

NOAA Technical Memorandum NMFS



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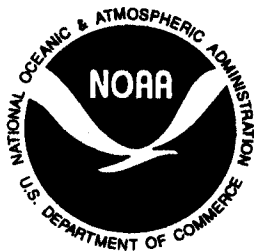
NOAA-TM-NMFS-SWFSC-178

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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NOAA Technical Memorandum NMFS

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ABSTRACT

The endangered Hawaiian monk seal (*Monachus schauinslandi*) was studied at French Frigate Shoals (FFS) in the Hawaiian Islands National Wildlife Refuge from 4 April-31 August 1988 and from 25 March-4 September 1989.

Eight atoll-wide beach counts made in 1988 averaged 240 adults, subadults, and juveniles and 71 pups. At least 127 pups were born. By the end of the 1988 field season 5 pups were still nursing, and 118 of 121 (98%) pups had survived to weaning; 114 of those were tagged and 4 remained untagged. At least 7 pups were fostered by females other than their mothers. We assisted 2 of these fosterings. The mean axillary girth and standard length for recently weaned pups was 105 and 126 cm, respectively. Eight prematurely weaned female pups were collected and transported to Oahu to receive special care prior to release at Kure Atoll. Sixty-seven parturient females were identified from previous years; at least 46 gave birth in 1987. The mean interbirth interval for 12 of these was 382 days. Minimum first year survival of 1987 weaned and tagged pups was 98 of 106 (92%). Six male seals moved between Laysan Island and FFS. A juvenile was freed from entangling debris. Injuries to 37 seals were recorded. Five seals, including 3 pups, were presumed or found dead. Two of these seals, both juveniles, were necropsied.

Fifteen atoll beach counts made in 1989 averaged 278 adults, subadults, and juveniles and 58 pups. At least 120 pups were born, including the first pup known to have successfully weaned at Tern Island since at least 1947, and one by a five-year-old female, the youngest recorded to have pupped at FFS. By the end of the field season 4 pups were still nursing and 101 of 116 (87%) pups had survived to weaning; all 101 were tagged. At least 9 pups were fostered by females other than their mothers. The mean axillary girth and standard length for recently weaned pups was 102 and 125 cm, respectively. Three prematurely weaned female pups were collected and transported to Oahu for special care prior to release at Kure Atoll. Eighty-eight parturient females were identified from previous years; at least 47 gave birth in 1988. The mean interbirth interval for 16 of these was 374 days. Minimum first year survival of 1988 weaned and tagged pups was 78 of 114 (68%). Two male and two female seals moved between FFS and Laysan Island. Six seals were entangled in marine debris, and one was found stranded on the runway at Tern Island. Injuries to 92 seals were recorded. Thirty-four seals were presumed or found dead, including 15 neonatal pups and 1 prematurely weaned pup. Seven seals were necropsied.

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INTRODUCTION

The largest population of the Hawaiian monk seal (*Monachus schauinslandi*) is at French Frigate Shoals (FFS), 450 nmi northwest of Oahu. The history, geology, and biology of FFS through 1969 is described in Amerson (1971). Tern Island is the largest island in FFS and covers 37 acres; all the other islands range in size from <1 to 12 acres.

Johnson et al. (1982) summarized changes in the seal population at FFS between 1957 and 1978. Schulmeister (1981) described Tern Island censuses made between 1956 to 1980: essentially there were always less than 10 seals hauled out on Tern Island until 1979. Since 1979 the seal counts at Tern Island have increased to a high of 181 seals in 1985 (Eliason et al. in prep.). Fairaizl (1984) reported haul-out patterns of identifiable monk seals at FFS from January-September 1983.

Long-term research and population monitoring began at FFS in 1980 with the work of Johnson and Johnson (1984). The National Marine Fisheries Service (NMFS), Southwest Fisheries Science Center, Honolulu Laboratory began annual studies in 1982. The NMFS began tagging weaned pups at FFS in 1984 using plastic Temple Tags¹ (cattle ear tags). In earlier studies an average of 37% of weaned pups with an axillary girth measurement less than 90 cm had survived to their first year (NMFS, unpublished data). Consequently, the NMFS began collecting undersized weaned female pups in 1984. These pups received special care on Oahu and were released as yearlings at Kure Atoll as part of a program to aid in the recovery of the population there (Gilmartin and Gerrodette 1986).

During 1988 and 1989, the primary objectives at FFS were to conduct atoll-wide beach censuses of monk seals to assess productivity, survival, movements between atolls and islands, and population structure and distribution. Secondary objectives were to monitor reproduction of identified females, tag weaned pups, collect weaned female pups with an axillary girth measurement less than 90 cm for rehabilitation, collect tissue samples when tagging weaned pups and juveniles for DNA fingerprinting, record injuries and deaths, perform necropsies, and catalogue and destroy debris capable of entangling wildlife. This report presents the results of this work.

MATERIALS AND METHODS

The NMFS field camp for FFS was based at Tern Island from 4 April-31 August 1988 and from 25 March-4 September 1989 (See Appendixes A and B for itineraries).

¹The use of brand-name products does not constitute endorsement by the National Marine Fisheries Service.

Censusing

FFS is made up of 10 permanent islands, including La Perouse Pinnacle, and 7 semi-permanent sand spits (Fig. 1). Atoll censuses were counts of all seals hauled out on all beaches of the FFS; island censuses were counts on single islands. We began seasonal atoll-wide censuses on 12 April 1988 and 29 March 1989 using the standard census form (Forsyth et al. 1988) and following the coding instructions in Gerrodette and Frizelle (1988). For 1989, these instructions were revised (Appendix C). Tern Island censuses were made weekly throughout the year.

Atoll censuses were conducted every 1-2 weeks, and took 2 consecutive days to complete. Counts were made beginning between 0900 and 1000 and ending between 1500 and 1700. During atoll censuses the islands were visited in the same order. Island censuses started around 1300. Round Island and Mullet Island were censused from a boat or from a nearby reef, while the remaining islands were censused on foot by one or two persons (walking in opposite directions). Seven of the larger islands had been divided into unequal sectors using artificial or natural landmarks (Figs. 2 and 3).

Sex and Size/Age Designation, Tagging and Weaned Pup Measurement, and Individual Identification

During each census observers assigned a size/age and sex to each seal, recorded tag numbers and colors, and made drawings of individual markings and injuries. Sex and size/age classification followed Stone (1984). To assign a sex, the observer had to see teats of a female, the penile opening and/or hairline between the opening and the anus of a male, or must have observed that a seal was lactating.

Since 1984, weaned pups have had standard length and axillary girth measured and one yellow Temple Tag attached in the webbing of each hind flipper (Gilmartin et al. 1986). Identifiable immature seals that had broken or missing tags were retagged. Weaned pups of 1988 and 1989 were tagged and measured in the same manner.

Photographs and drawings of seals with natural bleach marks, scars, and unusual physical characteristics (amputations, clouded eyes, deformed limbs, etc.) were made to augment individual identification files begun before 1980. New permanent four-character identification (ID) numbers (always beginning with the letter Y to indicate a seal from FFS) were assigned to newly tagged weaned pups and to untagged seals identified in 2 or more seasons. Temporary ID numbers (never beginning with the letter Y) were assigned to seals not identified previously and to all parturient seals to indicate the pupping site and order for each island in each year (i.e., E41-88 was the forty-first seal to pup on East Island in 1988; the prefix E = East, W = Whaleskate,

R = Round, TN = Tern, T = Trig, SH = Shark, LG = Little Gin, G = Gin, M = Mullet, D = Disappearing).

Pup Collection for Rehabilitation

Female pups whose girth measured less than 90 cm within 2 weeks after weaning were collected, if transport was available within 2 weeks, and then sent to the NMFS's Kewalo Research Facility, Oahu in 1988 and Sea Life Park, Oahu in 1989. After gaining appropriate weight they were released at Kure Atoll.

Collection of Tissue Samples

During the tagging procedure observers collected tissue from the webbing of the hind flippers using a leather punch. This tissue was frozen in the field and kept frozen at the NMFS laboratory until analyzed.

Marine Debris and Entanglement Studies

All nets, lines, and other debris capable of entangling wildlife were collected, cataloged, and burned. For each debris item observers recorded: (1) weight; (2) dimensions (length of rope or area of net, twine diameter and stretch-mesh of net); (3) debris type (net, line, other), material (monofilament, nylon, polypropylene, cotton, hemp, and other), and color; (4) collection location; and (5) date.

Injuries

Injuries for each year were those first observed at any time during the calendar year, and were categorized as punctures, abscesses, abrasions, lacerations, gaping wounds, circular wounds, or amputations. The general condition of the seals (alertness and fatness) was described as well as the wound observation date, location on the body, dimensions (length, width, and depth or height), condition (fresh, recent, or old), and cause (either known--actually witnessed, probable--cause known but not witnessed, or unknown). Photographs and drawings of the injuries were made, and the healing progress of resighted seals was recorded.

Deaths

Recently dead seals were necropsied following procedures described in Winchell (1990). These seals were examined for abnormalities and injuries; major organs were sampled; and observations were recorded on a Monk Seal Necropsy Report Form (Appendix D).

RESULTS

Population

Atoll Censuses

In 1988, observers made 8 atoll censuses from 27 May-15 July (Table 1, Fig. 4). The beach count of all seals averaged 311 (range 286-353, SD = 23.5) and, excluding pups, 240 (range 211-280, SD = 20.8) (Table 2). In 1989, the total count from 15 atoll censuses between 16 April and 28 August averaged 336 (range 280-377, SD = 29.7) and, excluding pups, 278 (range 222-317, SD = 29.9) (Tables 1, 2, and Fig. 5).

The seasonal fluctuation in atoll census totals was similar in both 1988 and 1989. The least biased comparison between years would use the censuses made during the same months of each year. The counts were lowest in late May and early June for juveniles and subadults and in mid June and July for adults (Figs. 4 and 5). However, atoll counts of adults were lower in 1989, while counts of subadults were lower in 1988. Inconsistent size estimations of seals may have caused this difference, since the sum of adults plus subadults was similar in both years. The highest age/sex class counts coincided with peak molting periods for those groups as observed earlier by Johnson and Johnson (1984).

Counts of adult males were lower than counts of adult females in both years (Fig. 6). The sex ratio of these counts were potentially biased because only females were additionally identified by scars and natural markings. Also, lactating seals were always counted as females even if their teats were not visible, further biasing the counts toward females. Nonetheless, even if all the unknown adults were considered males, the average sex ratio of adults would still be biased towards females.

Tern Island Censuses

Throughout 1988 and 1989, the U.S. Fish and Wildlife Service (FWS) and NMFS personnel conducted weekly censuses of seals on Tern Island (Tables 3 and 4, Figs. 7 and 8). The mean beach count of all seals in 1988 was 72 (range 34-123, SD = 21.3) and, excluding pups, 71 (range 34-118, SD = 19.9) (Table 5). In 1989 the mean totals were 84 (range 48-155, SD = 21.0) and 82 (range 48-151, SD = 19.6) with and without pups, respectively (Table 5).

The highest counts at Tern Island were found to be in late fall and early winter when adult males hauled out to molt. Adult females and subadults and juveniles of both sexes molted at Tern Island during late summer and fall.

Identified Seals

In 1988, observers identified 554 seals: 114 tagged pups (Table 6), 130 adult females, 3 adult males, and 307 tagged seals (1-4 years old) (Table 7). In 1989, the total was 597: 101 tagged pups (Table 8), 137 adult females, 2 adult males, and 358 tagged seals (1-5 years old) (Table 7). The identified seals accounted for an unknown fraction of the total population.

Births

At least 127 pups were born in 1988: 61 females, 54 males, and 12 of unknown sex (Table 6). At least 120 pups were born in 1989: 54 females, 54 males, and 12 of unknown sex (Table 8). Prior to the beginning of the NMFS field season, usual pupping sites were not frequently visited. During the season the smallest islands, Round and Mullet Islands, were not as closely approached as other pupping sites. Consequently, we did not identify every female that pupped and may have missed neonatal deaths or disappearances of prematurely weaned pups.

During both years, an average of 50% of pups were born on East Island and 40% on Whaleskate and Round Islands (Tables 6 and 8). Remaining pups were born on Little Gin, Gin, Trig, Tern, and Mullet Islands in 1988 and Little Gin, Gin, Trig, Tern, and Shark Islands in 1989 (Fig. 1). In 1989, for the first time in at least 47 years (Kenyon 1972, NMFS unpublished data), a pup successfully weaned on Tern Island.

During 1988 and 1989, 114 and 101 pups were tagged, respectively. The mean axillary girth for pups tagged within 2 weeks of weaning was 105 cm in 1988 ($N = 62$, $SD = 11.8$) (Table 6), and 102 cm in 1989 ($N = 37$, $SD = 13.2$) (Table 8). The mean length of these pups was 126 cm in 1988 ($N = 63$, $SD = 8.6$) (Table 6), and 125 cm in 1989 ($N = 37$, $SD = 8.8$) (Table 8).

In 1988 and 1989, 46 and 47 parturient females, respectively, were known to have pupped in the preceding year (Henderson in prep., Tables 9 and 10). For 12 females whose exact pupping dates were known for 1987 and 1988 the mean interval between births was 382 days ($SD = 13.6$). For 16 females whose exact pupping dates were known for 1988 and 1989 the mean interval between births was 374 days ($SD = 16.5$).

A 5-year-old female pupped at FFS in 1989. This is the earliest recorded age of first reproduction in the Hawaiian monk seal (Johanos et al. 1990). She was the only one of 29 5-year-old females in her cohort known to have pupped.

Pup Fostering

In 1988, at least 7 pups were fostered by mothers other than their own. Observers united two abandoned pups with females that

had recently lost their pups (Gerrodette et al. 1992). A description of the circumstances and location of these natural and human-assisted fosterings follows.

Case 1. The sizes of pups at East Island attended by females Y563 and Y227 changed dramatically between 15 and 25 July, suggesting that these females were fostering other seals' pups.

Case 2. Between 23 and 24 May at Whaleskate Island adult females Y022, Y150, and Y059 had exchanged pups. The result was that Y022 had no pup, Y150 had either Y022's or Y059's pup, and Y059 had two pups--either Y022's or its own pup, plus Y150's pup. On 25 May the circumstances were the same except that Y059 had rejected YF61, one of the two pups. Consequently, we placed YF61 2 m from female Y022. This pup vocalized, Y022 approached and presented its ventral, and YF61 began suckling.

Case 3. Between 25 and 26 May, Y022 switched pups with Y072 at Whaleskate Island. At weaning from Y072, YF61's girth was normal.

Case 4. An abandoned pup, YF82, had been separated from its mother at Whaleskate Island on 15 June and was found 3.4 miles away at Tern Island on 16 June. This pup was returned to Whaleskate Island the same day and introduced to a recently lactating female, Y061, without her own pup. She rejected the pup mildly at first but subsequently nursed and weaned it.

In 1989, at least 9 pups were fostered by mothers other than their own. A description of the circumstances and locations of these fosterings follows.

Case 1. Y523 had a male pup on 22 April and a female pup on 20 May at East Island.

Case 2. The neonatal pup of E17-89 died (death No. 31FFS89) on East Island 28 April. Later that day E17-89 accepted Y610's pup, YU03. On 30 April, E17 had rejected the pup. Pup YU03 was collected for rehabilitation.

Case 3. Female Y576 switched pups with female Y575 on 1 May at East Island.

Case 4. Female Y063 switched with female Y576 (who was fostering female Y575's pup) on 2 May. Y063's neonatal pup (now with female Y576) was not seen after 2 May (death No. 32FFS89).

Case 5. Observers found female Y583 at Trig Island on 5 May with two pups--both hers and female Y623's. On 30 May Y583 had her pup and Y623's pup had weaned.

Cases 6 and 7. The disparity between 2 June and 6 June in the size of pups being nursed by female's Y272 and Y521 at East Island suggested that these females were fostering other seals' pups.

Case 8. On 17 July, recently parturient female Y209 was fostering an unusually large pup on East Island. Y209's pup was separated from her on 9 July. Her smaller pup remained separated and subsequently disappeared on 10 August (death No. 27FFS89).

Survival to Weaning

In 1988 and 1989, the survival of pups from birth to weaning was 98% (118 of 121) and 87% (101 of 116), respectively (Tables 6 and 8). Between 20 May and 10 August, in both years, East Island was inspected on average once every 3 days and other pupping islets except Whaleskate Island were inspected once every 8 days. Whaleskate Island was inspected once every 4 days in 1988 and once every 7 days in 1989. During this comparable effort one pup was found dead in 1988, whereas 2 pups were found dead and 4 had disappeared in 1989.

Pups Collected for Rehabilitation

Observers collected 8 and 3 recently weaned and tagged female pups in 1988 and 1989, respectively, with axillary girths below 90 cm. They were transported to NMFS's Kewalo Research Facility on Oahu in 1988 and to Sea Life Park on Oahu in 1989. (See Tables 6 and 8 for tagging/collection dates and weaning islands; see Appendixes A and B for transportation dates.)

Survival Through the First Full Year

The minimum survival through the first full year of pups tagged in 1987 and 1988 was 92% (98 of 106) and 68% (78 of 114), respectively (Table 11). These survival rates include seals sighted in 1989, 1990, and 1991 (NMFS, unpublished data). In order to standardize survival calculations, the female pups collected for rehabilitation are included in the tagged total but were considered to be dead in subsequent years.

Retagging

During 1988, observers replaced broken or lost tags on 4 immature seals (Table 12), and during 1989 tags were replaced on 48 seals (Table 13). Effort had been increased in 1989, compared to 1988. Thirty-three of the 48 retagged in 1989 were originally tagged in 1986, a year when the tags were engraved too deeply and were observed to break easily.

Inter-island Movement Between Laysan Island and FFS

During 1988, 2 adult males moved from Laysan Island to FFS (Table 14). Between 1987 and 1988 a male, born at Laysan Island in 1985, moved from Laysan Island to FFS and 2 males, born at FFS in 1984 and 1986, moved to Laysan Island from FFS. Between 1986 and 1988 a male, born at Laysan Island in 1984, moved from Laysan Island (Johanos et al. 1990) to FFS.

During 1989, 2 adult females moved from Laysan Island to FFS and a male, born at FFS in 1984, moved to Laysan Island from FFS (Becker et al. in prep., Table 14). One of these adult females pupped at FFS in 1989, the other had pupped at FFS at least 4 times previously but apparently did not pup there in 1989. Both females returned to Laysan Island in 1989. One male, born at Laysan Island in 1986, moved from Laysan Island to FFS between 1988 and 1989.

Entanglements and Rescues

In 1988, one seal was found entangled in debris (Table 15). This juvenile female had a plastic screen cone around her neck on Shark Island, 13 June. An unsuccessful attempt was made to remove the cone, but later that day the cone was removed when the seal hauled out on Tern Island. She was not injured.

In 1989, six seals were found entangled in debris (Table 15) and a seventh seal, not entangled, was stranded on the runway at Tern Island. A description of these seven cases follows.

Case 1. On 15 January (Tern Island, sector 1), two FWS personnel restrained a yearling male (YF59) and removed a net fragment from around his neck and torso. His movement had been partially restricted, but he was not injured.

Case 2. On 10 April (East Island, sector 7), a weanling male (YU01) was at the water's edge with a piece of copper wire loosely around his neck. This wire was part of the debris left on East Island from the LORAN station vacated in 1952. We removed the wire without restraining the seal. There was no injury.

Case 3. On 12 April (Tern Island, sector 4) an adult male had a 12 mm-wide nylon reinforced packing band snugly around his mid-torso. We removed the band with a hook on a long pole. There was no apparent injury, but the band had begun to wear away hair on his ventral side, leaving a mark that was visible the following day.

Case 4. On 8 May (Tern Island, sector 2), an adult male had a ring of 18 mm-diameter polypropylene line snugly around his mid-torso. We cut off the line without restraint. There was no apparent injury.

Case 5. On 11 June (Whaleskate Island, sector 1) a lactating adult female (W24-89) had a 10 mm-diameter nylon line very loosely around her neck. We collected the line after it fell off.

