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ABSTRACT

Data on population size, reproduction, and factors affecting survival were collected on the endangered Hawaiian monk seal, *Monachus schauinslandi*, on Laysan Island, Northwestern Hawaiian Islands, 23 April to 21 July 1983. Beach counts excluding weaned and nursing pups ranged from 65 to 98 seals ($\bar{x} = 81.8$); including pups, the range was 73 to 113 ($\bar{x} = 95.2$). Of an unknown total of seals hauling out on Laysan Island, 244 individuals were identified. Adult males outnumbered adult females by more than 2:1 in the identified sample. At least 24 pups were born. Average nursing period ($N = 4$) was 39.3 days. Twenty weaned pups and three adult males were tagged. Five seals died, 1 disappeared, and 12 injuries were observed. One hundred thirteen scats, 16 spews, and samples from 5 seal necropsies were collected. Four pieces of net and rope flotsam capable of entangling seals were sampled prior to being burned. This paper also describes a "mobbing" on land by adult males, resulting in the death of a subadult female; the haul out of seals on the south ledge, where they have not been reported before; and the transport of a juvenile male to Honolulu to initiate a captive research program.

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INTRODUCTION

Laysan Island (lat. 25°42'N, long. 171°44'W), a low, coral-sand island in the Northwestern Hawaiian Islands (Fig. 1), is a major haul-out and pupping site for the endangered Hawaiian monk seal, *Monachus schauinslandi*. Intensive studies on the Hawaiian monk seal have been conducted yearly at Laysan Island since 1977 (Johnson and Johnson 1978, 1981a, 1981b; Alcorn 1984; Johanos and Kam 1986; Johanos and Austin 1988; Johanos et al. 1987; Becker et al.[1]; Knudtson[2]). This ongoing research is authorized under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, with the intent of monitoring and aiding in the recovery of the species. Our report describes the findings of the 1983 seal study at Laysan Island.

The primary objectives of the 1983 study were to identify all individuals and determine the total number in the Laysan Island population, tag weaned pups, monitor injuries and mortalities and identify the factors causing them, and collect scats, spews, necropsy samples, as well as marine debris capable of entangling seals.

MATERIALS AND METHODS

A two-person field camp was established on Laysan Island, 23 April to 21 July 1983, by the Southwest Fisheries Center Honolulu Laboratory, National Marine Fisheries Service (NMFS). The two observers were the sole occupants of the island except during the first week when additional NMFS personnel helped establish camp and assisted with research (Appendix A).

Camp was established on the west side of the island by the ironwood tree, *Casuarina litorea*, in sector 1 (Fig. 2). All research was conducted from land. The entire perimeter of the island (about 11.3 km (7 mi)) was usually traversed every other day, whereas pupping areas near camp were visited daily. The perimeter was divided into the same 20 numbered sectors as used in 1982 (Fig. 2). To facilitate data collection and processing, preprinted forms were used for identification, tagging, censusing, and scat and spew collection (Appendix B). Identical forms were used by other NMFS personnel conducting monk seal research on French Frigate Shoals, Necker Island, Lisianski Island, Pearl and Hermes Reef, and Kure Atoll in 1983. Data collection was standardized as much as possible to allow comparisons between islands and years.

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[1]Becker, B. L., R. G. Morrow, and J. K. Leialoha. Census data and interatoll movement of the Hawaiian monk seal on Laysan Island, 1985. Manuscr. in prep. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, 2570 Dole St., Honolulu, HI 96822-2396.

[2]Knudtson, E. P. 1981. Hawaiian monk seal observations at Laysan Island, March-July 1981. Unpubl. manuscr.Southwest Fish. Cent. Honolulu Lab., Natl. Marine Fisheries Service, NOAA, 2570 Dole St., Honolulu, HI 96822-2396, 23 p.

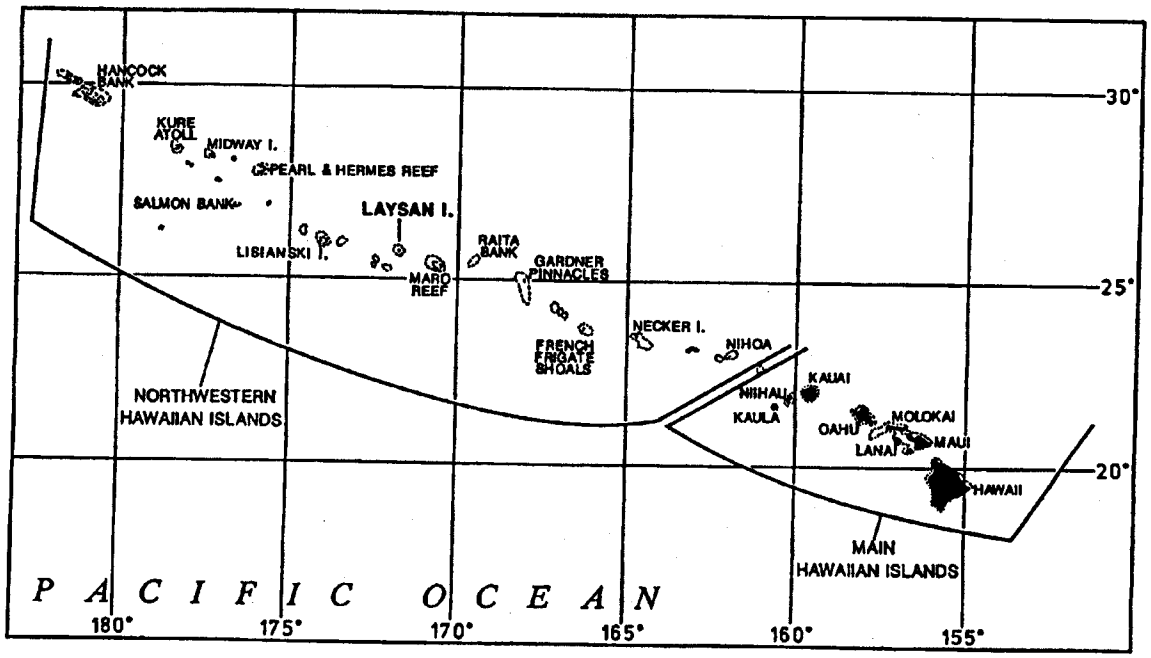

Figure 1.--Location of Laysan Island, Northwestern Hawaiian Islands.

Identifying Individuals

Bleach Marking

Seals were not marked at Laysan Island in 1982, so the 1983 research season started with an unmarked population. An attempt was made to bleach mark (numbers, letters, or both) all seals except the following: mothers and suckling pups, seals with serious, fresh injuries, and pregnant females who appeared close to parturition (see Johanos and Kam (1986) for information on bleaching methods). A seal was not considered marked until a resighting showed the bleach mark was readable. Temporary marks lasting 2-3 weeks were applied with blue Woolite[3] paint from a squeeze bottle and were used mainly on molting seals. Sketches of the bleach marks, scars, and natural markings were recorded on preprinted cards (Appendix B1). Scars and natural markings were photographed, the film was processed in Honolulu after the field season, and the photographs were added to the Laysan photo ID files started in 1982.

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[3]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

Seals with distinctive scars, natural markings, and postmolt bleach numbers, which would make them identifiable in 1984, were assigned a permanent ID number if they had not already been assigned one in 1982. The ID numbers presented here are comparable with the 1982 Laysan report (Alcorn 1984) except where otherwise noted. An island code system has been implemented; therefore, a *T* prefix appears on all permanent ID numbers assigned on Laysan Island after 1982, and temporary bleach numbers, valid only within the 1983 season, are preceded by the word "bleach."

Tagging

Weaned pups were bleach marked and tagged with tan Temple Tags as soon as possible after weaning was verified. Verification of weaning was based on absence of the mother and the observers' familiarity with the habits of the mother and pup; it was not based on a predetermined nursing time span. Whether tagging or bleaching was done first depended on the circumstances. Tagging required two persons and usually was not done on a rough coral substrate, whereas bleaching required only one person and could be done anywhere as long as the pup was dry and asleep. The pup tagging procedure is described in Gilmartin et al. (1986). Pups were monitored from a distance for 10-15 minutes following tagging. Tagging information was recorded on a preprinted form (Appendix B2). Pups were checked throughout the field season to ascertain whether all tags were still present.

Adult males designated as "destructively" aggressive (see Male Aggression) were tagged with a single metal Monel tag on a hind flipper. They were not restrained but were quietly approached while asleep, and tagging pliers were used to quickly clip a tag onto a hind flipper. Actual placement of the tag depended upon which hind flipper and portion of the web was exposed.

Censuses and Patrols

Beach counts were made every 4 days, with few exceptions. Counts commenced between 1200 and 1230 Hawaii standard time and usually took 3.0 to 3.5 hours. This allowed sufficient time to record a variety of data (Appendix B3), taking advantage of the fact many seals were identifiable by bleach marks. Two persons censused, starting in opposite directions from the camp in sector 1 and usually meeting in sector 8 or 9; observers alternated the direction taken in the previous census. Seals in the water (more than 50% of the body submerged) or on offshore reefs were recorded but not tallied in census totals. This differs from 1982 when a small number of seals seen in the water, i.e., adult females accompanying nursing age pups, were included in the totals. Offshore rocks were scanned with binoculars, and when possible, the observer waded or swam to the offshore rocks in sectors 11, 12, and 14 to identify seals. During May and June, seal areas were not visited for 2 hours prior to censusing, and tagging and bleaching were not done until after the census. By July, low sightings of unmarked seals indicated the majority of the seals had been bleached; therefore, a few seals were bleached during censusing if it appeared practicable without affecting the census.

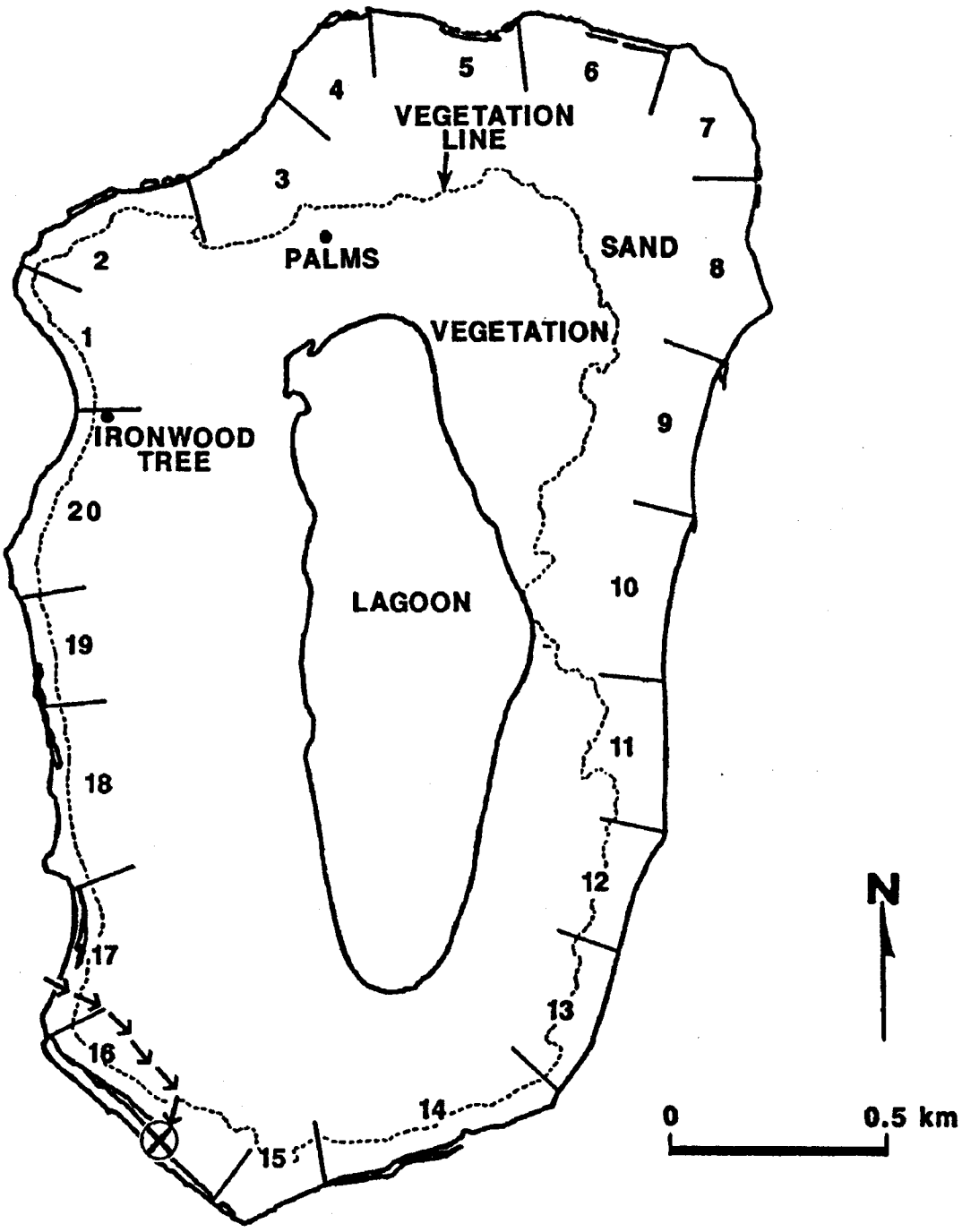

Figure 2.--Map of Laysan Island, 1983, showing 20 sectors. The X indicates the unusual haul-out site of two Hawaiian monk seals, and the arrows indicate their route to the site (for details, see Incidental Observations in text).

