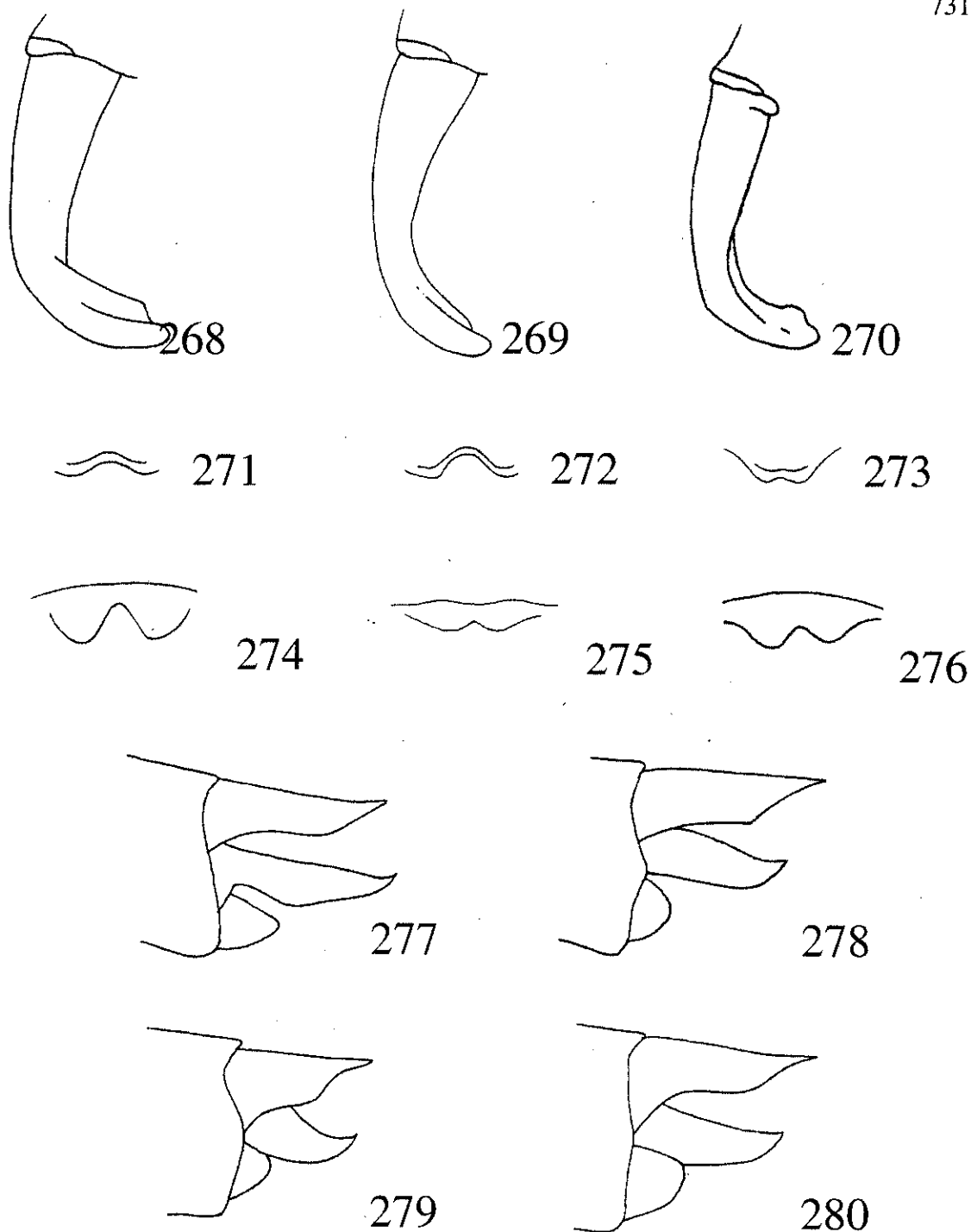
Figs. 225-236. Caudal appendages of male Ischnurine (lateral view). 225. *Hesperagrion heterodoxum*. 226-236. *Ischnura*. 226. *I. barberi*. 227. *I. damula*. 228. *I. demorsa*. 229. *I. denticollis*. 230. *I. hastata*. 231. *I. kellicotti*. 232. *I. perparva*. 233. *I. posita posita*. 234. *I. prognata*. 235. *I. ramburii*. 236. *I. verticalis*.



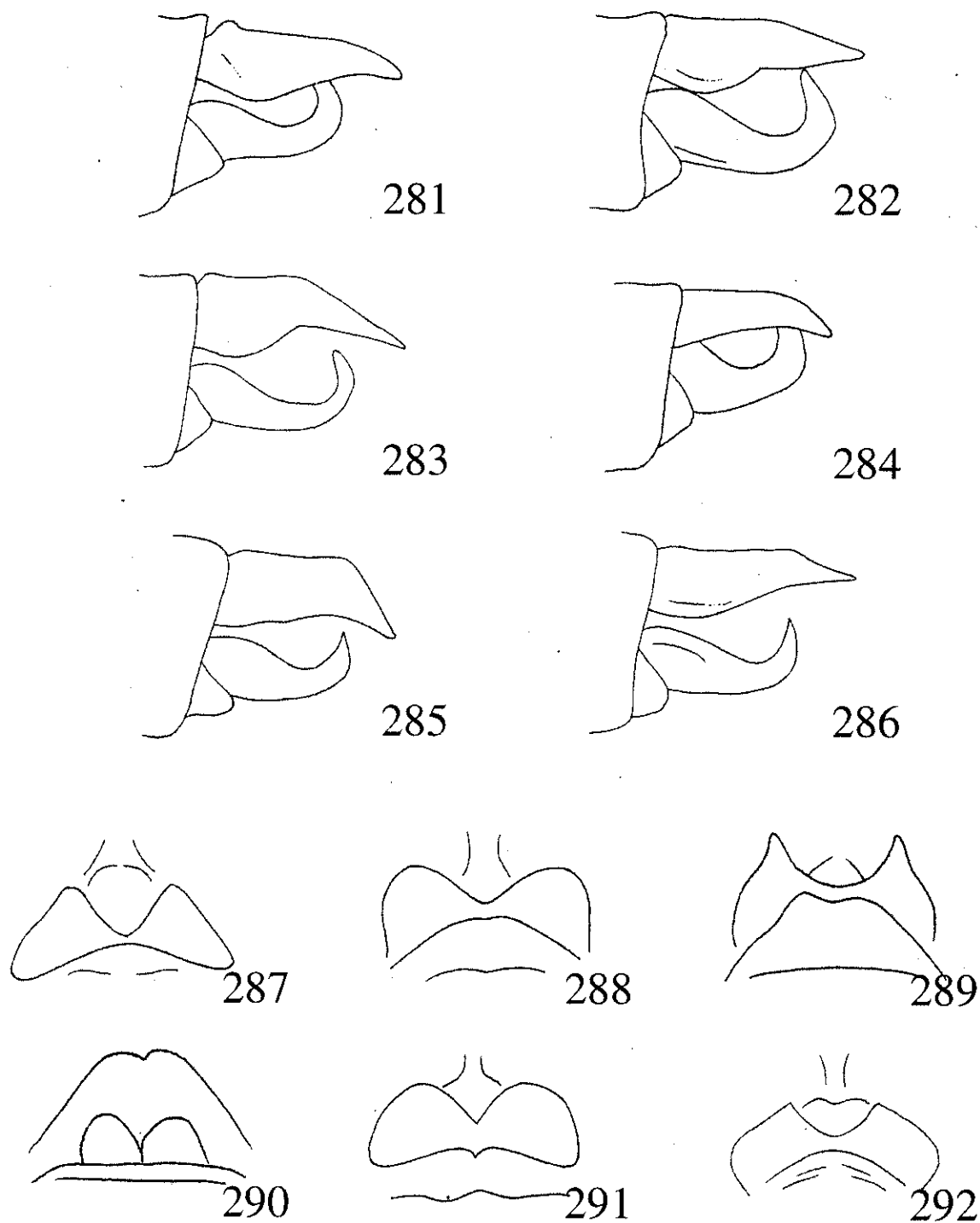
Figs. 237-253. Female mesostigmal plates. 237. *Enallagma vesperum*. 238. *Hesperagrion heterodoxum*. 239-249. *Ischnura*. 239. *I. barberi*. 240. *I. damula*. 241. *I. demorsa*. 242. *I. denticollis*. 243. *I. hastata*. 244. *I. kellicotti*. 245. *I. perparva*. 246. *I. posita posita*. 247. *I. prognata*. 248. *I. ramburii*. 249. *I. verticalis*. 250. *Nehalennia integricollis*. 251. *Neoerythromma cultellatum*. 252-253. *Telebasis*. 252. *T. byersi*. 253. *T. salva*.



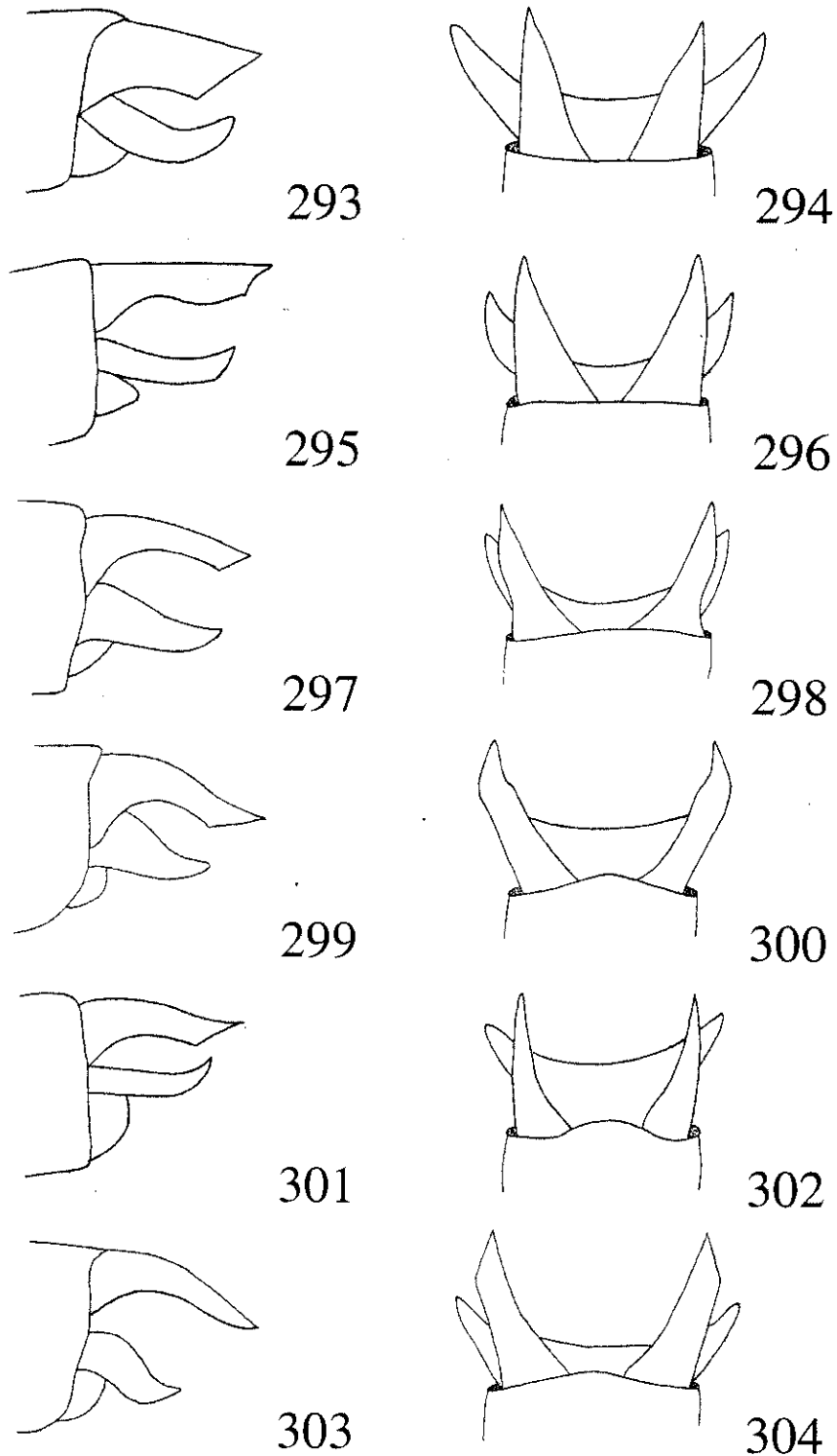
Figs. 254-267. Caudal appendages of male Odonata. **254.** *Nehalennia integricollis*, lateral. **255.** *Neoerythromma cultellatum*, lateral. **256.** *Neoerythromma cultellatum*, dorsal. **257-260.** *Telebasis*. **257.** *T. byersi*, lateral. **258.** *T. byersi*, dorsal. **259.** *T. salva*, lateral. **260.** *T. salva*, dorsal, dorsal. **261-265.** *Aeshna*, lateral view. **261.** *A. constricta*. **262.** *A. dugesi*. **263.** *A. multicolor*. **264.** *A. psilus*. **265.** *A. umbrosa*. **266-267.** *Gomphaeschna*, lateral view. **266.** *G. antilope*. **267.** *G. furcillata*.



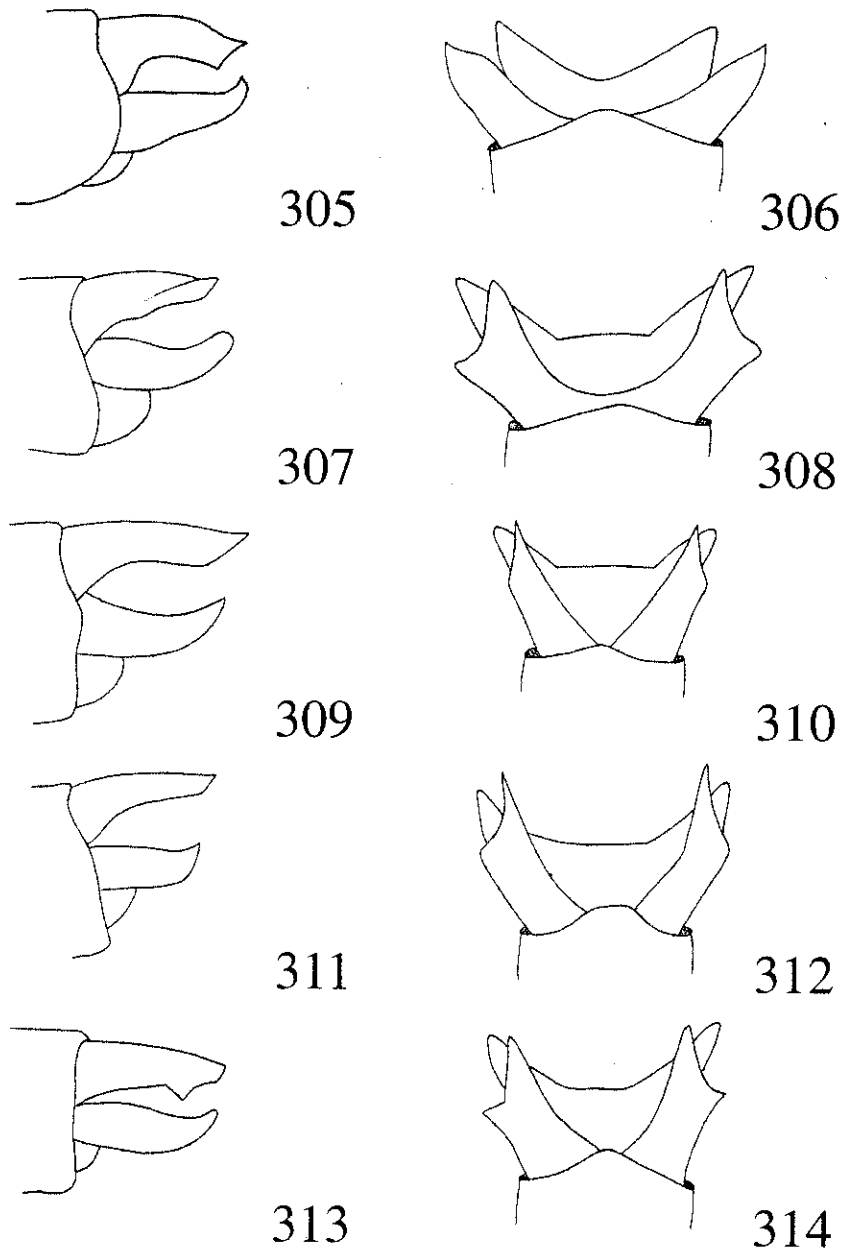
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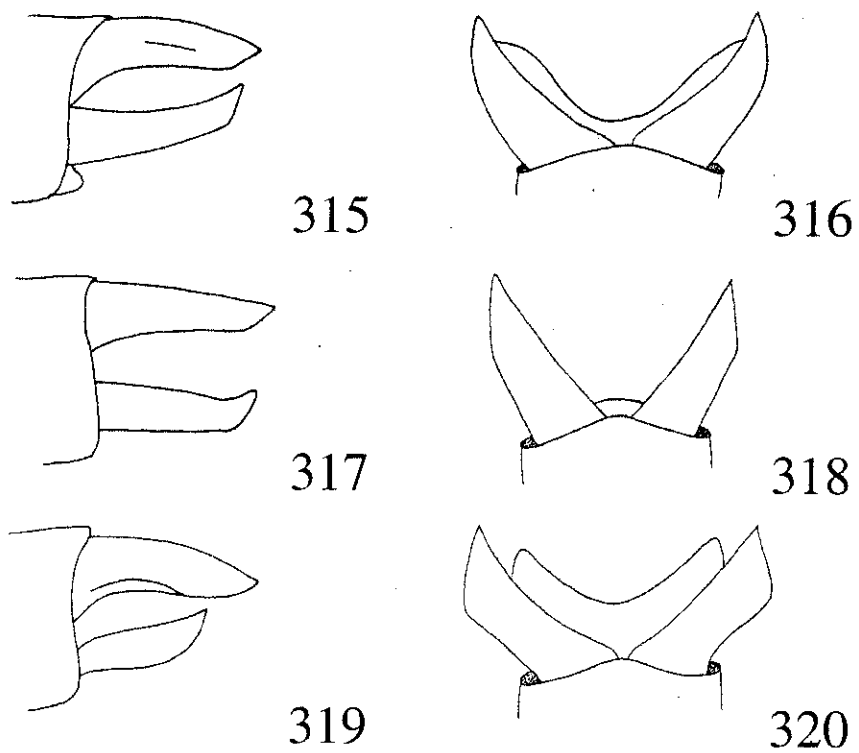
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Figs. 293-304. *Gomphus* (*Gomphurus*) male caudal appendages. **293.** *G. externus*, lateral view. **294.** *G. externus*, dorsal view. **295.** *G. gonzalezi*, lateral view. **296.** *G. gonzalezi*, dorsal view. **297.** *G. hybridus*, lateral view. **298.** *G. hybridus*, dorsal view. **299.** *G. modestus*, lateral view. **300.** *G. modestus*, dorsal view. **301.** *G. ozarkensis*, lateral view. **302.** *G. ozarkensis*, dorsal view. **303.** *G. vastus*, lateral view. **304.** *G. vastus*, dorsal view.

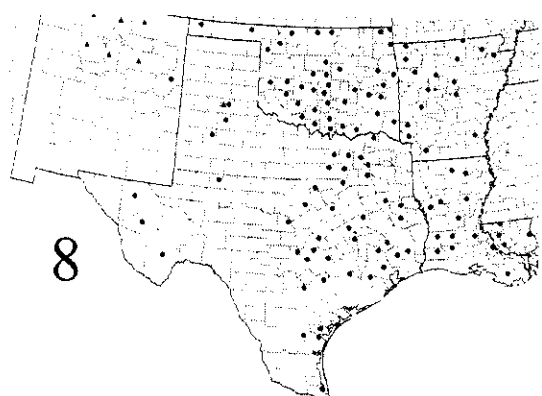
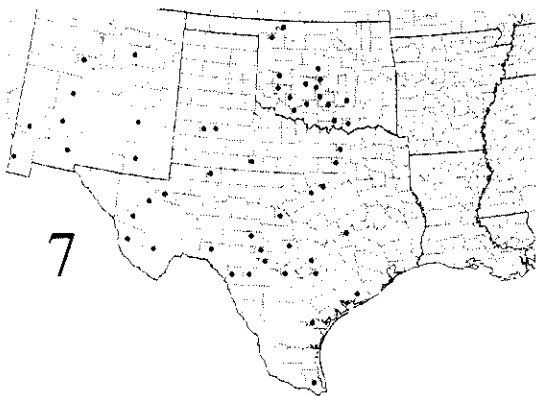
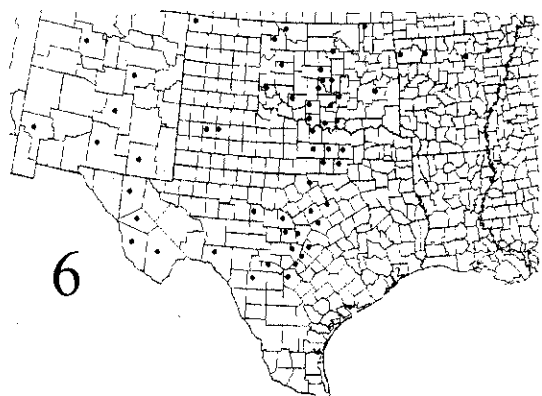
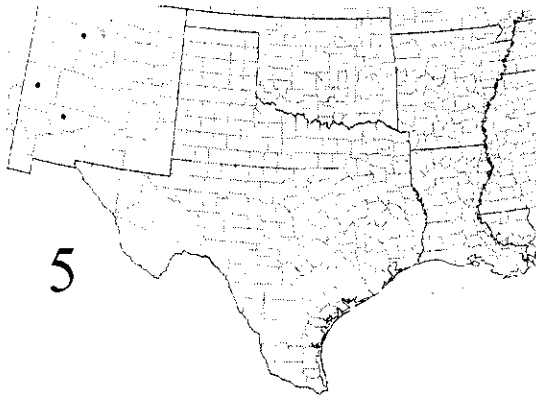
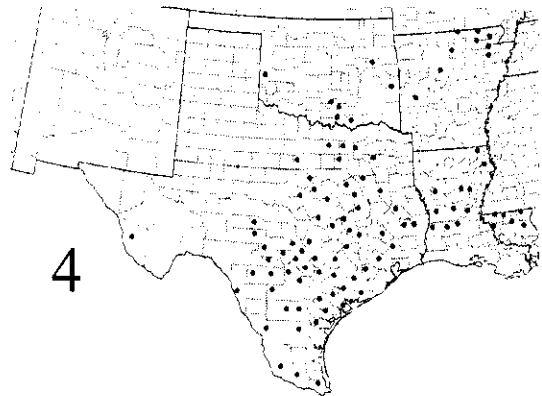
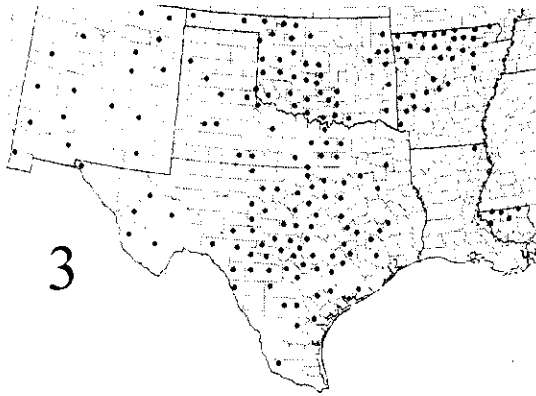
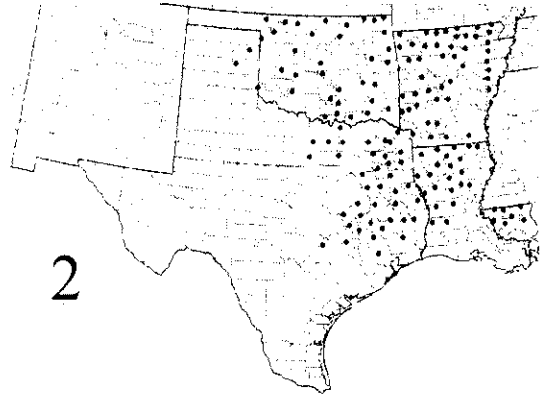
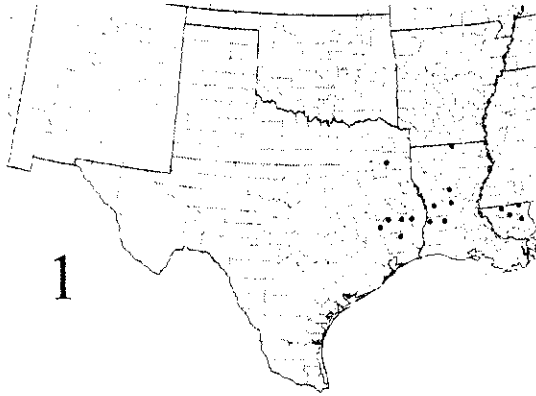


Figs. 305-314. *Gomphus* (*Gomphus*) male caudal appendages. **305.** *G. apomyius*, lateral view. **306.** *G. apomyius*, dorsal view. **307.** *G. graslinellus*, lateral view. **308.** *G. graslinellus*, dorsal view. **309.** *G. lividus*, lateral view. **310.** *G. lividus*, dorsal view. **311.** *G. militaris*, lateral view. **312.** *G. militaris*, dorsal view. **313.** *G. oklahomensis*, lateral view. **314.** *G. oklahomensis*.

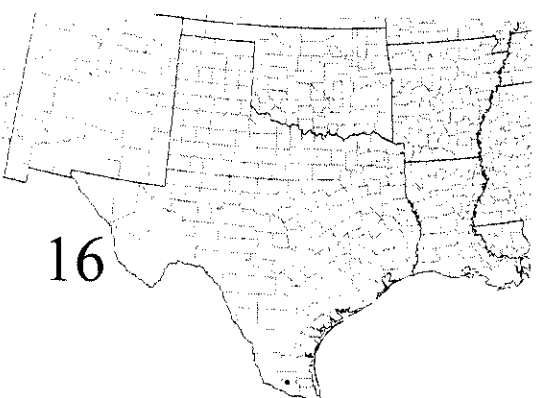
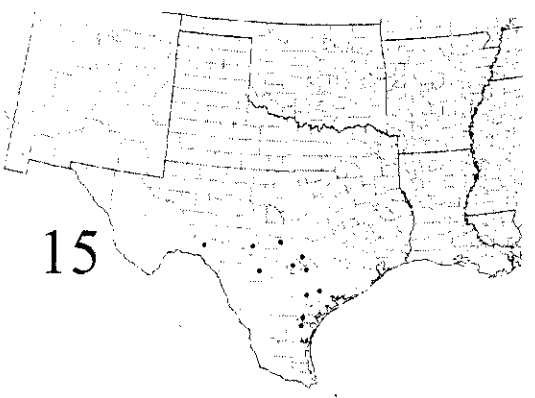
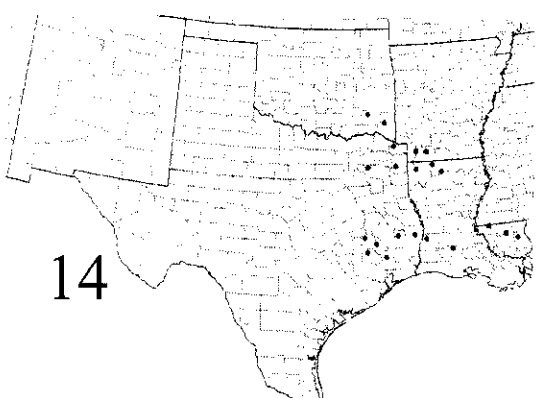
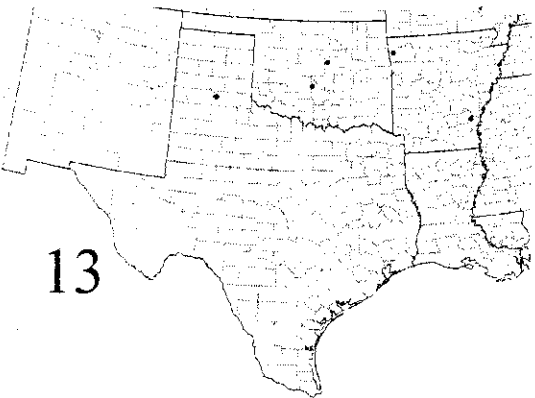
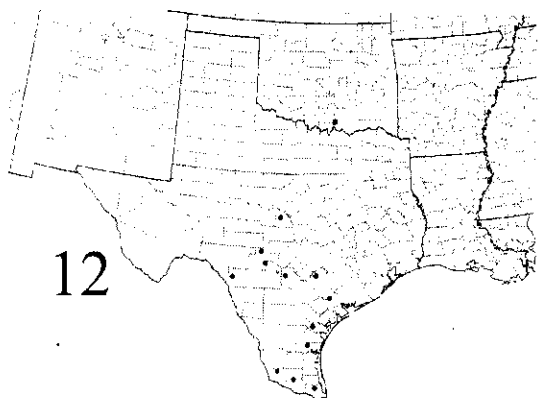
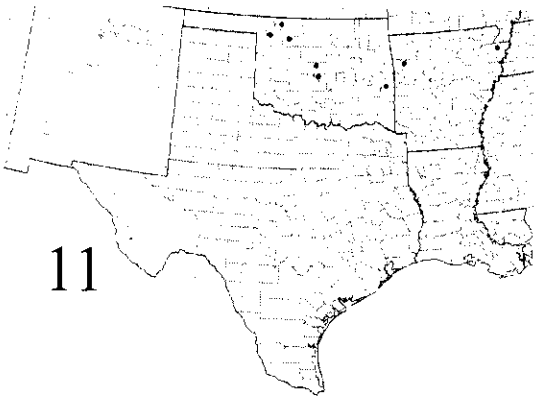
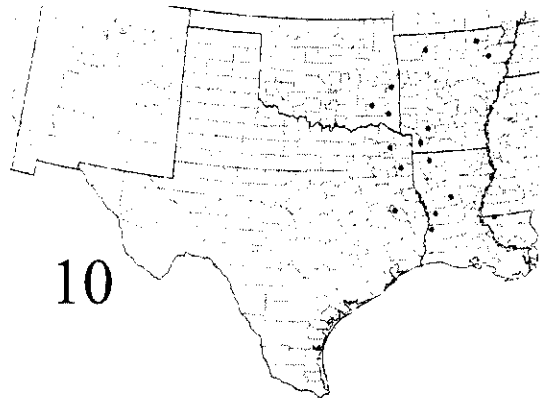
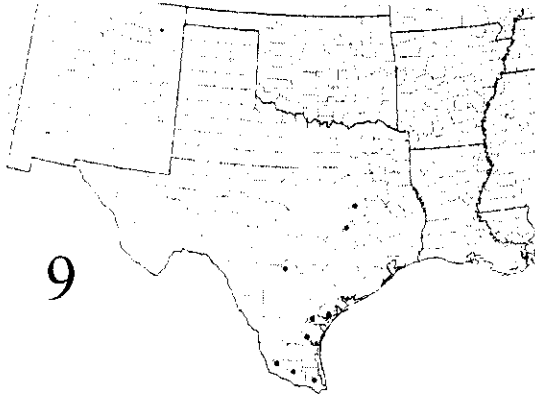


Figs. 315-320. *Stylurus* male caudal appendages. **315.** *S. intricatus*, lateral view. **316.** *S. intricatus*, dorsal view. **317.** *S. laurae*, lateral view. **318.** *S. laurae*, dorsal view. **319.** *S. plagiatus*, lateral view. **320.** *S. plagiatus*, dorsal view.

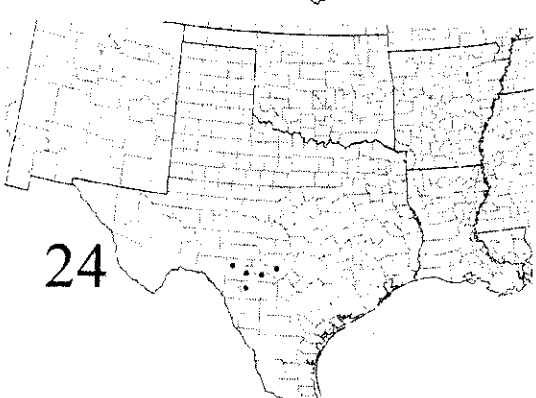
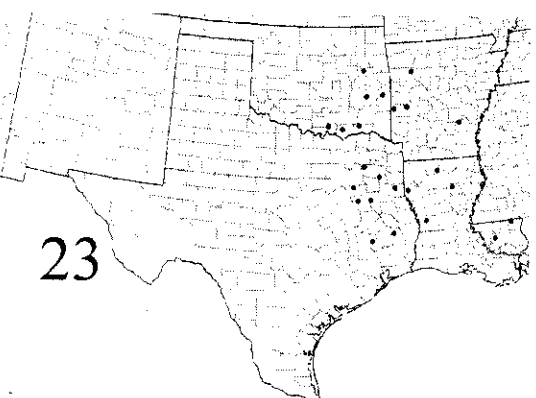
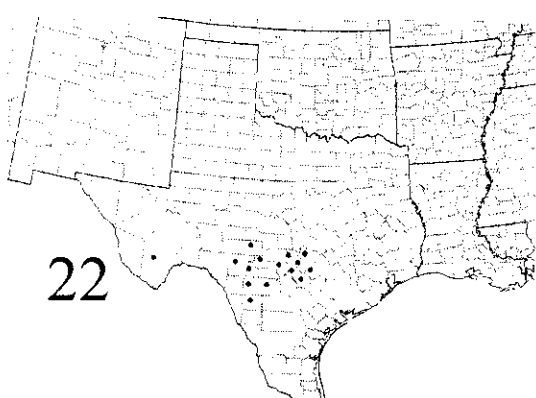
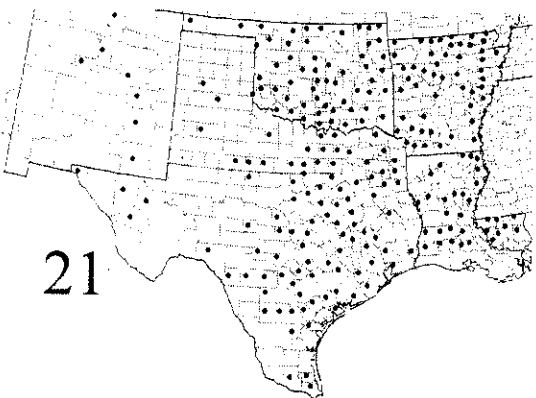
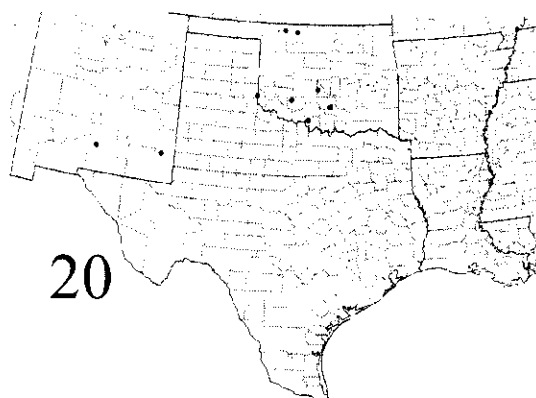
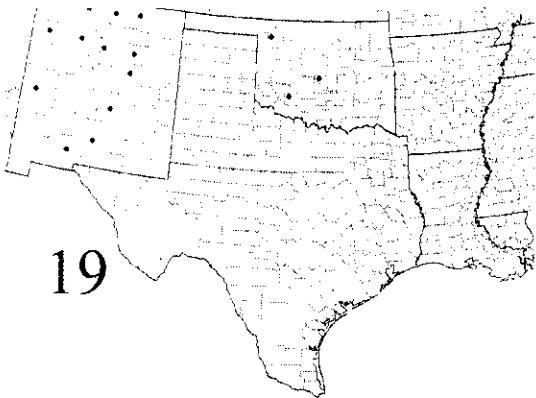
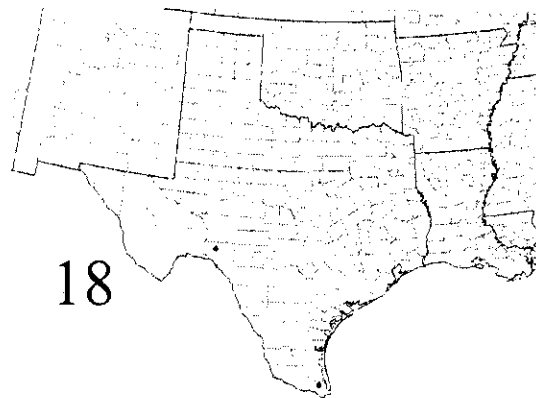
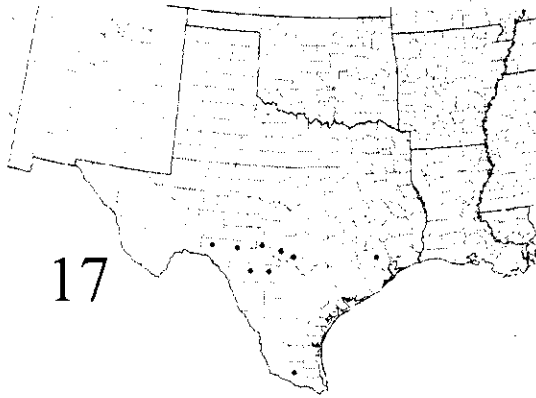
Maps. 1-8. Odonata distributions. 1. *Calopteryx dimidiata*. 2. *C. maculata*. 3. *Hetaerina americana*. 4. *H. titia*. 5. *H. vulnerata*. 6. *Archilestes grandis*. 7. *Lestes alacer*. 8. *L. disjunctus disjunctus* (▲), *L. d. australis* (●).



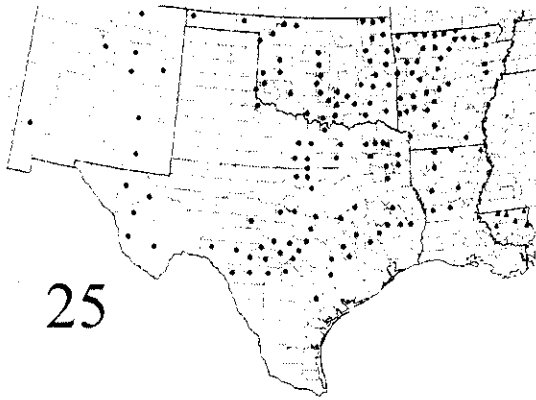
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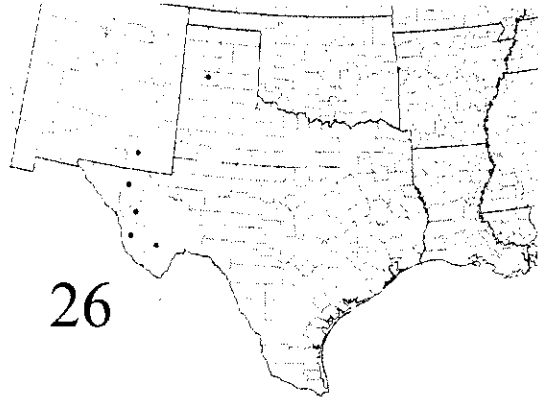
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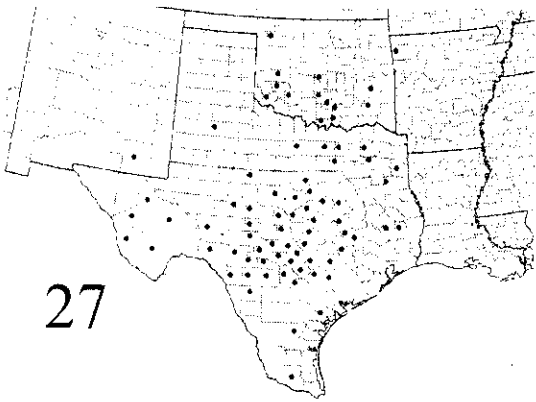
Maps. 25-32. Odonata distributions. 25. *Argia fumipennis fumipennis* (▲), *A. f. violacea* (●). 26. *A. hinei*. 27. *A. immunda*. 28. *A. leonora*. 29. *A. lugens*. 30. *A. moesta*. 31. *A. munda*. 32. *A. nahuana*.



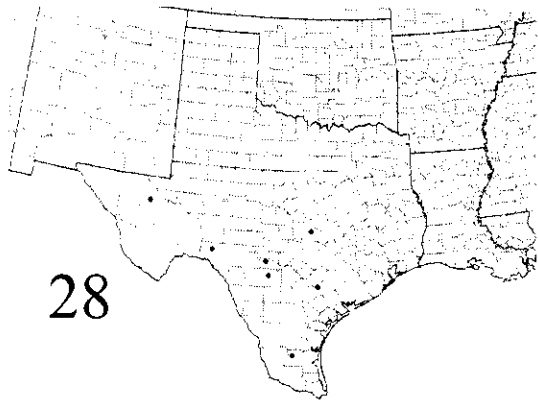
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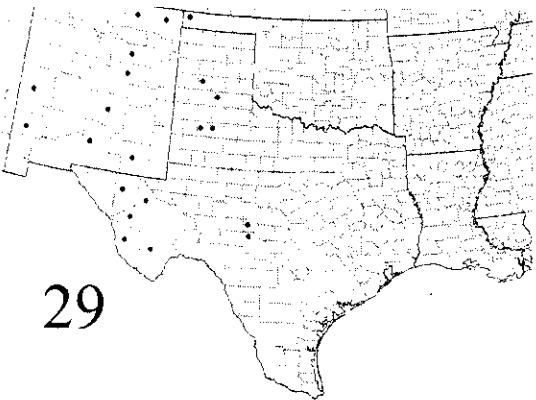
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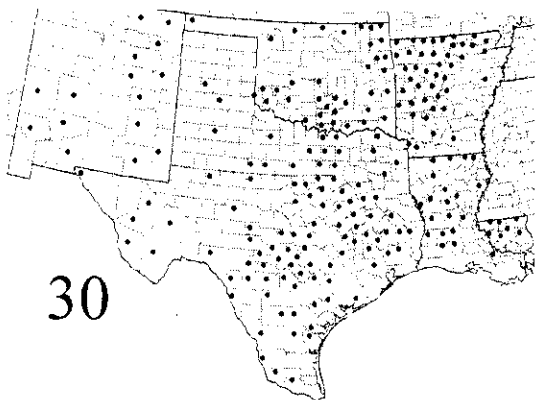
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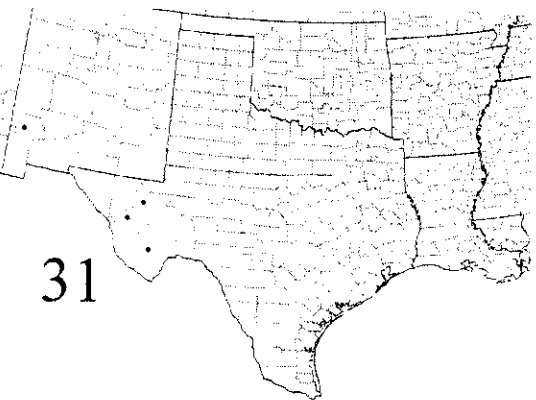
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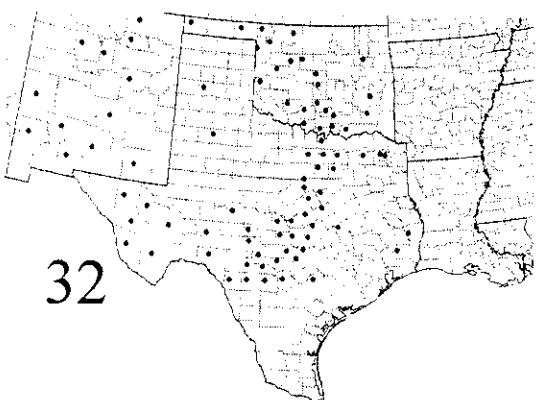
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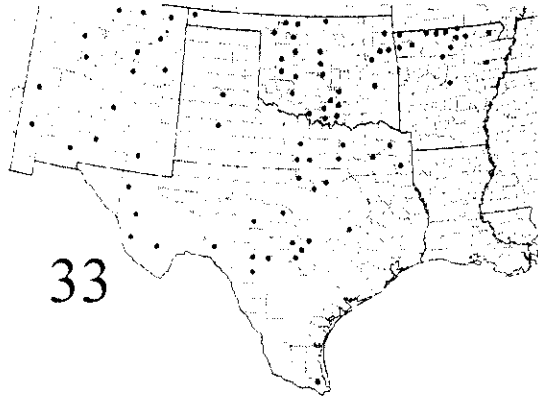


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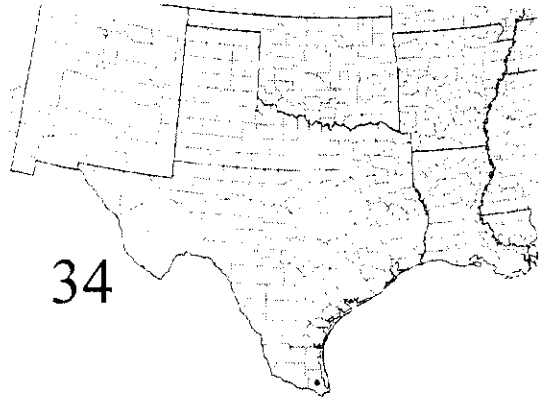


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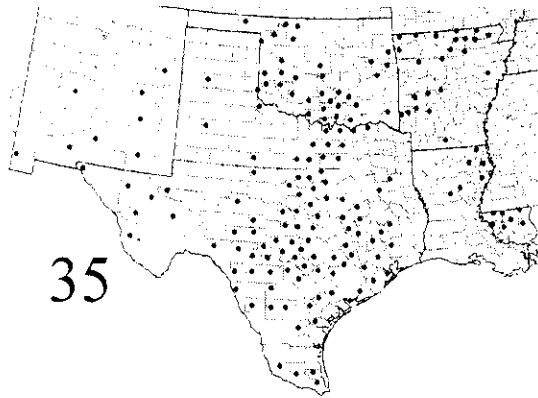
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40. *E. aspersum*.



