Status of Wheeler Reservoir

An Overview of Reservoir Conditions

Tennessee Valley Authority
Resource Development
River Basin Operations
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INTRODUCTION

This is one in a series of status reports prepared by the Tennessee Valley Authority (TVA) for those interested in the conditions of TVA reservoirs. This overview of Wheeler Reservoir summarizes reservoir purposes and operation, reservoir and watershed characteristics, reservoir uses and use impairments, and water quality and aquatic biological conditions. The information presented here is from the most recent reports, publications, and original data available. If no recent data were available, historical data were summarized. If data were completely lacking, environmental professionals with special knowledge of the resource were interviewed.

Wheeler Reservoir provides many public and private uses for the people of north Alabama and for overall regional economic growth and development. Operated primarily for flood control, navigation, and power generation, Wheeler Reservoir also supports other uses including shoreline development, water supply, recreation, aquatic and wildlife habitats, and sport fisheries.

Several conditions limit uses of Wheeler Reservoir. Colonization of the reservoir with aquatic plants affects industrial water supply, boating, shoreline use, aesthetic quality of the environment, and power production. The associated mosquito populations are also a nuisance. Contamination of fish from Wheeler Reservoir with the pesticide DDT has affected the commercial fishery and may detract from the sport fishing experience for some users. Concentrations of fecal coliform bacteria and the presence of wastewater discharges make some areas of the reservoir unsuitable for swimming and other water contact recreation. In addition, the oxygen demand of discharged wastewaters sometimes lowers the dissolved oxygen concentration of the reservoir to below desirable levels. In turn, the naturally high water temperature of the reservoir during the summer constrains industrial discharges of cooling water.

The sauger population of Wheeler Reservoir has declined significantly in recent years, possibly because of the impact of several years of drought conditions. Large populations of mussels once present in the reservoir have been largely depleted by commercial harvesting.

Several agencies have a part in improving and protecting the beneficial uses of Wheeler Reservoir including TVA, the Alabama Department of Environmental Management, and the Alabama Department of Conservation and Natural Resources. These agencies investigate and monitor the reservoir and attempt to mitigate those conditions impairing its uses.

PURPOSES AND OPERATION OF WHEELER DAM AND RESERVOIR

Wheeler Reservoir was formed on the Tennessee River in north Alabama with the closing of TVA's Wheeler Dam in 1936. In accordance with the purposes established by the TVA Act, TVA operates the dam for navigation, flood control, and, to the extent consistent with these primary purposes, for power production.

Normal operation for flood control involves starting reservoir filling by March 15 to reach full pool (elevation 556 feet above mean sea level (msl) by April 15, and starting drawdown July 1 to reach normal winter operating range (elevation 550-552 feet msl) by late fall. To provide a navigable channel depth of at least eleven feet, the winter pool elevation is kept at el. 550 or above, unless sufficient releases are being made from Guntersville Dam to provide minimum depth in the upper reaches of Wheeler Reservoir.

Annual Operating Curve of Wheeler Reservoir

After navigation and flood control constraints are met, Wheeler Dam is operated to meet power system demands as economically as possible. Because hydropower generation is the most economical, versatile, and dependable power source in the TVA system, it is used to provide peaking power quickly for those times of day when power demands are highest. Hydropower generation is also scheduled for high demand times of the week (generally during the 5-day workweek) and high demand times of the year (June through August and December through February), depending on the availability of water from upstream regulation.

When consistent with the three primary purposes of flood control, navigation, and power production, water levels in Wheeler Reservoir are regulated to benefit other uses. In recent years, full pool has been maintained through July for two of every three years to provide enhanced levels consistent with reservoir maintenance activities including rebrushing. Every third year, drawdown is begun earlier to allow for mowing of shoreline vegetation to assist in mosquito control. Between mid-May and mid-September, water levels are fluctuated for mosquito control by raising and lowering pool elevation about one foot on a weekly cycle.

DESCRIPTION OF WATERSHED AND RESERVOIR AREA

Watershed Characteristics

Wheeler Reservoir receives drainage from a total of 29,590 square miles; only 5,140 square miles of that total is downstream of Guntersville Dam. The largest tributary to Wheeler Reservoir, the Elk River, has a total drainage area of 2,249 square miles. The next largest tributaries are Flint River, Paint Rock River, and Flint Creek, with drainage areas of 568, 458, and 455 square miles, respectively.

The watershed is primarily mixed hardwood forests and farms, many on prime farmland. The floodplain zones of Wheeler Reservoir also support many areas of bottomland hardwood forest that provide important wildlife habitat. This habitat is especially important because such wetlands are rapidly being lost to clearing for agriculture.