Case 6. On 14 June (Tern Island) a 2-year-old male (Y494) was on the runway at Tern Island, apparently unable to find his way back to the beach. We guided him toward the beach. He then moved to the water's edge and into the water 10 minutes later.

Case 7. On 5 July (Tern Island, sector 4) a subadult of unknown sex had a 12 mm-wide nylon-reinforced packing band snugly around its neck. We removed the band with pruning shears without restraining or disturbing the seal. There was no apparent injury.

Injuries

Observers discovered 37 injured seals in 1988 (Table 16). Conspecifics injured 20 seals (54%). Eight of these injuries were large--probably from multiple male mating attempts. Sharks caused 8 injuries (22%): 4 from the cookie cutter shark (*Isistius brasiliensis*) and 4 severe injuries from larger sharks. The cause of the remaining 10 injuries (27%) could not be determined.

In 1989, 97 injuries to 94 seals were observed (Table 17). Conspecifics inflicted 22 injuries (20%) of which 5 were probably from multiple male mating attempts. Sharks caused 35 injuries (40%): 5 from the cookie cutter shark and 30 more severe injuries from larger sharks. Propeller strikes likely caused 11 injuries (10%). Another seal (injury No. 21) had its mandible severely damaged (immobile and twisted), a very unusual injury, apparently caused by a blow to its head. This male seal also had dorsal lacerations from mounting attempts by other seals. The cause of 29 (30%) injuries could not be determined.

Injuries were considered to be from propeller strikes when they were deep, had smooth edges, were slightly curved and lacked other lacerations near the injury (a shark bite typically has more than one tooth mark when lacerations are deep), or were uniformly spaced parallel gashes. One seal, apparently injured by a propeller (injury No. 09), was a pregnant female that pupped prematurely on Tern Island (only 321 days had passed since she had pupped the year before). She did not respond to her live pup, which subsequently drowned.

The 8 large, seal mating injuries observed in 1988 were inflicted on 7 adult females and 1 subadult female (Table 16). One adult female (injury No. 19) had weaned a pup between 26 May and 1 June and was severely injured on 23 June (22-28 days later). She successfully weaned a pup born 22 May 1989 (333 days after the injury). Another very severely injured adult female

(injury No. 24) was not seen after the injury or in 1989 and is probably dead. Four juveniles and 3 weaned pups were injured in 1988 on their dorsa from seal bites.

In 1989, the seals injured from multiple male mating attempts included a 4-year-old female (injury No. 65), two 5-year-old females (injuries No. 52 and 57), a 3-year-old male (injury No. 50), and an adult of unknown age and sex (injury No. 22) (Table 17). One of the 5-year-old females was Y335, the first 5-year-old known to have pupped at FFS. She was first observed with the fresh injury 37-48 days after weaning her pup. Nine other females (6 subadults and 3 adults, injuries No. 36, 41, 42, 43, 45, 48, 53, 55, 71) had less severe injuries likely associated with mating. Four weaned pups (injuries No. 72, 73, 75, 76) sustained dorsal injuries in 1989 at Whaleskate Island, probably from seal bites.

In December 1988, large, shark-inflicted wounds were observed on 3 juveniles and 1 weaned pup. In 1989, 30 seals had shark-inflicted injuries, including 12 adults, 5 subadults, 9 juveniles, and 4 weaned pups. Three of the injuries to weaned pups and 4 other bite injuries were inflicted in November and December of 1989 and observed on Tern Island. Only Tern Island was consistently censused by the FWS during this period in both years.

In 1988 and 1989, islands were visited at a similar rate between 21 May and 7 August. During that period, we observed 3 large shark-inflicted wounds in 1988, and 10 in 1989, suggesting an increase in shark attacks.

Deaths--1988

Between 11 April and 19 December, 1988 observers found five dead seals (Table 18). Information relating to these 5 deaths follows.

Case 1. Yearling female, YN42, found 23 May on Whaleskate Island (sector 1). Body condition was emaciated, the blubber thickness at the base of the sternum was 6 mm (the most emaciated seals are usually between 4-5 mm). She had a gash across the top of the snout and the right eye protruded unusually. There was evidence of hemorrhaging around the skull. She was last seen alive on 27 April at Whaleskate Island.

Case 2. Yearling male, YN23, found 20 July on Tern Island (sector 9). Body condition was nearly emaciated; blubber thickness at the base of the sternum measured 8 mm. The lungs contained frothy liquid, suggesting drowning. There were also various lacerations, gashes, and punctures, probably from shark bites. None of these injuries appeared deep enough to be life threatening. The stomach lining was slightly ulcerated. The

stomach contained numerous nematodes, parts of a lobster, and one octopus beak. The intestines were relatively full of digested food and contained at least one tapeworm. The seal was last seen alive without injuries on Shark Island on July 15. At that time he was thin.

Case 3. Newborn pup of unknown sex, YFX1, found 30 May on Whaleskate Island (sector 3). It had been dead at least 1 day. Its mother, Y206, was less than 2 meters away. The pup was very decomposed by the time Y206 left it. The pup was not necropsied.

Case 4. Newborn pup of unknown sex, YFX2, found 17 November by FWS personnel on Tern Island (sector 1). It was not necropsied.

Case 5. Newborn pup of unknown sex, YFX3, found 19 December on Tern Island (sector 1). It was not necropsied.

Deaths and Disappearances--1989

Between 3 February and November, 1989, 34 seals had either died or disappeared and were presumed dead (Table 18).

Deaths--1989

Information relating to 27 deaths follows.

Case 1. Yearling male, YF82, found 27 March on Tern Island (sector 4) with a large, fresh shark bite wound in the muscle layer just behind his left foreflipper. There was a trail of blood leading from the water up to the beach crest where the dead seal lay. The blubber thickness at the base of the sternum measured 7 mm. There were ulcers on the stomach wall, and the stomach contained 50-100 nematodes, two octopus beaks, and a few very small fish bones. The large intestines were full. He was seen alive without the wound on 26 March at Tern Island and his condition was thin, but not emaciated.

Case 2. Newborn female pup, YUX1, found 4 April on Tern Island (sector 4). The skin around the pup's umbilicus had pulled partially away so that her intestines had begun to protrude. The pup's mother, Y009, did not leave the vicinity for two days. YUX1 was decaying and therefore, not examined.

Case 3. Yearling female, YF15, found by FWS personnel on 3 February on Tern Island. She was seen alive, emaciated, and breathing laboriously, on 26 January on Tern Island. She was necropsied, and FWS personnel found that the gastrointestinal tract was empty.

Case 4. Yearling male, YF57, found desiccated by FWS personnel between 24 March and 31 March on Whaleskate Island (sector 5). He was last seen alive and emaciated on 26 January on Tern Island. YF57 was not necropsied.

Case 5. Newborn male pup, YUX2, found drowned 10 April on Tern Island (sector 3). YUX2 had followed his severely injured mother (injury No. 9, table 17) to the water's edge. The pup was not necropsied.

Case 6. Adult of unknown sex (no baculum was recovered, so it was assumed to be a female) found desiccated on 1 April on Whaleskate Island (sector 6). It was not necropsied.

Case 7. Yearling female, YF38, found bloated on 17 April on East Island. The seal was last seen alive on 30 March at East Island. YF38 was not necropsied.

Case 8. Newborn female pup, YUX3, found decayed on 17 April on East Island (sector 1). She still had 18-20 cm of her umbilicus. YUX3 was not necropsied.

Case 9. Two-year-old male, YN30, found desiccated on 16 April on Trig Island (sector 2). He was last seen alive on 9 December, 1988. YN30 was not necropsied.

Case 10. Juvenile male, untagged, found bloated on 11 April on Disappearing Island. There were only small cuts on the side of his head. He was not necropsied.

Case 11. Subadult male, untagged, found desiccated on 11 April on Disappearing Island. He was not necropsied.

Case 12. Subadult, untagged and of unknown sex, found decayed on 17 April on Disappearing Island.

Case 13. Newborn pup, YUX4, found on 22 April on East Island (sector 1). Its mother, Y574, was still less than 1 meter from the pup and very alert. YUX4 was not collected.

Case 14. Neonatal pup, YUX5, found on 4 May on Little Gin Island (sector 2). Its mother, Y382, remained 2 meters from the pup and alert. YUX5 was not collected.

Case 15. Three-year-old female, YL07, found desiccated on 17 April on Disappearing Island. FWS personnel had last seen her alive at Tern Island on 6 October 1988. YL07 was not necropsied.

Case 16. Neonatal pup, YUX6, found on 12 May on Whaleskate Island (sector 2). Its mother (W16-89) remained 3 meters away. YUX6 was not necropsied.

Case 17. Nine-day-old female pup, YUX7, found on 20 May on Tern Island (sector 3). Her mother, Y617, had appeared on Tern Island on 8 May with fresh shark-bite wounds (injury No. 27, Table 17). Y617 refused to nurse her pup during the evening of 19 May. When the pup was found dead, her stomach and intestines contained a small amount of viscous fluid and her anus was covered with feces. Blubber thickness at the base of the sternum measured 4.5 mm. Cause of death was unknown.

Case 18. Yearling female, YF96, found on 25 May on Tern Island (sector 8). Her body condition was thin but not emaciated, and blubber thickness at the base of her sternum measured 7 mm. Both the stomach and intestines contained numerous parasites and some digested food material. A 1-cm-diameter hole in the bone at the top of its skull appeared eroded on the edge as if old. She was last seen alive at Trig Island on 5 May. Cause of death was unknown.

Case 19. Yearling female, YF23, found decayed on 30 May on Trig Island (sector 1). The right foreflipper was lacerated, probably from a shark bite. She was emaciated on 18 May on Trig Island. YF23 was not necropsied.

Case 20. Adult male found on 11 June on Trig Island (sector 1). His body condition was emaciated, his teeth were very worn, and his blubber and fat both measured 10 mm at the base of the sternum. Stomach wall ulcers were not perforated. The stomach contained only numerous nematodes. The intestines contained a few small fish bones and nematodes. The seal's cause of death appeared age related.

Case 21. Two-year-old female, YN98, found on 25 June on Whaleskate Island (sector 4). Body condition was emaciated. She was alive on 14 June at Disappearing Island. YN98 was not necropsied.

Case 24. Three-year-old male, YL84, found on 21 July at Tern Island (sector 9). Body condition was emaciated. Small nematodes inundated the walls of his small intestines. Stomach wall ulcers were not perforated. The stomach contained numerous nematodes and a few fish bones. He was alive on 15 June at Whaleskate Island. Cause of death was unknown.

Case 26. Three-day-old female pup, YUXA, found decayed by FWS personnel on 3 August on East Island (sector 2). On 6 August her mother, Y459, was seen fostering a recently weaned pup, YU70. A brief necropsy revealed that the stomach contained only a small amount of thin fluid while the intestines were full of a viscous, yellow matter. Cause of death was unknown.

Case 28. Adult female, Y519, found on 22 August near Tern Island (sector 1). An adult male copulated with the carcass in shallow water at this time. Y519 had successfully weaned a pup between

2 June and 4 June. She was alive, 30% molted, and thin on 10 August at Tern Island. She had a few minor, fresh scratches on her dorsum and sides that were probably from the necrophilic male. Blubber and fat thickness at the base of the sternum measured 12 mm and 15 mm, respectively. The stomach lining had a few unperforated ulcers. The stomach contained only a small number of parasites. The small and large intestines were partially full of a yellow viscous fluid. The thoracic cavity around the lungs contained approximately a liter of thin, translucent, blood-colored liquid. She may have drowned.

Case 29. Immature, unknown sex, observed being attacked by large sharks on 25 August near East Island. From the length of the attack and the violence, blood, and "flying parts" observed, the observer concluded the seal had been killed.

Case 33. Four-year-old male, Y434, found by FWS personnel on 24 October on Tern Island (sector 6). His body condition was emaciated. The left jaw was severely injured, and there were a series of three parallel gashes on his rump, probably caused by a propeller.

Case 34. Newborn pup, YUXF, found by FWS personnel in November on Tern Island (sector 3). YUXF was not necropsied.

Disappearances--1989

Information relating to 7 disappearances follows.

Case 22. Prematurely weaned male pup, YU22, tagged 12 June on Whaleskate Island (sector 5). He was subsequently not seen and was presumed dead.

Case 23. Prematurely weaned male pup, YUX8, disappeared after 7 July from Whaleskate Island (sector 4). On 27 June, a thin adult female (W24-89) had a small male pup at the opposite end of the island from sector 4. W24-89 was subsequently not seen on the island, and there were no abandoned pups seen after 7 July. YUX8 was presumed dead.

Case 25. A nursing pup, YUX9, disappeared between 10 and 18 July from Shark Island. YUX9 was first observed 10 July with its severely injured mother Y011 (injury No. 56, Table 17). On 18 July, Y011 was on Tern Island, without a pup. There were no abandoned pups on Shark Island. The pup was presumed dead.

Case 27. Prematurely weaned male pup, YUXB, disappeared around 10 August from East Island. On 8 July YUXB was separated from his mother and subsequently never paired with a lactating female.

Case 30. One- to 3-day-old pup, YUXC, disappeared between 11 and 17 April from East Island. Its mother (Y630) was not on the island. No abandoned pups were observed on 17 April. YUXC was

presumed dead. Y630 was seen at East Island on 29 April without her pup.

Case 31. Newborn pup, YUXD, disappeared between 27 and 28 April from East Island (sector 5). YUXD tried to approach its mother (E17-89) 2 meters up a steep berm. Five minutes later both were in the water 10 meters from the beach. This unusually small adult female followed her pup as the current carried it away from the island. She did not attempt to guide or pull the pup back to shore. On 28 April, we found E17-89 without a pup. No abandoned pups were on the island. YUXD was presumed dead.

Case 32. Nursing pup, YUXE, disappeared after 2 May from East Island (sector 1). A nursing pup, YU26, belonging to adult female Y575 was abandoned after a pup switch with another lactating adult female, Y576, earlier in the day. YU26 found the newly parturient female Y063 and displaced her 2-day-old pup YUXE. YUXE disappeared and was presumed dead.

Conclusions

The number of seals counted on the beaches and pup production between 1988-1989 was the highest recorded at FFS. The minimum numbers of pups born from 1983-1986 was 98, 106, 96, and 108, respectively (Gilmartin et al. in press) compared to 121, 127, and 120 for 1987-1989.

Although it appears this population continues to grow, there are indications of instability: (1) a larger number of undersized weaned pups in 1988--8 compared to 3 in 1986 and 0 in 1987, (2) fewer pups survived to weaning in 1989 compared to 1988, and (3) fewer pups that weaned in 1988 survived the first year--68% compared to a mean of 90% for the 1984-87 weaned pups.

Of 10 1- through 4-year-olds found freshly dead in both years, all had been considered thin or emaciated just prior to or at the time of death, suggesting some food or disease related stress. There may also have been an increase in shark attacks in 1989 affecting mortality rates. Importantly, incidents of propeller injuries and human interactions (injury No. 21, Table 17) were observed that present serious, though previously unrecognized, impediments to the Hawaiian monk seal's recovery.

ACKNOWLEDGMENTS

We gratefully acknowledge the support and data collection contributions of the staff and volunteers of the U.S. Fish and Wildlife Service, Hawaiian Islands National Wildlife Refuge, especially R. Bauer, S. Hall, D. Hu, J. Kenyon, K. McDermond, J. Megyesi, and C. Rowland. We also thank P. Dye, J. Licciardi, A. Marks, and R. Withrow, all volunteers for the NMFS. Thanks also go to K. Turner, S. Scott, and C. Thomas for their assistance. Finally, we thank the captains and crews of the

fishing vessel *Feresa*, sailing vessel *Climax*, NOAA ship *Townsend Cromwell*, and the air service of both Hawaiian Sky Tours and Pearl Pacific Enterprises.

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TABLES

Table 1.--Atoll censuses of French Frigate Shoals in 1988 and 1989 (M = male, F = female, and U = unknown).

Date ^a	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-pup	Pup	Grand
1988															
5/27	27	64	35	10	14	20	20	31	5	9	12	44	227 ^b	65	292
6/ 1	29	60	34	14	12	16	32	28	15	13	6	44	240	63	303
6/12	28	49	49	10	11	25	13	12	14	16	13	48	211	77	288
6/17	24	48	44	17	15	21	21	23	14	14	7	37	228 ^b	58	286
6/24	20	68	45	13	12	22	26	19	10	21	15	43	236 ^b	79	315
6/30	22	68	52	16	24	14	27	27	6	14	9	48	256	71	327
7/10	17	71	37	18	25	35	20	16	4	24	20	40	243	84	327
7/14	25	54	58	27	27	29	27	25	8	16	16	41	280	73	353
1989															
4/16	35	52	33	18	33	26	55	56	7	1	3	12	317	16	333
4/24	27	51	31	36	23	32	50	45	15	4	4	18	311	26	337
5/ 4	26	66	31	33	30	21	38	33	3	2	5	33	282	40	322
5/11	38	60	27	20	25	22	40	32	8	5	4	31	273	40	313
5/29	28	59	27	28	19	10	31	19	5	8	11	34	227	53	280
6/14	13	59	11	34	28	15	31	22	8	24	17	29	222	70	292
6/26	16	45	21	23	15	48	25	16	30	22	17	43	239	82	321
7/ 9	15	64	7	46	45	21	35	36	7	25	18	36	276	79	355
7/19	11	62	19	32	32	49	40	35	25	27	23	22	305	72	377
7/26	15	53	30	36	28	42	39	32	14	32	15	29	289	76	365
8/ 3	19	45	39	31	32	47	36	31	18	29	18	29	298	76	374
8/ 9	20	49	25	37	44	35	44	35	5	27	18	23	294	68	362
8/13	7	46	22	39	35	31	46	37	17	26	17	16	280	59	339
8/21	19	50	23	42	31	33	52	38	13	17	28	4	301	59	360
8/27	17	44	22	32	25	23	46	37	9	24	20	9	255	53	308

^aDate refers to first day of the 2-day atoll census.

^bTotal includes one seal not assigned specific age class.

Table 2.--Summary statistics of atoll censuses in 1988 and 1989 (M = male, F = female, and U = unknown).

Date	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-pup	Pup	Grand
1988															
Mean	24.0	60.2	44.2	15.6	17.5	22.8	23.2	22.6	9.5	15.9	12.2	43.1	240.1	71.2	311.4
Std.dev.	4.1	9.0	8.6	5.5	6.6	6.8	5.9	6.5	4.4	4.7	4.8	3.8	20.8	8.8	23.5
1989															
Mean	20.4	53.7	24.5	32.5	29.7	30.3	40.5	33.6	12.3	18.9	57.9	24.5	277.9	57.9	335.9
Std.dev.	8.8	7.4	8.3	7.8	8.1	12.2	8.4	9.8	7.7	11.2	7.5	11.0	29.9	20.0	29.8

Table 3.--Censuses of Tern Island in 1988 (M = male, F = female, and U = unknown).

