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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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Southwest Fisheries Science Center

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Honolulu Laboratory,SWFSC
National Marine Fisheries Service, NOAA
2570 Dole Street
Honolulu, Hawaii 96822-2396

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U.S. DEPARTMENT OF COMMERCE
Ronald H. Brown, Secretary
National Oceanic and Atmospheric Administration
D. James Baker, Under Secretary for Oceans and Atmosphere
National Marine Fisheries Service
Rolland A. Schmitten, Assistant Administrator for Fisheries

ABSTRACT

The endangered Hawaiian monk seal (*Monachus schauinslandi*) was studied by the National Marine Fisheries Service at French Frigate Shoals (FFS) in the Hawaiian Islands National Wildlife Refuge 6-16 May 1990, 13 June-20 August 1990, and 23-29 September 1990; and from 24-26 January 1991 and 28 March-5 September 1991.

Ten atoll-wide beach counts made in 1990 averaged 248 adults, subadults, and juveniles. At least 89 pups were born. By the end of 1990, 80 of 89 (90%) pups had survived to weaning; 79 of those 80 were tagged (1 died before tagging). At least two pups were fostered by females other than their mothers. The means of axillary girth, dorsal standard length, and mass for recently weaned pups were 100 cm, 124 cm, and 63 kg, respectively. Six prematurely weaned female pups were collected and transported to Oahu for rehabilitation prior to reintroduction at Kure Atoll. Five weaned female pups of average girth were transported directly to Kure Atoll and released. Forty-five parturient females were identified from previous years. Minimum first year survival of 1989 weaned and tagged pups was 70 of 101 (69%). The means of axillary girth, standard length, and mass for a sample of yearlings were 97 cm, 140 cm, and 59 kg, respectively. Four seals moved between Laysan Island and FFS. One seal was seen at Brooks Bank, northwest of FFS. A juvenile was freed from entrapment in the seawall at Tern Island. A mating was observed near Tern Island. Injuries to 56 seals were recorded. Twenty-two seals, including 11 pups, were presumed or found dead. Necropsies were performed on 3 seals.

Ten atoll beach counts made in 1991 averaged 190 adults, subadults, and juveniles. At least 86 pups were born. By the end of 1991, 69 of 86 (80%) pups had survived to weaning, 68 of those were tagged (1 died before tagging). At least 8 pups were fostered by females other than their mothers. The means of axillary girth, dorsal standard length, and mass for recently weaned pups were 102 cm, 124 cm, and 64 kg, respectively. Six prematurely weaned female pups were collected and transported to Oahu for special care prior to release at Midway Atoll. Sixty-five parturient females were identified from previous years. Minimum first year survival of 1990 weaned and tagged pups was 48 of 74 (65%). The means of axillary girth, standard length, and mass for a sample of yearlings were 90 cm, 135 cm, and 52 kg, respectively. The means of axillary girth, standard length, and mass for a sample of 2-year-olds were 93 cm, 142 cm, and 60 kg, respectively. Five seals moved between FFS and Laysan Island and 12 seals moved between FFS and Necker Island or Nihoa Island. One seal from FFS was seen at Brooks Bank. Two seals were released from entangling marine debris, and one died from entrapment behind the seawall at Tern Island. Injuries to 154 seals were recorded. Twenty-eight seals were presumed or found dead, including 21 pups. One male seal was euthanized.

Necropsies were performed on 8 seals.

CONTENTS

INTRODUCTION

The largest population of the endangered Hawaiian monk seal (*Monachus schauinslandi*) is in the Northwestern Hawaiian Islands (NWHI) at French Frigate Shoals (FFS), 480 nmi northwest of the western tip 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 15 hectares; all the other islands range in size from less than 0.4 to 5.0 hectares.

Johnson et al. (1982) summarized changes in seal counts at FFS between 1957 and 1978. Schulmeister (1981) described Tern Island censuses made between 1956 to 1980 and observed that 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., 1993). 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 1979 (Schulmeister, 1981; Johnson and Johnson, 1984). The National Marine Fisheries Service, Southwest Fisheries Science Center, Honolulu Laboratory (NMFS) began annual studies in 1982 and began tagging weaned pups at FFS in 1984 using plastic Temple tags (cattle ear tags). From earlier studies at FFS the NMFS determined that less than 50% of the weaned pups with an axillary girth measurement less than 90 cm had survived to their first year (Eliason et al., 1992; Eliason et al., 1993; Craig et al., 1992; and unpublished data). Consequently, the NMFS began collecting prematurely weaned female pups in 1984. These pups were rehabilitated 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; and Gerrodette and Gilmartin, 1990). Hiruki and Ragen (1992) catalogued all historical counts at FFS.

During 1990 and 1991, the primary objectives at FFS were to conduct atoll-wide beach counts 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; apply Temple tags and PIT tags (Passive Integrated Transponder, Biosonics, Inc. Seattle, WA) to weaned pups and immature seals not previously tagged; retag seals with broken or missing tags; collect weaned female pups with an axillary girth measurement of less than 90 cm for rehabilitation; collect 5 weaned female pups of average girth (in 1990) for direct shipment and release at Kure Atoll; weigh and measure weaned pups, 1-year-olds, and 2-year-olds; collect tissue samples when tagging weaned pups and immature seals for DNA fingerprinting; release entangled seals, record injuries, deaths, and disappearances; perform necropsies; and catalogue and

destroy debris capable of entangling wildlife. The results of this work are presented in this report.

MATERIALS AND METHODS

NMFS field camp for FFS was based at Tern Island from 6-16 May 1990, 13 June-20 August 1990, and 23-29 September 1990; and from 24-26 January 1991 and 28 March-5 September 1991 (See Appendixes A and B for itineraries). During the rest of the year the population was monitored by the U.S. Fish and Wildlife Service (USFWS).

Census

FFS is made up of 10 permanent islands: Shark, Tern, Trig, Whale-Skate, Gin, Little Gin, Disappearing, Round, East, and La Perouse Pinnacle, and 9 semipermanent sand spits: Mullet Island, Bare Island, 3 spits north of Gin Island, 2 spits south of Little Gin Island, 1 spit northwest of Trig Island, and 1 spit east of Round Island (Fig. 1). Atoll censuses were counts of all seals hauled out on all beaches of FFS; island censuses were counts on single islands. We began seasonal atoll-wide censuses on 13 May 1990 and 9 April 1991 using the 1990 (Lee et al., 1993) and 1991 (unpublished data) revisions of the standard census form (Forsyth et al., 1988) and instructions (Johanos et al., 1987). Tern Island was censused approximately every week by the NMFS during their field season and by the USFWS throughout the remainder of the year.

Atoll censuses were conducted every 1-2 weeks and took 2 consecutive days to complete. These censuses began between 0900 and 1000 and ended between 1500 and 1700 each of the 2 days. During atoll censuses the islands were visited in the same order: (1) Round Island, (2) Disappearing Island, (3) Little Gin and Gin Islands, (4) Bare Island, and (5) East Island on one day; and (1) Shark Island, (2) Tern Island, (3) Trig Island, and (4) Whale-Skate Island on the other day.

Individual island censuses (i.e., counts of seals on single islands) started at approximately 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. These sector divisions facilitated communication between researchers about locations of specific events as well as enabling analyses of haulout trends, annual pupping locations, and marine debris accumulation. Figure 2 presents the sector divisions of the main pupping islands (East, Round, and Whale-skate Islands). Types of data recorded on censuses are described in Lee et al. (1993).

Size and Sex Designation, Tagging, and Individual Identification

During each census, observers assigned each seal a size and sex, recorded tag numbers and colors, and made drawings of individual markings and old or recent injuries. Size and sex classification followed Stone (1984).

One yellow, numbered, Temple tag was attached to weaned pups in the webbing of each hind flipper (Gilmartin et al., 1986). In 1991, weaned pups were also tagged near each ankle with PIT tags. Prior to injecting the tag, we prepared the skin with alcohol and an iodine solution and the tag with a coating of antibiotic ointment. To read the tag, a portable reader was held a few centimeters away from the skin. Identifiable immature seals that had broken or missing tags were retagged with the appropriately colored and numbered tag.

Photographs and drawings of seals with birthmarks, 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 two or more seasons. Temporary ID numbers (never beginning with the letter Y) were assigned to seals not previously identified and to all parturient seals in order to indicate the pupping site and order for each island in each year (i.e., E23-91 was the 23rd seal to pup on East Island in 1991; the prefix E = East, W = Whale-Skate, R = Round, TN = Tern, T = Trig, LG = Little Gin, and G = Gin). Since the 1990 field season started after pupping began, the temporary ID number assignment for parturient females did not necessarily follow chronological order for that entire year.

Prior to the beginning of the NMFS field season, usual pupping sites were visited only monthly by the USFWS, and during the field season the smallest permanent island, Round Island, was not as closely approached as other pupping sites. Consequently, we did not identify every female that pupped and may have missed some neonatal deaths or disappearances of prematurely weaned pups.

Pup Collection for Rehabilitation and Relocation

Female pups whose girth had measured less than 90 cm within 2 weeks after weaning (described herein as recently weaned) were collected (if transport were available within 2 weeks) and were sent to Sea Life Park, Oahu. After rehabilitation they were released the following year at Kure Atoll (rehabilitated seals from the 1990 cohort) and Midway Atoll (from the 1991 cohort). In 1990, in order to further enhance the reproductive potential

at Kure Atoll, five female pups that had weaned with an axillary girth greater than 99 cm were collected and transported directly to Kure Atoll. Seals with a girth of approximately 100 cm were considered to have weaned at an average size for FFS.

Immature Seal Measurement

Weaned pups were weighed and measured for dorsal standard length, standard length, and axillary girth (American Society of Mammalogists, 1967). In 1990, 1-year-old seals, and in 1991, both 1- and 2-year-old seals, were weighed and measured for axillary girth and standard length. These measurements were taken in order to compare growth rates between immature seals at Laysan Island and FFS.

To weigh immature seals we used a net strung between two 2 in by 2 in by 6 ft wood poles in order to wrap the seal for restraint. Straps with quick-release buckles were cinched in front of the shoulders and around the pelvis. Two lines with carabiners were wrapped as far apart along the net as possible and attached together above the seal in order to make a cradle. Finally, the lines were attached to a scale suspended from a hollow aluminum pole. Two people lifted the aluminum pole with the seal in the attached stretcher net to obtain the weight measurement.

Tissue Sample Collection

During the tagging procedure researchers collected tissue from the webbing of the hind flippers using a leather punch. This tissue was frozen. DNA from the tissue will be analyzed for genetic variation with the population.

Marine Debris Collection and Entanglement

Marine debris capable of entangling wildlife was collected, catalogued according to instructions in Johanos and Kam (1986), and destroyed. Entangled seals were freed when possible.

Injury

Injuries for each year were those first observed at any time during the calendar year and were categorized as punctures, abcesses, abrasions and lacerations, gaping wounds, circular wounds, or amputations of limbs (Hiruki et al., 1993). The general condition of the seals 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.

Death

Freshly dead seals were necropsied following procedures described in Winchell (1990). Abnormalities and injuries of these seals were examined; major organs were sampled; skulls were collected from all but nursing pups; and observations were recorded on a Monk Seal Necropsy Report Form (Craig et al., 1992).

RESULTS

Population

Atoll Census

In 1990, observers made 10 atoll censuses from 13 May-11 August (Table 1). The beach count of all seals averaged 290 (SD = 23.5) and, excluding pups, 248 (SD = 25.0) (Table 2). In 1991, the total count from 10 atoll censuses between 9 April and 9 August averaged 220 (SD = 39.5) and, excluding pups, 190 (SD = 32.2) (Tables 1 and 2).

The mean atoll beach count, excluding pups, decreased from 278 seals in 1989 (Craig et al., 1992 and Fig. 3) to 190 in 1991 - a significant decline in the means in two years (*t*-test, $p < 0.0001$).

Tern Island Census

The mean Tern Island beach count of all seals in 1990 was 85 (SD = 18.3, $n = 57$) and, excluding pups, 84 (SD = 17.9) (Tables 3 and 5). In 1991 the mean totals were 75 (SD = 17.5, $n = 43$) and 73 (SD = 17.8) with and without pups, respectively (Tables 4 and 5).

Minimum Population Total

In 1990, observers identified 537 seals: 89 pups (Tables 6 and 7) and 138 adult, 175 subadult, and 135 juvenile seals (Table 7). In 1991, the total was 606: 86 pups (Tables 8 and 9) and 247 adult, 172 subadult, and 101 juvenile seals (Table 9). During the longer field season in 1991 more effort to identify adults was expended (compared to 1990) (compared to any previous year). The identified seals in both years accounted for an unknown fraction of the total population.

Pup Production

At least 89 pups were born in 1990: 39 females, 45 males, and 5 of unknown sex (Table 6). Seventy-nine of these pups were tagged after weaning, and 11 of the 89 pups were found dead or had died before the end of the year. At least 86 pups were born in 1991: 49 females, 30 males, and 7 of unknown sex (Table 8). Sixty-eight of these pups were tagged after weaning, and 18 of the 86 pups were found dead or had died before the end of the field season. The numbers of the PIT tags applied to weaned pups are listed in Table 10.

In 1990, the birth sites and numbers at each site were: East I.--27 (30% of total births), Whale-Skate--20 (22%), Tern I.--10 (11%), and all other islets (Round, Trig, Little Gin, and Gin)-- 26 (29%); and 16 unknown (18%) (Table 6). In 1991, the birth sites and numbers were: East I.--29 (34%); Whale-Skate--26 (30%); Tern--13 (15%), and all other islets (Round, Trig, Little Gin, and Gin)--17 (20%); and 1 unknown (1%) (Table 8).