Cotton and soybeans are the most important crops in the area, and some of the subwatersheds draining to Wheeler Reservoir are the most intensively row-cropped land in the state. Cropland erosion rates in the counties bordering Wheeler Reservoir range from 11 to 30 percent above the state average, and about 40 percent of the cropland in the area is eroding at a rate greater than twice the soil loss tolerance (the maximum rate of erosion that will permit high level production economically and indefinitely). Because of these high erosion rates and the extensive use of pesticides and fertilizer on intensively row-cropped lands, the Tennessee River watershed has been identified by several sources as especially prone to water quality degradation from agricultural nonpoint sources. Several tributaries to Wheeler Reservoir are known to be affected by cropland erosion, including Piney Creek, Limestone Creek, Flint River, Beaverdam Creek, Round Island Creek, Swan Creek, Flat Creek, and Paint Rock River (Cox 1990).

Several counties bordering Wheeler Reservoir rank in the top ten counties in Alabama in production of dairy and beef cattle, hogs and pigs, broiler chickens, and eggs. Several tributaries to the reservoir

have been identified as affected by runoff of animal waste, including Piney Creek, Limestone Creek, Flint River, Round Island Creek, Flint Creek, and Flat Creek.

Over one-half million people live in the counties surrounding Wheeler Reservoir. The most populated area, Huntsville/Madison County, is expected to grow from 242,700 to 275,000 by 1995. The Decatur/Morgan County area is the second most populated with 98,000 residents and an expected growth to 99,000 by 1995. The remaining five counties adjoining the reservoir have a total population of 170,000.

Shoreline Characteristics

There are 1,063 miles of shoreline around Wheeler Reservoir. Of 115 miles of privately owned shoreline, 43 miles are developed. The upstream third of Wheeler Reservoir shoreline is mostly composed of tracts sold by TVA that have remained undeveloped and narrow strips of undeveloped TVA property. Developments in the area include the U. S. Army's Redstone Arsenal and Huntsville's marina and public use area. Huntsville is about 10 miles north of the river near Tennessee River mile (TRM) 333. The Redstone Arsenal complex occupies most of the north bank from TRM 332 downstream to about TRM 321. Decatur and its large waterfront industrial complex stretch along the south bank from about TRM 309 to TRM 298, and TVA's Browns Ferry Nuclear Plant (BFN) is located on the north bank at TRM 294.0. Wheeler National Wildlife Refuge, a 34,000-acre wintering ground for migratory waterfowl, occupies both sides of roughly the middle third of Wheeler Reservoir east of Decatur (from TRM 305 to TRM 324). The westernmost edge of the refuge is within the city limits of Decatur, and its easternmost edge borders the city limits of Huntsville. Two state wildlife management areas are also located near Decatur. Private residential development has occurred along the lower portion of the reservoir and in the Elk River area. Joe Wheeler State Park (1939 acres) is located at both ends of the dam. The remaining downstream reservoir shoreline has either been sold or is retained by TVA in forestry or agricultural production.

RESERVOIR CHARACTERISTICS AND USES

Physical Characteristics

Of the nine mainstem Tennessee River reservoirs, Wheeler Reservoir ranks third in area and fourth in volume. The main channel of Wheeler Reservoir varies from 20 to 50 feet deep. Throughout much of the length of the reservoir, the main channel is bound by shallow overbank areas (floodplain inundated when the reservoir was impounded); consequently, about half of the reservoir area is less than 15 feet deep. Additional physical features of Wheeler Reservoir are summarized below.

<u>Feature</u>	<u>Measurement</u>
Location of dam, Tennessee River mile	274.9
Location of reservoir Tennessee River mile	274.9 to 349.0
Reservoir length, miles	74.1
Shoreline length, miles at normal maximum pool	1,063
Surface elevation, feet above mean sea level	
Normal maximum pool	556.0
Normal minimum pool	550.0
Surface area, acres	
Normal maximum pool	67,070
Normal minimum pool	45,450
Volume, acre-feet	
Normal maximum pool	1,050,000
Normal minimum pool	720,000
Mean depth, feet	15.8

Hydrologic Characteristics

Average monthly discharges from Wheeler Dam vary from a high of 78,000 ft³/sec in March to a low of 32,400 ft³/sec in September, with an estimated annual average flow of 49,500 ft³/sec. On average, the entire volume of Wheeler Reservoir is renewed every nine days. On annual average, 83 percent of the total inflow of Wheeler Reservoir originates from discharges from Guntersville Dam and 17 percent originates from local tributaries (primarily the Elk River). Guntersville's average

contribution to the total inflow to Wheeler varies seasonally from a low of 74 percent in March to a high of 90 percent in September.