Date	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-pup	Pup	Grand
1/ 5	13	18	14	23	2	15	10	6	2	0	0	0	103	0	103
1/12	8	13	17	8	7	0	5	6	5	1	0	1	69	2	71
1/19	11	7	15	8	3	4	4	2	0	0	0	0	54	0	54
1/27	19	15	16	11	6	5	3	7	0	0	0	0	82	0	82
2/ 3	22	16	17	7	6	1	0	4	0	0	0	0	73	0	73
2/ 9	18	12	14	7	6	1	2	4	0	0	0	0	64	0	64
2/16	22	10	15	10	4	5	4	5	2	0	0	0	77	0	77
2/24	17	14	11	11	5	2	6	4	0	0	0	0	70	0	70
3/ 1	9	12	13	10	8	4	3	3	0	0	0	0	62	0	62
3/ 8	10	9	12	10	12	4	7	3	1	0	0	0	68	0	68
3/15	19	10	3	16	11	9	8	7	1	0	0	0	84	0	84
3/22	22	6	11	8	0	2	5	5	0	0	0	0	59	0	59
3/29	8	9	5	10	6	1	5	6	0	0	0	0	50	0	50
4/ 5	11	11	12	11	4	3	3	6	3	0	0	0	64	0	64
4/12	7	9	6	8	4	8	2	8	4	0	0	0	56	0	56
4/20	13	4	20	4	7	9	6	7	3	0	0	0	73	0	73
4/24	11	6	12	4	7	5	0	3	0	0	0	0	48	0	48
4/25	11	10	10	6	3	4	3	1	0	0	0	0	48	0	48
4/26	15	11	8	6	5	1	3	0	0	0	0	0	49	0	49
5/ 2	12	10	20	2	2	3	8	1	1	0	0	0	59	0	59
5/ 4	10	8	16	3	4	1	4	5	1	0	0	0	52	0	52
5/ 6	13	8	16	1	6	2	3	3	2	0	0	0	54	0	54
5/ 7	7	14	9	5	2	3	3	3	0	0	0	0	46	0	46
5/10	11	4	20	5	3	3	1	3	0	0	0	0	50	0	50
5/11	18	5	10	7	4	1	3	4	0	0	0	0	52	0	52
5/15	10	7	19	8	5	11	2	3	1	0	0	0	66	0	66
5/22	10	7	3	4	6	1	2	2	0	0	0	0	35	0	35
5/28	10	5	12	6	6	8	5	5	0	0	0	0	57	0	57
6/ 2	7	7	8	7	7	4	6	5	0	0	0	0	51	0	51
6/ 8	8	5	7	0	3	6	1	4	0	0	0	0	34	0	34
6/13	13	9	19	3	1	3	2	2	0	0	0	0	52	0	52
6/18	7	9	13	8	4	8	1	4	2	0	0	0	56	0	56
6/25	7	15	16	4	3	6	6	1	1	2	0	0	59	2	61
7/ 1	8	15	16	10	12	5	2	4	0	0	0	0	72	0	72
7/10	4	13	17	6	6	17	6	0	0	0	0	0	69	0	69
7/15	12	17	10	18	7	17	5	4	2	0	1	0	92	1	93
8/ 6	8	14	16	10	6	5	3	7	1	1	2	0	70	3	73
8/12	9	6	24	9	11	14	6	5	1	0	1	1	85	2	87
8/19	10	9	13	9	7	7	1	6	2	0	0	0	64	0	64
8/22	8	10	20	7	8	4	4	9	0	2	1	0	70	3	73
8/28	9	3	28	15	5	12	3	8	1	2	0	0	84	2	86
9/ 9	2	3	1	21	4	13	7	5	0	1	0	0	56	1	57
9/15	5	3	4	26	6	12	5	6	1	1	0	0	68	1	69
9/22	0	1	1	21	9	15	4	5	2	0	2	0	58	2	60
9/29	17	13	28	7	2	4	3	4	0	0	1	1	78	2	80
10/ 6	1	1	10	4	6	37	2	4	0	0	3	1	65	4	69

Table 3.--Continued.

Date	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non- pup	Pup	Grand
10/13	12	2	11	32	5	19	7	5	1	2	4	0	94	6	100
10/20	6	3	6	26	6	44	10	10	0	4	4	0	111	8	119
10/27	17	7	34	19	4	30	2	5	0	2	3	0	118	5	123
11/ 3	14	8	40	13	3	22	4	4	0	1	1	0	108	2	110
11/10	22	4	37	13	2	9	8	5	2	3	2	2	102	7	109
11/17	13	5	31	8	7	11	5	4	0	0	1	0	84	1	85
11/24	12	7	21	10	6	30	5	4	1	1	1	1	96	3	99
12/ 1	18	12	23	17	4	8	6	2	3	2	2	0	93	4	97
12/ 8	24	10	29	10	3	7	6	4	1	3	3	1	94	7	101
12/15	17	11	18	11	5	14	7	8	0	1	1	0	91	2	93
12/22	21	14	22	13	16	6	13	9	4	1	3	0	118	4	122
12/29	15	14	16	12	2	8	2	7	0	0	3	0	76	3	79

Table 4.--Censuses of Tern Island in 1989 (M = male, F = female, and U = unknown).

Date	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-Pup	Pup	Grand
1/13	18	11	22	7	7	3	6	4	1	0	0	0	79	0	79
1/18	21	10	28	8	6	2	1	5	1	0	0	0	82	0	82
1/26	20	12	25	7	6	7	6	6	1	0	0	0	90	0	90
2/ 2	23	11	12	7	6	4	6	7	0	0	0	0	76	0	76
2/ 9	16	13	9	6	4	3	1	6	0	0	0	0	58	0	58
2/16	19	10	21	14	10	2	6	8	4	0	0	0	94	0	94
2/23	22	15	16	5	3	3	4	3	0	0	0	0	71	0	71
3/ 2	27	10	10	9	11	2	7	7	0	0	0	0	83	0	83
3/ 9	15	7	7	6	7	14	6	6	1	0	0	0	69	0	69
3/16	9	12	8	9	7	2	4	5	0	0	0	0	56	0	56
3/23	10	15	8	13	5	10	8	6	1	0	0	0	76	0	76
3/31	15	8	6	4	7	3	3	4	1	0	0	0	51	0	51
4/ 7	11	13	15	13	10	11	4	8	0	0	0	0	85	0	85
4/13	16	13	8	7	7	2	6	8	1	0	0	0	68	0	68
4/16	16	10	8	2	12	0	10	11	0	0	0	0	69	0	69
4/25	14	10	8	14	6	9	6	4	2	1	0	0	73	1	74
5/ 3	6	11	9	14	5	9	8	3	1	0	0	1	66	1	67
5/ 5	9	15	12	11	7	2	11	7	0	1	0	0	74	1	75
5/12	11	6	10	6	5	7	10	3	1	1	0	1	59	2	61
5/18	12	13	4	9	11	5	7	6	0	1	0	1	67	2	69
5/26	19	16	7	10	7	1	3	9	1	1	0	0	73	1	74
5/30	6	7	8	16	11	6	5	2	2	0	0	0	63	0	63
6/15	5	10	1	14	11	4	8	2	0	1	0	0	55	1	56
6/23	8	14	2	2	9	7	2	3	1	0	0	0	48	0	48
6/27	7	8	5	11	4	16	5	6	2	0	0	0	64	0	64
7/ 7	4	10	4	9	14	6	7	3	0	1	0	0	57	1	58
7/10	4	18	5	14	13	5	7	5	1	1	0	0	72	1	73
7/20	5	15	7	15	14	8	9	8	2	0	0	0	83	0	83
7/27	8	17	12	15	12	8	6	8	3	1	0	0	89	1	90
8/ 4	6	9	16	18	16	23	7	12	3	2	0	0	110	2	112
8/10	11	19	8	18	18	7	6	8	1	1	1	0	96	2	98
8/14	3	15	11	16	17	12	7	6	4	1	3	0	91	4	95
8/22	8	20	6	14	14	10	11	7	3	0	1	0	93	1	94
8/28	7	12	10	12	10	9	11	6	0	1	2	0	77	3	80
9/14	11	15	20	11	8	10	5	2	0	2	1	0	82	3	85
9/22	24	17	19	8	5	3	4	5	0	0	0	0	85	0	85
9/28	15	5	26	8	6	1	8	13	0	1	1	0	82	2	84
10/14	11	15	22	8	7	5	5	9	0	1	1	0	82	2	84
10/19	30	17	25	7	3	0	5	4	1	2	5	0	92	7	99
10/26	26	14	31	6	4	6	7	4	2	1	5	0	100	6	106
11/ 2	27	8	37	4	7	3	5	2	1	1	3	2	94	6	100
11/ 9	36	11	36	1	3	3	3	5	0	1	3	0	98	4	102
11/16	54	18	43	6	9	7	7	6	1	1	3	0	151	4	155
11/24	26	8	49	12	5	5	8	10	1	2	2	0	124	4	128
11/30	29	8	29	5	3	4	6	9	1	2	3	0	94	5	99
12/ 7	29	17	24	10	9	4	9	6	0	1	2	0	108	3	111

Table 4.--Continued.

Date	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-Pup	Pup	Grand
12/14	20	16	37	10	8	9	8	10	1	3	4	1	119	8	127
12/21	21	12	32	6	9	6	6	7	1	1	2	0	100	3	103
12/28	22	15	16	14	8	5	7	3	0	2	1	0	90	3	93

Table 5.---Summary statistics for Tern Island censuses in 1988 and 1989 (M = male, F = female, and U = unknown).

Date	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-pup	Pup	Grand
1988															
Mean	12.0	9.0	15.4	10.1	5.4	8.8	4.3	4.6	0.9	0.5	0.7	0.1	70.6	1.3	71.9
Std.dev.	5.5	4.3	8.5	6.5	2.9	9.0	2.6	2.2	1.2	0.9	1.2	0.4	20.0	2.1	21.5
1989															
Mean	16.2	12.5	16.2	9.6	8.3	6.0	6.3	6.1	1.0	0.7	0.9	0.1	82.0	1.7	83.7
Std.dev.	9.9	3.7	11.6	4.3	3.8	4.4	2.4	2.7	1.1	0.8	1.4	0.4	19.8	2.1	21.2

Table 6.--Summary of pups born in 1988 (M = male, F = female, and U = unknown).

ID	Tag No. ^a		Birth		Weaning		Nursing period (days)	Measurement ^d (cm)			Mother ID	Rehab ^e
	L	R	Date ^b	Islet ^c	Date ^b	Islet ^c		Tag date	AG	SL		
YF00	F00	F100	F				Ea	04/22	109	135		
YF01	F01	F101	M				Ea	04/22	115	133		
YF02	F02	F102	F				WS	04/27	88	130		YES
YF03	F03	F103	F				WS	04/27	98	130		
YF04	F04	F104	F				WS	04/27	100	131		
YF05	F05	F105	M				WS	04/27	104	133		
YF06	F06	F106	M				WS	04/27	107	130		
YF07	F07	F107	M				WS	04/29	87	113		
YF08	F08	F108	F				Ea	04/30	75	125		YES
YF09	F09	F109	F		Ea	04/23-30	Ea	05/01	89	119		YES
YF10	F10	F110	F				WS	05/08	107	128		
YF11	F11	F111	M				Ea	05/16	95	121		
YF12	F12	F112	M				Ea	05/16	107	124		
YF13	F13	F113	F				Ea	05/16	116	137		
YF14	F14	F114	F				WS	05/17	113	138		
YF15	F15	F115	F	<04/21			Tr	05/18	123	131		
YF16	F16	F116	F	<04/22			LG	05/19	102	125		
YF17	F17	F117	F				WS	05/23	97	123		
YF18	F18	F118	F				WS	05/23	84	113		YES
YF19	F19	F119	F	<04/21			Tr	05/24	101	127		
YF20	F20	F120	M				Ea	05/25	98	119		
YF21	F21	F121	F				Ea	05/26	104	129		
YF22	F22	F122	F	<04/22			Gi	05/27	96	127		
YF23	F23	F123	F				Ea	05/27	126	136		
YF24	F24	F124	M				Ea	05/27	97	114		
YF25	F25	F125	F				Ea	05/27	110	125		
YF26	F26	F126	M				Ea	05/30	121	130		
YF27	F27	F127	M				Ea	05/30	125	131		
YF28	F28	F128	M				Gi	06/01	104	124		
YF29	F29	F129	M				Ea	06/01	119	132		

Table 6.--Continued.

ID NO.	Tag No. ^a		Birth		Weaning		Nursing period (days)	Tag date	Measurement ^d (cm)			Mother ID	Rehab ^e
	L	R	Date ^b	Islet ^c	Date ^b	Islet ^c			AG	SL	SL		
YF30	F30	F130	M	WS	06/02	WS	WS	06/02	112	128			
YF31	F31	F131	F					06/06	90	123			
YF32	F32	F132	F				RO	06/08	89	115			YES
YF33	F33	F133	M					06/08	104	131			
YF34	F34	F134	F				RO	06/08	94	127			
YF35	F35	F135	M					06/08	91	117			
YF36	F136	F36	F					06/08	85	111			YES
YF37	F37	F137	M	Ea	06/05-10	Ea	Ea	06/08	108	126			
YF38	F38	F138	F	Ea	06/05-10	Ea	Ea	06/10	92	120			
YF39	F39	F139	M	WS	06/03-11	WS	WS	06/11	109	133			
YF40	F40	F140	M	WS	06/03-11	WS	WS	06/11	95	121			
YF41	F41	F141	F	WS	06/03-11	WS	WS	06/11	110	130			
YF42	F42	F142	M					06/12	71	111			
YF43	F43	F143	M	Gi	06/02-12	Gi	Gi	06/12	97	110		Y558	
YF44	F44	F144	M	Ea	06/11-12	Ea	Ea	06/12	90	120			
YF45	F45	F145	F	WS	06/03-13	WS	WS	06/13	105	119			
YF46	F46	F146	M	WS	06/03-13	WS	WS	06/13	105	123			
YF47	F47	F147	F	Tr	06/03-13	Tr	Tr	06/13	117	129		Y539	
YF48	F48	F148	F	Tr	06/03-13	Tr	Tr	06/13	86	112		Y589	YES
YF49	F49	F149	F	WS	06/14-18	WS	WS	06/18	92	122			
YF50	F50	F150	M	Ea	06/13-18	Ea	Ea	06/18	106	120			
YF51	F51	F151	F	Ea	06/13-19	Ea	Ea	06/19	94	121			
YF52	F52	F152	F	Ea	06/13-19	Ea	Ea	06/21	111	150			
YF53	F53	F153	F	Ea	06/19-21	Ea	Ea	06/21	102	123			
YF54	F54	F154	M	Ea	06/19-21	Ea	Ea	06/21	111	130			
YF55	F55	F155	F	Ea	06/19-21	Ea	Ea	06/21	105	121			
YF56	F56	F156	M	WS	06/14-21	WS	WS	06/21	97	120			
YF57	F57	F157	M	WS	06/14-21	WS	WS	06/21	99	127			
YF58	F58	F158	F	WS	06/14-21	WS	WS	06/21	97	127			
YF59	F59	F159	M	WS	06/22-25	WS	WS	06/25	116	139			

Table 6.--Continued.

ID NO.	Tag No. ^a		Birth		Weaning		Nursing period (days)	Tag date	Measurement ^d (cm)			Mother ID	Rehab ^e
	L	R	Date ^b	Islet ^c	Date ^b	Islet ^c			AG	SL	AG		
YF60	F60	F160	F	WS	06/22-25	WS	WS	06/25	110	127			
YF61	F61	F161	M	WS	06/22-25	WS	WS	06/25	100	121			
YF62	F62	F162	F	Ea	05/17-18	Ea	Ea	06/28	108	130	Y526		
YF63	F63	F163	F	Ea	06/22-28	Ea	Ea	06/28	119	148			
YF64	F64	F164	M	Ea	06/22-28	Ea	Ea	06/28	116	131			
YF65	F65	F165	M	Ea	06/22-28	Ea	Ea	06/28	121	136			
YF66	F66	F166	F	WS	07/03-10	WS	WS	07/10	95	120			
YF67	F67	F167	M					07/10	73	107			
YF68	F68	F168	F					07/11	81	115			
YF69	F69	F169	F	Gi	07/01-11	Gi	Gi	07/11	105	132			
YF70	F70	F170	M					07/14	102	132			
YF71	F71	F171	M					07/14	115	140			
YF72	F72	F172	F					07/14	98	127			
YF73	F73	F173	F					07/14	100	134			
YF74	F74	F174	M					07/14	96	122			
YF75	F75	F175	F					07/14	119	150			
YF76	F76	F176	M	Ea	07/07-14	Ea	Ea	07/14	98	116			
YF77	F77	F177	M	Ea	07/07-14	Ea	Ea	07/14	112	124			
YF78	F78	F178	M	Ea	07/07-14	Ea	Ea	07/14	115	129			
YF79	F79	F179	F	Ea	07/07-14	Ea	Ea	07/14	106	125			
YF80	F80	F180	M	Tr	07/08-10	Tr	Tr	07/15	108	129	Y584		
YF81	F81	F181	M	WS	07/11-15	WS	WS	07/15	91	115			
YF82	F82	F182	M	WS	07/11-15	WS	WS	07/15	115	132			
YF83	F83	F183	M	Ea	07/12-20	Ea	Ea	07/20	116	140			
YF84	F84	F184	F	Ea	07/12-20	Ea	Ea	07/20	116	139			
YF85	F85	F185	F					07/20	80	116			
YF86	F86	F186	F	Ea	07/12-14	Ea	Ea	07/23	118	133	Y286		
YF87	F87	F187	M	Ea	07/12-23	Ea	Ea	07/23	110	128			
YF88	F88	F188	M	WS	07/16-25	WS	WS	07/25	102	120			
YF89	F89	F189	M					07/25	89	124			

Table 6.--Continued.

ID NO.	Tag No. ^a		Birth		Weaning		Nursing period (days)	Tag date	Measurement ^d (cm)			
	L	R	Date ^b	Islet ^c	Date ^b	Islet ^c			AG	SL	ID	Rehab ^e
YFU2			U									
YFU3			U		<08/30		WS					
YFU4			U		<08/30		WS					
YFP1			U	>08/30			Ea					
YFX1			U	05/28-29	WS							Y206
YFX2			U	<11/17	Te							
YFX3			U	<12/19	Te							

^aL = left; R = right.

^bDates are either exact; i.e., 04/21 or ranges: i.e., 04/21-04/23 or before and after; i.e., <08/24 or >08/30 (field observations ended before weaning).

^cIslet abbreviations: Te = Tern, Ea = East, WS = Whaleskate, Tr = Trig, Gi = Gin, LG = Little Gin, and Ro = Round.

^dMeasurement abbreviations: AG = axillary girth, SL = standard length

^eRehab indicates the seals collected and transported to Oahu for rehabilitation and released at Kure atoll.

^fFound dead on this date.

Table 7.--Temple-tagged seals sighted in 1988 and 1989.

Year	Weaned pups	Age (years)				
		One	Two	Three	Four	Five
1988	114	98	77	69 ^a	63 ^b	
1989	101	78	88	69 ^a	63 ^a	60 ^b

^aIncludes 1 seal born on Laysan Island.

^bIncludes 2 seals born on Laysan Island.

Table 8.--Summary of pups born in 1989 (M = male, F = female, and U = unknown).

ID NO.	Tag No. ^a		Birth		Weaning		Islet ^c	Nursing period (days)	Tag date	Measurement ^d (cm)			Mother ID	Rehab? ^e
	L	R	Date ^b	Islet ^c	Date ^b	Islet ^c				AG	SL	Rehab? ^e		
YU00	U00	U100	F	<02/07	Ea	02/15-03/30	Ea		03/30	80	111	E00-89		
YU01	U01	U101	M	<03/30	Ea	03/31-04/10	Ea		04/11	90	130 ^f	E01-89		
YU02	U02	U102	M	<04/01	WS	04/17-25	WS		04/25	94	118	T85F		
YU03	U03	U103	F	<03/30	Ea	04/30	Ea		04/28	87		Y610	YES	
YU04	U04	U104	F	<04/01	WS	04/26-05/05	WS		05/05	105	122			
YU05	U05	U105	M	<03/30	Ea	04/28	Ea		05/11	102	129	Y572		
YU06	U06	U106	F		WS	04/26-05/18	WS		05/18	120	139			
YU07	U07	U107	F		Ea	05/18-20	Ea		05/22	95	122			
YU08	U08	U108	M	<04/11	LG	05/05-11	LG		05/24	104	117			
YU09	U09	U109	F		Ea	05/12-20	Ea		05/24	120	132			
YU10	U10	U110	M	<04/11	LG	05/05-11	LG		05/29	106	121			
YU11	U11	U111	F		Ea	05/21-29	Ea		05/29	118	135			
YU12	U12	U112	M		Ea	05/21-29	Ea		05/29	108	129			
YU13	U13	U113	F		WS	05/19-30	WS		06/04	108	123			
YU14	U14	U114	M		WS	05/19-30	WS		06/04	103	119			
YU15	U15	U115	M		Ea	05/21-06/02	Ea		06/05	135	138			
YU16	U16	U116	F	04/29	Ea	06/03	Ea	35	06/05	103	119			
YU17	U17	U117	F	04/14-05/05	Tr	05/31-06/07	Tr	26-54	06/11	92	118			
YU18	U18	U118	M	04/30	Ea	06/06	Ea	37	06/11	104	120			
YU19	U19	U119	M		WS	05/19-06/11	WS		06/11	108	125			
YU20	U20	U120	F		WS	05/19-06/11	WS		06/11	102	127			
YU21	U21	U121	M		WS	05/19-06/11	WS		06/11	105	123			
YU22	U22	U122	M		WS	05/31-06/04	WS		06/11	84	116			
YU23	U23	F123	F		WS	05/19-06/11	WS		06/11	123	136			
YU24	U24	U124	M	04/20	Te	05/27	Te	37	06/12	90	117			
YU25	U25	U125	M	05/01	Ea	06/12	Ea	42	06/14	103	127			
YU26	U26	U200	M	04/28	Ea	05/31	Ea	33	06/14	84	117			
YU27	U27	U127	F	04/27	Ea	06/14	Ea	48	06/14	123	138			
YU28	U28	U128	F	<04/22	Ea	05/26	Ea		06/17	105	135			
YU29	U29	U129	F		Ea	06/03-14	Ea		06/17	98	124			

Table 8.--Continued.