Patrols (untimed walks along all or a portion of the island perimeter) were conducted in addition to censuses. The frequency of patrols was such that, in conjunction with the censuses, the entire island perimeter was usually traversed at least once every 2 days. Emphasis was on resighting and photographing identified individuals, bleach marking individuals, and monitoring injuries, mortalities, births, and weanings. Direction and duration of the patrols varied, as did the number of persons (one or two) conducting them.

Monitoring Reproduction

Sector location of birth, date the pup was first seen, identity of mother, and sex of pup were recorded when first observed. The northwest (sectors 1-2) and western areas (sectors 19-20), where the majority of pupping occurred in 1982 (Alcorn 1984), were visited daily with few exceptions.

Monitoring Survival

Deaths, injuries, and incidents contributing to them were recorded. Emphasis was on monitoring aggressive behavior of adult male seals and shark interactions with seals. A list was maintained of aggressive interactions between adult males and other seals. Criteria for recording were subjective, but included males biting other seals (whether or not obvious injury resulted), large numbers of males collectively attacking or harassing other seals, and repetitive acts of aggression against weaned pups. Observed interactions between seals and sharks were recorded, and a log of shark sightings was maintained. Time-sample studies were not directed towards shark observations; data were obtained during the course of other research activities. Shark species identification was based on size (total length), coloration, and fin shape.

Collecting Samples

Necropsy

Seal carcasses were examined for external injuries, abnormalities, and identifying marks. Photographs were taken when possible. If death appeared recent, a blood sample was taken from the extradural intervertebral venous sinus. A syringe needle was inserted into the dorsal surface, above the posterior end of the foreflippers. The vertebral column was located by touch and, for seals with extensive fat, by making an incision through the fat. In some instances, blood was also taken from the heart after the body had been opened. Hematocrit determinations were made in the field, and serum was frozen for later testing. Results will be presented elsewhere. Major organs were weighed. Endoparasites and small samples of organs were preserved in 10% formalin. Contents of the digestive tract were sieved through three different mesh sizes, 2.80, 1.18, and 0.71 mm. Prey item parts (lenses, scales, bones, otoliths, and other) recovered from the digestive tract were preserved in 70% alcohol when it was available; otherwise, they were stored in dry vials. Fresh prey flesh in the stomach was frozen for later ciguatoxin analysis. Skulls were flensed and secured with stakes to dry in the sun before they were shipped to Honolulu.

Scats and Spews

Scats and spews were collected in Whirl-Pak bags and usually processed within 2 days of collection, but always processed within a week. Processing and preservation were done as described above for necropsy stomach and intestine contents. Identification of parasites, fish, crustacean, and cephalopod parts is ongoing at the Honolulu Laboratory. Emphasis was placed on collecting scats and spews from seals of known size, sex, or both. Data were recorded on preprinted cards (Appendix B4).

Entanglement Debris

A record and samples were kept of fishing net or rope flotsam that washed ashore during the study period (April-July 1983) and appeared capable of entangling seals. Type of data collected is presented in Alcorn (1984). Incidents of seals resting within 2 m of such flotsam were recorded on census forms (cf. Appendix B3).

RESULTS AND DISCUSSION

Beach Counts

Twenty-four censuses were conducted from 24 April to 21 July 1983 (Appendix C). The average 1983 count (excluding pups) of 81.8 seals was down from the 1982 average of 90. The decrease is partly because seals in the water were not included in census totals in 1983, whereas mothers and pups in the water were included in 1982. Also, the highest field season counts in 1982 occurred at the end of March to the first part of April, a period not covered in 1983.

Population Size and Composition

A total of 244 individual seals were identified (Table 1); a record of individual sightings by date is presented in Appendix D. The total number of seals using Laysan Island in 1983 is unknown but is >244, given that unidentified seals, mostly adult males, continued to arrive onshore (at the rate of about 1 seal per week) at the end of the study. Forty-six adult females were identified. This likely is the total number of adult females using Laysan Island in 1983, given the emphasis on identifying this group and that many were known from 1982 by scars. All adult females seen on Laysan Island during the last few weeks of the 1983 season were known individuals.

Interisland Movement

During the 3-month study, two seals originally identified at French Frigate Shoals were seen at Laysan Island in 1983 (Table 2). Two seals bleached at Laysan Island in 1983 were seen by observers at Lisianski Island, and three seals marked at Lisianski Island postmolt in 1982 were seen at Laysan Island (Table 2). Adult female T25F exhibited the same movement pattern as in 1982 (Alcorn 1984): She pupped on Laysan Island and molted on Lisianski Island.

Table 1.--Number of Hawaiian monk seals, by size and sex, identified on Laysan Island, 1983. (Note: The 244 identified individuals were of an unknown total number of seals at Laysan Island.)

Size	Male	Female	Total
Adults	96	46	142
Subadults	20	25	45
Juveniles	17	16	33
Pups	11	13	24
Total	144	100	

Reproduction

Pups Born and Tagged

The known number of pups born at Laysan Island in 1983 was 24 (11 males and 13 females) (Table 3). At least 15 pups were born prior to the 1983 field season, and 9 more pups were born before the field season ended. Pup production was down from the 29 known births in the same time period in 1982 (Alcorn 1984) and was the lowest on record for Laysan Island since yearly seal studies began in 1977. Since the majority of pups were born prior to our observations, it is unknown whether the low number of pups in 1983 reflects fewer births, higher pup mortality, or both. Pupping areas were traversed thoroughly, and carcasses were not found. One perinatal female pup appeared deformed and died on 14 June shortly after birth; details are given in the section on deaths.

Nineteen of 20 pups that weaned prior to or during the field season were tagged (Table 3), and all 20 were bleach marked. One pup (TA40) began suckling on a foster mother before the pup could be tagged, so it was tagged later in 1983 by other researchers. Only one newly tagged pup (TA16) is known to have lost a tag during the field season. Its left hind flipper was torn where the tag appeared to have been; a new tag was applied in a different location on the same flipper.

Parturient Females

Fifteen parturient females were individually identified. Twelve of these females had pupped in 1982 (Alcorn 1984). Pupping dates and sites are known for seven females for both 1982 (Alcorn 1984) and 1983, and in all instances, pupping occurred later in the season in 1983 than in 1982. Six of the seven females exhibited pupping site fidelity, pupping in

Table 2.--Observations of interisland movement to and from Laysan Island by Hawaiian monk seals in 1983.

ID No.	Bleach No.	Size[a]	Sex[b]	Movement from: Location	Movement from: Date last seen	Movement to: Location	Movement to: Date last seen	Comments
GJ02	J02	S	F	Lisianski	11/2/82	Laysan	4/23/83	Molted and rebleached on Laysan.
Y156	P43	A	F	French Frigate Shoals (FFS)	5/16/82	Laysan	5/19/83	Molted on Laysan 1983.
T27F	383	A	F	FFS[c]	1967	Laysan	5/9/83	Molted on Laysan 1983; given tag No. A5 as a yearling in 1967.
GS33	S33	S	M	Lisianski Laysan	10/31/82 7/6/83	Laysan FFS	5/20/83 10/30/83	Molted on Laysan 1983.
T25F	165	A	F	Lisianski[d] Laysan	5/12/83 7/3/83	Laysan Lisianski[d]	5/22/83 7/18/83	Pupped on Laysan on 23 or 24 May 1983. Departed Laysan on day pup weaned. Molted on Lisianski.
T57F	P82	A	F	Laysan	5/12/83	Lisianski[d]	5/30/83	Molted on Lisianski.
TP77	Y63	A	M	Laysan	6/6/83	Lisianski[d]	6/14/83	

[a]A = adult; S = subadult.

[b]F = female; M = male.

[c]Southwest Fisheries Center Honolulu Laboratory (unpubl. data).

[d]Lisianski data from Johanos and Kam (1986).

Table 3.--Summary of Hawaiian monk seal pups born at Laysan Island, 1983.

Pup ID	Tag No.[a] Left	Right	Sex[b]	Date tagged	Measurement (cm)[c] AG	SL	Birth date	Birth sector	Date weaned	Mother ID
TA02	A02	A01	F	4/23	--	--	--	--	<4/23	--
TA04	A04	A03	F	4/23	--	--	--	--	<4/23	--
TA06	A06	A05	M	4/23	--	--	--	--	<4/23	--
TA07	A07	A08	F	4/24	--	--	--	--	<4/23	--
TA10	A10	A09	M	4/24	--	--	--	--	<4/23	--
TA12	A12	A11	M	4/25	--	--	--	--	<4/23	--
TA13	A13	A14	M	4/28	--	--	--	--	<4/23	--
TA16	A37[d]	A15	M	4/29	--	--	--	--	<4/23	--
TA18	A18	A17	M	5/2	--	--	--	--	<4/23	--
TA19	A19	A20	F	5/2	102.0	125.0	--	--	5/1	T45F
TA22	A22	A21	F	5/4	103.3	120.0	--	--	5/3	T12F[e]
TA23	A23	A24	M	5/10	111.0	135.0	--	--	5/10	T03F[e]
TA26	A26	A25	F	5/12	93.0	126.0	--	--	5/11-12	T04F[e]
TA28	A28	A27	F	5/13	(100-105)	118.0	--	--	5/11-12	T41F[f]
TA30	A30	A29	F	5/15	116.0	128.0	--	--	5/13-15	T11F[e]
TA32	A32	A31	F	6/8	113.0	128.0	4/24-26	11	6/6	T14F[e]
TA34	A34	A33	M	8/6-7	(120)	125.0	4/29	11	6/6-7	T36F[f]
TA36	A36	A35	M	8/17	105.5	122.0	4/27	02	6/1-2	T18F[e]
TA39	A39	A38	M	7/5	94.5	136.5	5/23-24	02	7/3-4	T25F[e]
TA40	A51	A40[g]	F	>7/21	--	--	4/29	20	6/9-10	T16F[e]
									7/20	T24F[h]
--	--	--	F	--	--	--	6/14	19	Died	T24F[e]
--	--	--	F	--	--	--	6/22	20	--	T32F[e]
--	--	--	M	--	--	--	6/28	19	--	T39F[e]
--	--	--	F	--	--	--	6/30-7/1	02	--	T34F[e]

[a]L = left; R = right.

[b]M = male; F = female.

[c]AG = axillary girth; SL = standard length. Parentheses indicate measurement is an estimate because pup was moving.

[d]Pup lost A16 tag, and it was replaced with A37 (during the 1983 field season).

[e]Known to have pupped in both 1982 and 1983. The 1982 data are from Appendix C in Alcorn (1984); seal 04F does not appear in the 1982 summary because she was assigned an ID No. later based on photographs; however, her pup is listed in that summary as No. 2.

[f]ID No. 41F = 48F; 36F = 49F.

[g]Tags were applied after the 1983 field season by other researchers of the National Marine Fisheries Service and the U.S. Fish and Wildlife Service.

[h]Foster mother. Nursing by this mother began on 14 June.

the same sector in both years; most pupped at the exact site where they had pupped in 1982. (See Johanos and Austin (1988) for a summary table of individual female pupping histories, Laysan Island, 1982-85.)

Nursing Duration

Only five pups were observed from birth to weaning. Nursing period ranged from 36 to 78 days ($\bar{x}$ = 47). One pup (TA40) nursing for 78 days constituted an unusual event in that it suckled 41 days on its natural mother, was weaned for 4 days, and resumed suckling on a foster mother for 37 days (Table 3). A similar event occurred on Laysan Island in 1982 (Alcorn and Henderson 1984). If pup TA40 is excluded, the average nursing period (N = 4 pups) in 1983 is 39.3 days. This is similar to the average of 39.4 days (N = 16 pups) reported on Laysan Island in 1982 (Alcorn 1984). Nursing duration is unknown for most pups, but all pups weaned during the field season appeared average to large in girth. Three pups were still suckling when observations ended; the youngest pup at that time was 20 days old, and it along with the other two pups appeared to exhibit normal growth and suckling behavior.

General Observations

The placenta remained attached to one pup (TA39) for an unusually long period of time, 29.5-34.5 hours, following birth. During that time, the mother (T25F) and pup made at least two round trips from the vegetation to the edge of the water, an estimated distance of about 24 m each way. The pup's movements were hindered by the weight of the placenta and, at times, when the mother rested on the placenta. The pup did not appear to suffer any immediate ill effects, and it appeared healthy but not extremely fat (Table 3) when weaned after suckling 40-42 days.

Pups being exchanged between lactating females were not observed at Laysan Island in 1983. This is not surprising given that pup numbers were low and only five pups were observed from birth to weaning.