Uses of Wheeler Reservoir

The Alabama Department of Environmental Management (ADEM) has assigned use classifications to Wheeler Reservoir and its tributaries that determine the water quality criteria that applied when making management decisions such as issuing permits for the discharge of wastewater.

ADEM classifies the Tennessee River for use as a public water supply from Wheeler Dam to the Elk River, from U.S. Highway 31 to Flint Creek, and from Cotaco Creek to the Flint River. Except for the immediate vicinity of the discharge from Decatur's sewage treatment plant and the reach from Indian Creek to Flint River, the Tennessee River from Wheeler Dam to Guntersville Dam is classified as suitable for swimming and other whole body water-contact sports. The entire reservoir and most of its tributaries are classified as suitable for fish and wildlife.

In accordance with the TVA Act, TVA operates Wheeler Reservoir for the primary purposes of navigation, flood control, and hydroelectric generation. However, Wheeler Reservoir supports many secondary benefits such as shoreline development, recreation, wastewater assimilation, habitat for biological communities, and sport and commercial fishing, in addition to the uses designated by ADEM.

Navigation

Wheeler Dam has two navigation locks. Barge traffic on Wheeler Reservoir increased from 6.6 million tons in 1970 to 9.5 million tons in 1986. Important tonnage included grains and grain products, coal and coke, and chemicals. Recent increases in tonnage are partly the result of opening of the Tennessee-Tombigbee Waterway in January 1985. Further increases are predicted over the next few years because the waterway provides a direct connection between the Port of Mobile, the Tennessee River, and 16,000 miles of inland navigable waterways.

Power Production

Wheeler Dam has 11 hydropower units with a total capacity of 378 megawatts, which is 11 percent of the total hydrogenerating capacity of the TVA reservoir system.

Flood Control

Wheeler Reservoir provides 349,000 acre-feet of flood storage capacity--about three percent of the total flood storage capacity for the TVA reservoir system.

Public Water Supply

The four municipal water supply intakes located on Wheeler Reservoir are listed below. Their average daily use totals about 43 million gallons. In many cases, the municipal systems also supply potable and process water to nearby industries.

<u>Water supply</u>	<u>Intake location</u>
Decatur, Alabama	TRM 306.0
Northeast Morgan County	
Water and Fire Protection Authority	TRM 331.1
Huntsville, Alabama	TRMs 319.4 and 334.2

Industrial Water Supply

The nine industrial water supply intakes located on Wheeler Reservoir are listed below. Excluding the water used to generate hydropower at Wheeler Dam, their average daily use totals over 800 million gallons.

<u>Water supply</u>	<u>Intake location</u>
TVA--Wheeler Dam Hydro	TRM 274.9
TVA--Browns Ferry Nuclear Plant	TRM 293.6
Champion International	TRM 282.6
AMOCO Chemicals Corporation	TRM 299.5
3M Company	TRM 299.7
Monsanto Textile Company	TRM 301.9
Redstone Arsenal	TRM 330.2 and 324.2
Norton Company, Inc.	TRM 335.3
Independence Tube--proposed	(TRM 297.0)

Agricultural Water Supply

The two agricultural water supplies on Wheeler Reservoir are listed below. Their average daily use totals less than one million gallons.

<u>Water supply</u>	<u>Intake location</u>
Joe Wheeler State Park	TRM 278.5
City of Decatur--Point Mallard Park Golf Course	TRM 308.2

Wastewater Assimilation

Most treatment plants for municipal and domestic wastewater in the Wheeler Reservoir area are small facilities that discharge to tributary streams rather than directly to the reservoir. The major (more than one million gallons per day) municipal and industrial wastewater discharges into Wheeler Reservoir are listed below.

<u>Wastewater discharger</u>	<u>Discharge location(s)</u>
Huntsville	TRMs 332.1 and 333.4
Decatur	TRM 303.4
Champion International	TRM 282.3
Browns Ferry Nuclear Plant	TRM 294.0
Amoco Chemicals Corp.	TRM 299.4
Minnesota Mining and Manufacturing	TRM 301.0
American Fructose	TRM 301.4
Monsanto Company, Inc.	TRMs 301.3, 301.5, 301.8, and 302.2
Fruehauf Corporation	Betty Rye Branch Embayment
Redstone Arsenal	TRM 323.4
Norton Company	TRM 335.3

Recreation

Wheeler Reservoir receives about 3.4 million visits per year at its various developed recreation areas, making it one of the most frequently visited reservoirs in the TVA system. There are 22 sites with either boat docks or boat launch ramps, 5 sites with developed swimming areas, and 6 sites with lakeshore camping. Pleasure boating, fishing, and water skiing are popular in the summer months. Most overnight campgrounds are full during June, July, and August.