In 1990 and 1991, 45 and 65 parturient females, respectively, were identified from previous years (Tables 11 and 12). The field season in 1990 was shorter than in 1991, so fewer females were identified in 1990 as parturient. The age of the youngest Hawaiian monk seal known to have pupped is 5 years (Johanos et al., 1990). During 1990, none of 23 5-year-olds and only 1 of 29 6-year-olds were known to have pupped. In 1991, none of the 42 5- and 6-year-olds and only 2 of the 26 7-year-olds were observed to have pupped.

Pup Fostering

In 1990, at least 2 pups were fostered by mothers other than their own. Information related to these fosterings follows.

No. 1. On 8 May, an unidentified female was observed on East Island nursing 2 young pups.

No. 2. On 6 August, at Whale-Skate Island, female Y611 without a pup was observed interacting with Y535 and her pup. Later, in that day Y611 had begun nursing a tagged weaned pup, YG56.

In 1991, at least 8 pups were fostered by mothers other than their own. Information related to these fosterings follows.

No. 1. On 8 May, female Y543 was observed with a young pup on Whale-Skate Island. On 11 May, female Y624 had fostered Y543's pup. Y624's pup was dead (Death No. 12 in 1991).

No. 2 and 3. On 17 June, at East Island, females Y014 and Y489 were found with each other's pups. They fostered the pups to

weaning.

No. 4 and 5. On 28 June at East Island females Y523 and Y459 were found with each other's pups. They fostered the pups to weaning.

No. 6 and 7. On 30 June, at Whale-Skate Island, females Y351 and Y568 were found with each other's pups. By 14 July, Y351 had her own pup again and Y568 had weaned.

No. 8. On 30 June, at Whale-Skate Island, female Y613 was found with female Y055's pup (Y055 had weaned between 25 June and 30 June). Y613's pup was not observed then. On 2 July, Y613 was again with her own pup.

Survival to Weaning

In 1990 and 1991, the survival of pups from birth to weaning was 90% (80 of 89) and 80% (69 of 86), respectively (Tables 6 and 8). In 1990 and 1991, 7 and 10 neonatal deaths, respectively, were found on Tern Island. Pregnant seals consistently haul out at Tern Island prior to pupping on other islets. Hence, premature births may have been more likely to occur here compared to other islets at FFS. The experience and increased survey effort by USFWS personnel on Tern Island during these 2 years may account, in part, for the increase in the number of dead pups found compared to previous years.

Pup Collection for Rehabilitation and Relocation

In both 1990 and 1991, observers collected 6 recently weaned female pups with axillary girths below 90 cm. These pups were transported to Sea Life Park on Oahu. (See Tables 6 and 8 for tagging/collection dates and weaning islands; see Appendixes A and B for transportation dates). Also in 1990, 5 female pups with axillary girths, measured within two weeks of weaning, greater than 99 cm were collected and transported directly to Kure Atoll (Table 6).

Survival Post-Weaning

The minimum survival rate of pups tagged in 1989 and 1990 through the first full year was 69% (70 of 101) and 65% (48 of 74), respectively (Table 13). These survival rates include seals known to be alive in 1992 but not sighted in 1990 or 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. However, the 5 seals sent directly to Kure Atoll in 1990 are not included in the tagged total. The minimum

survival rate into 1990 and 1991 of each cohort tagged since 1984 is reported in Table 13.

Immature Seal Measurement

The mean, standard deviation, and sample size for axillary girth, dorsal standard length or standard length, and mass for recently weaned pups, for 1-year-olds in 1990, and 1- and 2-year-olds in 1991, is presented in Table 14. A more detailed analysis of the relationship of size and condition of immature seals at FFS, compared to immature seals at Laysan Island will be reported elsewhere.

Retagging

During 1990, observers replaced broken or lost tags on 2 immature seals, and during 1991, tags were replaced on 38 seals (Table 15).

Interisland Movement

In 1990, 1 male and 3 female seals moved between Laysan Island and FFS (Table 16, unpublished data). Adult female Y156 has often moved between these two locations in the past but is only known to pup at FFS (Craig et al., 1992; Eliason and Henderson, 1992; unpublished data). Adult female Y608 pupped at FFS in 1990 soon after leaving Laysan Island. In 1990, a NMFS observer on a fishing vessel at Brooks Banks photographed adult female Y162, usually resident at FFS (unpublished data).

In 1991, 5 female seals moved between FFS and Laysan Island. Seven male and 6 female seals moved between Necker Island or Nihoa Island and FFS (Table 16, unpublished data). In 1991, personnel from the USFWS and the NMFS censused Necker and Nihoa Islands, respectively, more extensively than usual (unpublished data). Hence, more sightings of FFS tagged seals were made at these islands. Adult females Y156 and T77F pupped at FFS then moved to Laysan Island. A fishing vessel reported the tag numbers of a juvenile female, YN37, observed at Brooks Banks in 1991.

Marine Debris Collection and Entanglement

In 1990 and 1991, 254 and 164 pieces, respectively, of net and line were collected.

In 1990, one juvenile male seal was found entrapped behind the seawall on Tern Island (Table 17). Personnel from the USFWS

rescued him. He had few lacerations and abrasions (Injury no. 49, Table 18).

In 1991, two seals were found entangled and a third seal died while entrapped in the Tern Island seawall (Table 17). Further information relating to these three cases follows.

No. 01FFS91. We removed a 2.5 cm diameter braided nylon loop from around the chest of an adult male. He was not injured. By using pruning shears to cut the line we were able to avoid restraining the seal.

No. 02FFS91. We found a recently dead subadult male that had hauled out behind the seawall (between sector 9 and 10) and apparently had not been able to return to the water.

No. 03FFS91. Using pruning shears we cut a net from around this female seal's neck. The female suffered two lacerations--one from the net and one from the shears (Injury numbers 90a and b, Table 19).

Mating Attempt

In 1990, an attempted mating was observed from Tern Island in sector 1. While 10 meters from shore, six adult males had attempted to mate with adult female Y150. Y150 was injured (Injury No. 7, Table 18). After approximately 30 minutes, the group moved onto shore where the activity stopped.

Injury

Observers discovered 57 different injuries to seals in 1990 (Table 18). Conspecifics had injured 13 seals (23%). At least 1 of these injuries had been from a multiple-male mating attempt. Sharks caused 21 injuries (37%): 2 injuries from the cookie cutter shark (*Isistius brasiliensis*) and 19 potentially life-threatening injuries from larger sharks. One seal had been injured from entanglement in a fishing net. The cause of the remaining 21 injuries (37%) could not be determined.

In 1991, 154 injuries were observed (Table 19). Conspecifics had inflicted 50 injuries (32%) of which 8 were probably from multiple male mating attempts. Sharks had caused 63 injuries (41%): 8 injuries from the cookie cutter shark and 55 more severe injuries from larger sharks. Two seals had been found with fishhooks embedded, one in its mouth and the other in its chest. One seal had been injured from entanglement in a fishing net (No. 03FFS91 in Table 17). The cause of 38 (25%) injuries could not be determined. [After the USFWS personnel at Tern Island had found the two seals with embedded hooks (Injuries No. 3 and 5b, Table 19) and had received reports from fishermen

of other interactions, the NMFS initiated regulatory action to establish a protected species zone for all waters within 50 nmi of the islands and atolls of the NWHI from Kure Atoll to Nihoa Island, including the corridors between these islands (Federal Register v. 56, p. 15842 and v. 56, p. 33211). The emergency plans became law in May 1991 (Amendment No. 3 to the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region) and in June 1991 (Amendment No. 4 to the Combined Fishery Management Plan, Environmental Assessment and Regulatory Impact Review for the Bottomfish and Seamount Groundfisheries of the Western Pacific Region)].

Death, Disappearance, and Removal

Between 4 January and 25 November 1990, observers found 22 dead seals (Table 20). More detailed information gathered from some deaths follows.

No. 01FFS90. Juvenile male. Body condition was emaciated. The seal had a deep gash exposing muscle in front of the right ankle (Injury No. 6, Table 18). It was last seen alive with the injury on 29 March in the same place on Tern Island. The cause of death was probably starvation.

No. 02FFS90. Juvenile female. The seal was last seen alive without injuries 27 March on Tern Island. It had been thin then and may have died from starvation.

No. 06FFS90. Adult male. It was last seen 7 February with an infected cookie cutter shark wound on its left eye and supraorbital ridge (Injury No. 01, Table 18). The cause of death was not determined.

No. 09FFS90. Juvenile female. It was last seen alive 22 March on Tern Island. It was considered gaunt when found dead and probably died from starvation.

No. 11FFS90. Weaned male pup. It was last seen alive 3 June on Whale-Skate Island. There were fresh scratches on the seal's dorsum similar to those found on recently mated adult females (Injury No. 55, Table 18). Its head had been traumatized. The bronchi had water in them suggesting that the seal had drowned.

No. 12FFS90. Newborn pup. The pup had been born next to a cement slab (a foundation for quonset huts used by the U.S. military 30-40 years ago) between the evening of 27 July and morning of 28 July. Its head and neck had been traumatized. The cause of death was not determined.

No. 13FFS90. Weaned male pup. It was last seen alive 6 August on Whale-Skate Island. There were fresh lacerations on its

dorsum similar to mating injuries of mature females (Injury No. 56, Table 18). Its head had been traumatized. The bronchi had water in them suggesting that the seal had drowned.

No. 14FFS90. Aborted fetus. Its mother, Y059, had fresh gashes from a large shark bite (Injury No. 00, Table 18). This trauma may have induced the abortion.

No. 17FFS90. Newborn male pup. The pup and its mother were found next to a section of the seawall that had been covered partially with sand. This pup appeared normal in size but apparently had been crushed by its mother.

No. 21FFS90. Juvenile male. This seal was last seen 19 August on Tern Island. It was considered severely emaciated then. The cause of death was probably starvation.

Between 1 January and 31 December 1991, 29 seals had either died or had disappeared and had therefore been presumed dead (Tables 20 and 21) and 2 were removed from the population. Information relating to deaths follows.

No. 04FFS91. Newborn female pup. Its mother had apparently crushed it.

No. 07FFS91. Adult male. The seal was very emaciated. The worn condition of its teeth suggested old age as the cause of death.

No. 10FFS91. Newborn male pup. It was found rolling in the intertidal zone. Two cm of its umbilicus remained. The head was traumatized. The bronchi didn't have water in them, so we assume it didn't drown. The cause of death was not determined.

No. 12FFS91. Newborn female pup. The placenta was still attached to the pup. The stomach contained yellowish-red tinted milk, and the intestines were full of digesting milk. No obvious trauma was observed. The cause of death was not determined.

No. 13FFS91. Weaned female pup. The seal was last known to be alive on 22 May on Whale-Skate Island. The seal had scratches on its dorsum and a patch of skin missing from the ventrum (Injury No. 151, Table 19). Adult male Y267 may have drowned this seal while attempting to copulate with it.

No. 14FFS91. Weaned male pup. The seal was last seen alive with its mother on 30 May on Whale-Skate Island. It had many fresh scratches on its shoulders and dorsum (Injury No. 152, Table 19). It had water in the bronchi. This seal had drowned.

No. 15FFS91. Weaned male pup. It was found rolling in the surf 6 June on Whale-Skate Island (sector 5). The seal was last seen alive on 2 June on Whale-Skate Island. It had fresh scratches on its ventrum and dorsum (Injury No. 153, Table 19). Its bronchi

had water in them suggesting drowning as the cause of death.

No. 16FFS91. Weaned female pup. The pup was found rolling in the intertidal zone. The seal was last seen alive on 7 June on Whale-Skate Island. It had fresh scratches on its dorsum and lacerations on its left foreflipper (Injury No. 154, Table 19). Its bronchi had water in them suggesting drowning as the cause of death.

No. 18FFS91. Subadult male. The seal was found behind the seawall between sector 9 and 10 (No. 02FFS91 in Table 17). It was last seen alive on Whale-Skate Island 4 days earlier. The stomach lining contained many ulcers and attached nematodes. The seal may have died from heat stress; no other cause of death was apparent.

No. 19FFS91. Newborn male pup. It appeared to have a wound on the left side of its head and the left eye was bulging. It may have been crushed by its mother. The pup's mother was next to the pup so we didn't recover it.

No. 20FFS91. Adult female. She was last seen alive 6 August on Tern Island (sector 1) and was considered emaciated then. She was at least 16 years old and had pupped consecutively 6 times since 1984. She had received shark bite injuries on 16 February (Injury No. 27, Table 19) and her pelage was noticeably deteriorating during this year. The incidence of injury and the deteriorating pelage suggested that the cause of death may have been age related.

No. 21FFS91. Subadult male. He was last seen alive on 24 August on Tern Island. There was a swollen, fresh shark bite injury to the right side of his neck and the right hindflipper (Injury No. 143, Table 19). The bites were not severe. The cause of death was not clearly determined.

Information relating to disappearances follows.

No. 25FFS91. A young nursing pup was 1 of 5 pups with mothers on Round Island on 10 May. On 18 May, only 3 pups could be accounted for. On 31 May, 5 pups were counted of which 1 was newborn. Consequently, we assumed at least one pup disappeared between 10 May and 18 May. There was a very high tide during that week.