ID NO.	Tag No. ^a		Birth		Weaning		Islet ^c	Nursing period (days)	Tag date	Measurement ^d (cm)			Mother ID	Rehab? ^e
	L	R	Date ^b	Date ^b	Date ^b	Date ^b				AG	SL	SL		
YU30	U30	F			WS	05/19-06/11	WS		06/25	102	138			
YU31	U31	M	04/18-24		LG	05/12-29	LG	18-41	06/26	106	136 ^e	Y555		
YU32	U32	F	05/22		Ea	06/22-07/04	Ea	31-43	06/26	103	131	Y147		
YU33	U33	M	04/23-30		Ea	06/19	Ea	50-57	06/26	113	134			
YU34	U34	M	<04/16		Tr	05/19-30	Tr		06/27	95	115	Y623		
YU35	U35	M			WS	06/16-27	WS		06/27	106	119			
YU36	U36	M			WS	06/16-27	WS		06/27	118	129			
YU37	U37	M			WS	06/16-27	WS		06/27	102	124			
YU38	U38	M			Ea	06/03-28	Ea		06/28	91	120			
YU39	U39	M			Ea	06/03-28	Ea		06/28	95	129			
YU40	U40	F	05/05-30		Tr	06/26-27	Tr	27-53	06/28	80	108	Y264	YES	
YU41	U41	M							07/04	78	109			
YU42	U42	M	05/06		Ea	06/18-20	Ea	43-45	07/04	113	132	Y266		
YU43	U43	F	05/13		Ea	06/17	Ea	35	07/04	106	130	Y272		
YU44	U44	M			Tr	07/06-07	Tr		07/07	106	131			
YU45	U45	F			WS	06/16-27	WS		07/07	110	129			
YU46	U46	M			WS	06/16-27	WS		07/07	112	127			
YU47	U47	M	05/12-29		LG	06/27-07/09	LG	29-58	07/09	103	134	Y022		
YU48	U48	F	05/12-29		Gi	06/27-07/09	Gi	29-58	07/09	83	124	G02-89	YES	
YU49	U49	F			WS	06/16-27	WS		07/10	103	130			
YU50	U50	M			Ea	06/15-07/04	Ea		07/15	102	118			
YU51	U51	M	06/01		Ea	06/15-07/04	Ea	14-33	07/16	95	115			
YU52	U52	M			Ea	06/15-07/04	Ea		07/16	114	130			
YU53	U53	M			Ea	06/15-07/04	Ea		07/19		120			
YU54	U54	M							07/19	80	122			
YU55	U55	F							07/19	104	131			
YU56	U56	F							07/19	88	127			NO
YU57	U57	M							07/19	97	135			
YU58	U58	F							07/19	110	143			
YU59	U59	F							07/19	99	125			

Table 8.--Continued.

ID NO.	Tag No. ^a		Birth		Weaning		Nursing period (days)	Tag date	Measurement ^d (cm)			Mother ID	Rehab? ^e
	L	R	Date ^b	Islet ^c	Date ^b	Islet ^c			AG	SL	SL		
YU60	U60	U160	M	05/13	Ea	06/18-07/04	Ea	07/19	96	125		E27-89	
YU61	U61	U161	M	05/31-06/11	Tr	07/11-20	Tr	07/20	84	109		T04-89	
YU62	U62	U162	M		WS	06/28-07/07	WS	07/20	87	123			
YU63	U63	U163	F		WS	06/28-07/07	WS	07/20	97	122			
YU64	U64	U164	M		WS	06/28-07/07	Ea	07/20	108	122			
YU65	U65	U165	M		Ea	07/05-25	Ea	07/25	110	128			
YU66	U66	U166	F		Ea	07/05-25	Ea	07/25	99	124			
YU67	U67	U167	F		Ea	07/05-25	Ea	07/25	97	124			
YU68	U68	U168	M	05/22	Ea	07/05-09	Ea	07/25	116	145		Y523	
YU69	U69	U169	M		Ea	07/05-25	Ea	07/25	103	126			
YU70	U70	U170	F		Ea	07/05-25	Ea	07/25	100	117			
YU71	U71	U171	F		Ea	07/05-25	WS	07/27	114	137			
YU72	U72	U172	F					07/31	106	129			
YU73	U73	U173	F					07/31	97	125			
YU74	U74	U174	F		Ea	07/05-31	Ea	07/31	126	144			
YU75	U75	U175	F		Ea	07/05-31	Ea	07/31	112	131			
YU76	U76	U176	F	06/28-07/10	Sh	07/28-08/04	Sh	08/03	84	110		Y150	NO
YU77	U77	U177	M		Ea	07/05-08/06	Ea	08/04	102	131			
YU78	U78	U178	F		Ea	07/05-08/06	Ea	08/06	88	131			
YU79	U79	U179	M					08/07	118	139			
YU80	U80	U180	F	<04/11	Gi	05/12-29	Gi	08/09	101	137		Y622	
YU81	U81	U181	M		Ea	08/07-09	Ea	08/09	97	116			
YU82	U82	U182	M					08/15	111	139			
YU83	U83	U183	F					08/15	123	140			
YU84	U84	U184	F		Ea	08/15-17	Ea	08/17	94	115			
YU85	U85	U185	M					08/17	110	124			
YU86	U86	U186	F					08/17	130	140			
YU87	U87	U187	F					08/17	116	136			
YU88	U88	U188	F					08/17	116	144			
YU89	U89	U189	M					08/17	113	135			

Table 8.--Continued.

ID NO.	Tag No. ^a		Birth		Weaning		Nursing period (days)	Tag date	Measurement ^d (cm)			Mother ID	Rehab? ^e
	L	R	Date ^b	Islet ^c	Date ^b	Islet ^c			AG	SL	SL		
YU90	U90	U190	F					08/17	113	135			
YU91	U91	U191	F		Ea	08/17-21	Ea	08/21	105	131			
YU92	U92	U192	F					08/22	117	139			
YU93	U93	U193	F					08/22	105	131			
YU94	U94	U194	M					08/23	110	128			
YU95	U95	U195	F		Ea	08/22-25	Ea	08/25	104	130			
YU96	U96	U196	F		Ea	08/24-25	Ea	08/25	116	132			
YU97	U97	U197	M					08/28	88	127			
YU98	U98	U198	F					08/31	107	126			
YU99	U99	U199	M	07/10-19	Gi	08/28-09/03	Gi	09/03	113	131		Y466	
Y515	U204	U203	F	07/20-26	Gi	08/28-09/03	Gi	09/03	120	140		Y556	
YUN1			U	07/26-27	WS	>09/02						Y067	
YUN2			U	08/18-21	Ea	>09/03						Y201	
YUN3			U	07/28-31	WS	>09/02						Y213	
YUN4			U	07/26-28	WS	>09/02						Y273	
YUX1			F	04/04	Te	04/04 ^h			41	69		Y009	
YUX2			M	04/10	Te	04/10 ^h			42	87		Y033	
YUX5			U	04/25-05/03	LG	05/03 ^h						Y382	
YUX4			U	04/18-22	Ea	04/22 ^h						Y574	
YUX3			F	04/12-17	Ea	04/17 ^h							
YUXB			M	06/22	Ea	08/10 ⁱ			63 ^j	95		Y530	
YUX6			U	05/06-12	WS	05/12 ^h						W16-89	
YUX7			F	05/19-20	Te	05/20 ^h			44	108		Y617	
YUX8			M		WS	07/07 ⁱ							
YUX9			U	06/28-07/10	Sh	07/10-20 ⁱ						Y011	
YUXA			F	07/31	Ea	08/03 ^h						Y459	
YUXC			U	04/09-10	Ea	04/11 ⁱ						Y630	
YUXD			U	04/27	Ea	04/28 ⁱ						E17-89	
YUXE			U	04/30	Ea	05/02 ⁱ						Y063	
YUXF			U	11//89	Te	11//89 ^h							

Table 8.--Continued.

- ^aL = left; R = right.
- ^bDates are either exact; i.e., 04/21 or ranges; i.e., 04/21-04/23 or before and after; i.e., <08/24 or >08/30 (weaned or born before or after date).
- ^cIslet abbreviations: Te = Tern, Ea = East, WS = Whaleskate, Tr = Trig, Sh = Shark, Gi = Gin, and LG = Little Gin.
- ^dMeasurement abbreviations: AG = axillary girth; SL = standard length.
- ^eRehab? indicates the seals collected and transported to Oahu for rehabilitation (feeding and release at Kure Atoll).
- ^fMeasured to the end of the hind flippers.
- ^gCurvilinear measure from nose to tip of tail.
- ^hFound dead on this date.
- ⁱDisappeared by this date.
- ^jMeasured on 07/15.

Table 9.--Summary of parturition for adult females in 1988.

ID No.	Temp. ID No.	Birth		Wean date ^a	Lactation period (days)	Pupped last year? ^c	Inter-pup. time ^d
		Date ^a	Islet ^b				
Y004	E30	05/28-30	Ea	07/01-11	32-44	Y	363
Y011	W23	06/01	WS	07/16-25	45-54	Y	
Y014	E19	<05/25	Ea	07/06		Y	
Y015	T01	<04/23	Tr	04/24-05/18		U	
Y022	W06	<05/17	WS	06/12-14		Y	
Y030	W17	<05/24	WS	06/12-15		U	
Y033	E13	05/25	Ea	06/20-21	26-27	Y	408
Y055	W01	<04/27	WS	05/31-06/11		Y	
Y059	W10	<05/23	WS	06/12-15		U	
Y061	W28	06/11	WS	07/11-15	30-34	Y	
Y063	E04	<04/22	Ea	05/28-06/01		U	
Y067	W32	06/29-07/01	WS	07/26-08/30	25-62	Y	
Y072	W07	<05/17	WS	06/22-25		Y	
Y084	W34	07/04-15	WS	07/26-08/30	11-46	U	
Y128	E43	07/07-11	Ea	>07/23 ^e		Y	374
Y146	R02	<06/03	Ro	>06/04		U	
Y147	E05	<05/26	Ea	05/27-06/01		Y	
Y150	W09	<05/23	WS	06/16-21		U	
Y173	E44	07/07-11	Ea	>07/23 ^e		U	
Y180	E34	06/01	Ea	07/12-20	41-49	Y	378
Y190	W18	<05/24	WS	06/03-11		U	
Y206	W20	05/28	WS	05/29 ^f		U	
Y209	E11	<05/25	Ea	06/22-24		Y	
Y213	W37	07/23-25	WS	>08/30 ^e		Y	
Y218	E39	06/27-28	Ea	>07/20 ^e		Y	371
Y220	E06	<05/05	Ea	06/02-04		Y	
Y227	W35	07/11-15	WS	06/12-15		Y	
Y229	W13	<05/24	WS	06/12-15		Y	
Y251	E42	06/29-30	Ea	>07/23 ^e		Y	383
Y253	W04	<04/27	WS	05/26-06/11		Y	
Y266	E21	<05/23	Ea	06/05/10		Y	
Y272	E07	<05/05	Ea	06/05-10		Y	
Y279	E40	06/22-28	Ea	>07/23 ^e		Y	381
Y285	E20	<05/25	Ea	06/13-18		U	
Y286	E33	05/31-06/01	Ea	07/12-14	41-44	Y	
Y288	W39	08/17-30	WS	>08/30 ^e		U	
Y458	E12	<05/25	Ea	06/19		Y	
Y459	E45	07/12-14	Ea	>07/23 ^e		Y	365
Y461	E35	06/05-10	Ea	>07/23 ^e		Y	
Y462	E41	06/30	Ea	>07/23 ^e		Y	394
Y463	W30	06/12-15	WS	07/26-08/30	41-79	Y	
Y465	W25	06/06-07	WS	07/16-25	39-49	U	
Y466	G03	06/18-24	Gi	08/09-14	46-57	Y	
Y500	W29	06/11-15	WS	07/16-25	31-44	Y	
Y502	E32	06/01	Ea	07/07-11	36-40	Y	380
Y516	E01	<04/22	Ea	05/06-30		Y	

Table 9.--Continued.

ID No.	Temp. ID No.	Birth		Wean date ^a	Lactation period (days)	Pupped last year? ^c	Inter-pup. time ^d
		Date ^a	Islet ^b				
Y522	E24	<05/26	Ea	>05/27		U	
Y523	E23	<05/26	Ea	06/11-18		Y	
Y524	E15	<05/25	Ea	06/22-24		Y	
Y526	E09	05/17-18	Ea	06/25-28	38-42	U	
Y528	E29	<05/30	Ea	06/29-07/11		Y	
Y529	E22	<05/26	Ea	07/07-11		Y	
Y531	E37	06/13-18	Ea	>07/23 ^e		Y	
Y532	W03	<04/27	WS	05/26-06/11		Y	
Y534	E08	05/14-16	Ea	06/19	34-36	Y	394
Y535	W26	06/03-04	WS	07/16-25	45-52	U	
Y537	E25	<05/26	Ea	06/11-18		Y	
Y539	T03	04/22-23	Tr	06/03-13	41-52	Y	
Y544	E02	<04/22	Ea	>05/05		U	
Y545	W27	06/03-11	WS	07/03-10	22-37	Y	
Y546	W15	<05/23	WS	06/03-11		Y	
Y551	W33	06/26-07/01	WS	07/25-08/30	24-65	U	
Y553	E36	06/05	Ea	07/11	36	Y	397
Y557	G02	04/23-05/27	Gi	07/01-11	35-80	U	
Y558	G01	04/23-06/01	Gi	06/02-12	1-51	Y	
Y560	E38	06/21	Ea	>07/23 ^e		U	
Y563	W31	06/22-25	WS	07/25-08/30	30-69	U	
Y581	W21	<05/30	WS	06/03-11		U	
Y584	T05	<05/28	Tr	06/26-07/10		U	
Y589	T04	04/24-05/03	Tr	06/03-13	31-50	U	
Y595	W36	07/23-25	WS	>08/30 ^e		U	
Y603	W19	<05/30	WS	07/03-06		U	
Y607	W14	<05/23	WS	06/22-25		U	
	E10	<05/25	Ea	05/27-30		U	
	E16	<05/25	Ea	>05/26		U	
	T02	<05/03	Tr	05/04-24		U	
	W05	<05/03	WS	05/04-23		U	
	W38	07/16-25	WS	>08/30 ^e		U	

^aDates are of observations that were either exact; i.e., 06/92 or ranges; i.e., 06/02-04 or before of after; i.e., <08/23 or >08/23.

^bIslet abbreviations: Ea = East, WS = Whaleskate, Tr = Trig, Gi = Gin, and Ro = Round.

^cY = yes, N = No, and U = unknown.

^dInterpupping time is the number of days between pupping in consecutive years. When dates are ranges the median date of birth and of weaning are used if the ranges are less than 11 days.

^eFemale still lactating on this date.

^fPup found dead.

Table 10.--Summary of parturition for adult females in 1989.

ID No.	Temp. ID No.	Birth		Wean date ^a	Lactation period (days)	Pupped last year? ^c	Inter-pup. time ^d
		Date ^a	Islet ^b				
Y004	E39	06/17	Ea	07/26-29	39-42	Y	385
Y009	TN4	04/04	Te	04/04 ^e		U	
Y011	SH2	06/28-07/10	Sh	07/11-18 ^f		Y	
Y014	E33	06/02	Ea	07/20/25	48-53	Y	
Y022	LG4	05/12-29	LG	06/27-07/09	29-58	Y	
Y027	W07	04/17-25	WS	05/19-06/04	24-48	U	
Y030	W21	05/19-06/04	WS	06/28-07/07	24-49	Y	
Y033	TN2	04/10	Te	04/10 ^e		Y	321
Y055	W06	04/24-25	WS	06/05-15	41-52	Y	
Y059	W22	05/19-06/04	WS	06/28-07/07	24-49	Y	
Y061	W29	06/14-15	WS	07/08-10	23-26	U	369
Y063	E20	04/30	Ea	06/03-05	34-36	Y	
Y067	W37	07/26-27	WS	>09/02 ^g		Y	
Y084	W33	07/02-07	WS	08/15-17	40-46	Y	361
Y094	R12	06/20-07/19	Ro	08/04-09	16-50	U	
Y128	E49	07/16	Ea	08/18-21	33-36	Y	373
Y145	R02	<06/08	Ro	>06/09		U	
Y146	E25	05/13	Ea	06/18-20	36-38	Y	
Y147	E30	05/22	Ea	06/22-07/04	31-43	Y	
Y150	SH1	06/28-07/10	Sh	07/27-08/04	17-37	Y	
Y162	E07	03/31-04/11	Ea	05/23	42-53	U	
Y190	W18	05/13-18	WS	06/16-25	29-43	Y	
Y201	E52	08/18-21	Ea	>09/03 ^g		U	
Y209	E32	06/01	Ea	07/05-09	34-38	Y	
Y213	W38	07/28-31	WS	>09/02 ^g		Y	
Y218	E47	07/10	Ea	08/24-27	45-48	Y	378
Y251	E50	07/10-16	Ea	08/22-27	37-48	Y	380
Y253	W11	04/26-05/05	WS	06/05-15	31-50	Y	
Y264	T03	05/05-30	Tr	06/26-27	27-53	U	
Y265	Z75	04/29-05/20	U	05/21-07/26	1-88	U	
Y266	E24	05/06	Ea	06/18-20	43-45	Y	
Y268	E05	03/31-04/10	Ea	05/22	42-52	U	
Y272	E26	05/13	Ea	06/17	36	Y	
Y273	W36	07/26-07/27	WS	>09/02 ^g		U	
Y279	E45	07/08	Ea	08/14-17	37-40	Y	379
Y286	E36	06/06	Ea	07/20-25	44-49	Y	371
Y287	E28	05/16	Ea	06/18-20	33-35	U	
Y335	W15	05/06-12	WS	06/05-15	24-40	N	
Y382	LG3	04/25-05/04	LG	05/04 ^e		U	
Y459	E51	07/31	Ea	>08/27 ^g		Y	384
Y461	E46	07/08-09	Ea	08/14-17	36-40	Y	
Y462	E43	07/05	Ea	08/07-09	33-35	Y	370
Y464	W32	06/20-06/25	WS	07/28-08/03	33-44	U	
Y466	G03	07/18-07/19	Gi	08/28-09/03	40-47	Y	395
Y502	E34	06/03	Ea	07/20-25	47-52	Y	367
Y516	E08	04/08-10	Ea	04/12-24 ^f		Y	

Table 10.--Continued.