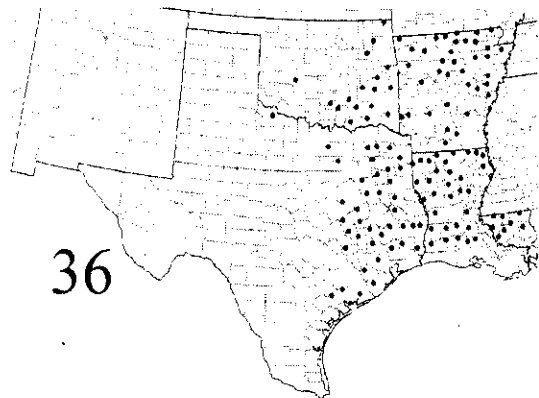
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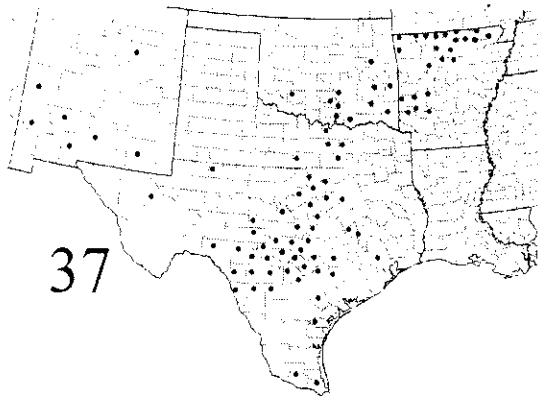
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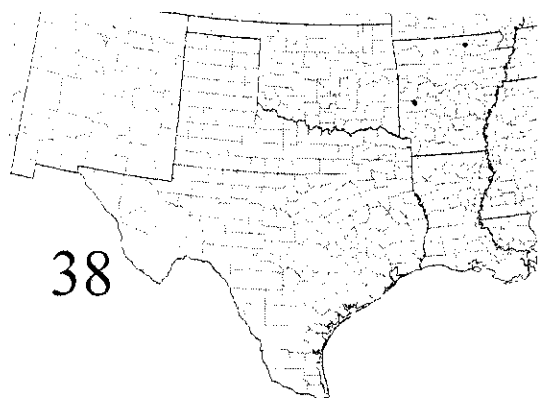
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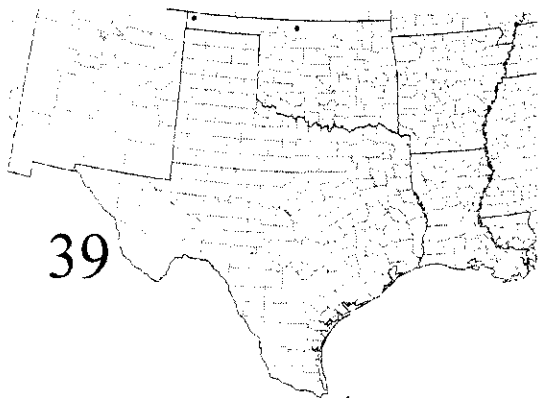
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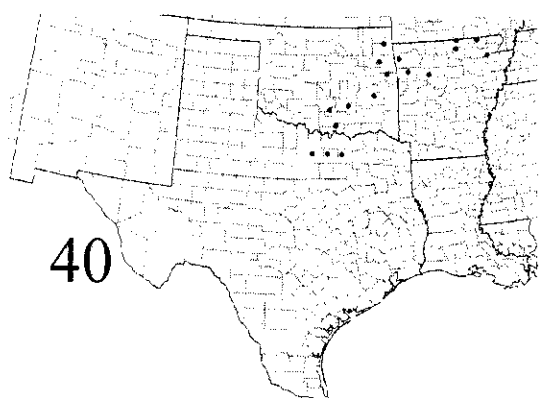
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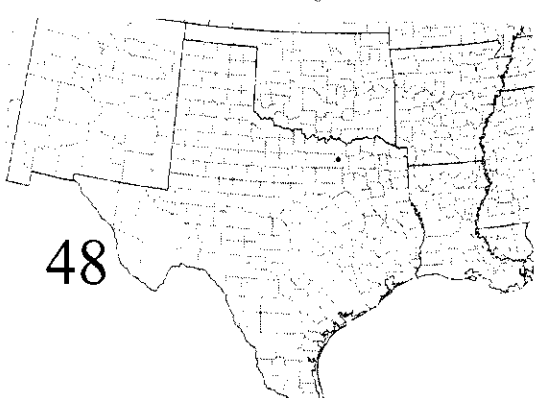
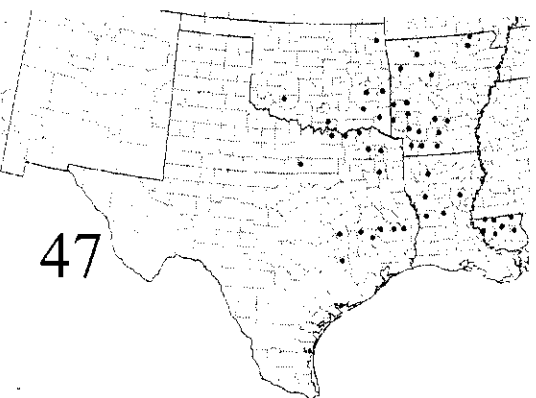
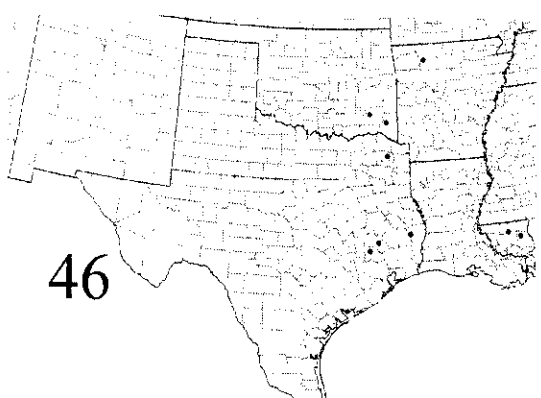
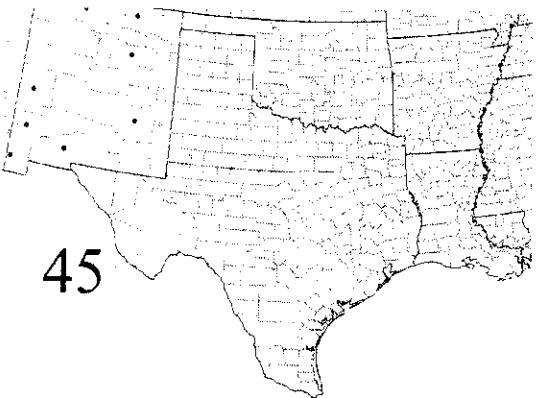
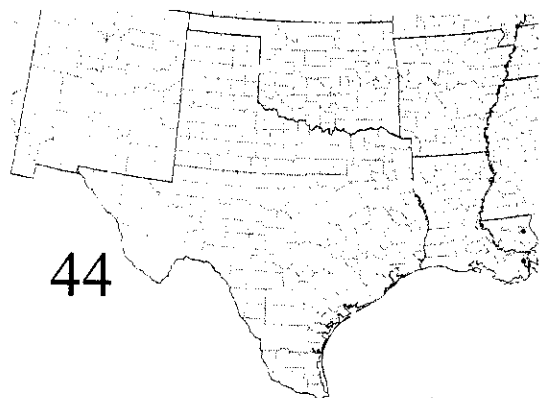
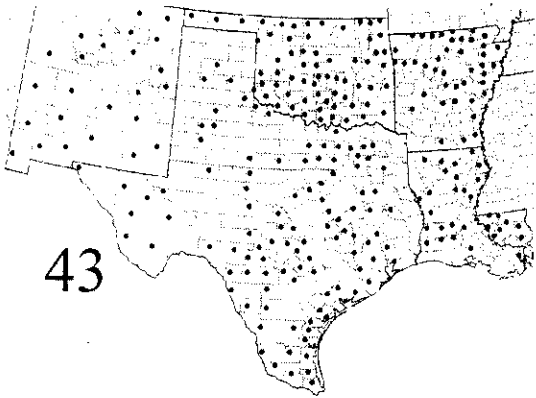
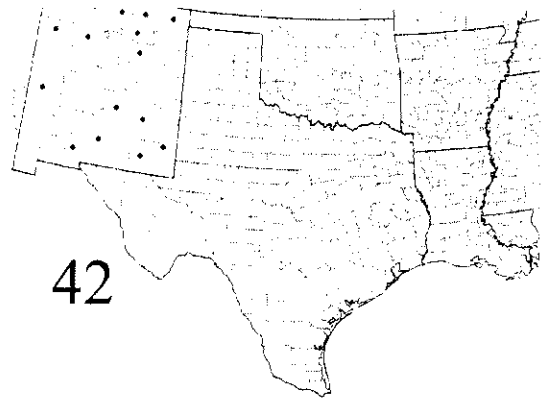
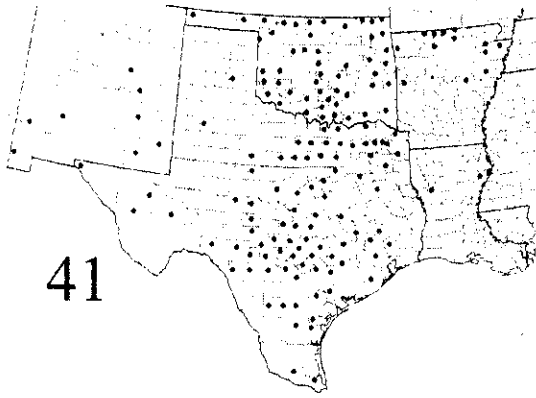


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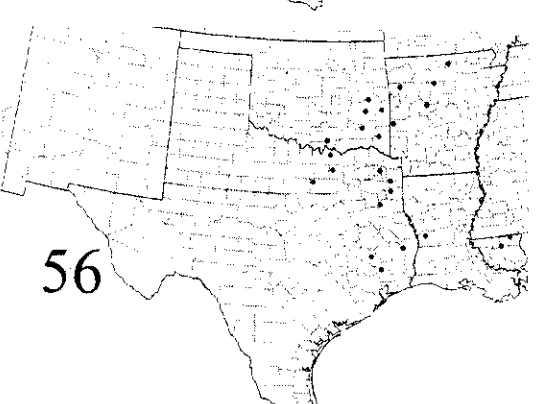
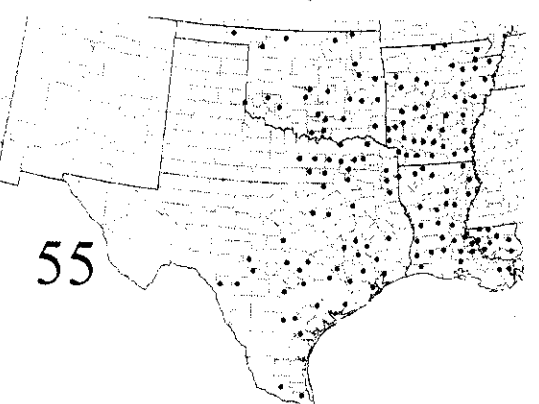
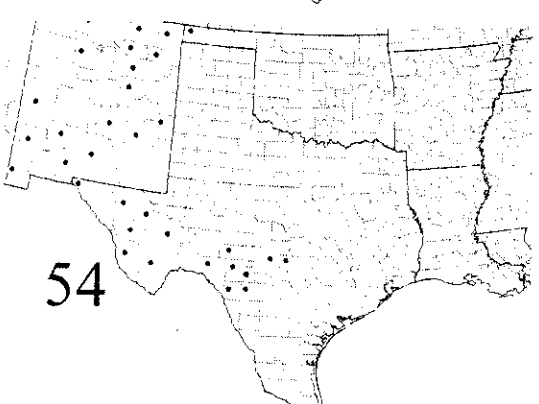
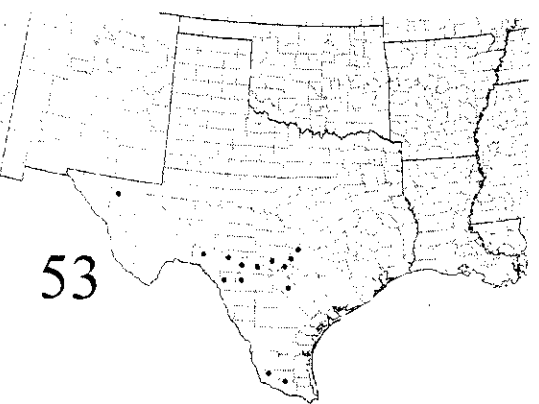
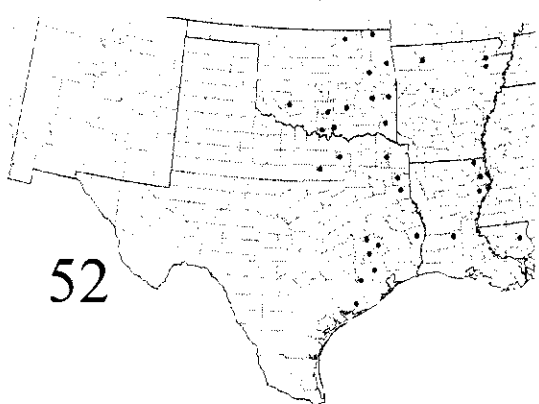
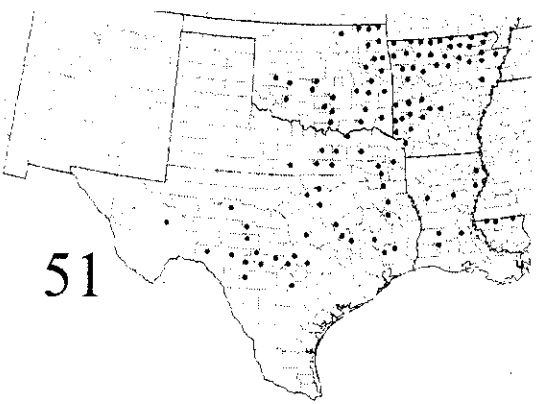
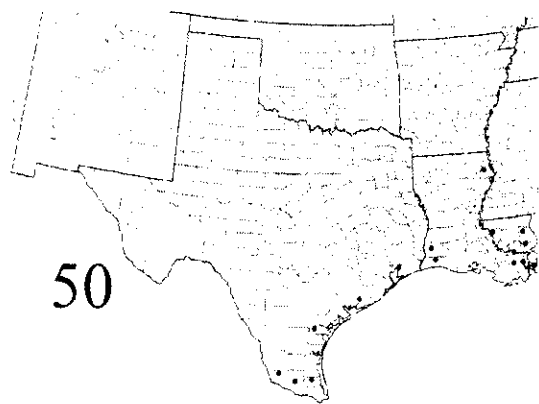
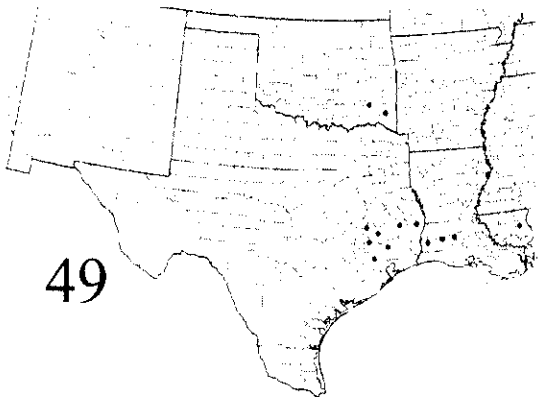


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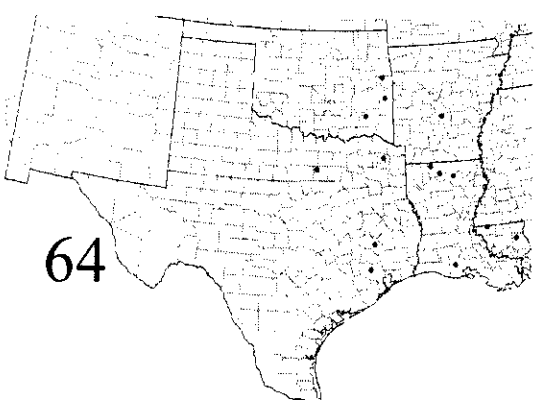
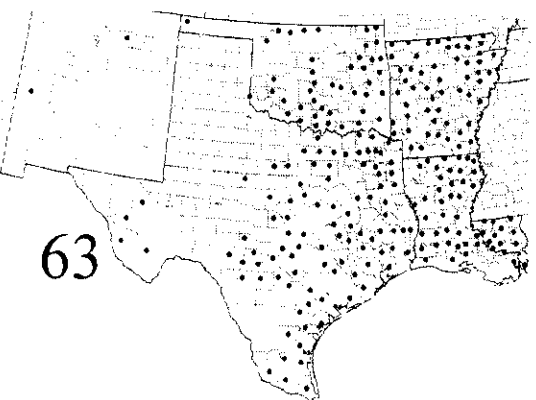
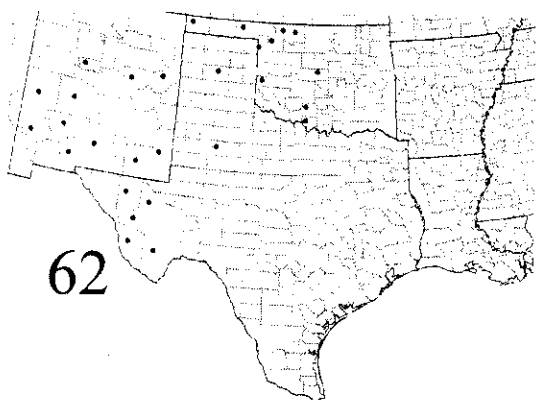
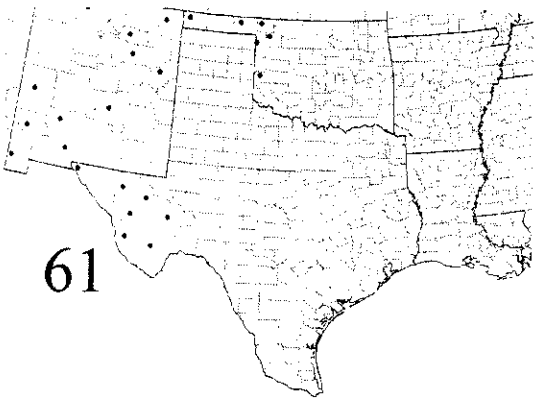
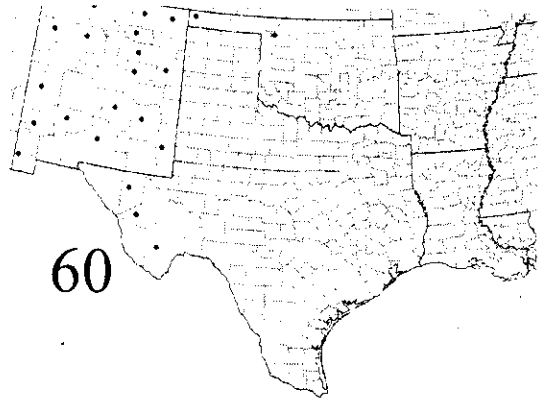
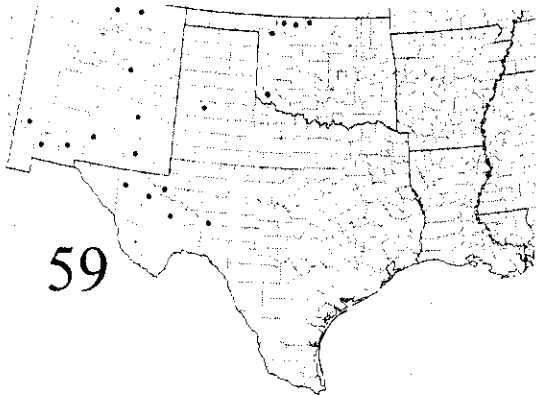
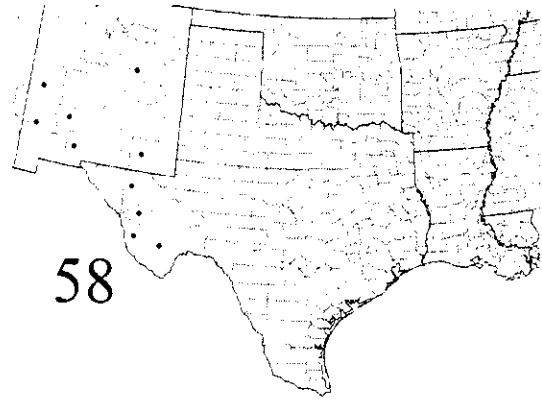
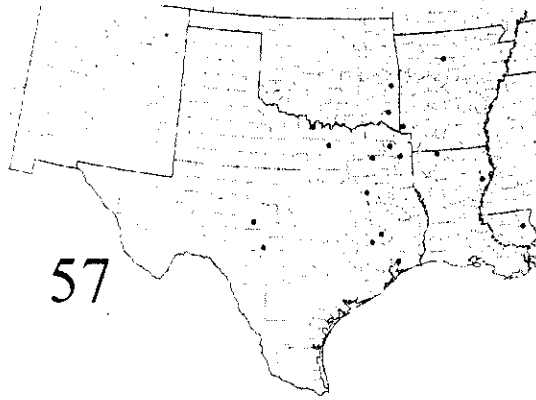
Maps. 41-48. Odonata distributions. 41. *Enallagma basidens*. 42. *E. boreale*. 43. *E. civile*. 44. *E. concisum*. 45. *E. cyathigerum*. 46. *E. daeckii*. 47. *E. divagans*. 48. *E. doubledayi*.



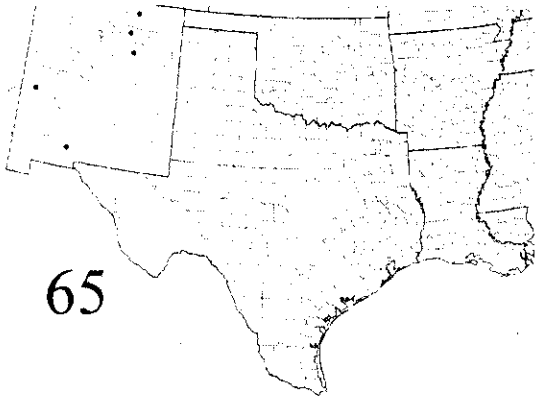
Maps. 49-56. Odonata distributions. 49. *Enallagma dubium*. 50. *E. durum*. 51. *E. exsulans*. 52. *E. geminatum*. 53. *E. novaehispaniae*. 54. *E. praevarum*. 55. *E. signatum*. 56. *E. traviatum westfalli*.



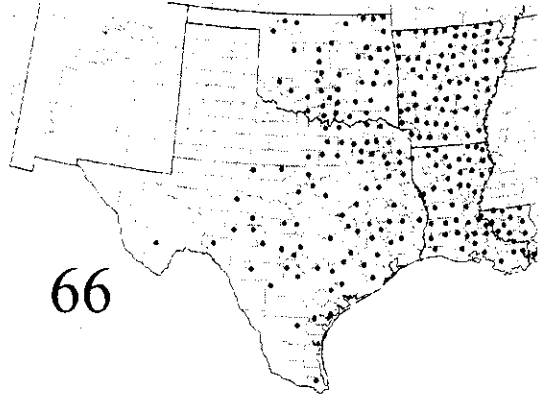
Maps. 57-64. Odonata distributions. 57. *Enallagma vesperum*. 58. *Hesperagrion heterodoxum*. 59. *Ischnura barberi*. 60. *I. damula*. 61. *I. demorsa*. 62. *I. denticollis*. 63. *I. hastata*. 64. *I. kellicotti*.



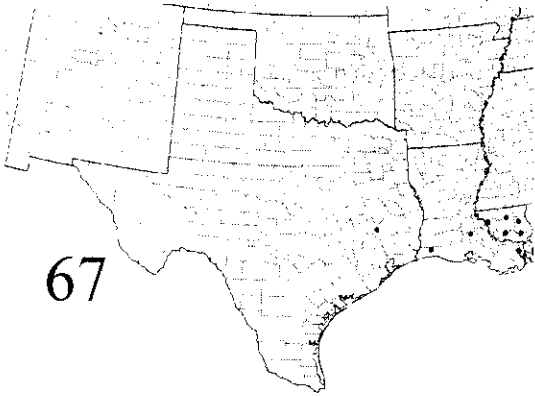
Maps. 65-72. Odonata distributions. 65. *Ischnura parparva*. 66. *I. posita*. 67. *I. prognata*. 68. *I. ramburii*. 69. *I. verticalis*. 70. *Nehalennia integricollis*. 71. *Neoerythromma cultellatum*. 72. *Telebasis byersi*.



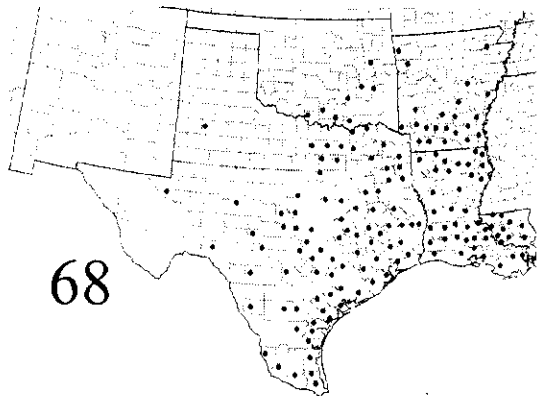
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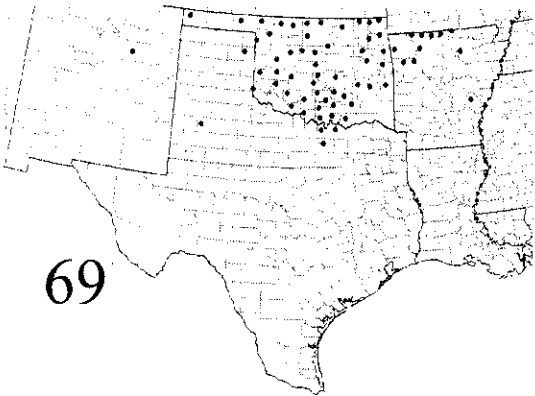
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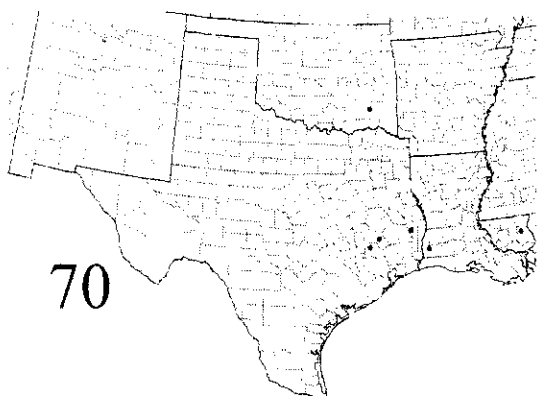
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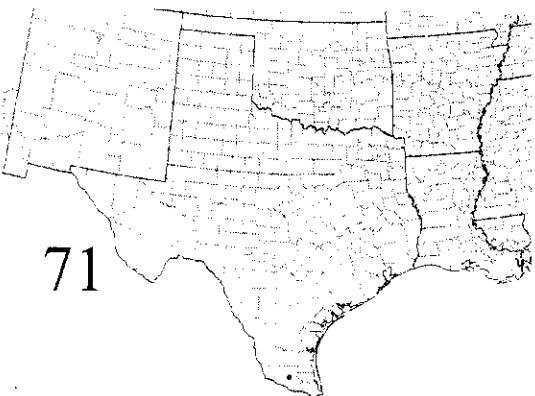
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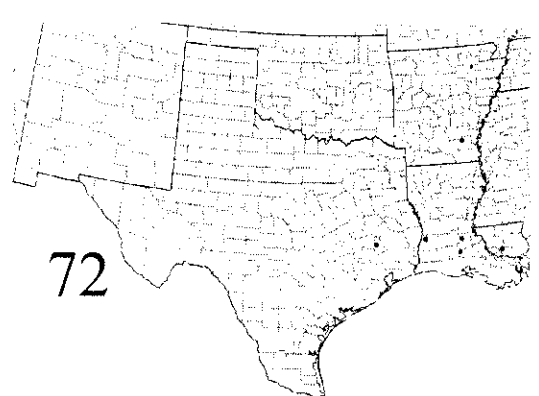
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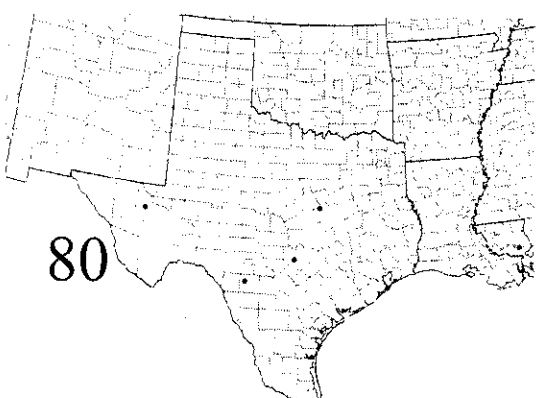
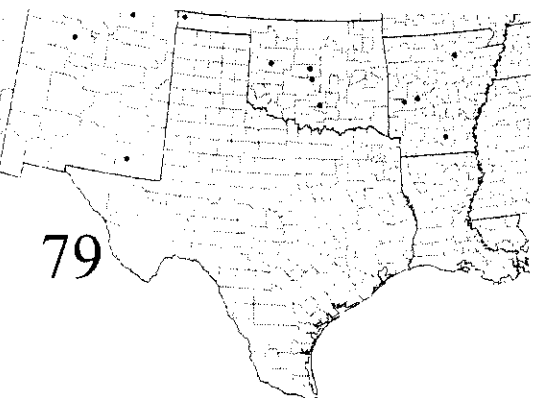
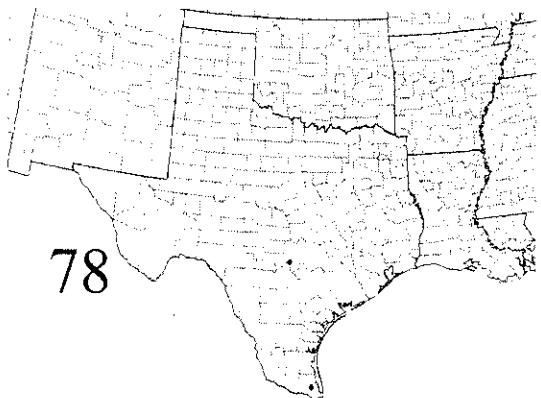
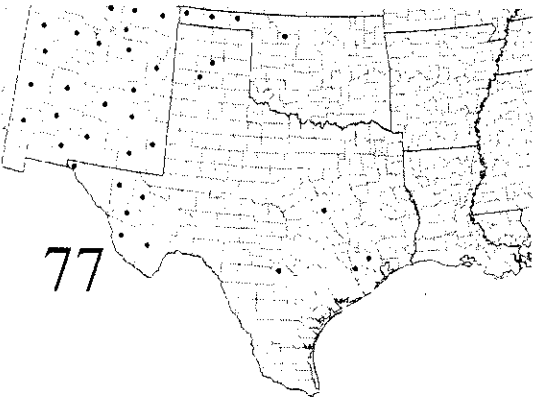
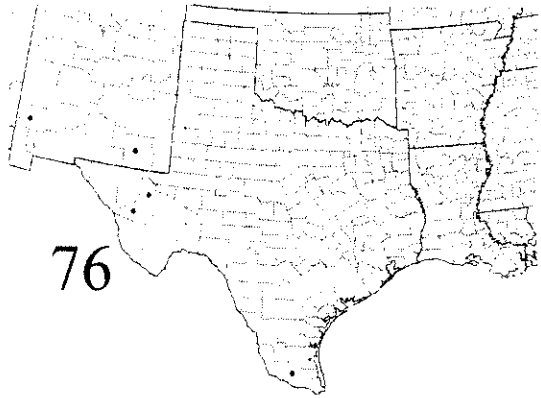
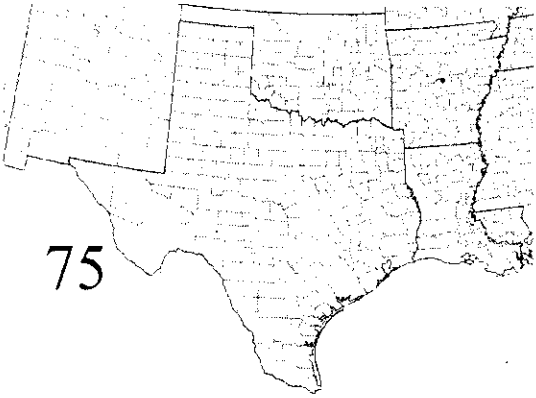
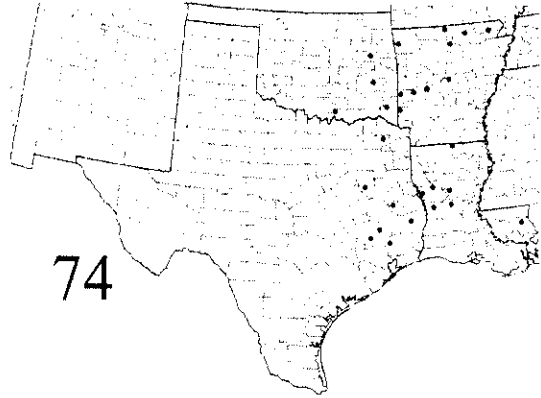
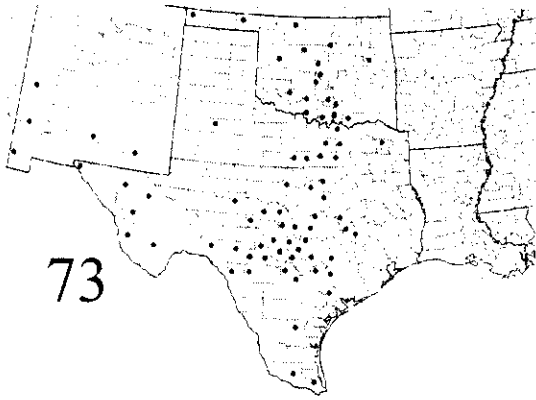


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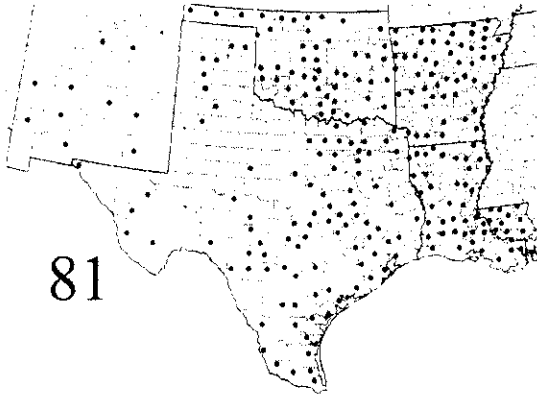


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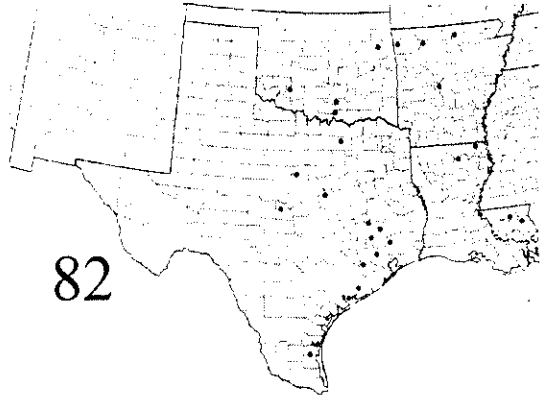
Maps. 73-80. Odonata distributions. 73. *Telebasis salva*. 74. *Tachopteryx thoreyi*. 75. *Aeshna constricta*. 76. *A. dugesi*. 77. *A. multicolor*. 78. *A. psilus*. 79. *A. umbrosa*. 80. *Anax amazili*.



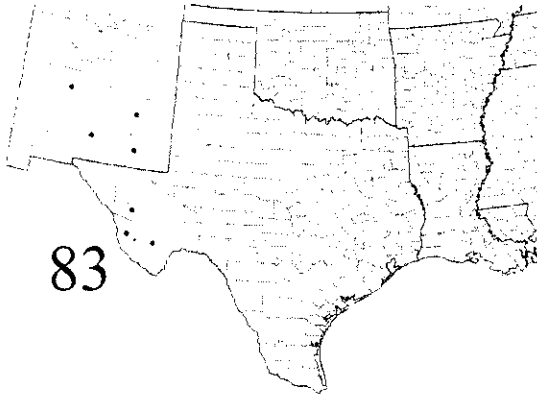
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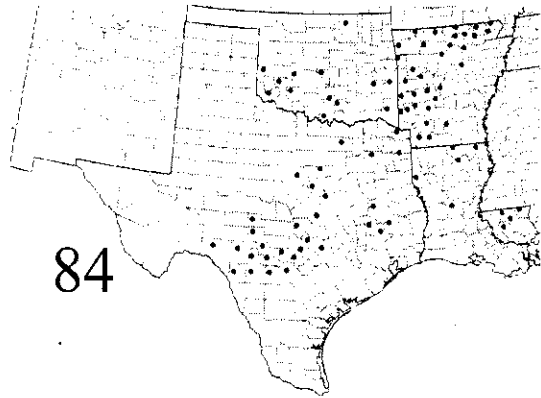
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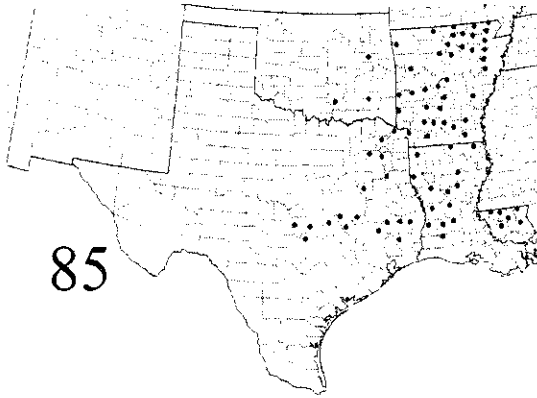
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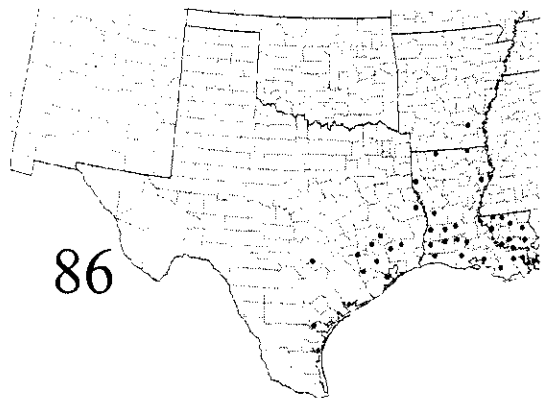
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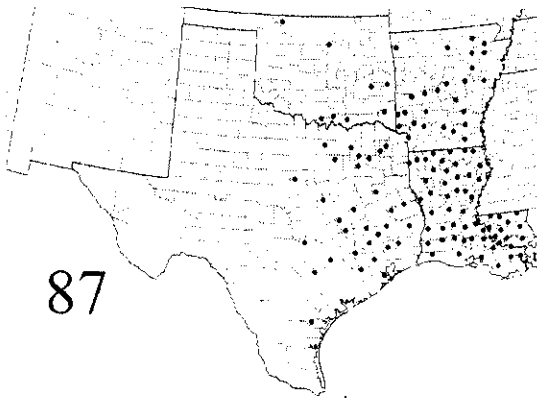
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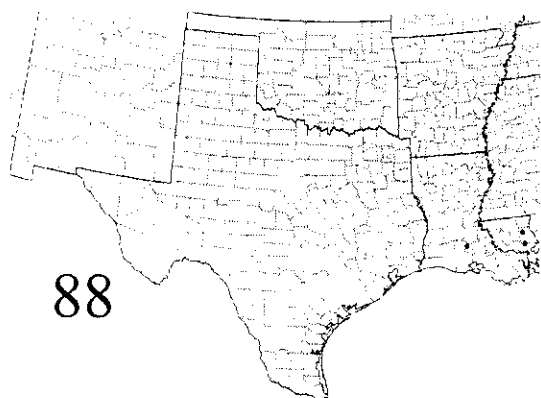
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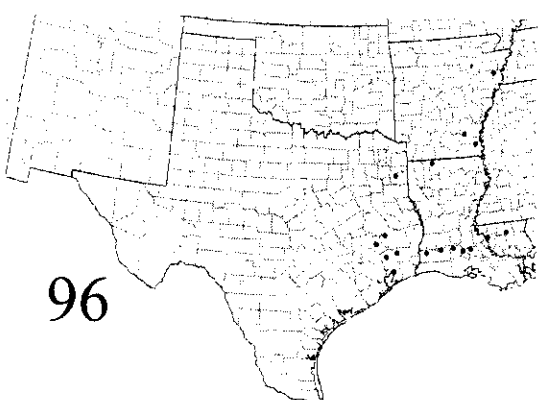
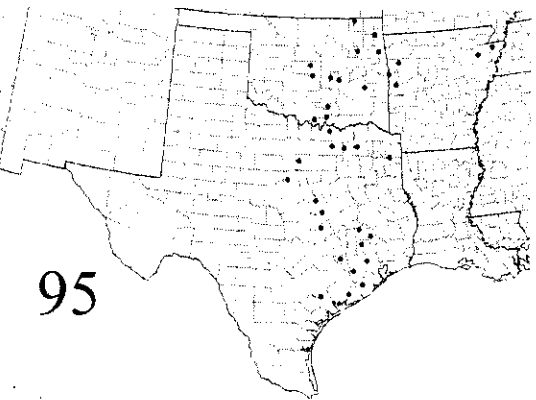
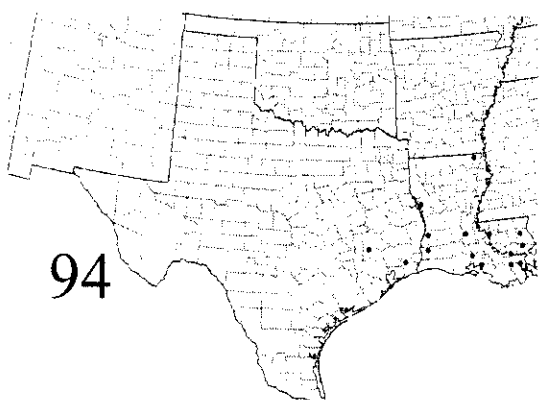
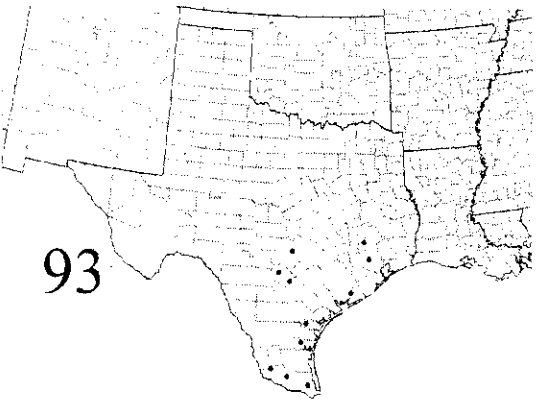
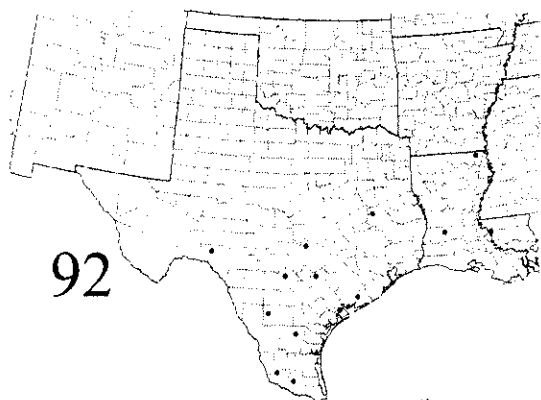
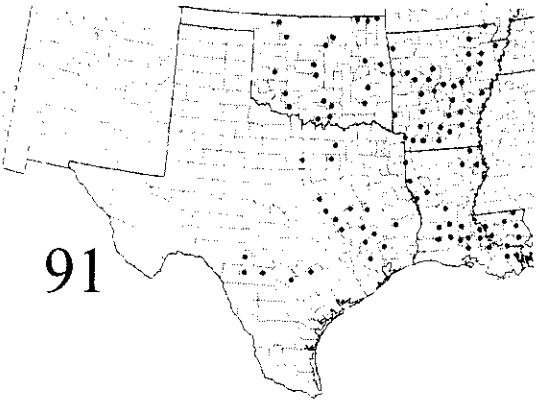
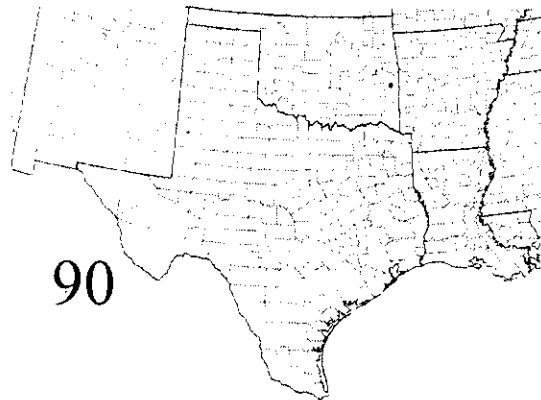
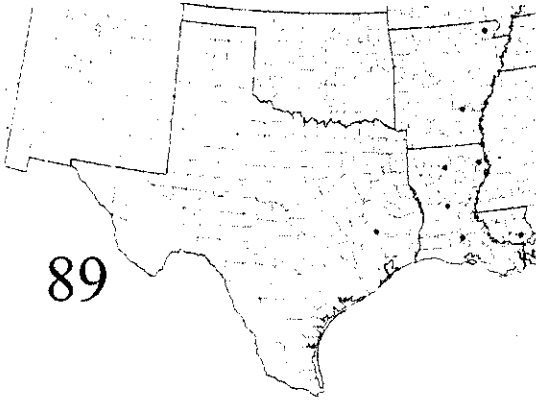


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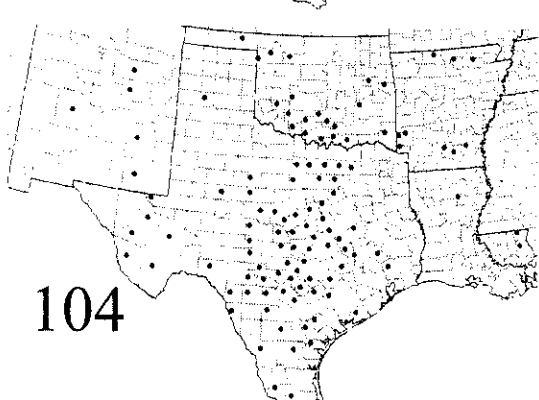
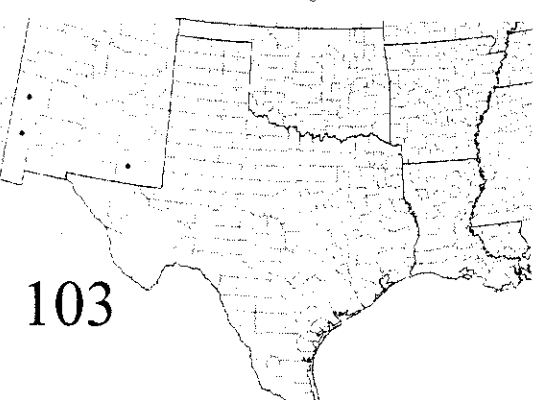
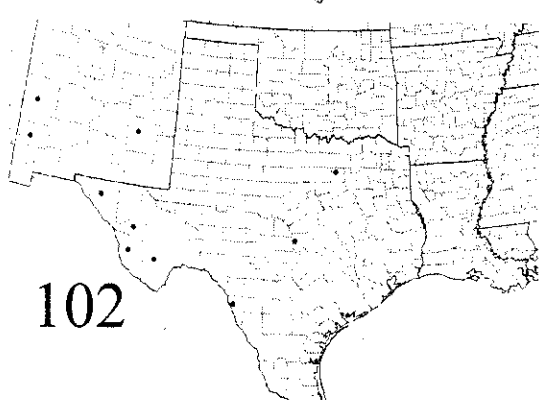
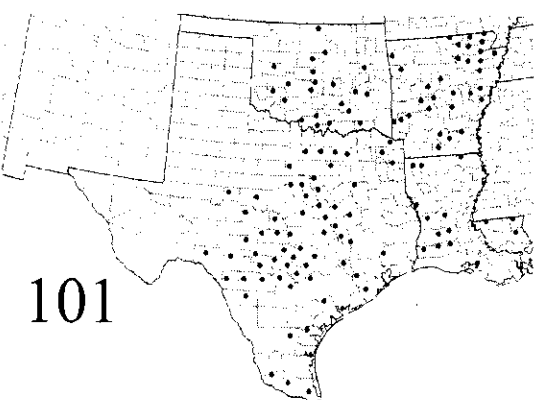
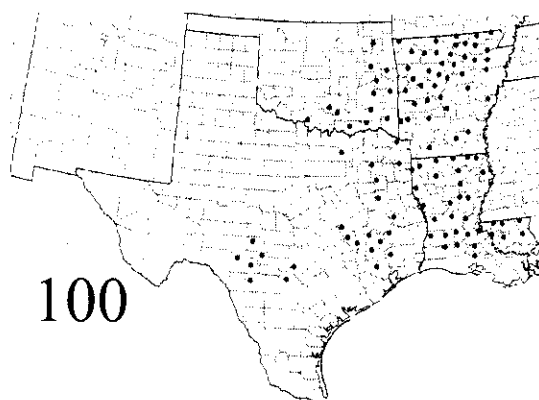
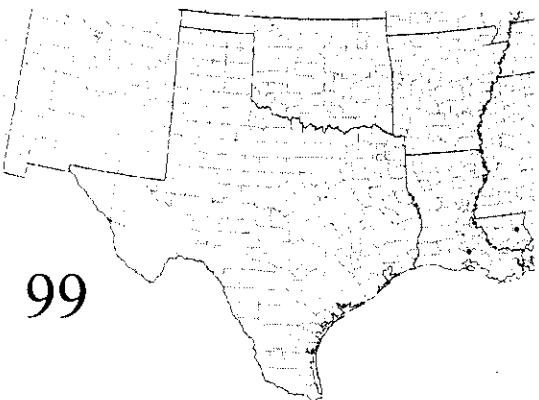
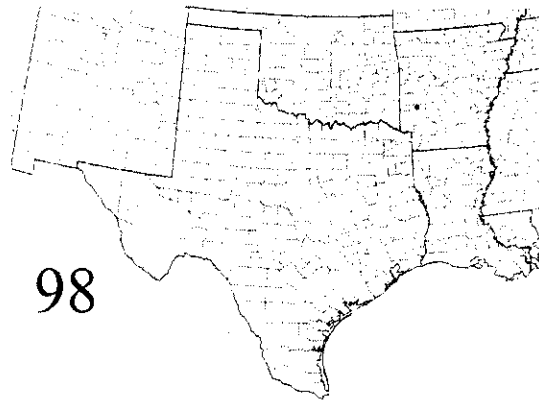
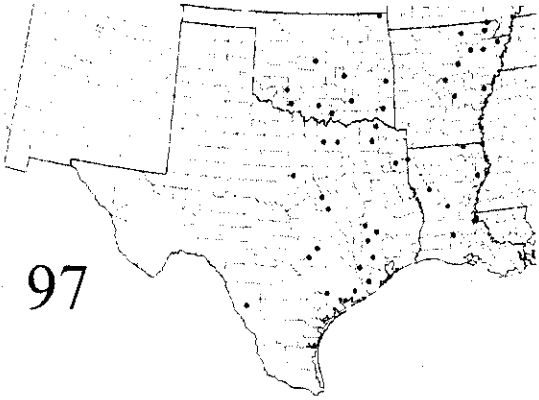