No. 26FFS91. A young nursing pup was last seen 18 May on Little Gin. Neither the pup nor its mother were seen after that date.

No. 27FFS91. Only two young nursing pups were observed 8 August on Round Island. On 14 August and thereafter only one nursing pup was observed and no prematurely weaned pups were found.

Information relating to removals follows.

No. 17FFS91. Adult male Y267 was euthanized 13 June on Whale-Skate Island (Emergency permit No. 741 issued by the NMFS). On 2 June, Y267 aggressively defended the freshly drowned weaned pup YZX0 (Death No. 14FFS91 in Table 20). During 24-hour observations on Whale-Skate Island between 8 June and 13 June Y267 had aggressively attempted to mate with other seals and was found in the process of trapping weaned male pup YZ11 underwater while attempting to mount it (Y267 was thwarted by J. Megyesi in this instance). We had also highly suspected its involvement in the deaths of YZ00 (Death No. 13FFS91), YZ09 (Death No. 15FFS91), and YZ12 (Death No. 16FFS91).

No. 28FFS91. Subadult female Y634 was considered emaciated and not likely to survive in the wild. Consequently, she was relocated 7 August (NMFS permit No. 707) to Sea Life Park, Oahu as a joint effort between the NMFS and the Hawaii Institute of Marine Biology.

Conclusion

The number of seals counted on the beaches and the pup production during 1988-89 was the highest recorded at FFS (Craig et al., 1992). In 1990-91, the beach counts, pup production, survival to weaning, and survival of immature seals all decreased. In addition, the number of undersize weaned females collected continued to be high. This population clearly is declining after 30 years of increase (Fig. 3).

Importantly, reports of interactions with fisherman and observations of fishhooks embedded in seals represent an unknown percentage of the total interactions with humans. We are unable to determine the relative contribution these interactions have to the loss of seals in 1990 and 1991 at FFS.

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TABLES

Table 1.--Atoll censuses of French Frigate Shoals in 1990 and 1991.[a]

Date[b]	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-pup	Pup	Grand
1990															
5/13	34	54	42	19	25	15	13	17	6	7	3	29	225	39	264
7/05	25	44	55	17	20	19	18	7	15	16	11	24	220	51	271
7/09	14	48	57	23	25	21	16	14	5	12	6	21	223	39	262
7/15	23	52	51	33	24	22	21	10	11	17	8	27	248[c]	52	300
7/26	23	58	62	23	27	27	14	20	4	15	5	21	258	41	299
7/29	27	54	68	32	24	12	18	9	6	14	10	26	250	50	300
8/02	18	50	55	27	23	31	16	13	11	11	11	16	244	38	282
8/05	19	42	58	29	28	20	19	12	6	9	11	19	233	39	272
8/08	24	51	53	49	43	23	22	14	10	13	11	8	289	32	321
8/10	34	50	55	42	29	27	27	20	5	11	9	20	289	40	329
1991															
4/09	27	33	25	16	11	13	11	9	3	1	2	4	188[c]	7	195
5/10	21	39	32	13	20	8	9	10	3	6	4	11	155	21	176
5/18	30	44	24	24	17	3	12	9	4	8	8	8	167	24	191
5/30	36	50	29	21	14	6	14	10	6	10	9	11	186	30	216
6/17	35	57	23	15	16	10	13	11	2	10	17	8	182	35	217
6/24	25	58	22	17	18	9	7	7	1	11	12	10	164	33	197
7/05	33	43	18	21	18	6	9	6	1	12	13	5	155	30	185
7/18	31	80	29	35	25	7	14	13	2	13	18	14	236	45	281
7/29	28	77	21	37	34	8	12	14	2	14	18	6	235[c]	38	273
8/08	27	65	45	31	22	12	12	13	1	19	19	2	228	40	268

[a]M = male, F = female, and U = unknown.
[b]Date refers to first day of the 2-day atoll census.
[c]Total includes seals not assigned specific age class.

Table 2.--Summary statistics for whole atoll census counts in 1990 and 1991 (S.D. = standard deviation).

For 10 Censuses in 1990:			**For 10 Censuses in 1991:**		
Size Class	Mean	S.D.	Size Class	Mean	S.D.
Adults	130.0	10.3	Adults	110.7	19.2
Males	24.1	6.4	Males	29.3	4.6
Females	50.3	4.8	Females	54.6	15.8
Unknowns	55.6	6.8	Unknowns	26.8	7.7
Subadults	77.9	17.7	Subadults	50.7	14.1
Males	29.4	10.1	Males	23.0	8.6
Females	26.8	6.3	Females	19.5	6.4
Unknowns	21.7	5.7	Unknowns	8.2	3.0
Juveniles	39.9	5.6	Juveniles	24.0	5.1
Males	18.4	4.1	Males	11.3	2.3
Females	13.6	4.4	Females	10.2	2.6
Unknowns	7.9	3.6	Unknowns	2.5	1.6
Pups	42.1	6.6	Pups	30.3	10.9
Males	12.5	3.1	Males	10.4	4.8
Females	8.5	2.9	Females	12.0	6.1
Unknowns	21.1	6.1	Unknowns	7.9	3.7
Nonpup Total	247.9	25.0	Nonpup Total	189.6	32.2
Grand Total	290.0	23.5	Grand Total	219.9	39.5

Table 3.--Censuses of Tern Island in 1990.[a]

Date	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-pup	Pup	Grand
1/05	14	12	19	8	7	3	3	4	0	0	0	0	70	0	70
1/11	21	16	20	9	13	3	7	6	0	0	0	0	95	0	95
1/18	22	18	14	10	7	6	8	3	0	0	0	1	88	1	89
1/25	26	18	27	8	11	3	7	6	0	0	0	1	106	1	107
2/01	18	11	22	7	13	5	4	2	1	0	0	0	83	0	83
2/08	21	20	21	14	12	2	7	6	0	1	0	0	103	1	104
2/15	22	19	11	7	12	5	5	5	1	1	0	0	87	1	88
2/22	21	16	11	12	7	6	2	4	1	0	0	0	80	0	80
3/01	16	8	27	9	9	4	2	3	0	0	0	0	78	0	78
3/09	21	21	24	13	15	3	5	6	2	1	0	0	110	1	111
3/15	20	20	17	4	14	5	8	4	1	1	0	0	93	1	94
3/22	21	18	11	8	10	5	5	5	1	1	0	0	84	1	85
3/27	6	6	18	5	9	8	3	3	3	1	0	0	61	1	62
3/29	4	6	7	12	8	11	5	6	9	0	0	0	68	0	68
4/05	9	9	12	12	12	10	5	7	2	0	0	0	78	0	78
4/12	13	12	16	11	8	9	6	4	4	0	0	0	83	0	83
4/20	12	5	9	12	11	5	8	2	1	0	0	0	65	0	65
4/27	13	9	19	4	7	0	4	4	2	0	0	0	62	0	62
5/03	6	17	9	5	11	9	4	2	4	0	0	0	67	0	67
5/14	18	7	24	7	12	2	4	2	0	0	0	0	76	0	76
5/17	8	10	9	7	8	3	7	3	1	0	0	0	56	0	56
5/24	6	18	11	5	6	3	5	3	1	0	0	0	58	0	58
5/31	5	11	9	5	4	5	3	2	2	0	0	1	46	1	47
6/08	17	12	15	4	11	1	3	6	0	0	1	1	69	2	71
6/14	6	13	15	6	4	3	4	2	1	0	0	2	54	2	56
6/22	9	16	13	6	5	1	2	2	0	1	0	1	54	2	56
6/28	5	11	13	5	8	4	2	3	1	0	0	2	52	2	54
7/06	11	10	22	4	6	5	3	2	2	1	2	0	65	3	68
7/10	6	16	27	2	8	5	3	2	1	1	1	0	70	2	72
7/16	7	15	21	9	12	12	3	1	2	1	1	1	82	3	85
7/27	11	26	20	8	13	9	2	5	1	1	1	1	95	3	98

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
7/30	5	16	33	12	9	4	5	2	1	1	1	1	87	3	90
8/03	7	18	24	9	8	15	4	2	4	1	1	0	91	2	93
8/06	11	10	32	9	7	7	4	2	2	0	2	0	84	2	86
8/09	15	25	25	16	17	9	6	2	0	1	2	0	115	3	118
8/11	20	16	31	13	12	12	5	2	2	0	1	0	113	1	114
8/17	11	16	23	7	10	8	5	0	0	0	2	0	80	2	82
8/19	10	11	20	9	11	9	6	0	1	0	0	0	77	0	77
8/26	18	20	8	12	8	1	8	2	0	0	0	0	77	0	77
9/02	15	12	18	13	11	2	6	2	0	0	0	0	79	0	79
9/09	17	20	14	12	19	1	3	3	0	0	1	0	89	1	90
9/16	14	18	24	10	15	7	1	0	0	2	2	0	89	4	93
9/23	16	21	17	6	14	8	2	1	0	0	0	0	85	0	85
9/30	11	12	16	9	11	9	2	3	0	0	1	0	73	1	74
10/07	21	11	20	9	14	5	4	3	0	2	1	0	87	3	90
10/14	25	8	26	13	9	8	2	4	0	1	1	0	96[b]	2	98
10/21	27	12	19	14	4	9	1	3	1	0	1	0	90	1	91
10/28	23	8	50	8	7	3	3	3	0	0	1	0	105	1	106
11/04	41	9	23	13	10	4	1	0	0	2	0	0	101	2	103
11/11	30	10	38	12	9	4	2	4	0	0	1	0	109	1	110
11/18	36	13	26	6	7	0	3	1	0	0	2	0	92	2	94
11/25	31	12	38	7	9	0	2	3	0	1	0	0	102	1	103
12/02	40	17	49	5	7	1	6	2	0	2	2	1	127	5	132
12/09	25	12	25	10	9	0	1	2	0	1	0	0	84	1	85
12/17	39	17	23	8	7	0	1	2	0	0	1	0	97	1	98
12/23	18	7	36	4	5	3	3	0	0	0	1	0	76	1	77
12/30	27	27	40	8	11	0	3	1	0	1	1	0	117	2	119

[a]M = male, F = female, and U = unknown.
[b]This count includes seals not assigned a size or sex.

Table 4.--Censuses of Tern Island in 1991.[a]

Date	Adults			Subadults			Juveniles			Pups			Totals		
	M	F	U	M	F	U	M	F	U	M	F	U	Non-pup	Pup	Grand
1/06	24	32	31	7	5	0	3	3	0	0	0	0	105	0	105
1/15	23	18	22	8	9	0	4	1	0	0	0	0	85	0	85
1/21	20	21	12	2	8	0	3	1	0	0	0	0	67	0	67
1/28	32	30	22	11	5	0	5	4	0	0	0	0	109	0	109
2/03	25	19	18	16	3	0	3	3	0	0	0	0	87	0	87
2/10	27	16	16	10	7	0	3	1	0	0	1	0	80	1	81
2/17	22	18	15	9	10	0	3	0	0	0	1	0	77	1	78
2/24	28	19	24	12	4	1	3	1	0	0	1	0	92	1	93
3/03	21	26	17	7	9	0	1	1	0	0	1	0	82	1	83
3/10	14	19	23	7	7	0	2	2	0	0	0	0	74	0	74
3/17	19	16	21	11	6	0	5	2	1	0	1	0	81	1	82
4/01	12	14	8	9	7	4	3	3	1	0	1	0	61	1	62
4/10	17	15	9	8	5	6	2	3	0	0	0	1	65	1	66
4/16	13	9	6	9	4	1	2	1	1	0	0	0	46	0	46
4/20	14	9	7	11	8	4	2	2	0	0	0	1	57	1	58
4/29	18	8	18	5	2	5	3	2	1	0	1	0	62	1	63
5/04	14	13	16	2	6	1	1	3	1	0	2	0	57	2	59
5/11	12	14	9	2	5	1	1	0	0	1	1	0	44	2	46
5/19	13	13	5	4	5	0	2	3	1	1	1	0	46	2	48
5/30	12	13	16	3	5	1	2	1	2	1	1	0	55	2	57
6/18	14	13	2	3	2	0	1	1	0	2	0	0	36	2	38
6/25	11	13	7	5	3	0	2	1	0	2	0	0	42	2	44
7/06	15	11	12	6	6	1	0	2	0	1	1	0	53	2	55
7/19	10	30	14	7	6	2	2	2	1	0	1	1	74	2	76
7/30	8	38	3	11	15	0	1	3	0	0	1	0	79	1	80
8/09	14	29	14	13	7	1	2	2	0	1	2	0	82	3	85
8/25	6	29	23	9	10	1	2	3	0	0	1	0	83	1	84
9/11	17	22	8	11	8	0	4	2	0	1	2	0	72	3	75
9/18	17	15	12	8	6	0	0	2	0	1	1	0	60	2	62
9/25	21	10	21	11	9	0	1	1	0	1	1	0	74	2	76
10/03	11	14	11	17	7	2	1	1	0	1	1	0	64	2	66

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
10/10	11	3	21	8	4	5	1	1	1	0	1	0	55	1	56
10/17	35	11	23	4	3	1	1	2	0	1	0	0	80	1	81
10/24	34	14	29	6	6	3	1	1	0	1	0	0	94	1	95
10/31	32	10	37	5	9	1	1	3	1	1	0	0	99	1	100
11/07	14	18	17	22	5	17	1	2	1	2	0	0	97	2	99
11/14	28	15	17	11	7	9	0	2	1	3	0	0	90	3	93
11/21	28	10	20	19	8	6	0	5	0	1	0	0	96	1	97
11/28	26	16	20	13	4	2	2	2	0	0	0	0	85	0	85
12/05	15	22	15	13	5	6	0	1	0	2	0	0	77	2	79
12/12	18	16	19	9	6	2	0	1	0	2	1	0	71	3	74
12/19	26	14	24	11	5	3	2	4	0	1	1	0	89	2	91
12/29	11	13	19	10	7	7	0	1	0	1	1	0	68	2	70

[a]M = male, F = female, and U = unknown.