ID No.	Temp. ID No.	Birth		Wean date ^a	Lactation period (days)	Pupped last year? ^c	Inter-pup. time ^d
		Date ^a	Islet ^b				
Y517	E09	04/01-17	Ea	05/22	35-51	U	
Y518	E12	04/18-22	Ea	05/28-29	36-41	U	
Y519	E15	04/25-27	Ea	06/04	38-40	U	
Y520	E16	04/25-27	Ea	06/02	36-38	U	
Y521	E22	05/01	Ea	06/07-14	37-44	U	
Y522	E23	05/05	Ea	06/07-14	33-40	Y	
Y523	E29	05/22	Ea	07/05-09	44-48	Y	
Y524	E31	06/01	Ea	07/05-09	32-36	Y	381
Y527	E37	06/07	Ea	07/10-16	33-39	U	
Y528	E38	06/12	WS	07/10-19	28-37	Y	
Y529	E41	06/19	Ea	07/20-25	31-36	Y	
Y530	E42	06/22	Ea	07/27-08/06	35-45	U	
Y531	E44	07/05-08	Ea	08/22-08/23	45-49	Y	
Y532	W13	04/23-05/05	WS	06/05-15	31-53	Y	
Y534	W23	05/19-06/04	WS	07/08-09	34-51	Y	
Y535	W34	07/02-07	WS	08/11-14	35-43	Y	
Y536	R01	04/26-06/08	Ro	06/09-07/18	1-83	U	
Y537	R05	04/26-06/08	Ro	07/19-08/17	41-103	Y	
Y538	R15	<08/17	Ro	08/28-08/31		U	
Y551	W35	07/08-10	WS	08/18-08/22	39-45	Y	376
Y552	W39	08/08-14	WS	>09/03		U	
Y554	W20	05/13-18	WS	06/26-27	39-45	U	
Y555	LG2	04/17-24	LG	05/12-29	18-42	U	
Y556	G04	07/25-26	Gi	08/28-09/03	33-40	U	
Y559	LG1	<04/11	LG	05/05-11		U	
Y560	E48	07/15	Ea	08/18-21	34-37	Y	389
Y572	E03	<03/30	Ea	>04/28		U	
Y573	E10	04/12-17	Ea	05/12-17	25-35	U	
Y574	E11	04/20-22	Ea	04/22 ^e		U	
Y575	E18	04/28	Ea	05/30	32	U	
Y576	E19	04/29	Ea	>05/02 ^f		U	
Y577	W01	<04/01	WS	04/26-05/05		U	
Y578	W04	04/11-16	WS	05/19-06/04	35-54	U	
Y579	W08	04/26-05/05	WS	05/19-06/04	14-41	U	
Y580	W12	04/26-05/05	WS	06/05-06/15	31-50	U	
Y581	W17	05/13-05/18	WS	06/16-06/25	34-43	Y	
Y582	TN1	04/20	Te	05/27	37	U	
Y583	T02	04/26-05/05	Tr	05/31-06/07	26-42	U	
Y584	R04	04/26-06/08	Ro	06/09-07/18	1-83	Y	
Y585	R06	04/13-06/08	Ro	06/09-07/22	1-100	U	
Y587	Z05	04/14-06/06	U	04/14-06/06		U	
Y610	E02	<03/30	Ea	>04/28		U	
Y611	W28	06/05-15	WS	07/21-27	36-52	U	
Y612	W09	04/26-05/05	WS	06/05-15	31-45	U	
Y614	E14	04/23-27	Ea	06/04	38-42	U	
Y616	W25	06/02-04	WS	07/11-20	37-48	U	

Table 10.--Continued.

ID No.	Temp. ID No.	Birth		Wean date ^a	Lactation period (days)	Pupped last year? ^c	Inter-pup. time ^d
		Date ^a	Islet ^b				
Y617	TN3	05/11	Te	05/19 ^e		U	
Y620	W10	04/26-05/05	WS	06/05-15	31-50	U	
Y622	G01	<04/11	Gi	05/12-29		U	
Y623	T01	<04/16	Tr	04/26-05/05		U	
Y624	W05	04/17-25	WS	05/19-06/04	24-48	U	
Y625	W14	05/06-12	WS	06/16-06/25	35-50	U	
Y630	E06	03/31-04/10	Ea	04/11-04/17 ^f		U	
Y636	E13	04/18-22	Ea	05/27	35-39	U	
Y637	E40	06/17	Ea	07/19/25	32-38	U	
T85F	W02	<04/01	WS	04/17-25		U	
	E00	<03/30	Ea	>03/31		U	
	E01	<03/30	Ea	03/31-04/10		U	
	E04	03/29-30	Ea	05/20	51-52	U	
	E17	04/25-27	Ea	04/28-29 ^f		U	
	E21	04/30	Ea	06/18-19	49-50	U	
	E27	05/13	Ea	06/18-07/04	36-52	U	
Y642	W03	<04/01	WS	04/26-05/05		U	
	W16	05/11-12	WS	05/12 ^e		U	
	W19	05/15-18	WS	06/16-25	29-41	U	
	W24	06/02-04	WS	06/28-07/07	24-35	U	
Y568	W26	06/05-10	WS	07/11-20	31-45	U	
	W27	06/11-15	WS	07/11-20	26-39	U	
	W30	06/12-15	WS	07/21-27	36-45	U	
	G02	05/12-29	Gi	06/27-07/09	29-58	U	
	T04	05/30-06/11	Tr	07/11-20	30-51	U	
	R03	04/26-06/08	Ro	06/09-07/18	1-83	U	
	R07	04/26-06/08	Ro	06/09-07/18	1-83	U	
	R08	04/26-06/08	Ro	06/09-07/18	1-83	U	
	R09	04/26-06/08	Ro	06/09-07/18	1-83	U	
	R10	04/26-06/08	Ro	06/09-07/18	1-83	U	
	R11	<07/19	Ro	>07/20		U	
	R13	<07/31	Ro	>08/01		U	
	R14	<07/31	Ro	>08/01		U	

^aDates are of observations that were either exact; i.e., 06/02 or ranges; i.e., 06/02-04 or before or after; i.e., <08/23 or >08/23.

^bIslet abbreviations: Ea = East, WS = Whaleskate, Tr = Trig, Gi = Gin, Ro = Round, and U = unknown.

^cY = yes, N = No, and U = unknown.

^dInterpupping time is the number of days between pupping in consecutive years. When dates are ranges the median date of birth and of weaning are used if the ranges are less than 11 days.

^ePup found dead.

^fPup had disappeared during this time.

^gFemale still lactating on this date.

Table 11.--Cohort survival, 1984-1988.

Year tagged	Sex ^a	No. tagged ^b	Number/% surviving to year X ^c				
			1	2	3	4	5
1984	F	43	36/84	36/84	34/79	31/72	29/67
	M	49	42/86	38/78	33/67	31/63	30/61
1985	F	38	35/92	33/87	32/84	30/79	
	M	47	45/96	39/83	36/77	32/68	
1986	F	48	43/90	40/83	35/73		
	M	52	45/87	39/75	33/63		
1987	F	51	47/92	43/84			
	M	55	51/93	45/82			
1988	F	62	40/65				
	M	52	38/73				

^aSex: F = female; M = male.

^bPrematurely weaned female pups tagged and collected for rehabilitation are included in the "Number tagged" but are considered dead in subsequent years. Number of pups collected 1984-88: 3, 2, 3, 0, 8.

^cNumber surviving includes seals not seen in 1988 or 1989 but resighted in 1990 or 1991.

Table 12.--Seals retagged with yellow Temple Tags at French Frigate Shoals in 1988.

ID No.	Sex ^a	Left tag		Right tag		Date
		New	Old	New	Old	
Y418	F	-	K35	K102	K35	07/24
YL18	M	-	L18	L518	L118	07/24
YL48	F	L516	L48	L515	L148	07/15
YL51	F	-	L507		-	05/23

^aSex: F = female; M = male

Table 13.--Seals retagged with yellow Temple Tags at French Frigate Shoals in 1989.

ID No.	Sex ^a	Left tag			Right tag		Date
		New	Old	Old	New	Old	
Y376	M	-	T89		T100	-	08/16
Y387	M	K113	K04		-	K04	09/02
Y393	F	-	K10		K99	-	08/22
Y408	M	K111	K25		-	K25	08/26
Y413	M	-	K30		K105	K30	04/06
Y430	F	K88	-		-	K48	08/16
Y434	M	-	K52	K104	K112	K52	08/30
Y435	F	K110	K53		-	K53	08/26
Y448	M	K96	K66		-	K66	08/22
Y475	F	-	K77		K87	K77	08/11
YL00	M	L504	L00		L505	L100	04/05
YL02	M	L560	-		L561	L02	08/01
YL05	M	L562	L05		L559	L105	08/15
YL10	F	L573	L10		L571	L110	08/25
YL13	M	-	L13		L568	L113	08/22
YL19	M	L567	-		-	L119	08/17
YL22	M	-	L22		L563	L122	08/17
YL24	M	L570	L24		L569	L124	08/22
YL34	M	L539	L34		L538	L134	05/15
YL35	F	L528	L35		L529	L135	07/19
YL39	M	L522	L39		L523	L139	04/21
YL40	F	-	L511		L575	L140	08/31
YL42	M	L549	L42		L548	-	08/05
YL46	F	L500	L46		-	L508	07/18
YL47	M	L525	L47		L524	-	04/07
YL53	M	L564	L53		L565	L153	08/17
YL56	F	L534	L56		L535	L156	03/30
YL61	F	L557	-		L556	L161	07/26
YL63	M	-	L63		L555	L163	08/09
YL64	F	L546	L64		-	L164	05/10
YL69	F	L520	-		L547	L169	04/15
YL71	F	L501	L71		-	L171	04/07
YL73	F	L537	L73		L536	L173	07/18
YL75	F	-	L75		L521	L175	05/14
YL77	M	L554	L77		-	L177	07/25
YL78	F	L566	L78		-	L178	08/17
YL81	F	L542	L81		-	L181	07/19
YL83	M	L540	L83		L541	L183	05/14
YL90	F	L552	-		L553	L190	07/25
YL91	F	L574	-		L572	L785	08/25
YL96	M	-	L96		L558	L781	08/11
L485	M	L526	L448		L527	L478	05/09
L488	F	L551	L484		L550	-	07/25
YN29	M	N72	-		-	N29	08/12
YN45	M	N73	-		-	N145	08/12

Table 13.--Continued.

ID No.	Sex ^a	Left tag			Right tag		Date
		New	Old	Old	New	Old	
YF12	M	-	F12		F231	-	08/17
YF80	M	F230	-		F229	F180	08/07
YU26	M	-	U26		U200	-	08/27

^aSex: F = female; M = male

Table 14. --Inter-island movement between French Frigate Shoals and Laysan Island in 1988 and 1989.

ID No.	Tag No.		Tag Color	Temp. ID No.	Age Class ^a	Sex ^b	Movement from		Movement to	
	L	R					Location	Date last seen	Location	Date first seen
T45M				293 ^c	A	M	Laysan	04/21/88	FFS	05/23/88
T46M				125 ^c	A	M	Laysan	03/15/88	FFS	09/15/88
Y322	T33	T33	Yellow		S	M	FFS	07/06/87	Laysan	03/07/88
YL11	L11	L111	Yellow		J	M	FFS	06/23/87	Laysan	03/12/88
TK25	K25	K24	Tan		J	M	Laysan	07/13/87	FFS	08/19/88
TT08	T08	T07	Tan		S	M	Laysan	08/02/86	FFS	09/15/88
T85F				610 ^d	A	F	Laysan	11/09/88	FFS	03/29/89
T85F				610	A	F	FFS	04/16/89	Laysan	05/19/89
TL08	L08	L09	Tan		S	M	Laysan	06/13/88	FFS	03/09/89
Y156				135 ^d	A	F	Laysan	04/14/89	FFS	04/26/89
Y156				135	A	F	FFS	04/26/89	Laysan	05/30/89
Y296	T07	T07	Yellow		S	M	FFS	02/06/89	Laysan	04/05/89

^aAge class: A = adult, S = subadult, and J = juvenile.

^bSex: M = male; F = female.

^cNumbers applied with hair bleach at Laysan Island in 1988.

^dNumbers applied with hair bleach at Laysan Island in 1989.

Table 15.--Entanglement in debris at French Frigate Shoals in 1988 and 1989.

Field No.	Date found	Age class ^a	Sex ^b	ID No.	Islet ^c	Type of debris	Part of body entangled	Extent of restriction ^d
01	06/13/88	J	F		Sh	plastic basket	neck	none
01	01/15/89	J	M	YF59	Te	net	neck, head	partial
02	04/10/89	W	M	YU01	Ea	wire	neck	none
03	04/12/89	A	M		Te	band	mid-torso	none
04	05/08/89	A	M		Te	rope	mid-torso	none
05	06/11/89	A	F		WS	rope	neck	none
07	07/05/89	S	U		Te	band	neck	none

^aAge class: A = adult, S = subadult, J = juvenile, and W = weaned pup.

^bSex: M = male; F = female.

^cIslet: Sh = Shark, Te = Tern, Ea = East, and WS = Whaleskate.

^dAll materials were removed.

Table 16.--Injuries from April 12-December 9, 1988.

Field No.	Islet ^a	Date	Age class ^b	Sex ^c	ID No.	Injury type ^d	Location on body ^e	Dimension(cm.) ^f			Condition ^g	Cause ^h
								Depth	lxw/diam			
01	WS	05/03	J	U		gaping	left face				older	Unknown
02	WS	05/03	J	M		puncture	ant.dorsal				fresh	P-seal bite
03	WS	05/03	J	F	YN94	puncture	ant.dorsal				fresh	P-seal bite
04	Ea	05/18	A	F	Y162	circular	post.dors.	2.0	10.0		fresh	P-small shark
05	WS	05/23	A	F	Y609	lacerations	dorsal	4.0	30.0x10.0		fresh	P-mating
06	Tr	05/24	J	M	Y380	gaping	r.hind flip.	3.5	13.0x	3.5	fresh	P-shark bite
07	WS	05/27	J	F	YN10	laceration	head		6.5		fresh	P-seal bite
08	Di	05/27	A	F		puncture	mid-dorsal					
10	Ea	05/30	A	F		lg.gaping	dorsal	10.0	50.0x?		fresh	P-male mobbing
11	Ea	05/30	A	F	Y286	circular	ant.ventral	1.0	3.0		fresh	P-small shark
13	Ea	06/01	J	M	YN36	laceration	left eye	0.5	2.0x1.5		fresh	Unknown
						part.amput.	1.hind flip.				fresh	P-shark bite
14	Te	06/02	S	U		gaping	r.hind flip.	1.8	6.5x2.0		fresh	
15	Te	06/04	S	F	Y586	gaping	dorsal	0.5	8.0x6.0		fresh	P-mating
16	Te	06/04	A	F		abcess,lacer.	dorsal	5.0	40.0x30.0		fresh	P-male mobbing
						punctures	dorsal		20.0x10.0		fresh	P-male mobbing
17	Te	06/04	A	M		laceration	r.shoulder	1.0	15.0x?		fresh	Unknown
18	Ea	06/19	A	F		laceration	post.dorsal				fresh	P-mating
19	Te	06/23	A	F	Y147	gaping,lacer.	dorsal	1.0	45.0x15.0		fresh	P-male mobbing
20	Te	06/25	A	F	Y573	laceration	r.post.later.	0.5	13.0x0.3		fresh	P-mating
21	WS	06/25	W	F	YF41	abcess,punct.	ant.dorsal		20.0x15.0		fresh	P-seal bite
22	WS	06/25	A	F	Y545	lacerations	post.ventral	0.5	8.5x0.3		fresh	Unknown
23	Te	06/29	A	U		gaping	mid-shoulder	2.5	8.0x5.0		fresh	Unknown
24	Tr	07/01	A	F	Y151	gaping	dorsal	4.5	65.0x30.0		fresh	P-male mobbing
25	Tr	07/01	W	F	YF15	circular	mid-shoulder	2.0	5.0		fresh	P-seal bite
26	LG	06/30	A	F		gaping	mid-dorsal	3.0	20.0x12.0		fresh	P-male mobbing
27	Tr	07/01	A	M		lacerations	mid-ventral	0.3	3.0x0.2		fresh	Unknown
28	WS	07/10	A	F	Q68-88	gaping	mid-dorsal	1.5	26.0x15.0		fresh	P-male mobbing
29	Te	07/12	A	M		circular	r.shoulder	2.5	8.0		fresh	P-small shark
30	Te	07/12	A	M		circular	post.dorsal	2.5	7.0		fresh	P-small shark
31	Te	07/12	A	U		lacerations	dorsal	0.5	120x20.0		fresh	P-mating

Table 16.--Continued.

Field No.	Islet ^a	Date	Age class ^b	Sex ^c	ID No.	Injury type ^d	Location on body ^e	Dimension(cm.) ^f			Cause ^h
								Depth	lxw/diam	Condition ^g	
32	Ea	07/14	J	F	YL70	abcess	1. shoulder	15.0x8.0	fresh		P-seal bite
33	Te	07/23	W	F	YF10	abcess	mid-shoulder	9.0x7.0	fresh		Unknown
34	Te	07/24	A	F		gaping	1. post.later.	1.5	8.0x5.0	fresh	P-mating
35	Te	07/24	A	F		lacerations	dorsal	1.0	120x20.0	fresh	P-mating
36	WS	07/25	W	M	YF89	gaping	1.head	1.0	8.0x2.0	fresh	Unknown
37	Ea	08/08	J	F	YL41	gaping	r.post.later.	17.5x7.5	infect.		P-shark bite
						gaping	1.head	12.5x2.5	infect.		
38	Te	08/24	A	U		abrasion	r. foreflipper	4.0x2.5	fresh		Unknown
39	WS	12/09	W	U		amputation	hindflippers		healing		P-shark bite

^aIsland: Te = Tern, Ea = East, WS = Whaleskate, Tr = Trig, Di = Disappearing, and LG = Little Gin.

^bAge class: A = adult, S = subadult, J = juvenile, and W = weaned pup.

^cSex: F = female, M = male, and U = unknown.

^dInjury type: amput. = amputation, lacer. = laceration, lg. = large, part. = partial, and punct. = puncture.

^eLocation: ant. = anterior, dors. = dorsal, flip. = flipper, later. = lateral, l. = left, post. = posterior, and r. = right.

^fDimension: lxw = length by width, diam. = diameter. A single number indicates a diameter.

^gComments: inj. = injury; infect = infection.

^hCause: P = probable.

Table 17. --Injuries from January 1-December 21, 1989.

Field No.	Islet ^a	Date	Age class ^b	Sex ^c	ID No.	Injury type ^d	Location on body ^e	Dimension(cm.) ^f			Cause ^g
								Depth	lxw/diam	Condition	
00	Te	01/01	J	F	YL69	laceration	ventral	4.0	20.0x2.5	fresh	P-propeller
01	Te	03/29	S	M		laceration	ant. vent.	4.0	5.5x3.0	fresh	Unknown
02	Ea	03/30	J	M	YF79	gaping	r. neck	2.0	17.0x10.0	fresh	
						punctures	r. mid-vent.	1.0		fresh	
03	Ea	03/30	A	F	Y529	laceration	1. ant. vent.	3.0	18.0x0.5	fresh	P-propeller
						laceration	mid-ventral	1.0	8.0x0.3	fresh	
04	Te	03/31	S	F	Y412	other/swell.	right eye			closed	Unknown
05	Te	04/02	S	F	Y633	laceration	1. mouth	2.0	5.0x4.0	fresh	Unknown
06	Te	04/06	A	U		gaping	r. foreflip.	2.5	6.0x3.0	fresh	P-propeller
07	Te	04/06	J	F	YN08	laceration	mid-ventral	3.0	9.0x3.0	fresh	P-propeller
08	Te	04/08	S	M	Y448	gaping	r. mouth	3.5	5.0x3.5	fresh	P-propeller
09	Te	04/08	A	F	Y033	gaping	r. ventral	12.0	36.0x15.0	fresh	P-propeller
						gaping(s)	ventral	3.0	13.0x3.0	fresh	
10	Te	04/08	A	F	Y459	lacerations	ventral	2.5	9.0x2.0	fresh	P-propeller
11	Te	04/13	A	M		gaping	1. foreflip.	6.0	12.0x7.0	fresh	P-shark
						lacerations	ant. ventral	2.0	5.0x1.5	fresh	
12	Di	04/17	J	F		circular	mid=dorsal	1.0	9.0	fresh	P-sm. shark
13	Gi	04/17	J	M	Y512	unknown	post. vent.?			bleeding	Unknown
14	LG	04/24	J	U		circular	post. dorsal	0.5	6.0	fresh	Unknown
84		04/24	J	M	YF35	gaping	dorsal	1.0	8.0x3.0	fresh	P-propeller
15	Te	04/26	J	F	Y511	gaping	r. mouth	3.0	6.0x2.5	fresh	P-propeller
						lacerations	r. lateral			fresh	
16	Ea	05/03	A	F	Y522	circular	post. vent.	2.0	10.0	fresh	P-sm. shark
17	Te	05/05	A	F	Y279	laceration	1. hindflip.	0.5	4.0x2.0	fresh	Unknown
18	Te	05/05	S	F	X31-89	lacerations	r. head	0.5	3.0x1.0	fresh	Unknown
19	Tr	05/05	S	F	Y415	gaping	1. lateral	4.5	22.0	fresh	P-shark
20	WS	05/05	A	M		gaping	r. lateral	1.5	8.0x3.0	fresh	P-shark
21	Te	05/09	S	M		other/broke	r. jaw			fresh	Unknown
						lacerations	dorsal	0.5	6.0x0.5	fresh	P-mating
22	Sh	05/09	A	U		gaping	dorsal	3.0	40.0x22.0	fresh	P-mating
						lacerations	dorsal			fresh	
23	Gi	05/11	A	F		laceration	vent. neck	3.0	5.0x2.0	fresh	Unknown

Table 17.--Continued.