Deaths, Injuries, and Factors Affecting Survival

Deaths

Deaths of five monk seals at Laysan Island were recorded in 1983 (Table 4). One of the seals was found dead when the field camp was established, and four seals were found dead during the field season. Five necropsies were performed (Appendix E). In addition, death was probably the reason for the disappearance of the injured adult female (T41F, Case 1 in Injuries). A brief description of each known death is presented below:

Table 4.--Hawaiian monk seal deaths recorded at Laysan Island in 1983.

No.	Date found	Size[a]	Sex[b]	Bleach No.	Cause of death
01NECLA83	14 May	S	F	P73	Adult males.
02NECLA83	11 June	A	F	Y85	Unknown.
03NECLA83	14 June	N	F		Deformed at birth.
04NECLA83[c]	23 April	A	U		Unknown.
05NECLA83	8 July	A	F	Y14	Unknown. Teeth worn, appeared old. Two shallow dorsal punctures possibly male inflicted.

[a]A = adult, S = subadult, and N = nursing pup.
[b]F = female; U = unknown.
[c]This seal appeared to have been dead for more than 1 month when found.

Case 1. A large subadult female (bleach P73, necropsy No. 01NECLA83) was "mobbed" by adult males on 12 May (see Case 1 under Adult Aggression). A mobbing is defined as adult male monk seals collectively performing acts of aggression towards an individual seal and inflicting obvious injury. Eight (dorsolateral) puncture wounds and numerous scratches were inflicted, but none seemed serious enough to cause death. She remained on the beach above the mobbing site where she was found dead on 14 May. Weather conditions between the time of mobbing and death were sunny skies and air temperatures of >30°C in the shade.

Case 2. An adult female (necropsy No. 02NECLA83), bleach marked Y85 on 11 May, was not resighted until 11 June when she was found dead near the water and was being mounted by an adult male. The female was very large, had worn teeth, and was probably old.

Case 3. A newborn female pup (necropsy No. 03NECLA83), born during the night of 13 June or on the morning of 14 June, died on 14 June. The pup was first seen at 1135 on 14 June, thrashing about at the vegetation line. The apparent mother (T24F) was alone at the edge of the water approximately 33 m away. The pup's eyes were bulging outward, and it had difficulty breathing and moving. The placenta was still attached to the pup. After a series of convulsions, the pup died at 1248. The necropsy showed that the skull was deformed. Low wartlike growths covered 20 to 25% of the body's surface. The apparent mother subsequently adopted a weaned pup (TA40, see Reproduction).

Case 4. A dead adult seal (necropsy No. 04NECLA83) was found when research commenced on 23 April. The body was badly decomposed and partly mummified.

Case 5. A large adult female (necropsy No. 05NECLA83) was bleach marked Y14 on 23 April and resighted each month until she was found dead on 8 July. She was seen in sector 17 on 7 July, an area predominately visited by adult males. At that time, she was alert, had two small dorsal puncture wounds, and was attended by an adult male (bleach Y18). She was found dead the next day at the same site and was attended by an unidentified adult male.

Injuries

Numerous injuries occurred (Table 5). Omitted from the table are minor injuries, such as those inflicted on adult males during fighting (e.g., small tears in flippers, bloody noses, and lips). The two most serious injuries seen are described below. With the exception of the adult female, all injured seals were either stable or healing when last seen.

Case 1. An adult female (T41F) was observed with two open back wounds at 0600 on 17 June. Additionally, over half her dorsal surface had a dark, rippled appearance. She was seen in sector 1, an estimated 400 m north of the area in sector 20 where adult males were "mobbing" the night before (see Case 2 under Adult Aggression). She remained in the general area (sectors 1 and 2) for 3 days, disappeared, then reappeared (in sector 8) on 23 June. She was there daily on 23-26 June (Fig. 3b), then disappeared.

Between 17 June and her last sighting on 26 June, the dorsal wounds enlarged to cover over 60% of her dorsal surface. The wounds did not appear to be deep and extended mainly into the fat layer. She was attended by one or more different males. She was neither emaciated nor bleeding when last seen, but because of the massive nature of the injuries, she may have died from the injuries or fallen victim to sharks. She was not seen the following year (Johanos et al. 1987).

Case 2. An adult male (bleach Y79) seen hauled out in sector 8 on 8 June had a large, deep laceration on the right side. The injury was recent, extending into the muscle layer but not bleeding, and there was no edema. This male was subsequently observed throughout the field season, usually in the southwest or northeast area, and the injury appeared to be healing.

Adult Aggression

One mobbing, a probable mobbing, and one group harassment (where injury did not occur) were observed. All three incidents were on land or at the edge of the water. Monk

Table 5.--Injuries of Hawaiian monk seals observed at Laysan Island, 1983.

Date	ID	Bleach	Size[a]	Sex[b]	Injury type	Cause[c]
4/27		P97	J	F	Swelling on left posterior, 10 x 10 cm	Male inflicted (P)
4/29	T02F	P28	A	F	Small lacerations covering 30% dorsal surface	Male inflicted (P)
5/21		P21	J	F	Swelling on left posterior, ca. 5 x 10 cm	Male inflicted (P)
5/28		P70	A	M	Spewed toxic puffer fish; seal appeared okay	*Arothron hispidus* (K)
5/30	T16F	P22	A	F	Swelling on dorsal surface, largest 10 x 10 cm	Male inflicted (P)
6/8		Y79	A	M	Deep laceration 20 x 35 cm extending from posterior dorsal surface to right side	Shark (P)
6/8	T26F	Y64	A	F	Laceration on left side 2 x 10 cm, and two dorsal punctures, ca. 2 cm diameter each	Male inflicted (P)
6/9	--	--	A	U	Dorsal puncture, 3 cm diameter	Male inflicted (P)
6/17	T41F		A	F	Small dorsal wounds, later enlarged to cover ca. 60% dorsal surface	Male inflicted (P)
7/4	T34F	P23	A	F	Two open dorsal wounds (the largest 9 cm across) with associated swelling	Male inflicted (P)
7/8	T11F	325	A	F	Two small punctures on left posterior	Male inflicted (P)
7/8	T01F	Y34	A	F	Large abrasion on ventral surface left hind flipper	Unknown

[a]A = adult; J = juvenile.
[b]F = female, M = male, and U = unknown.
[c]P = probable; K = known.

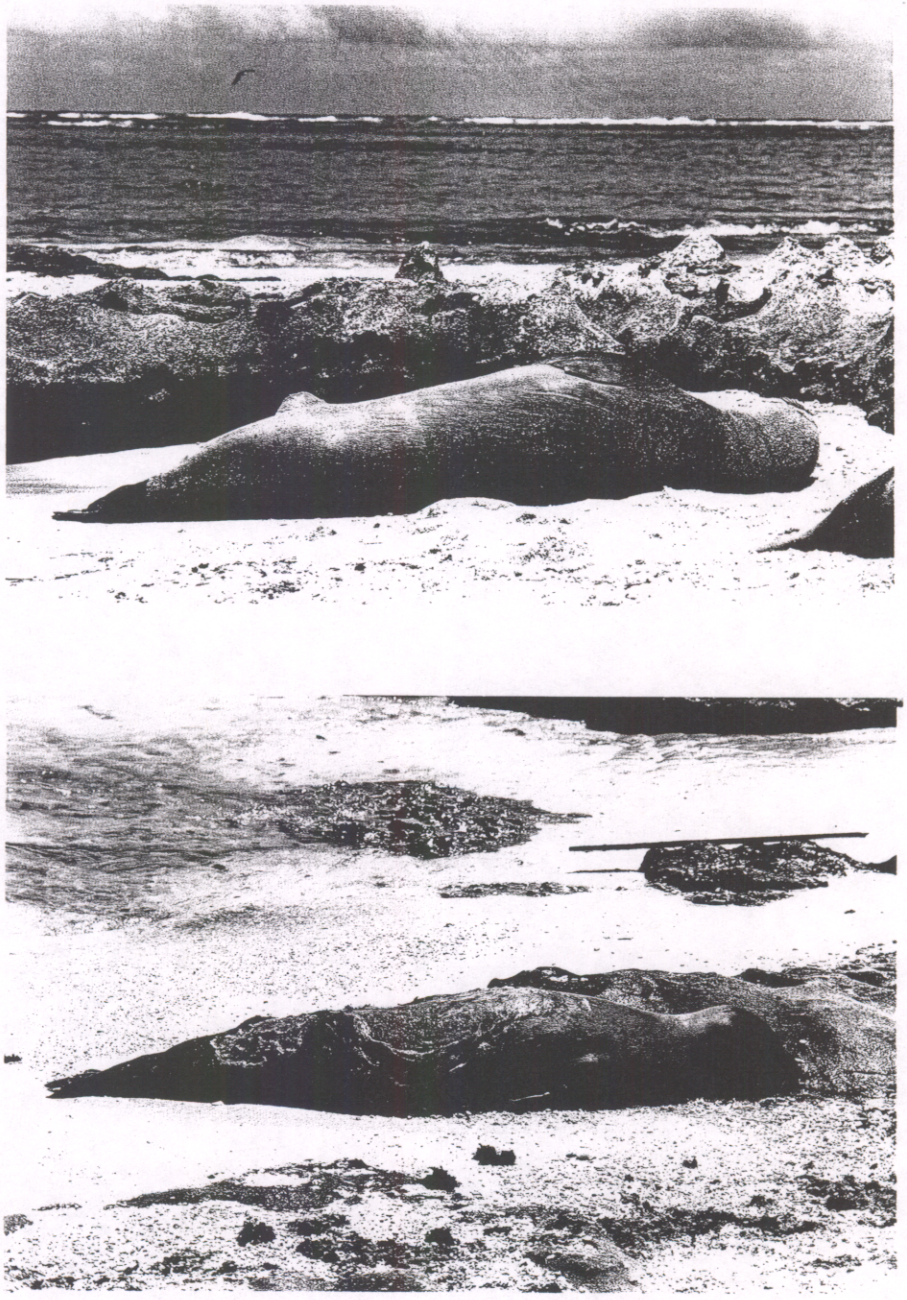

Figure 3.--Examples of injuries on female Hawaiian monk seals probably inflicted by adult males, Laysan Island, 1983. The upper photo is of a juvenile (bleach P97) with swelling on left side. Swelling later drained and healed. The lower photo is of an adult (ID No. 41F) with large dorsal wounds. She disappeared and is probably dead.

seal mobbings had been observed twice prior to 1983 (Johnson and Johnson 1981b; DeLong et al.[4]); the 1983 incident is the first time this behavior was reported to occur on land. The three incidents of adult aggression observed in 1983 on Laysan Island are described below.

Case 1. From 27 to 32 adult and subadult monk seals were seen concentrated in a small area in sector 7 on 12 May 1983. At least nine were adult males. Between 1015 and 1115, fighting occurred on land and in a shallow tidal pool among the seals as one to three at a time attempted to mount a large subadult female (bleach P73). Successful copulation was not seen. She was bitten repeatedly on the back and at least twice on the head. One male (bleach P94) appeared to be the most successful in preventing other males from approaching her. An hour later, all but 12 seals were dispersed by intervention of an observer. At 1300 when observations ended, adult male P94 was successfully driving away approaching males. The same male was still attending her the next day, 13 May, and was in the general vicinity when she was found dead at the mobbing site on 14 May (see Case 1 under Deaths).

Case 2. At 2101 on 17 June, 14 adult seals were observed aggregating at the edge of the water in sector 20. They surged up the beach as a group into the vegetation, an estimated 30 m from the water, and crowded together (within an area approximately 8 x 11 m) where they jousted, chased, bit, and vocalized. Ten of the 14 seals still remained 4.5 hours later, when observations were terminated at 0129 because of darkness. All 10 seals were gone by 0550 the next morning. Although presence of a female in the aggregation was never determined, an adult female (T41F) with fresh dorsal injuries was found on the beach in nearby sector 1 at 0600. The 10 adults remaining at 0129 on 18 June were adult males; all 10 seals were marked with a blue painted *X* at the scene and were resighted and their sex confirmed within a few weeks following the incident.

Case 3. On 11 July at 1915, an adult female (bleach Y54) rapidly hauled out in sector 3, followed by five adult males. The males fought, attempted to mount her, and bit at her back. Fifteen minutes later, two of them were dispersed by an observer. All five males had blood around their mouths and foreflippers, but the female did not sustain any obvious injuries.

Adult Males Tagged

Three adult males designated as "destructively" aggressive were each tagged on a single hind flipper. A description of each tagging and the reason for it are provided below.

---

[4]DeLong, R., W. G. Gilmartin, E. Shallenberger, and G. Naftel. Observations of Hawaiian monk seal mating. Manuscr. in prep. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, 2570 Dole St., Honolulu, HI 96822-2396.

Case 1. An adult male (bleach P35) was observed to act aggressively towards weaned pups on 20 June and 2 July. In one instance, he bit a weaned female pup (TA02) and possibly inflicted a small shoulder puncture. This male was tagged X026 in sector 1 on 4 July. He was sleeping soundly near a molting adult female, awoke during tagging, then immediately went back to sleep. The female near him remained asleep. He was resighted several days after tagging, and the tag was still in place.