The reservoir is open to sport fishing year-round, subject to state regulations. The principal sport species harvested are crappie, largemouth and smallmouth bass, sunfish (mostly bluegill and redear), white and yellow bass, and sauger. The estimated annual sport fish harvest on Wheeler Reservoir is 188,000 pounds taken during 100,000-120,000 sport fishing trips. The value of this sport fishery to the local economy is estimated to be between \$11,500,000 and \$13,000,000 per year.

Support For Biological Communities

Wheeler Reservoir provides habitat for a variety of aquatic organisms and wildlife. Several aquatic organisms are threatened or endangered and have state or federal protected status. Four endangered mussel species are present in the reservoir (pink mucket, orange-foot pimpleback, rough pigtoe, and fanshell). A single threatened fish species, the snail darter, may occur in the Paint Rock River region of the reservoir. An amphibian (eastern hellbender) and the American alligator are the only other aquatic species of protected status known to occur in the reservoir. Peregrine falcons, listed as threatened by Alabama and endangered federally, feed primarily on waterfowl and shorebirds as they pass through Wheeler National Wildlife Refuge during migration. The endangered gray bat, which feeds over water, occurs in caves in the Wheeler Reservoir area. Also, a small population of bald eagles, federally listed as endangered, spends the winter in the area. Recent efforts to hack bald eagles and osprey in north Alabama may eventually result in reproducing populations of these species on Wheeler Reservoir.

Human Consumption of Aquatic Life and Wildlife

TVA does not have any numerical estimates on the amount of fish consumed, but Wheeler Reservoir has a popular sport fishery and a significant intrastate commercial fishery.

Commercial Fishing

Wheeler Reservoir supports an extensive commercial fishery. The estimated annual commercial harvest is 1,400,000 pounds, comprised mostly of buffalo (932,000 pounds) and catfish (468,000 pounds). Carp, gar, redhorse, drum, and paddlefish are also marketed. The total value of the annual fish harvest from Wheeler Reservoir is estimated to be \$510,000, about one-sixth of the total for all TVA reservoirs.

The mussel harvest on Wheeler Reservoir is limited. Habitat of mussels native to the Tennessee River has been altered by impoundment except in the Guntersville Dam tailwater (the portion of Wheeler Reservoir directly downstream of Guntersville Dam). Although the annual mussel harvest from Wheeler Reservoir was 4,800 tons in 1953, the harvest is now probably less than 80 tons, with an approximate value of \$80,000 to \$95,000 (depending on shell quality). Various sources have attributed the decline of the mussel fishery to high rate of exploitation, unfavorable environmental conditions, sediment effects, and industrial wastes.

Shoreline Usage

Much of the Wheeler Reservoir shoreline is used by municipalities, industries, and farms. Residential development is important along the lower end of the reservoir. The presence of Wheeler National Wildlife Refuge on either side of the middle third of Wheeler Reservoir significantly limits increased use of the shoreline for residential and commercial development. Numerous sites along the reservoir support water-oriented recreation, including marina areas with boat docks and ramps, swimming areas, lakeshore camping areas, and other public access areas (see centerfold map).

WATER QUALITY AND BIOLOGICAL CONDITIONS

Temperature and Dissolved Oxygen

Wheeler Reservoir behaves less like a lake than like a large river: the rapid movement of water through the system usually keeps the reservoir relatively well mixed from surface to bottom. Depending on flow rates and weather conditions, surface temperatures in Wheeler Reservoir are sometimes as much as 10°F warmer than temperatures at the bottom, but these periods are usually short (hours or a few days). Naturally occurring surface water temperatures during the summer sometimes exceed Alabama's water quality criterion of 86°F (maximum) established for protection of sauger populations. This can pose a problem for industries that discharge heated water; cooling towers may be required to comply with water quality criteria.

Although Wheeler Reservoir does not have consistent or strong thermal stratification to inhibit mixing, concentrations of dissolved oxygen are usually higher at the surface than deeper in the water column. Part of this dissolved oxygen gradient arises from oxygen production during photosynthesis by algae in the sunlit surface waters. Algal photosynthesis sometimes leads to supersaturation with oxygen in the surface waters. Deeper in the water column, however, where there is no sunlight to support algal photosynthesis, dissolved oxygen concentrations are decreased by decay of naturally occurring organic matter and oxygen-demanding wastes discharged by municipalities and industries. The difference between dissolved oxygen concentrations in surface water and deep water tends to be largest in embayments (where tributaries enter the main body of the reservoir). Directly over the sediments in the summer, dissolved oxygen concentrations are 1 milligram per liter (mg/l) or less both in embayments and in the main channel.