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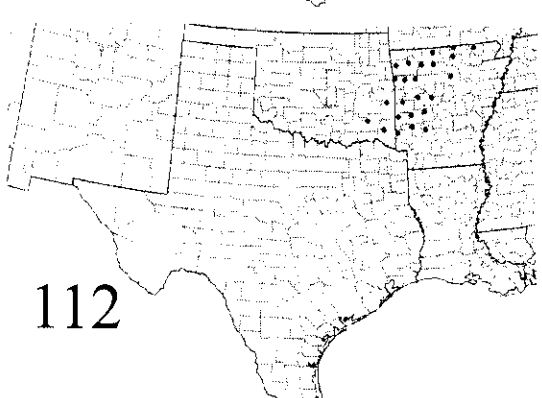
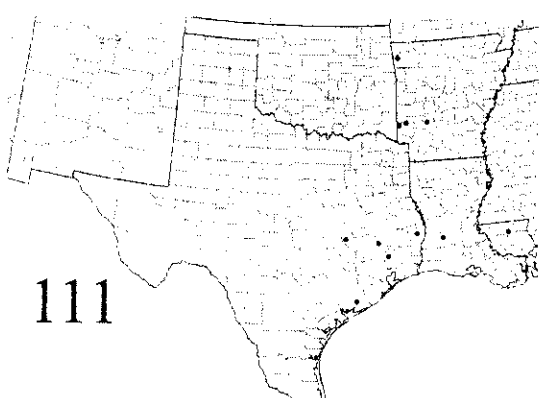
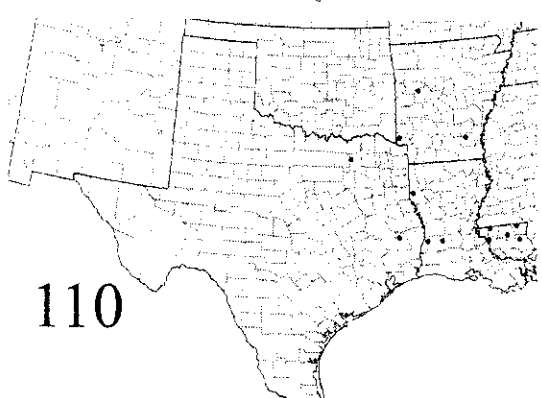
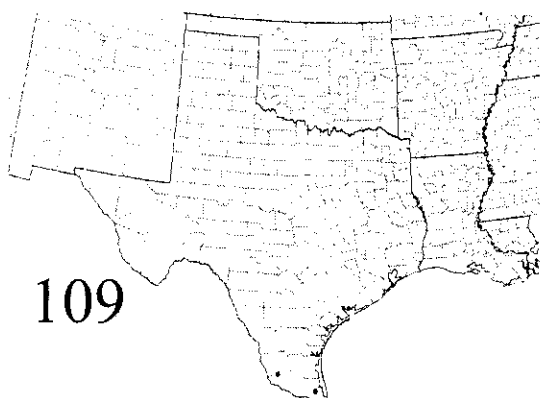
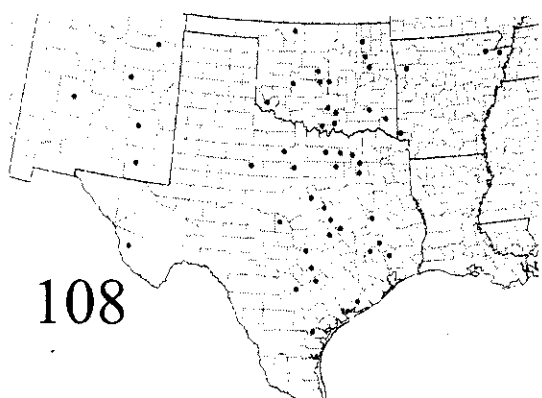
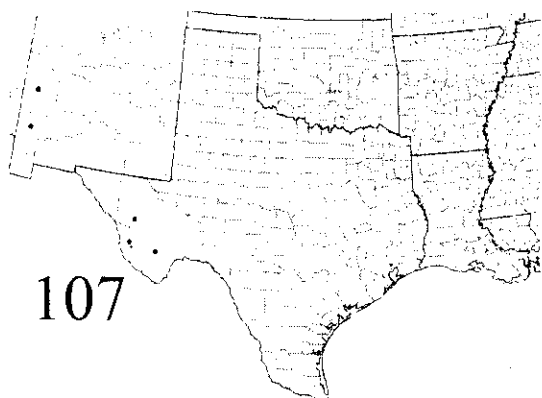
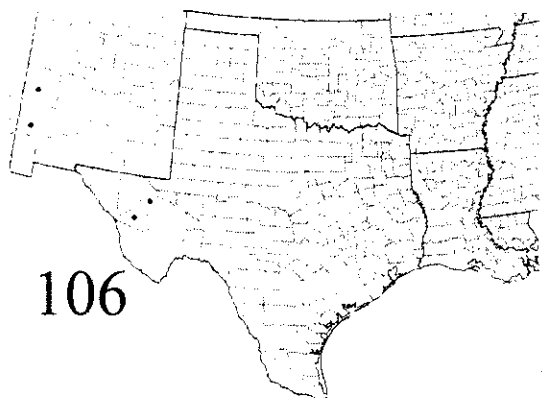
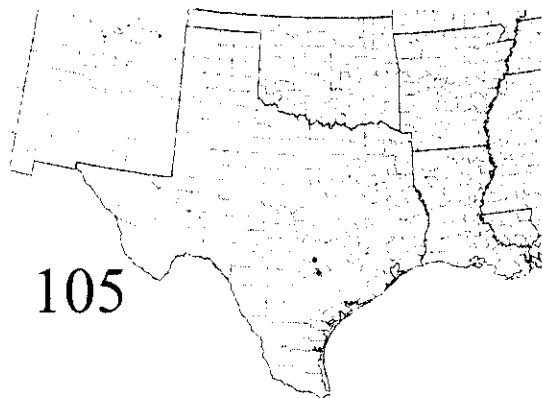
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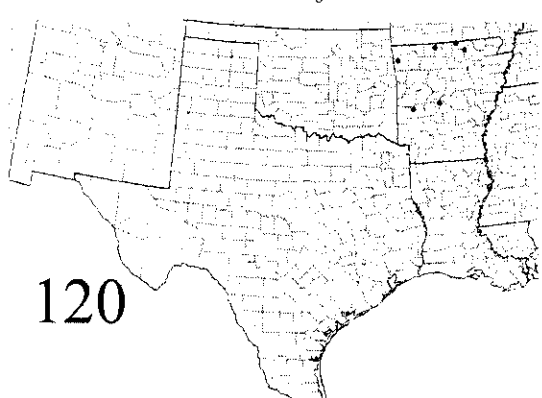
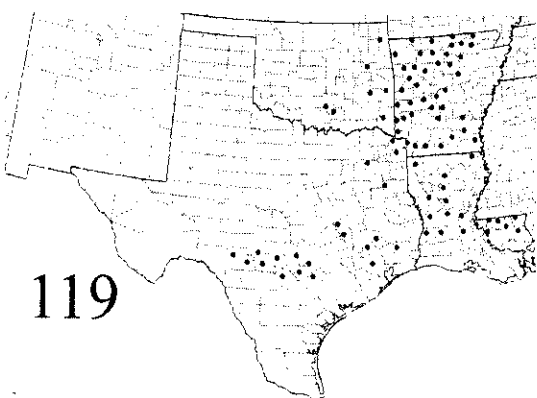
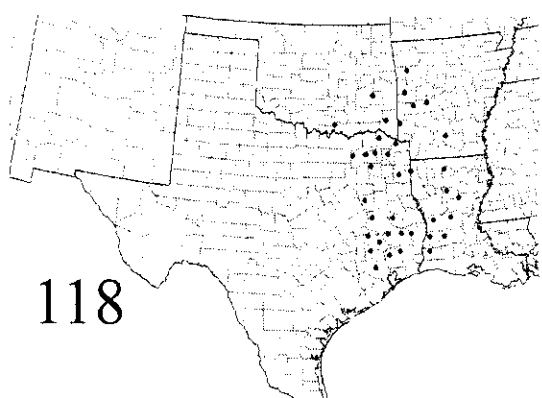
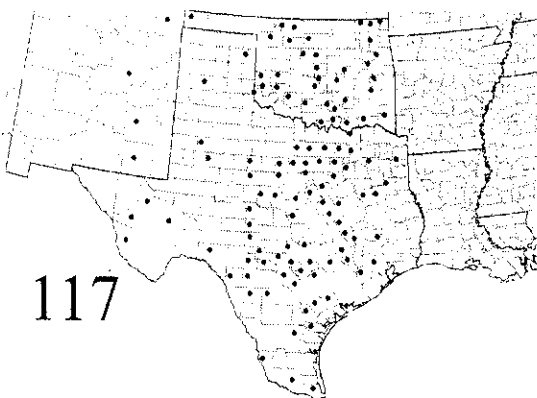
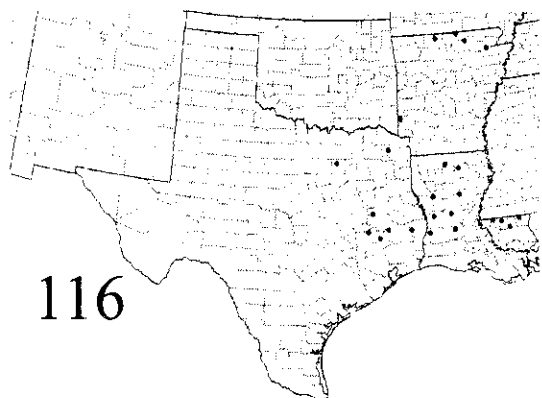
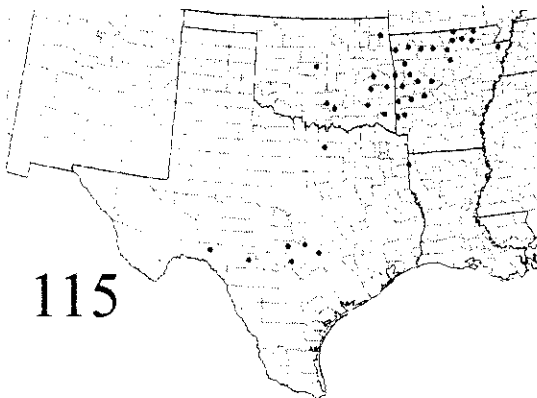
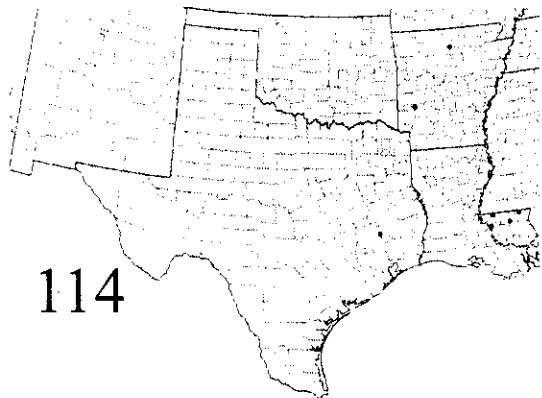
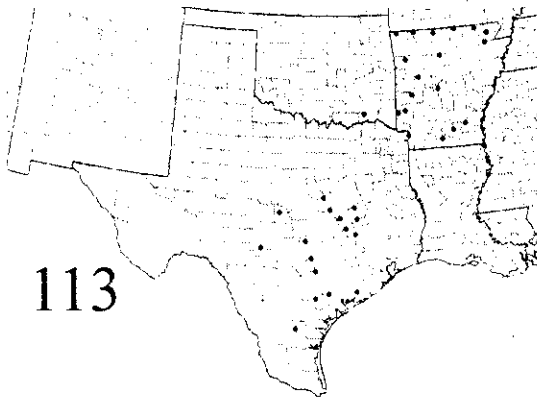
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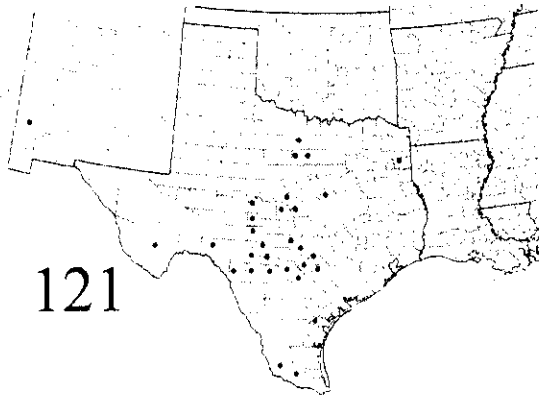
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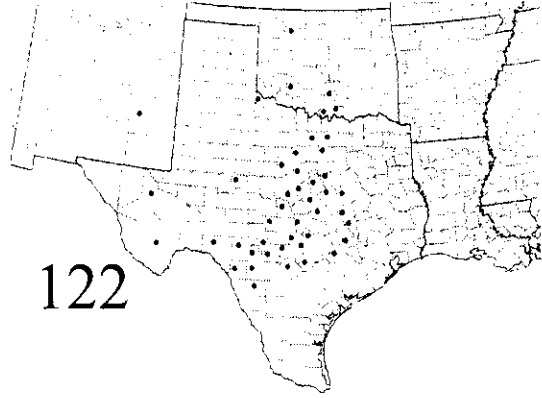
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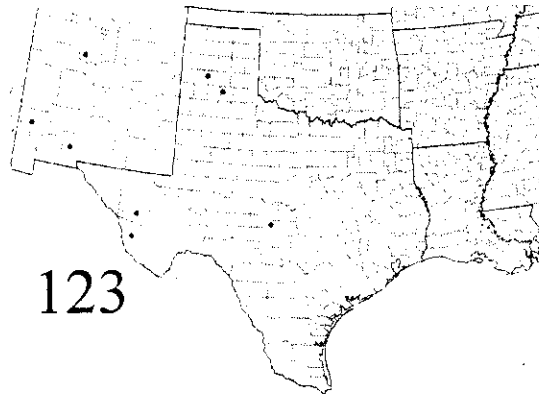
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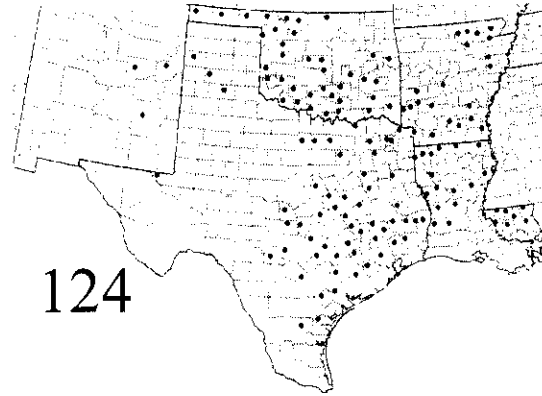
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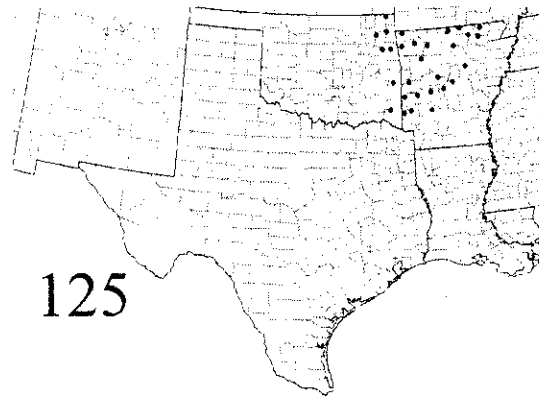
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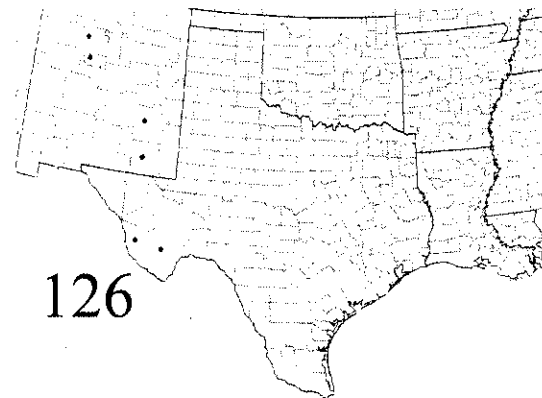
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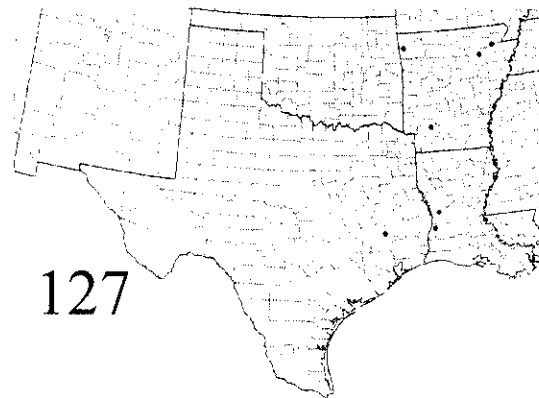
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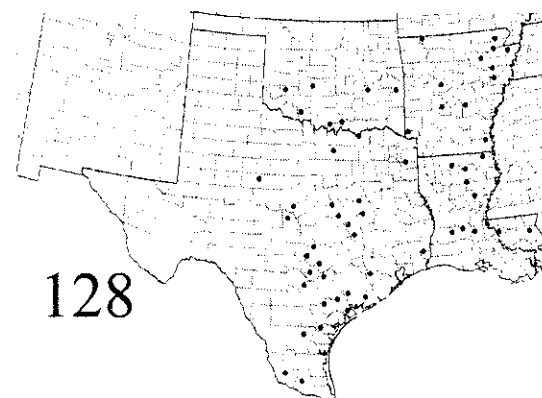
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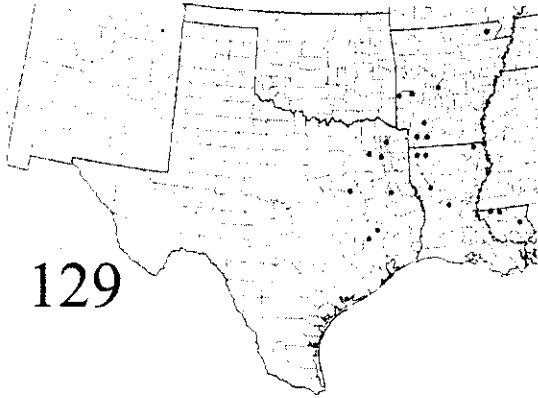


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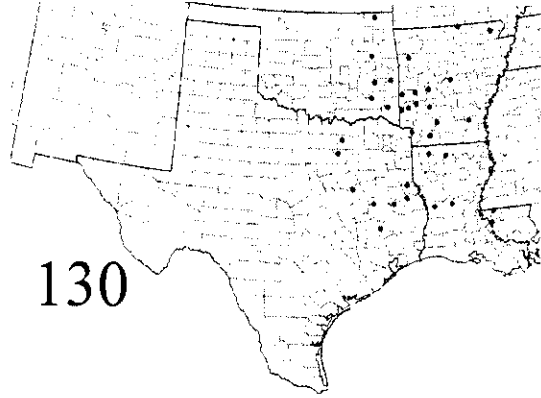


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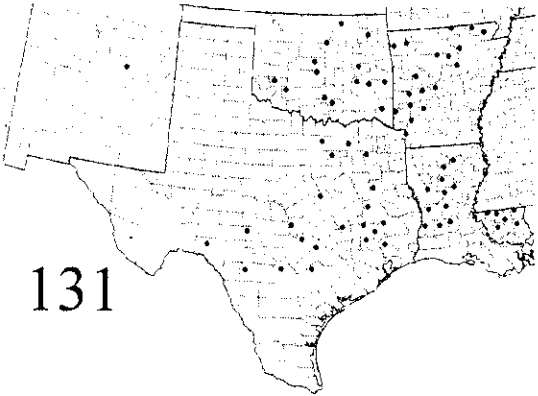
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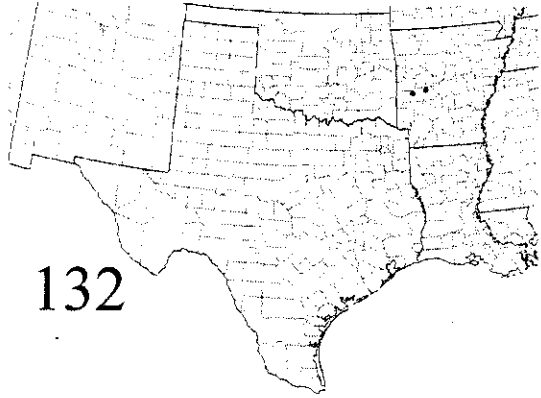
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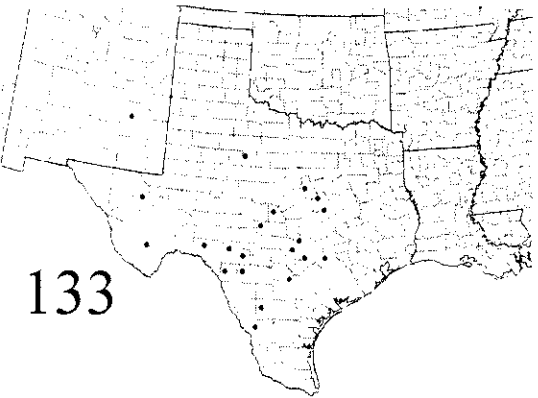
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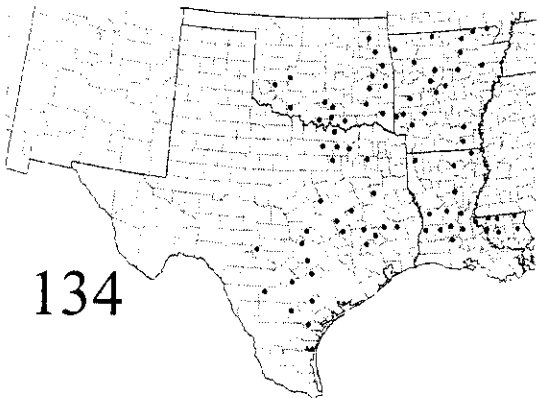
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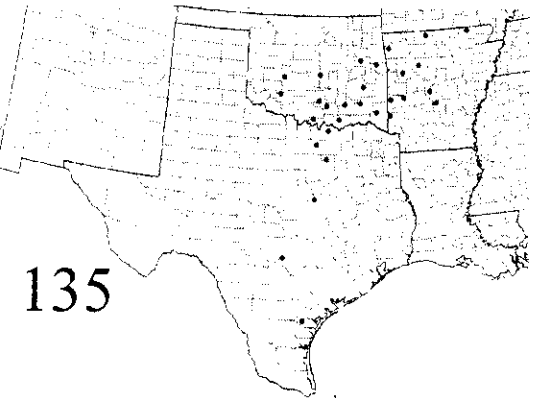
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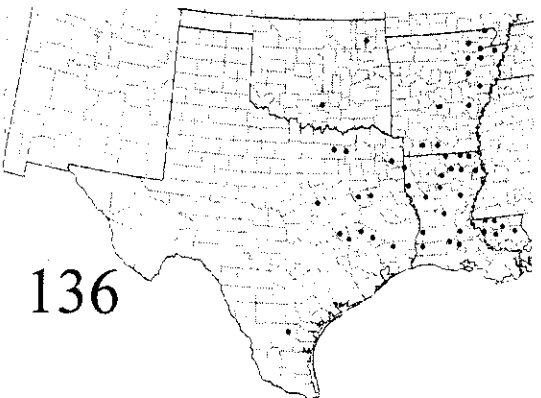
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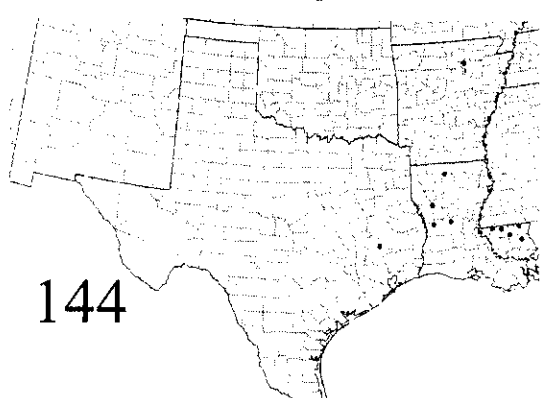
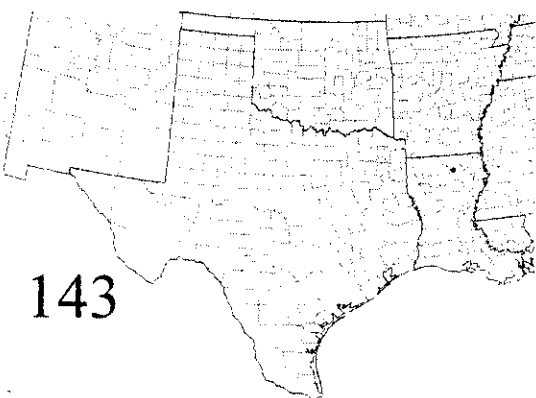
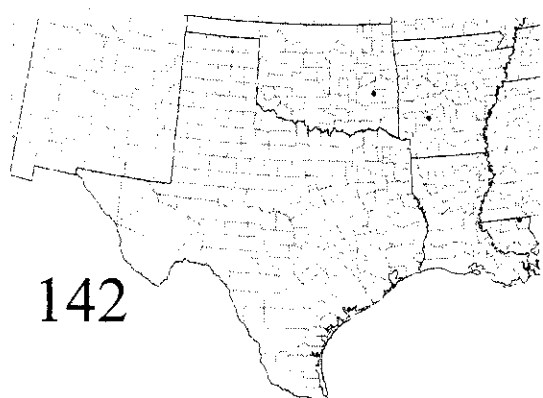
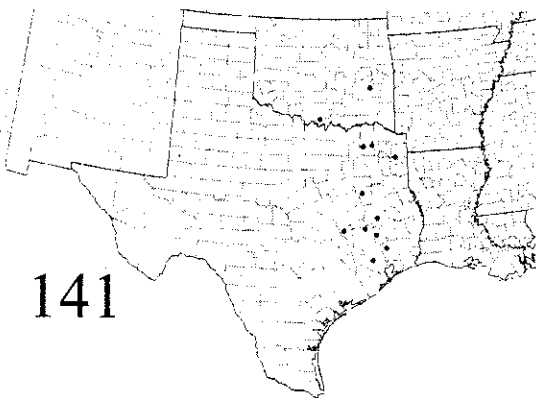
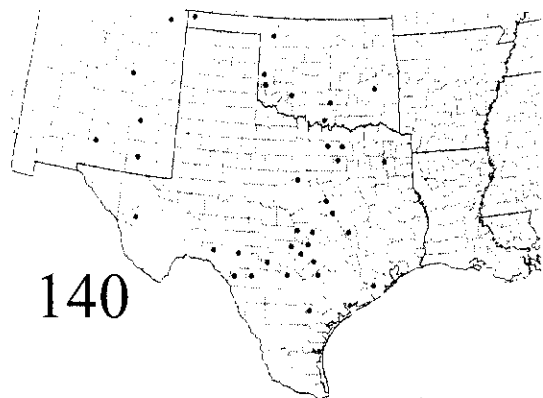
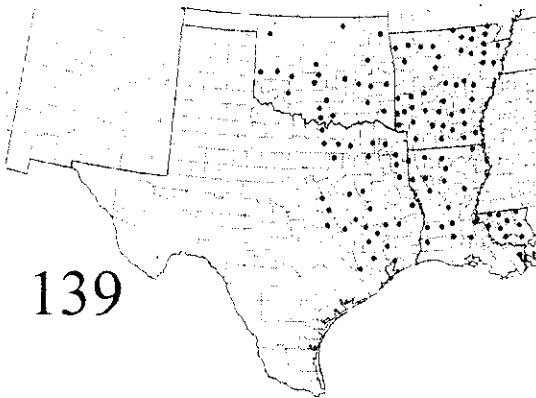
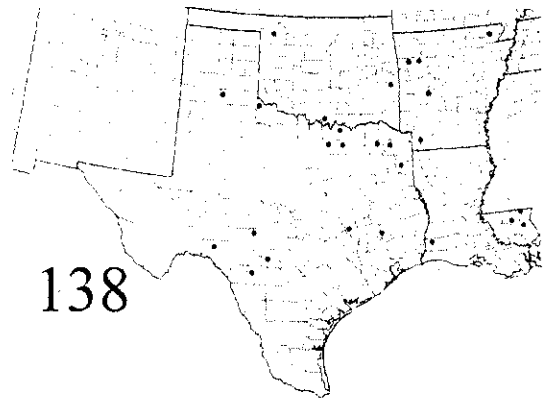
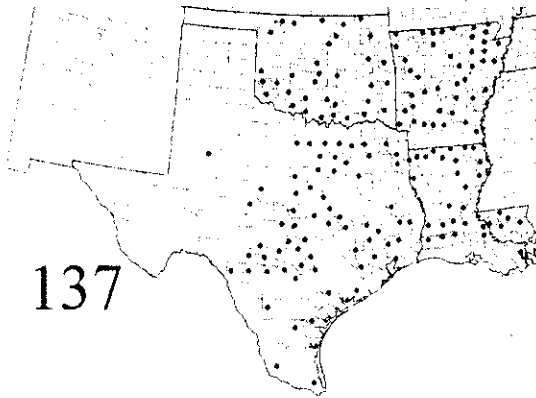


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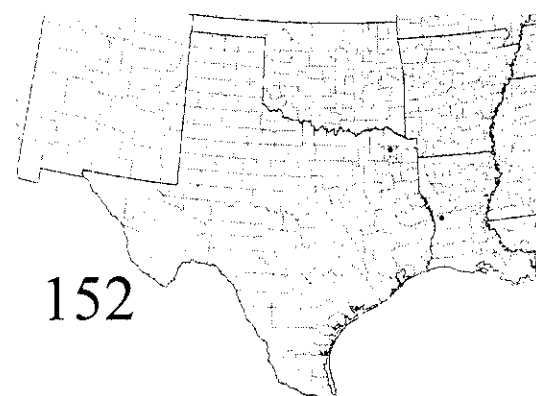
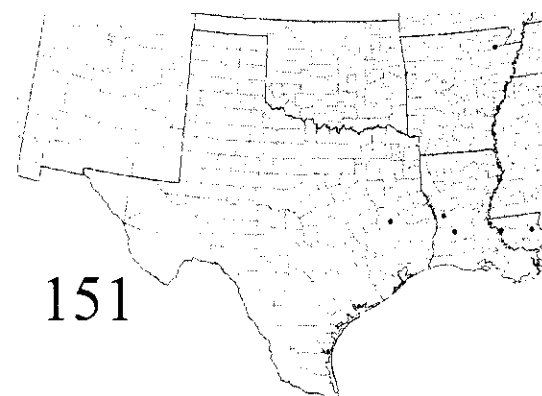
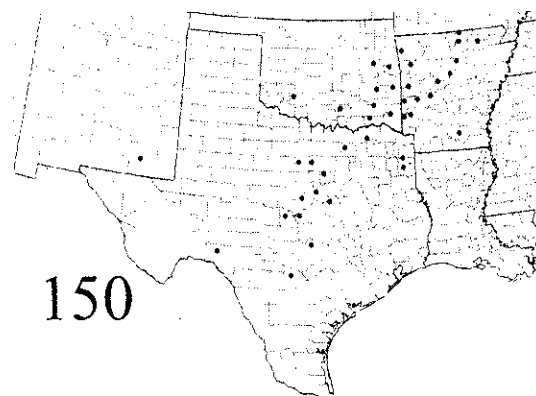
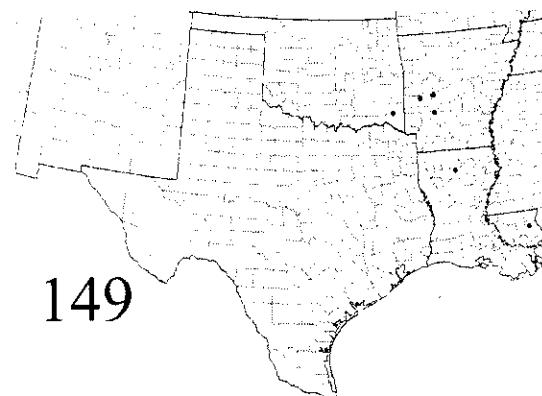
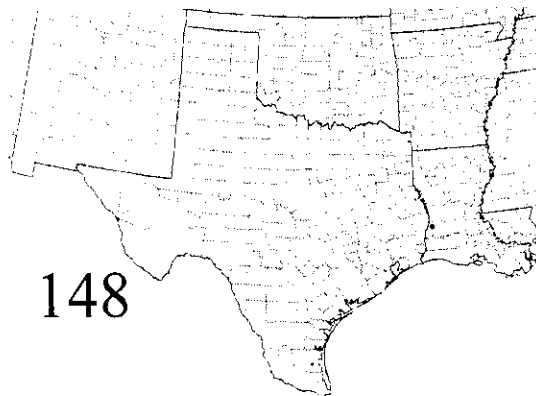
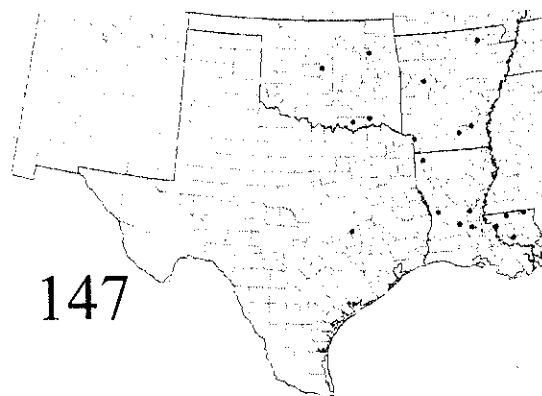
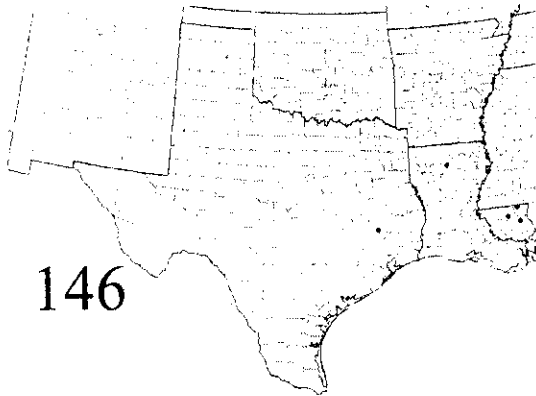
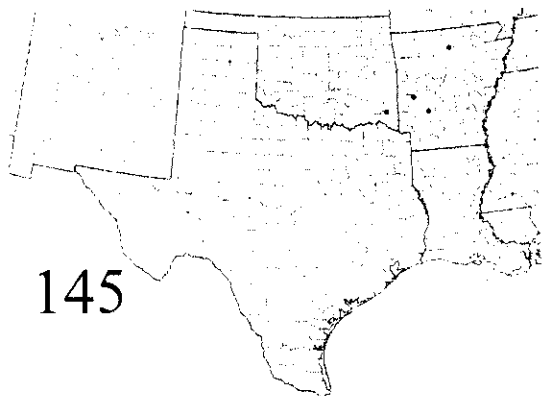


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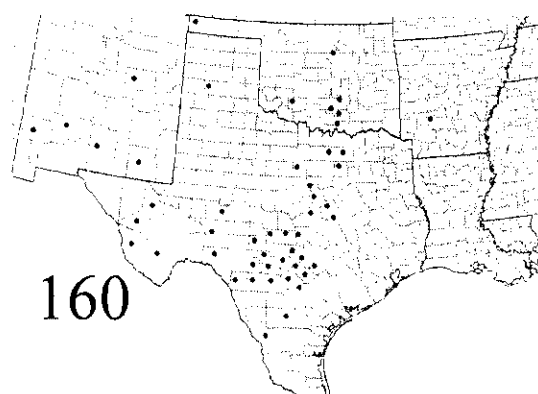
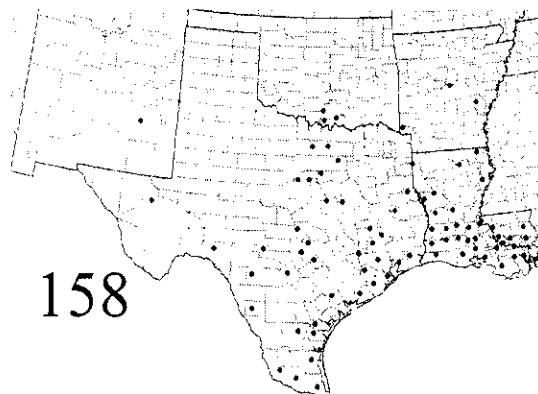
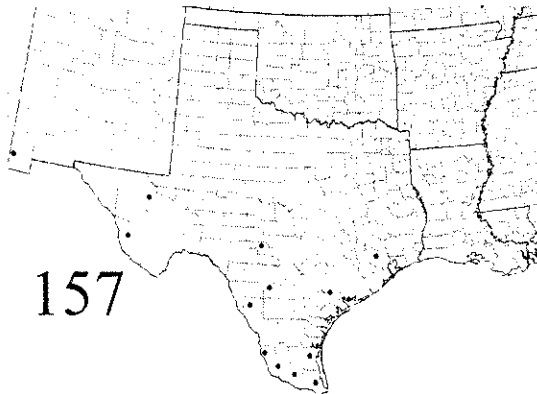
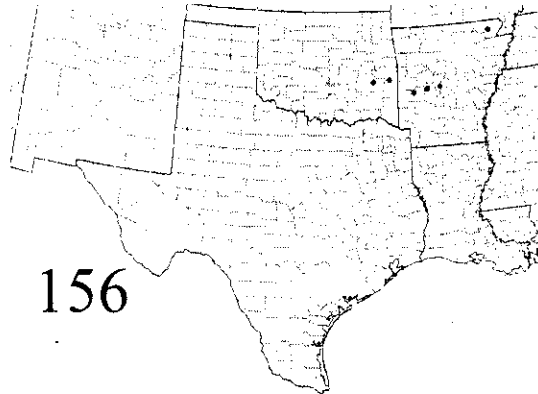
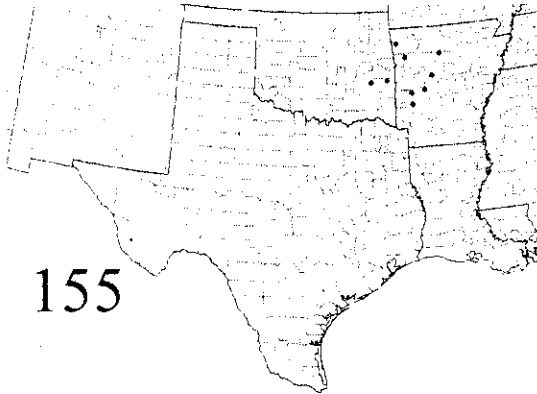
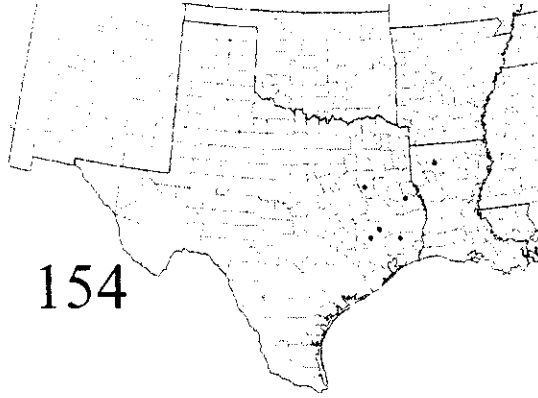
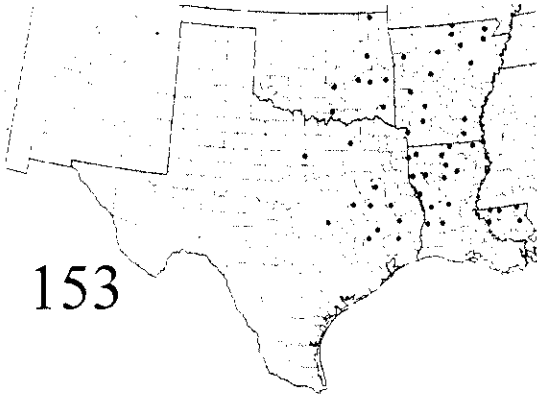
Maps. 137-144. Odonata distributions. 137. *Epithea princeps*. 138. *E. costalis*. 139. *E. cynosura*. 140. *E. petechialis*. 141. *E. semiaquea*. 142. *E. spinosa*. 143. *E. stella*. 144. *Helocordulia selysii*.



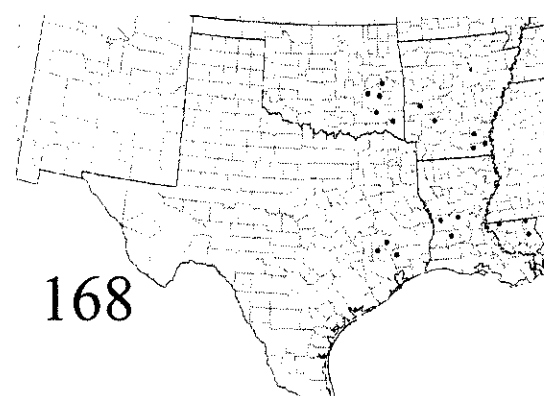
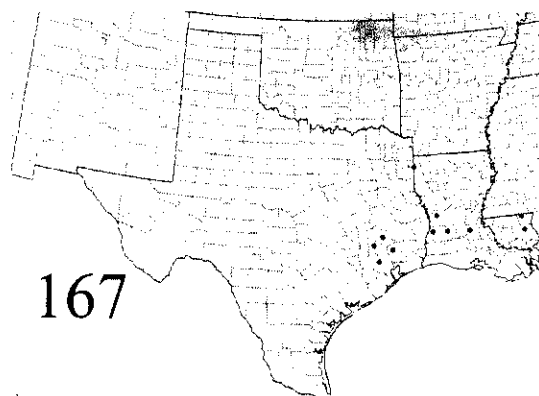
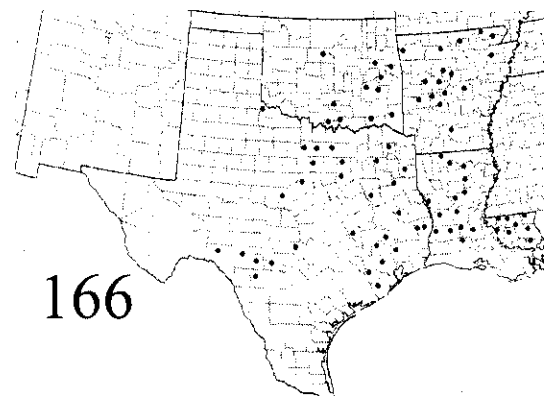
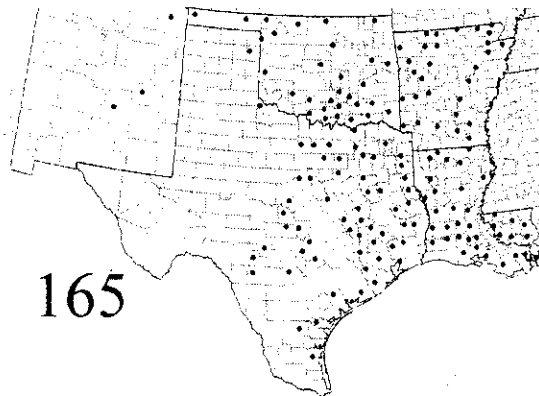
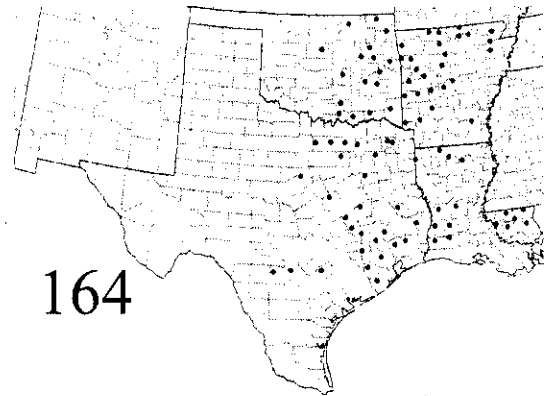
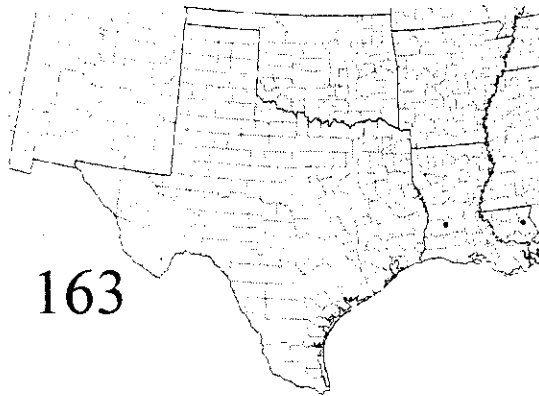
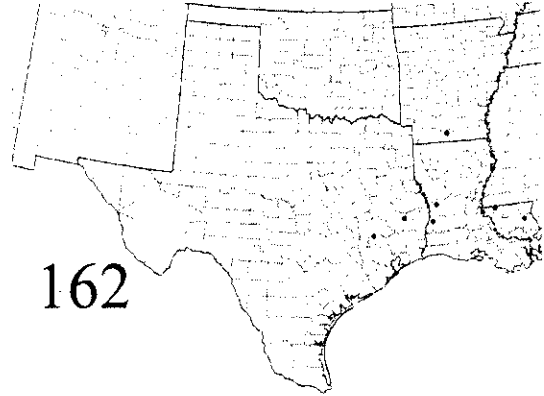
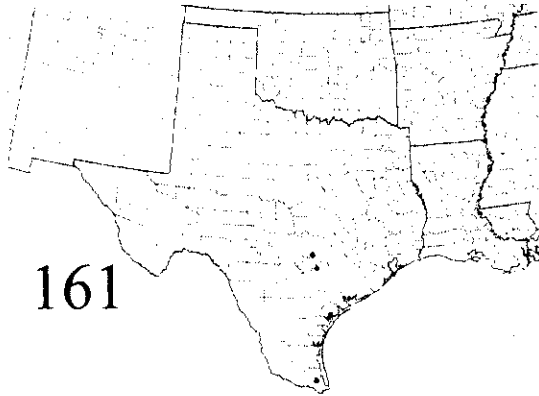
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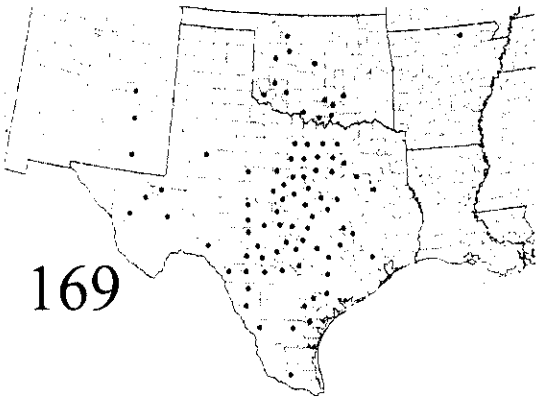
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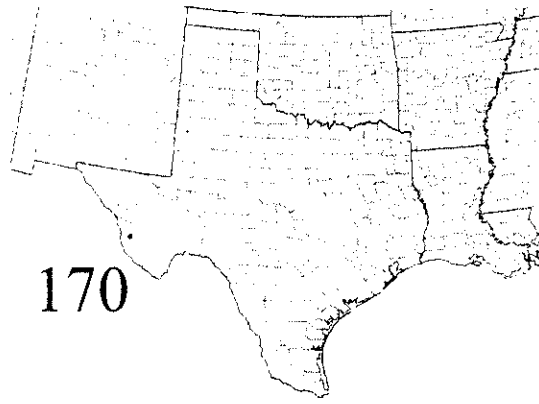
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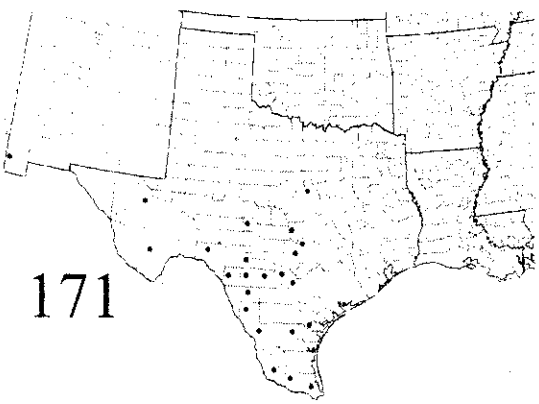
Maps. 169-176. Odonata distributions. 169. *Dythemis fugax*. 170. *D. maya*. 171. *D. nigrescens*. 172. *D. velox*. 173. *Erythemis collocata*. 174. *E. plebeja*. 175. *E. simplicicollis*. 176. *E. vesiculosa*.