Case 2. On 26 June, an adult male (bleach Y18) that was hauled out in sector 6 with an adult female (T02F) repeatedly bit the female, causing lacerations to the ventral and lateral body surfaces. Bleeding was observed posterior to the right foreflipper and around the vaginal opening. Blood was observed on the nose of male Y18. Male Y18 was tagged X028 in sector 7 on 18 July while he was sleeping alone near the edge of the water. He awoke during tagging, moved about 4 m, then went back to sleep. Bleeding was observed where the tag pierced the web. He was asleep when the area was checked 2 hours later, and the tag was still attached.

Case 3. On 8 June in sector 8, an adult male (bleach 336) bit the back of an adult female (T26F) and appeared to make a shallow laceration. He was tagged X029 on 18 July in sector 9. The tag appeared to be attached, but he was not resighted so tag retention could not be confirmed.

Sharks

Three shark species were observed in the nearshore waters of Laysan Island during the field season: the tiger shark, *Galeocerdo cuvieri,* whitetip reef shark, *Triaenodon obesus*, and gray reef shark, *Carcharhinus amblyrhynchos*. No obvious interactions were observed that could be related to seal mortality.

A tiger shark was seen only once during the field season. During the mobbing of the subadult female on 12 May, a 3.0 to 4.5 m long shark patrolled the water immediately adjacent to the mobbing. An adult male seal appeared to roll off a coral ledge where the seals were fighting and onto the shark. The shark and seal swam parallel briefly, then swam in opposite directions. There was blood in the water at the time, apparently from the female being mobbed.

Individual whitetip reef sharks were seen on two different occasions, once in sector 2 with gray reef sharks and once alone in sector 4. No interactions with seals were seen.

Gray reef sharks were commonly seen offshore in large numbers in the northwest area of Laysan Island, sectors 2 and 3. Seals, including a mother with nursing age pup, swam through the large aggregations without incident. Individuals and small groups of gray reef sharks were also seen in sectors 1, 4-7, and 18-20. Once during June, an aggregation of about 40 sharks in sector 2 was viewed underwater; 7 of them were viewed closely and sexed as female.

Materials Collected

Preliminary Analysis of Scats and Spews

A total of 113 scats and 16 spews were collected and screened. Of these, 115 were from seals of known age, sex, or both and represented a minimum of 52 different individuals. Of the 129 samples collected, 40 (31%) contained obvious parasitic worms. Ten parasitic oocyte samples were collected and have not yet been analyzed. Detailed analysis of scats and spews is ongoing and will be presented elsewhere.

Entanglement Debris

Entangled seals were not observed in 1983, and only four pieces of rope or net flotsam washed ashore during the field camp. A net was seen offshore but not recovered. Lack of time precluded burning all rope and net flotsam that had accumulated onshore since the 1982 research. Nineteen pieces were burned, and those remaining in sectors 7 and 8 and along the east and southeast perimeter were piled inland for burning the following year.

Incidental Observations

Unusual Haul-Out Site

Two adult seals were hauled out in an area where seals have not previously been reported (Figs. 2, 4). An injured female (T02F) and an unidentified male were seen resting on the top of a ledge (sector 16) on 1 May. When previously sighted on 29 April in sector 20, the female was without the injuries. This is an unusual haul-out site because the sheerness of the ledge makes access to land via the sea difficult. Tracks in the sand behind the ledge indicated the seals gained access to it by traversing an estimated 0.5 km overland from sector 17. This unusual haul-out behavior may have resulted from the female's attempting to avoid mobbing males or becoming disoriented following a mobbing. She had injuries on the middorsal surface of her back (Table 5). The two seals were still in the same location on 7 May but were gone from the ledge when it was next observed on 9 May. Tracks in the sand between the ledge and inland vegetation indicated the seals had made several trips to the vegetation, probably at night. The female was resighted on 30 May in sector 5.

Seal Transported to Honolulu

To enable future research to be conducted on captive males, a juvenile male (bleach P15) was captured on 21 July with a small hoop net while he was asleep in sector 1. He was immediately transported to the NOAA ship *Townsend Cromwell* via Zodiac. He was housed in a covered wooden container on the deck of the vessel during the return trip to Honolulu. He did not feed during the 5-day voyage but was monitored and frequently dampened with water. He appeared healthy upon arrival in Honolulu and began eating within 24 hours.

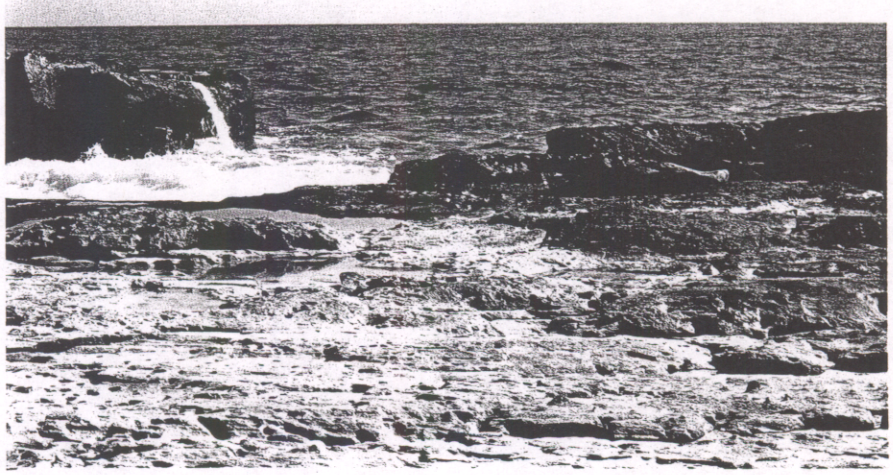

Figure 4.--Two Hawaiian monk seals (upper right) on a ledge in sector 16, Laysan Island, 1 May 1983.

"Nuka" was housed at the Waikiki Aquarium as a NMFS research animal; at that time, he was the only Hawaiian monk seal in captivity.

Dead Whale

A dead beaked whale, *Mesophlodon densirostris*, in advanced stages of decomposition was found in sector 17 on 23 April during the first 1983 circuit of the island's perimeter. The skull was collected and forwarded to the Smithsonian Institution.

ACKNOWLEDGMENTS

We wish to acknowledge the support of the U.S. Fish and Wildlife Service, which administers the Hawaiian Islands National Wildlife Refuge of which Laysan Island is a part. We especially thank Stewart Fefer, Wayne Gagne, and Sheila Conant for their assistance on Laysan Island, and thank Steve Fairaizl at Tern Island for monitoring radio calls and forwarding messages to and from Honolulu. We also thank the U.S. Coast Guard flight crew from Barbers Point for the airdrop. Comments on this manuscript by Bud Antonelis and G. Causey Whittow were appreciated.

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APPENDIXES

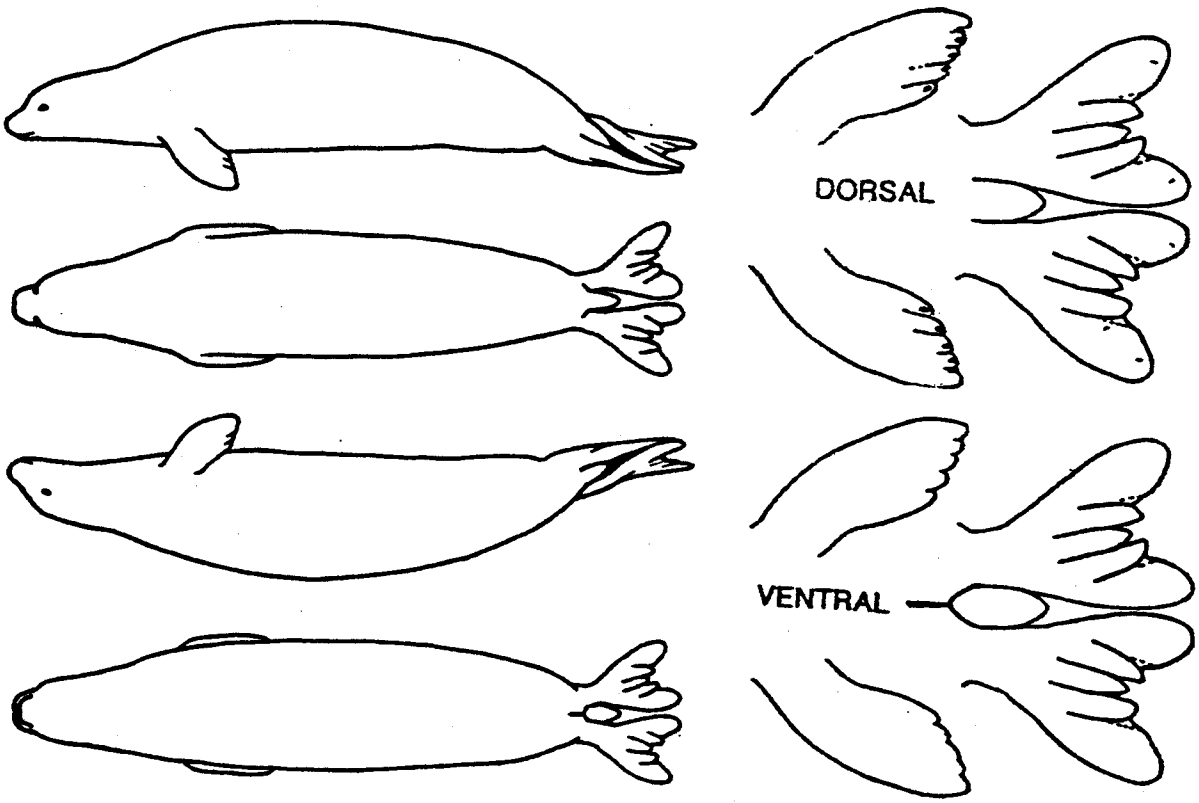
Appendix A.--Itinerary for the 1983 Laysan Island field camp.

Date	Event
18 April	D. J. Alcorn, W. G. Gilmartin, T. C. Johanos, A. K. H. Kam, R. J. Morrow, and G. A. Peiterson, who are all with the National Marine Fisheries Service (NMFS), depart Honolulu aboard the fishing vessel *Easy Rider*.
21 April	*Easy Rider* arrives at French Frigate Shoals and embarks E. K. Buelna.
23 April	Alcorn, Buelna, Gilmartin, Johanos, Kam, Morrow, and Peiterson arrive at Laysan Island, establish field camp, and commence tagging pups and bleaching seals.
24 April	*Easy Rider* departs Laysan Island for Lisianski Island with Gilmartin, Johanos, Kam, and Morrow. Three-person research camp (Alcorn, Buelna, and Peiterson) remains at Laysan Island.
29 April	*Easy Rider* arrives and Peiterson embarks for Honolulu. Alcorn and Buelna remain on Laysan Island.
21 July	NOAA ship *Townsend Cromwell* arrives. NMFS camp disbanded, as U.S. Fish and Wildlife Service sponsored research camp (S. Fefer, W. Gagne, and S. Conant) is established. Alcorn and Buelna depart for Honolulu.
27 July	Arrive Honolulu.

Appendix B.--Forms used for 1983 Hawaiian monk seal research.

B1.--Identification Card.

ORIGINAL SIGHTING LOCATION _____ DATE _____ SEX _____ AGE CLASS _____ ID NUMBER _____



Appendix B.--Continued.

B2.--Hawaiian Monk Seal Tagging Card.