At some times during the summer and fall (when warm water temperature speeds up the rate of oxygen removal by microbial activity and limits the amount of oxygen that will dissolve in the water), oxygen diffusion from the atmosphere into the reservoir and oxygen production by algal

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photosynthesis are not rapid enough to prevent dissolved oxygen concentrations near the surface from declining to near 5 mg/l--the Alabama water quality criterion. The average 5-day biochemical oxygen demand (BOD_5), a measure of the amount of oxygen that would be used over a five-day period by bacteria degrading the organic material in the water) is about 2 mg/l.

Dissolved oxygen profile in Wheeler Reservoir forebay
(Tennessee River mile 275.1) in 1988

The turbines in Wheeler Dam withdraw water from essentially the entire depth of the forebay; therefore, the discharge consists of a

mixture of oxygenated surface water and deoxygenated deep water. The dissolved oxygen concentration in discharges from Wheeler Reservoir is usually less than 5 mg/l for about four or five weeks each summer. The minimum dissolved oxygen concentration of the reservoir discharge varies from year to year.

Water Clarity

Secchi depth (a measure of the transparency of the water) is usually less than 2 meters, and total nonfilterable solids (a measure of suspended materials in the water) averages 10 mg/l. Light penetration is temporarily reduced even further following rainfall, when tributary streams carry in a load of eroded soil and silt. These conditions are comparable to those in other TVA mainstem reservoirs. Measurements of true color in Wheeler Reservoir waters indicate levels that would be barely noticeable to a casual observer but that could require special treatment before some sensitive industrial uses, like textile production and food processing.

Chemical Characteristics

Wheeler Reservoir waters range from slightly soft to moderately hard, and they are well buffered to a typical pH of 7.5. Higher pH values (greater than 9.0) occur occasionally near the surface and are probably due to the photosynthetic activity of algae and aquatic macrophytes.

Concentrations of lead and copper in Wheeler Reservoir sometimes exceed Alabama's water quality criteria for protection of aquatic life from toxicity. However, because the available metals data are for total concentrations—including not only the dissolved portion available for uptake by aquatic organisms but also the portion adsorbed to suspended matter—values that exceed these criteria do not necessarily indicate that aquatic life is being affected. Concentrations of lead and copper in fish from Wheeler Reservoir are comparable to concentrations in fish from other TVA reservoirs and are not a concern for either public health or aquatic life.

Radiologic Characteristics

As part of the operation of Browns Ferry Nuclear Plant, TVA routinely monitors radioactivity levels in reservoir water, commercial and game fish tissue, tissue from the asiatic clam Corbicula, and bottom sediments. All radioactivity levels have been consistent with naturally occurring or "background" levels or have been too low to be of consequence.

Bacteriological Water Quality

TVA investigated bacteriological water quality at recreation areas in Wheeler Reservoir in 1986 and again in 1990. All sites in the main body of the reservoir complied with the Alabama water quality criterion (geometric mean of 10 samples must be less than 200 fecal coliform bacteria per 100 milliliters). The occasional high values (greater than 1,000 fecal coliforms per 100 ml) noted in some individual samples, especially following rainfall, indicate that the bacteriological quality of the reservoir is vulnerable to nonpoint sources of pollution such as runoff from livestock areas and failure of septic tanks along the reservoir shoreline.

Plankton

Diverse communities of both phytoplankton (microscopic algae) and zooplankton (microscopic animals) occur in Wheeler Reservoir. These floating organisms are normally transported through Wheeler Reservoir in one to two weeks. Wheeler Reservoir is typical of other mainstream reservoirs in that productivity and abundance of phytoplankton and zooplankton generally increase in pooled downstream areas where water movement is slower.

Trophic State

Eutrophication (enrichment) in the TVA mainstem reservoirs results in abundant colonization by large aquatic plants and floating algal mats along shorelines, and in abundant phytoplankton in the main body of the reservoir. The supply of the plant nutrients nitrogen and phosphorus

exceeds demand in Wheeler Reservoir. Total nitrogen concentrations are typically in the range of 0.5 to 0.6 mg/l, and total phosphorus concentrations are typically 0.03 to 0.04 mg/l. Growth of aquatic vegetation in Wheeler Reservoir is believed to be limited primarily by shallow sunlight penetration into the water, availability of suitable bottom substrate for anchorage of plant roots, fluctuations of pool elevation, and application of herbicides.