Field No.	Islet ^a	Date	Age class ^b	Sex ^c	ID No.	Injury type ^d	Location on body ^e	Dimension(cm.) ^f			Cause ^g
								Depth	lxw/diam	Condition	
24	Sh	05/12	A	M		laceration	1.hindflip.	2.0	9.0x3.0	fresh	P-shark
25	Te	05/12	A	M		lacerations	vent.hindfl.	1.0	4.0x1.0	fresh	P-shark
26	Ea	05/02	J	F	Y499	part.amput.	1.hindflip.		3.0x2.0	tip chop	Unknown
27	Te	05/08	A	F	Y617	lacerations	ventral	7.0	12.0x4.0	fresh	P-shark
28	Sh	05/18	S	F	Y327	laceration	1.ventral	0.5	6.0x0.5	bleeding	Unknown
29	Tr	05/18	A	M		laceration	1.foreflip.		5.5x4.0	fresh	Unknown
						abrasion	1.foreflip.		2.0x2.0	fresh	
30	Te	05/21	J	M	YN45	gaping	1.hindflip.	1.5	8.0x6.0	fresh	P-shark
						part.amput.	r.hindflip.		8.0x7.0	#5 digit	
31	Te	05/21	S	F	Y328	lacerations	hindflips.	1.5	7.0x1.0	fresh	P-shark
32	Te	05/25	J	F	YL69	laceration	r.lateral	0.5	6.0x?	fresh	Unknown
33	Te	05/25	J	M	Y387	gaping(s)	1.head	1.5	15.0x?	3 gashes	P-shark
34	Te	05/26	J	F	Y315	laceration	r.lateral			fresh	P-propeller
						lacerations	l.lateral			fresh	
35	Te	05/28	J	M	Y376	laceration	ventral	1.5	8.0x1.0	fresh	Unknown
36	Te	06/09	S	F	Y635	gaping(s)	dorsal	1.5	6.0x4.0	fresh	P-mating
						lacerations	dorsal			fresh	
37	Te	06/09	A	F	Y589	lacerations	dorsal	2.0	3.0x2.0	fresh	Unknown
38	Te	06/10	S	M	Y395	lacerations	ventral	1.5	6.0x?	fresh	P-shark
39	Te	06/09	S	U		lacerations	r.head	<1.0	1.5x0.5	fresh	Unknown
40	Te	06/13	J	F	YN37	laceration	1.hindflip.	<1.0	6.0x0.5	fresh	Unknown
41	Te	06/13	S	F	Y308	lacerations	ventral	<0.5	6.0x0.5	fresh	P-mating
42	Te	06/13	S	F		lacerations	l.lateral	<0.5	9.0x0.5	fresh	P-mating
43	Te	06/13	S	F	X09-89	lacerations	dorsal	<0.5	9.0x0.5	fresh	P-mating
44	Te	06/15	J	M	Y486	circular	dors.head	0.7	2.0	fresh	Unknown
45	Te	06/19	A	F	Y199	lacerations	dorsal	0.7	9.0x0.5	fresh	P-mating
46	Te	06/22	A	M		laceration	r.foreflip.	<0.5	1.5x1.0	fresh	P-seal bite
47	Te	06/22	A	M		laceration	l.lateral	0.5	2.0x0.5	fresh	P-seal bite
48	Te	06/22	S	F	Y606	lacerations	mid-dors.	0.5	6.0x0.5	fresh	P-mating
49	Te	07/01	S	M		laceration	r.lateral	1.0	5.0x3.0	fresh	Unknown
50	Te	07/06	J	M	YL42	gaping	dorsal	3.0	55.0x25.0	fresh	P-mating
51	WS	07/07	A	F	X22-89	circular	dorsal	1.5	7.0	fresh	P-sm.shark

Table 17. --Continued.

Field No.	Islet ^a	Date	Age class ^b	Sex ^c	ID No.	Injury type ^d	Location on body ^e	Dimension(cm.) ^f		Condition	Cause ^g
								Depth	lxw/diam		
52	Te	07/07	S	F	Y377	gaping	dorsal	3.0	29.0x20.0	fresh	P-mating
53	Ea	07/09	S	F	Y351	circular abrasions	r. lateral	2.0	8.0	fresh	P-sm. shark
54	Te	07/10	A	F	Y626	laceration	r. lateral			fresh	P-mating
55	Tr	07/10	A	F	Y063	lacerations	r. post. dors.	1.5	6.0x3.0	fresh	P-shark
56	Sh	07/10	A	F	Y011	amputation	r. mid-dors.	0.5	12.0x0.5	fresh	P-mating
						part. amput.	1. hindflip.			75% gone	P-shark
						gaping(s)	r. hindflip.			2 tips	
57	Te	07/22	A	F	Y335	gaping(s)	mid-dors.	2.5	12.0x6.0	fresh	P-mating
							mid-dors.	2.5	5.0x4.0	fresh	
58	Ea	07/25	S	F	Y378	gaping lacerations	dors. neck	2.0	17.0x12.0	fresh	P-shark
							dors. neck	1.0	10.0x0.5	fresh	
59	Te	07/22	J	F	YL48	circular	ant. dors.	1.0	3.0	2 wounds	Unknown
60	Sh	07/20	J	M	YN96	puncture	head				
61	Ea	07/26	W	M	YU65	laceration	mid-dors.	0.5	3.0x0.5	fresh	Unknown
62	WS	07/27	S	U		laceration	r. head	0.5	4.0x0.5	fresh	Unknown
63	Te	08/02	A	F	Z01-89	lacerations	ant. vent.	3.0	12.0x2.0	fresh	P-shark
64	Te	08/07	W	M	YU31	gaping(s)	1. hindflip,	3.0	10.0x3.0	fresh	P-shark
						amputation	post. dors.			fresh	
						gaping	r. hindflip.			total	
65	WS	08/04	S	F	Y435	gaping	dorsal	3.0	25.0x10.0	recent	P-mating
66	Te	08/07	S	M		gaping	r. hindflip.	3.5	9.0x5.0	fresh	Unknown
67	WS	08/07	J	M	YN95	lacerations	ant. vent.	0.5	25.0x0.5	multiple	P-shark
68	Ea	08/09	J	U		circular	ant. dors.	0.5	3.0	fresh	P-sm. shark
69	Ea	08/09	J	F	YF99	gaping	vent. neck	4.0	15.0x8.0	fresh	P-shark
70	Te	08/10	J	M	Y448	abcess	ant. dors.		10.0	fresh	P-seal bite
71	WS	08/10	A	F	Y022	laceration	r. lateral	0.5	8.0x0.5	fresh	P-mating
72	WS	08/10	W	M	YU64	abcess	ant. dors.		5.0x15.0	fresh	P-seal bite
73	WS	08/10	W	M	YU79	abcess	ant. dors.		25.0x15.0	recent	P-seal bite
74	WS	08/10	A	M		circular	ant. dors.	0.5	5.0	fresh	Unknown
75	WS	08/14	W	F	YU71	abcess	ant. dors.		15.0x15.0	recent	P-seal bite
76	WS	08/17	W	M	YU89	abcess	ant. dors.	1.0	20.0x16.0	recent	P-seal bite

Table 17. -- Continued.

Field No.	Islet ^a	Date	Age class ^b	Sex ^c	ID No.	Injury type ^d	Location on body ^e	Dimension(cm.) ^f			Cause ^g
								Depth	lxw/diam	Condition	
77	Ea	08/27	A	F	E27-89	gaping	r. lateral	2.0	10.0x5.0	fresh	P-shark
						punctures	r. mid-vent.	1.0	1.0x0.5	multiple	
78	Ea	08/27	J	M	YN32	gaping(s)	hindflips.	3.0	8.0x5.0	multiple	P-shark
79	Te	08/28	S	F	Y366	gaping	ant. vent.	2.0	10.0x3.0	fresh	P-propeller
80	WS	08/28	A	M		part. amput.	r. hindflip.		5.0x2.5	fresh	Unknown
81	Te	08/29	J	F	Y490	laceration	ant. vent.	2.0	7.0x2.0	fresh	P-shark
82	Te	08/30	A	M		gaping	ant. vent.	3.0	40.0x20.0	fresh	P-shark
83	Te	08/31	A	F		laceration	l. lateral	2.0	6.0x2.0	fresh	P-shark
85	Te	10/24	S	M	Y434	gaping	l. head			died	Unknown
						lacerations	post. dors.		12.5x1.0	recent	P-propeller
86	Te	11/02	S	M	YL13	amputation	l. hindflip.		total		P-shark
						part. amput.	r. hindflip.		25% gone		
87	Te	11/20	W	F	YU25	gaping	l. foreflip.	2.5	13.0x5.0	fresh	P-shark
88	Te	11/30	W	F	YU63	gaping	post. dorsal	5.0	20.0x12.5	fresh	P-shark
89	Te	12/07	W	M	YU62	gaping	r. lateral	2.5	18.0x10.0	recent	P-shark
90	Te	12/11	S	M	Y304	lacerations	dors. neck	1.5	30.0x2.5	recent	Unknown
91	Te	12/14	J	M	YN02	gaping	r. hindflip.	2.5	10.0x2.5	recent	P-shark
						laceration	l. hindflip.	1.0	10.0x1.0	recent	
92	Te	12/18	A	M		gaping	ant. ventral	2.0	25.0x15.0	recent	P-shark
93	Te	12/21	J	F	YL20	gaping	l. foreflip.	0.5	10.0x7.5	fresh	P-shark
						laceration	ant. ventral	0.5	20.0x1.0	fresh	

^aIsland: Te = Tern, Ea = East, WS = Whaleskate, Tr = Trig, Di = Disappearing, and LG = Little Gin.

^bAge class: A = adult, S = subadult, J = juvenile, and W = weaned pup.

^cSex: F = female, M = male, and U = unknown.

^dInjury type: amput. = amputation, lacer. = laceration, lg. = large, part. = partial, and punct. = puncture.

^eLocation: ant. = anterior, dors. = dorsal, flip. = flipper, later. = lateral, l. = left, post. = posterior, and r. = right.

^fDimension: lxw = length by width, diam. = diameter. A single number indicates a diameter.

^gCause: K = known; P = probable.

Table 18.--Deaths between April 11, 1988 and December 1, 1989.

Death No.	Death date	Age class ^a	Sex ^b	ID No.	Cause known(K) or probable(P)	or	Necropsy No.
01FFS88	05/23/88	J	F	YN42	P-Snout injury		01FFS88
02FFS88	07/20/88	J	M	YN23	Unknown		02FFS88
03FFS88	05/29/88	P	U	YFX1	Unknown		
04FFS88	11/17/88	P	U	YFX2	Unknown		
05FFS88	12/19/88	P	U	YFX3	Unknown		
01FFS89	03/27/89	J	M	YF82	P-shark bite		01FFS89
02FFS89	04/04/89	P	F	YUX1	K-stillborn		
03FFS89	<02/03/89	J	F	YF15	Unknown, decayed		
04FFS89	<04/01/89	J	M	YF57	Unknown, decayed		
05FFS89	04/10/89	P	M	YUX2	K-drowned		
06FFS89	<04/01/89	A	U		Unknown, decayed		
07FFS89	04/17/89	J	F	YF38	Unknown		
08FFS89	<04/17/89	P	F	YUX3	Unknown, decayed		
09FFS89	<04/16/89	J	M	YN30	Unknown, decayed		
10FFS89	04/11/89	J	M		Unknown		
11FFS89	04/11/89	S	M		Unknown		
12FFS89	04/17/89	S	U		Unknown, decayed		
13FFS89	04/22/89	P	U	YUX4	Unknown		
14FFS89	05/04/89	P	U	YUX5	Unknown		
15FFS89	04/17/89	J	F	YL07	Unknown, decayed		
16FFS89	05/12/89	P	U	YUX6	Unknown		
17FFS89	05/20/89	P	F	YUX7	Unknown		02FFS89
18FFS89	05/25/89	J	F	YF96	Unknown		03FFS89
19FFS89	05/30/89	J	F	YF23	Unknown		
20FFS89	06/11/89	A	M		P-old age		04FFS89
21FFS89	06/25/89	J	F	YN98	Unknown		
22FFS89	>06/12/89	P	M	YU22	Unk.-disappeared		
23FFS89	>07/07/89	P	M	YUX8	Unk.-disappeared		
24FFS89	07/21/89	J	M	YL84	Unknown		05FFS89
25FFS89	>07/10/89	P	U	YUX9	Unk.-disappeared		
26FFS89	08/03/89	P	F	YUXA	Unknown		06FFS89
27FFS89	>08/10/89	P	M	YUXB	K-starved, disapp.		
28FFS89	08/22/89	A	F	Y519	P-drowned		07FFS89
29FFS89	08/25/89	J	U		K-shark-eaten		
30FFS89	>04/11/89	P	U	YUXC	Unk.-disappeared		
31FFS89	>04/28/89	P	U	YUXD	Unk.-disappeared		
32FFS89	>05/02/89	P	U	YUXE	Unk.-disappeared		
33FFS89	10/24/89	S	M	Y434	P-injury, starvat.		
34FFS89	11//89	P	U	YUXF	K-stillborn		

^aAge class: A = adult, S = subadult, J = juvenile, and P = neonatal pup.

^bSex: F = female, M = male, and U = unknown.

FIGURES

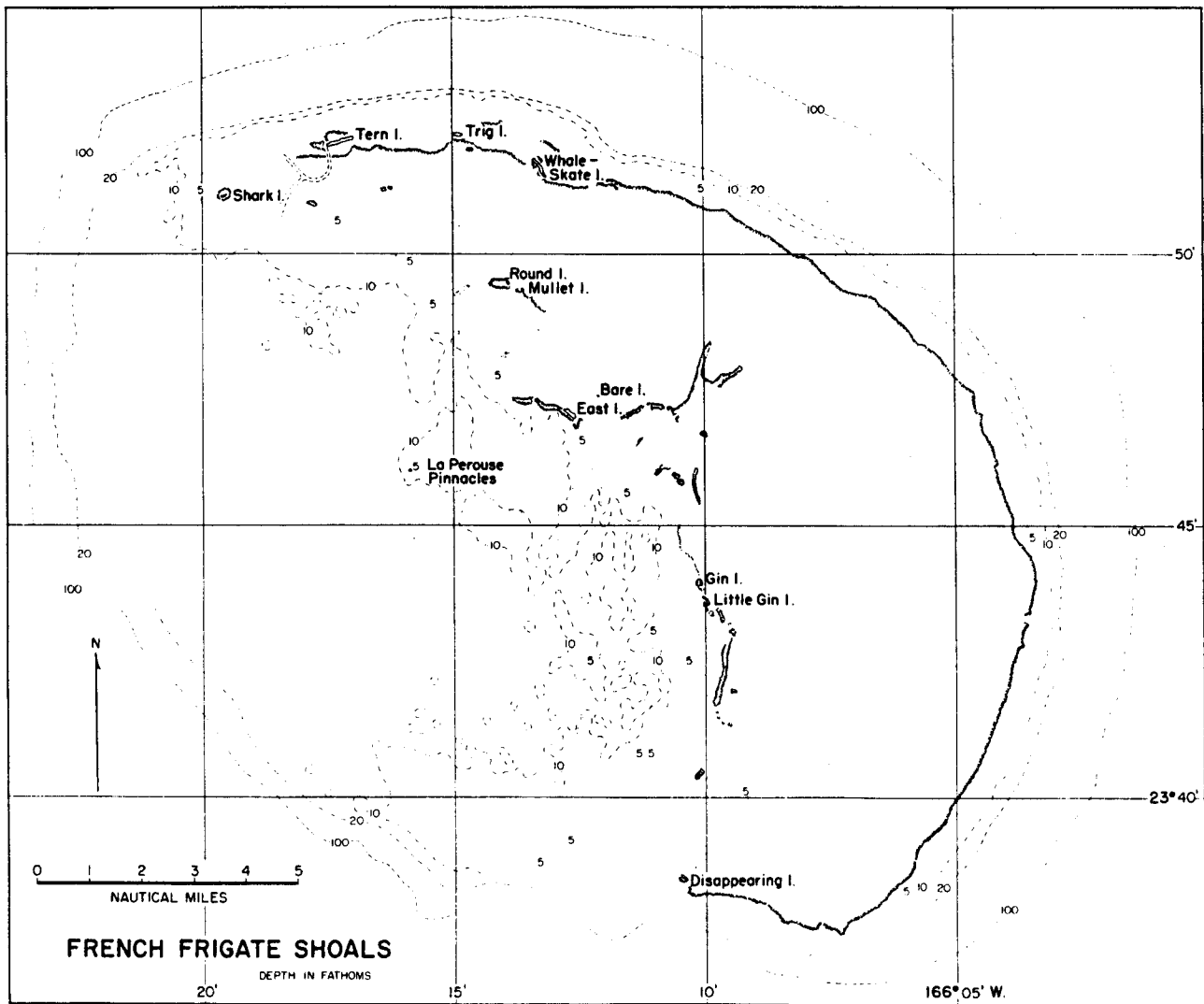


FIGURE 1. Permanent islands at French Frigate Shoals.