MONK SEAL TAGGING CARD

R: _____

L: _____ _____ _____ _____

Tag Nos. Age Sex Location

_____ _____ _____ _____

Tag Color Tag Type Tagger Date

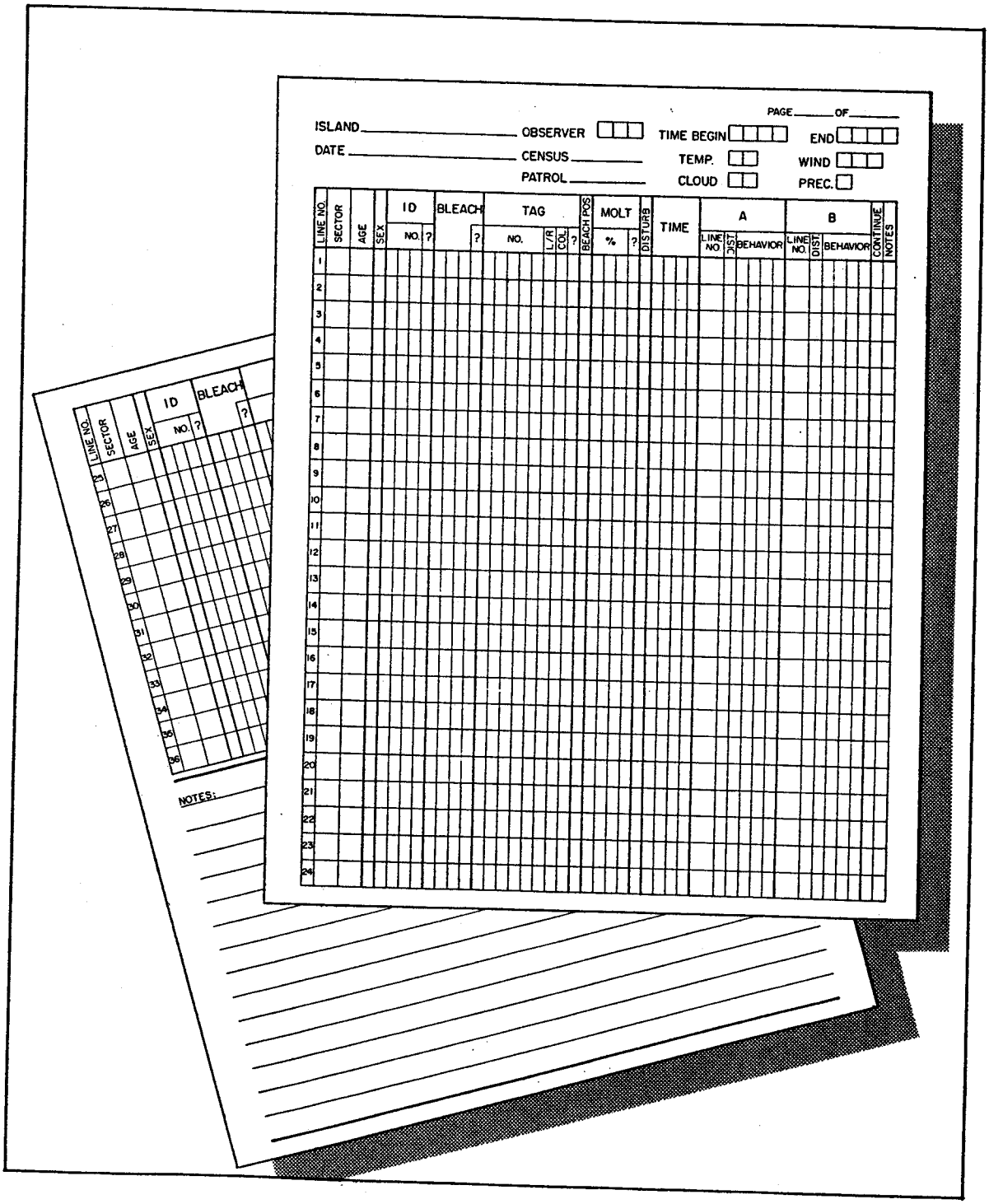
_____ _____ _____

Length Girth Weight

Comments: _____

Appendix B.--Continued.

B3.--Hawaiian Monk Seal Census Form.



Appendix B (B3).--Continued.

Census Form Explanation

OBSERVER - Three initials

CENSUS - Checked when conducting census

PATROL - Checked when walking beach to bleach, collect scats, etc., but not on a timed/scheduled census.

PAGE - If census (or patrol) requires three pages, then mark first page as "Page 1 of 3," etc. If two people census with separate sheets, then combine page numbers: person A has pages 1 and 2, while person B has 3 and 4 of a 4-page census day.

TIME - Noted by a 24-hour clock; e.g., 6 p.m. = 1800.

TEMPERATURE - Noted in degrees Celsius at beginning of census/patrol.

WIND- 0 - no wind, calm
1 - light breeze
2 - strong wind

DIRECTION - NW,N,NE,E,WE,S,SW,W

Example: 2 N E = strong wind from NE

CLOUD - Cloud cover 0 - no clouds
1-9 - 10% to 90% cover
10 - 100% cover

PRECIPITATION - 0 - no precipitation
1 - mist/drizzle
2 - rain
3 - intermittent rain

WEATHER INFORMATION SHOULD BE RECORDED AS A SUMMARY OF THE ENTIRE DAY, NOT MERELY INSTANTANEOUS OBSERVATION!

SECTOR - Location on island by region (e.g., on Lisianski from 1 to 49)

AGE: P - pup nursing, prior to weaning
W - pup weaned
J1 - juvenile I } J - juvenile } I - immature
J2 - juvenile II
S3 - subadult III } S - subadult }
S4 - subadult IV
A - adult
T1 - turtle, juvenile (< 65 cm)
T2- turtle, subadult (65-80 cm)
T3- turtle, adult (80 cm)

Appendix B (B3).--Continued.

SEX: F - female
M - male
U - unknown

ID No. - record ID No. of seal if known: seal No. 23 = 023 in blanks
- ? column checked if ID is questionable

BLEACH No. - may be same as ID No. on some islands
- ? column checked if bleach No. is questionable

TAG No. - Three to five number or letter-number combination; right justify numbers, e.g., tag No. 023 is recorded as 00023
- L/R column: if tag on left flipper, mark as "L," etc.
- COL: color code G - green
K - Kure gray
M - metal
B - blue
T - tan
R - red
- ? column checked if tag No. is questionable

BEACH POSITION - Location of seal (turtle) when observer comes abreast of the animal (i.e., seal may be seen midbeach from a distance and yet be at waterline when observer comes abreast; seal would therefore be recorded as at waterline)
- 0 - animal in water (which means it will not be included in census tally but used for behavioral information)
1 - along waterline, wet sand
2 - midbeach, dry sand
3 - vegetation zone or beach crest; permanent beach

MOLT STATUS: 0 - no molting evident (right justify)
1-99 - 1% to 99% (right justify)
100 - 100% molted, freshly molted
? - column checked if molt status questionable
example: [0][5][0] = seal believed 50% molted but prone position makes estimate questionable

DISTURBANCE - The degree the seal may have been disturbed by presence of observer
___ - space left blank signified no disturbance or seal merely looked at observer
1 - seal vocalized, gestured, or moved 2 body lengths
2 - seal alerted to observer and moved 2 body lengths
3 - seal alerted to observer and fled into water

TIME - Included at observer's option to note time of a behavior, etc. Recorded on a 24-hour clock.

Appendix B (B3).--Continued.

ASSOCIATION DATA: There's room to describe 2 different associations (A & B)

LINE No. - Identity of the other party
1) entangleable object
NR - net and/or rope
FL - flotsam

2) individual seal (turtle): put its line No. here

CLOSEST DISTANCE-
0 - body contact
1 - <2 m
2 - 2-5 m
3 - >5 m

BEHAVIOR
1) entangleable object (<2 m away)
L - association by location on beach only
E - subject is entangled

2) individual seal (turtle)
A) passive
L - association by location only (<5 m apart except for mother-pup pairs)

B) active
A - approach/investigate
B - bite
C - chase
D - displace
F - flee/move away
J - joust/spar/fight
M - mount/attempted mount
N - mother/pup pair
V - vocalize

ASSOCIATIONS RECORDED:

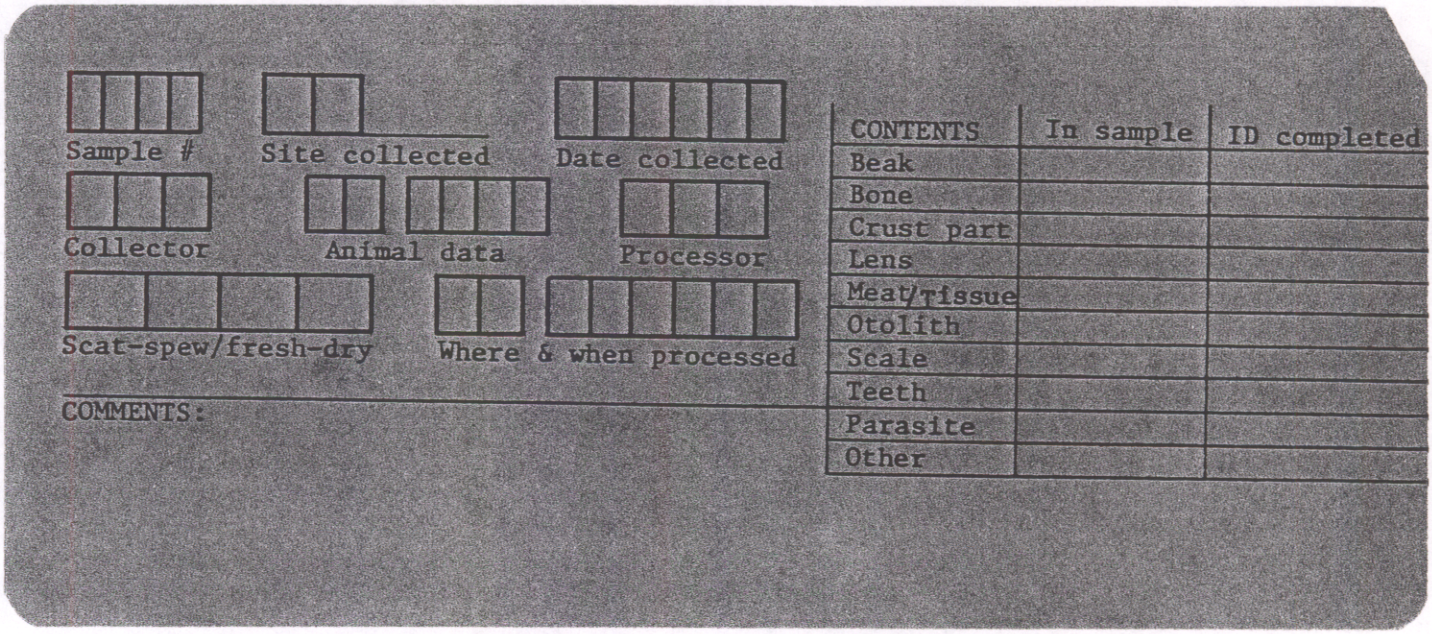
ACTIVE ASSOCIATIONS:
1) must take place within 30 m of observer
2) subjects may be any distance apart

PASSIVE ASSOCIATIONS:
1) noted as observer comes abreast of the subject
2) entangleable object--distances <2 m away
3) individual seal (turtle)
A) mother-pup pair--any distance

B) all others--distance--$\leq$5 m away, record 2 nearest neighbors in straight line of sight

Appendix B.--Continued.

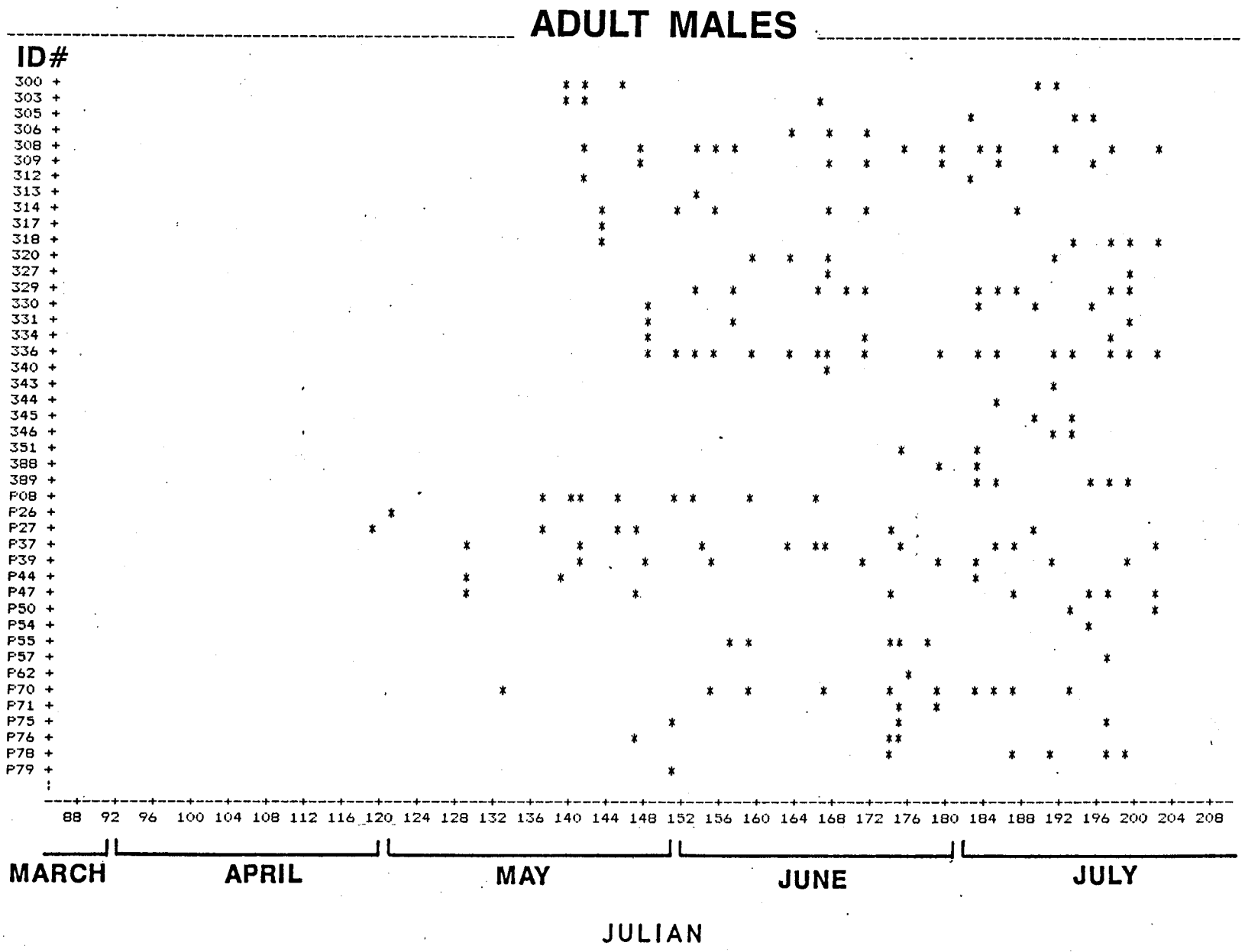
B4.--Hawaiian Monk Seal Scat and Spew Processing Card.