Table 5.--Summary statistics for census counts on Tern I. in 1990 and 1991 (S.D. = standard deviation).

For 57 Censuses in 1990:			**For 43 Censuses in 1991:**		
Size Class	Mean	S.D.	Size Class	Mean	S.D.
Adults	52.3	17.5	Adults	51.9	15.1
Males	17.0	9.3	Males	18.7	7.5
Females	14.1	5.2	Females	16.9	7.3
Unknowns	21.2	9.7	Unknowns	16.3	7.5
Subadults	23.3	7.1	Subadults	17.3	7.2
Males	8.6	3.2	Males	9.0	4.4
Females	9.7	3.2	Females	6.2	2.5
Unknowns	5.0	3.6	Unknowns	2.2	3.3
Juveniles	7.8	3.6	Juveniles	4.0	1.9
Males	4.0	2.0	Males	1.8	1.3
Females	2.9	1.7	Females	1.9	1.1
Unknowns	1.0	1.5	Unknowns	.3	.5
Pups	1.2	1.2	Pups	1.3	.9
Males	.5	.6	Males	.7	.8
Females	.5	.7	Females	.6	.6
Unknowns	.2	.5	Unknowns	.1	.3
Nonpup Total	83.5	17.9	Nonpup Total	73.3	17.8
Grand Total	84.7	18.3	Grand Total	74.7	17.5

Table 6.--Summary of pup data collected in 1990.[a]

ID No.	Tag No.[b] L	Tag No.[b] R	Sex	Birth Date[c]	Birth Islet[d]	Weaning Date[c]	Weaning Islet[d]	Nursing period (days)	Tag date	Measurement[e] AG(cm)	Measurement[e] DSL(cm)	Measurement[e] Mass(kg)
YG00	G00	G100	F						5/07	85	116	
YG01	G01	G101	F		Ea		Ea		5/11	95	123	
YG02	G02	G102	M		Ea		Ea		5/11	90	121	
YG03	G03	G103	M		Ea		Ea		5/11	93	118	
YG04	G04	G104	M		Ea		Ea		5/11	117	138	
YG05	G05	G105	F		Ea		Ea		5/11	96	125	
YG06	G06	G106	M		Tr	5/12-13	Tr		5/13	109	127	
YG07	G07	G107	F		Ea		Ea		5/14	93	119	
YG08	G08	G108	M		Ro		Ro		5/18	114	131	
YG09	G09	G109	F		Ro		Ro		5/15	105	126	
YG10[f]	G10	G110	F		Tr	5/14-15	Tr		5/15	108	133	
YG11	G11	G111	M		Tr		Tr		5/14	108	139	
YG12	G12	G112	F		Ea		Ea		6/17	96	125	
YG13	G13	G113	M		Ea	6/10-17	Ea		6/17	101	121	
YG14	G14	G114	M		Ea		Ea		6/17	88	113	
YG15[g]	G15	G115	F		Ea	6/10-17	Ea		6/17	84	118	
YG16	G16	G116	F		WS		WS		7/02	102	128	
									7/14[h]	97		55.4
YG17	G17	G117	M						6/20	88	113	
YG18	G18	G118	F		WS	6/16-23	WS		6/23	106	127	
YG19	G19	G119	M		WS		WS		6/23	112	129	
									7/16[h]	108		65.8
YG20	G20	G120	M		WS	6/16-23	WS		6/23	105	128	
YG21[g]	G21	G121	F		WS	6/16-23	WS		6/23	83	106	
YG22	G22	G122	M		WS		WS		7/02	113	130	
YG23	G23	G123	F						7/02	97	120	
YG24[g]	G24	G124	F		Tr	6/23-7/1	Tr		7/01	89	118	
									7/07[h]	89		40.2
YG25	G25	G125	M	5/27	Te	7/02	Te	36	7/03	96	128	
									7/07[h]	96		51.3
YG26	G26	G126	F		Ea	6/25-7/3	Ea		7/03	96	123	
YG27	G27	G127	M						7/03	86	116	

Table 6.--Continued.

ID No.	Tag No.[b] L	Tag No.[b] R	Sex	Birth Date[c]	Birth Islet[d]	Weaning Date[c]	Weaning Islet[d]	Nursing period (days)	Tag date	Measurement[e] AG(cm)	Measurement[e] DSL(cm)	Measurement[e] Mass(kg)
YG28	G28	G128	M		Ea	6/25-7/3	Ea		7/03	102	120	
									7/17[h]	100		49.5
YG29	G29	G129	M		Ea		Ea		7/03	97	118	
YG30	G30	G130	M		Ea	7/01-03	Ea		7/03	77	113	
									7/17[h]	71		26.8
YG31[f]	G31	G131	F		WS	6/20-7/3	WS		7/03	105	138	
									7/21[h]	102		56.7
YG32	G32	G132	F		LG		LG		7/05	101	132	
YG33	G33	G133	M		LG		LG		7/05	114	128	
YG34[f]	G34	G134	F						7/05	102	130	
									7/21[h]	98		59.0
YG35	G35	G135	F		Ea	6/22-7/5	Ea		7/05	120	132	
									7/24[h]	112		85.3
YG36	G36	G136	M		Tr	7/01-06	Tr		7/06	94	121	
YG37[g]	G37	G137	F		Tr	7/01-06	Tr		7/06	87	113	
YG38	G38	G138	F	6/01-08	Te	7/04	Te	26-33	7/06	99	121	
									7/07[h]			45.8
YG39	G39	G139	M						7/11	100	120	
YG40	G40	G140	M						7/11	95	129	
YG41[f]	G41	G141	F		Ea	7/01-11	Ea		7/11	101	129	
									7/17[h]	100		55.4
YG42	G42	G142	M		WS	7/01-14	WS		7/14	93	112	46.7
YG43	G43	G143	M						7/17	86	122	
YG44	G44	G144	F		Ea	7/10-17	Ea		7/17	95	124	51.7
YG45	G45	G145	F						7/17	98	139	64.4
YG46	G46	G146	F						7/18	90	125	
YG47[f]	G47	G147	F						7/19	99	130	54.4
YG48	G48	G148	F		Ea	7/07-20	Ea		7/20	119	131	92.6
YG49	G49	G148	M		Ea	7/11-24	Ea		7/24	123	129	90.3
YG50	G50	G150	M		WS	7/14-27	WS		7/27	106	130	69.4
YG51	G51	G151	F						7/29	94	118	49.0
YG52	G52	G152	F		Ea	7/20-8/2	Ea		8/02	104	125	74.0

Table 6.--Continued.

ID No.	Tag No.[b] L	Tag No.[b] R	Sex	Birth Date[c]	Birth Islet[d]	Weaning Date[c]	Weaning Islet[d]	Nursing period (days)	Tag date	Measurement[e] AG(cm)	Measurement[e] DSL(cm)	Measurement[e] Mass(kg)
YG53[g]	G53	G153	F	6/30-7/6	Tr	7/30-8/3	Tr	24-34	8/03	80	113	34.5
YG54	G54	G154	M		WS	7/30-8/3	WS		8/03	120	141	101.6
YG55[g]	G55	G155	F	7/05-09	Gi	8/02-05	Gi	24-31	8/05	87	113	40.4
YG56	G56	G156	F	7/02-06	WS	8/03-06	WS	28-35	8/06	98	129	54.0
YG57	G57	G157	M		WS	8/01-06	WS		8/06	100	126	59.9
YG58	G58	G158	M						8/08	97	123	
YG59	G59	G159	M						8/08	100	135	
YG60	G60	G160	M		Ea	8/01-08	Ea		8/08	116	134	93.3
YG61	G61	G161	M						8/09	109	133	
YG62	G62	G162	M		WS	8/02-09	WS		8/09	107	122	76.7
YG63	G63	G163	M						8/12	100	130	
YG64	G64	G164	F	7/07	Te	8/10	Te	34	8/12	92	119	47.2
YG74	G74	G174	F		Ea		Ea		9/24			
YG75	G75	G175	M		WS		WS		9/24			
YG76	G76	G176	M		WS		WS		9/24			
YG77	G77	G177	F		WS		WS		9/24			
YG78	G78	G178	F		Ea		Ea		9/26			
YG79	G79	G179	M		Ea		Ea		9/27			
YG80	G80	G180	M		Ea		Ea		9/27			
YG81	G81	G181	M		Ro		Ro		9/27			
YG82	G82	G182	M		Ro		Ro		9/27			
YG83	G83	G183	F		Ro		Ro		9/27			
YG84	G84	G184	F		Ro		Ro		9/28			
YG85	G85	G185	M		WS	9/25-10/11	WS		10/11	115	120	
YG86	G86	G186	M		WS	9/25-10/11	WS		10/11	122	132	
YG88	G88	G188	F		WS	9/25-10/11	WS		10/11	112	128	
YGX1			U	1/11	Te	PUP DEAD[i]						
YGX2			U	2/16	Te	PUP DEAD[i]						
YGX3			U	2/05	Te	PUP DEAD[i]						
YGX4			M	3/09	Te	PUP DEAD[i]						
YGX5			U	3/22	Te	PUP DEAD[i]						
YGX6			U	3/27	Te	PUP DEAD[i]						

Table 6.--Continued.

ID No.	Tag No.[b] L	Tag No.[b] R	Sex	Birth Date[c]	Birth Islet[d]	Weaning Date[c]	Weaning Islet[d]	Nursing period (days)	Tag date	Measurement[e] AG(cm)	Measurement[e] DSL(cm)	Measurement[e] Mass(kg)
YGX7			M	5/04-06	Ea	PUP DEAD[i]						
YGX8			F	7/29	Ea	PUP DEAD[i]						
YGX9			M	< 6/03	WS	6/03-23	WS		6/23[j]	102	131	64.0
YGXA			U	11/24-25	Te	PUP DEAD[i]						

[a]M = male, F = female, and U = unknown.
[b]L = left; R = right.
[c]Event dates are either exact (i.e., 4/21), known to have occurred within a range (i.e., 4/21-4/23), or known to have occurred before or after another date (i.e., <8/24 or >8/30, respectively).
[d]Islet abbreviations: Te = Tern, Ea = East, WS = Whale-Skate, Tr = Trig, Gi = Gin, LG = Little Gin, and Ro = Round.
[e]Measurement abbreviations: AG = axillary girth, DSL = dorsal standard length
[f]Collected to enhance Kure Atoll population.
[g]Collected for rehabilitation.
[h]Only measured and weighed on this date.
[i]Pup found dead on birth date (see also Table 21).
[j]Found dead on this date.

Table 7.--Number of individually identifiable seals observed in 1990, by sex and estimated size class.[a]

Size	Number of seals M	F	U	Total	Sex ratio[b]
Adults					
- known age[c]	16	16	0	32	
- unknown age[d]	7	99	0	106	
Total	23	115	0	138	
Subadults					
- known age[c]	86	87	0	173	1:1
- unknown age	0	2	0	2	
Total	86	89	0	175	1:1
Juveniles[c]	71	64	0	135	1.1:1
Pups	45	39	5	89	1.2:1
Total	225	307	5	537	
Total excluding pups	180	268	0	448	

[a]M = male, F = female, and U = unknown sex.
[b]Sex ratio is number of males to females. Sex ratio is provided only when the tagged seals represent most or all of the seals in that size category.
[c]Tagged seals. Age: adult = 5-6 years old, subadult = 2-6 years old, juvenile = 1-4 years old.
[d]Note that more effort was made to identify unknown age females compared to unknown age males.