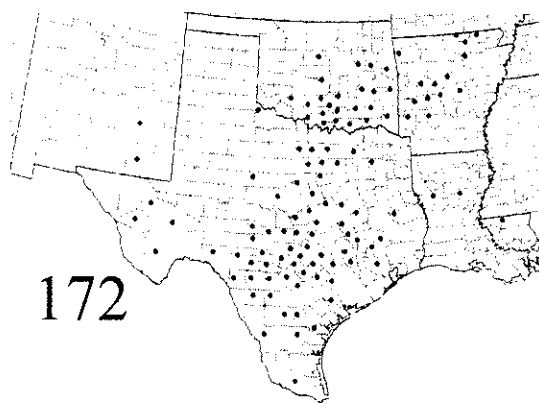
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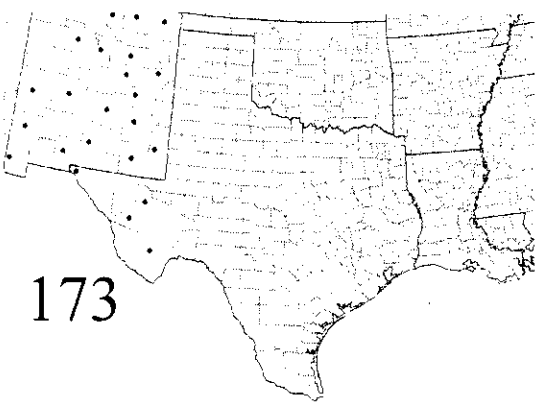
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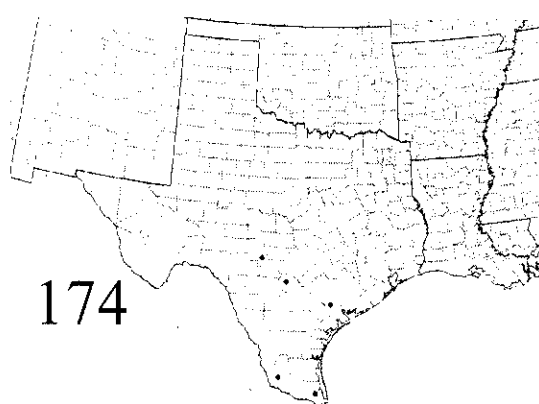
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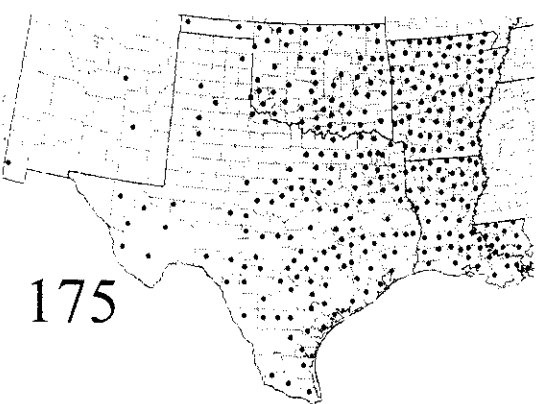
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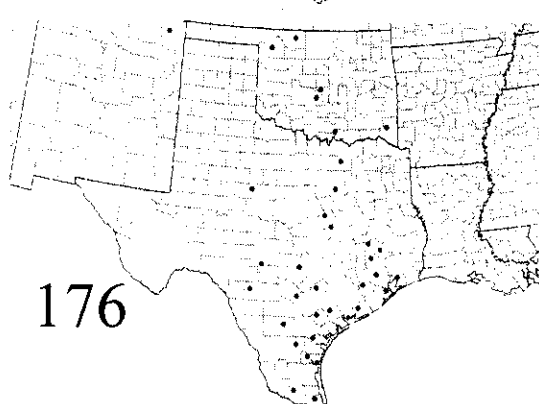
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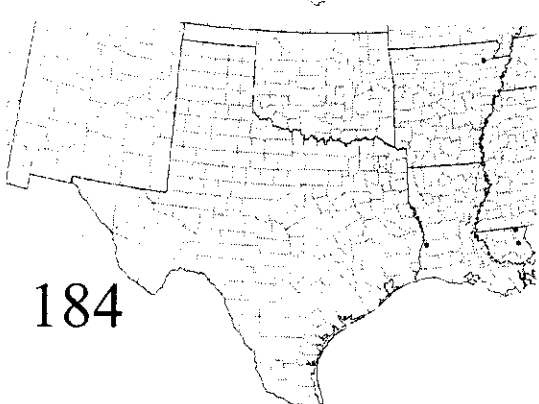
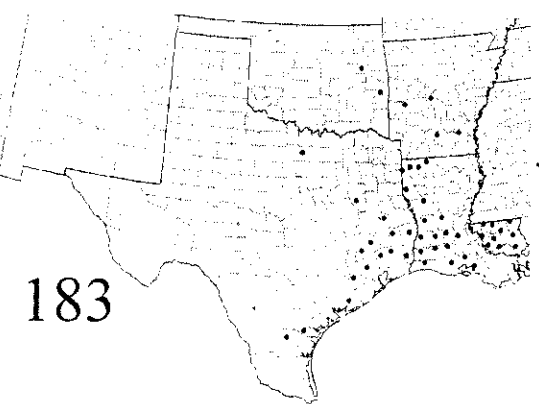
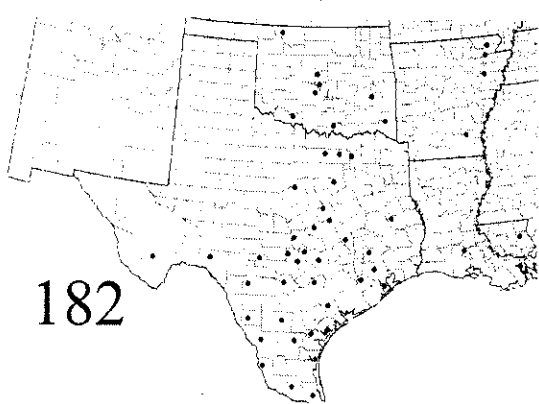
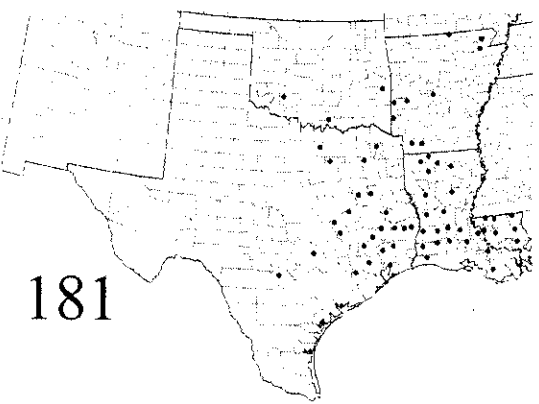
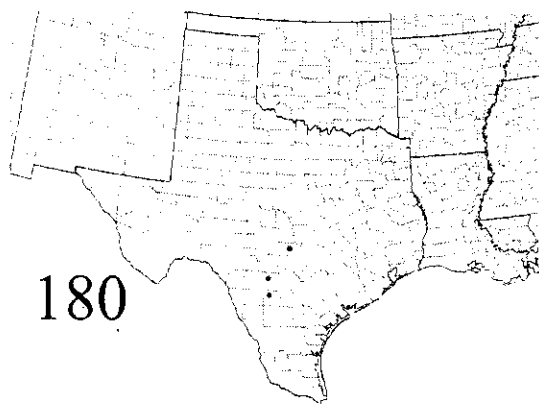
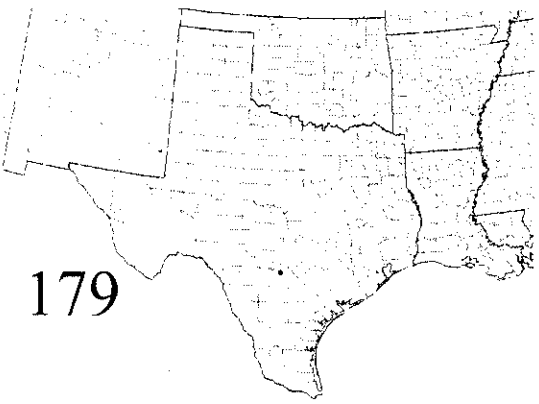
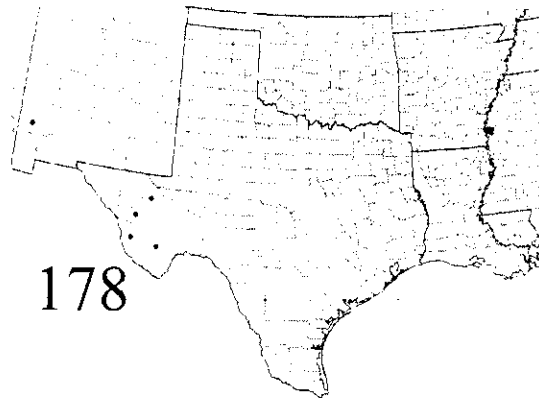
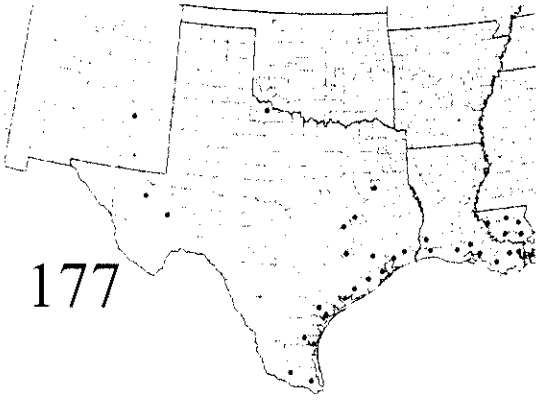


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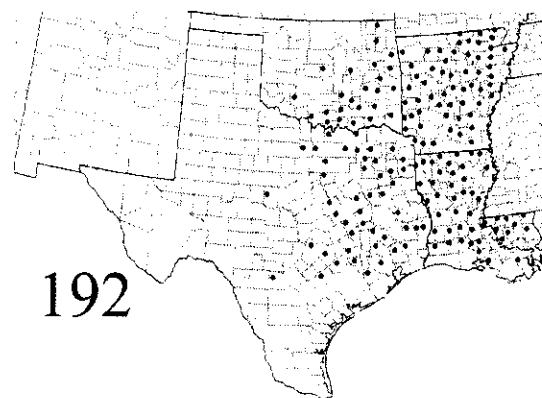
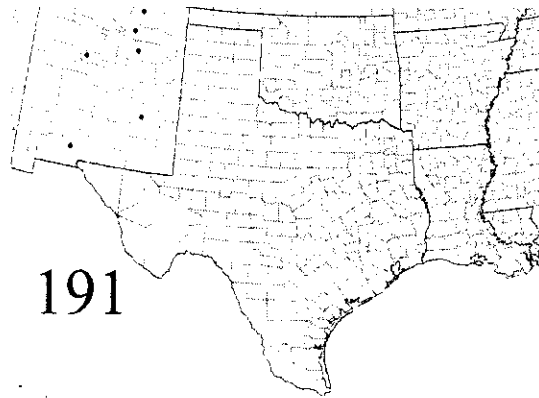
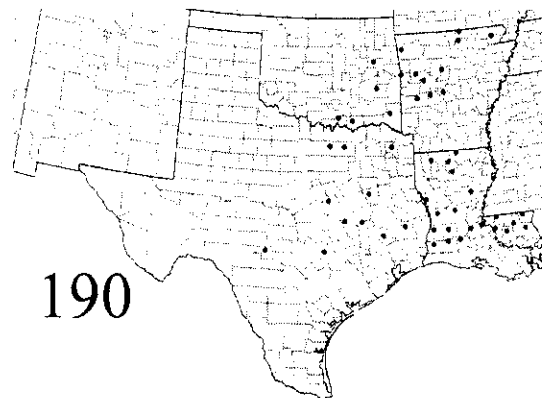
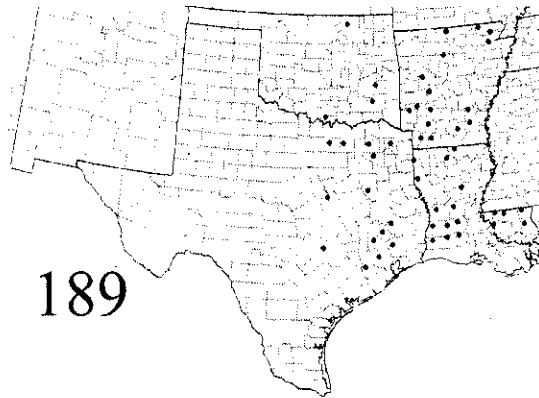
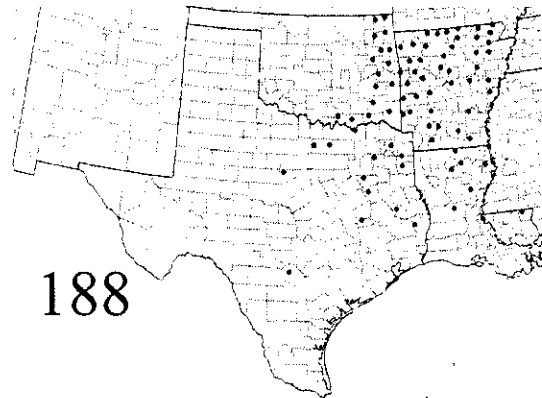
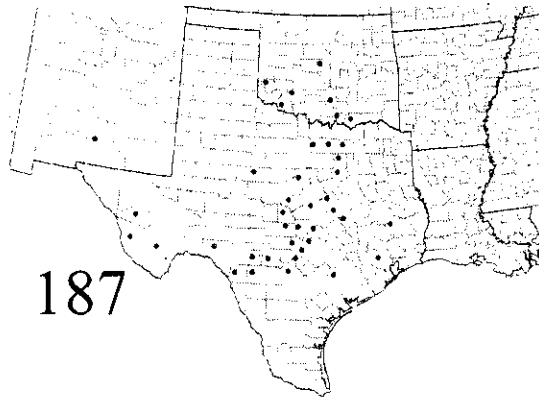
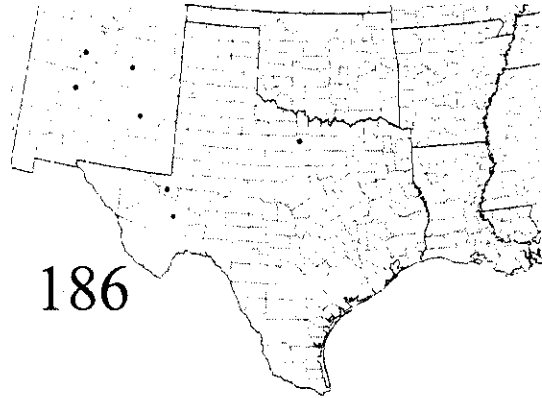
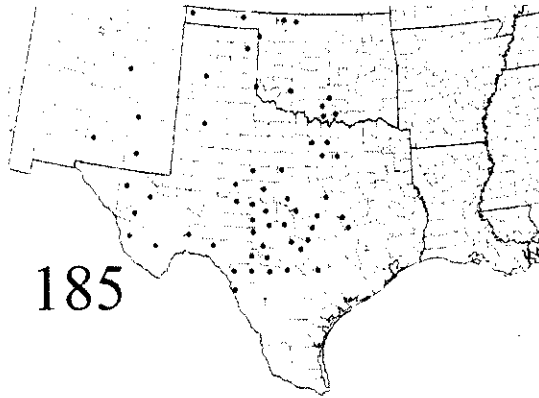


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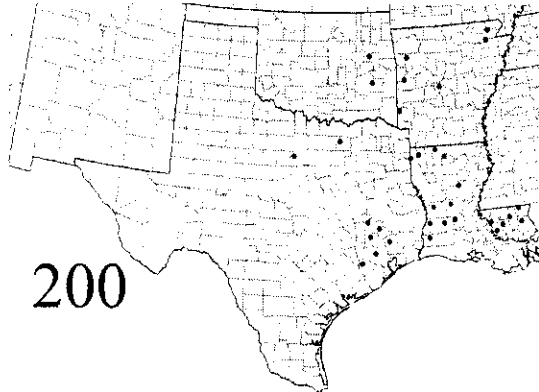
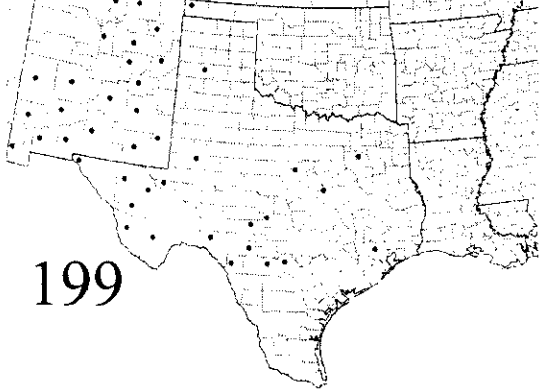
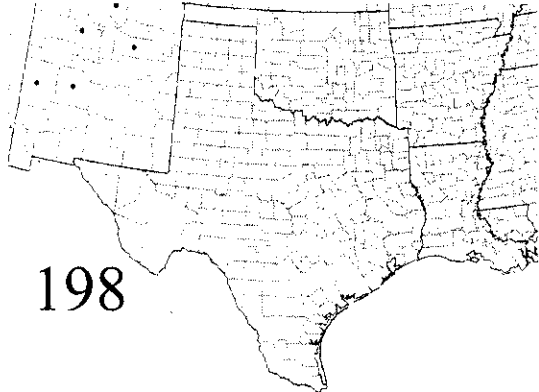
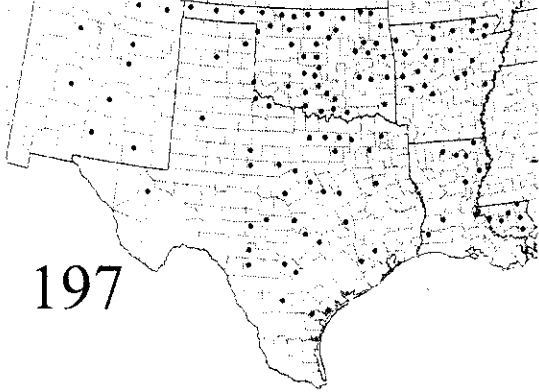
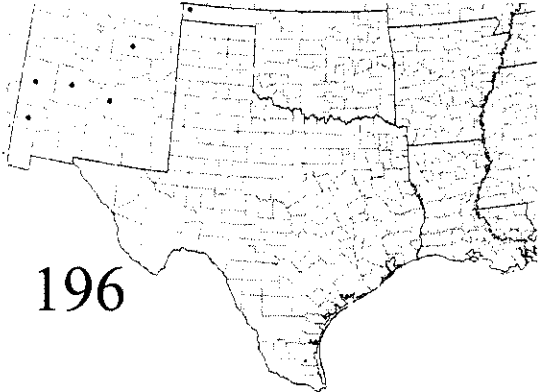
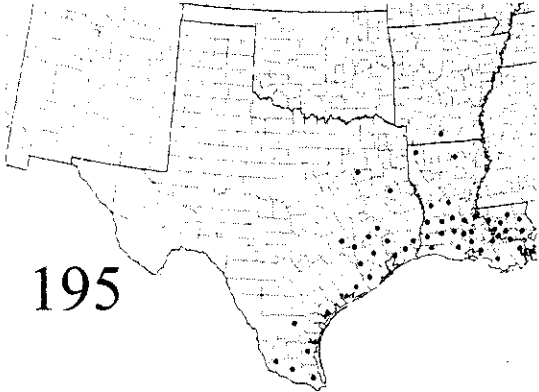
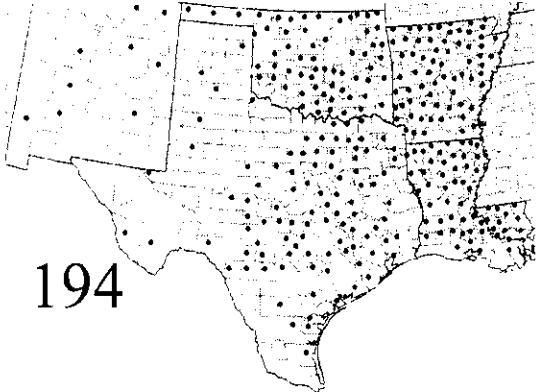
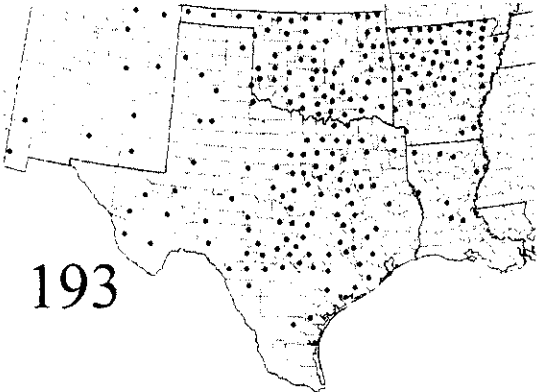
Maps. 177-184. Odonata distributions. 177. *Erythrodiplax berenice*. 178. *E. connata*. 179. *E. funerea*. 180. *E. fusca*. 181. *E. minuscula*. 182. *E. umbrata*. 183. *Libellula auripennis*. 184. *L. axilena*.



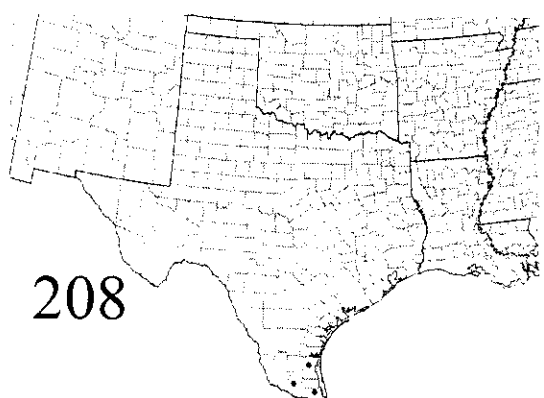
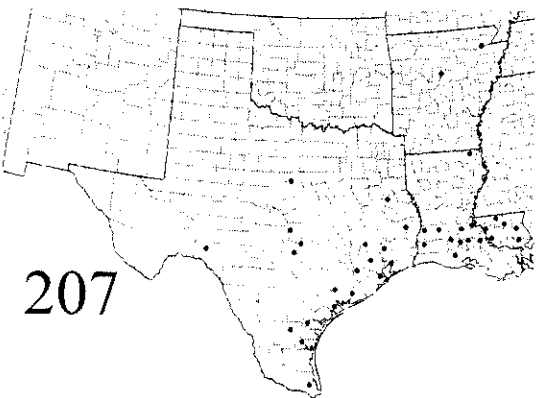
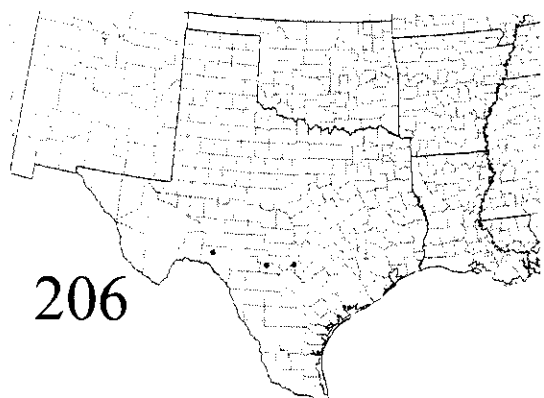
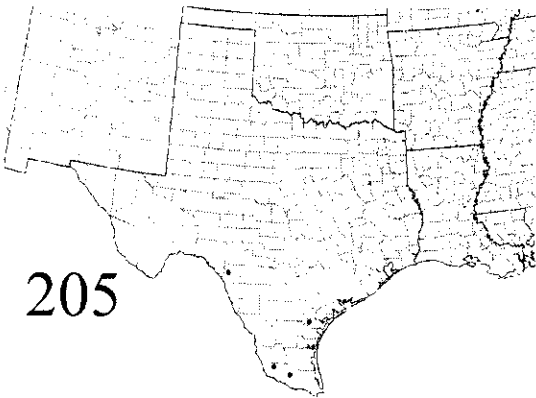
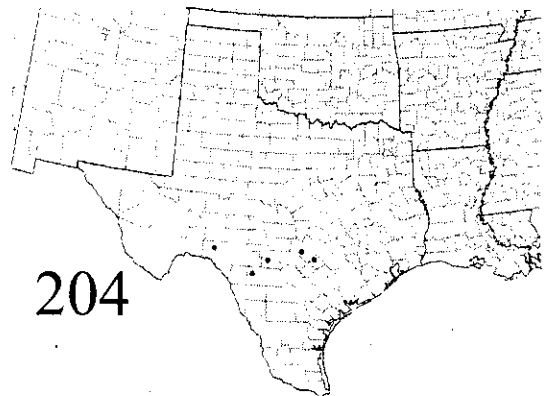
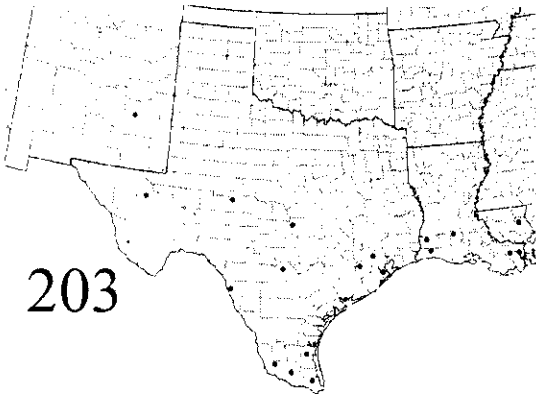
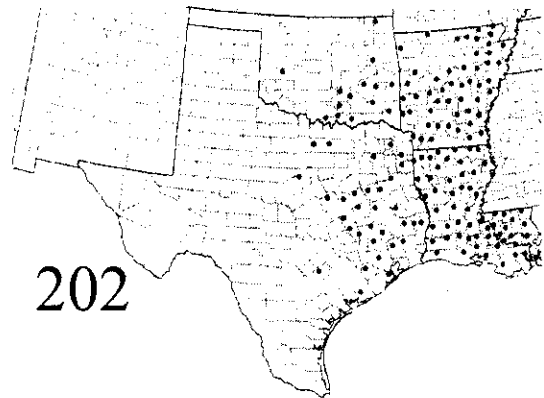
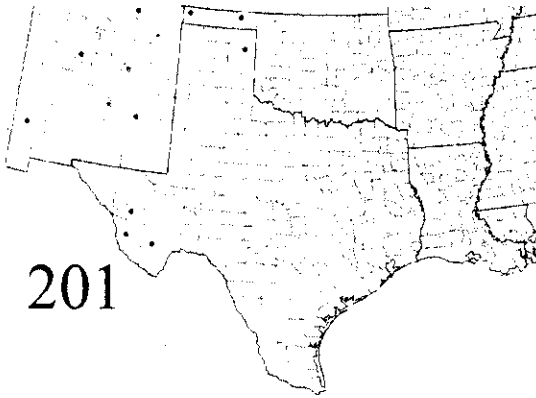
Maps. 185-192. Odonata distributions. 185. *Libellula comanche*. 186. *L. composita*. 187. *L. croceipennis*. 188. *L. cyanea*. 189. *L. deplanata*. 190. *L. flavida*. 191. *L. forensis*. 192. *L. incesta*.



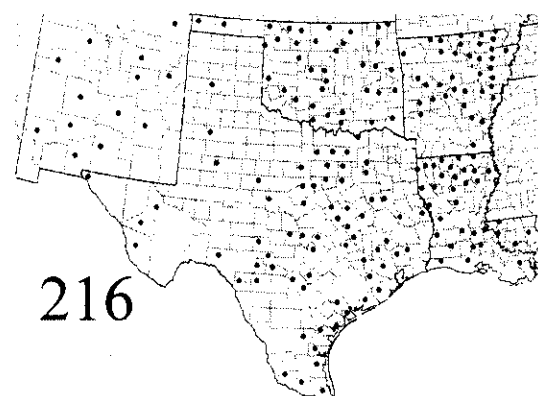
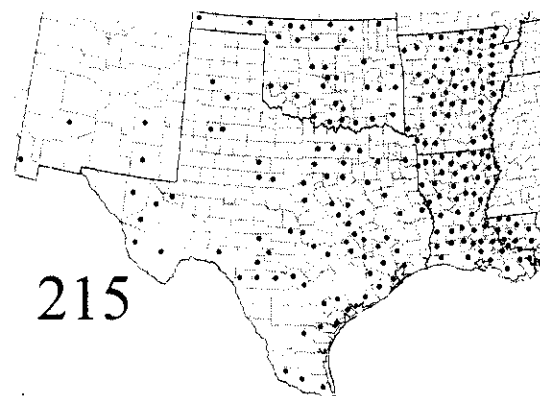
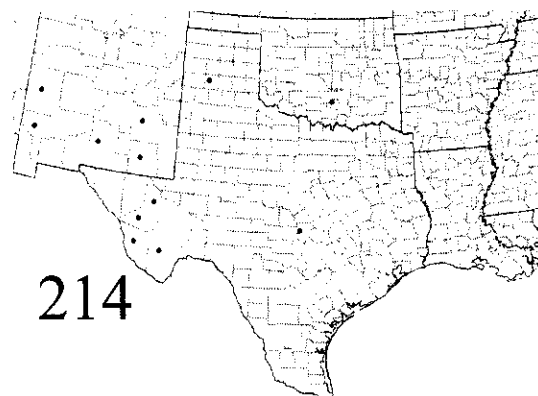
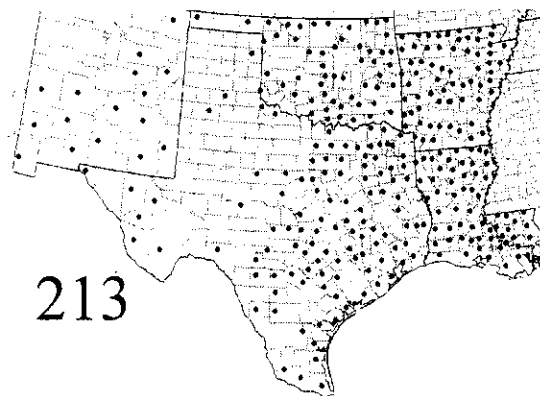
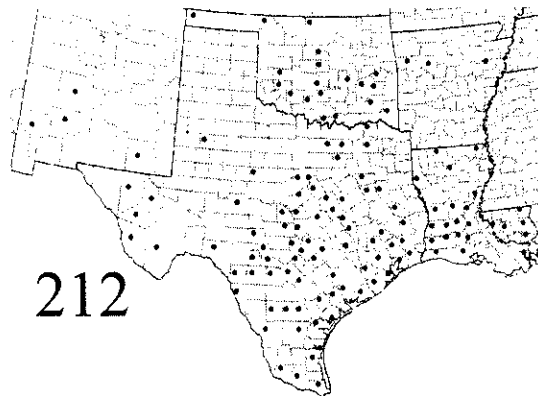
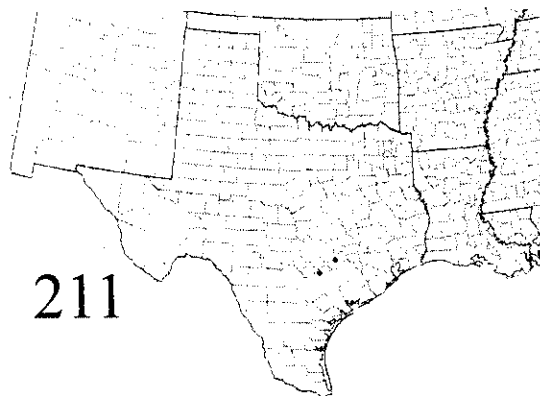
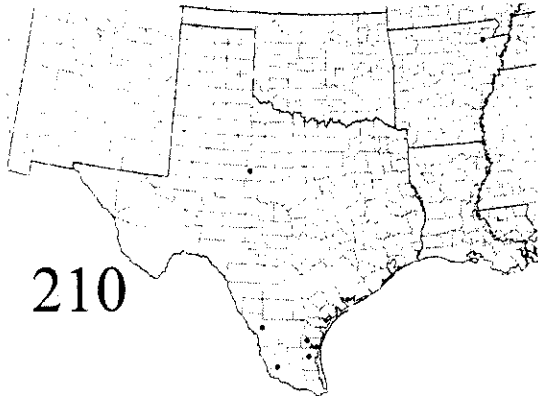
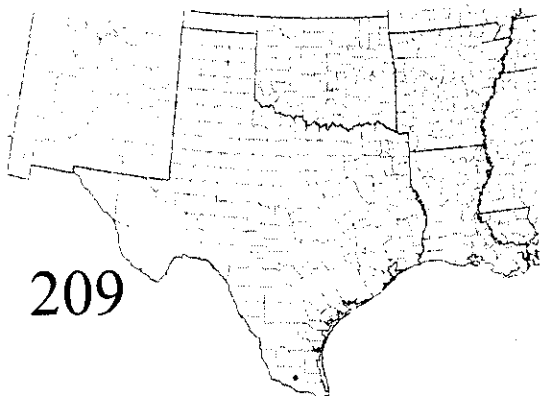
Maps. 193-200. Odonata distributions. 193. *Libellula luctuosa*. 194. *L. lydia*. 195. *L. needhami*. 196. *L. nodisticta*. 197. *L. pulchella*. 198. *L. quadrimaculata*. 199. *L. saturata*. 200. *L. semifasciata*.



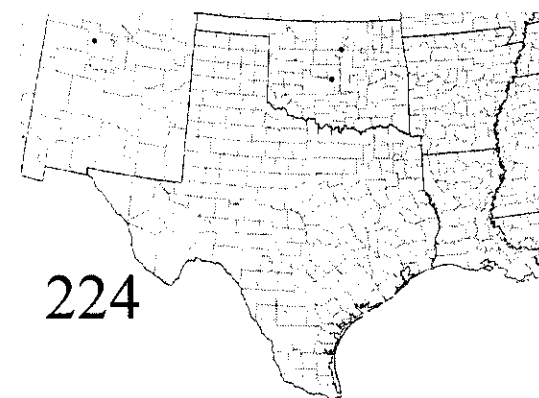
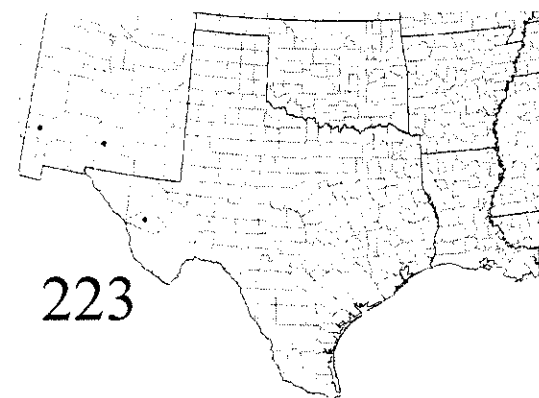
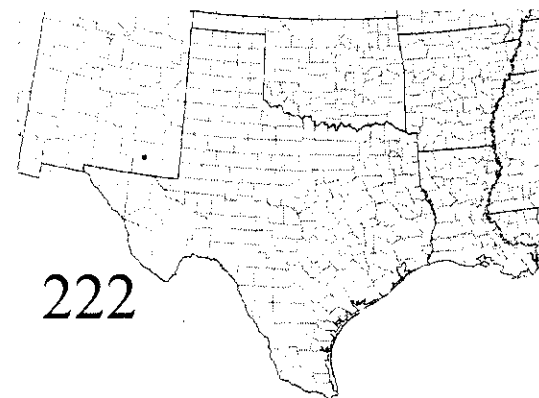
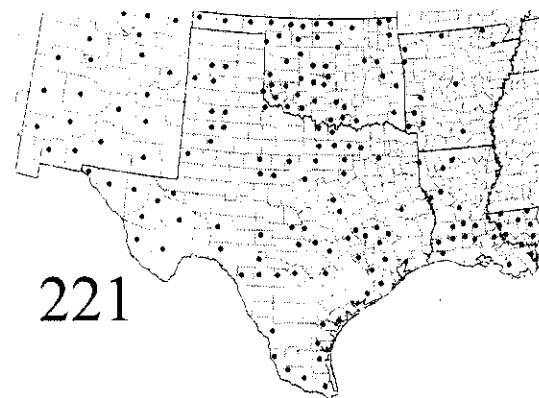
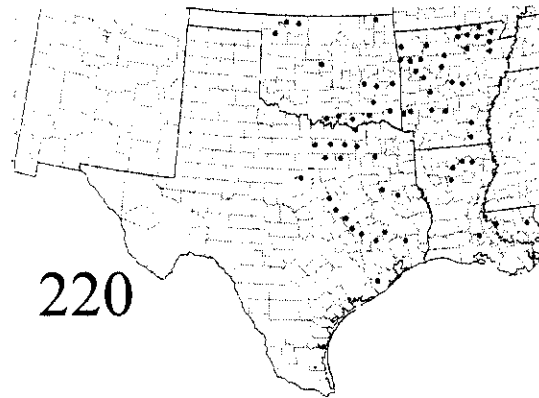
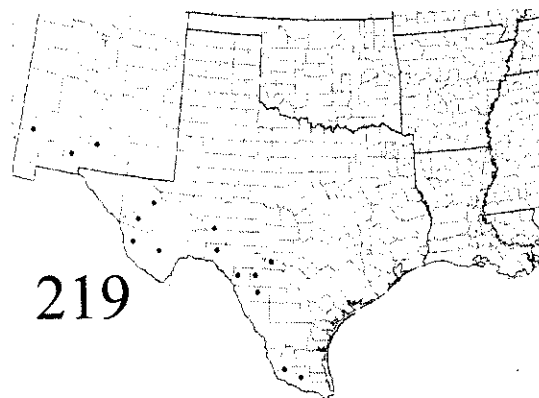
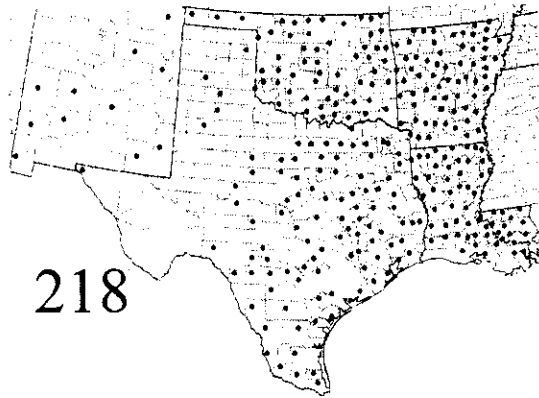
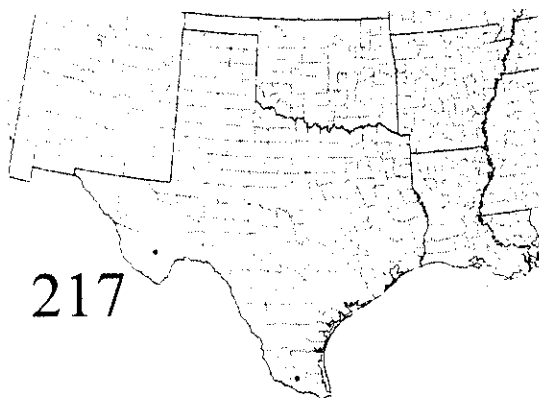
Maps. 201-208. Odonata distributions. 201. *Libellula subornata*. 202. *L. vibrans*. 203. *Macrodiplex balteata*. 204. *Macrothemis imitans*. 205. *M. inacuta*. 206. *M. inequiunguis*. 207. *Miathyria marcella*. 208. *Micrathyria aequalis*.



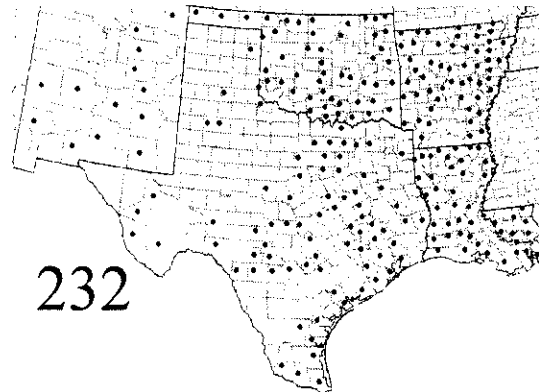
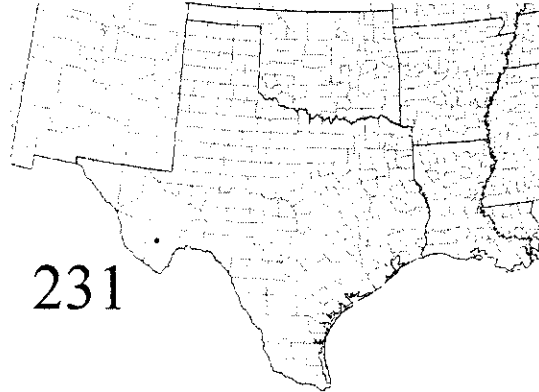
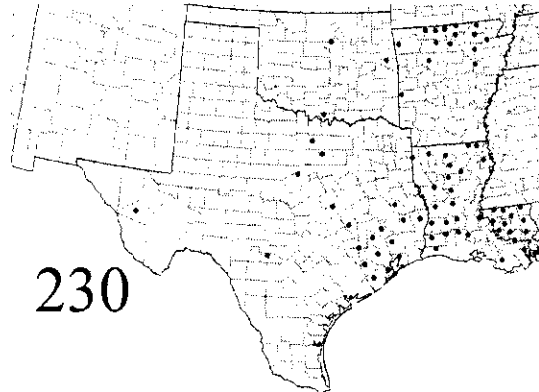
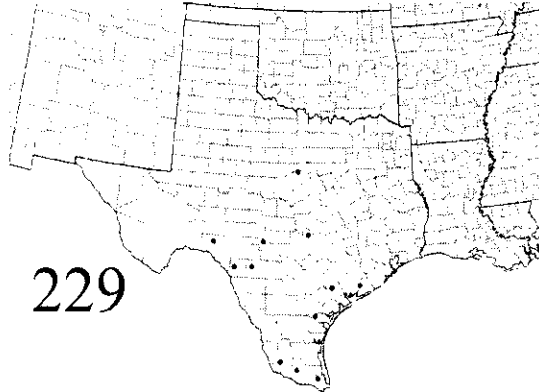
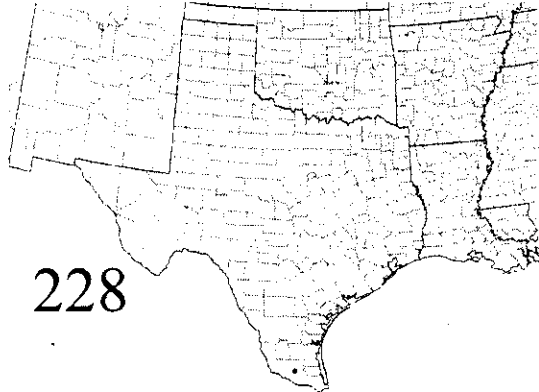
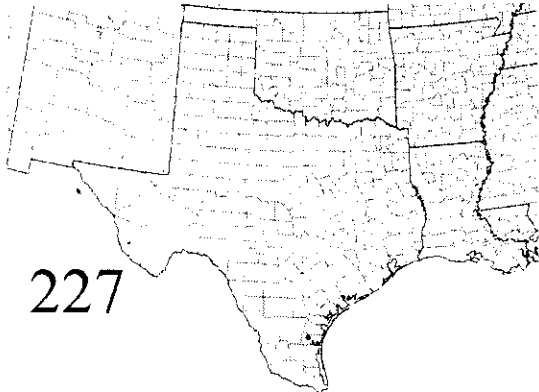
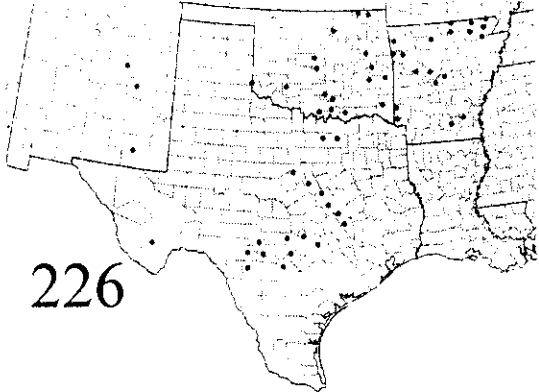
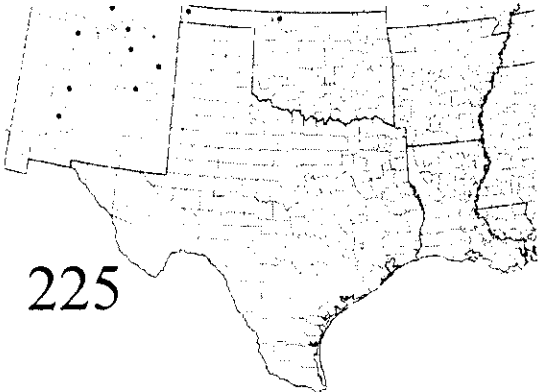
Maps. 209-216. Odonata distributions. 209. *Micrathyria didyma*. 210. *M. hagenii*. 211. *Orthemis discolor*. 212. *O. ferruginea*. 213. *Pachydiplax longipennis*. 214. *Paltothemis lineatipes*. 215. *Pantala flavescens*. 216. *Pantala hymenaea*.