Appendix C.--Summary of census counts of Hawaiian monk seals, by size and sex, on Laysan Island, 1983 (M = males, F = females, and U = unknown).

	Adults			Subadults			Juveniles			Pups			Totals		
Date	M	F	U	M	F	U	M	F	U	M	F	U	Non-pup	Pup	Grand
4/24	11	8	26	3	3	10	5	3	6	1	1	9	75	11	86
4/27	25	16	23	3	4	9	6	5	4	5	2	6	95	13	108
5/1	19	10	18	3	4	5	6	5	2	8	1	3	72	12	84
5/5	23	16	14	3	9	1	12	9	8	7	6	4	95	17	112
5/9	24	17	8	3	8	3	4	5	2	6	6	5	74	17	91
5/13	15	8	19	3	8	5	7	5	4	2	4	2	74	8	82
5/17	26	17	6	0	5	8	8	6	3	4	5	1	79	10	89
5/21	36	15	3	10	11	3	6	10	1	6	7	2	95	15	110
5/23	33	12	10	8	11	1	9	7	7	7	8	0	98	15	113
5/27	27	15	2	2	6	3	6	8	1	8	8	1	70	17	87
5/31	23	16	9	6	10	2	5	4	1	5	8	1	76	14	90
6/4	20	16	4	5	13	3	4	6	0	6	7	2	71	15	86
6/8	16	11	4	5	12	4	6	5	2	2	6	0	65	8	73
6/12	19	17	12	5	8	3	2	3	1	4	3	0	70	7	77
6/16	25	14	11	10	12	6	4	5	4	8	7	0	91	15	106
6/20	26	18	6	9	14	4	9	5	0	8	7	0	91	15	106
6/24	25	20	4	12	14	1	10	5	2	8	7	1	93	16	109
6/28	25	16	9	10	9	5	5	5	1	8	6	2	85	16	101
7/2	23	21	6	10	15	0	6	7	2	6	6	3	90	15	105
7/6	19	13	3	11	12	2	6	7	3	5	6	2	76	13	89
7/10	22	20	4	6	10	5	5	6	0	6	5	1	78	12	90
7/14	28	18	0	12	15	2	7	8	0	7	4	3	90	14	104
7/18	25	16	6	7	9	1	8	8	2	5	6	2	82	13	95
7/21	23	13	1	7	10	6	7	8	3	6	5	2	78	13	91

Appendix D.--Sighting of individually identified Hawaiian monk seals on Laysan Island, 1983 (D = last observation--seal died or disappeared, M = molting, and P = part of a mother-pup pair).



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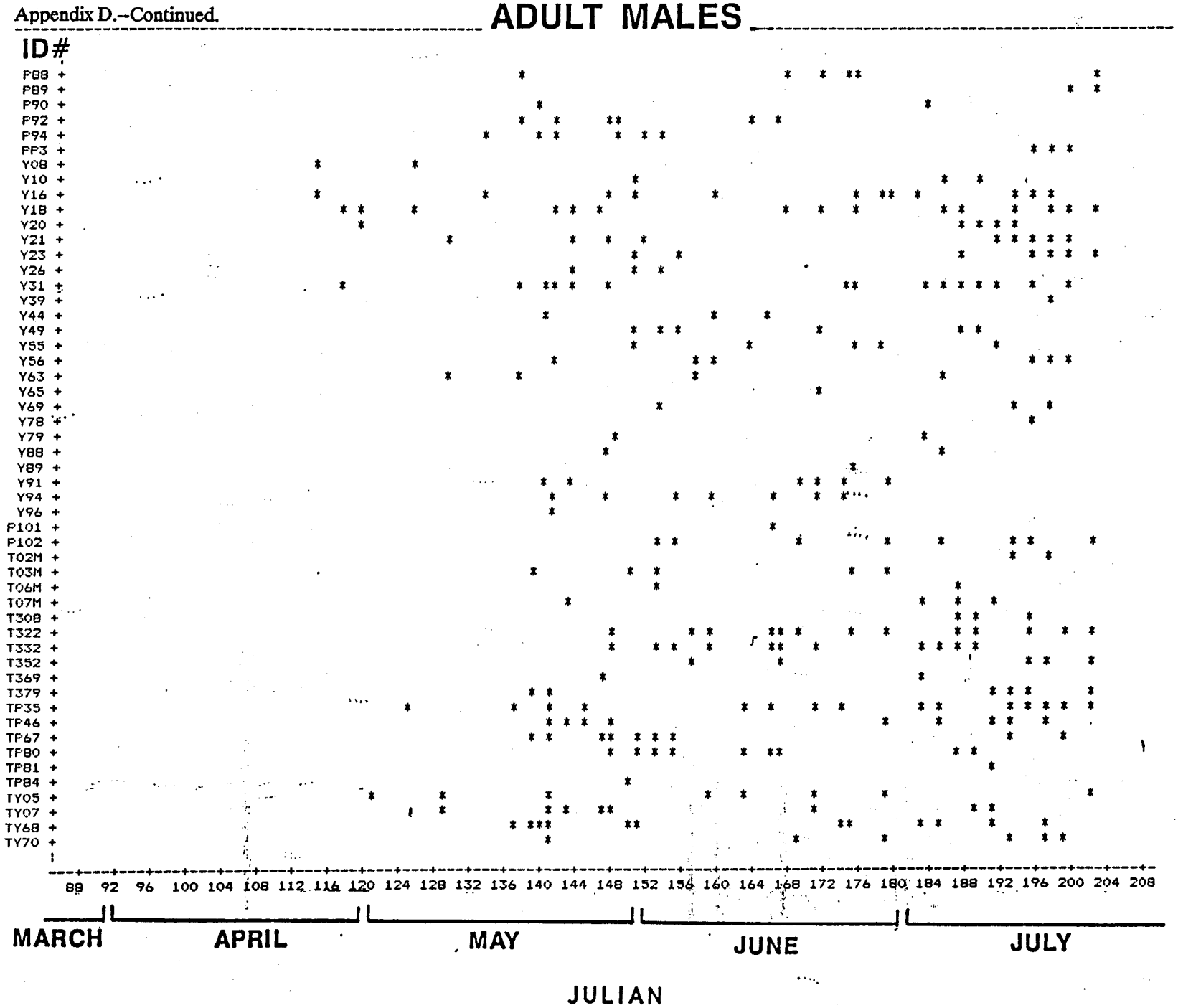

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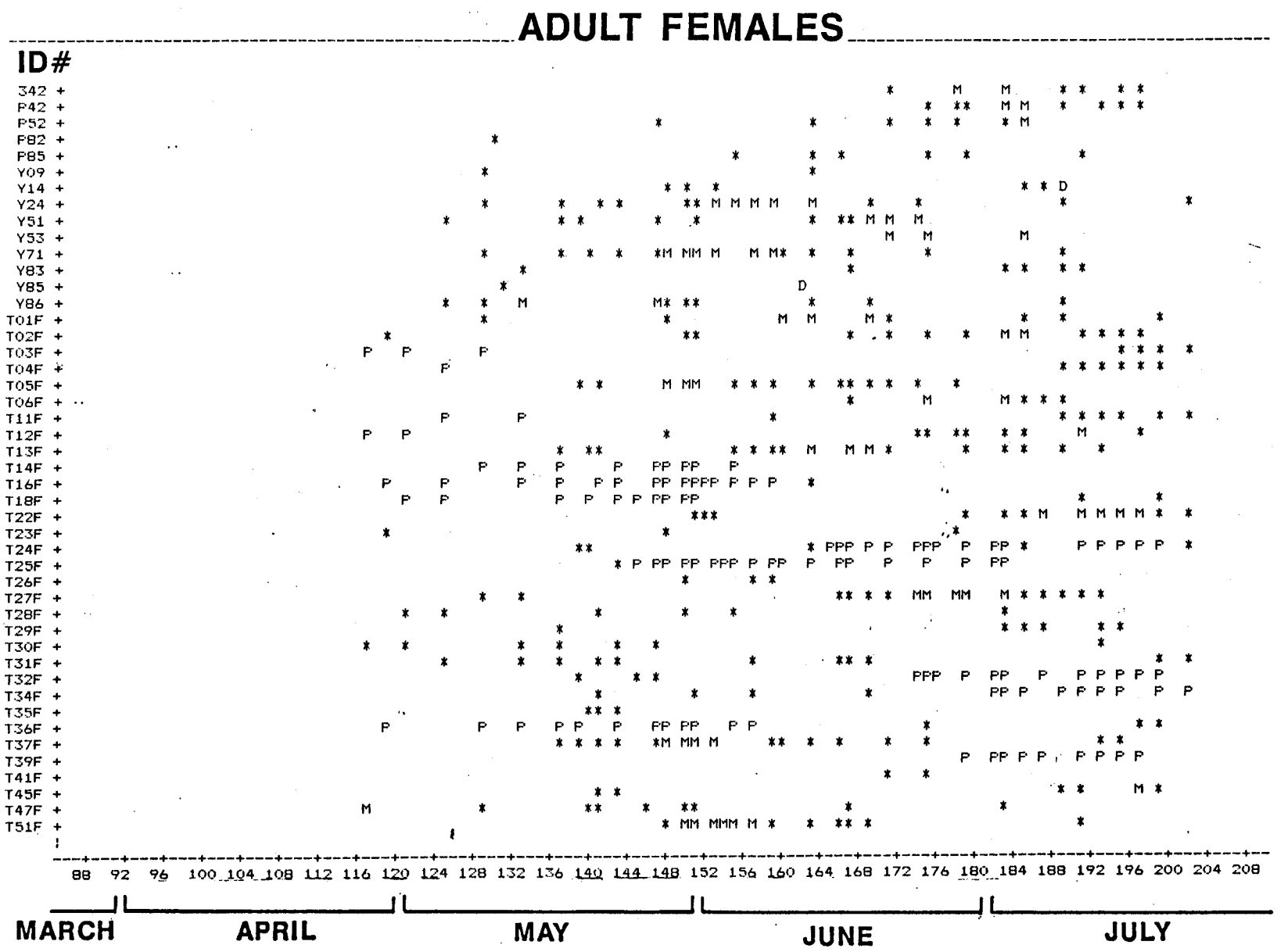