Aquatic Plants

Aquatic plant colonization in Wheeler Reservoir has fluctuated substantially over the last ten years. From 1979 to 1988, the number of acres colonized increased from 100 to 9,843. For the most part, this pattern of increase results from the fact that most of these plants are not native to the Tennessee Valley and therefore are not subject to the natural control mechanisms that limit populations of native species in TVA reservoirs. Drought conditions between 1984 and 1988 brought lower flows and increased water clarity that also markedly accelerated colonization. As of 1989, however, only 5,991 acres (a decline of 39 percent from 1988) were colonized. This decline is believed to be the result of flood conditions during the spring and summer of 1989. Presently, Wheeler Reservoir ranks second among TVA reservoirs in terms of number of acres colonized and fourth in terms of the percentage of the reservoir surface area colonized.

Most of the aquatic plant colonization is between TRMs 293 and 310, and in the Spring Creek and Flint Creek embayments. The predominant species is Eurasian watermilfoil. Colonies of hydrilla were discovered in Wheeler Reservoir in 1987 and now cover 266 acres, primarily around Decatur. The successful establishment of this aggressive and prolific plant may lead to more serious and frequent interference with reservoir uses in the future for several reasons: (1) hydrilla can colonize deeper areas than most of the other species found in the TVA system, (2) hydrilla is more difficult to control than many of the other species, and (3) hydrilla colonies tend to be very dense and can severely impede boat traffic and other recreation.

The objective of TVA's Aquatic Plant Management Program is to minimize impacts on other desirable reservoir uses. Complete eradication of aquatic plant colonization is not feasible or desirable because this vegetation is important feeding habitat for many species of migrant-wintering waterfowl and provides cover for game and forage fish. Aquatic plant management activities on Wheeler Reservoir include water level manipulation and herbicide treatment at high priority areas. Winter pool drawdown for flood control benefits aquatic plant management by exposing plant colonies to freezing and drying. Herbicides (primarily 2,4-D) are used in priority areas, generally around industrial intakes and along developed shorelines with high recreational usage.

Mosquitoes

Because the primary habitat for larval mosquito incubation is surface mats of aquatic plants, mosquito production has increased measurably over the last several years. Compared to other TVA reservoirs, Wheeler ranks about third in severity of mosquito problems. TVA has an active mosquito abatement program.

Benthic Organisms

The benthic community (bottom-dwelling organisms) in Wheeler Reservoir includes worms, mayflies, midges, snails, sponges, bryozoans, asiatic clams, mussels, and crayfish. Caddisflies and other flowing-water species are abundant in the upstream portion of the reservoir near Guntersville Dam. Historically, asiatic clams were abundant in Wheeler Reservoir, but a steady decline in clam populations has been documented during the past ten years.

Mussels

In the past, several locations on Wheeler Reservoir provided habitat for large populations of mussels that supported a fairly important commercial fishery for their shells. These populations and associated fisheries have declined, however, presumably because of overharvesting and unfavorable environmental conditions. There have been no recent

surveys of mussel resources in Wheeler Reservoir. Existing information indicates these animals occur throughout much of the length of the reservoir. In the upstream part of the reservoir (essentially from Decatur upstream to Guntersville Dam), most mussels are found in the old river channel. An almost continuous mussel bed in the Guntersville Dam tailwater (TRM 331-348.4) resembles the preimpoundment mussel fauna. Many of the mussels found in the Guntersville tailwater were present before the reservoir was filled and very few young mussels have been found in this area. Downstream from Decatur, most mussels are found on the overbanks. These mussel stocks include many young individuals and a different mix of species from those found in the old river channel upstream. The former river channel in this downstream part of the reservoir is covered with silt and is, generally, unsuitable mussel habitat.

Four mussels (pink mucket, orange-foot pimpleback, rough pigtoe, and fanshell) that occur in the reservoir are listed as endangered both federally and by Alabama (note--the fanshell was listed by the U.S. Fish and Wildlife Service in 1990; its status by Alabama is unknown). All four species occur in the river channel upstream of Decatur. The pink mucket also occurs in the downstream reaches of the Paint Rock River near Wheeler Reservoir.

Fish

The Wheeler Reservoir fish community is diverse (81 species) and dominated by warmwater species. It includes important game and commercial warmwater species and also the coolwater species sauger and walleye. Dominant prey species are gizzard and threadfin shad.

The fish community of Wheeler Reservoir is monitored annually by TVA by means of three cove rotenone surveys, which provide data on standing stock of game, rough, and forage species. Between 1969 and 1984, total standing stock averaged 20,871 fish per acre weighing 635 lbs. More recent estimates in 1985 and 1986 were 36,482 fish/acre weighing 627 lbs/acre and 11,569 fish/acre weighing 547 lbs/acre, respectively.