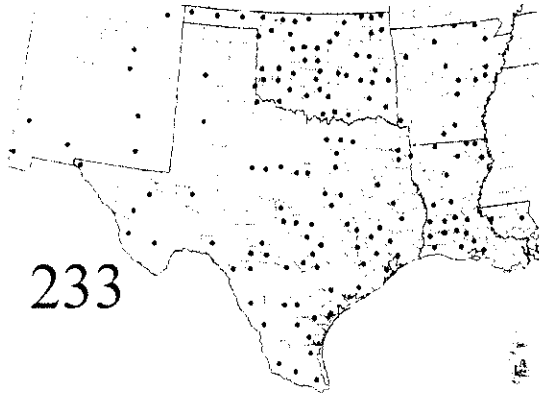
Maps. 217-224. Odonata distributions. 217. *Perithemis domitia*. 218. *P. tenera*. 219. *Pseudoleon superbus*. 220. *Sympetrum ambiguum*. 221. *S. corruptum*. 222. *S. costiferum*. 223. *S. illotum*. 224. *S. internum*.



Maps. 225-232. Odonata distributions. 225. *Sympetrum occidentale*. 226. *S. vicinum*.
227. *Tauriphila azteca*. 228. *Tholymis citrina*. 229. *Tramea calverti*. 230. *T. carolina*.
231. *T. insularis*. 232. *T. lacerata*.



Map. 233. Odonata distributions. 233. *Tramea onusta*.



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APPENDIX

County Records

ARKANSAS (133 spp.)

Arkansas (18)

Argia apicalis
Boyeria vinosa
Brachymesia gravida
Enallagma civile
Enallagma signatum
Epitheca princeps
Epitheca cynosura
Erythemis simplicicollis
Ischnura posita
Ischnura verticalis
Libellula incesta
Libellula vibrans
Macromia taeniolata
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Tramea lacerata

Ashley (25)

Argia fumipennis
Boyeria vinosa
Calopteryx maculata
Celithemis eponina
Celithemis verna
Enallagma civile
Enallagma signatum
Ephiaeschna heros
Epitheca cynosura
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula cyanea
Libellula incesta
Libellula luctuosa
Libellula vibrans
Macromia illinoiensis
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Somatochlora linearis
Sympetrum ambiguum
Tramea lacerata

Baxter (24)

Argia apicalis
Argia fumipennis

Argia moesta
Argia plana
Argia tibialis
Argia translata
Calopteryx maculata
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma signatum
Epitheca princeps
Erythemis simplicicollis
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura verticalis
Libellula cyanea
Libellula deplanata
Libellula luctuosa
Libellula lydia
Pachydiplax longipennis
Stylogomphus albistylus
Tramea carolina

Benton (23)

Anax junius
Argia apicalis
Argia fumipennis
Argia moesta
Argia plana
Argia sedula
Argia tibialis
Argia translata
Calopteryx maculata
Dromogomphus spinosus
Enallagma exsulans
Epitheca princeps
Erythemis simplicicollis
Gomphus vastus
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula luctuosa
Libellula lydia
Pachydiplax longipennis
Stylogomphus albistylus
Tramea lacerata

Boone (25)

Anax junius
Argia apicalis
Argia fumipennis
Argia moesta

Argia plana
Argia translata
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Enallagma basidens
Enallagma civile
Enallagma exsulans
Erythemis simplicicollis
Hetaerina americana
Ischnura posita
Ischnura verticalis
Libellula cyanea
Libellula luctuosa
Libellula lydia
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Tramea carolina
Tramea lacerata

Bradley (32)

Aeshna umbrosa
Argia apicalis
Argia moesta
Argia tibialis
Boyeria vinosa
Celithemis eponina
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma signatum
Ephiaeschna heros
Epitheca cynosura
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus vastus
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula cyanea
Libellula deplanata
Libellula incesta
Libellula vibrans
Nasiaeschna pentacantha
Neurocordulia molesta
Neurocordulia xanthosoma
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Stylurus spiniceps
Sympetrum corruptum

Sympetrum vicinum
Tramea onusta

Calhoun (24)

Anax junius
Argia tibialis
Basiaeschna janata
Boyeria vinosa
Celithemis fasciata
Enallagma divagans
Enallagma signatum
Ephiaeschna heros
Epitheca princeps
Epitheca cynosura
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus oklahomensis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula auripennis
Libellula incesta
Libellula lydia
Libellula vibrans
Nasiaeschna pentacantha
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus

Carroll (19)

Argia fumipennis
Argia moesta
Argia sedula
Argia translata
Basiaeschna janata
Enallagma civile
Enallagma exsulans
Erythemis simplicicollis
Gomphus vastus
Hagenius brevistylus
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura verticalis
Libellula luctuosa
Libellula lydia
Pachydiplax longipennis
Perithemis tenera
Tramea lacerata

Chicot (21)

Anax junius
Argia apicalis

- Arigomphus maxwelli*
Celithemis verna
Enallagma civile
Enallagma signatum
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula luctuosa
Libellula vibrans
Libellula lydia
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Stylurus plagiatus
Tramea lacerata
- Clark (42)*
- Anax junius*
Argia apicalis
Argia fumipennis
Argia moesta
Argia sedula
Argia tibialis
Argia translata
Basiaeschna janata
Boyeria vinosa
Brechmorhoga mendax
Celithemis elisa
Celithemis verna
Cordulegaster obliqua
Didymops transversa
Dromogomphus spinosus
Dythemis velox
Enallagma exsulans
Epiaeschna heros
Epithea cynosura
Epithea spinosa
Erythemis simplicicollis
Gomphus modestus
Gomphus ozarkensis
Hagenius brevistylus
Hefocordulia uhleri
Hetaerina americana
Ischnura posita
Libellula cyanea
Libellula deplanata
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia illinoensis
Nasiaeschna pentacantha
Neurocordulia virginicensis
Pantala flavescens
Pantala hymenaea
Progomphus obscurus
Somatochlora linearis
Stylogomphus albistylus
Sympetrum ambiguum
Tramea lacerata
- Clay (32)*
- Anax junius*
Argia apicalis
Argia tibialis
Arigomphus submedianus
Basiaeschna janata
Boyeria vinosa
Calopteryx maculata
Celithemis eponina
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma exsulans
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Gomphus exilis
Hetaerina americana
Ischnura hastata
Ischnura posita
Libellula cyanea
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia illinoensis
Macromia taeniolata
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum vicinum
Tramea lacerata
- Cleburne (20)*
- Anax junius*
Argia moesta
Argia tibialis
Argia translata
Boyeria vinosa
Calopteryx maculata
Didymops transversa
Dromogomphus spinosus
Enallagma exsulans
Epithea princeps
Erythemis simplicicollis
Gomphus ozarkensis
Gomphus graslinellus
Hagenius brevistylus
Hetaerina americana
Ischnura posita
Libellula luctuosa
Libellula lydia
Libellula pulchella
Neurocordulia xanthosoma
- Cleveland (14)*
- Celithemis eponina*
Enallagma divagans
Enallagma signatum
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
- Libellula incesta*
Libellula lydia
Libellula vibrans
Nasiaeschna pentacantha
Perithemis tenera
- Columbia (28)*
- Anax junius*
Argia apicalis
Basiaeschna janata
Boyeria vinosa
Calopteryx maculata
Cordulegaster maculata
Cordulegaster obliqua
Dromogomphus spinosus
Enallagma divagans
Enallagma signatum
Erythemis simplicicollis
Erythrodiplax minuscula
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes vigilax
Libellula cyanea
Libellula deplanata
Libellula incesta
Libellula lydia
Libellula vibrans
Macromia taeniolata
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
- Conway (27)*
- Anax junius*
Argia apicalis
Argia fumipennis
Argia moesta
Argia tibialis
Celithemis elisa
Celithemis fasciata
Dromogomphus spinosus
Enallagma civile
Enallagma divagans
Enallagma signatum
Epithea cynosura
Erythemis simplicicollis
Hetaerina titia
Ischnura posita
Libellula cyanea
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Macromia illinoensis
Nasiaeschna pentacantha
Pachydiplax longipennis
Perithemis tenera
Sympetrum ambiguum
Tramea lacerata
- Craighead (59)*
- Anax junius*
Archilestes grandis
Argia apicalis
Argia fumipennis
Argia moesta
Argia tibialis
Boyeria vinosa
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma aspersum
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Erythrodiplax umbrata
Gomphus externus
Gomphus vastus
Gomphus lividus
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Perithemis tenera
Libellula axilena
Libellula cyanea
Libellula deplanata
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula semifasciata
Libellula vibrans
Macromia taeniolata
Miathyria macella
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora filosa
Somatochlora linearis
Stylurus laurae
Stylurus plagiatus
Sympetrum ambiguum
Sympetrum corruptum
Sympetrum vicinum
Tramea carolina
Tramea lacerata
Tramea onusta
- Crawford (10)*
- Anax junius*
Basiaeschna janata
Celithemis elisa

- Enallagma civile
 Erythemis simplicicollis
 Gomphus ozarkensis
 Ischnura posita
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
- Crittenden* (14)
- Anax junius
 Arigomphus maxwelli
 Enallagma civile
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura posita
 Libellula lydia
 Libellula vibrans
 Pachydiplax longipennis
 Perithemis tenera
 Tramea lacerata
- Cross* (28)
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia plana
 Calopteryx maculata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma civile
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax umbrata
 Ischnura hastata
 Ischnura posita
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia illinoiensis
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Stylurus plagiatas
 Tramea lacerata
- Dallas* (15)
- Boyeria vinosa
 Enallagma divagans
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Hagenius brevistylus
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
- Libellula incesta
 Libellula lydia
 Pantala flavescens
 Perithemis tenera
 Sympetrum ambiguum
- Desha* (15)
- Anax junius
 Argia apicalis
 Enallagma civile
 Enallagma signatum
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes unguiculatus
 Libellula lydia
 Libellula vibrans
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Tramea lacerata
- Drew* (41)
- Anax junius
 Arigomphus maxwelli
 Boyeria vinosa
 Celithemis elisa
 Celithemis eponina
 Celithemis verna
 Cordulegaster obliqua
 Coryphaeschna ingens
 Dromogomphus spoliatus
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax umbrata
 Dromogomphus spinosus
 Gomphus hybridus
 Gomphus vastus
 Hagenius brevistylus
 Ischnura hastata
 Ischnura ramburii
 Lestes disjunctus
 Libellula auripennis
 Libellula deplanata
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia illinoiensis
 Nasiaeschna pentacantha
 Neurocordulia molesta
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Stylurus spiniceps
 Sympetrum ambiguum
 Sympetrum vicinum
 Telebasis byersi
 Tramea lacerata
- Faulkner* (32)
- Argia apicalis
 Argia moesta
 Argia tibialis
 Celithemis fasciata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma civile
 Enallagma traviatum
 Epithea costalis
 Erythemis simplicicollis
 Hagenius brevistylus
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes disjunctus
 Lestes rectangularis
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Miathyria marcella
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum ambiguum
 Sympetrum vicinum
 Tramea lacerata
 Tramea onusta
- Fulton* (55)
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia plana
 Argia sedula
 Argia tibialis
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Cordulegaster obliqua
 Didymops transversa
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma aspersum
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus ozarkensis
 Gomphus vastus
 Gomphus graslinellus
 Gomphus lividus
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes disjunctus
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Neurocordulia xanthosoma
 Ophiogomphus westfalli
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
- Franklin* (45)
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Arigomphus lentulus
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Cordulegaster obliqua
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma aspersum
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Gomphus externus
 Gomphus ozarkensis
 Gomphus vastus
 Gomphus graslinellus
 Gomphus oklahomensis
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus

- Somatochlora linearis*
Stylogomphus albistylus
Sympetrum ambiguum
Sympetrum vicinum
Tramea carolina
Tramea lacerata
Tramea onusta
- Garland (52)*
- Aeshna umbrosa*
Anax junius
Argia fumipennis
Argia moesta
Argia sedula
Argia translata
Basiaeschna janata
Boyeria vinosa
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciatus
Cordulegaster obliqua
Didymops transversa
Dromogomphus spinosus
Dromogomphus spoliatus
Dythemis velox
Enallagma civile
Enallagma exsulans
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea costalis
Epithea cynosura
Erythemis simplicicollis
Gomphus ozarkensis
Gomphus graslinellus
Gomphus oklahomensis
Hagenius brevistylus
Hetaerina americana
Libellula cyanea
Libellula deplanata
Libellula flavida
Libellula incesa
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Macromia alleghaniensis
Nasiaeschna pentacantha
Neurocordulia virginensis
Neurocordulia xanthosoma
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Somatochlora ozarkensis
Somatochlora tenebrosa
Stylogomphus albistylus
Sympetrum ambiguum
Tachopteryx thoreyi
Tramea lacerata
- Grant (21)*
- Anax junius*
Argia moesta
- Argia tibialis*
Boyeria vinosa
Calopteryx maculata
Dromogomphus spoliatus
Enallagma civile
Enallagma exsulans
Epithea cynosura
Erythemis simplicicollis
Hagenius brevistylus
Ischnura hastata
Ischnura kellicotti
Ischnura posita
Libellula incesa
Libellula vibrans
Macromia pacifica
Macromia taeniolata
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
- Greene (52)*
- Anax junius*
Argia apicalis
Argia fumipennis
Argia moesta
Argia plana
Argia sedula
Argia translata
Arigomphus maxwelli
Basiaeschna janata
Boyeria vinosa
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Cordulegaster maculata
Cordulegaster obliqua
obliqua
Didymops transversa
Dromogomphus spoliatus
Enallagma civile
Enallagma exsulans
Enallagma signatum
Epithea princeps
Epithea costalis
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Erythrodiplax umbrata
Gomphaeschna furciflata
Gomphus vastus
Hetaerina titia
Ischnura hastata
Ischnura posita
Libellula cyanea
Libellula deplanata
Libellula flavida
Libellula incesa
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula semifasciata
Libellula vibrans
Pachydiplax longipennis
Pantala flavescens
- Argia apicalis*
Argia fumipennis
Argia sedula
Argia tibialis
Argia translata
Basiaeschna janata
- Pantala hymenaea*
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Stylurus plagiatu
Sympetrum ambiguu
Sympetrum vicinum
Tachopteryx thoreyi
Tramea lacerata
- Hempstead (23)*
- Argia apicalis*
Celithemis elisa
Celithemis eponina
Didymops transversa
Enallagma divagans
Enallagma exsulans
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula incesa
Libellula lydia
Macromia illinoensis
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Stylurus plagiatu
Sympetrum corruptu
Tramea lacerata
- Hot Spring (21)*
- Anax junius*
Argia fumipennis
Argia moesta
Basiaeschna janata
Calopteryx maculata
Celithemis fasciata
Dromogomphus spoliatus
Enallagma exsulans
Enallagma signatum
Erythemis simplicicollis
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Libellula incesa
Libellula lydia
Libellula pulchella
Libellula vibrans
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Tramea lacerata
- Howard (36)*
- Argia apicalis*
Argia fumipennis
Argia sedula
Argia tibialis
Argia translata
Basiaeschna janata
- Calopteryx maculata*
Cordulegaster obliqua
Dromogomphus spinosus
Dromogomphus spoliatus
Dythemis velox
Enallagma exsulans
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus modestus
Gomphus vastus
Gomphus graslinellus
Hagenius brevistylus
Hetaerina americana
Ischnura posita
Libellula cyanea
Libellula deplanata
Libellula incesa
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia illinoensis
Neurocordulia xanthosoma
Pachydiplax longipennis
Progomphus obscurus
Stylogomphus albistylus
Sympetrum ambiguu
- Independence (36)*
- Aeshna umbrosa*
Anax junius
Archilestes grandis
Argia apicalis
Argia moesta
Argia sedula
Basiaeschna janata
Boyeria vinosa
Calopteryx maculata
Didymops transversa
Dromogomphus spinosus
Dromogomphus spoliatus
Dythemis velox
Enallagma civile
Enallagma exsulans
Enallagma signatum
Epithea cynosura
Erythemis simplicicollis
Hagenius brevistylus
Helocordulia selysii
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura verticalis
Lestes congener
Libellula incesa
Libellula lydia
Macromia illinoensis
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus

- Somatochlora linearis
 Sympetrum ambiguuum
 Tramea lacerata
- Izard* (46)
 Anax junius
 Anax longipes
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia plana
 Argia sedula
 Argia tibialis
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis fasciata
 Dromogomphus spinosus
 Enallagma aspersum
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma traviatum
 westfalli
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus ozarkensis
 Gomphus graslinellus
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Lestes congener
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Sympetrum ambiguuum
 Sympetrum vicinum
 Tramea carolina
 Tramea lacerata
- Jackson* (28)
 Anax junius
 Argia tibialis
 Arigomphus submedianus
 Boyeria vinosa
 Dromogomphus spoliatus
 Enallagma exsulans
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
- Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Libellula cyanea
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Stylurus plagiatus
 Tramea carolina
 Tramea onusta
- Jefferson* (21)
 Anax junius
 Arigomphus submedianus
 Celithemis eponina
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Ischnura posita
 Ischnura ramburii
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Tramea lacerata
 Tramea onusta
- Johnson* (24)
 Anax junius
 Argia apicalis
 Argia bipunctulata
 Argia fumipennis
 Argia moesta
 Argia sedula
 Calopteryx maculata
 Enallagma civile
 Enallagma exsulans
 Epithea costalis
 Erythemis simplicicollis
 Gomphus ozarkensis
 Hagenius brevistylus
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Libellula cyanea
 Libellula luctuosa
 Libellula lydia
 Macromia illinoensis
 Pachydiplax longipennis
 Perithemis tenera
 Stylogomphus albistylus
- Sympetrum ambiguuum
Lafayette (27)
 Anax junius
 Argia apicalis
 Argia moesta
 Basiaeschna janata
 Cordulegaster maculata
 Enallagma divagans
 Enallagma signatum
 Epithea costalis
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Hagenius brevistylus
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Lestes inaequalis
 Lestes vigilax
 Libellula deplanata
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Tramea lacerata
- Lawrence* (47)
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus graslinellus
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura posita
 Lestes disjunctus
 Lestes inaequalis
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
- Libellula vibrans
 Macromia taeniolata
 Nasiaeschna pentacantha
 Neurocordulia molesta
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Stylogomphus albistylus
 Sympetrum ambiguuum
 Sympetrum vicinum
 Tramea carolina
- Lee* (20)
 Argia apicalis
 Argia tibialis
 Calopteryx maculata
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma signatum
 Epiaeschna heros
 Erythemis simplicicollis
 Ischnura posita
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Tramea onusta
- Lincoln* (16)
 Argia bipunctulata
 Argia tibialis
 Epithea cynosura
 Erythemis simplicicollis
 Gomphaeschna furcillata
 Ischnura posita
 Libellula cyanea
 Libellula deplanata
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Nasiaeschna pentacantha
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Tramea lacerata
- Little River* (28)
 Argia apicalis
 Brachymesia gravida
 Celithemis elisa
 Celithemis eponina
 Enallagma exsulans
 Enallagma signatum
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps

- Epitheca cynosura*
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus externus
Gomphus hybridus
Hagenius brevistylus
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula lydia
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Stylurus plagiatus
Sympetrum corruptum
Tramea lacerata
Tramea onusta
- Logan (29)*
- Argia apicalis*
Argia fumipennis
Argia moesta
Basiaeschna janata
Boyeria vinosa
Celithemis elisa
Celithemis eponina
Dromogomphus spinosus
Enallagma exsulans
Enallagma signatum
Epitheca princeps
Erythemis simplicicollis
Gomphus graslinellus
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Libellula cyanea
Libellula flavida
Libellula incesa
Libellula luctuosa
Libellula vibrans
Macromia pacifica
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum ambiguum
Tramea lacerata
- Lonoke (22)*
- Anax junius*
Celithemis fasciata
Dromogomphus spoliatus
Dythemis velox
Enallagma civile
Epitheca princeps
Epitheca cynosura
Erythemis simplicicollis
Ischnura posita
Libellula incesa
Libellula luctuosa
Libellula lydia
Libellula pulchella
- Libellula vibrans*
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum ambiguum
Tramea lacerata
Tramea onusta
- Madison (19)*
- Argia moesta*
Argia plana
Argia tibialis
Calopteryx maculata
Didymops transversa
Dromogomphus spinosus
Enallagma exsulans
Epitheca cynosura
Erythemis simplicicollis
Gomphus ozarkensis
Gomphus graslinellus
Hetaerina americana
Libellula cyanea
Libellula luctuosa
Libellula lydia
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Stylogomphus albistylus
- Marion (43)*
- Aeshna interrupta*
Anax junius
Argia apicalis
Argia fumipennis
Argia moesta
Argia plana
Argia sedula
Argia tibialis
Argia translata
Basiaeschna janata
Boyeria vinosa
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Dromogomphus spinosus
Enallagma basidens
Enallagma civile
Enallagma exsulans
Epitheca princeps
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus ozarkensis
Gomphus vastus
Gomphus lividus
Hagenius brevistylus
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura verticalis
Libellula cyanea
Libellula luctuosa
Libellula lydia
Libellula pulchella
- Macromia illinoensis*
Macromia pacifica
Ophiogomphus westfalli
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum corruptum
Tramea carolina
Tramea lacerata
- Miller (26)*
- Anax junius*
Argia apicalis
Argia fumipennis
Argia moesta
Boyeria vinosa
Calopteryx maculata
Cordulegaster obliqua
Didymops transversa
Enallagma exsulans
Enallagma signatum
Epiaeschna heros
Erythemis simplicicollis
Gomphus vastus
Hagenius brevistylus
Ischnura posita
Libellula incesa
Libellula luctuosa
Libellula lydia
Libellula vibrans
Nasiaeschna pentacantha
Neurocordulia molesta
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
- Mississippi (31)*
- Anax junius*
Argia apicalis
Argia tibialis
Arigomphus lentulus
Arigomphus submedianus
Celithemis eponina
Dromogomphus spoliatus
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma signatum
Epitheca princeps
Epitheca cynosura
Erythemis simplicicollis
Gomphus externus
Gomphus graslinellus
Ischnura hastata
Ischnura posita
Lestes rectangularis
Libellula incesa
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia taeniolata
Nasiaeschna pentacantha
- Pachydiplax longipennis*
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Stylurus plagiatus
Tramea lacerata
- Monroe (18)*
- Anax junius*
Argia apicalis
Argia tibialis
Dromogomphus spoliatus
Enallagma signatum
Epitheca cynosura
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Libellula incesa
Libellula lydia
Libellula vibrans
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Tramea lacerata
Tramea onusta
- Montgomery (67)*
- Aeshna umbrosa*
Anax junius
Argia bipunctulata
Argia fumipennis
Argia moesta
Argia sedula
Argia translata
Basiaeschna janata
Boyeria vinosa
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Celithemis verna
Chromagrion conditum
Cordulegaster maculata
Cordulegaster obliqua
Cordulegaster nov. spec.
Didymops transversa
Dromogomphus spinosus
Dythemis velox
Enallagma civile
Enallagma divagans
Enallagma exsulans
Enallagma signatum
Epiaeschna heros
Epitheca princeps
Epitheca cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus ozarkensis
Gomphus vastus
Gomphus graslinellus
Gomphus oklahomensis
Hagenius brevistylus
Helocordulia uhleri
Hetaerina americana

Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Lestes disjunctus
 Libellula auripennis
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Macromia alleghaniensis
 Macromia illinoiensis
 Macromia pacifica
 Neurocordulia virginiensis
 Neurocordulia xanthosoma
 Ophiogomphus westfalli
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Somatochlora ozarkensis
 Somatochlora tenebrosa
 Stylogomphus albistylus
 Sympetrum corruptum
 Tachopteryx thoreyi
 Tramea lacerata

Nevada (22)

Argia apicalis
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Cordulegaster maculata
 Enallagma divagans
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Ischnura posita
 Ischnura ramburii
 Lestes inaequalis
 Libellula cyanea
 Libellula deplanata
 Libellula lydia
 Libellula vibrans
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Perithemis tenera
 Somatochlora linearis
 Stylurus laurae

Newton (33)

Anax junius
 Anax longipennis
 Archilestes grandis
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Basiaeschna janata
 Calopteryx maculata
 Celithemis eponina

Dromogomphus spinosus
 Enallagma daeckii
 Enallagma divagans
 Enallagma exsulans
 Enallagma geminatum
 Epithea cynosura
 Erythemis simplicicollis
 Gomphus ozarkensis
 Gomphus graslinellus
 Gomphus oklahomensis
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes inaequalis
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Stylogomphus albistylus
 Sympetrum ambiguum
 Tramea lacerata

Ouachita (19)

Argia apicalis
 Argia fumipennis
 Argia moesta
 Boyeria vinosa
 Calopteryx maculata
 Celithemis eponina
 Cordulegaster obliqua
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura kellicotti
 Ischnura posita
 Ischnura ramburii
 Libellula cyanea
 Libellula lydia
 Libellula vibrans
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera

Perry (28)

Anax junius
 Argia moesta
 Celithemis fasciata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma traviatum
 Erythemis simplicicollis
 Gomphus ozarkensis
 Gomphus graslinellus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans

Macromia illinoiensis
 Nasiaeschna pentacantha
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Somatochlora linearis
 Somatochlora ozarkensis
 Stylogomphus albistylus
 Stylurus plagiatus
 Sympetrum vicinum

Phillips (25)

Anax junius
 Argia apicalis
 Argia tibialis
 Arigomphus submedianus
 Calopteryx maculata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma civile
 Epithea princeps
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Tramea lacerata

Pike (33)

Argia fumipennis
 Argia moesta
 Argia sedula
 Argia translata
 Arigomphus villosipes
 Basiaeschna janata
 Calopteryx maculata
 Cordulegaster obliqua
 Didymops transversa
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Gomphus ozarkensis
 Gomphus apomyius
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii

Libellula deplanata
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora ozarkensis

Pointsett (38)

Anax junius
 Argia apicalis
 Argia tibialis
 Arigomphus lentulus
 Arigomphus submedianus
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma geminatum
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Lestes inaequalis
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum ambiguum
 Tramea lacerata

Polk (37)

Anax junius
 Argia bipunctulata
 Argia fumipennis
 Argia moesta
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Cordulegaster maculata
 Cordulegaster obliqua
 Enallagma civile
 Enallagma divagans

- Enallagma exsulans
 Enallagma traviatum
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus ozarkensis
 Gomphus graslinellus
 Hagenius brevistylus
 Hetaerina americana
 Ischnura posita
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia pacifica
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Perithemis tenera
 Stylogomphus albistylus
 Tachopteryx thoreyi
 Tramea carolina
 Tramea lacerata
- Pope (26)*
- Anax junius
 Argia apicalis
 Argia moesta
 Argia translata
 Celithemis eponina
 Dromogomphus spinosus
 Enallagma aspersum
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Erythemis simplicicollis
 Hagenius brevistylus
 Ischnura hastata
 Ischnura posita
 Lestes disjunctus
 Libellula cyanea
 Libellula incesta
 Libellula lydia
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Macromia pacifica
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Tramea carolina
 Tramea lacerata
- Prairie (26)*
- Anax junius
 Argia apicalis
 Argia tibialis
 Celithemis eponina
 Dromogomphus spinosus
 Enallagma basidens
 Enallagma civile
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
- Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula cyanea
 Libellula incesta
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Tramea lacerata
 Tramea onusta
- Pulaski (38)*
- Aeshna constricta
 Anax junius
 Argia fumipennis
 Argia moesta
 Argia plana
 Arigomphus submedianus
 Boyeria vinosa
 Brachymesia gravida
 Calopteryx maculata
 Celithemis elisa
 Cordulegaster obliqua
 Enallagma civile
 Epiaeschna heros
 Epithea cynosura
 Erythemis simplicicollis
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Lestes disjunctus
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia illinoiensis
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Stylogomphus albistylus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Tachopteryx thoreyi
 Tramea lacerata
 Tramea onusta
- Randolph (50)*
- Anax junius
 Argia apicalis
 Argia moesta
 Argia sedula
 Argia tibialis
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
- Celithemis eponina
 Celithemis fasciata
 Didymops transversa
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma aspersum
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Gomphus ozarkensis
 Gomphus vastus
 Gomphus graslinellus
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Libellula cyanea
 Libellula deplanata
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Macromia illinoiensis
 Macromia pacifica
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Stylogomphus albistylus
 Stylurus spiniceps
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Tramea carolina
 Tramea lacerata
- Saline (45)*
- Anax junius
 Anax longipes
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis fasciata
 Cordulegaster maculata
 Didymops transversa
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus vastus
- Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Libellula auripennis
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Macromia pacifica
 Nasiaeschna pentacantha
 Ophiogomphus westfalli
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Progomphus obscurus
 Somatochlora tenebrosa
 Stylogomphus albistylus
 Sympetrum vicinum
 Tramea lacerata
- Scott (25)*
- Argia apicalis
 Argia moesta
 Arigomphus lentulus
 Basiaeschna janata
 Celithemis elisa
 Dromogomphus spinosus
 Enallagma basidens
 Erythemis simplicicollis
 Gomphus ozarkensis
 Gomphus graslinellus
 Gomphus oklahomensis
 Hagenius brevistylus
 Ischnura hastata
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula semifasciata
 Libellula vibrans
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Perithemis tenera
 Stylogomphus albistylus
 Tramea lacerata
- Searcy (30)*
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia translata
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Dromogomphus spinosus
 Enallagma basidens
 Enallagma exsulans
 Epithea princeps

Epitheca cynosura
 Erythemis simplicicollis
 Gomphus ozarkensis
 Gomphus apomyius
 Gomphus graslinellus
 Hagenius brevistylus
 Hetaerina americana
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Sympetrum vicinum
 Tramea carolina
 Tramea lacerata

Sebastian (12)

Anax junius
 Argia fumipennis
 Arigomphus lentulus
 Basiaeschna janata
 Erythemis simplicicollis
 Gomphus graslinellus
 Libellula cyanea
 Libellula flavida
 Libellula luctuosa
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Perithemis tenera

Sevier (44)

Argia fumipennis
 Argia sedula
 Argia tibialis
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Cordulegaster obliqua
 Didymops transversa
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma divagans
 Enallagma exsulans
 Enallagma signatum
 Epiaschna heros
 Epitheca cynosura
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus modestus
 Gomphus ozarkensis
 Gomphus vastus
 Gomphus graslinellus
 Gomphus lividus
 Gomphus oklahomensis
 Hagenius brevistylus
 Ischnura hastata
 Ischnura posita
 Lestes disjunctus
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia

Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Macromia pacifica
 Nasiaeschna pentacantha
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Progomphus obscurus
 Stylogomphus albistylus
 Sympetrum ambiguum
 Sympetrum vicinum
 Tachopteryx thoreyi

Sharp (40)

Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia plana
 Argia sedula
 Argia tibialis
 Argia translata
 Arigomphus submedianus
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Chromagrion conditum
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma civile
 Enallagma exsulans
 Epitheca cynosura
 Erythemis simplicicollis
 Gomphus graslinellus
 Gomphus lividus
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia illinoiensis
 Ophiogomphus westfalli
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Stylogomphus albistylus
 Sympetrum ambiguum
 Tachopteryx thoreyi

St. Francis (22)

Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Enallagma basidens
 Enallagma civile

Enallagma exsulans
 Erythemis simplicicollis
 Ischnura hastata
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Stylurus plagiatas
 Tramea lacerata

Stone (36)

Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia plana
 Argia sedula
 Argia tibialis
 Argia translata
 Argia tibialis
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Dromogomphus spinosus
 Enallagma civile
 Enallagma exsulans
 Epiaschna heros
 Erythemis simplicicollis
 Gomphus apomyius
 Gomphus graslinellus
 Gomphus quadricolor
 Hagenius brevistylus
 Helocordulia uhleri
 Hetaerina americana
 Hetaerina titia
 Ischnura posita
 Lestes disjunctus
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Stylogomphus albistylus
 Tachopteryx thoreyi
 Tramea carolina
 Tramea lacerata

Union (22)

Anax junius
 Argia apicalis
 Argia sedula
 Argia tibialis
 Calopteryx maculata
 Celithemis amanda
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma divagans
 Enallagma signatum
 Epitheca cynosura
 Erythemis simplicicollis

Gomphus vastus
 Hagenius brevistylus
 Ischnura posita
 Ischnura ramburii
 Libellula needhami
 Macromia taeniolata
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Perithemis tenera
 Tramea onusta

Van Buren (33)

Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia plana
 Argia sedula
 Argia tibialis
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Didymops transversa
 Dromogomphus spinosus
 Enallagma civile
 Enallagma exsulans
 Enallagma traviatum
 Enallagma vesperum
 Epitheca cynosura
 Erythemis simplicicollis
 Gomphus vastus
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Libellula cyanea
 Libellula deplanata
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pantala flavescens
 Somatochlora linearis
 Somatochlora ozarkensis
 Sympetrum ambiguum

Washington (62)

Aeschna interrupta
 Anax junius
 Anax longipes
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia plana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Didymops transversa

- Dromogomphus spoliatus*
Dythemis velox
Enallagma aspersum
Enallagma basidens
Enallagma civile
Enallagma exsulans
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Gomphus ozarkensis
Gomphus grasilinellus
Hagenius brevistylus
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura ramburii
Ischnura verticalis
Lestes disjunctus
Lestes unguiculatus
Libellula cyanea
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Macromia illinoensis
Macromia pacifica
Nasiaeschna pentacantha
Neurocordulia xanthosoma
Ophiogomphus westfalli
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Somatochlora ozarkensis
Stylogomphus albistylus
Sympetrum ambiguum
Sympetrum corruptum
Sympetrum vicinum
Tachopteryx thoreyi
Tramea carolina
Tramea lacerata
- White* (20)
Anax junius
Argia apicalis
Argia tibialis
Arigomphus submedianus
Basiaeschna janata
Calopteryx maculata
Didymops transversa
Dromogomphus spinosus
Erythemis simplicicollis
Hagenius brevistylus
Ischnura posita
Libellula incesta
Libellula luctuosa
Libellula vibrans
Macromia illinoensis
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Stylogomphus albistylus
- Tramea lacerata*
- Woodruff* (25)
Anax junius
Celithemis eponina
Enallagma civile
Enallagma signatum
Epiaeschna heros
Epithea princeps
Erythemis simplicicollis
Hetaerina americana
Ischnura hastata
Ischnura posita
Libellula cyanea
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Macromia taeniolata
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Somatochlora linearis
Tramea carolina
Tramea lacerata
- Yell* (39)
Anax junius
Argia apicalis
Argia fumipennis
Argia moesta
Argia tibialis
Basiaeschna janata
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Didymops transversa
Dromogomphus spinosus
Dythemis velox
Epithea princeps
Erythemis simplicicollis
Gomphus hybridus
Gomphus ozarkensis
Gomphus vastus
Gomphus grasilinellus
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Lestes disjunctus
Libellula cyanea
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Nasiaeschna pentacantha
Neurocordulia moesta
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
- Perithemis tenera*
Sympetrum ambiguum
Sympetrum vicinum
Tramea lacerata
- LOUISIANA (124 spp.)**
- Acadia* (45)
Anax junius
Argia apicalis
Argia moesta
Argia tibialis
Arigomphus maxwelli
Arigomphus submedianus
Brachymesia gravida
Celithemis eponina
Celithemis fasciata
Coryphaeschna ingens
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma civile
Enallagma dubium
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula auripennis
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula lydia
Libellula needhami
Libellula semifasciata
Libellula vibrans
Macromia illinoensis
Nasiaeschna pentacantha
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Miathyria marcella
Somatochlora filosa
Somatochlora linearis
Stylurus plagiatus
Sympetrum corruptum
Tramea carolina
Tramea lacerata
Tramea onusta
- Ascension* (27)
Anax junius
Argia apicalis
Argia tibialis
Brachymesia gravida
Celithemis eponina
Enallagma civile
Enallagma signatum
Epiaeschna heros
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
- Allen* (58)
Anax junius
Aphylla angustifolia
Argia apicalis
Argia moesta
Argia tibialis
Boyeria vinosa
Brachymesia gravida
Calopteryx dimidiata
- Calopteryx maculata*
Celithemis berthae
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Celithemis ornata
Celithemis verna
Coryphaeschna ingens
Didymops transversa
Dromogomphus spinosus
Enallagma civile
Enallagma exsulans
Enallagma weewa
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus hybridus
Gomphus modestus
Gomphus oklahomensis
Hagenius brevistylus
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula auripennis
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula lydia
Libellula needhami
Libellula semifasciata
Libellula vibrans
Macromia illinoensis
Nasiaeschna pentacantha
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Miathyria marcella
Somatochlora filosa
Somatochlora linearis
Stylurus plagiatus
Sympetrum corruptum
Tramea carolina
Tramea lacerata
Tramea onusta

Libellula auripennis
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula semifasciata
 Libellula vibrans
 Miathyria marcella
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata

Assumption (11)

Argia moesta
 Brachymesia gravida
 Epiaeschna heros
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Libellula needhami
 Libellula vibrans
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera

Avoyelles (25)

Anax junius
 Argia apicalis
 Argia moesta
 Argia tibialis
 Celithemis eponina
 Dromogomphus spinosus
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Hagenius brevistylus
 Hetaerina titia
 Ischnura ramburii
 Ischnura hastata
 Ischnura posita
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Macromia illinoiensis
 Neurocordulia molesta
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Tramea lacerata

Beauregard (60)

Anax junius
 Aphylla williamsoni
 Argia apicalis
 Argia moesta
 Argia tibialis
 Boyeria vinosa
 Brachymesia gravida
 Calopteryx dimidiata
 Calopteryx maculata

Celithemis amanda
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Celithemis ornata
 Coryphaeschna ingens
 Didymops transversa
 Dromogomphus spinosus
 Enallagma civile
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus hybridus
 Gomphus lividus
 Gomphus oklahomensis
 Hagenius brevistylus
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Lestes inaequalis
 Lestes vigilax
 Libellula auripennis
 Libellula axitena
 Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Macromia taeniolata
 Miathyria marcella
 Neurocordulia obsolata
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Stylurus laurae
 Telebasis byersi
 Tramea carolina
 Tramea lacerata
 Tramea onusta

Bienville (21)

Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Calopteryx maculata
 Dromogomphus spinosus
 Enallagma divagans
 Epiaeschna heros
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Ischnura posita
 Ischnura ramburii

Libellula incesta
 Libellula lydia
 Libellula vibrans
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Somatochlora margarita
 Sympetrum corruptum

Bossier (28)

Anax junius
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Cordulegaster maculata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Epiaeschna heros
 Erythemis simplicicollis
 Hagenius brevistylus
 Ischnura ramburii
 Lestes vigilax
 Libellula auripennis
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Neurocordulia molesta
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Tramea lacerata

Caddo (32)

Anax junius
 Argia tibialis
 Arigomphus submedianus
 Brachymesia gravida
 Celithemis elisa
 Celithemis ornata
 Dromogomphus spinosus
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Gomphus oklahomensis
 Ischnura posita
 Libellula auripennis
 Libellula deplanata
 Libellula incesta
 Libellula lydia
 Libellula semifasciata
 Libellula vibrans
 Macromia taeniolata
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens

Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
 Tramea onusta

Calcasieu (46)

Anax junius
 Aphylla williamsoni
 Argia apicalis
 Argia tibialis
 Arigomphus maxwelli
 Brachymesia gravida
 Celithemis elisa
 Celithemis eponina
 Coryphaeschna ingens
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma dubium
 Enallagma durum
 Enallagma signatum
 Epiaeschna heros
 Epithea costalis
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax berenice
 Erythrodiplax minuscula
 Gomphus oklahomensis
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula auripennis
 Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula semifasciata
 Libellula vibrans
 Macrodiplax balteata
 Macromia taeniolata
 Miathyria marcella
 Nehalennia integricollis
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
 Tramea onusta

Caldwell (24)

Argia bipunctulata
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Celithemis fasciata
 Dromogomphus spinosus
 Enallagma civile

Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura posita
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Somatochlora linearis
 Stylurus plagiatus
 Tramea carolina
 Tramea lacerata

Cameron (24)

Anax junius
 Brachymesia gravida
 Coryphaeschna ingens
 Enallagma durum
 Enallagma signatum
 Epiaeschna heros
 Erythemis simplicicollis
 Erythrodiplax berenice
 Erythrodiplax minuscula
 Ischnura hastata
 Ischnura posita
 Ischnura prognata
 Ischnura ramburii
 Libellula auripennis
 Libellula needhami
 Libellula vibrans
 Macrodiplax balteata
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Tramea carolina
 Tramea lacerata
 Tramea onusta

Catahoula (28)

Anax junius
 Argia apicalis
 Argia tibialis
 Calopteryx maculata
 Dromogomphus spinosus
 Enallagma civile
 Enallagma divagans
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula pulchella

Libellula vibrans
 Macromia taeniolata
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum corruptum

Claiborne (35)

Anax junius
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Arigomphus maxwelli
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Coryphaeschna ingens
 Dromogomphus spinosus
 Enallagma signatum
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Ischnura hastata
 Ischnura kellicotti
 Ischnura posita
 Ischnura ramburii
 Lestes vigilax
 Libellula auripennis
 Libellula incesta
 Libellula lydia
 Libellula semifasciata
 Libellula vibrans
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Tramea lacerata
 Tramea onusta

Concordia (13)

Anax junius
 Argia apicalis
 Enallagma civile
 Epiaeschna heros
 Erythemis simplicicollis
 Ischnura posita
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera

DeSoto (26)

Anax junius
 Argia bipunctulata
 Argia tibialis

Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Coryphaeschna ingens
 Dromogomphus spinosus
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Gomphus hybridus
 Libellula auripennis
 Libellula deplanata
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Somatochlora linearis
 Tramea lacerata

East Baton Rouge (65)

Anax junius
 Aphylla williamsoni
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Arigomphus maxwelli
 Brachymesia gravida
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Cordulegaster obliqua
 Coryphaeschna ingens
 Dromogomphus spinosus
 Enallagma civile
 Enallagma divagans
 Enallagma durum
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax berenice
 Erythrodiplax minuscula
 Gomphus hybridus
 Gomphus apomyius
 Gomphus exilis
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura prognata
 Ischnura ramburii
 Lestes disjunctus
 Libellula auripennis
 Libellula deplanata
 Libellula flavida

Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Macromia taeniolata
 Miathyria marcella
 Nasiaeschna pentacantha
 Neurocordulia molesta
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora filosa
 Somatochlora linearis
 Stylurus plagiatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
 Tramea onusta

East Carroll (9)

Argia apicalis
 Argia tibialis
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula lydia
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera

East Feliciana (56)

Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Celithemis amanda
 Celithemis eponina
 Celithemis fasciata
 Celithemis verna
 Cordulegaster maculata
 Cordulegaster obliqua
 fasciata
 Coryphaeschna ingens
 Didymops transversa
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Enallagma signatum
 Epiaeschna heros
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula

- Gomphus hybridus
Gomphus apomyioides
Gomphus exilis
Gomphus lividus
Hagenius brevistylus
Helocordulia selysii
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura kelicotti
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Lestes inaequalis
Lestes vigilax
Libellula auripennis
Libellula flavida
Libellula incesta
Libellula lydia
Libellula vibrans
Macromia illinoensis
Macromia taeniolata
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Sympetrum corruptum
Tramea carolina
- Evangeline* (46)
Anax junius
Argia apicalis
Argia moesta
Argia tibialis
Boyeria vinosa
Brachymesia gravida
Celithemis eponina
Celithemis fasciata
Coryphaeschna ingens
Didymops transversa
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma civile
Enallagma geminatum
Enallagma signatum
Epiaeschna heros
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus lividus
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula auripennis
Libellula deplanata
Libellula incesta
Libellula tuctuosa
Libellula lydia
Libellula needhami
Libellula semifasciata
Libellula vibrans
- Orthemis ferruginea
Macromia illinoensis
Nasiaeschna pentacantha
Neurocordulia molesta
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Stylurus plagiatus
Sympetrum corruptum
Tramea carolina
Tramea lacerata
Tramea onusta
- Franklin* (11)
Anax junius
Epiaeschna heros
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula lydia
Libellula vibrans
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
- Grant* (28)
Argia apicalis
Argia moesta
Argia sedula
Argia tibialis
Boyeria vinosa
Calopteryx dimidiata
Calopteryx maculata
Celithemis fasciata
Didymops transversa
Dromogomphus spinosus
Enallagma signatum
Epiaeschna heros
Erythemis simplicicollis
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Lestes inaequalis
Libellula incesta
Libellula lydia
Libellula vibrans
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Tachopteryx thoreyi
Tramea carolina
Tramea lacerata
- Iberia* (25)
Anax junius
Aphylla williamsoni
Brachymesia gravida
Celithemis eponina
Dromogomphus armatus
Dromogomphus spinosus
Enallagma civile
- Enallagma signatum
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax berenice
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula auripennis
Libellula incesta
Libellula lydia
Libellula needhami
Libellula vibrans
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Tramea lacerata
Tramea onusta
- Iberville* (17)
Anax junius
Enallagma signatum
Epiaeschna heros
Epithea princeps
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula lydia
Libellula vibrans
Miathyria marcella
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Sympetrum corruptum
- Jackson* (31)
Argia tibialis
Calopteryx maculata
Cordulegaster maculata
Didymops transversa
Dromogomphus spinosus
Enallagma civile
Epiaeschna heros
Epithea cynosura
Erythemis simplicicollis
Gomphaeschna furcillata
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula cyanea
Libellula flavida
Libellula incesta
Libellula lydia
Macromia taeniolata
Neurocordulia alabamensis
Neurocordulia virginiana
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
- Perithemis tenera
Somatochlora linearis
Stylurus laurac
Sympetrum ambiguum
Tramea carolina
Tramea lacerata
- Jefferson* (29)
Anax junius
Aphylla williamsoni
Brachymesia gravida
Celithemis eponina
Coryphaeschna ingens
Enallagma civile
Enallagma concisum
Enallagma durum
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax berenice
Erythrodiplax umbrata
Ischnura hastata
Ischnura posita
Ischnura prognata
Ischnura ramburii
Libellula needhami
Libellula vibrans
Nasiaeschna pentacantha
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Sympetrum corruptum
Tramea carolina
Tramea lacerata
- Jefferson Davis* (43)
Anax junius
Argia apicalis
Argia moesta
Argia tibialis
Arigomphus maxwelli
Boyeria vinosa
Brachymesia gravida
Celithemis elisa
Celithemis eponina
Coryphaeschna ingens
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma civile
Enallagma dubium
Enallagma exulans
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula auripennis

- Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula vibrans
 Macrodiplax balteata
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Lafayette (33)*
- Anax junius
 Argia apicalis
 Argia tibialis
 Arigomphus maxwelli
 Brachymesia gravida
 Celithemis eponina
 Coryphaeschna ingens
 Epiaeschna heros
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax umbrata
 Gomphaeschna antilope
 Gomphaeschna furcillata
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula vibrans
 Macromia taeniolata
 Miathyria marcella
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Telebasis byersi
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- LaFourche (22)*
- Anax junius
 Aphylla williamsoni
 Brachymesia gravida
 Celithemis eponina
 Coryphaeschna ingens
 Enallagma durum
 Enallagma signatum
 Epiaeschna heros
 Erythemis simplicicollis
 Erythrodiplax berenice
 Ischnura posita
- Ischnura ramburii
 Libellula incesta
 Libellula needhami
 Libellula vibrans
 Macrodiplax balteata
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Tramea lacerata
- LaSalle (36)*
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Celithemis eponina
 Celithemis fasciata
 Didymops transversa
 Dromogomphus spinosus
 Dythemis vexox
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epiaeschna heros
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus lividus
 Gomphus oklahomensis
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula deplanata
 Libellula incesta
 Libellula lydia
 Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
- Lincoln (43)*
- Anax junius
 Argia apicalis
 Argia bipunctulata
 Argia tibialis
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Cordulegaster obliqua
 Enallagma civile
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
- Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus lividus
 Gomphus oklahomensis
 Hagenius brevistylus
 Helocordulia selysii
 Ischnura hastata
 Ischnura kellicotti
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Lestes vigilax
 Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula semifasciata
 Libellula vibrans
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Somatochlora linearis
 Stylurus plagiatus
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
- Livingston (42)*
- Anax junius
 Argia apicalis
 Argia bipunctulata
 Argia moesta
 Argia sedula
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis fasciata
 Didymops transversa
 Dromogomphus spinosus
 Enallagma civile
 Enallagma divagans
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus exilis
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula auripennis
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula semifasciata
 Libellula vibrans
- Macromia illinoiensis
 Macromia taeniolata
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Stylurus amnicola
 Tramea carolina
- Madison (32)*
- Anax junius
 Argia apicalis
 Argia moesta
 Argia sedula
 Argia tibialis
 Dromogomphus spinosus
 Enallagma civile
 Enallagma durum
 Enallagma exsulans
 Enallagma geminatum
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Gomphaeschna furcillata
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula cyanea
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Morehouse (25)*
- Argia apicalis
 Argia moesta
 Argia tibialis
 Arigomphus submedianus
 Calopteryx maculata
 Celithemis eponina
 Coryphaeschna ingens
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura posita
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Pachydiplax longipennis
 Pantala flavescens

- Pantala hymenaea
 Perithemis tenera
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Natchitoches* (45)
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Arigomphus submedianus
 Boyeria vinosa
 Brachymesia gravida
 Calopteryx maculata
 Celithemis eponina
 Cordulegaster maculata
 Didymops transversa
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus lividus
 Hagenius brevistylus
 Helocordulia selysii
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula auripennis
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Tachopteryx thoreyi
 Tramea carolina
 Tramea lacerata
- Orleans* (35)
 Anax amazili
 Anax junius
 Aphylla williamsoni
 Brachymesia gravida
 Celithemis eponina
 Celithemis fasciata
 Coryphaeschna ingens
 Enallagma civile
 Enallagma durum
 Enallagma signatum
 Epiaeschna heros
- Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax berenice
 Erythrodiplax minuscula
 Gomphaeschna antilope
 Gomphaeschna furcillata
 Ischnura hastata
 Ischnura posita
 Ischnura prognata
 Ischnura ramburii
 Libellula auripennis
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula vibrans
 Miathyria marcella
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
- Ouachita* (41)
 Anax junius
 Anax longipes
 Basiaeschna janata
 Brachymesia gravida
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Didymops transversa
 Dromogomphus spinosus
 Enallagma civile
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Epithea stella
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus lividus
 Ischnura hastata
 Ischnura kellicotti
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula vibrans
 Macromia illinoiensis
 Macromia taeniolata
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Stylurus plagiatus
 Sympetrum ambiguum
- Tramea lacerata
 Tramea onusta
- Plaquemines* (18)
 Anax junius
 Brachymesia gravida
 Celithemis eponina
 Coryphaeschna ingens
 Enallagma durum
 Erythemis simplicicollis
 Erythrodiplax berenice
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula needhami
 Libellula vibrans
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
- Pointe Coupee* (21)
 Anax junius
 Arigomphus submedianus
 Brachymesia gravida
 Dromogomphus spinosus
 Enallagma signatum
 Epiaeschna heros
 Epithea cynosura
 Erythemis simplicicollis
 Ischnura posita
 Ischnura ramburii
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula vibrans
 Miathyria marcella
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Tramea carolina
- Dromogomphus spoliatus
 Enallagma divagans
 Enallagma signatum
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus lividus
 Gomphus oklahomensis
 Hagenius brevistylus
 Helocordulia selysii
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula auripennis
 Libellula cyanea
 Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Macromia taeniolata
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Sympetrum corruptum
 Tachopteryx thoreyi
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Red River* (17)
 Anax junius
 Argia tibialis
 Calopteryx maculata
 Celithemis eponina
 Epiaeschna heros
 Epithea cynosura
 Erythemis simplicicollis
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Tramea lacerata
- Rapides* (60)
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Arigomphus submedianus
 Basiaeschna janata
 Boyeria vinosa
 Brachymesia gravida
 Calopteryx dimidiata
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Celithemis verna
 Cordulegaster maculata
 Cordulegaster obliqua
 Didymops transversa
 Dromogomphus spinosus
- Dromogomphus spinosus

- Erythemis simplicicollis*
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula lydia
Macromia taeniolata
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum ambiguum
- Sabine* (32)
Anax junius
Aphylla williamsoni
Argia moesta
Argia tibialis
Brachymesia gravida
Calopteryx maculata
Celithemis eponina
Celithemis fasciata
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma civile
Epiaeschna heros
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Lestes disjunctus
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Sympetrum corruptum
Tachopteryx thoreyi
Tramea lacerata
- Saint Bernard* (17)
Anax junius
Aphylla williamsoni
Brachymesia gravida
Celithemis eponina
Coryphaeschna ingens
Enallagma civile
Epiaeschna heros
Erythemis simplicicollis
Erythrodiplax berenice
Ischnura ramburii
Libellula needhami
Libellula vibrans
Miathyria marcella
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Sympetrum corruptum
- Saint Charles* (20)
Anax junius
Aphylla williamsoni
Brachymesia gravida
Coryphaeschna ingens
Enallagma durum
Epiaeschna heros
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Lestes inaequalis
Libellula lydia
Libellula needhami
Libellula vibrans
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Sympetrum corruptum
Tramea carolina
Tramea lacerata
- Saint Helena* (50)
Anax junius
Argia apicalis
Argia fumipennis
Argia moesta
Argia sedula
Argia tibialis
Basiaeschna janata
Boyeria vinosa
Calopteryx dimidiata
Calopteryx maculata
Celithemis elisa
Celithemis fasciata
Cordulegaster maculata
Coryphaeschna ingens
Didymops transversa
Dromogomphus spinosus
Dythemis velox
Enallagma civile
Enallagma divagans
Enallagma exsulans
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus exilis
Gomphus lividus
Hagenius brevistylus
Helocordulia selysii
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula auripennis
Libellula deplanata
Libellula incesta
Libellula lydia
Libellula vibrans
Macromia illinoiensis
Macromia taeniolata
- Miathyria marcella*
Neurocordulia molesta
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Tramea carolina
- Saint James* (12)
Brachymesia gravida
Coryphaeschna ingens
Epiaeschna heros
Erythemis simplicicollis
Ischnura hastata
Ischnura ramburii
Libellula lydia
Libellula needhami
Libellula vibrans
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
- St. John The Baptist* (24)
Anax junius
Brachymesia gravida
Celithemis eponina
Coryphaeschna ingens
Epiaeschna heros
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax berenice
Ischnura hastata
Ischnura posita
Ischnura prognata
Ischnura ramburii
Libellula auripennis
Libellula lydia
Libellula needhami
Libellula vibrans
Neurocordulia molesta
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Telebasis byersi
Tramea carolina
Tramea lacerata
- Saint Martin* (27)
Anax junius
Argia apicalis
Argia tibialis
Arigomphus maxwelli
Brachymesia gravida
Celithemis eponina
Dromogomphus spinosus
Enallagma signatum
Epiaeschna heros
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Ischnura hastata
Ischnura posita
Ischnura prognata
Ischnura ramburii
Libellula incesta
Libellula lydia
Libellula needhami
Libellula vibrans
Miathyria marcella
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum ambiguum
- Saint Landry* (45)
Anax junius
Aphylla williamsoni
Argia apicalis
Argia tibialis
Brachymesia gravida
Celithemis eponina
Celithemis fasciata
Celithemis ornata
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma civile
Enallagma exsulans
Enallagma signatum
Epiaeschna heros
Epithea princeps
- Epithea cynosura*
Erythemis simplicicollis
Erythrodiplax minuscula
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula auripennis
Libellula incesta
Libellula lydia
Libellula vibrans
Macromia illinoiensis
Macromia taeniolata
Miathyria marcella
Neurocordulia molesta
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Tramea carolina
Tramea lacerata
- Epithea cynosura*
Erythemis simplicicollis
Erythrodiplax minuscula
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula auripennis
Libellula incesta
Libellula lydia
Libellula vibrans
Macromia illinoiensis
Macromia taeniolata
Miathyria marcella
Nasiaeschna pentacantha
Neurocordulia molesta
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Stylurus plagiatum
Sympetrum corruptum
Telebasis byersi
Tramea lacerata
Tramea onusta
- Saint Mary* (20)
Anax junius
Aphylla williamsoni
Brachymesia gravida
Celithemis eponina

- Coryphaeschna ingens
 Epiaeschna heros
 Erythemis simplicicollis
 Erythrodiplax berenice
 Ischnura posita
 Ischnura ramburii
 Libellula lydia
 Libellula auripennis
 Libellula incesta
 Libellula needhami
 Libellula vibrans
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Tramea lacerata
 Tramea onusta
- Saint Tammany* (90)
 Anax junius
 Anax longipes
 Aphylla williamsoni
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Boyeria vinosa
 Brachymesia gravaida
 Calopteryx dimidiata
 Calopteryx maculata
 Celithemis amanda
 Celithemis berthae
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Celithemis ornata
 Celithemis verna
 Cordulegaster maculata
 Coryphaeschna ingens
 Didymops transversa
 Dromogomphus armatus
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma concisum
 Enallagma daeckii
 Enallagma divagans
 Enallagma dubium
 Enallagma durum
 Enallagma geminatum
 Enallagma signatum
 Enallagma weewa
 Epiaeschna heros
 Epithea princeps
 Epithea costalis
 Epithea cynosura
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax berenice
 Erythrodiplax minuscula
 Erythrodiplax umbrata
 Gomphaeschna antilope
 Gomphus exilis
 Gomphus hodgesi
 Gomphus hybridus
- Hagenius brevistylus
 Helocordulia selysii
 Hetaerina titia
 Ischnura hastata
 Ischnura kellicotti
 Ischnura posita
 Ischnura prognata
 Ischnura ramburii
 Lestes disjunctus
 Lestes vigilax
 Libellula auripennis
 Libellula axilena
 Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula semifasciata
 Libellula vibrans
 Macrodiplax balteata
 Macromia illinoiensis
 Macromia taeniolata
 Miathyria marcella
 Nasiaeschna pentacantha
 Nehalennia integracollis
 Neurocordulia alabamensis
 Neurocordulia virginensis
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora filosa
 Somatochlora linearis
 Styrius plagiatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Tachopteryx thoreyi
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Tangipahoa* (62)
 Anax junius
 Anax longipes
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Arigomphus maxwelli
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx dimidiata
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Coryphaeschna ingens
 Didymops transversa
 Gomphus modestus
 Enallagma civile
 Enallagma daeckii
- Enallagma divagans
 Enallagma signatum
 Epithea princeps
 Epithea costalis
 Erythemis simplicicollis
 Gomphus hybridus
 Gomphus apomyius
 Gomphus exilis
 Gomphus lividus
 Hagenius brevistylus
 Helocordulia selysii
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura prognata
 Ischnura ramburii
 Lestes vigilax
 Libellula auripennis
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula semifasciata
 Libellula vibrans
 Macromia taeniolata
 Miathyria marcella
 Nasiaeschna pentacantha
 Neurocordulia alabamensis
 Ophiogomphus australis
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
- Tensas* (28)
 Argia apicalis
 Argia moesta
 Argia sedula
 Arigomphus submedianus
 Brachymesia gravaida
 Celithemis eponina
 Coryphaeschna ingens
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma geminatum
 Enallagma signatum
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula luctuosa
- Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Tramea lacerata
- Terrebonne* (18)
 Anax junius
 Brachymesia gravaida
 Celithemis eponina
 Coryphaeschna ingens
 Epiaeschna heros
 Erythemis simplicicollis
 Erythrodiplax berenice
 Erythrodiplax minuscula
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula needhami
 Libellula vibrans
 Pachydiplax longipennis
 Pantala flavescens
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
- Union* (28)
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx dimidiata
 Calopteryx maculata
 Dromogomphus spinosus
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Ischnura hastata
 Libellula cyanea
 Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Tachopteryx thoreyi
 Tramea lacerata
- Vermilion* (23)
 Anax junius
 Brachymesia gravaida
 Celithemis eponina
 Coryphaeschna ingens
 Epiaeschna heros
 Erythemis simplicicollis

- Erythrodiplax berenice*
Ischnura hastata
Ischnura kellicott
Ischnura posita
Ischnura ramburii
Libellula auripennis
Libellula lydia
Libellula needhami
Libellula vibrans
Miathyria marcella
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Tramea lacerata
Tramea onusta
- Vernon (62)*
Anax junius
Argia bipunctulata
Argia fumipennis
Argia moesta
Argia tibialis
Boyeria vinosa
Brachymesia gravida
Calopteryx dimidiata
Calopteryx maculata
Celithemis amanda
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Celithemis ornata
Celithemis verna
Cordulegaster obliqua
Coryphaeschna ingens
Dromogomphus spinosus
Dromogomphus spoliatus
Didymops transversa
Enallagma civile
Enallagma divagans
Enallagma signatum
Enallagma triviatum
Enallagma weewa
Epiaeschna heros
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus lividus
Gomphus oklahomensis
Hagenius brevistylus
Helocordulia selysii
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes inaequalis
Libellula auripennis
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula lydia
Libellula needhami
Libellula semifasciata
Libellula vibrans
- Macromia illinoensis*
Neurocordulia molesta
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora filosa
Somatochlora georgina
Somatochlora linearis
Stylurus laurae
Tachopteryx thoreyi
Tramea carolina
Tramea lacerata
Tramea onusta
- Washington (67)*
Anax junius
Argia apicalis
Argia bipunctulata
Argia fumipennis
Argia moesta
Argia sedula
Argia tibialis
Basiaeschna janata
Boyeria vinosa
Calopteryx dimidiata
Calopteryx maculata
Celithemis elisa
Celithemis fasciata
Celithemis ornata
Celithemis verna
Cordulegaster bileniata
Didymops transversa
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma divagans
Enallagma exsulans
Enallagma triviatum
Epiaeschna heros
Epithea costalis
Epithea cynosura
Epithea spinosa
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus dilatatus
Gomphus hybridus
Gomphus modestus
Gomphus apomyius
Gomphus exilis
Gomphus lividus
Hagenius brevistylus
Helocordulia selysii
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Libellula auripennis
Libellula axilena
Libellula cyanea
Libellula deplanata
Libellula flavida
Libellula incesta
- Libellula lydia*
Libellula pulchella
Libellula semifasciata
Libellula vibrans
Macromia illinoensis
Nasiaeschna pentacantha
Neurocordulia alabamensis
Neurocordulia molesta
Ophiogomphus australis
Orthemis ferruginea
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Somatochlora provocans
Stylurus amnicola
Stylurus laurae
Sympetrum corruptum
Tramea carolina
Tramea lacerata
- West Carroll (15)*
Anax junius
Argia apicalis
Argia tibialis
Enallagma signatum
Epiaeschna heros
Erythemis simplicicollis
Libellula incesta
Libellula lydia
Libellula pulchella
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Somatochlora linearis
Stylurus plagiatus
- West Feliciana (42)*
Anax junius
Anax longipes
Aphylla angustifolia
Aphylla williamsoni
Argia apicalis
Argia fumipennis
Argia moesta
Argia sedula
Argia tibialis
Basiaeschna janata
Boyeria vinosa
Brachymesia gravida
Calopteryx maculata
Cordulegaster maculata
Dromogomphus spinosus
Enallagma civile
Enallagma geminatum
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Hagenius brevistylus
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula incesta
Libellula lydia
Libellula vibrans
Macromia illinoensis
Macromia taeniolata
Miathyria marcella
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Tramea carolina
Tramea lacerata
Tramea onusta
- Webster (28)*
Anax junius
Argia tibialis
Celithemis eponina
Cordulegaster maculata
Cordulegaster obliqua
Dromogomphus spoliatus
Enallagma civile
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Ischnura hastata
Ischnura posita
Lestes inaequalis
Libellula auripennis
Libellula flavida
Libellula incesta
Libellula lydia
Libellula vibrans
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Tramea carolina
Tramea lacerata
- West Baton Rouge (14)*
Anax junius
Enallagma signatum
Epiaeschna heros
Epithea princeps
Erythemis simplicicollis
Erythrodiplax minuscula
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula lydia
Libellula vibrans
Nasiaeschna pentacantha
Pachydiplax longipennis
- Winn (23)*
Argia moesta

Argia tibialis
 Calopteryx maculata
 Didymops transversa
 Epiaschna heros
 Epithea cynosura
 Erythemis simplicicollis
 Hagenius brevistylus
 Gomphus oklahomensis
 Ischnura hastata
 Ischnura posita
 Libellula incesta
 Libellula tydia
 Libellula vibrans
 Macromia taeniolata
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Somatochlora linearis
 Sympetrum ambiguum
 Tramea carolina
 Tramea onusta

NEW MEXICO (97 spp.)

Bernalillo (12)

Argia apicalis
 Argia plana
 Enallagma civile
 Ischnura denticollis
 Lestes alacer
 Libellula composita
 Libellula forensis
 Libellula lydia
 Libellula subornata
 Progomphus borealis
 Stylurus intricatus
 Sympetrum corruptum

Catron (43)

Aeshna multicolor
 Aeshna palmata
 Aeshna persephone
 Amphigiagrion abbreviatum
 Anax junius
 Archilestes grandis
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia plana
 Argia tonto
 Argia translata
 Argia vivida
 Enallagma boreale
 Enallagma carunculatum
 Enallagma civile
 Enallagma cyathigerum
 Enallagma praevarum
 Erpetogomphus compositus
 Erpetogomphus crotalinus
 Erpetogomphus heterodon
 Erpetogomphus lampropeltis
 Erythemis collocata
 Hesperagrion heterodoxum

Hetaerina americana
 Hetaerina vulnerata
 Ischnura damula
 Ischnura demorsa
 Ischnura denticollis
 Ischnura hastata
 Ischnura perparva
 Libellula nodisticta
 Libellula quadrimaculata
 Libellula saturata
 Ophiogomphus arizonicus
 Oplonaeschna armata
 Pachydiplax longipennis
 Paltotemis lineatipes
 Perithemis tenera
 Sympetrum corruptum
 Sympetrum pallipes
 Telebasis salva
 Tramea lacerata

Chaves (46)

Aeshna multicolor
 Anax junius
 Anax walsinghami
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Brachymesia gravida
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma boreale
 Enallagma civile
 Enallagma cyathigerum
 Enallagma praevarum
 Epithea petechialis
 Erpetogomphus compositus
 Erpetogomphus designatus
 Erythemis collocata
 Erythemis simplicicollis
 Erythrodiplax berenice
 Gomphus externus
 Gomphus militaris
 Hetaerina americana
 Ischnura barberi
 Ischnura damula
 Lestes alacer
 Libellula comanche
 Libellula composita
 Libellula forensis
 Libellula luctuosa
 Libellula lydia
 Libellula saturata
 Libellula subornata
 Macrodiplax balteata
 Macromia annulata
 Pachydiplax longipennis
 Paltotemis lineatipes
 Pantala flavescens
 Pantala hymenaea
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Stylurus intricatus
 Sympetrum corruptum

Tramea lacerata
 Tramea onusta

Cibola (34)

Aeshna multicolor
 Aeshna palmata
 Aeshna umbrosa
 Amphigiagrion abbreviatum
 Argia fumipennis
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia plana
 Argia vivida
 Enallagma antennatum
 Enallagma boreale
 Enallagma carunculatum
 Enallagma civile
 Enallagma cyathigerum
 Enallagma praevarum
 Erythemis collocata
 Hetaerina americana
 Ischnura barberi
 Ischnura damula
 Ischnura perparva
 Lestes congener
 Lestes disjunctus
 Lestes dryas
 Libellula forensis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula saturata
 Libellula subornata
 Ophiogomphus severus
 Sympetrum corruptum
 Sympetrum danae
 Sympetrum pallipes

Curry (1)

Enallagma civile

De Baca (16)

Aeshna multicolor
 Argia apicalis
 Argia moesta
 Argia sedula
 Argia vivida
 Celithemis eponina
 Dythemis fugax
 Enallagma basidens
 Enallagma civile
 Erythemis collocata
 Libellula saturata
 Pachydiplax longipennis
 Sympetrum corruptum
 Sympetrum occidentale
 Sympetrum vicinum
 Tramea lacerata

Dona Ana (30)

Aeshna multicolor
 Amphigiagrion abbreviatum
 Anax junius
 Argia moesta

Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Argia vivida
 Enallagma boreale
 Enallagma civile
 Enallagma cyathigerum
 Enallagma praevarum
 Erythemis collocata
 Hesperagrion heterodoxum
 Hetaerina americana
 Ischnura barberi
 Ischnura demorsa
 Ischnura denticollis
 Ischnura perparva
 Lestes alacer
 Libellula forensis
 Libellula saturata
 Pachydiplax longipennis
 Pantala hymenaea
 Progomphus borealis
 Pseudoleon superbus
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta

Eddy (51)

Aeshna dugesi
 Aeshna multicolor
 Aeshna umbrosa
 Anax junius
 Anax walsinghami
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia hinei
 Argia immunda
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Argia vivida
 Brechmorhoga mendax
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma boreale
 Enallagma civile
 Epithea petechialis
 Erpetogomphus crotalinus
 Erpetogomphus designatus
 Erythemis collocata
 Gomphus externus
 Gomphus militaris
 Hesperagrion heterodoxum
 Hetaerina americana
 Ischnura barberi
 Ischnura denticollis
 Lestes alacer
 Libellula comanche
 Libellula luctuosa
 Libellula pulchella

- Libellula saturata
 Neurocordulia xanthosoma
 Orthemis ferruginea
 Pachydiplax longipennis
 Paltothemis lineatipes
 Pantala flavescens
 Perithemis tenera
 Stylurus intricatus
 Sympetrum corruptum
 Sympetrum costiferum
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Grant (54)*
 Aeshna californica
 Aeshna dugesi
 Aeshna multicolor
 Anax junius
 Archilestes grandis
 Argia fumipennis
 Argia lugens
 Argia moesta
 Argia munda
 Argia nahuana
 Argia plana
 Argia tonto
 Argia translata
 Argia vivida
 Brechmorhoga mendax
 Cordulegaster diadema
 Enallagma basidens
 Enallagma civile
 Enallagma cyathigerum
 Enallagma praevarum
 Erpetogomphus compositus
 Erpetogomphus crotalinus
 Erpetogomphus heterodon
 Erpetogomphus lampropeltis
 Erythemis collocata
 Erythrodiplax connata
 Hesperagrion heterodoxum
 Hetaerina americana
 Hetaerina vulnerata
 Ischnura barberi
 Ischnura cervula
 Ischnura damula
 Ischnura demorsa
 Ischnura denticollis
 Lestes alacer
 Libellula luctuosa
 Libellula lydia
 Libellula nodisticta
 Libellula saturata
 Libellula subornata
 Oplonaeschna armata
 Orthemis ferruginea
 Pachydiplax longipennis
 Paltothemis lineatipes
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides albrighti
 Progomphus borealis
 Pseudoleon superbus
- Sympetrum corruptum
 Sympetrum illotum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Guadalupe (36)*
 Amphigrion abbreviatum
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia plana
 Brechmorhoga mendax
 Enallagma basidens
 Enallagma praevarum
 Epithea petechialis
 Erpetogomphus designatus
 Erythemis collocata
 Erythemis simplicicollis
 Gomphus externus
 Gomphus militaris
 Hesperagrion heterodoxum
 Hetaerina americana
 Ischnura barberi
 Ischnura damula
 Ischnura denticollis
 Libellula comanche
 Libellula composita
 Libellula luctuosa
 Libellula pulchella
 Libellula saturata
 Libellula subornata
 Macromia annulata
 Pachydiplax longipennis
 Pantala hymenaea
 Progomphus obscurus
 Sympetrum pallipes
 Sympetrum vicinum
 Tramea lacerata
 Tramea onusta
- Harding (7)*
 Argia moesta
 Argia plana
 Enallagma civile
 Enallagma praevarum
 Gomphus externus
 Hetaerina americana
 Libellula saturata
- Hidalgo (15)*
 Argia sedula
 Enallagma basidens
 Enallagma civile
 Enallagma cyathigerum
 Enallagma praevarum
 Erythemis collocata
 Hetaerina americana
 Ischnura damula
 Ischnura demorsa
 Libellula luctuosa
 Libellula saturata
- Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Telebasis salva
- Lea (12)*
 Aeshna multicolor
 Argia alberta
 Argia moesta
 Enallagma basidens
 Enallagma boreale
 Enallagma civile
 Erythemis collocata
 Ischnura damula
 Ischnura denticollis
 Libellula saturata
 Pachydiplax longipennis
 Perithemis tenera
- Lincoln (26)*
 Aeshna multicolor
 Amphigrion abbreviatum
 Anax junius
 Archilestes grandis
 Argia lugens
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Brechmorhoga mendax
 Enallagma boreale
 Enallagma civile
 Enallagma praevarum
 Epithea petechialis
 Erythemis collocata
 Hetaerina americana
 Ischnura damula
 Ischnura demorsa
 Libellula nodisticta
 Libellula pulchella
 Libellula saturata
 Libellula subornata
 Ophiogomphus severus
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Sympetrum pallipes
 Tramea lacerata
- Luna (4)*
 Enallagma civile
 Ischnura barberi
 Libellula saturata
 Sympetrum corruptum
- McKinley (7)*
 Aeshna multicolor
 Aeshna palmata
 Amphigrion abbreviatum
 Enallagma boreale
 Ischnura damula
 Lestes congener
 Sympetrum pallipes
- Mora (16)*
 Aeshna multicolor
 Argia nahuana
- Enallagma boreale
 Enallagma civile
 Enallagma clausum
 Enallagma praevarum
 Ischnura damula
 Ischnura demorsa
 Ischnura hastata
 Ischnura perparva
 Libellula forensis
 Libellula luctuosa
 Sympetrum corruptum
 Sympetrum occidentale
 Sympetrum pallipes
 Tramea lacerata
- Otero (32)*
 Aeshna multicolor
 Amphigrion abbreviatum
 Anax walsinghami
 Archilestes grandis
 Argia alberta
 Argia lugens
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Brechmorhoga mendax
 Enallagma boreale
 Enallagma civile
 Enallagma praevarum
 Epithea petechialis
 Erythemis collocata
 Ischnura barberi
 Ischnura damula
 Ischnura denticollis
 Libellula comanche
 Libellula croceipennis
 Libellula luctuosa
 Libellula pulchella
 Libellula saturata
 Pachydiplax longipennis
 Paltothemis lineatipes
 Pantala hymenaea
 Pseudoleon superbus
 Sympetrum corruptum
 Sympetrum illotum
 Telebasis salva
 Tramea lacerata
- Quay (22)*
 Aeshna multicolor
 Argia fumipennis
 Argia moesta
 Argia plana
 Argia sedula
 Argia vivida
 Enallagma civile
 Erythemis collocata
 Hetaerina americana
 Ischnura damula
 Ischnura demorsa
 Ischnura denticollis
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia

- Libellula saturata
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Sympetrum occidentale
- Rio Arriba* (26)
 Aeshna interrupta
 Aeshna multicolor
 Aeshna palmata
 Aeshna umbrosa umbrosa
 Amphigrion abbreviatum
 Anax junius
 Enallagma boreale
 Enallagma cyathigerum
 Enallagma praevarum
 Erythrodiplex berenice
 Hesperagrion heterodoxum
 Ischnura damula
 Ischnura demorsa
 Lestes congener
 Lestes disjunctus
 Lestes dryas
 Libellula lydia
 Libellula pulchella
 Libellula quadrimaculata
 Ophiogomphus severus
 Pantala flavescens
 Phyllogomphoides albrighti
 Sympetrum corruptum
 Sympetrum ternum
 Sympetrum occidentale
 Sympetrum pallipes
- Roosevelt* (1)
 Enallagma praevarum
- San Juan* (22)
 Aeshna multicolor
 Amphigrion abbreviatum
 Anax junius
 Argia plana
 Argia vivida
 Enallagma boreale
 Enallagma civile
 Enallagma praevarum
 Erythemis collocata
 Hetaerina americana
 Ischnura damula
 Ischnura denticollis
 Lestes congener
 Libellula forensis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula saturata
 Pachydiplax longipennis
 Sympetrum corruptum
 Sympetrum danae
 Sympetrum occidentale
- San Miguel* (40)
 Aeshna multicolor
- Amphigrion abbreviatum
 Anax junius
 Argia fumipennis
 Argia lugens
 Argia moesta
 Argia plana
 Argia translata
 Argia vivida
 Enallagma boreale
 Enallagma civile
 Enallagma cyathigerum
 Enallagma praevarum
 Erpetogomphus designatus
 Erythemis collocata
 Hetaerina americana
 Ischnura damula
 Ischnura demorsa
 Ischnura perparva
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Lestes dryas
 Libellula forensis
 Libellula lydia
 Libellula nodisticta
 Libellula pulchella
 Libellula quadrimaculata
 Libellula saturata
 Ophiogomphus severus
 Oplonaeschna armata
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Sympetrum danae
 Sympetrum occidentale
 Sympetrum pallipes
 Tramea lacerata
 Tramea onusta
- Sandoval* (29)
 Aeshna interrupta
 Aeshna multicolor
 Aeshna umbrosa
 Amphigrion abbreviatum
 Archilestes grandis
 Argia nahuana
 Argia plana
 Enallagma boreale
 Enallagma civile
 Enallagma praevarum
 Erythemis collocata
 Hetaerina americana
 Hetaerina vulnerata
 Ischnura damula
 Lestes congener
 Lestes disjunctus
 Lestes dryas
 Libellula pulchella
 Libellula quadrimaculata
 Ophiogomphus severus
 Oplonaeschna armata
 Pantala hymenaea
 Stylurus intricatus
 Sympetrum corruptum
- Sympetrum danae
 Sympetrum ternum
 Sympetrum obtusum
 Sympetrum occidentale
 Sympetrum pallipes
- San Juan* (1)
 Enallagma cyathigerum
- Santa Fe* (10)
 Aeshna multicolor
 Amphigrion abbreviatum
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia nahuana
 Enallagma civile
 Erythemis collocata
 Lestes disjunctus
 Libellula saturata
- Sierra* (26)
 Aeshna interrupta
 Aeshna multicolor
 Anax junius
 Argia moesta
 Argia nahuana
 Argia translata
 Brechmorhoga mendax
 Enallagma basidens
 Enallagma civile
 Enallagma praevarum
 Hesperagrion heterodoxum
 Hetaerina americana
 Hetaerina vulnerata
 Ischnura damula
 Ischnura demorsa
 Ischnura denticollis
 Lestes alacer
 Libellula lydia
 Libellula saturata
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Sympetrum occidentale
- Socorro* (28)
 Aeshna multicolor
 Anax junius
 Anax walsinghamsi
 Argia moesta
 Argia sedula
 Enallagma civile
 Erpetogomphus designatus
 Erythemis collocata
 Gomphus externus
 Hetaerina americana
 Ischnura denticollis
 Lestes alacer
 Libellula composita
 Libellula lydia
 Libellula nodisticta
- Libellula pulchella
 Libellula quadrimaculata
 Libellula saturata
 Ophiogomphus severus
 Oplonaeschna armata
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Sympetrum obtusum
 Sympetrum occidentale
 Tramea lacerata
- Taos* (20)
 Aeshna juncea
 Aeshna multicolor
 Aeshna palmata
 Amphigrion abbreviatum
 Argia apicalis
 Argia plana
 Argia vivida
 Enallagma boreale
 Erythemis collocata
 Ischnura barberi
 Lestes disjunctus
 Lestes dryas
 Libellula quadrimaculata
 Libellula saturata
 Ophiogomphus severus
 Somatochlora semicircularis
 Sympetrum corruptum
 Sympetrum danae
 Sympetrum occidentale
 Sympetrum pallipes
- Union* (24)
 Aeshna multicolor
 Argia lugens
 Argia moesta
 Argia plana
 Celithemis eponina
 Enallagma boreale
 Enallagma civile
 Enallagma praevarum
 Epiteca petechialis
 Erythemis collocata
 Erythemis vesiculosa
 Gomphus militaris
 Hetaerina americana
 Ischnura damula
 Ischnura demorsa
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Valencia* (4)
 Aeshna multicolor
 Enallagma civile

Pantala hymenaea
 Sympetrum corruptum

OKLAHOMA (133 spp.)

Adair (24)

Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia plana
 Argia sedula
 Arigomphus lentulus
 Calopteryx maculata
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma geminatum
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Perithemis tenera
 Stylogomphus albistylus

Alfalfa (39)

Anax junius
 Argia alberta
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Calopteryx maculata
 Celithemis eponina
 Enallagma antennatum
 Enallagma basidens
 Enallagma civile
 Enallagma signatum
 Epithea princeps
 Erythemis simplicicollis
 Erythemis vesiculosa
 Gomphus externus
 Gomphus militaris
 Hetaerina americana
 Ischnura barberi
 Ischnura denticollis
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea

Perithemis tenera
 Progomphus obscurus
 Sympetrum ambiguum
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta

Atoka (20)

Argia apicalis
 Argia fumipennis
 Argia sedula
 Argia tibialis
 Arigomphus submedianus
 Celithemis eponina
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma civile
 Enallagma signatum
 Erythemis simplicicollis
 Ischnura posita
 Ischnura verticalis
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Macromia pacifica
 Pachydiplax longipennis
 Perithemis tenera
 Tramea lacerata

Beaver (30)

Aeshna multicolor
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia nahuana
 Argia sedula
 Celithemis eponina
 Enallagma basidens
 Enallagma civile
 Enallagma signatum
 Erpetogomphus designatus
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura demorsa
 Ischnura denticollis
 Ischnura verticalis
 Lestes disjunctus
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula subornata
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta

Beckham (29)

Anax junius
 Argia apicalis

Argia fumipennis
 Argia nahuana
 Argia sedula
 Basiaeschna janata
 Celithemis eponina
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Epithea cynosura
 Epithea petechialis
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura demorsa
 Ischnura denticollis
 Ischnura verticalis
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta

Blaine (19)

Argia apicalis
 Argia nahuana
 Argia plana
 Calopteryx maculata
 Dythemis fugax
 Enallagma basidens
 Enallagma civile
 Hetaerina americana
 Ischnura posita
 Ischnura verticalis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pantala hymenaea
 Sympetrum corruptum
 Tramea onusta

Bryan (49)

Anax junius
 Argia apicalis
 Argia bipunctulata
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia tibialis
 Argia translata
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Dromogomphus spinosus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Epiaeschna heros
 Epithea princeps
 Erpetogomphus designatus

Erythemis simplicicollis
 Gomphus vastus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Libellula croceipennis
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Macromia illinoiensis
 Macromia pacifica
 Neurocordulia molesta
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
 Tramea onusta

Caddo (29)

Anax junius
 Argia apicalis
 Argia moesta
 Argia plana
 Argia sedula
 Argia tibialis
 Basiaeschna janata
 Calopteryx maculata
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma exsulans
 Epithea princeps
 Epithea cynosura
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus externus
 Gomphus graslinellus
 Hetaerina americana
 Ischnura verticalis
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia
 Macromia illinoiensis
 Macromia pacifica
 Pachydiplax longipennis
 Perithemis tenera
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta

Canadian (14)

Anax junius

- Argia apicalis
 Enallagma civile
 Hetaerina americana
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Tramea onusta
- Carter* (27)
- Anax junius
 Argia apicalis
 Argia moesta
 Argia sedula
 Arigomphus submedianus
 Brachymesia gravida
 Celithemis eponina
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Epithea cynosura
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Ischnura verticalis
 Lestes disjunctus
 Libellula comanche
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Tramea lacerata
- Cherokee* (20)
- Anax longipes
 Argia moesta
 Argia plana
 Enallagma aspersum
 Enallagma civile
 Enallagma exsulans
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Libellula cyanea
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Macromia illinoensis
 Pachydiplax longipennis
 Perithemis tenera
 Stylogomphus albistylus
 Tramea lacerata
- Choctaw* (34)
- Argia apicalis
 Argia bipunctulata
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Epithea princeps
 Erythemis simplicicollis
 Gomphus vastus
 Gomphus militaris
 Ischnura hastata
 Ischnura posita
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Neurocordulia molesta
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum ambiguum
 Tramea lacerata
- Cimarron* (45)
- Aeshna multicolor
 Aeshna umbrosa
 Anax junius
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia plana
 Brechmorhoga mendax
 Celithemis eponina
 Enallagma antennatum
 Enallagma basidens
 Enallagma carunculatum
 Enallagma civile
 Enallagma praevarum
 Epithea petechialis
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Ischnura damula
 Ischnura demorsa
 Ischnura denticollis
 Ischnura hastata
 Ischnura verticalis
 Lestes disjunctus
 Libellula comanche
- Libellula luctuosa
 Libellula lydia
 Libellula nodisticta
 Libellula pulchella
 Libellula saturata
 Libellula subornata
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Sympetrum occidentale
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Cleveland* (50)
- Aeshna umbrosa
 Amphigrion abbreviatum
 Anax junius
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Arigomphus lentulus
 Basiaeschna janata
 Calopteryx maculata
 Didymops transversa
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus externus
 Gomphus militaris
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Lestes rectangularis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Sympetrum internum
- Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Coal* (23)
- Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Celithemis eponina
 Dromogomphus spoliatus
 Dythemis fugax
 Enallagma aspersum
 Enallagma basidens
 Enallagma civile
 Enallagma geminatum
 Erythemis simplicicollis
 Gomphus militaris
 Ischnura ramburii
 Ischnura verticalis
 Lestes alacer
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Pachydiplax longipennis
 Perithemis tenera
- Comanche* (62)
- Amphigrion abbreviatum
 Anax junius
 Anax longipes
 Archilestes grandis
 Argia alberta
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Arigomphus submedianus
 Basiaeschna janata
 Brechmorhoga mendax
 Calopteryx maculata
 Celithemis eponina
 Didymops transversa
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Enallagma geminatum
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Epithea petechialis
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax minuscula

- Gomphus militaris
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Libellula comanche
 Libellula croceipennis
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula pulchella
 Macromia pacifica
 Nasiaeschna pentacantha
 Neurocordulia xanthosoma
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Cotton* (18)
- Anax junius
 Argia apicalis
 Argiomphus submedianus
 Enallagma civile
 Epithea princeps
 Erpetogomphus designatus
 Erythrodiplax umbrata
 Hetaerina americana
 Ischnura hastata
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Libellula luctuosa
 Macromia illinoensis
 Nasiaeschna pentacantha
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum corruptum
- Craig* (34)
- Argia apicalis
 Argia fumipennis
 Argia moesta
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Cordulegaster obliqua
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma geminatum
 Erythemis simplicicollis
 Gomphus militaris
 Ischnura hastata
 Ischnura posita
- Ischnura verticalis
 Lestes disjunctus
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Somatochlora linearis
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Tramea lacerata
 Tramea onusta
- Custer* (19)
- Aeshna umbrosa
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia nahuana
 Argia plana
 Argia sedula
 Dythemis fugax
 Enallagma civile
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura verticalis
 Libellula luctuosa
 Libellula lydia
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
- Delaware* (32)
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia plana
 Argiomphus lentulus
 Calopteryx maculata
 Celithemis elisa
 Enallagma aspersum
 Enallagma basidens
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Epithea cynosura
 Erythemis simplicicollis
 Gomphus graslinellus
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes disjunctus
 Libellula cyanea
- Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Perithemis tenera
 Stylogomphus albistylus
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Dewey* (1)
- Progomphus obscurus
- Ellis* (28)
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia nahuana
 Argia sedula
 Calopteryx maculata
 Celithemis eponina
 Enallagma basidens
 Enallagma civile
 Erpetogomphus designatus
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura demorsa
 Ischnura denticollis
 Ischnura verticalis
 Lestes disjunctus
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Erpetogomphus designatus
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Orthemis ferruginea
 Pachydiplax longipennis
 Progomphus obscurus
 Tramea lacerata
 Tramea onusta
- Grady* (9)
- Anax junius
 Enallagma civile
 Hetaerina americana
 Lestes alacer
 Lestes disjunctus
 Libellula lydia
 Libellula pulchella
 Stylurus plagiatus
 Sympetrum corruptum
- Grant* (18)
- Anax junius
 Argia apicalis
 Enallagma basidens
 Enallagma civile
 Erythemis simplicicollis
 Ischnura barberi
 Ischnura hastata
 Ischnura verticalis
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Orthemis ferruginea
 Pachydiplax longipennis
 Perithemis tenera
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Greene* (1)
- Libellula pulchella
- Greer* (21)
- Anax junius
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia moesta
- Garvin* (26)
- Anax junius
 Argia apicalis

- Argia sedula
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Epithea petechialis
 Erythemis simplicicollis
 Gomphus militaris
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Harmon (22)*
- Argia alberta
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Calopteryx maculata
 Enallagma civile
 Enallagma signatum
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Ischnura hastata
 Ischnura verticalis
 Libellula comanche
 Libellula luctuosa
 Libellula pulchella
 Pachydiplax longipennis
 Perithemis tenera
 Sympetrum corruptum
 Sympetrum vicinum
 Tramea lacerata
 Tramea onusta
- Harper (22)*
- Anax junius
 Argia apicalis
 Argia nahuana
 Calopteryx maculata
 Celithemis eponina
 Enallagma basidens
 Enallagma civile
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura demorsa
 Ischnura verticalis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Progomphus obscurus
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Haskell (29)*
- Argia apicalis
 Argia fumipennis
 Argia sedula
 Argia tibialis
 Celithemis elisa
 Celithemis fasciata
 Celithemis verna
 Dromogomphus spinosus
 Enallagma basidens
 Enallagma exsulans
 Enallagma traviatum
 Erythemis simplicicollis
 Gomphus graslinellus
 Gomphus militaris
 Ischnura hastata
 Ischnura posita
 Lestes disjunctus
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Macromia illinoensis
 Macromia wabashensis
 Orthemis ferruginea
 Pachydiplax longipennis
 Perithemis tenera
 Sympetrum corruptum
 Sympetrum vicinum
 Tramea onusta
- Howard (1)*
- Sympetrum corruptum
- Hughes (12)*
- Anax junius
 Arigomphus lentulus
 Arigomphus submedianus
 Enallagma civile
 Epithea cynosura
 Ischnura hastata
 Lestes disjunctus
 Libellula lydia
 Orthemis ferruginea
 Progomphus obscurus
 Tramea lacerata
 Tramea onusta
- Jackson (13)*
- Argia immunda
 Argia moesta
 Basiaeschna janata
 Dythemis fugax
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Erythemis simplicicollis
 Gomphus externus
 Hetaerina americana
 Ischnura barberi
 Libellula luctuosa
 Sympetrum corruptum
- Jefferson (36)*
- Archilestes grandis
- Argia alberta
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Celithemis eponina
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura denticollis
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Ischnura verticalis
 Lestes disjunctus
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
- Erythemis simplicicollis
 Gomphus externus
 Gomphus graslinellus
 Gomphus militaris
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Epithea princeps
 Macromia illinoensis
 Macromia pacifica
 Nasiaeschna pentacantha
 Neurocordulia obsoleta
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
- Kay (23)*
- Anax junius
 Argia apicalis
 Argia moesta
 Argia plana
 Calopteryx maculata
 Celithemis eponina
 Dromogomphus spoliatus
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura verticalis
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
- Kingfisher (13)*
- Anax junius
 Argia nahuana
 Enallagma basidens
 Enallagma civile
 Erythemis simplicicollis
 Gomphus militaris
 Ischnura verticalis
 Libellula luctuosa
 Pachydiplax longipennis
- Johnston (57)*
- Anax junius
 Anax longipes
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia tibialis
 Argia translata
 Arigomphus lentulus
 Basiaeschna janata
 Boyeria vinosa
 Brechmorhoga mendax
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Didymops transversa
 Dromogomphus spinosus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epithea princeps
 Erpetogomphus designatus

- Perithemis tenera
Telebasis salva
Tramea lacerata
Tramea onusta
- Kiowa* (34)
Anax junius
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Basiaeschna janata
Didymops transversa
Dromogomphus spoliatus
Dythemis fugax
Enallagma basidens
Enallagma civile
Enallagma signatum
Epiteca princeps
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus militaris
Ischnura hastata
Ischnura posita
Ischnura verticalis
Lestes alacer
Lestes disjunctus
Libellula luctuosa
Libellula lydia
Macromia illinoiensis
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Stylurus plagiatu
Sympetrum corruptum
Tramea lacerata
Tramea onusta
- Latimer* (77)
Anax junius
Archilestes grandis
Argia apicalis
Argia bipunctulata
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia tibialis
Argia translata
Arigomphus lentulus
Basiaeschna janata
Calopteryx maculata
Celithemis elisa
Celithemis fasciata
Celithemis verna
Cordulegaster obliqua
Didymops transversa
Dromogomphus spinosus
Dromogomphus spoliatus
Dythemis velox
Enallagma aspersum
- Enallagma basidens
Enallagma civile
Enallagma divagans
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Enallagma traviatum
Epieaschna heros
Epiteca princeps
Epiteca canis
Epiteca cynosura
Epiteca petechialis
Epiteca semiaquea
Epiteca spinosa
Erythemis simplicicollis
Erythrodiplax umbrata
Gomphus graslinellus
Gomphus militaris
Gomphus oklahomensis
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Ischnura ramburii
Ischnura verticalis
Lestes disjunctus
Libellula cyanea
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula semifasciata
Libellula vibrans
Macromia illinoiensis
Macromia pacifica
Macromia wabashensis
Nasiaeschna pentacantha
Neurocordulia xanthosoma
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora ensigera
Somatochlora linearis
Somatochlora ozarkensis
Somatochlora tenebrosa
Sympetrum ambiguu
Sympetrum vicinum
Tachopteryx thoreyi
Tramea lacerata
Tramea onusta
- LeFlore* (62)
Anax junius
Argia apicalis
Argia bipunctulata
Argia fumipennis
Argia moesta
Argia tibialis
Argia translata
Arigomphus submedianus
Basiaeschna janata
- Cordulegaster obliqua
Didymops transversa
Dromogomphus spinosus
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma divagans
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Enallagma traviatum
Enallagma vesperum
Epieaschna heros
Epiteca princeps
Epiteca costalis
Epiteca cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus ozarkensis
Gomphus graslinellus
Gynacantha nervosa
Hagenius brevistylus
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura kellicotti
Ischnura posita
Ischnura verticalis
Lestes inaequalis
Lestes rectangularis
Libellula auripennis
Libellula cyanea
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Macromia illinoiensis
Neurocordulia xanthosoma
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Somatochlora linearis
Somatochlora ozarkensis
Somatochlora tenebrosa
Stylogomphus albistylus
Stylurus plagiatu
Sympetrum ambiguu
Sympetrum corruptum
Sympetrum vicinum
Tramea lacerata
Tramea onusta
- Lincoln* (4)
Argia apicalis
Enallagma civile
Lestes disjunctus
Lestes unguiculatus
- Logan* (25)
Anax junius
Argia apicalis
Argia fumipennis
Argia plana
- Celithemis elisa
Celithemis fasciata
Dromogomphus spoliatus
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma signatum
Erythemis simplicicollis
Gomphus militaris
Ischnura hastata
Ischnura posita
Ischnura verticalis
Lestes disjunctus
Libellula luctuosa
Libellula lydia
Libellula pulchella
Orthemis ferruginea
Pachydiplax longipennis
Perithemis tenera
Tramea lacerata
Tramea onusta
- Love* (60)
Anax junius
Archilestes grandis
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Arigomphus lentulus
Basiaeschna janata
Brachymesia gravida
Calopteryx maculata
Celithemis eponina
Celithemis fasciata
Dromogomphus spoliatus
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma geminatum
Enallagma signatum
Epieaschna heros
Epiteca princeps
Epiteca costalis
Epiteca petechialis
Epiteca semiaquea
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus externus
Gomphus militaris
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura verticalis
Lestes disjunctus
Libellula comanche
Libellula deplanata
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella

- Libellula vibrans
 Macromia illinoiensis
 Macromia pacifica
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Major* (23)
- Aeshna multicolor
 Argia apicalis
 Argia plana
 Argia sedula
 Dythemis fugax
 Enallagma civile
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Lestes rectangularis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Sympetrum corruptum
 Tramea onusta
- Marshall* (78)
- Anax junius
 Anax longipes
 Archilestes grandis
 Argia apicalis
 Argia bipunctulata
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Arigomphus submedianus
 Brachymesia gravis
 Brechmorhoga mendax
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
- Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma aspersum
 Enallagma basidens
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Enallagma geminatum
 Enallagma signatum
 Enallagma traviatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax minuscula
 Erythrodiplax umbrata
 Gomphus externus
 Gomphus militaris
 Gomphus oklahomensis
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Lestes sigma
 Libellula comanche
 Libellula croceipennis
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Macromia illinoiensis
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Somatochlora linearis
 Stylurus plagiatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Tachopteryx thoreyi
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Maves* (24)
- Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Didymops transversa
- Dromogomphus spinosus
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Epithea princeps
 Gomphus militaris
 Ischnura hastata
 Ischnura verticalis
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Macromia illinoiensis
 Macromia taeniolata
 Pantala hymenaea
 Perithemis tenera
 Stylogomphus albistylus
 Tramea lacerata
 Tramea onusta
- McClain* (35)
- Anax junius
 Archilestes grandis
 Argia alberta
 Argia apicalis
 Argia fumipennis
 Dromogomphus spoliatus
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus militaris
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Lestes unguiculatus
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- McCurtain* (74)
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Argia translata
- Arigomphus submedianus
 Basiaeschna janata
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Celithemis verna
 Cordulegaster obliqua
 Didymops transversa
 Dromogomphus spinosus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma daeckii
 Enallagma divagans
 Enallagma exsulans
 Enallagma geminatum
 Enallagma signatum
 Enallagma traviatum
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus externus
 Gomphus graslinellus
 Gomphus militaris
 Gomphus oklahomensis
 Gomphus ozarkensis
 Hagenius brevistylus
 Helocordulia selysii
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Lestes disjunctus
 Lestes inaequalis
 Lestes vigilax
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Macromia illinoiensis
 Macromia pacifica
 Neurocordulia obsoleta
 Neurocordulia virginienensis
 Neurocordulia xanthosoma
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Stylogomphus albistylus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Tachopteryx thoreyi

- Tramea lacerata*
Tramea onusta
- McIntosh* (2)
Didymops transversa
Erythemis simplicicollis
- Murray* (63)
Aeshna umbrosa
Anax junius
Archilestes grandis
Argia alberta
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia tibialis
Argia translata
Basiaeschna janata
Brechmorhoga mendax
Calopteryx maculata
Celithemis eponina
Celithemis fasciata
Didymops transversa
Dromogomphus spinosus
Dythemis fugax
Dythemis velox
Enallagma aspersum
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Epithea princeps
Epithea cynosura
Epithea petechialis
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus externus
Gomphus graslinellus
Gomphus militaris
Hagenius brevistylus
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Ischnura verticalis
Lestes disjunctus
Libellula auripennis
Libellula cyanea
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula semifasciata
Libellula vibrans
Macromia pacifica
Nasiaeschna pentacantha
Neurocordulia obsoleta
Neurocordulia xanthosoma
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Sympetrum corruptum
Sympetrum vicinum
- Muskogee* (61)
Anax junius
Argia apicalis
Argia bipunctulata
Argia fumipennis
Argia moesta
Argia plana
Argia sedula
Argia translata
Boyeria vinosa
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Cordulegaster obliqua
Dromogomphus spinosus
Dromogomphus spoliatus
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Epithea princeps
Epithea cynosura
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus externus
Gomphus militaris
Hagenius brevistylus
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Ischnura verticalis
Lestes disjunctus
Libellula auripennis
Libellula cyanea
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula semifasciata
Libellula vibrans
Macromia pacifica
Nasiaeschna pentacantha
Neurocordulia obsoleta
Neurocordulia xanthosoma
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Sympetrum corruptum
Sympetrum vicinum
- Tachopteryx thoreyi*
Telebasis salva
Tramea lacerata
Tramea onusta
- Nowata* (24)
Archilestes grandis
Argia apicalis
Argia fumipennis
Argia moesta
Argomphus lentulus
Calopteryx maculata
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma signatum
Epithea princeps
Erythemis simplicicollis
Gomphus militaris
Ischnura posita
Ischnura verticalis
Libellula luctuosa
Libellula lydia
Libellula pulchella
Nasiaeschna pentacantha
Pachydiplax longipennis
Perithemis tenera
Sympetrum vicinum
Tramea lacerata
Tramea onusta
- Okmulgee* (14)
Anax junius
Celithemis elisa
Dythemis velox
Enallagma civile
Ischnura hastata
Ischnura posita
Libellula lydia
Libellula pulchella
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum corruptum
Tramea onusta
- Okfuskee* (6)
Argia apicalis
Enallagma basidens
Erythemis simplicicollis
Gomphus militaris
Libellula incesta
Libellula luctuosa
- Oklahoma* (51)
Aeshna umbrosa
Anax junius
Archilestes grandis
Argia apicalis
Argia fumipennis
Argia nahuana
Argia plana
Argia sedula
Argomphus lentulus
Argomphus submedianus
Calopteryx maculata
Celithemis eponina
Didymops transversa
Dromogomphus spoliatus
Dythemis fugax
Enallagma basidens
Enallagma civile
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax umbrata
Gomphus externus
Gomphus graslinellus
Gomphus militaris
Hetaerina americana
- Ischnura denticollis*
Ischnura hastata
Ischnura posita
Ischnura verticalis
Lestes alacer
Lestes disjunctus
Lestes rectangularis
Libellula croceipennis
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Nasiaeschna pentacantha
Neurocordulia molesta
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Sympetrum ambiguum
Sympetrum corruptum
Sympetrum vicinum
Telebasis salva
Tramea lacerata
Tramea onusta
- Osage* (28)
Anax junius
Argia apicalis
Argia moesta
Basiaeschna janata
Calopteryx maculata
Celithemis elisa
Didymops transversa
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Ischnura posita
Ischnura verticalis
Libellula deplanata
Libellula luctuosa
Libellula lydia
Libellula pulchella

- Pachydiplax longipennis*
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum corruptum
Tramea lacerata
Tramea onusta
- Ottawa* (26)
Argia apicalis
Argia fumipennis
Argia moesta
Argia tibialis
Arigomphus submedianus
Calopteryx maculata
Enallagma basidens
Enallagma civile
Enallagma exsulans
Erythemis simplicicollis
Gomphus militaris
Ischnura hastata
Ischnura posita
Ischnura verticalis
Lestes disjunctus
Libellula cyanea
Libellula luctuosa
Libellula lydia
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala hymenaea
Perithemis tenera
Stylogomphus albistylus
Sympetrum corruptum
Tramea lacerata
Tramea onusta
- Pawnee* (10)
Calopteryx maculata
Epithea princeps
Libellula pulchella
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Sympetrum vicinum
Tramea lacerata
Tramea onusta
- Payne* (24)
Anax junius
Archilestes grandis
Brechmorhoga mendax
Celithemis eponina
Didymops transversa
Dromogomphus spoliatus
Epiaeschna heros
Epithea princeps
Erythemis simplicicollis
Ischnura posita
Ischnura verticalis
Libellula luctuosa
Libellula lydia
Libellula pulchella
Nasiaeschna pentacantha
Pachydiplax longipennis
- Pantala flavescens*
Pantala hymenaea
Perithemis tenera
Sympetrum corruptum
Sympetrum internum
Telebasis salva
Tramea carolina
Tramea onusta
- Pittsburg* (39)
Anax junius
Argia apicalis
Argia fumipennis
Argia tibialis
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Celithemis verna
Didymops transversa
Dromogomphus spoliatus
Dythemis velox
Enallagma civile
Enallagma exsulans
Enallagma signatum
Epithea cynosura
Erpetogomphus designatus
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Ischnura verticalis
Lestes disjunctus
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Stylurus plagiatus
Sympetrum ambiguum
Tramea lacerata
Tramea onusta
- Pontotoc* (26)
Anax junius
Archilestes grandis
Argia fumipennis
Argia moesta
Argia plana
Argia sedula
Argia translata
Brechmorhoga mendax
Calopteryx maculata
Celithemis eponina
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans
- Erythemis simplicicollis*
Hetaerina americana
Ischnura posita
Ischnura verticalis
Lestes disjunctus
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
- Pottawatomie* (39)
Archilestes grandis
Argia apicalis
Celithemis verna
Cordulegaster obliqua
Dromogomphus spinosus
Dythemis velox
Enallagma civile
Enallagma daeckii
Enallagma divagans
Enallagma dubium
Enallagma exsulans
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Gomphus externus
Gomphus ozarkensis
Gomphus graslinellus
Ischnura hastata
Ischnura kellicotti
Ischnura posita
Lestes disjunctus
Lestes inaequalis
Lestes vigilax
Libellula cyanea
Libellula deplanata
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia illinoensis
Macromia pacifica
Nasiaeschna pentacantha
Neurocordulia xanthosoma
Orthemis ferruginea
Pachydiplax longipennis
Progomphus obscurus
Sympetrum ambiguum
Tramea lacerata
Tramea onusta
- Celithemis eponina*
Celithemis verna
Cordulegaster obliqua
Dromogomphus spinosus
Dythemis velox
Enallagma civile
Enallagma daeckii
Enallagma divagans
Enallagma dubium
Enallagma exsulans
Enallagma traviatum
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Gomphus externus
Gomphus ozarkensis
Gomphus graslinellus
Ischnura hastata
Ischnura kellicotti
Ischnura posita
Lestes disjunctus
Lestes inaequalis
Lestes vigilax
Libellula cyanea
Libellula deplanata
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia illinoensis
Macromia pacifica
Nasiaeschna pentacantha
Neurocordulia xanthosoma
Orthemis ferruginea
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Sympetrum ambiguum
Tramea onusta
Tramea lacerata
- Roger Mills* (1)
Hetaerina americana
- Rogers* (26)
Argia apicalis
Argia fumipennis
Argia moesta
Arigomphus submedianus
Calopteryx maculata
Celithemis eponina
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma geminatum
Epithea princeps
Erythemis simplicicollis
Gomphus externus
Ischnura posita
Ischnura verticalis

- Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Perithemis tenera
 Progomphus obscurus
 Sympetrum vicinum
 Tramea lacerata
- Seminole* (21)
- Anax junius
 Argia apicalis
 Arigomphus lentulus
 Celithemis elisa
 Celithemis eponina
 Dromogomphus spoliatus
 Enallagma basidens
 Enallagma civile
 Enallagma signatum
 Epithea princeps
 Erythemis simplicicollis
 Gomphus militaris
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Perithemis tenera
 Tramea lacerata
 Tramea onusta
- Sequoyah* (42)
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Dromogomphus spinosus
 Dythemis velox
 Enallagma aspersum
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura hastata
 Ischnura keliccotti
 Ischnura posita
 Ischnura verticalis
 Lestes disjunctus
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
- Libellula lydia
 Libellula pulchella
 Macromia illinoensis
 Macromia pacifica
 Nasiaeschna pentacantha
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Tramea carolina
 Tramea lacerata
- Stephens* (33)
- Anax junius
 Archilestes grandis
 Argia apicalis
 Argia nahuana
 Argia sedula
 Celithemis eponina
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Ischnura denticollis
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Texas* (12)
- Aeshna multicolor
 Anax junius
 Enallagma civile
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Tillman* (10)
- Argia apicalis
- Enallagma basidens
 Enallagma civile
 Erythemis simplicicollis
 Libellula croceipennis
 Perithemis tenera
 Progomphus obscurus
 Sympetrum corruptum
 Telebasis salva
 Tramea onusta
- Tulsa* (1)
- Pachydiplax longipennis
- Wagoner* (17)
- Argia apicalis
 Argia fumipennis
 Argia nahuana
 Argia tibialis
 Arigomphus lentulus
 Celithemis elisa
 Enallagma signatum
 Erythemis simplicicollis
 Gomphus externus
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Libellula luctuosa
 Libellula pulchella
 Neurocordulia molesta
 Pachydiplax longipennis
 Perithemis tenera
- Washington* (1)
- Libellula lydia
- Washita* (24)
- Anax junius
 Argia fumipennis
 Argia immunda
 Argia plana
 Argia sedula
 Argia vivida
 Calopteryx maculata
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Epithea cynosura
 Gomphus militaris
 Hetaerina americana
 Ischnura hastata
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Perithemis tenera
 Tramea onusta
- Woods* (38)
- Anax junius
 Archilestes grandis
 Argia alberta
- Argia fumipennis
 Argia plana
 Argia sedula
 Calopteryx maculata
 Enallagma basidens
 Enallagma civile
 Epiaeschna heros
 Epithea princeps
 Erythemis simplicicollis
 Erythrodiplax umbrata
 Gomphus militaris
 Hetaerina americana
 Ischnura barberi
 Ischnura denticollis
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Lestes rectangularis
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Nasiaeschna pentacantha
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum occidentale
 Tramea lacerata
 Tramea onusta
- Woodward* (46)
- Amphagriion abbreviatum
 Anax junius
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Calopteryx maculata
 Celithemis eponina
 Enallagma basidens
 Enallagma civile
 Enallagma signatum
 Epithea princeps
 Epithea costalis
 Epithea cynosura
 Epithea petechialis
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Gomphus militaris
 Hetaerina americana
 Ischnura barberi
 Ischnura damula
 Ischnura demorsa
 Ischnura denticollis

Ischnura hastata
Ischnura posita
Ischnura verticalis
Lestes alacer
Lestes disjunctus
Lestes rectangularis
Libellula luctuosa
Libellula lydia
Libellula pulchella
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Sympetrum ambiguum
Sympetrum corruptum
Tramea lacerata
Tramea onusta

TEXAS (197 spp.)

Anderson (34)

Argia bipunctulata
Argia moesta
Argia tibialis
Boyeria vinosa
Calopteryx maculata
Celithemis eponina
Celithemis fasciata
Enallagma civile
Enallagma signatum
Enallagma vesperum
Epiteca cynosura
Epiteca semiaquea
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus militaris
Gomphus oklahomensis
Ischnura posita
Ischnura ramburii
Libellula auripennis
Libellula cyanea
Libellula incesta
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia taeniolata
Orthemis ferruginea
Pachydiplax longipennis
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora margarita
Tachopteryx thoreyi

Angelina (46)

Anax junius
Argia apicalis
Argia fumipennis
Argia moesta
Argia tibialis
Brachymesia gravida
Brachymesia herbida

Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Cordulegaster obliqua
Dromogomphus spinosus
Dythemis velox
Enallagma civile
Enallagma exsulans
Epiaschna heros
Epiteca princeps
Erythemis simplicicollis
Erythrodiplax minuscula
Erythrodiplax umbrata
Gomphus oklahomensis
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Lestes inaequalis
Libellula auripennis
Libellula cyanea
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Sympetrum corruptum
Tachopteryx thoreyi
Tramea carolina
Tramea lacerata
Tramea onusta

Aransas (22)

Anax junius
Brachymesia gravida
Cannaphilularis funerea
Enallagma civile
Erythemis simplicicollis
Erythrodiplax berenice
Erythrodiplax minuscula
Erythrodiplax umbrata
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Lestes forclicula
Libellula needhami
Libellula pulchella
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum corruptum
Tramea onusta

Austin (20)

Argia fumipennis
Argia sedula
Arigomphus lentulus
Dromogomphus spoliatus
Dythemis velox
Enallagma divagans
Enallagma signatum
Erythemis simplicicollis
Erythrodiplax berenice
Gomphus militaris
Hetaerina americana
Ischnura hastata
Ischnura posita
Libellula incesta
Libellula luctuosa
Libellula lydia
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Sympetrum corruptum

Bandera (52)

Anax junius
Archilestes grandis
Argia cuprea
Argia fumipennis
Argia immunda
Argia leonora
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Basiaeschna janata
Brechmorhoga mendax
Celithemis fasciata
Dromogomphus spoliatus
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma novaehispaniae
Enallagma signatum
Epiteca princeps
Epiteca costalis
Epiteca petechialis
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus militaris
Hagenius brevistylus
Hetaerina americana
Hetaerina titia
Ischnura hastata
Lestes alacer
Lestes sigma
Libellula comanche
Libellula croceipennis
Libellula luctuosa
Libellula lydia
Macrothemis imitans
Macrothemis inequiunguis
Orthemis ferruginea
Pantala hymenaea
Perithemis tenera

Phyllogomphoides albrighti
Phyllogomphoides stigmatus
Progomphus obscurus
Pseudoleon superbus
Sympetrum vicinum
Telebasis salva
Tramea carolina
Tramea lacerata
Tramea onusta

Bastrop (27)

Arigomphus submedianus
Basiaeschna janata
Calopteryx maculata
Didymops transversa
Dromogomphus spoliatus
Dythemis fugax
Enallagma basidens
Enallagma signatum
Erythemis simplicicollis
Erythrodiplax minuscula
Erythrodiplax umbrata
Gomphus graslinellus
Ischnura ramburii
Lestes disjunctus
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula pulchella
Micrathyria hagenii
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Sympetrum corruptum
Sympetrum vicinum
Tramea onusta

Baylor (3)

Argia apicalis
Argia moesta
Hetaerina americana

Bee (8)

Argia apicalis
Argia sedula
Dythemis fugax
Enallagma signatum
Epiteca petechialis
Erpetogomphus designatus
Gomphus militaris
Ischnura hastata

Bell (29)

Anax junius
Archilestes grandis
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia sedula
Argia translata
Basiaeschna janata

- Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax umbrata
 Hetaerina americana
 Hetaerina titia
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Orthemis ferruginea
 Pachydiplax longipennis
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Telebasis salva
 Tramea lacerata
- Bexar (62)**
 Aeshna multicolor
 Anax junius
 Aphylla angustifolia
 Aphylla protracta
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brachymesia gravida
 Brechmorhoga mendax
 Celithemis elisa
 Celithemis eponina
 Didymops transversa
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Erpetogomphus designatus
 Erythemis plebeja
 Erythemis simplicicollis
 Erythrodiplax funerea
 Erythrodiplax minuscula
 Erythrodiplax umbrata
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes alacer
 Lestes forficula
 Lestes sigma
 Libellula comanche
 Libellula croceipennis
 Libellula cyanea
- Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula saturata
 Macrodiplax balteata
 Micrathyria hagenii
 Neurocordulia xanthosoma
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Blanco (42)**
 Anax junius
 Archilestes grandis
 Argia barretti
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Brechmorhoga mendax
 Celithemis fasciata
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma praeviarum
 Epithea princeps
 Epithea petechialis
 Erpetogomphus designatus
 Erythrodiplax fusca
 Erythrodiplax umbrata
 Gomphus grasilinellus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Lestes alacer
 Lestes disjunctus
 Libellula comanche
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Neoneura aaroni
 Orthemis ferruginea
 Pachydiplax longipennis
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
- Borden (4)**
 Dythemis fugax
- Epithea princeps
 Gomphus militaris
 Pantala hymenaea
- Bosque (41)**
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brechmorhoga mendax
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus externus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Lestes alacer
 Lestes simplex
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Macromia annulata
 Neurocordulia xanthosoma
 Orthemis ferruginea
 Pachydiplax longipennis
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Sympetrum vicinum
 Telebasis salva
- Bowie (14)**
 Anax junius
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma basidens
 Erythemis simplicicollis
 Gomphus oklahomensis
 Hagenius brevistylus
 Ischnura hastata
 Lestes vigilax
 Pachydiplax longipennis
 Progomphus obscurus
- Brazos (69)**
 Anax junius
 Argia apicalis
 Argia immunda
 Argia moesta
 Argia plana
 Argia sedula
 Argia tibialis
 Argia translata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Didymops transversa
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma civile
 Enallagma divagans
 Enallagma exsulans
 Epiaeschna heros
 Epithea princeps
 Epithea costalis
 Epithea cynosura
 Epithea petechialis
 Epithea semiaquea
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax berenice
 Erythrodiplax minuscula
 Erythrodiplax umbrata
 Gomphus modestus

- Gomphus vastus
 Gomphus militaris
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes alacer
 Lestes disjunctus
 Lestes forficula
 Libellula comanche
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Macromia illinoiensis
 Macromia taeniolata
 Nasiaeschna pentacantha
 Neurocordulia molesta
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Brewster (57)*
 Aeshna multicolor
 Anax junius
 Anax walsinghami
 Archilestes grandis
 Argia barretti
 Argia fumipennis
 Argia hinei
 Argia immunda
 Argia lugens
 Argia moesta
 Argia munda
 Argia nahuana
 Argia plana
 Brechmorhoga mendax
 Dythemis nigrescens
 Dythemis velox
 Enallagma civile
 Enallagma praevarum
 Erpetogomphus compositus
 Erpetogomphus designatus
 Erpetogomphus lampropeltis
 Erythemis collocata
 Erythemis simplicicollis
 Erythrodiplax connata
 Erythrodiplax umbrata
 Hesperagrion heterodoxum
 Hetaerina americana
- Ischnura damula
 Ischnura demorsa
 Ischnura denticollis
 Ischnura hastata
 Ischnura posita
 Lestes alacer
 Lestes disjunctus
 Libellula comanche
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Libellula saturata
 Libellula subornata
 Macromia annulata
 Micrathyria hagenii
 Orthemis ferruginea
 Pachydiplax longipennis
 Paltothemis lineatipes
 Pantala flavescens
 Perithemis domitia
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Progomphus borealis
 Pseudoleon superbus
 Stylurus intricatus
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Trameasularis
 Tramea lacerata
- Briscoe (17)*
 Argia apicalis
 Argia lugens
 Argia moesta
 Argia plana
 Epitheca costalis
 Erythemis simplicicollis
 Hetaerina americana
 Lestes disjunctus
 Lestes unguiculatus
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus borealis
 Progomphus obscurus
 Tramea lacerata
- Brooks (4)*
 Argia leonorae
 Enallagma civile
 Ischnura hastata
 Perithemis tenera
- Brown (12)*
 Argia immunda
 Celithemis fasciata
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
- Hetaerina americana
 Ischnura hastata
 Libellula luctuosa
 Pachydiplax longipennis
- Burleson (8)*
 Anax junius
 Enallagma civile
 Erythemis simplicicollis
 Ischnura ramburii
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
- Burnet (49)*
 Anax junius
 Archilestes grandis
 Argia apicalis
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Boyeria vinosa
 Brachymesia gravaida
 Brechmorhoga mendax
 Celithemis eponina
 Didymops transversa
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma signatum
 Epitheca princeps
 Epitheca petechialis
 Erpetogomphus compositus
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax umbrata
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lanthus parvulus
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Macrodiplax balteata
 Miathyria marcella
 Orthemis ferruginea
 Pachydiplax longipennis
 Paltothemis lineatipes
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Caldwell (45)*
 Argia apicalis
 Argia barretti
 Argia immunda
 Argia moesta
 Argia sedula
 Argia translata
 Arigomphus submedianus
 Brachymesia gravaida
 Brechmorhoga mendax
 Cannaphilasularis funerea
 Coryphaeschna ingens
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epitheca princeps
 Epitheca petechialis
 Erpetogomphus designatus
 Erpetogomphus eutainia
 Erythemis simplicicollis
 Gomphus externus
 Gomphus vastus
 Gomphus militaris
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura ramburii
 Lestes alacer
 Libellula luctuosa
 Libellula lydia
 Macromia annulata
 Macromia illinoiensis
 Macrothemis imitans
 Neoneura aaroni
 Orthemis ferruginea
 Pachydiplax longipennis
 Perithemis tenera
 Phyllogomphoides albrighti
 Progomphus obscurus
 Stylurus plagiatus
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Calhoun (13)*
 Anax junius
 Aphylla angustifolia
 Argia apicalis
 Erythemis simplicicollis
 Hetaerina titia
 Ischnura ramburii
 Libellula lydia
 Miathyria marcella
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Stylurus plagiatus
 Tramea lacerata
- Callahan (4)*
 Ischnura ramburii
 Pantala flavescens

- Sympetrum corruptum*
Tramea onusta
- Cameron* (48)
Acanthagrion quadratum
Aeshna psilus
Anax junius
Aphylla protracta
Argia apicalis
Argia plana
Argia rhoadsi
Argia sedula
Argia translata
Brachymesia furcata
Brachymesia gravida
Cannaphilastarus funerea
Dromogomphus spoliatus
Dythemis nigrescens
Enallagma basidens
Enallagma civile
Enallagma signatum
Epithea princeps
Erythemis pletja
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax berenice
Erythrodiplax umbrata
Gomphus gonzalezi
Gomphus militaris
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes alacer
Lestes disjunctus
Lestes forficula
Lestes sigma
Libellula needhami
Macrodiplax balteata
Miathyria marcella
Micrathyria aequalis
Micrathyria hagenii
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum corruptum
Telebasis salva
Tramea calverti
Tramea lacerata
Tramea onusta
- Camp* (1)
Epiaeschna heros
- Carson* (6)
Aeshna multicolor
Anax junius
Enallagma civile
Ischnura denticollis
Libellula pulchella
Sympetrum corruptum
- Cass* (1)
- Hagenius brevistylus*
- Chambers* (29)
Anax junius
Aphylla angustifolia
Argia apicalis
Arigomphus maxwelli
Brachymesia gravida
Celithemis eponina
Enallagma civile
Enallagma durum
Enallagma signatum
Enallagma vesperum
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax berenice
Erythrodiplax minuscula
Ischnura hastata
Ischnura ramburii
Libellula lydia
Libellula needhami
Miathyria marcella
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Sympetrum corruptum
Tramea carolina
Tramea lacerata
Tramea onusta
- Cherokee* (40)
Anax junius
Argia apicalis
Argia bipunctulata
Argia moesta
Argia sedula
Argia tibialis
Calopteryx maculata
Celithemis eponina
Didymops transversa
Dromogomphus spinosus
Dythemis fugax
Enallagma basidens
Enallagma civile
Epiaeschna heros
Erythemis simplicicollis
Erythrodiplax berenice
Erythrodiplax minuscula
Gomphus militaris
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Macromia illinoiensis
Macromia taeniolata
- Orthemis ferruginea*
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum ambiguum
Tramea lacerata
Tramea onusta
- Childress* (2)
Enallagma civile
Hetaerina americana
- Coke* (4)
Dromogomphus spoliatus
Libellula comanche
Perithemis tenera
Phyllogomphoides stigmatus
- Coleman* (12)
Dromogomphus spoliatus
Epithea princeps
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus militaris
Hetaerina americana
Libellula comanche
Libellula incesta
Libellula lydia
Pachydiplax longipennis
Pantala hymenaea
Tramea lacerata
- Collin* (69)
Anax junius
Anax longipes
Archilestes grandis
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Arigomphus lentulus
Arigomphus submedianus
Basiaeschna janata
Brechmorhoga mendax
Calopteryx maculata
Celithemis elisa
Cordulegaster obliqua
Dromogomphus spinosus
Dromogomphus spoliatus
Dythemis fugax
Enallagma aspersum
Enallagma basidens
Enallagma civile
Enallagma doubledayi
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Enallagma traviatum
Epithea princeps
- Epithea costalis*
Epithea cynosura
Epithea petechialis
Erpetogomphus designatus
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax umbrata
Gomphus externus
Gomphus militaris
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes alacer
Lestes disjunctus
Libellula croceipennis
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula semifasciata
Macromia illinoiensis
Macromia taeniolata
Nasiaeschna pentacantha
Neurocordulia xanthosoma
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum ambiguum
Sympetrum corruptum
Sympetrum vicinum
Telebasis salva
Tramea lacerata
Tramea onusta
- Colorado* (34)
Anax junius
Argia apicalis
Argia sedula
Arigomphus lentulus
Celithemis elisa
Dromogomphus spoliatus
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma signatum
Epithea princeps
Epithea petechialis
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax minuscula
Erythrodiplax umbrata
Gomphus militaris
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus

- Libelluacesta
 Libellula luctuosa
 Macromia taeniolata
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Stylurus plagiatus
 Tramea lacerata
- Comal* (34)
 Aeshna psilus
 Archilestes grandis
 Argia barretti
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia munda
 Argia plana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brechmorhoga mendax
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma basidens
 Enallagma exsulans
 Enallagma novaehispaniae
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus grasilinellus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura posita
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Macromia pacifica
 Macrothemis inequiunguis
 Orthemis ferruginea
 Protoneura cara
 Sympetrum vicinum
 Telebasis salva
- Comanche* (4)
 Argia sedula
 Dythemis fugax
 Erythemis simplicicollis
 Telebasis salva
- Concho* (14)
 Archilestes grandis
 Argia immunda
 Dromogomphus spoliatus
 Dythemis fugax
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Epithea cynosura
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
- Libellula comanche
 Libellula lydia
 Phyllogomphoides albrighti
- Cooke* (14)
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Enallagma basidens
 Epithea cynosura
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura verticalis
 Libellula incesta
 Pachydiplax longipennis
- Coryell* (13)
 Archilestes grandis
 Argia immunda
 Argia nahuana
 Argia sedula
 Argia translata
 Brechmorhoga mendax
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Erpetogomphus designatus
 Hetaerina americana
 Libellula croceipennis
 Phyllogomphoides stigmatus
- Crane* (2)
 Erythemis simplicicollis
 Libellula luctuosa
- Crockett* (8)
 Argia immunda
 Argia nahuana
 Brechmorhoga mendax
 Ischnura barberi
 Libellula luctuosa
 Pseudoleon superbus
 Sympetrum corruptum
 Tramea lacerata
- Crosby* (14)
 Archilestes grandis
 Argia immunda
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia plana
 Enallagma civile
 Hetaerina americana
 Lestes alacer
 Libellula luctuosa
 Pantala flavescens
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
- Culberson* (29)
 Aeshna multicolor
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia hinei
 Argia lugens
 Argia nahuana
 Argia plana
 Argia sedula
 Enallagma civile
 Enallagma novaehispaniae
 Enallagma praevarum
 Erpetogomphus designatus
 Erythemis simplicicollis
 Hesperagrion heterodoxum
 Hetaerina americana
 Ischnura barberi
 Ischnura damula
 Ischnura demorsa
 Ischnura denticollis
 Ischnura posita
 Lestes disjunctus
 Libellula comanche
 Libellula saturata
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Sympetrum corruptum
 Telebasis salva
- Dallas* (64)
 Anax junius
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia tibialis
 Argia translata
 Brachymesia gravida
 Brechmorhoga mendax
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Cordulegaster obliqua
 Didymops transversa
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Epithea petechialis
 Erpetogomphus compositus
 Erpetogomphus designatus
 Erythemis simplicicollis
- Erythrodiplax minuscula
 Gomphus externus
 Gomphus lividus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes alacer
 Lestes disjunctus
 Libellula comanche
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Macromia illinoiensis
 Macromia pacifica
 Micrathyria hagenii
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Sympetrum ambiguum
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Dawson* (1)
 Libellula lydia
- Deaf Smith* (1)
 Sympetrum corruptum
- Delta* (1)
 Neurocordulia xanthosoma
- Denton* (70)
 Anax junius
 Archilestes grandis
 Argia apicalis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia tibialis
 Argia translata
 Arigomphus submedianus
 Brachymesia gravida
 Brechmorhoga mendax
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Didymops transversa
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma aspersum
 Enallagma basidens
 Enallagma civile

- Enallagma exsulans
 Enallagma signatum
 Enallagma vesperum
 Epiaschna heros
 Epithea princeps
 Epithea costalis
 Epithea cynosura
 Epithea petechialis
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Erythrodiplax umbrata
 Gomphus externus
 Gomphus graslinellus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Ischnura verticalis
 Lestes disjunctus
 Libellula comanche
 Libellula croceipennis
 Libellula cyanea
 Libellula deplanata
 Libellula flavida
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Macromia illinoiensis
 Macromia pacifica
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Dewitt* (4)
 Argia leonorae
 Erythemis simplicicollis
 Ischnura hastata
 Pachydiplax longipennis
- Dimmit* (13)
 Argia sedula
 Arigomphus submedianus
 Brachymesia furcata
 Brachymesia gravida
 Dythemis fugax
 Dythemis nigrescens
 Enallagma civile
 Erythemis simplicicollis
 Erythrodiplax umbrata
 Ischnura ramburii
- Pachydiplax longipennis
 Perithemis tenera
 Tramea onusta
- Donley* (2)
 Enallagma basidens
 Enallagma civile
- Eastland* (13)
 Dythemis fugax
 Erythemis simplicicollis
 Gomphus militaris
 Ischnura posita
 Libellula comanche
 Libellula cyanea
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pachydiplax longipennis
 Perithemis tenera
 Phyllogomphoides stigmatus
 Tramea onusta
- Edwards* (26)
 Argia barretti
 Argia cuprea
 Argia fumipennis
 Argia immunda
 Argia sedula
 Argia translata
 Basiaeschna janata
 Celithemis fasciata
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma novaehispaniae
 Enallagma praevarum
 Epithea petechialis
 Erythemis simplicicollis
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Macromia annulata
 Phyllogomphoides stigmatus
 Protoneura cara
 Telebasis salva
- El Paso* (19)
 Aeshna multicolor
 Anax junius
 Argia apicalis
 Argia moesta
 Argia nahuana
 Argia sedula
 Enallagma basidens
 Enallagma civile
 Enallagma praevarum
 Erythemis collocata
 Hetaerina americana
 Ischnura demorsa
 Libellula saturata
- Pachydiplax longipennis
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Telebasis salva
 Tramea onusta
- Ellis* (27)
 Anax junius
 Argia apicalis
 Argia moesta
 Celithemis eponina
 Celithemis fasciata
 Dythemis fugax
 Enallagma basidens
 Enallagma civile
 Enallagma signatum
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus militaris
 Ischnura hastata
 Lestes disjunctus
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Erath* (42)
 Anax junius
 Anax longipes
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia plana
 Argia sedula
 Arigomphus lentulus
 Arigomphus submedianus
 Basiaeschna janata
 Brachymesia gravida
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Epiaschna heros
 Epithea princeps
 Epithea petechialis
 Erythemis simplicicollis
 Erythrodiplax umbrata
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula saturata
 Libellula vibrans
- Miathyria marcella
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Tramea calverti
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Falls* (35)
 Aeshna multicolor
 Anax junius
 Argia apicalis
 Arigomphus lentulus
 Arigomphus submedianus
 Brechmorhoga mendax
 Dromogomphus spoliatus
 Dythemis fugax
 Enallagma civile
 Epithea princeps
 Epithea cynosura
 Epithea petechialis
 Erpetogomphus designatus
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus externus
 Gomphus vastus
 Gomphus militaris
 Libellula croceipennis
 Libellula incesta
 Libellula lydia
 Macromia annulata
 Macromia wabashensis
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pantala flavescens
 Pantala hymenaea
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Fannin* (29)
 Anax junius
 Argia apicalis
 Argia moesta
 Argia sedula
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Dromogomphus spoliatus
 Dythemis fugax
 Enallagma basidens
 Enallagma divagans
 Enallagma exsulans

- Enallagma signatum
 Epithea princeps
 Erythemis simplicicollis
 Gomphus militaris
 Ischnura ramburii
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum ambiguum
 Tramea lacerata
- Fayette* (26)
- Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia sedula
 Argia translata
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Epiaeschna heros
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura ramburii
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Macromia annulata
 Orthemis discolor
 Pachydiplax longipennis
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Telebasis salva
- Fisher* (2)
- Argia apicalis
 Hetaerina americana
- Floyd* (5)
- Anax junius
 Enallagma civile
 Libellula disjunctus
 Perithemis tenera
 Sympetrum corruptum
- Fort Bend* (52)
- Aeschna multicolor
 Anax junius
 Anax longipes
 Aphylla angustifolia
 Argia apicalis
 Argia tibialis
 Arigomphus lentulus
- Arigomphus submedianus
 Brachymesia gravida
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Coryphaeschna ingens
 Dromogomphus spoliatus
 Enallagma civile
 Enallagma geminatum
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax minuscula
 Erythrodiplax umbrata
 Gomphus militaris
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula auripennis
 Libellula deplanata
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Libellula pulchella
 Libellula semifasciata
 Libellula vibrans
 Macrodiplax balteata
 Miathyria marcella
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Franklin* (16)
- Argia fumipennis
 Argia moesta
 Argia tibialis
 Arigomphus submedianus
 Enallagma basidens
 Enallagma civile
 Enallagma divagans
 Enallagma signatum
 Epithea costalis
 Epithea cynosura
 Epithea semiaquea
 Erythemis simplicicollis
 Gomphus oklahomensis
 Ischnura hastata
 Ischnura posita
 Pachydiplax longipennis
- Freestone* (14)
- Anax junius
 Argia apicalis
 Argia moesta
 Cordulegaster maculata
 Cordulegaster obliqua
 Epithea cynosura
 Erythemis simplicicollis
 Hetaerina titia
 Libellula incesta
 Libellula luctuosa
 Libellula vibrans
 Perithemis tenera
 Stylurus plagiatus
 Tramea lacerata
- Frio* (17)
- Argia apicalis
 Argia moesta
 Argia sedula
 Argia translata
 Brachymesia furcata
 Dythemis velox
 Enallagma civile
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax fusca
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura posita
 Macromia illinoiensis
 Pachydiplax longipennis
 Perithemis tenera
- Gaines* (1)
- Sympetrum corruptum
- Galveston* (19)
- Anax junius
 Argia sedula
 Brachymesia gravida
 Enallagma signatum
 Epiaeschna heros
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax berenice
 Erythrodiplax umbrata
 Ischnura ramburii
 Libellula vibrans
 Miathyria marcella
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Garza* (1)
- Ischnura denticollis
- Gillespie* (32)
- Anax junius
 Argia fumipennis
 Argia immunda
- Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brechmorhoga mendax
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma praevarum
 Epithea princeps
 Epithea petechialis
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hagenius brevistylus
 Hetaerina americana
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Perithemis tenera
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
- Goliad* (25)
- Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia translata
 Dythemis fugax
 Enallagma basidens
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Gomphus vastus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura ramburii
 Libellula lydia
 Macromia illinoiensis
 Neoneura aaroni
 Orthemis ferruginea
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Stylurus plagiatus
- Gonzales* (53)
- Anax junius
 Aphylla angustifolia
 Argia apicalis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula

- Argia translata*
Cannaphilasularis funerea
Celithemis elisa
Didymops transversa
Dromogomphus spoliatus
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea petechialis
Erpetogomphus designatus
Erpetogomphus eutainia
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax umbrata
Gomphus externus
Gomphus vastus
Gomphus militaris
Hagenius brevistylus
Hetaerina americana
Hetaerina titia
Ischnura posita
Ischnura ramburii
Lestes alacer
Lestes disjunctus
Lestes sigma
Libellula comanche
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia illinoensis
Nasiaeschna pentacantha
Neoneura aaroni
Orthemis discolor
Pachydiplax longipennis
Perithemis tenera
Phyllogomphoides albrighti
Stylurus plagiatus
Sympetrum corruptum
Telebasis salva
Tramea lacerata
Tramea onusta
- Gray (1)*
Calopteryx maculata
- Grayson (20)*
Anax junius
Argia apicalis
Argia moesta
Argia sedula
Arigomphus lentulus
Calopteryx maculata
Enallagma basidens
Enallagma civile
Enallagma divagans
Enallagma traviatum
Epithea costalis
Erythemis simplicicollis
Ischnura posita
Ischnura verticalis
Libellula luctuosa
- Libellula lydia*
Macromia illinoensis
Macromia pacifica
Telebasis salva
Tramea lacerata
- Gregg (18)*
Argia apicalis
Argia bipunctulata
Argia fumipennis
Argia moesta
Argia tibialis
Calopteryx dimidiata
Calopteryx maculata
Enallagma basidens
Enallagma civile
Enallagma divagans
Enallagma exsulans
Erythemis simplicicollis
Hetaerina americana
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula incesta
Pachydiplax longipennis
- Grimes (40)*
Argia apicalis
Argia fumipennis
Argia immunda
Argia moesta
Argia sedula
Argia tibialis
Argia translata
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Dromogomphus spinosus
Dromogomphus spoliatus
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma signatum
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus vastus
Gomphus militaris
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia taeniolata
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Progomphus obscurus
Sympetrum ambiguum
Sympetrum corruptum
Telebasis salva
- Tramea lacerata*
Tramea onusta
- Guadalupe (30)*
Argia apicalis
Argia barretti
Argia immunda
Argia moesta
Argia sedula
Argia translata
Brechmorhoga mendax
Dromogomphus spoliatus
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Epithea princeps
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus militaris
Hagenius brevistylus
Hetaerina americana
Hetaerina titia
Ischnura hastata
Libellula luctuosa
Neoneura aaroni
Pachydiplax longipennis
Pantala hymenaea
Perithemis tenera
Phyllogomphoides albrighti
Phyllogomphoides stigmatus
Stylurus plagiatus
Tramea lacerata
Tramea onusta
- Hale (3)*
Erythemis simplicicollis
Pachydiplax longipennis
Sympetrum corruptum
- Hall (2)*
Ischnura barberi
Lestes alacer
- Hamilton (26)*
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Dythemis fugax
Enallagma basidens
Enallagma civile
Epithea princeps
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus militaris
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula luctuosa
Libellula lydia
- Neurocordulia xanthosoma*
Orthemis ferruginea
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Phyllogomphoides stigmatus
- Hardeman (20)*
Argia fumipennis
Argia sedula
Celithemis eponina
Celithemis fasciata
Dythemis fugax
Dythemis velox
Enallagma civile
Epithea princeps
Epithea costalis
Erythemis simplicicollis
Gomphus militaris
Hetaerina americana
Libellula luctuosa
Libellula lydia
Libellula pulchella
Pachydiplax longipennis
Phyllogomphoides stigmatus
Sympetrum corruptum
Tramea lacerata
Tramea onusta
- Hardin (36)*
Anax junius
Argia moesta
Argia nahuana
Argia tibialis
Arigomphus maxwelli
Boyeria vinosa
Calopteryx dimidiata
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Coryphaeschna ingens
Enallagma exsulans
Epiaeschna heros
Epithea princeps
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus oklahomensis
Hagenius brevistylus
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula auripennis
Libellula incesta
Libellula lydia
Libellula vibrans
Macromia taeniolata
Orthemis ferruginea
Pachydiplax longipennis
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Somatochlora margarita
Sympetrum ambiguum

Harris (71)

Aeshna multicolor
Anax junius
Anax longipes
Aphylla protracta
Argia apicalis
Argia moesta
Argia sedula
Argia tibialis
Argia translata
Arigomphus lentulus
Arigomphus submedianus
Brachymesia furcata
Brachymesia gravida
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Celithemis ornata
Coryphaeschna ingens
Dromogomphus spinosus
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma dubium
Enallagma geminatum
Enallagma signatum
Epiaschna heros
Epiteca princeps
Epiteca cynosura
Epiteca semiaquea
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax berenice
Erythrodiplax minuscula
Erythrodiplax umbrata
Gomphus militaris

Gomphus oklahomensis
Hagenius brevistylus
Hetaerina americana
Hetaerina tita
Ischnura hastata
Ischnura kellicotti
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula auripennis
Libellula croceipennis
Libellula deplanata
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula needhami
Libellula pulchella
Libellula saturata
Libellula semifasciata
Libellula vibrans
Macrodiplax balteata
Miathyria marcella
Nasiaeschna pentacantha
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens

Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Protoneura cara
Sympetrum corruptum
Tramea carolina
Tramea lacerata
Tramea onusta

Harrison (31)

Argia apicalis
Argia fumipennis
Argia immunda
Argia plana
Argia tibialis
Arigomphus maxwelli
Arigomphus submedianus
Calopteryx maculata
Celithemis eponina
Celithemis fasciata
Enallagma geminatum
Enallagma signatum
Enallagma traviatum
Epiteca princeps
Epiteca costalis
Epiteca cynosura
Erythemis simplicicollis
Gomphus oklahomensis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes inaequalis
Libellula cyanea
Libellula incesta
Libellula lydia
Libellula vibrans
Neurocordulia xanthosoma
Pachydiplax longipennis
Perithemis tenera
Phyllogomphoides albrighti
Tramea onusta

Hays (49)

Anax amazili
Anax junius
Aphylla protracta
Archilestes grandis
Argia barretti
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Basiaeschna janata
Brachymesia gravida
Brechmorhoga mendax
Celithemis eponina
Dromogomphus spoliatus
Dythemis nigrescens
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans

Enallagma novaehispaniae
Enallagma signatum
Epiteca princeps
Epiteca petechialis
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax umbrata
Hagenius brevistylus
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula comanche
Libellula croceipennis
Libellula incesta
Libellula luctuosa
Libellula lydia
Macromia annulata
Macrothemis imitans
Miathyria marcella
Orthemis ferruginea
Pachydiplax longipennis
Phyllogomphoides albrighti
Phyllogomphoides stigmatus
Stylurus plagiatus
Telebasis salva

Hemphill (13)

Anax junius
Calopteryx maculata
Celithemis eponina
Erythemis simplicicollis
Gomphus militaris
Ischnura verticalis
Libellula comanche
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula subornata
Pachydiplax longipennis
Tramea lacerata

Henderson (12)

Argia bipunctulata
Argia tibialis
Celithemis eponina
Erythemis simplicicollis
Hetaerina americana
Hetaerina titia
Libellula cyanea
Libellula luctuosa
Libellula lydia
Libellula needhami
Orthemis ferruginea
Progomphus obscurus

Hidalgo (57)

Aeshna dugesi
Anax junius
Aphylla angustifolia
Aphylla protracta
Argia apicalis
Argia immunda

Argia moesta
Argia sedula
Argia translata
Brachymesia furcata
Brachymesia gravida
Brachymesia herbida
Dromogomphus spoliatus
Dythemis fugax
Dythemis nigrescens
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma durum
Enallagma novaehispaniae
Enallagma signatum
Erpetogomphus designatus
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax berenice
Erythrodiplax umbrata
Gomphus militaris
Hetaerina titia
Ischnura hastata
Ischnura ramburii
Lestes alacer
Lestes forcifera
Lestes sigma
Libellula needhami
Macrodiplax balteata
Macrothemisacuta
Micrathyrina aequalis
Micrathyrina didyma
Micrathyrina hagenii
Neoerythromma cultellatum
Neoneura amelia
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis domitia
Perithemis tenera
Phyllogomphoides albrighti
Protoneura cara
Pseudoleon superbus
Stylurus plagiatus
Sympetrum corruptum
Telebasis salva
Tholymis citrina
Tramea calverti
Tramea lacerata
Tramea onusta

Hill (18)

Argia apicalis
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Dromogomphus spoliatus
Enallagma basidens
Enallagma civile
Enallagma exsulans
Erpetogomphus designatus
Erythemis simplicicollis