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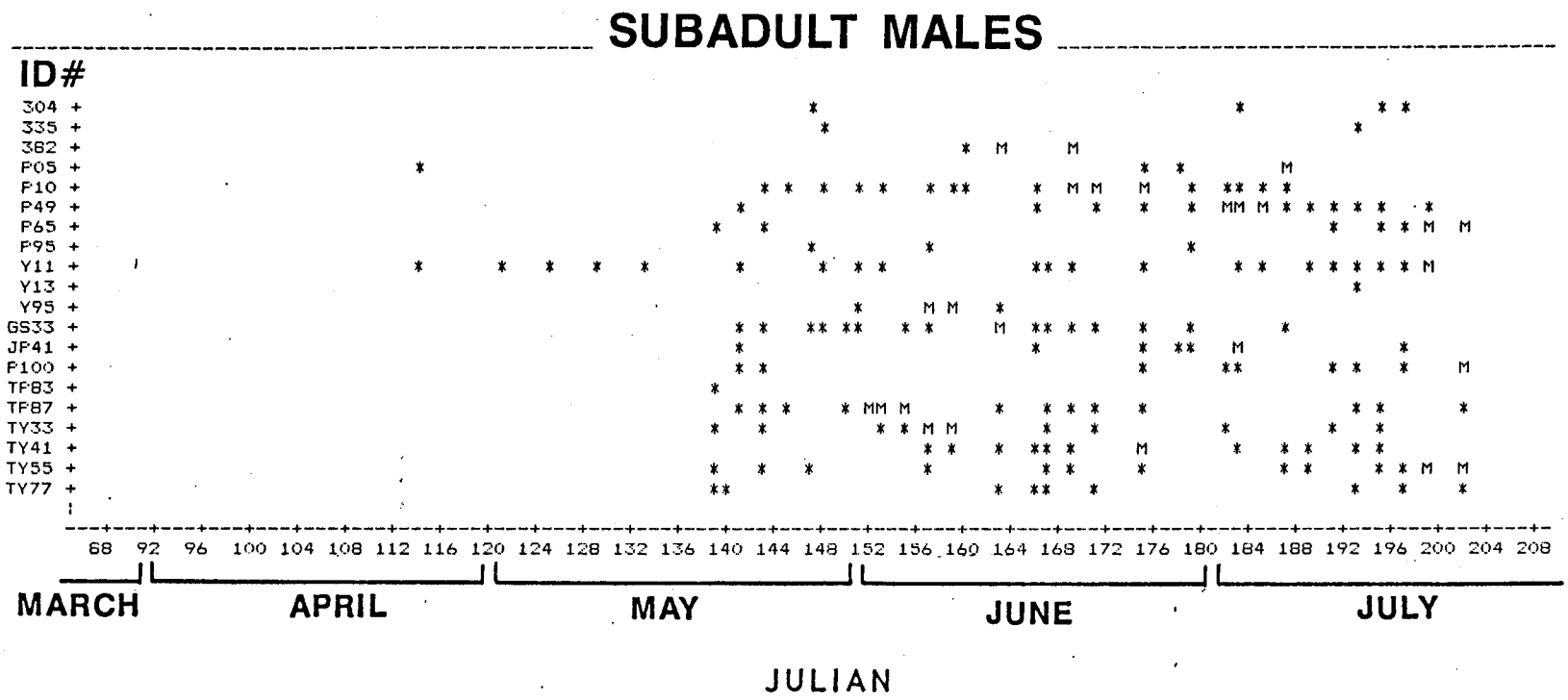
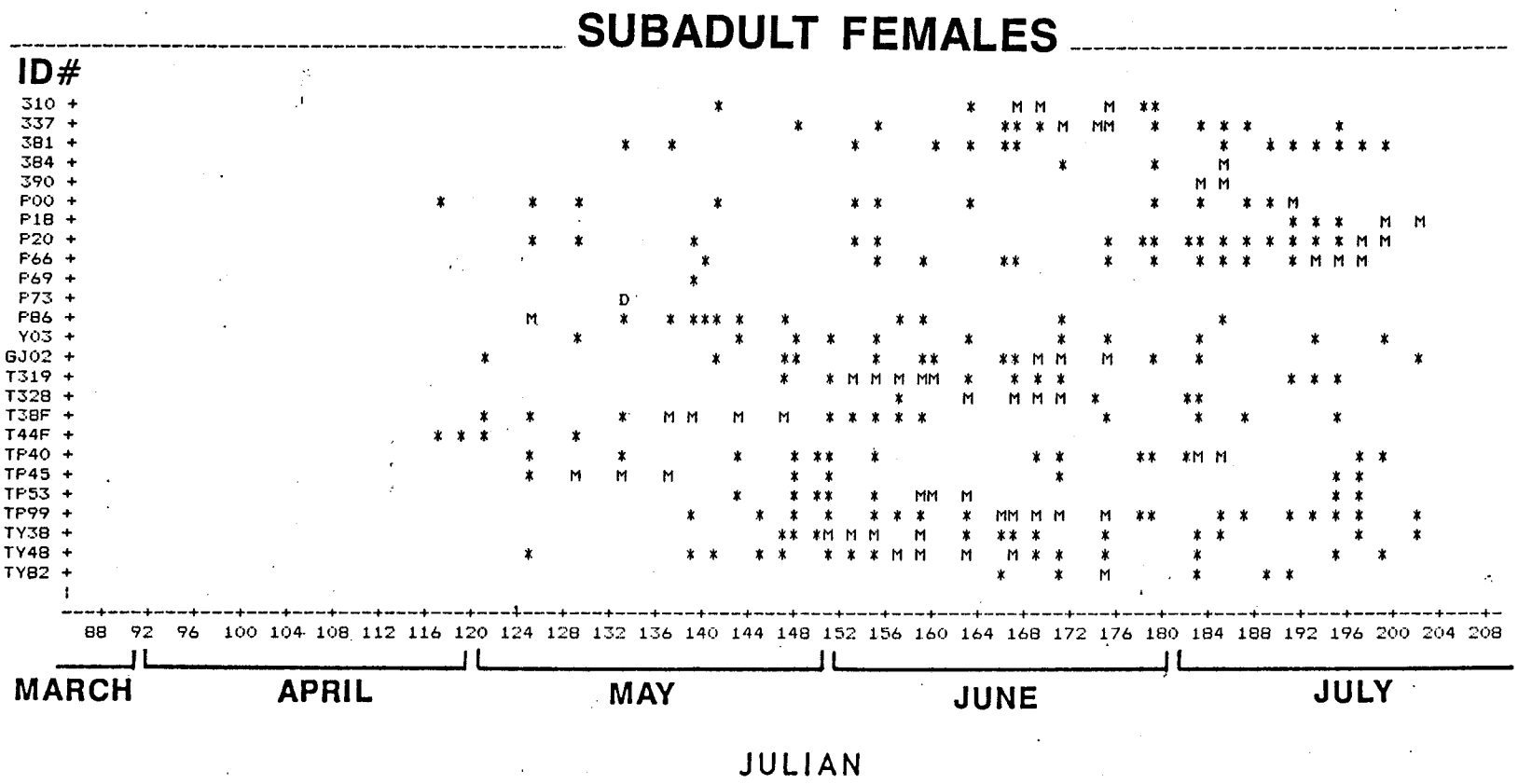
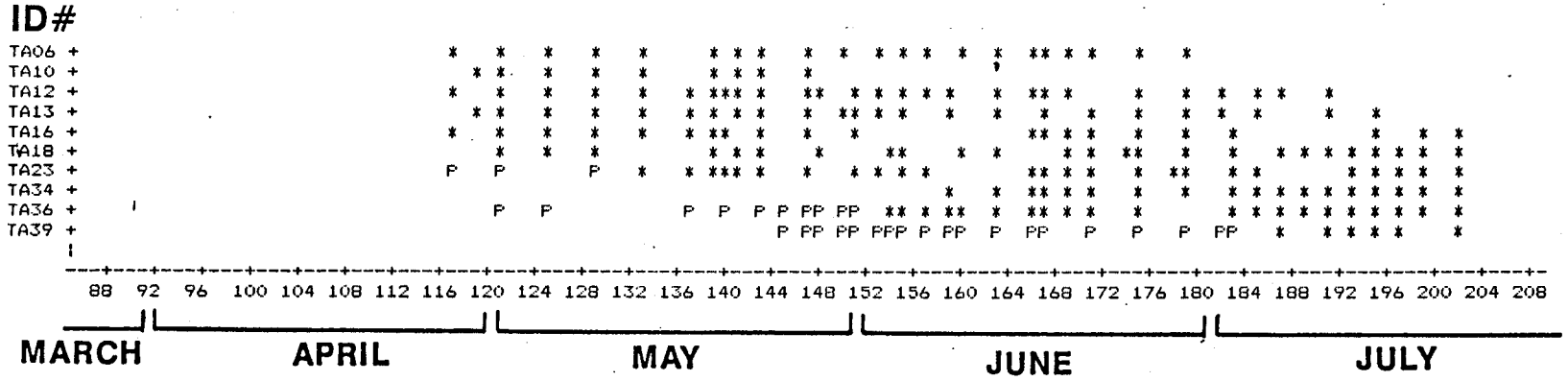


Appendix D.--Continued.

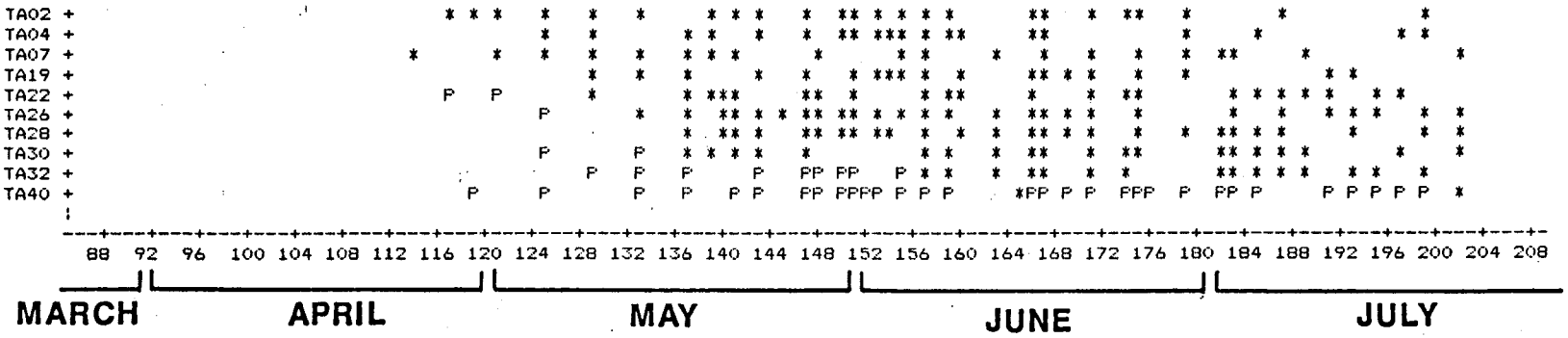


Appendix D.--Continued.

MALE PUPS



FEMALE PUPS



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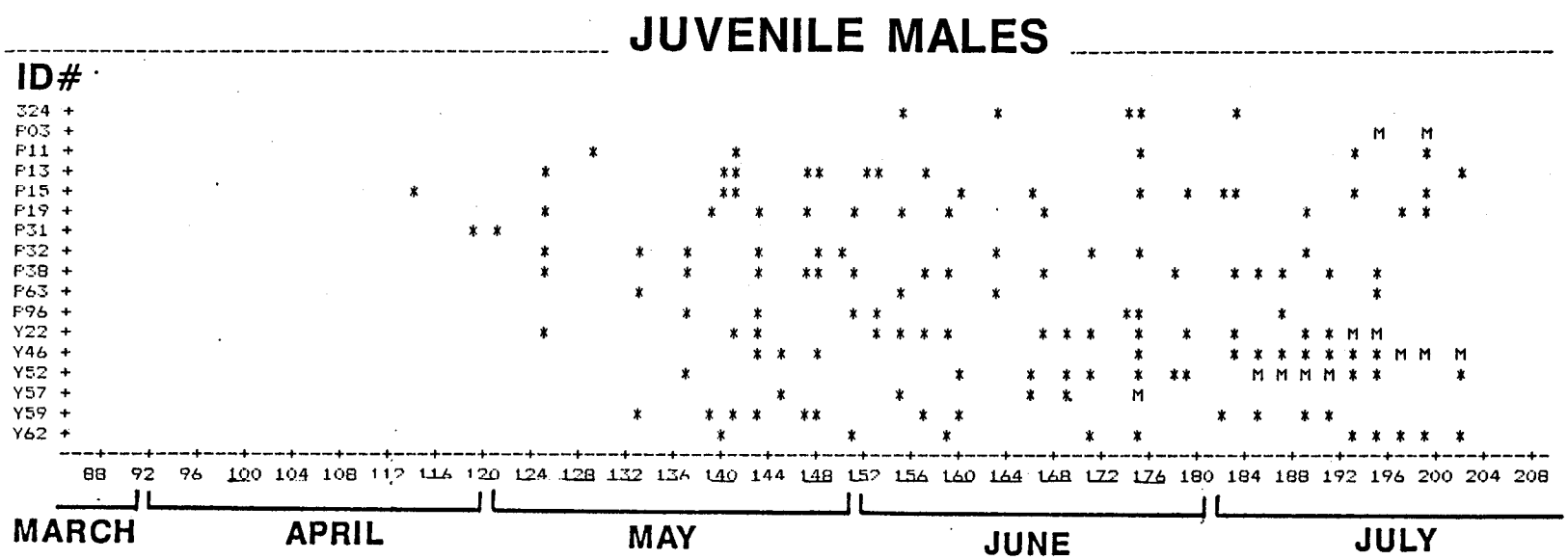

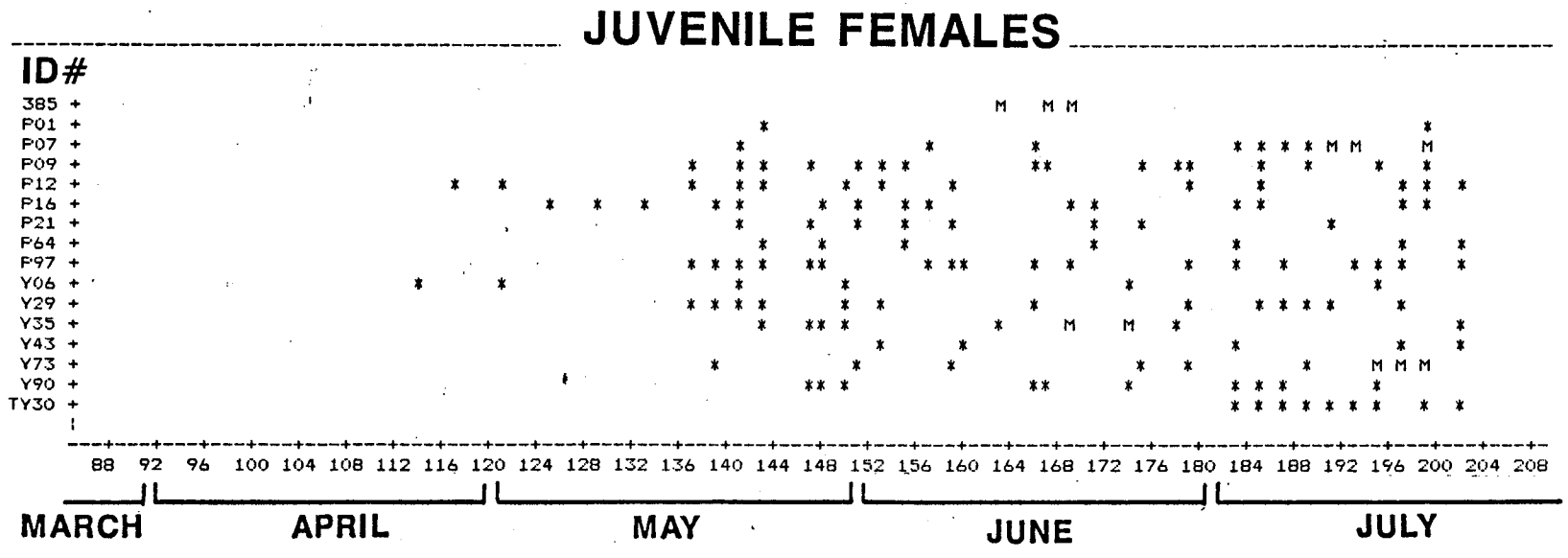

Appendix E.--Hawaiian monk seal necropsy report summaries, Laysan Island, 1983. (Specific age estimates appearing after size class are based on tooth ageing done at the National Marine Fisheries Service, Marine Mammal Laboratory.)