Approximately 96 percent by number and 64 percent by weight were forage species (primarily gizzard shad). Game species comprised 4 percent of the total number and 11 percent of the total biomass. Estimates of abundance since 1969 have been cyclic, with a generally increasing trend over the 16-year period. Maximum abundance occurred in 1982. Below is a comparison of biomass of game, rough, and forage fishes in Wheeler Reservoir with other mainstem Tennessee River reservoirs for the period 1949-1989.

Reservoir	Inclusive dates	Number of samples	Biomass (pounds per acre)			
			Game	Rough	Forage	Total
Kentucky	1949 - 1982	105	33	112	156	301
Pickwick	1949 - 1987	67	54	115	217	386
Wilson	1949 - 1983	29	53	132	149	334
Wheeler	1949 - 1989	96	110	205	361	676
Guntersville	1949 - 1988	93	68	82	141	291
Nickajack	1972 - 1981	22	91	41	88	220
Chickamauga	1949 - 1989	129	48	78	137	263
Watts Bar	1949 - 1986	73	28	115	89	232
Ft. Loudoun	1949 - 1984	33	43	79	157	279

The snail darter, listed as a threatened species both federally and by Alabama, is the only fish species of sensitive status likely to occur in Wheeler Reservoir. Snail darters have been found in the Paint Rock River. In other streams, young of this species are known to drift downstream into the Tennessee River during their first summer. Adult snail darters return to gravel shoals in tributary streams each year to spawn.

The commercial fishery in Wheeler Reservoir has been adversely affected for several years by significant levels of the pesticide DDT in fish tissues. Interstate sale of fish caught in Wheeler Reservoir is banned by the Food and Drug Administration. However, the completion of DDT clean-up activities in Huntsville Spring Branch in 1988 is expected to resolve this problem within a few years.

Important sport fishes include largemouth bass, smallmouth bass, white crappie, bluegill, redear sunfish, white bass, yellow bass, and sauger.

Also, Alabama has stocked striped bass and hybrid striped bass x white bass in Wheeler Reservoir to provide additional sport fish species.

Largemouth bass. Fishermen consider this fishery excellent on Wheeler Reservoir as evidenced by the number of bass tournaments held from early spring through late fall. Area clubs and bass anglers correlate recent improvements in the fishery with the increase of aquatic vegetation. The milfoil around Decatur has become a "hot spot" for largemouth bass fishing. Data from TVA population studies since 1982 show a minimum of 40 harvestable bass per acre. In 1988 electrofishing samples taken by TVA, catch rates of largemouth bass were more than twice the average historical catch rate, and relative weight analysis indicated that largemouth bass were heavier than expected for Tennessee River reservoirs. Analysis of the electrofishing data indicated a fair largemouth bass fishery, as 28% of the fish collected were of quality size (fish 37% or more of the maximum attainable size). However, the proportion of larger fish was small, and no trophy-sized bass were collected in 1988.

Smallmouth bass. Rocky bluffs and gravel bars abound in the lower end of Wheeler Reservoir, and the deep water and current adjacent to these areas provide prime smallmouth bass habitat. Recent TVA population studies have shown an increase in numbers of all sizes of smallmouth bass, but catch rates in electrofishing samples in 1988 were less than the historical average.

Panfish (white crappie, bluegill, redear sunfish). Results of a creel survey in 1980 indicated that white crappie was the dominant species harvested from Wheeler Reservoir in terms of number (62%) and biomass (54%). Bluegill ranked second in number. Although catch rates of bluegill were less than the historical average, they were the most abundant sunfish in TVA electrofishing collections in 1988, and 36% of those collected were quality fish. Catch rates of redear sunfish were more than twice the historical catch rate. Fishing for these species is heaviest from early spring through mid-summer, especially in the downstream half of the reservoir. Numerous tributaries, coves, and expansive overbank areas provide prime spawning and nursery areas for these species.

Sauger. In recent years, sauger populations appear to have declined significantly in several TVA reservoirs, including Wheeler Reservoir. TVA studies in Wheeler Reservoir in 1987 and 1988 did not collect any sauger; they previously had been collected every year since 1969. Recent larval fish sampling in Wheeler Reservoir also suggests a decline in the population. The cause of the sauger decline is not known but is believed to be related to the drought that began in 1985. Water temperature fluctuations, flow rates and turbidity--all factors known to influence the success of sauger spawning--were atypical throughout the system during the drought. Fishing for this species is heaviest January through March in the Gunterville Dam tailwater and around tributary mouths in the upper end of the reservoir.

White and yellow bass. Schools of white bass provide angling action spring through early fall. The yellow bass population in Wheeler Reservoir is increasing. In 1988 electrofishing catches, the species was about five times more abundant than in historical catches.