Table 8.--Summary of pup data collected in 1991.[a]

ID No.	Tag No.[b] L	Tag No.[b] R	Sex	Birth Date[c]	Birth Islet[d]	Weaning Date[c]	Weaning Islet[d]	Nursing period (days)	Tag date	Measurement[e] AG(cm)	Measurement[e] DSL(cm)	Measurement[e] Mass(kg)
YZ00	Z00	Z100	F	2/17	Te	3/29-4/02	Te	41-45	4/04	101	125	
YZ01	Z01	Z101	F		Ea	3/31-4/09	Ea		4/10	98	128	58.1
YZ02	Z02	Z102	F		Ea	4/10-4/30	Ea		4/30	113	142	
YZ03[f]	Z03	Z103	F		Ea	4/10-4/30	Ea		4/30	86	113	
YZ04	Z104	Z04	M	3/31-4/10	Ea	5/10	Ea	31-41	5/10	106	123	69.9
YZ05	Z05	Z105	F	4/10-4/30	Ea	5/21	Ea	22-42	5/23	95	119	45.8
YZ06	Z06	Z106	F	4/10-4/30	Ea	5/17-5/23	Ea	18-44	5/24	109	137	85.7
YZ07	Z07	Z107	M	< 4/09	LG	5/18-5/30	LG	>39	5/30	104	127	71.7
YZ08	Z08	Z108	M	4/10-4/30	Ea	5/23-5/28	Ea	24-49	6/02	113	132	88.5
YZ09	Z09	Z109	M	4/10-5/01	WS	5/30-6/02	WS	30-54	6/02	93	120	54.9
YZX0			M	4/10-5/01	WS	5/30-6/02	WS	30-54	6/02[g]	99	102	
YZ10[f]	Z10	Z110	F	5/02	Te	6/05	Te	35	6/05	81	120	41.7
YZ11	Z11	Z111	M	4/16-5/01	WS	5/22-5/30	WS	30-45	6/06	94	123	50.3
YZ12	Z12	Z112	F	5/01-5/04	WS	6/06	WS	34-37	6/06	95	119	50.3
YZ13[f]	Z13	Z113	F	5/04-5/11	Tr	6/10	Tr	31-38	6/11	87	115	43.1
YZ14[f]	Z14	Z114	F	5/11-5/19	WS	6/11	WS	24-32	6/11	79	113	34.1
YZ15	Z15	Z115	M	5/09	Te	6/15	Te	38	6/16	93	116	48.5
YZ16	Z16	Z116	F	4/30-5/05	Ea	6/10-6/14	Ea	37-46	6/17	104	122	62.6
YZ17	Z117	Z17	F	4/30-5/05	Ea	6/10-6/14	Ea	37-46	6/17	103	126	66.2
YZ18	Z18	Z118	M	5/04-5/08	WS	6/13-6/17	WS	37-45	6/18	107	123	72.6
YZ19	Z19	Z119	F	5/13	Ea	6/24	Ea	43	6/24	111	128	81.2
YZ20	Z20	Z120	F	5/22	Ea	6/24	Ea	34	6/24	92	124	52.6
YZ21	Z21	Z121	M	4/30-5/05	Ea	6/10-6/14	Ea	37-46	6/24	109	121	68.0
YZ22	Z22	Z122	F						6/25	86	127	
YZ23	Z23	Z123	F	5/11-5/19	WS	6/18-6/25	WS	31-46	6/25	97	122	57.6
YZ24	Z24	Z124	F	5/19-5/30	Tr	6/18-6/25	Tr	20-38	6/25	94	123	54.9
YZ25	Z25	Z125	M	5/19-5/22	WS	6/25-6/30	WS	35-43	6/30	106	124	68.5
YZ26	Z26	Z126	F	5/11-5/19	WS	6/25-6/30	WS	38-51	6/30	114	135	88.5
YZ27[f]	Z27	Z127	F	5/22-5/30	WS	6/25-6/30	WS	27-40	6/30	82	106	39.5
YZ28	Z28	Z128	M	5/19-5/30	Tr	7/03	Tr	35-46	7/03	94	119	49.9
YZ29	Z29	Z129	M	5/18-5/31	LG	6/24-7/05	LG	25-49	7/05	118	131	92.1
YZ30	Z30	Z130	F	5/28	Ea	6/26	Ea	30	7/05	91	122	44.9

Table 8.--Continued.

ID No.	Tag No.[b] L	Tag No.[b] R	Sex	Birth Date[c]	Birth Islet[d]	Weaning Date[c]	Weaning Islet[d]	Nursing period (days)	Tag date	Measurement[e] AG(cm)	Measurement[e] DSL(cm)	Measurement[e] Mass(kg)
YZ31	Z31	Z131	F	5/28	Ea	6/29-7/05	Ea	33-39	7/05	110	136	79.8
YZ32	Z32	Z132	F	5/27-5/28	Ea	6/30	Ea	34-35	7/05	94	118	49.4
YZ33	Z33	Z133	M	5/22-5/30	WS	6/30-7/03	WS	32-43	7/06	101	122	55.8
YZ34[f]	Z34	Z134	F		Ro	5/31-6/17	Ro		7/09	89	119	
YZ35	Z135	Z35	F	6/02-6/06	WS	7/06-7/14	WS	30-42	7/14	94	118	54.9
YZ36	Z36	Z136	M	5/30-6/02	WS	7/06-7/14	WS	35-46	7/14	90	118	44.0
YZ37	Z37	Z137	M	6/02-6/17	Ea	7/15-7/16	Ea	29-45	7/18	107	127	71.2
YZ38	Z38	Z138	F	6/09	WS	7/15-7/19	WS	37-41	7/19	105	133	68.9
YZ39	Z39	Z139	M	6/08	WS	7/15-7/19	WS	38-42	7/19	99	124	57.2
YZ40	Z40	Z140	M	6/09	WS	7/19-7/24	WS	41-46	7/24	110	126	75.3
YZ41	Z41	Z141	F	6/10-6/12	Tr	7/19-7/26	Tr	38-47	7/26	104	128	68.0
YZ42	Z42	Z142	M	6/17-6/22	Ea	7/23-7/28	Ea	32-42	7/28	107	126	66.7
YZ43	Z43	Z143	M	6/17	Ea	7/18-7/21	Ea	32-35	7/28	89	120	49.0
YZ44	Z44	Z144	F		Ro	7/18-7/29	Ro		7/29	105	127	
YZ45	Z45	Z145	F	6/22	Ea	7/28-7/29	Ea	37-38	7/29	93	116	52.2
YZ46	Z46	Z146	M	6/22	Ea	7/29	Ea	38	7/29	98	118	54.4
YZ47	Z47	Z147	F	6/18-6/25	Tr	7/26-7/30	Tr	32-43	7/30	101	122	59.0
YZ48	Z48	Z148	M		Ro		Ro		8/04	110	130	
YZ49	Z49	Z149	F	6/17	Ea	8/05-8/06	Ea	50-51	8/08	117	132	87.5
YZ50	Z50	Z150	F	7/05	Te	8/08	Te	35	8/10	100	123	55.8
YZ51	Z51	Z151	F		Ro		Ro		8/14	99	128	
YZ52	Z52	Z152	F	7/03	Ea	8/13	Ea	41	8/14	117	131	91.6
YZ53	Z53	Z153	F		Ro		Ro		8/16	99	131	
YZ54	Z54	Z154	F	7/16-7/19	WS	8/16-8/17	WS	28-32	8/17	99	123	61.2
YZ55	Z55	Z155	F	7/06-7/14	WS	8/09-8/16	WS	26-41	8/17	100	120	59.0
YZ56	Z56	Z156	M	7/06-7/14	WS	8/17-8/20	WS	34-45	8/20	99	114	51.7
YZ57	Z57	Z157	M	7/06-7/14	WS	8/20-8/23	WS	37-48	8/23	112	127	84.4
YZ58	Z58	Z158	F	7/17	Ea	8/24-8/25	Ea	38-39	8/25	111	124	83.0
YZ59	Z59	Z159	M	7/22-7/23	Ea	8/30	Ea	38-39	8/31	102	121	64.9
YZ60	Z60	Z160	F	7/30	Ea	8/31	Ea	32	9/01	94	112	55.8
YZ61	Z61	Z161	M	7/24-8/09	WS	8/29-9/12	WS	20-50	9/12	108	129	71.7
YZ62	Z62	Z162	F	7/18-7/29	Ro	8/14-9/17	Ro	16-61	9/17	117	137	76.8

Table 8.--Continued.

ID No.	Tag No.[b] L	Tag No.[b] R	Sex	Birth Date[c]	Birth Islet[d]	Weaning Date[c]	Weaning Islet[d]	Nursing period (days)	Tag date	Measurement[e] AG(cm)	Measurement[e] DSL(cm)	Measurement[e] Mass(kg)
YZ63	Z63	Z163	F	7/24-8/09	WS	9/12-9/17	WS	34-44	9/22	116	135	87.5
YZ64	Z64	Z164	F	8/18	Ea	9/26-10/1	Ea	39-44	10/05	112	133	83.9
YZ65	Z65	Z165	F	8/16-8/29	WS	9/26-10/6	WS	28-51	10/06	112	133	83.0
YZ66	Z66	Z166	F	8/16-8/29	WS	9/26-10/6	WS	28-51	10/06	119	140	88.0
YZ67	Z67	Z167	F	8/08-8/15	Gi	8/31-10/8	Gi	16-61	10/08	108	132	
YZXM			U	1/17	WS	PUP DEAD[h]						
YZXA			U	1/22	Te	PUP DEAD[h]						
YZXB			M	2/04	Te	PUP DEAD[h]						
YZXC			M	2/06	Te	PUP DEAD[h]						
YZXD			F	2/13	Te	PUP DEAD[h]						
YZXN			F	3/13	Te	PUP DEAD[h]						
YZXE			F	3/17	Te	PUP DEAD[h]						
YZXF			M	4/29	Ea	PUP DEAD[h]						
YZXG			M	5/11	Ea	PUP DEAD[h]						
YZXH			F	5/08	WS	PUP DEAD[h]						
YZXI			M	6/17	Ea	PUP DEAD[h]						
YZXJ			F	10/14	Te	PUP DEAD[h]						
YZXK			U	11/07	Te	PUP DEAD[h]						
YZXL			U	12/12	Te	PUP DEAD[h]						
YZD1			U	< 5/10	Ro	DISAPPEARED[i]						
YZD2			U	4/09-5/11	LG	DISAPPEARED[i]						
YZD3			U	7/18-7/29	Ro	DISAPPEARED[i]						

[a]M = male, F = female, and U = unknown.
[b]L = left; R = right.
[c]Event dates are either exact (i.e., 4/21), known to have occurred within a range (i.e., 4/21-4/23), or known to have occurred before or after another date (i.e., <8/24 or >8/30).
[d]Islet abbreviations: Te = Tern, Ea = East, WS = Whale-Skate, Tr = Trig, Gi = Gin, LG = Little Gin, and Ro = Round.
[e]Measurement abbreviations: AG = axillary girth, DSL = dorsal standard length.
[f]Collected for rehabilitation.
[g]Found dead on this date (see Table 20).
[h]Pups found dead on birth date (see Table 20).
[i]Pups assumed to have disappeared (see Table 21).

Table 9.--Number of individually identifiable seals observed in 1991, by sex and estimated size class.[a]

Size	Number of seals				Sex ratio[b]
	M	F	U	Total	
Adults					
- known age[c]	28	32	0	60	
- unknown age[d]	50	137	0	187	
Total	78	169	0	247	
Subadults					
- known age[c]	87	78	0	165	1.1:1
- unknown age	4	3	0	7	
Total	91	81	0	172	
Juveniles					
- known age[c]	50	43	0	93	1.2:1
- unknown age	4	4	0	8	
Total	54	47	0	101	
Pups	30	49	7	86	0.6:1
Total	253	346	7	606	
Total excluding pups	223	297	0	520	

[a]M = male, F = female, and U = unknown sex.
[b]Sex ratio is the number of males to females. Sex ratio is provided only when the tagged seals represent most or all of the seals in that size category.
[c]Tagged seals. Age: adult = 5-8 years old, subadult = 2-7 years old, juvenile = 1-4 years old.
[d]Note that more effort was made to identify untagged females compared to unknown age males.

Table 10.--Passive Integrated Transponder (PIT) tags applied to weaned pups in 1991.[a]

ID No.	Tag number		Tag Date	ID No.	Tag number		Tag Date
	Left	Right			Left	Right	
YZ00	E3266	D7018	4/04	YZ39	F693A	D7E65	7/19
YZ01	D3C63	D2D0D	4/10	YZ40	D155B	D3A21	7/24
YZ03	D4143	E0E41	4/30	YZ41	E2047	E2912	7/26
YZ04	E1206	D4341	5/10	YZ42	E0F0E	D2A77	7/28
YZ05	D3007	E1063	5/23	YZ45	E120C	E342B	7/29
YZ10	A447F	D2715	6/05	YZ46	E5A5D	E7F2A	7/29
YZ15	E2A77	E1B1F	6/16	YZ47	D4036	E1674	7/30
YZ16	D0154	E117A	6/17	YZ48	A4816	D1875	8/04
YZ17	D2F3F	D3975	6/17	YZ49	D1A53	E127D	8/08
YZ18	E3502	E340C	6/18	YZ50	D281F	D161E	8/10
YZ19	E3511	D1719	6/24	YZ51	D321C	D1319	8/14
YZ20	E0F10	D3F45	6/24	YZ52	E0D25	E0E44	8/14
YZ22	E2F50	E1018	6/25	YZ53	D4264	D035A	8/16
YZ23	D1504	D2C2C	6/25	YZ54	E346B	E3137	8/17
YZ24	E7D36	E124C	6/25	YZ55	E1031	E120F	8/17
YZ25	D385E	E3846	6/30	YZ56	D7C44	E1020	8/20
YZ27	D2711	D3916	6/30	YZ57	E2D3A	E245A	8/23
YZ28	D1362	A3D5B	7/03	YZ58	E0210	D1A5F	8/25
YZ29	D4819	D301A	7/05	YZ59	D2919	F0119	8/31
YZ30	D1551	E311F	7/05	YZ60	D3068	E100D	9/01
YZ31	D7D28	D3B5F	7/05	YZ61	E432A	E2016	9/12
YZ32	E1B7B	E0F02	7/05	YZ62	E255C	D7B70	9/17
YZ33	E0E62	D367E	7/06	YZ63	E4A47	E1E18	9/22
YZ34	D4773	D4475	7/09	YZ64	E0D65	D742D	10/05
YZ35	D472E	E1A3A	7/14	YZ65	D4242	D006D	10/06
YZ36	D1314	E1869	7/14	YZ66	E4F3F	D2C2F	10/06
YZ37	D2E22	D725B	7/18	YZ67	D183C	D3444	10/08
YZ38	E3330	E0060	7/19				

[a]Each PIT tag number listed here is the last 5 digits of a 10-digit number. The first 5 digits for each tag are **7F7D1**.