NECROPSY NO.:	01NECLA83
ID:	Bleach No. P73
SEX:	Female
SIZE CLASS:	Subadult (large), ca. 6 years old
DATE/TIME OF DEATH:	Between 13 May (1345) and 14 May 1983 (1500)
DATE/TIME OF NECROPSY:	14 May (ca. 1700)

CIRCUMSTANCES OF DEATH: Seal had been bleached "P73" on 9 May. On 12 May, she was seen on the reef edge and was being "mobbed" by adult males (see Adult Male Aggression). She was seen hauled out in the same area at 1345 on 13 May at which time she was alive and alert. She was found dead when the area was next visited at 1500 on 14 May. Although the necropsy was done shortly after death, pelage was slipping, skin and fat were separating from the muscle layer, and all organs showed severe autolysis.

EXTERNAL DESCRIPTION: Lacked distinctive natural ID markings. Pre-molt, green around muzzle. There were eight dorsolateral puncture wounds and numerous scratches; the largest puncture was 25 x 19 mm. Only two of the punctures appeared to be into the muscle layer, and none were into the body cavity.

Measurements:

1. Standard length	187.0 cm
2. Curvilinear length	192.0 cm
3. Anterior length foreflipper	31.0 cm
4. Anterior length hind flipper	30.0 cm
5. Blubber thickness	2.5 cm
6. Axillary girth	118.0 cm

INTERNAL: Parasitic worm load light. Roundworms and tapeworms in digestive tract, and stomach ulcerations (covering approximately 2% stomach area) associated with roundworms. Possible gallstone found in gallbladder; sample being analyzed. Organs were weighed and detailed notes taken; detailed report on file at the Honolulu Laboratory.

SAMPLES COLLECTED:

Stomach and intestine contents
Endoparasites
Reproductive tract
(minus right ovary)
Brain
Lung
Liver
Spleen
Pancreas
Gallbladder (possible stone)
Stomach, esophagus, intestine
Lymph
Blood samples
Kidney
Skull

PATHOLOGY SUMMARY: All organs show severe autolysis, which prevents any assessment of the cause of death. (G. Stemmerman, M.D., Kuakini Medical Center, Honolulu, Hawaii 96817.)

Appendix E.--Continued.

NECROPSY.:	02NECLA83
ID:	Bleach No. Y85
SEX:	Female
SIZE CLASS:	Adult, ca. 17 years old
DATE/TIME OF DEATH:	By 11 June 1983 (1025)
DATE/TIME OF NECROPSY:	11 June 1983

CIRCUMSTANCES OF DEATH: Seal was found dead on dry sand next to reef edge, about 7.5 m from the water. Seal was on ventral with adult male mounting her and biting her back. Body appeared fresh but stiff and had not been there when the area was visited about 38 hours before. Teeth were worn, and she appeared to be old. The pathologist substantiated her old age, saying there were many structural changes indicating this. He also stated there was "recent infarction of the cerebral cortex; severe pulmonary and hepatic congestion was due to terminal heart failure. Possible acute pancreatitis."

EXTERNAL DESCRIPTION: Lacked major external injuries; small (1 cm diameter), shallow, circular puncture with strip of hanging blubber, and small cut on right foreflipper.

Measurements:

1. Standard length . . . . . 206.5 cm
2. Curvilinear length . . . . . 223.0 cm
3. Anterior length foreflipper . . . . . .40.0 cm
4. Anterior length hind flipper . . . . . .39.0 cm
5. Blubber thickness (sternum) . . . . . 6.0 cm
   Blubber thickness (nipples) . . . . . 4.0 cm
6. Axillary girth . . . . . 142.0 cm

INTERNAL: Many roundworms in stomach, most alive; some associated with ulcerations (estimated $<5\%$ stomach surface ulcerated). Very light worm load in remainder of intestinal tract. Ovarian cysts. Possible gallstone in gallbladder. One eye lens opaque. Weights of organs and other details of necropsy are on file at the Honolulu Laboratory.

SAMPLES COLLECTED:

Stomach contents	Spleen
Endoparasites	Kidney
Reproductive tract	Adrenal
Brain	Heart
Blubber (frozen)	Pancreas
Lung	Thyroid
(possible) gallstone	Eye lenses
Skull	Blood samples

PATHOLOGY SUMMARY: This is obviously an old animal, with many structural changes indicative of old age-hyolinized pancreatic islets, small vessel sclerosis in the pancreas and periadrenal fat, healed scars of the renal cortex and ovary with corpora albicans, and no ova. The following changes may indicate the cause of death: a) recent

infarction of the cerebral cortex, b) possible acute pancreatitis. The former is preferred, although it could be secondary to the pancreatic change. The latter is difficult to assess morphologically and may be due to postmortem autolysis. The severe pulmonary and hepatic congestion is due to terminal heart failure. (G. Stemmerman, M.D., Kuakini Medical Center, Honolulu, Hawaii 96817.)

Appendix E.--Continued.

NECROPSY NO.:	O3NECLA83
ID:	Natural pup of T24F
SEX:	Female
SIZE CLASS:	Newborn pup
DATE/TIME OF DEATH:	14 June 1983 (1248)
DATE/TIME OF NECROPSY:	14 June 1983 (1325)

CIRCUMSTANCES OF DEATH: Pup was first seen at 1135 on 14 June, "thrashing around" at vegetation line in sector 19. Apparent mother (ID = T24F) was at the edge of the water. Pup appeared to be having difficulty breathing and moving; the eyes were distended out from the sockets. Placenta was still attached. Heart beat, 85/min. Pup had numerous sets of convulsions; yellow and white froth came out of nostrils. It died at 1248, following 2 minutes of mild convulsions. It was carried back to camp where necropsy was performed. The pathologist said tissue samples indicated "cause of death was pulmonary insufficiency due to inadequate aeration," and that evidence suggested "a difficult, prolonged labor with fetal distress through the birth canal." He further stated that eye enlargement was due to secondary glaucoma. No comment was made on the "growths" (see below), and those samples are being reexamined.

EXTERNAL DESCRIPTION: Pup had obvious abnormalities: low, black, hairless growths covered approximately 20-25% of the body surface; also growth on the umbilical cord 3.5 cm below place of attachment to pup had the appearance of a "ball" of hard tissue (4.0 x 7.5 cm) with blond hairs. Head appeared misshapen and eyes bulged.

Measurements:

1. Standard length . . . . . .95.5 cm
2. Curvilinear length . . . . . 105.0 cm
3. Anterior length foreflipper . . . . . .19.0 cm
4. Anterior length hind flipper . . . . . .22.0 cm
5. Blubber thickness (midventral) . . . . .11.0 cm
6. Axillary girth . . . . . .54.0 cm

Total body weight: 18.49 kg

INTERNAL: All internal organs appeared "normal." No parasites. Spleen, 26 x 6-9.5 cm. Entire digestive tract length (mouth to anus) measured 9.54 m; the combined length of large and small intestine was 9.4 m. The external growths extended through to the fat and muscle layers (at least on the ventral surface). Weights of individual organs and other necropsy details are on file at the Honolulu Laboratory.

SAMPLES COLLECTED:

Stomach contents	Lung
Reproductive tract	Liver
Blubber	Kidney
Brain	Adrenal
Heart	Pancreas
Muscle	Skull
Blood samples	

PATHOLOGY SUMMARY: This pup died shortly after birth. The cause of death is pulmonary insufficiency due to inadequate aeration. The presence of many aspirated amniotic elements in both bronchioles and alveoli suggests a difficult, prolonged labor with fetal distress during passage through the birth canal. The inflammation in the eye is acute and severe and probably was initiated prior to birth. Had the animal survived, it would have been blind. The enlargement of the eye is due to secondary glaucoma (buphthalmus). (G. Stemmerman, M.D., Kuakini Medical Center, Honolulu, Hawaii 96817.)

Appendix E.--Continued.

NECROPSY NO.:	O4NECLA83
ID:	Unknown
SEX:	Unknown; probably female
SIZE CLASS:	Adult, ca. 6 years old
DATE/TIME OF DEATH:	Before April 1983
DATE/TIME OF NECROPSY:	5 July 1983

CIRCUMSTANCES OF DEATH: Dead seal found in sector 17 on 23 April on first 1983 circuit of island. Seal was decomposing, partly mummified, and partially buried in the sand (below the vegetation line) about 30 m above the water. Limited measurements and samples could be obtained because of the advanced state of decay, so a necropsy was conducted later in the field season when time permitted. Information as to cause of death could not be obtained.

EXTERNAL DESCRIPTION: A rough estimate of straight length was obtained by excavating the sand and "allowing" for the twisted mummified state: estimated length (with the seal on its left side) was about 201 cm. Although the hind flippers were disintegrating, a search was made in the sand adjacent to them for possible tags, but none was found. External sex characteristics could not be distinguished.

INTERNAL: Most organs could not be located, but surprisingly, the lower portion of the large intestine was found and was packed with soft brown fecal matter; the fecal matter was sieved and prey parts were saved. Reproductive organs could not be located; a baculum could not be found on the carcass or in the nearby sand.

SAMPLES COLLECTED:

Contents of lower large intestine
Skull

Appendix E.--Continued.

NECROPSY NO.:	05NECLA83
ID:	Bleach No. Y14
SEX:	Female
SIZE CLASS:	Adult, ca. 22-24 years old
DATE/TIME OF DEATH:	Between 7 July (0710) and 8 July 1983 (1955)
DATE/TIME OF NECROPSY:	9 July (0600)

CIRCUMSTANCES OF DEATH: Seal had been seen in sector 17 with an adult male (bleach Y18) at 0710 on the day before she was found dead at the same location. A different male was found "attending" the body, but she was alone the next morning when the necropsy was conducted.

EXTERNAL DESCRIPTION: Two small (4 cm diameter) punctures on back, shallow and extend only into skin. Small amount of light scratches on back. Teeth worn; seal appeared "old." Tissues showed severe postmortem autolysis, so pathologist examining them was unable to suggest cause of death.

Measurements:

1. Standard length . . . . . 212.0 cm
2. Curvilinear length . . . . . 231.0 cm
3. Anterior length foreflipper . . . . . .36.0 cm
4. Anterior length hind flipper . . . . . .33.0 cm
5. Blubber thickness (ant. nipples) . . . . 4.2 cm
   Blubber thickness (sternum) . . . . . 4.2 cm
6. Axillary girth . . . . . 150.0 cm

INTERNAL: Light parasite load in digestive tract; no live worms. At least 22 ulcerations in stomach (largest 5 x 2 cm), but none perforating the stomach lining. What appeared to be a gallstone (12 x 10 mm) was found in gallbladder. Entire length of digestive tract measured (mouth to anus) 16.76 m long. Weight of individual organs and other details of necropsy are on file with detailed report at the Honolulu Laboratory.

SAMPLES COLLECTED:

Endoparasites	Spleen
Reproductive tract	Kidney
Brain	Adrenal
Lung	Heart
Liver	Pancreas
Blood samples	Skull

PATHOLOGY SUMMARY: Postmortem autolysis is so extensive that it is difficult to assess the state of the viscera; hence, microscopy cannot contribute to assigning a cause of death. The animal does have fairly severe enteric and gastric parasitic infection. The gastric parasites are associated with extensive ulceration and granuloma formation. The intestinal parasites have caused little or no change in the mucosal architecture. (G. Stemmerman, M.D., Kuakini Medical Center, Honolulu, Hawaii 96817.)

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