- Gomphus militaris
Hetaerina americana
Lestes alacer
Libellula luctuosa
Phyllogomphoides stigmatus
Telebasis salva
- Hood* (5)
Argia apicalis
Argia fumipennis
Argia nahuana
Gomphus militaris
Hetaerina americana
- Hopkins* (26)
Anax junius
Argia fumipennis
Argia immunda
Argia nahuana
Argia tibialis
Arigomphus lentulus
Calopteryx maculata
Enallagma basidens
Enallagma civile
Enallagma signatum
Epiaschna heros
Epiteca princeps
Epiteca cynosura
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax umbrata
Gomphus externus
Gomphus hybridus
Gomphus militaris
Gomphus oklahomensis
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula incesta
Libellula luctuosa
Libellula lydia
Orthemis ferruginea
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Tramea lacerata
- Houston* (16)
Aphylla angustifolia
Argia moesta
Basiaeschna janata
Calopteryx maculata
Cordulegaster obliqua
Didymops transversa
Enallagma civile
Epiteca cynosura
Gomphus externus
Gomphus lividus
Gomphus oklahomensis
Ischnura ramburii
Libellula vibrans
Nasiaeschna pentacantha
Perithemis tenera
Somatochlora linearis
- Howard* (5)
Argia moesta
Argia translata
Enallagma civile
Lestes alacer
- Lestes disjunctus
- Hudspeth* (2)
Erpetogomphus compositus
Sympetrum corruptum
- Hunt* (40)
Anax junius
Argia apicalis
Arigomphus lentulus
Celithemis elisa
Celithemis eponina
Didymops transversa
Dromogomphus spoliatus
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma signatum
Epiaschna heros
Epiteca princeps
Epiteca cynosura
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax umbrata
Gomphus externus
Gomphus hybridus
Gomphus militaris
Gomphus oklahomensis
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Macromia illinoensis
Macromia taeniolata
Pachydiplax longipennis
Pantala flavescens
Perithemis tenera
Somatochlora linearis
Sympetrum ambiguum
Sympetrum corruptum
Tramea lacerata
Tramea onusta
- Irion* (1)
Brechmorhoga mendax
- Jack* (15)
Argia fumipennis
Argia immunda
Argia plana
Celithemis eponina
Celithemis fasciata
Dythemis velox
Enallagma basidens
Erpetogomphus designatus
Gomphus militaris
Ischnura posita
Libellula composita
Libellula incesta
Perithemis tenera
- Phyllogomphoides stigmatus
Progomphus obscurus
- Jackson* (9)
Argia apicalis
Argia tibialis
Enallagma civile
Hetaerina titia
Ischnura posita
Ischnura ramburii
Miathyria marcella
Orthemis ferruginea
Stylurus plagiatus
- Jasper* (31)
Argia fumipennis
Argia moesta
Argia nahuana
Argia tibialis
Boyeria vinosa
Calopteryx dimidiata
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Enallagma daeckii
Enallagma divagans
Enallagma traviatum
Epiaschna heros
Epiteca princeps
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus lividus
Gomphus oklahomensis
Hetaerina titia
Ischnura hastata
Ischnura ramburii
Libellula cyanea
Libellula incesta
Libellula vibrans
Miathyria marcella
Nehalennia integricollis
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Tachopteryx thoreyi
- Jeff Davis* (58)
Aeshna dugesi
Aeshna multicolor
Anax junius
Anax walsinghami
Archilestes grandis
Argia apicalis
Argia fumipennis
Argia hinei
Argia immunda
Argia lugens
Argia moesta
Argia munda
Argia nahuana
Argia plana
Argia sedula
Brechmorhoga mendax
Dythemis fugax
- Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma praevarum
Epiteca petechialis
Erpetogomphus compositus
Erpetogomphus designatus
Erpetogomphus heterodon
Erpetogomphus lampropeltis
Erythemis collocata
Erythemis simplicicollis
Erythrodiplax connata
Gomphus militaris
Hesperagrion heterodoxum
Hetaerina americana
Ischnura damula
Ischnura demorsa
Ischnura denticollis
Ischnura hastata
Lestes alacer
Lestes disjunctus
Lestes unguiculatus
Libellula comanche
Libellula croceipennis
Libellula luctuosa
Libellula saturata
Libellula subornata
Neurocordulia virginienensis
Orthemis ferruginea
Pachydiplax longipennis
Paltothemis lineatipes
Pantala flavescens
Pantala hymenaea
Progomphus borealis
Pseudoleon superbus
Sympetrum corruptum
Sympetrum illiotum
Telebasis salva
Tramea carolina
Tramea lacerata
Tramea onusta
- Jefferson* (8)
Aphylla williamsoni
Brachymesia gravida
Erythrodiplax berenice
Ischnura ramburii
Libellula needhami
Orthemis ferruginea
Pachydiplax longipennis
Perithemis tenera
- Jim Wells* (44)
Anax junius
Aphylla angustifolia
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Brachymesia gravida
Celithemis eponina
Dythemis fugax
Dythemis nigrescens
Dythemis velox
Dromogomphus spoliatus

- Enallagma basidens
 Enallagma civile
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus vastus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula auripennis
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Macromia illinoiensis
 Macromia taeniolata
 Miathyria marceffa
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Stylurus plagiatus
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Johnson (20)*
 Argia moesta
 Argia sedula
 Basiaeschna janata
 Brachymesia gravida
 Celithemis eponina
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Epithea princeps
 Erythemis simplicicollis
 Ischnura ramburii
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Tramea lacerata
- Jones (15)*
 Argia apicalis
 Argia moesta
 Argia sedula
 Enallagma basidens
 Enallagma civile
 Erpetogomphus designatus
 Gomphus externus
 Gomphus militaris
 Hetaerina americana
- Lestes alacer
 Libellula pulchella
 Macromia annulata
 Pantala flavescens
 Perithemis tenera
 Sympetrum corruptum
- Karnes (1)*
 Argia apicalis
- Kaufman (4)*
 Dythemis fugax
 Epithea princeps
 Gomphus militaris
 Libellula luctuosa
- Kendall (28)*
 Argia apicalis
 Argia barretti
 Argia cuprea
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brechmorhoga mendax
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma exsulans
 Enallagma novaeahispaniae
 Epithea princeps
 Erpetogomphus designatus
 Gomphus militaris
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Libellula luctuosa
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Protoneura cara
 Telebasis salva
- Kenedy (20)*
 Anax junius
 Anax longipes
 Brachymesia furcata
 Brachymesia gravida
 Celithemis eponina
 Enallagma civile
 Erythemis simplicicollis
 Ischnura hastata
 Ischnura ramburii
 Libellula lydia
 Libellula needhami
 Macrodiplax balteata
 Micrathyria aequalis
 Micrathyria hagenii
 Orthemis ferruginea
 Pachydiplax longipennis
- Pantala hymenaea
 Sympetrum corruptum
 Tramea lacerata
 Tramea onusta
- Kerr (61)*
 Anax junius
 Argia apicalis
 Argia barretti
 Argia fumipennis
 Argia immunda
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brachymesia furcata
 Brachymesia gravida
 Brachymesia herbida
 Brechmorhoga mendax
 Celithemis eponina
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Enallagma vesperum
 Epithea princeps
 Erpetogomphus designatus
 Erythemis plebja
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus vastus
 Gomphus militaris
 Hagenius brevistylus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes alacer
 Lestes sigma
 Libellula comanche
 Libellula flavida
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Macromia illinoiensis
 Neoneura aaroni
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Protoneura cara
 Sympetrum vicinum
 Telebasis salva
 Tramea calverti
- Tramea lacerata
 Tramea onusta
- Kimble (36)*
 Anax junius
 Argia barretti
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brechmorhoga mendax
 Didymops transversa
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Epithea costalis
 Erpetogomphus designatus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes alacer
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Libellula saturata
 Orthemis ferruginea
 Pantala flavescens
 Pantala hymenaea
 Phyllogomphoides albrighti
 Sympetrum corruptum
 Tramea lacerata
- Kinney (46)*
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brechmorhoga mendax
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma novaeahispaniae
 Enallagma praevarum
 Enallagma signatum
 Epithea princeps
 Epithea petechialis
 Erpetogomphus designatus
 Erythemis simplicicollis

- Gomphus militaris*
Hetaerina americana
Lestes alacer
Lestes sigma
Libellula comanche
Libellula croceipennis
Libellula luctuosa
Libellula lydia
Libellula saturata
Macromia annulata
Macrothemisacuta
Orthemis ferruginea
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Phyllogomphoides albrighti
Phyllogomphoides stigmatus
Pseudoleon superbus
Sympetrum corruptum
Telebasis salva
Tramea calverti
Tramea lacerata
Tramea onusta
- Kleberg (17)*
Anax junius
Aphylla protracta
Enallagma civile
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax berenice
Ischnura hastata
Ischnura ramburii
Lestes forcifera
Lestes sigma
Miathyria marcella
Micrathyria hagenii
Pachydiplax longipennis
Pantala hymenaea
Sympetrum corruptum
Tramea lacerata
Tramea onusta
- Knax (2)*
Enallagma civile
Sympetrum corruptum
- Lamar (12)*
Anax junius
Argia sedula
Enallagma basidens
Enallagma divagans
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula lydia
Orthemis ferruginea
Pachydiplax longipennis
- Lampasas (18)*
Argia fumipennis
Argia immunda
Argia nahuana
- Argia sedula*
Dythemis velox
Enallagma basidens
Epithea princeps
Erpetogomphus designatus
Gomphus militaris
Hetaerina americana
Ischnura hastata
Ischnura ramburii
Libellula comanche
Libellula luctuosa
Neurocordulia xanthosoma
Orthemis ferruginea
Pachydiplax longipennis
Phyllogomphoides albrighti
- Lasalle (10)*
Aphylla angustifolia
Argia apicalis
Argia sedula
Enallagma basidens
Enallagma civile
Epithea princeps
Erythemis simplicicollis
Macromia annulata
Orthemis ferruginea
Pachydiplax longipennis
- Lavaca (22)*
Argia fumipennis
Argia immunda
Argia moesta
Argia sedula
Argia translata
Dythemis fugax
Dythemis velox
Enallagma basidens
Erpetogomphus designatus
Erythemis simplicicollis
Hetaerina americana
Hetaerina titia
Ischnura posita
Ischnura ramburii
Libellula croceipennis
Libellula luctuosa
Libellula lydia
Orthemis ferruginea
Pachydiplax longipennis
Progomphus obscurus
Telebasis salva
- Lee (3)*
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
- Leon (37)*
Anax junius
Argia apicalis
Argia fumipennis
Argia moesta
Argia sedula
Argia tibialis
Calopteryx maculata
Celithemis elisa
- Celithemis eponina*
Dromogomphus spoliatus
Dythemis velox
Enallagma civile
Epiaeschna heros
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax minusculum
Gomphus vastus
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Lestes forcifera
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Macromia illinoensis
Nasiaeschna pentacantha
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Stylurus plagiatus
Tramea lacerata
- Liberty (57)*
Anax junius
Anax longipes
Argia apicalis
Argia moesta
Argia sedula
Argia tibialis
Arigomphus maxwelli
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Celithemis ornata
Celithemis verna
Coryphaeschna ingens
Didymops transversa
Dromogomphus spinosus
Dromogomphus spoliatus
Enallagma basidens
Enallagma civile
Enallagma dubium
Enallagma exsulans
Enallagma signatum
Enallagma traviatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Epithea semiaquea
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus externus
Gomphus modestus
Gomphus oklahomensis
Hetaerina titia
Ischnura hastata
- Ischnura posita*
Ischnura ramburii
Lestes disjunctus
Lestes vigilax
Libellula auripennis
Libellula deplanata
Libellula incesta
Libellula lydia
Libellula needhami
Libellula semifasciata
Libellula vibrans
Miathyria marcella
Nasiaeschna pentacantha
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Progomphus obscurus
Tachopteryx thoreyi
Tramea carolina
Tramea lacerata
Tramea onusta
- Limestone (29)*
Argia apicalis
Argia immunda
Argia moesta
Argia sedula
Argia tibialis
Argia translata
Brachymesia gravida
Dromogomphus spoliatus
Dythemis fugax
Dythemis velox
Enallagma signatum
Erythemis simplicicollis
Gomphus militaris
Hetaerina americana
Ischnura ramburii
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula vibrans
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Phyllogomphoides stigmatus
Progomphus obscurus
Tramea lacerata
Tramea onusta
- Live Oak (13)*
Anax junius
Argia apicalis
Argia moesta
Dythemis velox
Enallagma basidens
Enallagma signatum
Erythemis simplicicollis
Hetaerina americana
Hetaerina titia
Ischnura ramburii

- Macromia illinoiensis
 Orthemis ferruginea
 Tramea onusta
- Llano* (32)
 Archilestes grandis
 Argia apicalis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Brechmorhoga mendax
 Celithemis eponina
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura posita
 Ischnura ramburii
 Libellula comanche
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Progomphus obscurus
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- Loving* (3)
 Erpetogomphus designatus
 Libellula lydia
 Progomphus obscurus
- Lubbock* (22)
 Anax junius
 Archilestes grandis
 Argia apicalis
 Argia lugens
 Argia sedula
 Enallagma basidens
 Enallagma civile
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura ramburii
 Ischnura verticalis
 Lestes alacer
 Lestes disjunctus
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Sympetrum corruptum
- Tramea onusta
- Lynn* (2)
 Gomphus militaris
 Orthemis ferruginea
- Madison* (21)
 Anax junius
 Argia apicalis
 Argia moesta
 Argia sedula
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Celithemis eponina
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax berenice
 Gomphus vastus
 Ischnura hastata
 Libellula cyanea
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Pachydiplax longipennis
 Perithemis tenera
 Tramea lacerata
- Marion* (38)
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia tibialis
 Arigomphus lentulus
 Basiaeschna janata
 Calopteryx maculata
 Celithemis eponina
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Enallagma basidens
 Enallagma exsulans
 Enallagma signatum
 Enallagma traviatum
 Enallagma vesperum
 Epithea princeps
 Epithea cynosura
 Epithea semiaquea
 Erythemis simplicicollis
 Gomphus militaris
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes vigilax
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia taeniolata
 Neurocordulia xanthosoma
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
- Stylurus plagiatus
 Tramea lacerata
 Tramea onusta
- Martin* (2)
 Libellula luctuosa
 Libellula saturata
- Mason* (14)
 Brechmorhoga mendax
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Erythemis simplicicollis
 Libellula comanche
 Libellula lydia
 Libellula pulchella
 Libellula saturata
 Macromia annulata
 Pachydiplax longipennis
 Phyllogomphoides stigmatus
 Progomphus borealis
 Tramea lacerata
- Matagorda* (44)
 Anax junius
 Anax longipes
 Aphylla protracta
 Argia apicalis
 Argia moesta
 Argia sedula
 Argia tibialis
 Arigomphus lentulus
 Arigomphus submedianus
 Brachymesia grava
 Celithemis eponina
 Enallagma civile
 Enallagma durum
 Enallagma geminatum
 Enallagma signatum
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax berenice
 Gomphus externus
 Gomphus modestus
 Gomphus vastus
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura ramburii
 Lestes alacer
 Libellula auripennis
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Libellula vibrans
 Miathyria marcella
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Stylurus plagiatus
- Sympetrum corruptum
 Tramea calverti
 Tramea lacerata
 Tramea onusta
- Maverick* (11)
 Argia moesta
 Argia sedula
 Argia translata
 Enallagma civile
 Erpetogomphus compositus
 Erpetogomphus designatus
 Hetaerina americana
 Hetaerina titia
 Libellula comanche
 Macrodiplax balteata
 Orthemis ferruginea
- McCulloch* (3)
 Hetaerina americana
 Libellula comanche
 Telebasis salva
- McLennan* (74)
 Anax amazili
 Anax junius
 Anax longipes
 Archilestes grandis
 Argia apicalis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Arigomphus lentulus
 Arigomphus submedianus
 Basiaeschna janata
 Brachymesia grava
 Brechmorhoga mendax
 Celithemis elisa
 Celithemis eponina
 Didymops transversa
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma signatum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Epithea petechialis
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus externus
 Gomphus vastus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii

- Lestes disjunctus
 Libellula comanche
 Libellula croceipennis
 Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula saturata
 Libellula vibrans
 Macromia annulata
 Macromia illinoiensis
 Macromia pacifica
 Macromia taeniolata
 Macromia wabashensis
 Nasiaeschna pentacantha
 Neurocordulia xanthosoma
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Stylurus plagiatus
 Sympetrum ambiguum
 Sympetrum corruptum
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
 Tramea onusta
- McMullen* (19)
 Anax junius
 Argia apicalis
 Argia moesta
 Argia sedula
 Brechmorhoga mendax
 Dythemis velox
 Enallagma basidens
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Hetaerina americana
 Hetaerina titia
 Ischnura ramburii
 Libellula lydia
 Libellula pulchella
 Orthemis ferruginea
 Perithemis tenera
 Tramea onusta
- Medina* (40)
 Anax junius
 Argia apicalis
 Argia barretti
 Argia fumipennis
 Argia immunda
 Argia leonorae
 Argia moesta
 Argia nahuana
 Argia sedula
- Argia translata
 Basiaeschna janata
 Brechmorhoga mendax
 Celithemis elisa
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Epithea princeps
 Erpetogomphus designatus
 Erythrodiplax fusca
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Libellula comanche
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula saturata
 Nasiaeschna pentacantha
 Neoneura aaroni
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Phyllogomphoides albrighti
 Protoneura cara
 Sympetrum corruptum
 Tramea lacerata
- Menard* (29)
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma exsulans
 Enallagma vesperum
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura posita
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Perithemis tenera
 Phyllogomphoides albrighti
 Telebasis salva
- Milam* (13)
 Anax junius
- Arigomphus lentulus
 Boyeria vinosa
 Dromogomphus spoliatus
 Enallagma civile
 Epithea princeps
 Epithea cynosura
 Erpetogomphus designatus
 Gomphus externus
 Hetaerina titia
 Libellula lydia
 Pachydiplax longipennis
 Somatochlora linearis
- Mills* (12)
 Celithemis eponina
 Dythemis fugax
 Erpetogomphus designatus
 Libellula comanche
 Libellula croceipennis
 Libellula luctuosa
 Libellula pulchella
 Perithemis tenera
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Stylurus plagiatus
 Tramea lacerata
- Mitchell* (1)
 Erpetogomphus designatus
- Montague* (3)
 Archilestes grandis
 Enallagma vesperum
 Sympetrum corruptum
- Montgomery* (73)
 Anax junius
 Anax longipes
 Aphylla protracta
 Aphylla williamsoni
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Arigomphus lentulus
 Arigomphus submedianus
 Brachymeria gravis
 Calopteryx maculata
 Celithemis amanda
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Celithemis ornata
 Celithemis verna
 Cordulegaster maculata
 Cordulegaster maculata
 Dromogomphus spoliatus
 Enallagma basidens
 Enallagma daeckii
 Enallagma divagans
 Enallagma geminatum
 Enallagma traviatum
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Epithea costalis
- Enallagma signatum
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax minuscula
 Erythrodiplax umbrata
 Gomphus externus
 Gomphus oklahomensis
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Lestes vigilax
 Libellula auripennis
 Libellula deplanata
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Miathyria marcella
 Nasiaeschna pentacantha
 Nehalennia integricollis
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Somatochlora margarita
 Sympetrum ambiguum
 Sympetrum corruptum
 Tachopteryx thoreyi
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Morris* (37)
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia nahuana
 Argia plana
 Argia tibialis
 Calopteryx maculata
 Celithemis elisa
 Cordulegaster maculata
 Dromogomphus spoliatus
 Enallagma basidens
 Enallagma daeckii
 Enallagma divagans
 Enallagma geminatum
 Enallagma traviatum
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Epithea costalis

- Epithea cynosura*
Erythemis simplicicollis
Gomphus lividus
Gomphus oklahomensis
Ischnura hastata
Ischnura kelicotti
Ischnura posita
Lestes inaequalis
Libellula cyanea
Libellula deplanata
Libellula flavida
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula vibrans
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
- Nacogdoches* (11)
Argia tibialis
Calopteryx maculata
Cordulegaster maculata
Enallagma exsulans
Ischnura hastata
Lestes disjunctus
Libellula needhami
Miathyria marcella
Pachydiplax longipennis
Perithemis tenera
Sympetrum ambiguum
- Navarro* (6)
Argia apicalis
Argia moesta
Hetaerina americana
Hetaerina titia
Libellula luctuosa
Libellula lydia
- Newton* (20)
Anax junius
Argia tibialis
Celithemis fasciata
Enallagma dubium
Enallagma geminatum
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus modestus
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes vigilax
Libellula auripennis
Libellula incesta
Libellula vibrans
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Tramea carolina
Tramea lacerata
- Nueces* (8)
Argia moesta
Brachymesia gravida
- Enallagma basidens*
Enallagma civile
Ischnura ramburii
Lestes disjunctus
Libellula lydia
Neoneura aaroni
- Oldham* (3)
Hetaerina americana
Libellula luctuosa
Progomphus obscurus
- Orange* (6)
Argia apicalis
Argia tibialis
Ischnura hastata
Libellula auripennis
Libellula needhami
Stylurus plagiatus
- Palo Pinto* (27)
Argia apicalis
Argia fumipennis
Argia moesta
Argia plana
Argia sedula
Argia translata
Brechmorhoga mendax
Dromogomphus spoliatus
Dythemis fugax
Enallagma basidens
Enallagma exsulans
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus externus
Gomphus militaris
Hetaerina americana
Hetaerina titia
Ischnura hastata
Libellula luctuosa
Libellula lydia
Libellula semifasciata
Neurocordulia xanthosoma
Perithemis tenera
Phyllogomphoides albrighti
Phyllogomphoides stigmatus
Telebasis salva
Tramea lacerata
- Panola* (11)
Argia apicalis
Argia bipunctulata
Celithemis eponina
Enallagma geminatum
Enallagma signatum
Epithea cynosura
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Pachydiplax longipennis
- Parker* (24)
Argia apicalis
Argia fumipennis
- Argia plana*
Argia sedula
Arigomphus lentulus
Calopteryx maculata
Celithemis fasciata
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma divagans
Gomphus militaris
Ischnura posita
Libellula luctuosa
Libellula lydia
Nasiaeschna pentacantha
Neurocordulia xanthosoma
Pachydiplax longipennis
Pantala flavescens
Phyllogomphoides albrighti
Somatochlora linearis
Sympetrum corruptum
Telebasis salva
- Pecos* (20)
Argia fumipennis
Argia moesta
Argia nahuana
Argia sedula
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma praevarum
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax berenice
Gomphus militaris
Hetaerina americana
Ischnura barberi
Ischnura demorsa
Libellula composita
Libellula luctuosa
Sympetrum corruptum
- Polk* (29)
Argia fumipennis
Argia immunda
Argia moesta
Argia sedula
Argia tibialis
Arigomphus maxwelli
Basiaeschna janata
Boyeria vinosa
Calopteryx dimidiata
Calopteryx maculata
Didymops transversa
Dromogomphus spinosus
Enallagma divagans
Epiaeschna heros
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus lividus
Gomphus oklahomensis
- Hetaerina americana*
Ischnura hastata
Ischnura posita
Ischnura ramburii
Libellula croceipennis
Libellula deplanata
Libellula lydia
Macromia illinoiensis
Progomphus obscurus
- Potter* (2)
Anax junius
Sympetrum corruptum
- Presidio* (49)
Aeshna multicolor
Anax junius
Anax walsinghami
Archilestes grandis
Argia fumipennis
Argia hinei
Argia immunda
Argia lugens
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Brachymesia furcata
Brechmorhoga mendax
Dythemis maya
Enallagma civile
Enallagma praevarum
Erpetogomphus compositus
Erpetogomphus designatus
Erpetogomphus lampropeltis
Erythemis simplicicollis
Erythrodiplax connata
Gomphus externus
Gomphus militaris
Hesperagrion heterodoxum
Hetaerina americana
Hetaerina titia
Ischnura demorsa
Ischnura denticollis
Ischnura hastata
Lestes alacer
Libellula comanche
Libellula croceipennis
Libellula luctuosa
Libellula lydia
Libellula saturata
Libellula subornata
Orthemis ferruginea
Pachydiplax longipennis
Paltothemis lineatipes
Pantala flavescens
Pantala hymenaea
Progomphus borealis
Pseudoleon superbus
Stylurus intricatus
Sympetrum corruptum
Telebasis salva
Tramea lacerata
Tramea onusta

Rains (12)

Anax junius
 Celithemis eponina
 Enallagma civile
 Enallagma signatum
 Epiaeschna heros
 Gomphus externus
 Ischnura posita
 Lestes disjunctus
 Libellula incesta
 Libellula lydia
 Pachydiplax longipennis
 Pantala hymenaea

Randall (26)

Aeshna multicolor
 Anax junius
 Argia apicalis
 Argia hinei
 Argia lugens
 Argia moesta
 Argia nahuana
 Argia sedula
 Brechmorhoga mendax
 Enallagma civile
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Libellula comanche
 Libellula luctuosa
 Libellula lydia
 Libellula saturata
 Paltotthemis lineatipes
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus borealis
 Progomphus obscurus
 Sympetrum corruptum
 Tramea onusta

Real (48)

Anax junius
 Argia barretti
 Argia cuprea
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Basiaeschna janata
 Brechmorhoga mendax
 Celithemis eponina
 Celithemis fasciata
 Dromogomphus spinosus
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Enallagma novae-hispaniae

Enallagma praevarum
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus graslinellus
 Gomphus militaris
 Hagenius brevistylus
 Hetaerina americana
 Ischnura hastata
 Libellula comanche
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula saturata
 Libellula lydia
 Libellula pulchella
 Libellula saturata
 Macromia annulata
 Macromia annulata
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Perithemis tenera
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Sympetrum vicinum
 Telebasis salva
 Tramea lacerata
 Tramea onusta

Red River (9)

Argia apicalis
 Argia moesta
 Arigomphus submedianus
 Enallagma signatum
 Erythemis simplicicollis
 Gomphus oklahomensis
 Ischnura hastata
 Ischnura posita
 Pachydiplax longipennis

Reeves (51)

Aeshna dugesi
 Aeshna multicolor
 Anax amazili
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia leonorae
 Argia lugens
 Argia moesta
 Argia munda
 Argia nahuana
 Argia sedula
 Argia translata
 Brachymesia furcata
 Brachymesia gravida
 Brechmorhoga mendax
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma praevarum
 Erpetogomphus designatus
 Erpetogomphus heterodon
 Erythemis simplicicollis

Erythrodiplax berenice
 Erythrodiplax connata
 Gomphus militaris
 Hetaerina americana
 Ischnura barberi
 Ischnura demorsa
 Ischnura hastata
 Lestes alacer
 Libellula comanche
 Libellula luctuosa
 Libellula pulchella
 Libellula saturata
 Macrodiplax balteata
 Macromia annulata
 Macromia annulata
 Orthemis ferruginea
 Pachydiplax longipennis
 Paltotthemis lineatipes
 Pantala flavescens
 Pantala hymenaea
 Phyllogomphoides stigmatus
 Pseudoleon superbus
 Sympetrum corruptum
 Telebasis salva
 Tramea lacerata
 Tramea onusta

Refugio (5)

Argia immunda
 Enallagma civile
 Erythrodiplax berenice
 Hetaerina titia
 Ischnura ramburii

Roberts (1)

Anax junius

Robertson (53)

Anax junius
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Dromogomphus spinosus
 Dromogomphus spoliatus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma exsulans
 Epiaeschna heros
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus externus
 Gomphus vastus
 Gomphus militaris
 Hagenius brevistylus
 Hetaerina americana

Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes disjunctus
 Libellula comanche
 Libellula croceipennis
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula vibrans
 Macromia illinoensis
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Stylurus plagiatius
 Sympetrum amgiguum
 Sympetrum vicinum
 Telebasis salva

Refugio (1)

Enallagma civile

Rusk (22)

Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia sedula
 Argia tibialis
 Boyeria vinosa
 Calopteryx maculata
 Celithemis fasciata
 Enallagma exsulans
 Enallagma traviatum
 Erythemis simplicicollis
 Gomphus militaris
 Hagenius brevistylus
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Libellula incesta
 Libellula lydia
 Libellula vibrans
 Pachydiplax longipennis
 Perithemis tenera
 Progomphus obscurus

Sabine (5)

Calopteryx maculata
 Coryphaeschna ingens
 Epithea cynosura
 Pantala flavescens
 Pantala hymenaea

San Augustine (4)

Epiaeschna heros
 Celithemis eponina
 Cordulegaster obliqua
 Somatochlora margarita

San Jacinto (94)

Anax junius
 Anax longipes
 Argia apicalis
 Argia bipunctulata
 Argia fumipennis
 Argia moesta
 Argia sedula
 Argia tibialis
 Arigomphus lentulus
 Arigomphus maxwelli
 Arigomphus submedianus
 Basiaeschna janata
 Boyeria vinosa
 Brachymesia gravida
 Calopteryx dimidiata
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Celithemis ornata
 Celithemis verna
 Cordulegaster maculata
 Cordulegaster obliqua
 Coryphaeschna ingens
 Didymops transversa
 Dromogomphus spinosus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma daeckii
 Enallagma divagans
 Enallagma dubium
 Enallagma exsulans
 Enallagma geminatum
 Enallagma signatum
 Enallagma traviatum
 Enallagma vesperum
 Epiaschna heros
 Epithea princeps
 Epithea costalis
 Epithea cynosura
 Epithea semiaqua
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax minuscula
 Gomphaeschna furcillata
 Gomphus modestus
 Gomphus externus
 Gomphus apomyius
 Gomphus lividus
 Gomphus militaris
 Gomphus oklahomensis
 Hagenius brevistylus
 Helocordulia selysii
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura kellicotti
 Ischnura posita
 Ischnura prognata
 Ischnura ramburii
 Lestes disjunctus
 Lestes vigilax

Libellula auripennis
 Libellula deplanata
 Libellula flavida
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Libellula semifasciata
 Libellula vibrans
 Macromia illinoiensis
 Macromia taeniolata
 Nasiaeschna pentacantha
 Nehalennia integricollis
 Neurocordulia alabamensis
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Progomphus obscurus
 Somatochlora linearis
 Somatochlora margarita
 Stylurus laurae
 Sympetrum ambiguum
 Sympetrum corruptum
 Tachopteryx thoreyi
 Telebasis byersi
 Tramea carolina
 Tramea lacerata
 Tramea onusta

San Patricio (55)

Anax junius
 Aphylla protracta
 Argia apicalis
 Argia moesta
 Argia sedula
 Argia translata
 Brachymesia gravida
 Celithemis eponina
 Coryphaeschna ingens
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma durum
 Enallagma signatum
 Epiaschna heros
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Erythrodiplax umbrata
 Gomphus externus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes alacer
 Lestes disjunctus
 Lestes forficula

Lestes sigma
 Libellula auripennis
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Macromia illinoiensis
 Macromia pacifica
 Macrothemisacuta
 Miathyria marcella
 Neoneura aaroni
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides albrighti
 Progomphus obscurus
 Stylurus plagiatius
 Sympetrum corruptum
 Tramea calverti
 Tramea lacerata
 Tramea onusta

San Saba (33)

Anax longipes
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia nahuana
 Argia plana
 Argia sedula
 Argia translata
 Celithemis eponina
 Dromogomphus spoliatus
 Dythemis fugax
 Enallagma civile
 Erpetogomphus designatus
 Gomphus externus
 Gomphus vastus
 Ischnura hastata
 Ischnura ramburii
 Lestes alacer
 Lestes disjunctus
 Lestes sigma
 Libellula croceipennis
 Libellula lydia
 Macromia annulata
 Neurocordulia xanthosoma
 Orthemis ferruginea
 Perithemis tenera
 Phyllogomphoides albrighti
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Stylurus plagiatius
 Telebasis salva
 Tramea onusta

Shackelford (2)

Argia apicalis
 Argia moesta

Shelby (5)

Brachymesia gravida
 Calopteryx maculata

Celithemis eponina
 Cordulegaster obliqua
 Erythemis simplicicollis

Smith (7)

Argia apicalis
 Argia tibialis
 Calopteryx maculata
 Dromogomphus spinosus
 Erythemis simplicicollis
 Libellula incesta
 Pachydiplax longipennis

Somervell (22)

Archilestes grandis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Brachymesia gravida
 Brechmorhoga mendax
 Celithemis eponina
 Dromogomphus spoliatus
 Dythemis fugax
 Erythemis simplicicollis
 Hetaerina americana
 Ischnura hastata
 Ischnura posita
 Lestes disjunctus
 Libellula luctuosa
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala hymenaea
 Tramea onusta

Starr (40)

Anax junius
 Aphylla angustifolia
 Aphylla protracta
 Argia moesta
 Argia sedula
 Brachymesia furcata
 Brachymesia gravida
 Brachymesia herbida
 Dromogomphus spoliatus
 Dythemis nigrescens
 Enallagma civile
 Enallagma durum
 Enallagma novaehispaniae
 Epithea princeps
 Erpetogomphus designatus
 Erythemis plebeja
 Erythemis simplicicollis
 Gomphus gonzalesi
 Hetaerina americana
 Hetaerina tita
 Ischnura hastata
 Ischnura ramburii
 Lestes forficula
 Lestes sigma
 Libellula needhami
 Macrodiplax balteata
 Macrothemisacuta

- Micrathyria hagenii*
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Phyllogomphoides albrighti
Pseudoleon superbus
Stylurus plagiatus
Sympetrum corruptum
Tramea calverti
Tramea lacerata
Tramea onusta
- Stephens (6)*
Enallagma basidens
Enallagma civile
Gomphus militaris
Ischnura hastata
Perithemis tenera
Sympetrum corruptum
- Sutton (4)*
Argia sedula
Enallagma praevarum
Hetaerina americana
Ischnura posita
- Swisher (1)*
Anax junius
- Tarrant (37)*
Anax junius
Archilestes grandis
Argia apicalis
Argia moesta
Argia nahuana
Argia sedula
Celithemis eponina
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Enallagma traviatum
Epithea princeps
Erpetogomphus designatus
Erythemis simplicicollis
Gomphus militaris
Hetaerina americana
Ischnura hastata
Ischnura kellicotti
Ischnura posita
Ischnura ramburii
Lestes disjunctus
Libellula comanche
Libellula incesta
Libellula luctuosa
Libellula lydia
Pachydiplax longipennis
Pantala hymenaea
Perithemis tenera
Phyllogomphoides stigmatus
- Sympetrum ambiguum*
Telebasis salva
Tramea carolina
Tramea lacerata
- Taylor (28)*
Anax junius
Argia apicalis
Argia moesta
Argia sedula
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Erpetogomphus designatus
Erythemis simplicicollis
Erythemis vesiculosa
Gomphus militaris
Hetaerina americana
Ischnura hastata
Ischnura posita
Libellula comanche
Libellula croceipennis
Libellula incesta
Libellula luctuosa
Libellula pulchella
Micrathyria hagenii
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Stylurus plagiatus
Sympetrum corruptum
Tramea onusta
- Terrell (1)*
Libellula comanche
- Titus (19)*
Argia fumipennis
Argia nahuana
Boyeria vinosa
Calopteryx maculata
Celithemis elisa
Celithemis eponina
Celithemis fasciata
Enallagma basidens
Erythemis simplicicollis
Erythrodiplax minuscula
Ischnura hastata
Ischnura ramburii
Libellula pulchella
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Somatochlora georgiana
Tachopteryx thoreyi
Telebasis salva
- Tom Green (18)*
Anax junius
Argia immunda
Argia moesta
Argia nahuana
- Argia sedula*
Enallagma basidens
Enallagma exsulans
Erythemis simplicicollis
Ischnura postia posita
Ischnura ramburii
Libellula comanche
Libellula luctuosa
Libellula lydia
Macrodiplax balteata
Orthemis ferruginea
Pachydiplax longipennis
Perithemis tenera
Telebasis salva
- Travis (64)*
Anax junius
Aphylla angustifolia
Archilestes grandis
Argia apicalis
Argia barretti
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Basiaeschna janata
Brachymesia gravida
Boyeria vinosa
Celithemis eponina
Didymops transversa
Dromogomphus spoliatus
Dythemis fugax
Dythemis nigrescens
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma novaehispaniae
Epiaeschna heros
Epithea princeps
Epithea petechialis
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax umbrata
Gomphus externus
Gomphus vastus
Gomphus graslinellus
Gomphus militaris
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura ramburii
Lestes disjunctus
Libellula comanche
Libellula croceipennis
Libellula incesta
Libellula luctuosa
Libellula lydia
Libellula pulchella
Macromia annulata
Macromia illinoiensis
Miathyria marcella
Micrathyria hagenii
- Neurocordulia xanthosoma*
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Phylogomphoides stigmatus
Progomphus obscurus
Stylurus plagiatus
Sympetrum corruptum
Sympetrum vicinum
Telebasis salva
Tramea calverti
Tramea lacerata
Tramea onusta
- Trinity (1)*
Epithea semiaquea
- Tyler (40)*
Argia bipunctulata
Argia fumipennis
Argia immunda
Argia moesta
Argia tibialis
Boyeria vinosa
Calopteryx dimidiata
Calopteryx maculata
Celithemis amanda
Celithemis eponina
Enallagma divagans
Enallagma dubium
Enallagma signatum
Epiaeschna heros
Epithea princeps
Epithea cynosura
Erythemis simplicicollis
Erythrodiplax minuscula
Gomphus hybridus
Gomphus oklahomensis
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes vigilax
Libellula auripennis
Libellula flava
Libellula incesta
Libellula vibrans
Macromia illinoiensis
Nasiaeschna pentacantha
Orthemis ferruginea
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Somatochlora linearis
Tramea carolina
Tramea lacerata
Tramea onusta
- Upshur (8)*
Boyeria vinosa
Calopteryx maculata
Cordulegaster maculata
Enallagma exsulans

- Epitheca petechialis*
Erythemis simplicicollis
Ischnura hastata
Ischnura posita
- Upton (1)*
Tramea onusta
- Uvalde (67)*
Anax amazili
Anax junius
Archilestes grandis
Argia apicalis
Argia barretti
Argia cuprea
Argia fumipennis
Argia immunda
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Basiaeschna janata
Brachymesia gravida
Brechmorhoga mendax
Celithemis eponina
Celithemis fasciata
Didymops transversa
Dromogomphus spinosus
Dromogomphus spoliatus
Dythemis fugax
Dythemis nigrescens
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma novaehispaniae
Enallagma praevarum
Enallagma signatum
Epitheca princeps
Epitheca costalis
Epitheca petechialis
Erpetogomphus designatus
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax umbrata
Gomphus militaris
Hetaerina americana
Ischnura posita
Ischnura ramburii
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes alacer
Libellula comanche
Libellula croceipennis
Libellula luctuosa
Libellula lydia
Libellula pulchella
Macromia annulata
Macrothemis imitans
Nasiaeschna pentacantha
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
- Perithemis tenera*
Phyllogomphoides albrighti
Phyllogomphoides stigmatus
Protoneura cara
Pseudoleon superbus
Sympetrum corruptum
Sympetrum vicinum
Telebasis salva
Tramea calverti
Tramea lacerata
Tramea onusta
- Val Verde (63)*
Acanthagrion quadratum
Anax junius
Aphylla angustifolia
Archilestes grandis
Argia apicalis
Argia fumipennis
Argia immunda
Argia leonorae
Argia moesta
Argia nahuana
Argia plana
Argia sedula
Argia translata
Basiaeschna janata
Brachymesia gravida
Brechmorhoga mendax
Didymops transversa
Dromogomphus spoliatus
Dythemis fugax
Dythemis nigrescens
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma exsulans
Enallagma novaehispaniae
Enallagma praevarum
Epitheca costalis
Epitheca petechialis
Erpetogomphus designatus
Erythemis simplicicollis
Erythrodiplax umbrata
Gomphus graslinellus
Gomphus militaris
Hetaerina americana
Ischnura posita
Ischnura ramburii
Lestes alacer
Libellula comanche
Libellula croceipennis
Libellula luctuosa
Libellula lydia
Libellula saturata
Macromia annulata
Macrothemis imitans
Macrothemis inequinguis
Miathyria marcella
Micrathyria hagenii
Neoneura aaroni
Neurocordulia xanthosoma
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
- Pantala hymenaea*
Perithemis tenera
Phyllogomphoides albrighti
Phyllogomphoides stigmatus
Protoneura cara
Pseudoleon superbus
Sympetrum corruptum
Telebasis salva
Tramea calverti
Tramea lacerata
Tramea onusta
- Van Zandt (13)*
Anax junius
Enallagma civile
Enallagma signatum
Epiaeschna heros
Erythemis simplicicollis
Gomphus externus
Ischnura posita
Lestes disjunctus
Libellula incesta
Libellula lydia
Libellula saturata
Pachydiplax longipennis
Pantala hymenaea
- Victoria (43)*
Anax junius
Argia apicalis
Argia moesta
Argia sedula
Argia tibialis
Arigomphus lentulus
Arigomphus submedianus
Brachymesia furcata
Brachymesia gravida
Brachymesia herbida
Celithemis eponina
Dromogomphus spoliatus
Dythemis fugax
Dythemis velox
Enallagma basidens
Enallagma civile
Enallagma signatum
Epitheca princeps
Erythemis plebja
Erythemis simplicicollis
Erythemis vesiculosa
Erythrodiplax umbrata
Gomphus vastus
Gomphus militaris
Hetaerina americana
Hetaerina titia
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes sigma
Libellula luctuosa
Neoneura aaroni
Orthemis ferruginea
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
- Progomphus obscurus*
Stylurus plagiatus
Telebasis salva
Tramea calverti
Tramea lacerata
Tramea onusta
- Walker (40)*
Anax junius
Anax longipes
Argia apicalis
Argia moesta
Argia tibialis
Arigomphus lentulus
Arigomphus submedianus
Basiaeschna janata
Brachymesia gravida
Calopteryx maculata
Celithemis eponina
Didymops transversa
Dromogomphus spinosus
Enallagma divagans
Enallagma dubium
Enallagma geminatum
Enallagma signatum
Epiaeschna heros
Epitheca princeps
Epitheca cynosura
Epitheca semiaquea
Erythemis simplicicollis
Erythemis vesiculosa
Gomphus lividus
Gomphus oklahomensis
Ischnura hastata
Ischnura posita
Ischnura ramburii
Lestes vigilax
Libellula incesta
Libellula semifasciata
Libellula vibrans
Macromia illinoiensis
Macromia taeniolata
Nasiaeschna pentacantha
Pachydiplax longipennis
Perithemis tenera
Progomphus obscurus
Sympetrum corruptum
Tramea lacerata
- Waller (20)*
Anax junius
Brachymesia gravida
Celithemis elisa
Celithemis eponina
Corphyaeschnagens
Enallagma civile
Epiaeschna heros
Epitheca princeps
Erythemis simplicicollis
Ischnura ramburii
Libellula luctuosa
Libellula lydia
Libellula needhami
Pachydiplax longipennis
Pantala flavescens

- Pantala hymenaea
 Perithemis tenera
 Tramea carolina
 Tramea lacerata
 Tramea onusta
- Ward* (10)
 Argia sedula
 Dythemis fugax
 Enallagma civile
 Ischnura barberi
 Ischnura ramburii
 Lestes alacer
 Libellula composita
 Libellula saturata
 Pantala flavescens
 Sympetrum corruptum
- Washington* (25)
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia moesta
 Argia sedula
 Argia tibialis
 Calopteryx maculata
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula needhami
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Tramea lacerata
- Webb* (16)
 Anax junius
 Argia moesta
 Brechmorhoga mendax
 Dythemis fugax
 Dythemis nigrescens
 Dythemis velox
 Enallagma civile
 Erpetogomphus designatus
 Erythrodiplax umbrata
 Hetaerina titia
 Macromia annulata
 Micrathyrina hagenii
 Orthemis ferruginea
 Perithemis tenera
 Sympetrum corruptum
 Tramea onusta
- Wharton* (2)
 Hetaerina titia
- Progomphus obscurus
- Wilbarger* (6)
 Argia tibialis
 Enallagma civile
 Erythemis simplicicollis
 Erythrodiplax berenice
 Libellula pulchella
 Pachydiplax longipennis
- Willacy* (7)
 Anax junius
 Argia apicalis
 Argia sedula
 Enallagma civile
 Enallagma durum
 Ischnura ramburii
 Perithemis tenera
- (30)
 Anax junius
 Argia apicalis
 Argia fumipennis
 Argia immunda
 Argia leonorae
 Argia moesta
 Argia nahuana
 Argia sedula
 Argia translata
 Boyeria vinosa
 Dythemis fugax
 Dythemis velox
 Enallagma basidens
 Enallagma exsulans
 Epithea petechialis
 Erpetogomphus designatus
 Hetaerina americana
 Ischnura hastata
 Ischnura ramburii
 Lestes disjunctus
 Libellula comanche
 Libellula croceipennis
 Libellula luctuosa
 Libellula lydia
 Macromia illinoiensis
 Neurocordulia virginiana
 Pachydiplax longipennis
 Pantala hymenaea
 Telebasis salva
 Tramea onusta
- Wilson* (40)
 Anax junius
 Aphylla protracta
 Argia apicalis
 Argia immunda
 Argia moesta
 Argia sedula
 Argia translata
 Brechmorhoga mendax
 Dromogomphus spoliatus
 Dythemis nigrescens
 Dythemis velox
 Enallagma basidens
 Enallagma civile
- Enallagma exsulans
 Enallagma novaehispaniae
 Enallagma signatum
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Erythemis vesiculosa
 Gomphus externus
 Gomphus militaris
 Hetaerina americana
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Lestes disjunctus
 Libellula pulchella
 Macromia annulata
 Macromia illinoiensis
 Nasiaeschna pentacantha
 Orthemis ferruginea
 Pachydiplax longipennis
 Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides albrighti
 Progomphus obscurus
 Stylurus plagiatus
 Telebasis salva
- Wise* (45)
 Anax junius
 Archilestes grandis
 Argia apicalis
 Argia fumipennis
 Argia moesta
 Argia nahuana
 Argia sedula
 Brachymesia gravida
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis fasciata
 Dromogomphus spoliatus
 Dythemis fugax
 Dythemis velox
 Enallagma aspersum
 Enallagma basidens
 Enallagma civile
 Enallagma signatum
 Epithea princeps
 Erpetogomphus designatus
 Erythemis simplicicollis
 Gomphus militaris
 Hetaerina americana
 Ischnura hastata
 Ischnura ramburii
 Libellula auripennis
 Libellula comanche
 Libellula croceipennis
 Libellula cyanea
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Pachydiplax longipennis
- Pantala flavescens
 Pantala hymenaea
 Perithemis tenera
 Phyllogomphoides stigmatus
 Progomphus obscurus
 Sympetrum ambiguum
 Sympetrum corruptum
 Tramea carolina
 Tramea lacerata
- Wood* (47)
 Anax junius
 Argia apicalis
 Argia bipunctulata
 Argia fumipennis
 Argia immunda
 Argia plana
 Argia tibialis
 Basiaeschna janata
 Boyeria vinosa
 Calopteryx maculata
 Celithemis elisa
 Celithemis eponina
 Celithemis obliqua
 Cordulegaster maculata
 Didymops transversa
 Dromogomphus spinosus
 Dythemis velox
 Enallagma basidens
 Enallagma civile
 Enallagma vesperum
 Epiaeschna heros
 Epithea princeps
 Epithea cynosura
 Erythemis simplicicollis
 Erythrodiplax minuscula
 Gomphus militaris
 Gomphus oklahomensis
 Hagenius brevistylus
 Hetaerina titia
 Ischnura hastata
 Ischnura posita
 Ischnura ramburii
 Lestes vigilax
 Libellula cyanea
 Libellula deplanata
 Libellula incesta
 Libellula luctuosa
 Libellula lydia
 Libellula pulchella
 Libellula vibrans
 Macromia illinoiensis
 Pachydiplax longipennis
 Pantala flavescens
 Perithemis tenera
 Progomphus obscurus
 Sympetrum ambiguum
 Sympetrum corruptum
- Young* (1)
 Gomphus externus
- Zapata* (16)
 Anax junius
 Aphylla angustifolia

Argia immunda
Argia moesta
Argia sedula
Brachymesia furcata
Dythemis nigrescens
Enallagma basidens
Enallagma civile
Erythrodiplax umbrata
Gomphus militaris
Hetaerina americana
Ischnura ramburii
Perithemis tenera
Pseudoleon superbus
Sympetrum corruptum

Zavala (9)

Argia barretti
Argia moesta
Argia translata
Dromogomphus spoliatus
Dythemis fugax
Dythemis velox
Gomphus militaris
Libellula luctuosa
Phyllogomphoides stigmatus

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