A variety of wildlife is also associated with the reservoir. Wheeler National Wildlife Refuge, the easternmost National Wildlife Refuge on the lower Mississippi Flyway, is a wintering area for about 30,000 Canada geese and 50,000 to 70,000 ducks. Before establishment of the refuge in 1958, the area wintered only 3,000 to 4,000 waterfowl; the refuge now boasts the Southeast's highest concentrations of Canada geese. Although most waterfowl that winter on Wheeler Reservoir nest far to the north, many wood ducks and some mallards and black ducks nest on the refuge each spring. Although waterfowl are the most spectacular visitors, a wide variety of other wildlife is present. Many species of shorebirds stop briefly in early fall and again in the spring. Quail and mourning doves are numerous. In all, the list of birds around Wheeler Reservoir includes 304 species.

CONDITIONS AFFECTING RESERVOIR USE

In assessing the condition of state waters for the period 1986-1987, ADEM concluded that all or parts of Wheeler Reservoir did not support the designated uses. Point and nonpoint source, toxic and nontoxic pollutants were identified as causes of impairments.

Some important causes of impairments to the uses of Wheeler Reservoir aquatic resources include the following.

<u>Condition</u>	<u>Use(s) affected</u>
Aquatic macrophyte colonization	Impairs or has the potential to impair industrial water supply, boating, shoreline usage, aesthetic quality of the environment, and power production. Associated mosquito populations are a nuisance.
Fish flesh contamination with DDT	Potential effect on human health limits interstate commerce for commercial catch and may impair the sport fishing experience for some.
Fecal coliform bacteria	Potential for adverse effect on human health may limit the use of reservoir waters in certain areas for swimming and other whole body contact sports.
Drought	May have contributed to the recent continuous decline of sauger population.
Low flows with high organic waste loading rates	Intermittently results in lowered ambient dissolved oxygen, which potentially impairs wastewater assimilation capacity of the reservoir.
High ambient water temperature	May impair use of reservoir for cooling water supply.
Commercial overharvesting of mussel stocks	Has depleted the large populations of mussels once present in the reservoir.

SELECTED RESERVOIR MANAGEMENT AGENCIES

Several agencies have a part in improving and protecting the health and integrity of Wheeler Reservoir. These agencies investigate and monitor the reservoir and attempt to mitigate those conditions impairing its uses. A number of those agencies are listed below.

The Alabama Department of Environmental Management is the primary environmental regulatory agency in Alabama. It determines water use classifications, criteria, and standards and issues permits for wastewater discharges.

Alabama Department of Environmental Management
1751 Federal Drive
Montgomery, Alabama 36140
Phone: 205/271-7700

The Tennessee Valley Authority Water Resources Division manages the daily operations of Wheeler Reservoir, conducts water quality and aquatic resource monitoring and assessment programs, and develops plans for the protection and enhancement of water resources. The Land Resources Division manages TVA lands and recreation sites along the reservoir and develops reservoir land management plans.

Tennessee Valley Authority
Water Resources Division
Evans Building
Room 1W 141A
Knoxville, Tennessee 37902-1499
Phone: 615/632-6770

Tennessee Valley Authority
Land Resources Division
170 Office Service Annex
Muscle Shoals, Alabama 35660
Phone: 205/386-2221

The Alabama Department of Conservation and Natural Resources is the fisheries management agency for Alabama. It is responsible for fish and game regulations and fish stocking.

Alabama Department of Conservation
and Natural Resources
Folsom Administration Building
64 North Union Street
Montgomery, Alabama 36130
Phone: 205/242-3471

The U.S. Department of Agriculture is responsible for soil conservation activities on farms. Various district conservationists located in county offices have responsibility for the Wheeler Reservoir area.

The U.S. Environmental Protection Agency is responsible for the implementation of the Clean Water Act and oversees federally mandated programs managed by the states. The Region IV office in Atlanta, Georgia, is responsible for the Wheeler Reservoir area and all of the southeastern United States.

U.S. Environmental Protection Agency
345 Courtland Street, NE
Atlanta, Georgia 30365
Phone: 404/347-5242

The U.S. Fish and Wildlife Service is responsible for ensuring the protection of fish and wildlife and their habitats during federally sponsored or permitted development activities and has responsibility for the identification of threatened and endangered species.

U.S. Fish and Wildlife Service
Aronor Building, Room 819
474 South Court Street
Montgomery, Alabama 36104-4186
Phone: 205/223-7228

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Your comments and suggestions are important to us! They help us better meet the information needs of reservoir users. Comments, suggestions, and requests for additional copies of this report should be directed to:

Larry R. Clark
Water Quality Department
Tennessee Valley Authority
Haney Building, Room 2S 270C
311 Broad Street
Chattanooga, Tennessee 37402-2801
Phone: (615) 751-7331

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