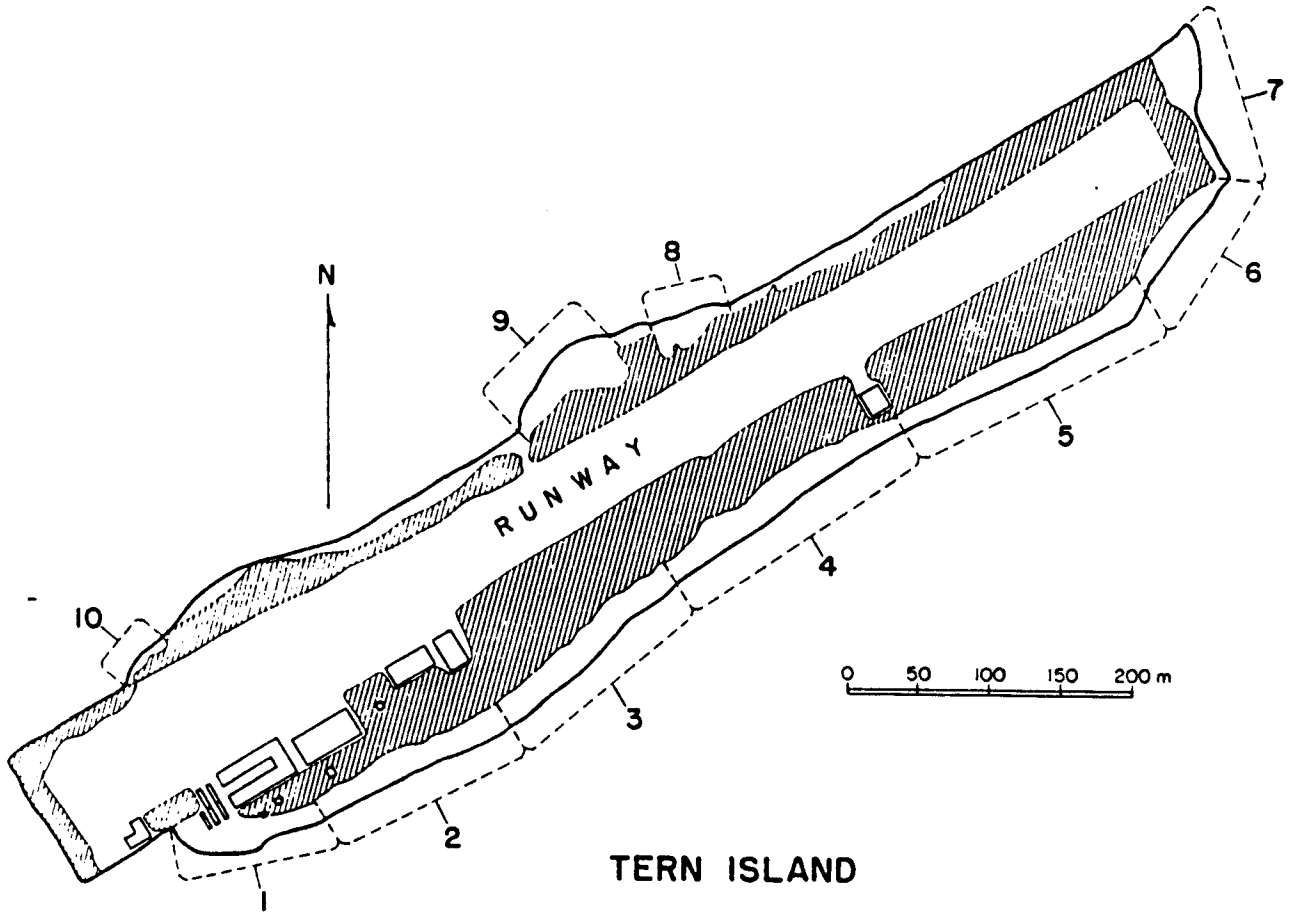


FIGURE 2. Tern I., FFS divided into sectors used in censuses.

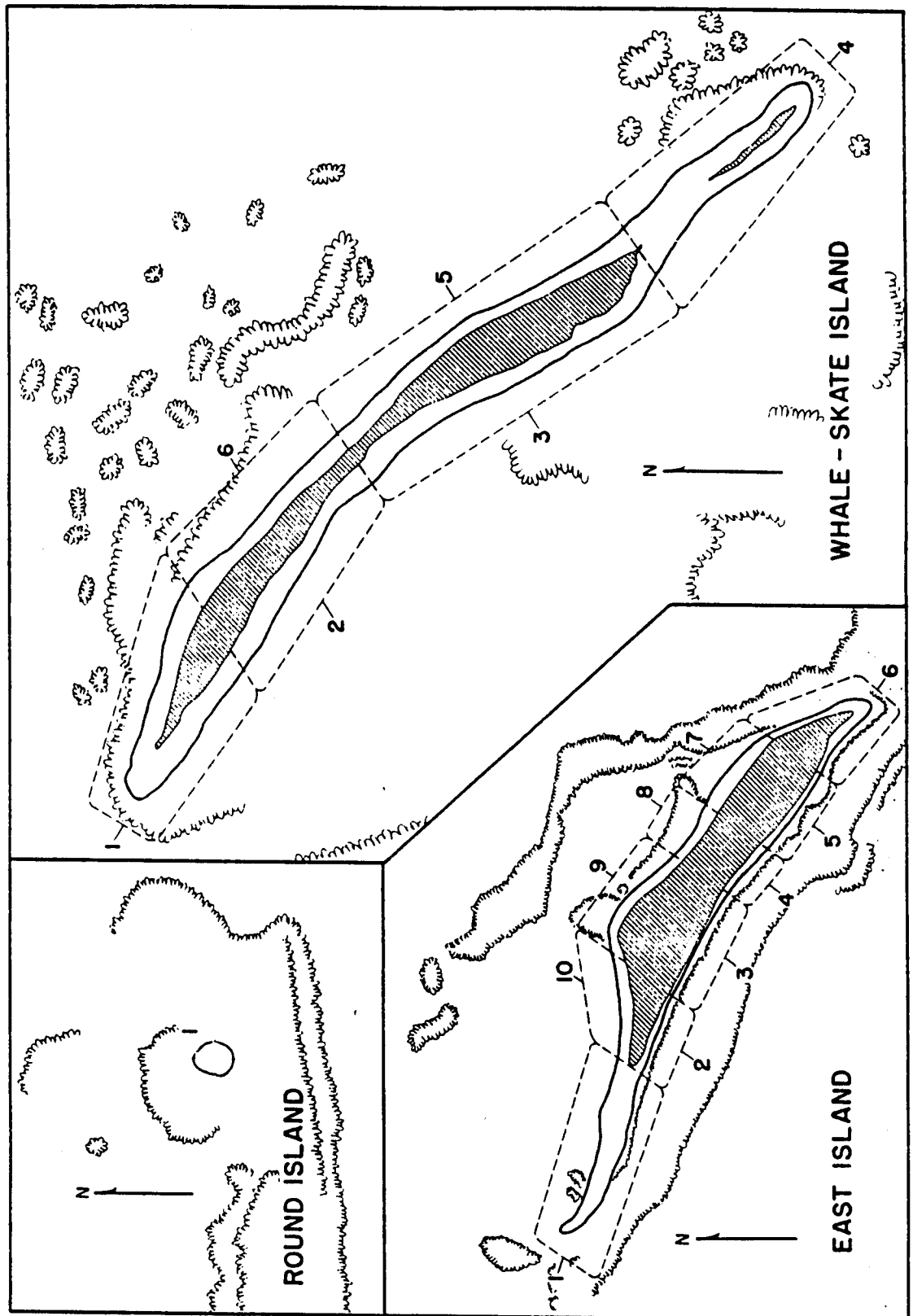


FIGURE 3. The major pupping islands; East, Whaleskate, and Round, divided into sectors used in censuses.

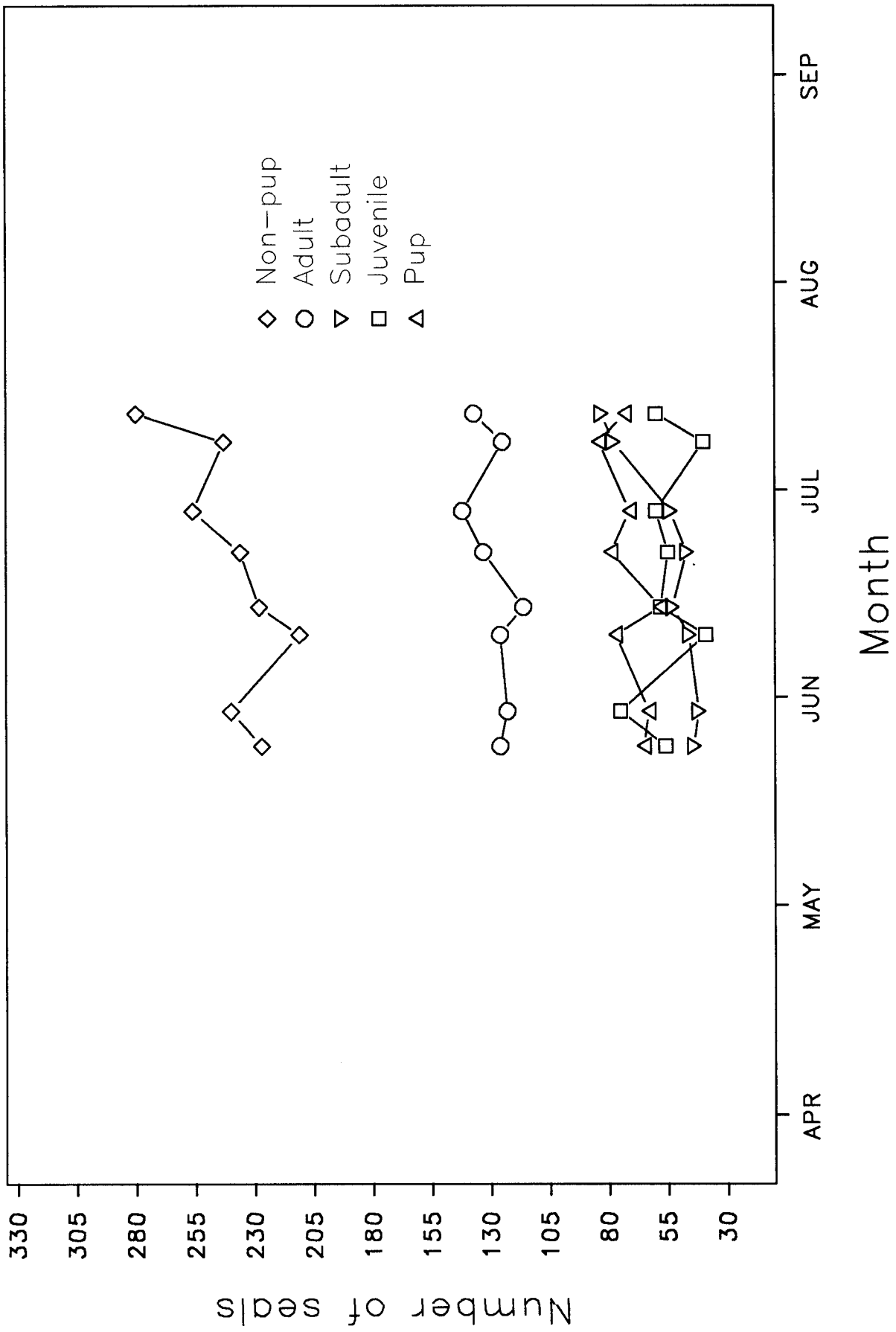


Figure 4. Non-pup and age class totals from 1988 atoll censuses..

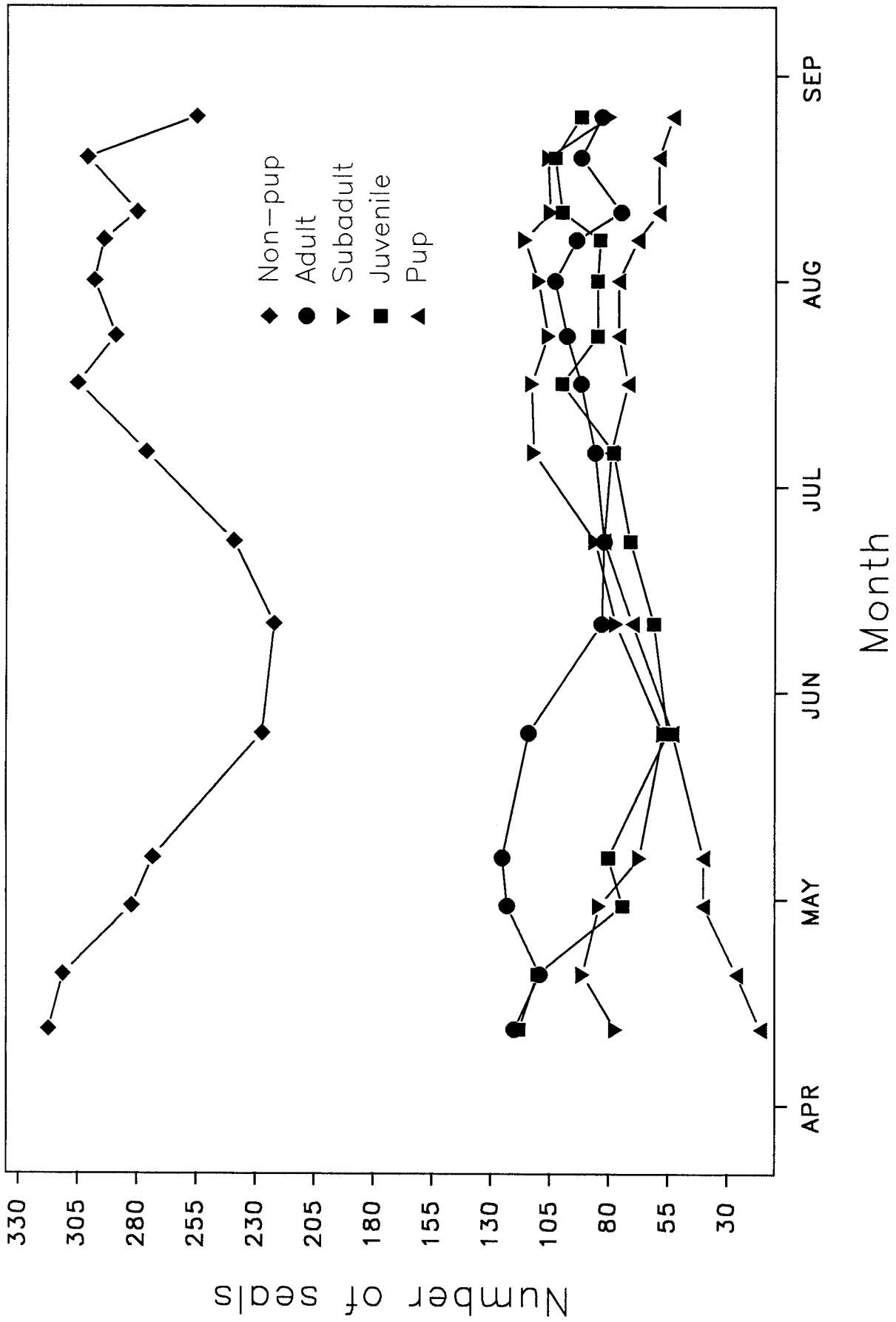


Figure 5. Non-pup and age class totals from 1989 atoll censuses.

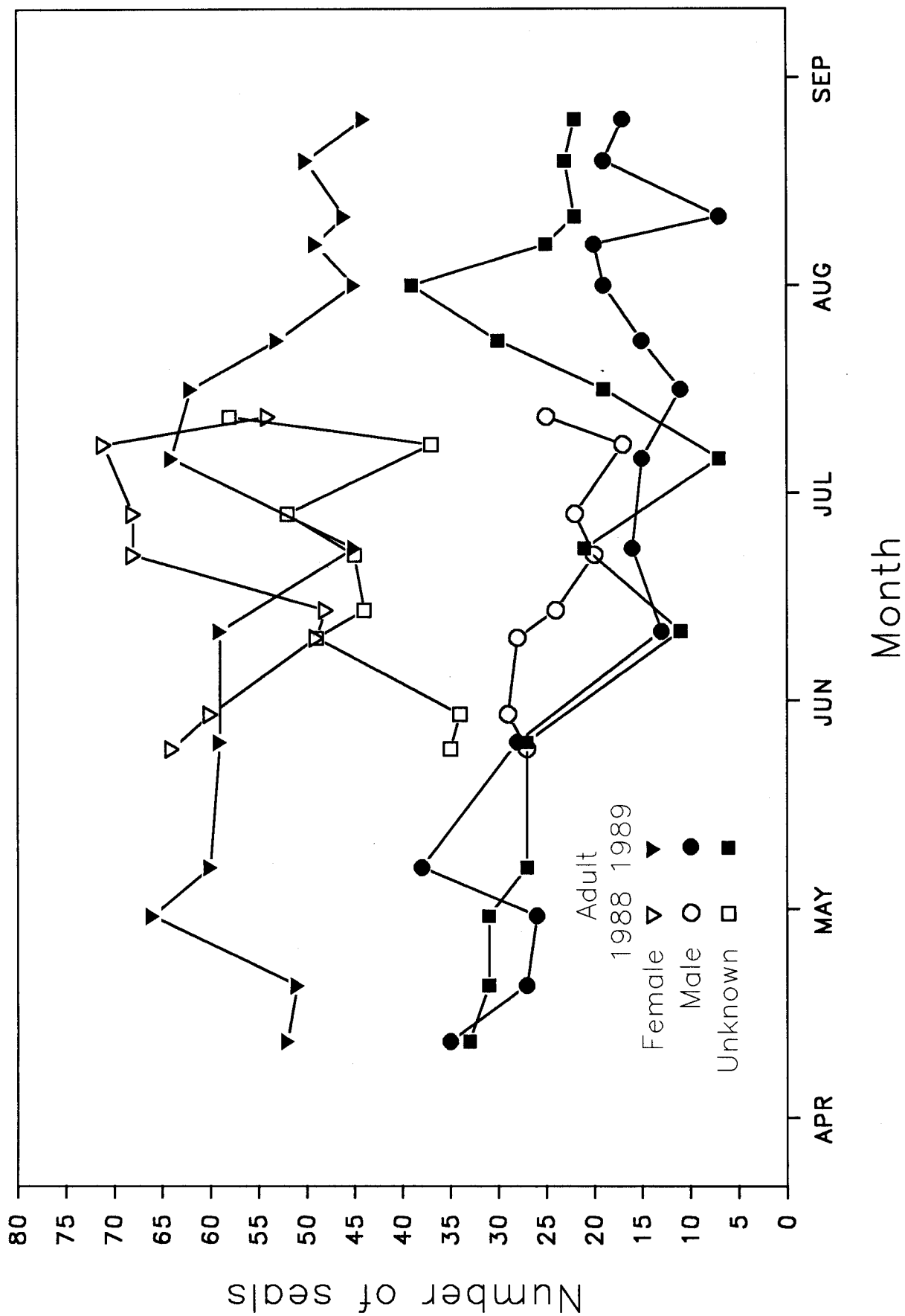


Figure 6. Number of adult seals by sex class from 1988 and 1989 atoll censuses.

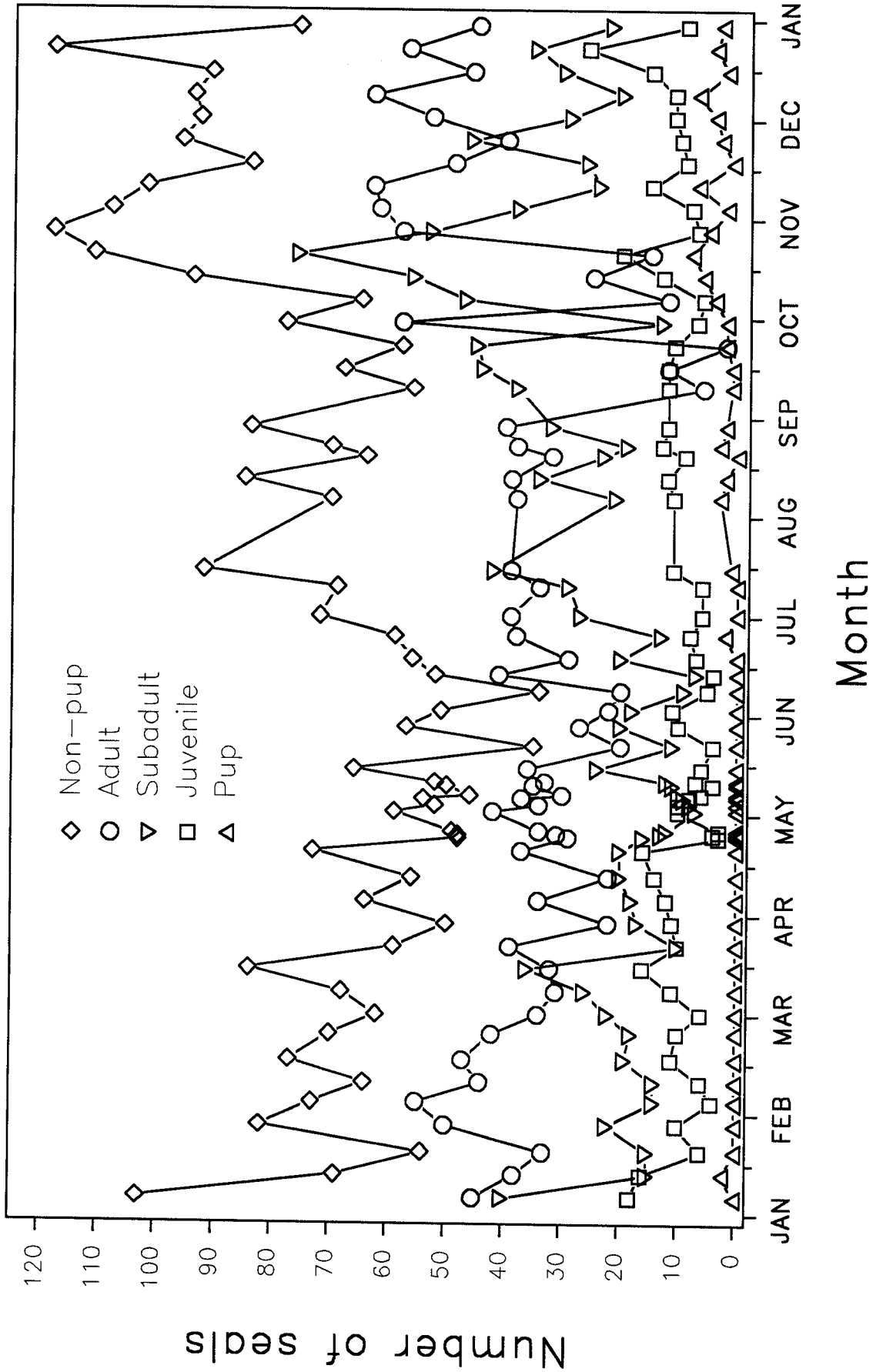


Figure 7. Non-pup and age class totals from 1988 Tern Island censuses.