Table 11.--Summary of parturition data collected in 1990.

Adult female		Birth			Wean date[a]	Lactation period (days)
ID No.	Temp. ID No.	Date[a]	Islet[b]	Sector		
Y004		7/12-7/15	Ea		8/09-8/23	25-42
Y009	TN2	5/27	Te	8	7/02	36
Y014	ED	<7/03	Ea		>7/04	
Y022	W06	6/24-6/30	WS	6	8/09	40-46
Y030	W01	<6/23	WS		7/15-7/27	
Y055	EJ	<5/14	WS		5/15-6/23	
Y059		2/05	Te	2	PUP DEAD[c]	
Y061	W07	6/24-6/30	WS	5	7/31-8/03	31-40
Y084	W13	7/15-7/27	WS		8/12-9/24	
Y103	C	<5/08	WS		5/10-6/03	
Y162	S	<5/06	Ea		5/15-6/17	
Y209	LG1	7/06-7/09	LG	2	8/03-8/05	25-30
Y214	E15	8/03-8/05	Ea	6	8/09-9/26	
Y227	W04	<6/23	WS		7/11-7/16	
Y228		<8/03	Ro	1	8/07-9/27	
Y265		<7/16	Ro	1	8/04-9/27	
Y268	EA	<5/06	Ea		5/15-6/17	
Y279	E14	7/27-7/29	Ea	2	8/11-9/26	
Y286	E01	<6/20	Ea		7/16-7/24	
Y288	W09	6/31-7/10	WS		8/12-9/24	
Y305		<5/08	Tr		5/15	
Y458		7/29	Ea	9	PUP DEAD[c]	
Y502		6/21-7/05	Ea		8/03-8/05	29-45
Y517	R	<5/11	Ea		>5/12	
Y521	E02	<7/03	Ea		7/06-7/15	
Y523		<7/15	Ea		7/16-7/24	
Y524		<8/02	Ea		8/09-9/26	
Y528	ES2	7/06-7/09	Ea		>7/10	
Y531		7/27-7/29	Ea	3	8/09-9/26	
Y532	EH	<5/14	Ea		>5/15	
Y535	W10	7/07-7/10	WS	6	8/12-9/24	
Y553	W08	<7/16	WS		8/04-9/24	
Y554	W02	<6/23	WS		7/17-7/27	
Y559	O	<5/10	WS		5/11-6/23	
Y575	TN4	7/07	Te	5	8/10	34
Y583	TR1	5/16-6/30	Tr		7/01	
Y595	TN1	6/01-6/08	Te	5	7/04	26-33
Y598	EC	<5/14	Ea		>5/16	
Y602	W	<5/07	Tr		>5/15	
Y608	160	5/29-7/06	Ro		7/11-7/27	
Y611	W12	7/28-7/30	WS		8/12-9/24	
Y616	W03	<6/23	WS		7/31-8/03	
Y626	W05	<6/23	WS		6/24-8/06	
Y631	AF	<5/07	Gi		5/16-7/05	
Y642	N	<5/10	WS		>5/11	
	TNA	1/12-1/18	Te		2/22-3/01	35-48

Table 11.--Continued.

Adult female		Birth			Wean date[a]	Lactation period (days)
ID No.	Temp. ID No.	Date[a]	Islet[b]	Sector		
	TNB	3/09	Te	6	PUP DEAD[c]	
	TN5	1/06-1/11	Te	5	PUP DEAD[c]	
	TN6	2/17	Te	3	PUP DEAD[c]	
	TN7	3/22	Te	4	PUP DEAD[c]	
	TN8	3/23-3/27	Te	3	PUP DEAD[c]	
	TN9	11/25	Te	3	PUP DEAD[c]	
	TR2	7/02-7/06	Tr	2	7/31-8/03	25-32
	H	<5/08	WS		>5/09	
	Q	<5/10	WS		>5/11	
	T	<5/10	WS		>5/11	
	E00	<5/06	Ea	1	PUP DEAD[c]	
	EB	<5/14	Ea		>5/15	
	EE	<5/14	Ea		>5/15	
	EF	<5/14	Ea		>5/15	
	EI	<5/14	WS		>5/15	
	EK	<5/14	WS		>5/15	
	ES1	<7/09	Ea		>7/10	
	ES3	<7/09	Ea		>7/10	
	AG	<5/07	Gi		5/16-7/05	

[a]Event dates are either exact (i.e., 4/21), known to have occurred within a range (i.e., 4/21-4/23), or known to have occurred before or after another date (i.e., <8/24 or >8/30, respectively).
[b]Islet abbreviations: Ea = East, WS = Whale-Skate, Te = Tern, Tr = Trig, LG = Little Gin, Gi = Gin, and Ro = Round.
[c]Pup found dead by last day of birth date (see also Table 20).

Table 12.--Summary of parturition data collected in 1991.

Adult female		Birth			Wean date[a]	Lactation period (days)
ID No.	Temp. ID No.	Date[a]	Islet[b]	Sector		
Y004	E26	7/22-23	Ea	4	8/30	38-39
Y008	E02	<3/30	Ea	6	4/10-30	>11-31
Y014	E12	5/13	Ea	2	6/24	42
Y022	E25	7/17	Ea	9	8/24-25	38-39
Y027	W17	6/09	WS	6	7/15-19	36-40
Y030	T05	6/18-25	Tr	2	7/26-30	31-42
Y055	W11	5/22-30	WS	6	6/25-30	26-39
Y061	W19	7/06-14	WS	3	8/09-16	26-41
Y084	W24	8/16-17	WS	6	9/26-10/06	40-52
Y101	W02	4/16-5/01	WS	2	5/22-30	21-44
Y145	T03	5/19-30	Tr	1	6/18-25	19-37
Y150	W20	7/06-14	WS	1	8/17-20	34-45
Y156	E07	4/10-30	Ea	4	5/23-28	23-48
Y180	TN3	5/09	Te	5	6/15	37
Y218	E19	6/17	Ea	5	7/18-21	31-34
Y253	W16	6/09	WS	5	7/19-24	40-45
Y261	W12	5/22-30	WS	4	6/25-30	26-39
Y265	E27	7/30	Ea	3	8/31	32
Y268	E00	4/29	Ea		PUP DEAD[c]	
Y272	E21	6/17-22	Ea	4	7/23-28	31-41
Y288	W23	8/04-09	WS	6	8/29-9/17	20-44
Y351	W15	6/08	WS	1	7/15-19	37-41
Y354	W01	4/10-5/01	WS	1	5/30-6/02	29-53
Y458	E11	5/11	Ea	8	PUP DEAD[c]	
Y459	E17	6/17	Ea	3	7/29	42
Y466	G01	8/08-15	Gi	1	8/31-10/08	
Y489	E13	5/22	Ea	1	6/24	33
Y502	E24	7/03	Ea	1	8/13	41
Y517	E16	5/28	Ea	4	6/29-7/05	32-38
Y518	W21	7/16-19	WS	3	8/16-17	28-32
Y523	E23	6/22	Ea	3	8/05-06	44-45
Y526	TN9	2/06	Te	2	PUP DEAD[c]	
Y527	E18	6/17	Ea	3	PUP DEAD[c]	
Y531	E28	8/18	Ea	3	9/26-10/01	39-45
Y535	W22	7/24-30	WS	6	8/29-9/17	30-55
Y543	W04	5/01-04	WS	1	5/08[d]	4-7
Y552	W25	8/23-29	WS	6	9/26-10/06	28-45
Y559	W08	5/11-19	WS	4	6/25-30	37-50
Y568	W14	6/02-06	WS	2	7/06-14	30-42
Y572	E14	5/28	Ea	1	6/26	29
Y574	E06	4/10-30	Ea	1	5/17-23	17-43
Y576	LG2	4/09-5/11	LG	2	5/18-31[e]	
Y578	E04	3/31-4/10	Ea	2	5/10	30-40
Y580	W10	5/19-22	WS	3	6/25-30	34-42
Y582	TN4	7/05	Te	6	8/08	34
Y583	T04	6/10-12	Tr	1	7/19-26	37-46

Table 12.--Continued.

Adult female		Birth			Wean date[a]	Lactation period (days)
ID No.	Temp. ID No.	Date[a]	Islet[b]	Sector		
Y586	TN8	2/04	Te		PUP DEAD[c]	
Y598	E10	5/04-05	Ea	2	6/10-14	36-41
Y607	LG3	5/18-31	LG	2	6/24-7/05	24-48
Y613	W13	5/30-6/02	WS	4	7/06-14	34-45
Y615	E05	4/10-30	Ea	1	5/21	21-41
Y616	W18	7/06-14	WS	6	8/20-23	37-48
Y617	R02	5/01-31	Ro	1	6/24-7/02	
Y622	LG1	<4/09	LG		5/18-31	>39-52
Y623	W03	4/10-5/01	WS	3	5/30-6/02	
Y624	W05	5/04-08	WS	1	6/08[d]	31-35
Y625	W06	5/04-08	WS	2	6/13-18	36-45
Y629	TN2	5/02	Te	3	6/05	28
Y632	E15	5/28	Ea	2	6/29	32
Y635	TN10	10/14	Te	2	PUP DEAD[c]	
Y636	E08	4/30-5/05	Ea	1	6/10-14	36-44
Y637	E22	6/22	Ea	2	7/28-29	36-37
Y641	E03	<3/30	Ea		4/10-30	>11-31
Y645	R07	7/29-8/08	Ro	1	8/08-9/17	
T77F	TN1	2/17	Te	5	3/29-4/02	40-43
	TN11	11/07	Te	5	PUP DEAD[c]	
	TN12	12/12	Te	2	PUP DEAD[c]	
	E01	<3/30	Ea		3/31-4/09	
	E09	4/30-5/05	Ea	2	6/10-14	36-45
	E20	6/02-17	Ea	5	7/15-16	28-44
	R00		Ro	1	5/31	
	R01	5/18-31	Ro	1	8/08-9/17	
	R03	<6/17	Ro	1	6/17-24	
	R04	<7/18	Ro	1	7/18-29	
	R05	<7/18	Ro	1	7/18-7/29	
	R06	7/18-29	Ro	1	8/08-9/17	
	R0A		Ro	1		
	R0B		Ro	1		
	TN14	1/16	Te		PUP DEAD[c]	
	TN5	1/22	Te	2	PUP DEAD[c]	
	TN6	2/13	Te	6	PUP DEAD[c]	
	TN13	3/13	Te		PUP DEAD[c]	
	TN7	3/17	Te	6	PUP DEAD[c]	
	T01	5/04-11	Tr	2	6/10	30-37
	T02	5/19-30	Tr	2	7/03	34
	W07	5/11-19	WS	3	6/18-25	30-45
	W09	5/11-19	WS	4	6/11	23-31

[a]Event dates are either exact (i.e., 4/21), known to have occurred within a range (i.e., 4/21-4/23), or known to have occurred before or after another date (i.e., <8/24 or >8/30, respectively).

Table 12.--Continued.

[b]Islet abbreviations: Ea = East, WS = Whale-Skate, Te = Tern, Tr = Trig, LG = Little Gin, Gi = Gin, Ro = Round, and U = unknown.
[c]Pups found dead on birth date (see also Table 20).
[d]These two females, Y543 and Y624, were involved in a switch (see Pup fostering case No. 1, 1991). Female Y543 ended up with a dead pup (Death No. 12FFS91, Table 20).
[e]Pup disappeared (Death No. 25FFS91, Table 21).

Table 13.--Cohort survival in 1990 and 1991.[a]

Year tagged	Sex	Known births (No.)	Pups tagged (No.)	Pups removed (No.)[b]	No. of seals resighted by year	
					1990	1991
1984	F	51	50	7	30	28
	M	43	42		28	26
	U	6				
1985	F	39	38	2	25	21
	M	49	47		28	23
	U	6				
1986	F	50	48	6	30	25
	M	56	52		24	22
	U	2				
1987	F	57	51	0	31	25
	M	58	55		34	30
	U	6				
1988	F	62	62	8	28	22
	M	53	52		37	22
	U	12				
1989	F	54	50	3	37	25
	M	54	51		33	24
	U	12				
1990	F	39	38	11		19
	M	45	41			29
	U	5				

[a]The number resighted also includes seals sighted in 1992 that were not seen in 1990 or 1991. (M = male, F = female, and U = unknown sex).

[b]Prematurely weaned pups collected for rehabilitation except in 1990 when 5 additional pups were collected and sent directly to Kure Atoll.

Table 14.--Summary statistics for measurements and mass of weaned pups, 1-year-olds, and 2-year-olds in 1990 and 1991.[a]

Age Class	Axillary girth (cm)			Length (cm)[b]			Mass (kg)		
	N	mean	s.d.	*N*	mean	s.d.	*N*	mean	s.d.
1990									
Weaned pup	32	100	12.0	32	124	8.1	17	63	21.5
1 year	24	97	8.3	26	140	7.0	26	59	12.4
1991									
Weaned pup	59	102	9.5	58	124	7.2	57	64	15.5
1 year	26	90	7.2	26	135	7.5	26	52	11.3
2 year	31	93	8.4	33	142	9.4	33	60	15.1

[a]*N* = sample size, s.d. = standard deviation.
[b]Length is dorsal standard length for weaned pups and standard length for 1- and 2-year-olds.