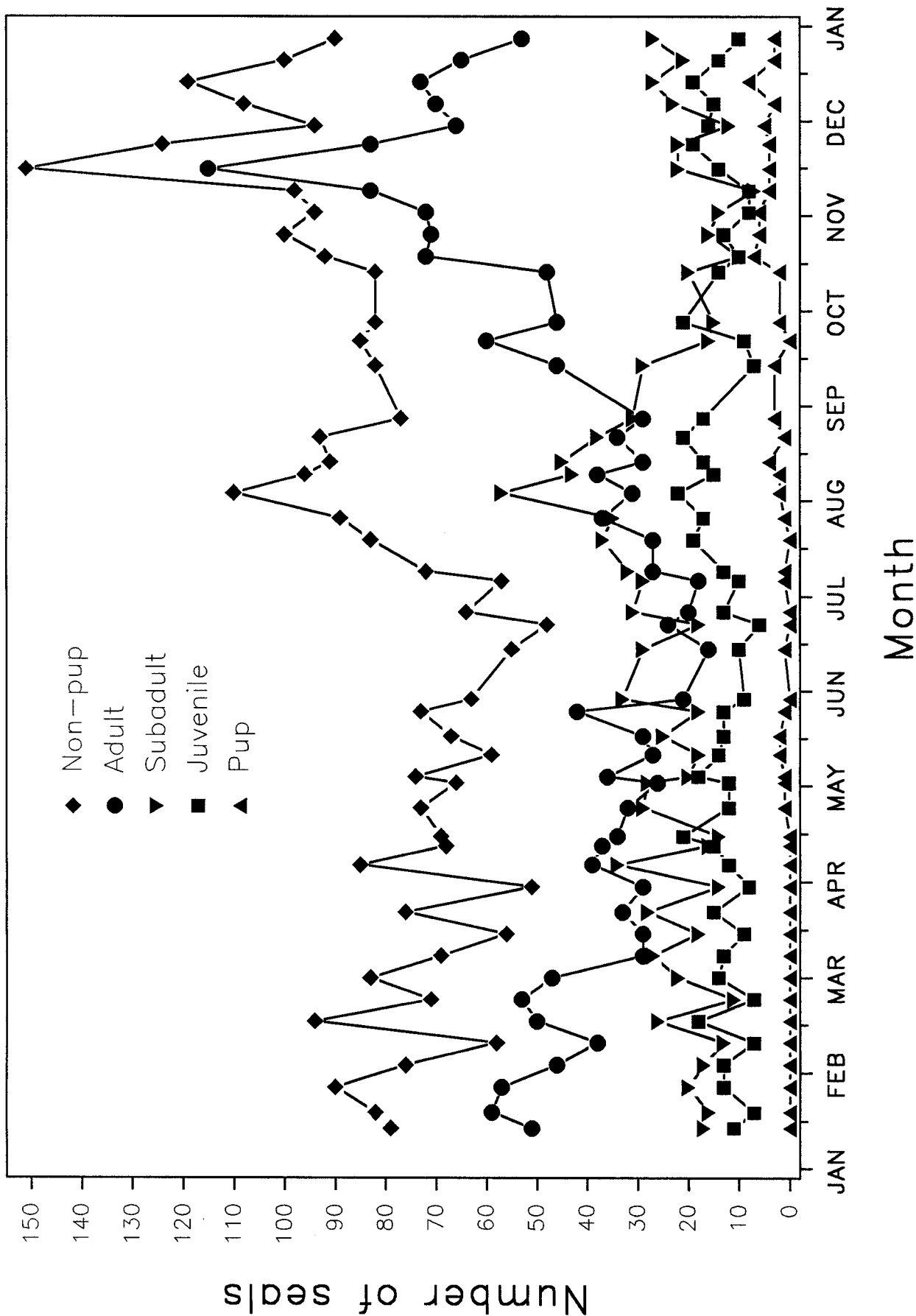


Figure 8. Non-pup and age class totals from 1989 Tern Island censuses.

APPENDIXES

Appendix A.--Itinerary of fieldwork conducted at French Frigate Shoals in 1988 by the National Marine Fisheries Service.

Date	Event
04/11	Fishing vessel <u>Feresa</u> disembarked R. Forsyth and L. Dean.
04/12	Research began.
05/12	NOAA ship <u>Townsend Cromwell</u> disembarked G. Balazs, S. Moriarty, H. Freifeld, G Nakai, T. Gerrodette, and A. Marks and embarked R. Forsyth and L. Dean.
05/13	Pups YF02, YF08, and YF09 were flown to Oahu.
05/21	<u>Townsend Cromwell</u> disembarked M. Craig and embarked G. Balazs and A. Marks.
05/25	Green turtle camp setup on Whaleskate Island and research began there.
06/06	<u>Townsend Cromwell</u> disembarked P. Dye.
06/09	Charter airplane <u>Venture 1</u> disembarked R. Withrow, J. Licciardi, and L. Fukuda and embarked T. Gerrodette and rehab. pups YF18, YF32, and YF36 bound for Oahu.
06/14	<u>Venture 1</u> disembarked J. Lenox and embarked G. Nakai and rehab. pup YF48 bound for Oahu.
06/22	<u>Townsend Cromwell</u> embarked R. Withrow, J. Licciardi, and H. Freifeld.
07/09	<u>Townsend Cromwell</u> disembarked T. Clark.
07/19	Sailing vessel <u>Climax</u> disembarked M. Brown.
07/25	<u>Venture 1</u> embarked M. Craig, J. Lenox, and S. Moriarty bound for Oahu.
08/13	<u>Feresa</u> disembarked D. Alcorn, A. Marks, M. Jacobs, and B. Choy.
08/16	<u>Feresa</u> departed with P. Dye and T. Clark for Oahu.
08/23	<u>Venture 1</u> embarked M. Brown and L. Fukuda bound for Oahu.
08/30	Field season for NMFS personnel ended.
08/31	<u>Townsend Cromwell</u> embarked D. Alcorn, B. Choy, A. Marks, and M. Jacobs.

Appendix B.--Itinerary of fieldwork conducted on French Frigate Shoals in 1989 by the National Marine Fisheries Service.

Date	Event
03/25	NOAA ship <u>Townsend Cromwell</u> arrived and disembarked M. Craig and L. Gill. Field camp was established.
03/27	Research commenced.
04/30	Rehabilitation pup YU03 was sent to Oahu via charter airplane of Pearl Pacific Airways (PPA).
05/26	PPA embarked L. Gill bound for Oahu.
06/19	<u>Townsend Cromwell</u> disembarked C. Lorence.
06/30	Rehab. pup YU40 was sent to Oahu via PPA.
07/13	Rehab. pup YU48 was sent to Oahu via research ship <u>Kila</u> .
07/15	<u>Townsend Cromwell</u> disembarked M. Lee and embarked C. Lorence.
09/03	Research by NMFS ended.
09/04	PPA embarked M. Craig and M. Lee bound for Oahu.

Appendix C.--Continued.

SECTOR--Location on island (e.g., 1-49 on Lisianski; 99 = no island)

SIZE--P1 = Nursing pup, wrinkles
 P2 = Nursing pup, no wrinkles
 P3 = Nursing pup, blimp, black
 P4 = Nursing pup, molting
 P5 = Nursing pup, molted
 PW = Prematurely weaned (undersized) pup
 W = Weaned pup
 J1 = Juvenile I
 J2 = Juvenile II
 S3 = Subadult III
 S4 = Subadult IV
 A = Adult
 T1 = Turtle, juvenile (<65 cm)
 T2 = Turtle, subadult (65-80 cm)
 T3 = Turtle, adult (>80 cm)
 U = Seal of unknown size

} P = Nursing pup

} J = Juvenile
 S = Subadult } I = Immature

} T = Turtle

SEX--M = Male
 F = Female
 U = Unknown

ID--Record ID number of seal if known; right justified: seal #25 = __25

? column: √ or 1 = ID number is questionable
 0 = seal is definitely not an IDed animal

BLEACH--Bleach number of seal if known; right justified; these columns may also be used for any temporary numbers assigned in the field

? column: √ or 1 = bleach is present, but the number is questionable
 0 = seal is definitely unmarked
 4 = partially read bleach number completed from other data

TAG--Tag number if known; right justified: tag #K23 = __K23.

L/R: Tag position L = tag on left flipper
 R = tag on right flipper
 B = tags on both flippers
 (only one tag number need be entered)

Appendix C.--Continued.

COL--Color code: T = tan (Laysan) R = red (Midway, Necker,
 K = gray (Kure) Nihoa)
 Y = yellow (FFS) B = blue (Pearl and Hermes)
 M = metal P = plastic Riese
 G = green (Lisianski)

? column: √ or 1 = seal is tagged, but the number is
 questionable
 0 = seal is definitely not tagged
 4 = partially read tag completed from other
 data
 5 = incompletely read tag, but partial data
 are certain

BEACH POS.--Location of seal or turtle when observer comes
 abreast of animal (e.g., if seal is seen midbeach
 from a distance and yet is at the waterline when
 the observer comes abreast, the seal is recorded
 as being at the waterline).

0 = animal floating in water or on an
 offshore rock (not included in census
 tally but may be used for behavioral
 data)
 1 = along waterline, on wet sand
 2 = midbeach, on dry sand
 3 = presentation zone or beach crest, on
 permanent beach

MOLT--Percentage of old pelage lost, optional for nursing
 pups

blank or 0 = no molting evident
 $\frac{1-99}{100}$ = 1 to 99% molted (right justified)
 $\frac{100}{100}$ = 100% molted, freshly molted, up to
 1 month after molt

? column: √ or 1 = % molt estimate is questionable
 0 = seal is definitely not molting

Appendix C.--Continued.

DISTURB--The degree to which the seal may have been disturbed by observer

- blank or 0 = 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--The time of an observation, on a 24-hour clock

ASSOCIATION DATA--There is room to describe two different associations (A and B).

Active associations

- 1) noted for all except behaviors between mother and nursing pup
- 2) must take place within 30 m of observer
- 3) subjects may be any distance apart

Spatial associations

- 1) noted as observer comes abreast of the subject
- 2) entangling object: distances < 2 m away
- 3) individual seals and turtles
 - mother-pup pair (N): any distance
 - all others (L): distances ≤ 10 m away, record two nearest neighbors in straight line of sight
 - record seal-seal and turtle-seal but not turtle-turtle associations

LINE NO.--Identity of the other party in the association

- 1) if a seal or turtle, put its line number here (note line number refers to within same census page only)
- 2) if an entangling object, put
 - NR or 99 = net and/or rope
 - FL or 98 = flotsam other than above

DIST.--Closest distance during behavior

- 0 = body contact
- 1 = < 2 m
- 2 = 2-5 m
- 3 = > 5 m (> 5 m but ≤ 10 m in the case of L behavior code)

Appendix C.--Continued.

BEHAVIOR--Up to four behaviors may be recorded for each association, but N, E, X, and Q should not appear together with other behaviors.

1) individual seal or turtle

a) active behavior

A = approach/investigate/sniff/nudge	}	B = bite
B1 = bite, nip		
B2 = bite, draws blood/breaks skin	}	C = chase*
C1 = chase, ≤ 2 body lengths*		
C2 = chase, > 2 body lengths*		
D = displace*		
F1 = flee/move away, ≤ 2 body lengths	}	F = flee/moveaway
F2 = flee/move away, > 2 body lengths		
J1 = joust ≤ 30 s*	}	J = joust/spar/fight*
J2 = joust > 30 s*		
M1 = mount/attempted mount ≤ 30 s	}	M = mount/attempted
M2 = mount/attempted mount > 30 s		
P = play*		
R = roll/present ventral		
V = vocalize		
Z = cruising (does not require a line number reference to an associated seal, but may have one)		

b) spatial association

N = mother-pup pair (any distance)
 L = association by location only (distance ≤ 10 m apart, for all except mother-pup pairs)

c) contests (optional)

L1 = pair association*
 Q = loser*
 W = winner*
 Y = tie*

2) entangling object

L = association by location only (distance < 2 m)
 E = subject is entangled

3) nothing nearby

O = no behavior or association

4) no data

X = no association data on census

*requires a corresponding code on the line of the associated seal

Appendix C.--Continued.

CONTINUE--If the same animal is recorded on another line for any reason (e.g., additional tag or association, behavior at a later time, change of beach position), put the line number you are continuing from here. Lines may be continued only within the same page.

NOTES--✓ or 1 if you have handwritten notes on the observation. Put handwritten notes on the back of the census form, labeled by line number. The following note codes have specific meanings:

L = observation is purely incidental--i.e., not on census or patrol

R = seal is on rock offshore (combined with beach position 0)

D = seal is dead

Additional notes:

1. Weather information (except temperature) should be a summary of the entire day up until the end of the census, not merely an instantaneous observation.
2. A separate data sheet should be filled out for each date, observer, data type, and island within an atoll. If no seals are present, you should still fill out the information at the top of the census form and write "No seals" in the data area. If the island itself is not present, indicate this by using "99" for the sector code, leaving the rest of the (first) line blank.
3. All associations (except with entangling objects) should be in pairs, i.e., between animals on two different lines. If the behavior is active, you should fill in the line numbers, distances, and behavior codes for both animals involved in the association. If the behavior is N or L, however, you may record the association on only one of the lines, and the computer will fill in the other line.
4. An association should either be all blank or have the 0 or X behavior only, with no line number or distance, or have a line number, a distance, and some behavior code (other than 0 or X) all present.
5. On a census it is assumed that molt, disturbance, and behavioral data will be taken. Thus, on a census data sheet, no code in any of the A or B columns means that the seal was alone, whereas on a patrol data sheet, no code may simply mean that no data were taken. It is not necessary to put an 0 code for each unassociated animal on census. The computer will fill this in later. If you are unable to record association data on a census for any reasons, indicate this information with an X for the behavior code.

Appendix C.--Continued.

-
6. Record all tag sightings explicitly (i.e., both left and right tag numbers) at least once during your stay. When a pup is tagged, record the first occurrence of that tag on a census data sheet for that date as well as on a tagging card. If a seal is identified via a tag, it is not necessary to determine and enter its ID number as well as tag number on the census form. The ID number will be added by computer later.

Appendix D.--Continued.

V. [For Honolulu Laboratory use]
Receiving veterinarian/biologist _____

Date of preparation for pathologist _____

Date of submission to pathologist _____

Agency/name of pathologist(s) _____

Cause of death _____ Known / Probable

Secondary pathology _____

VI. External Observations

Abnormalities and markings (Include any bruise, wound, old scars, condition of skin, external parasites, etc. Attach scar card and make drawings if deemed advantageous)

A. Head eyes: _____

nares: _____

mouth (look at tongue, gums, inner cheek, teeth): _____

B. Body dorsum: _____

ventrum: (include examination of umbilicus here): _____

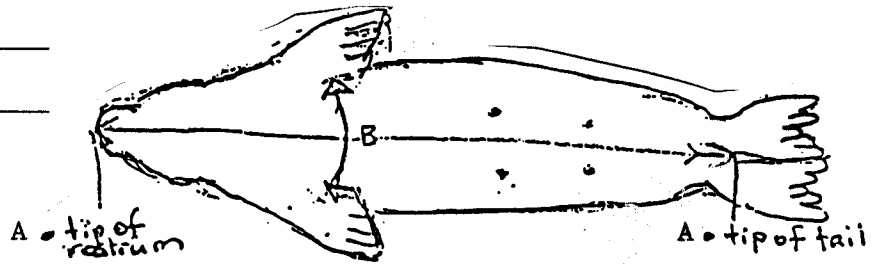
C. Limbs _____

Photographs: Note roll, frame, subject (i.e., why you are taking each shot)

Appendix D.--Continued.

VII. Measurements (take 3 with seal lying on its back)

- A. Standard length _____
- B. Girth at axilla _____



VIII. Reproductive status of female: Give what is known of reproductive history, i.e., dates of pupping, weaning, if she is thought to be pregnant, etc.

Was milk exuded from teats? _____

Description of milk _____

<p>Kidneys</p> <p>Weight: Left _____ Right _____</p> <p>Dimensions: Left _____ Right _____</p> <p>Observations: _____</p>	<p>kidneys L <input type="checkbox"/></p> <p>R <input type="checkbox"/></p> <p>100g kidney for toxicology <input type="checkbox"/></p>
<p>Spleen</p> <p>Weight: _____</p> <p>Dimensions: _____</p> <p>Observations: _____</p>	<p>spleen <input type="checkbox"/></p>
<p>Pancreas</p> <p>Observations: _____</p> <p>_____</p>	<p>pancreas <input type="checkbox"/></p>
<p>Stomach</p> <p>Omentum - if abnormal, i.e., red, thick, etc. (fat is normal), sample outer surface of stomach: _____</p>	<p>omentum <input type="checkbox"/></p>

Appendix D.--Continued.

Stomach lining note ulcers, etc. Are there parasites in ulcers? Ulcers: _____ _____ _____	stomach	<input type="checkbox"/>
Parasites: _____ Contents: Type: _____ Weight of full stomach: _____ Weight of empty stomach: _____	stomach contents	<input type="checkbox"/>
Intestines Outer surface: _____ _____ Lesions inside: _____ _____ Parasites: _____ _____	intestines intestinal parasites	<input type="checkbox"/> <input type="checkbox"/>
Mesenteric lymph nodes Condition: _____	mesenteric nodes	<input type="checkbox"/>
Liver Surface observations (include color, texture, rounded versus sharp edges): _____ _____ Weight: _____ Observations upon slicing lobes (of cut surfaces): _____ _____ Parasites: _____	liver liver for toxicology (100g) liver parasites	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Gall bladder--bile (include bile color): _____	gall bladder	<input type="checkbox"/>
Thoracic cavity Lung pleura: _____ Diaphragm: _____		
Thymus (largest in pup, may be absent in adults) Weight: _____	thymus	<input type="checkbox"/>
Skull _____ _____ _____	skull	<input type="checkbox"/>

Appendix D.--Continued.

"The Pluck"

Pericardial fluid: Amount _____ Color _____

Heart

External examination: _____ whole heart
_____ or
_____ heart muscle

Internal examination

Parasites in chambers: _____ heart

Parasites in pulmonary artery: _____ parasites

Plaque in pulmonary artery: _____

Other: _____ parasites in
_____ pulmonary
_____ artery_____ plaque

Lung

Tissue examination: _____ lung L
_____ R _____ note area
_____ where sampled
_____ i.e., tip,
_____ middle of lobe,
_____ dorsal, ventral

Trachea and bronchi

Abnormalities: _____ airway
_____ parasites

Parasites: _____

Weight of lung: Right: _____ Left: _____

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