Table 15.--Seals retagged with yellow Temple tags at French Frigate Shoals in 1990-91. (Sex: F = Female, M = Male)

			Left tag			Right tag		
ID No.	Sex	Date	New	Old	Old	New	Old	Old
				1990				
YF30	M	8/03		F30		F260	F130	
YN89	F	7/05		N89		N254		
				1991				
Y309	F	8/23	T187	T20		T185	T20	
Y395	M	8/30	K178	K12		K155	K12	
Y396	M	9/08	K184	K13		K185	K13	
Y405	F	8/29	K183	K22		K182	K22	
Y408	M	8/23	K153	K111		K154	K25	
Y412	F	8/21	K125	K29		K142	K29	
Y413	M	8/25	K158	K30		K157	K30	K105
Y418	M	8/24	K151	K35		K138	K35	
Y426	M	8/29	K180	K43		K181	K43	
Y427	M	8/20	K144	K44		K145	K44	
Y428	M	8/18	K115	K45		K116	K45	
Y429	F	8/22	K143	K46		K152	K46	
Y436	F	8/29	K175	K54		K174	K54	
Y453	M	8/25	K172	K100		K173	K71	
Y472	F	8/29	K188	K74		K177		
Y473	M	8/22	K148	K75		K150		
Y475	F	8/29	K137			K147	K77	K87
Y477	F	8/29	K170	K79		K171	K79	
YL12	M	8/21	L600	L12		L601	L112	
YL34	F	8/25	L605	L538			L134	L539
YL37	F	8/18	L58Q	L37		L583	L137	
YL49	M	8/19	L585	L49		L586	L97	
YL64	F	8/26		L64	L546	L614		
YL64						L615		
YL71	F	5/21	L579	L71	L501	L578	L171	
YL75	F	8/28	L618	L75		L617	L175	L521
YL85	M	8/21	L584	L85		L602	L185	
YL88	M	5/08	L577			L576	L188	
YL95	F	8/23	L604	L95		L603	L506	
TL08	M	8/22	L134	L08		L135	L09	
YN09	M	8/28	N253	N09		N228	N109	
YN22	M	7/24	N227	N22		N208	N122	
YN81	F	8/18	N209	N81		N213	N181	
Y496	M	8/18	N255	N218		N256	N219	
YF12	M	5/15	F238	F12			F231	
YF66	F	8/16	F237			F239	F166	
YU08	M	8/05	U220	U08			U108	
YU14	M	5/06	U127	U14			U114	
YG44	F	8/22	G200				G144	

Table 16.--Interisland movement to and from French Frigate Shoals in 1990 and 1991.

ID No.	Tag No. L	Tag No. R	Tag color	Temp. ID No.	Size class[a]	Sex[b]	Movement from Location	Movement from Date last seen	Movement to Location	Movement to Date first seen
T59M				198[c]	A	M	Laysan	6/06/90	FFS	7/16/90
Y608	5AA	5AB	Tan	160[c]	A	F	FFS	7/17/89	Laysan	5/28/90
							Laysan	5/28/90	FFS	7/06/90
							FFS	9/23/90	Laysan	11/01/90
							Laysan	6/02/91	FFS	6/29/91
T77F	5AE	5AF	Tan	132[c]	A	F	Laysan	7/08/90	FFS	9/- /90
							FFS	9/- /90	Laysan	11/01/90
							Laysan	11/01/90	FFS	12/23/90
							FFS	5/25/91	Laysan	6/21/91
Y156	6AG	6AH	Tan	135[d]	A	F	FFS	4/26/89	Laysan	5/31/90
							Laysan	2/07/91	FFS	4/30/91
							FFS	5/23/91	Laysan	6/18/91
Y162					A	F	FFS	8/09/90	Brooks Banks	10/20/90
Y635					A	F	FFS	7/25/89	Laysan	4/20/90
				222[c]			Laysan	8/03/90	FFS	2/03/91
Y610					A	F	FFS	7/28/90	Laysan	5/03/91
TA10	A10		Tan		A	M	FFS	8/06/85[e]	FFS	8/09/91
Y350		T62	Yellow		A	M	FFS	8/25/88	Necker	8/18/91
Y372	T84		Yellow		S	M	FFS	8/03/89	Necker	8/18/91
							Necker	8/18/91	FFS	12/05/91
Y401	K18		Yellow		A	M	FFS	6/17/91	Necker	8/18/91
Y384	K01	K01	Yellow		A	F	FFS	7/14/91	Nihoa	8/19/91
Y435	K53	K110	Yellow		A	F	FFS	6/27/91	Nihoa	8/18/91
Y474		K76	Yellow		A	F	FFS	7/15/90	Nihoa	8/23/91
YN16	N16	N116	Yellow		S	M	FFS	6/03/90	Nihoa	8/18/91
YN37	N37	N137	Yellow		J	F	FFS	4/05/91	Brooks Banks	4/15/91
							Brooks	4/15/91	FFS	5/26/91
YF19		F119	Yellow		S	F	FFS	8/08/88	Nihoa	8/23/91
YF47	F47	F147	Yellow		S	F	FFS	1/21/91	Nihoa	8/17/91

Table 16.--Continued.

ID No.	Tag No. L	Tag No. R	Tag color	Temp. ID No.	Size class[a]	Sex[b]	Movement from: Location	Movement from: Date last seen	Movement to: Location	Movement to: Date first seen
YF55		F155	Yellow		S	M	FFS	3/16/89	Nihoa	8/18/91
Y504	F206	F207	Yellow		S	F	FFS	5/13/90	Necker	8/18/91
							Necker	8/18/91	FFS	8/31/91
YF74	F74		Yellow		S	M	FFS	11/21/90	Nihoa	8/19/91

[a]Size class: A = adult, S = subadult, and J = juvenile.
[b]Sex: M = male; F = female.
[c]Numbers applied with hair bleach at Laysan Island in 1990.
[d]Numbers applied with hair bleach at Laysan Island in 1991.
[e]This seal was last positively identified at FFS in 1985. It was probably residing at a different location.

Table 17.--Entanglement in debris in 1990 and 1991.

Field No.	Date found	Size class[a]	Sex[b]	ID No.	Islet	Type of debris	Part of body entangled	Extent of restriction
01FFS90	1/11/90	J	M	YU68	Tern	Seawall	Entrap.[c]	Total[d]
01FFS91	4/16/91	A	M		Tern	Rope	Chest	Partial[d]
02FFS91	6/13/91	S	M	YL88	Tern	Seawall	Entrap.[e]	Total[f]
03FFS91	7/21/91	A	F	Y580	Tern	Net	Neck	None[d]

[a]Size class: A = adult, S = subadult, and J = juvenile.
[b]Sex: M = male; F = female.
[c]Entrapment behind seawall.
[d]These seals were disentangled and released.
[e]Entrapped in seawall.
[f]Found dead, Death No. 18FFS91, Table 20.

Table 18.--Injuries from January 1-December 31, 1990.

Field No.	Islet[a]	Date	Size class	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension(cm.)[f] Depth	Dimension(cm.)[f] LxW/Diam	Condition	Cause[g]
00	Te	2/05	A	F	Y059	gaping,lac.	l.lateral	2.5	12.0x5.0	fresh	P-Lg.shark
01	Te	2/07	A	M		circular	head	3.75	10.0	fresh	P-c.c.shark
02	Te	2/11	A	F		gaping	r.lateral	5.0	30x17.5	fresh	P-Lg.shark
03	Te	2/22	J	M	YL13	amputation	l.hindflip.			healing	P-Lg.shark
04a	Te	3/09	A	F		lacerations	r.hindflip.	1.8	22.5x2.5	fresh	P-Lg.shark
04b							r.foreflip.			fresh	P-Lg.shark
05a	Te	3/14	A	F	Y304	gaping	r.lateral	5.0	20.0x7.5	fresh	P-Lg.shark
05b									12.5		
06	Te	3/30	J	M	YU34	gaping	r.hindflip.	3.75	15x7.5		Unknown
07	Te	5/06	A	F	Y150	lacerations	dorsal		2/3 dorsum	fresh	P-Adult male
08	Sh	5/08	S	M		abrasion	head		3.0x3.0	fresh	Unknown
09	WS	5/08	A	M		abrasion	r.hindflip.		1.0x0.5	healing	Unknown
10	WS	5/08	A	U		gaping	dorsal	0.5	1.0x1.0	fresh	P-Adult male
11	Te	5/08	A	M		laceration	head		3.0x?	fresh	Unknown
12	Te	5/08	A	U		puncture	head		0.25x0.25	fresh	Unknown
13	Di	5/09	A	M		gaping	head	0.25	1.0x0.5	fresh	Unknown
14a	Sh	5/09	A	M		abrasions	r.hindflip.		2.0x1.0	fresh	Unknown
14b									1.0x1.0		
15	Te	5/10	S	F		abrasions	dorsal		1/2 dorsum	fresh	P-Adult male
16	Di	5/10	S	F	Y423	lacerations	dorsal	0.5	4.0x?	fresh	P-Lg.shark
17	Di	5/11	A	F		circular	head		2.5	fresh	P-c.c.shark
18	Sh	5/13	S	F	Y482	gaping	head	0.5	10.0x5.0	fresh	Unknown
19	Di	5/13	A	F	Y378	laceration	head		1.0x1.0	fresh	Unknown
20a	WS	5/14	J	F	YU88	abrasion	l.hindflip.	0.5	1.0x?	fresh	Unknown
20b						gaping	head	0.5	2.0x?	fresh	Unknown
21a	Gi	5/15	A	U		abrasions	dorsal	0.5		fresh	P-Adult male
21b						gaping(4)	head	0.5	1.0x2.0	fresh	
22	Te	5/14	A	U		laceration	head	0.5	0.5x?	fresh	Unknown
23	Te	6/18	A	F	Y147	gaping	right neck	2.0	4.0x2.0	fresh	P-Lg.shark
24	Te	6/22	S	F		gaping	left head	2.5	15.0x10.0	older	P-Lg.shark
25	Te	6/22	A	F	Y524	laceration	l. lateral	1.0	2.0x1.0	fresh	P-Lg.shark
26a	Te	6/22	A	F		abrasions	left dorsal	0.5	10.0x?	fresh	P-Lg.shark

Table 18.--Continued.

Field No.	Islet[a]	Date	Size class	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension(cm.)[f] Depth	LxW/Diam	Condition	Cause[g]
26b							right dorsal				
27	Te	6/22	A	F		abrasions	ventral	0.5	12.0xo.5	fresh	Unknown
28	Te	6/22	A	F		laceration	left eye	0.5	2.0x0.5	fresh	Unknown
29	Te	6/18	A	M		abrasion	l.foreflip.	0.5	2.0x0.5	fresh	P-seal bite
30	Te	6/30	A	F		gaping	r. lateral	7.0	12.0x8.0	older	P-Lg.shark
31	WS	6/30	W	U		abcess	dorsal	7.0	25.0x12.0	older	P-seal bite
32	Te	6/27	A	U		laceration	r.hindflip.	0.5	6.0x2.0	fresh	Unknown
33	Te	7/01	A	M		part.amput.	l.hindflip.		3.0x2.0	fresh	Unknown
34	Te	7/01	A	U		laceration	r.hindflip.	0.5	3.0x1.5	fresh	Unknown
35a	Te	7/11	A	U		gaping	dors.post.	1.5	12.5x10.0	older	P-Lg.shark
35b						laceration	r.hindflip.		2.5x5.0		
36	Ea	7/03	S	M	YN48	laceration	l.hindflip.	1.0	7.0x?	older	P-Lg.shark
37	Te	7/08	A	F		abcess	l. eyelid	0.75	1.0x1.0	older	Unknown
38	Te	7/30	A	F		punctures	dors.post.	<0.5	0.5	older	P-Adult male
39a	Te	7/30	A	F		lacerations	dorsal bil.		5.0x0.25	fresh	P-Adult male
39b						part.amput.	l.hindflip.			fresh	
40	WS	7/27	W	U	Y616	abcess	dorsal	2.5	7.0x6.0	fresh	P-seal bite
41	Te	7/28	A	F		laceration	r.hindflip.	2.0	6.0x1.0	fresh	P-Lg.shark
42	Te	7/28	J	M	Y496	laceration	left head	0.3	1.ox0.25	fresh	Unknown
43a	Te	8/01	A	M		laceration	r.hindflip.	0.5	3.0x1.0	fresh	P-seal bite
43b						part.amput.	r.hindflip.			fresh	
44	Tr	8/06	A	U		gaping	r.lateral	2.0	0.0x3.0	fresh	P-Lg.shark
45	Di	8/05	S	U		gaping	r.lateral	4.5	20.0x20.0	fresh	P-Lg.shark
46	Di	8/10	A	M		laceration	l.hindflip.	2.0	10.03.0	fresh	Unknown
47	Te	8/11	A	F		lacerations	dors.post.	1.0	15.0x3.0	fresh	P-Adult male
48	WS	1/04	S	F	Y450	gaping	left.post.	1.2	10.0x5.0	fresh	Unknown
49	Te	1/11	J	M	YU68	lacerations	left dors.		7.5x?	fresh	P-entanglemnt
50	Te	3/22	A	F	Y308	infection	left eye			infected	Unknown
51	Te	9/15	A	M		gaping	dorsal	2.5	30.0x20.0	fresh	K-Lg.shark
52	Te	8/17	A	F	Y147	part.amput.	l.foreflip.			older	Unknown
53a	Te	12/19	A	F	Y615	gaping	r.lateral	7.5	27.5x7.5	older	P-Lg.shark
53b						lacerations	r.lateral			older	

Table 18.--Continued.

Field No.	Islet[a]	Date	Size class	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension(cm.)[f] Depth	Dimension(cm.)[f] LxW/Diam	Condition	Cause[g]
54	Te	10/28	W	F	YG64	lacerations	head	2.5	5.0x?	infected	P-Lg.shark
55	WS	6/23	W	M	YGX9	lacerations	dorsal	0.5	8.0	fresh	P-Adult male
56	WS	8/09	W	M	YG57	lacerations	dorsal	1.5	6.0	fresh	P-Adult male

[a]Island: Te = Tern, Ea = East, WS = Whale-Skate, Tr = Trig, Di = Disappearing, and Sh = Shark.
[b]Size class: A = adult, S = subadult, J = juvenile, and W = weaned pup.
[c]Sex: F = female, M = male, and U = unknown.
[d]Injury type: amput. = amputation, lacer. = laceration, lg. = large, part. = partial, and punct. = puncture.
[e]Location: ant. = anterior, dors. = dorsal, flip. = flipper, later. = lateral, l. = left, post. = posterior, and r. = right.
[f]Dimension: LxW = length by width, Diam. = diameter. A single number indicates a diameter.
[g]Cause: K = known, P = probable.

Table 19.--Injuries from January 1-December 31, 1991.

Field No.	Islet[a]	Date	Size class[b]	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension (cm.)[f]		Condition	Cause[g]
								Depth	LxW/Diam		
1	Te	1/4	A	F	Y367	gaping	r. mid-lat.	5.0	12.0x4.0	fresh	P-lg.shark
2a	Te	1/4	A	U		lacerations	ant. ventral	2.5	37.0x1.0	fresh	Unknown
2b						puncture	r. ant.lat.	2.5		fresh	Unknown
2c						broken jaw	head			fresh	Unknown
3	Te	1/21	A	M	Y408	puncture	ant. ventral	2.5		fresh	K-fish.hook
4	Te	1/22	A	F		laceration	ant. ventral	3.7	7.5x1.2	fresh	Unknown
5a	Te	1/23	A	M		laceration	l. head	1.2	7.5x0.5	older	Unknown
5b						puncture	l. mouth	2.0	5.0x5.0	fresh	K-fish.hook
6	Te	1/29	A	M	TT08	laceration	l. ant.lat.	0.5	5.0x0.5	fresh	Unknown
7	Te	2/06	A	F	Y526	laceration	vent. neck	1.0	5.0x1.0	fresh	Unknown
8a	Te	4/01	J	M	YU33	laceration	l. post.lat.	1.0	7.0x1.0	fresh	Unknown
8b						gaping	l. hindflip.	0.5	12.0x2.0	fresh	Unknown
9	Te	2/26	S	M	Z18	gaping	r. neck	1.5	12.0x7.0	healing	Unknown
10	Te	4/01	S	M	Y413	gaping	l. hindflip.	1.5	6.0x1.5	fresh	P-lg.shark
11	Te	4/02	A	M	Z06	laceration	l. head	0.5	1.0x2.0	healing	Unknown
12	LG	4/09	A	M	Z23	laceration	l. mouth			fresh	Unknown
13	Ea	4/10	J	F	YG52	gaping	l. shoulder	0.5	1.0x1.5	fresh	Unknown
14	Ea	4/10	A	F	Y574	circular	mid-ventral	1.5	5.0	fresh	P-c.c.shark
15	WS	4/10	A	M	Y427	lacerations	l. foreflip.	<0.5	2.0x<0.5	fresh	Unknown
16	Te	4/02	A	M	Z05	laceration	l. mouth	<0.5	1.0x<0.5	fresh	Unknown
17	Te	4/05	A	M	Z34	laceration	ant. vent.	1.0	5.0x0.5	fresh	Unknown
18	Te	4/02	A	F	Y626	laceration	l. post.lat.	1.0	3.0x0.5	fresh	Unknown
19	Te	4/02	A	F	Z13	lacerations	l. head	1.0	2.0x0.5	fresh	Unknown
20	Te	4/01	A	F	Z17	lacerations	mid. ventral	1.0	10.0x1.0	fresh	Unknown
21	WS	4/10	A	F	Z50	laceration	l. head	0.5	2.0x0.5	fresh	Unknown
22	Te	5/04	A	F		circular	post. vent.	1.0	3.0x2.5	fresh	P-c.c.shark
23	Te	5/04	J	F	YG74	laceration	ant. vent.	<0.5	5.0x0.5	fresh	Unknown
24	Te	5/08	S	F	Y347	lacerations	r. head	0.5	9.0x1.0	fresh	P-lg.shark
25	Te	5/08	A	F		gaping	l. post.lat.	6.0	10.0x11.0	fresh	P-lg.shark
26	Te	2/11	A	M		gaping	l. post.lat.	8.0	22.0x15.0	fresh	P-lg.shark
26b						gaping	mid-ventral				
27	Te	2/16	A	F	Y128	gaping	r. post.lat.	2.5	20.0x20.0	fresh	P-lg.shark

Table 19.--Continued.

Field No.	Islet[a]	Date	Size class[b]	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension(cm.)[f] Depth	Dimension(cm.)[f] LxW/Diam	Condition	Cause[g]
27b						lacerations	mid-ventral				
28	Te	2/18	A	M		gaping	mid-ventral	2.5	15.0x3.0	fresh	P-lg.shark
28b						lacerations	mid-ventral				
29	Te	2/18	A	F	Y482	gaping	r. post.lat.	5.0	10.0x5.0	fresh	Unknown
29b						lacerations	vent. neck				
30	Te	2/17	A	M		gaping	snout(head)	5.0	12.0x4.0	fresh	Unknown
31	Te	2/26	A	U		gaping	l. lateral	4.0	20.0x7.5	fresh	P-lg.shark
31b						lacerations	r. lateral				
31c						lacerations	l. foreflip.				
32	WS	5/08	A	F	Z70	gaping	vent. head	2.0	6.0x4.0	fresh	P-c.c.shark
33	Sh	5/04	A	F		laceration	r. mouth	0.5	2.0x0.5	fresh	Unknown
34	Te	5/16	S	F	Y475	gaping	hindflipers	1.5	8.0x1.0	fresh	P-lg.shark
35	Te	5/16	A	F	Y279	amputation	r. foreflip.		7.0x5.0	since'90	Unknown
36	Sh	5/19	A	M	Y340	laceration	l. hindflip.	0.5	5.0x2.0	recent	Unknown
37	Te	5/21	A	F	Y595	lacerations	dorsal	0.5	10.0x0.5	fresh	P-adult male
38	Te	5/21	A	F	LAY.	lacerations	dorsal	0.5	8.0x0.5	fresh	P-adult male
39	Te	5/23	J	M	YG80	laceration	l. foreflip.	1.5	6.0x1.0	fresh	Unknown
39b						laceration	vent. head	1.0	10.0x1.5	fresh	Unknown
40	Ea	5/22	A	M		gaping	post. dors.	4.0	12.0x8.0	fresh	P-lg.shark
40b						laceration	r. hindflip.	1.0	4.0x1.0	fresh	P-lg.shark
40c						abrasion	post. vent.	0.5		fresh	P-lg.shark
41	Te	5/26	A	F	Y597	laceration	l. head		2.0x0.5	since'90	P-lg.shark
42	Te	5/27	A	F	Y615	lacerations	l. head	1.5	6.0x1.0	fresh	Unknown
43	Te	5/27	S	U	YL95	lacerations	r. hindflip.	0.5	3.5x0.5	fresh	Unknown
44	Te	5/28	A	M	X08	laceration	l. head	0.5	1.5x1.0	fresh	Unknown
45	Te	5/28	A	M	X16	laceration	r. dors. ant.	0.5	10.0x1.0	fresh	P-seal bite
46	Te	5/28	A	M	X18	part.amput.	l. hindflip.			healing	P-lg.shark
47	Te	5/29	S	M	X20	laceration	dors. post	1.0	6.0x1.5	fresh	P-lg.shark
48	Te	5/27	A	F	Y601	lacerations	mid. ventral	0.5	8.0x0.5	fresh	Unknown
49	Te	5/25	A	F	Y145	circular	neck	2.5	8.0	fresh	P-c.c.shark
50	Sh	5/30	S	M	YL12	laceration	vent. anter.	1.5	8.0x2.0	fresh	P-lg.shark
51	Te	6/02	A	M	X44	laceration	head	0.5	4.5x1.5	fresh	Unknown

Table 19.--Continued.

Field No.	Islet[a]	Date	Size class[b]	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension (cm.)[f]		Condition	Cause[g]
								Depth	LxW/Diam		
52	Te	6/02	J	U	YU33	lacerations	dorsal post.	<0.5	6.0x0.5	fresh	P-adult male
53	Tr	5/30	A	F	Z77	laceration	l. head	1.5	7.0x0.7	fresh	Unknown
54	Te	6/04	A	F	Y593	circular	ventral	1.5	5.0	fresh	Unknown
55	Te	6/04	A	F	Y004	laceration	r. foreflip.	1.0	3.0x2.0	fresh	Unknown
56	Te	6/07	S	U	Y473	laceration	l. hindflip.	1.0	5.0x1.5	fresh	Unknown
57	Ro	6/17	W	U		gaping	dorsal post.	6.0	20.0x6.0	fresh	P-lg.shark
58	Ea	6/17	S	F		laceration	mid. ventral	1.0	5.0x1.5	healing	P-lg.shark
59	WS	6/18	S	U		gaping	l. hindflip.	2.0	7.0x3.5	fresh	P-lg.shark
60	Te	6/05	S	F	YF79	laceration	l. hindflip.	1.0	3.0x1.0	fresh	Unknown
61	Te	6/07	A	F	Y581	lacerations	dorsal	0.5	10.0x0.5	fresh	P-adult male
62	Te	6/07	S	M	YL42	lacerations	r. lateral	0.5		fresh	Unknown
63	WS	6/08	A	F	Z86	lacerations	r. hindflip.	0.5	6.0x0.5	fresh	P-lg.shark
64a	Ea	6/22	A	F		gaping	mid. dorsal	3.0	8.0x4.0	infected	P-adult male
64b						lacerations	right mid.	0.5	5.0x0.5	fresh	P-adult male
65	Te	6/10	A	F	Y128	lacerations	dorsal	0.5	6.0x0.5	fresh	P-adult male
66	Te	6/10	A	F		lacerations	dorsal	0.5	8.0x0.5	fresh	P-adult male
67	Te	6/15	A	M	Y418	lacerations	dorsal	0.5	4.0x0.5	fresh	P-seal bite
68	Te	6/16	S	F	YL95	puncture	dorsal	1.0	1.0	fresh	P-seal bite
69	Te	6/16	A	F	Y562	lacerations	dorsal	0.5	18.0x0.5	fresh	P-adult male
70	Te	6/16	A	F	Z90	lacerations	dorsal	0.5	7.0x0.5	fresh	P-adult male
71	Te	6/16	A	F	Y562	laceration	neck	0.5	4.0x0.5	fresh	P-seal bite
72	Te	6/16	S	F	Y411	laceration	post. dors.	0.5	6.0x0.5	fresh	P-adult male
73	Te	6/16	A	F		gaping	l. hindflip.	0.5	2.0x2.0	fresh	P-seal bite
74	Te	6/17	A	M	Y129	laceration	l. lateral			fresh	Unknown
75	Te	6/27	A	F	Z77	lacerations	dorsal	0.5	9.0x0.5	fresh	P-adult male
76	Te	6/27	A	F	YL10	lacerations	r. head	1.0	2.5x8.0	fresh	P-lg.shark
77	Te	6/27	A	M	Y129	lacerations	ventral	1.0	8.0x0.5	fresh	Unknown
78	Te	6/28	A	F	Y578	gaping	r. hindflip.	2.0	3.0x2.0	fresh	P-lg.shark
79	WS	6/30	A	F	Y545	gaping	neck	2.0	18.0x8.0	fresh	P-lg.shark
80	Te	7/06	S	M	Y395	laceration	mid-ventral	0.5	3.5x0.5	fresh	Unknown
81a	Te	7/06	S	F	Y634	gaping	l. hindflip.	5.0	6.0x2.0	fresh	P-lg.shark
81b						lacerations	dorsal post.	1.0	8.0x1.0	fresh	P-lg.shark

Table 19.--Continued.

Field No.	Islet[a]	Date	Size class[b]	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension(cm.)[f] Depth	LxW/Diam	Condition	Cause[g]
82a	Te	7/09	A	U		laceration	dorsal mid	2.0	6.0x3.0	recent	P-adult male
82b						lacerations	left-mid	0.5	10.0x0.5	recent	P-adult male
83	Ea	6/17	A	F	E20	lacerations	vent. post.	0.5	2.0x0.5	fresh	P-lg.shark
84	Te	6/30	A	F	Y310	lacerations	head	1.0	5.0x2.0	fresh	P-lg.shark
85	Te	6/30	J	M	YU08	gaping	r. hindflip.	1.0	3.0x1.5	fresh	P-lg.shark
86a	Te	7/10	S	M	Y413	lacer(bite)	vent. post.	1.5	5.0x3.0	recent	P-lg.shark
86b						laceration	r. hindflip.	1.0	8.0x1.5	recent	P-lg.shark
87	Te	1/21	J	M	YU18	gaping	l. hindflip.	2.0		fresh	P-lg.shark
88a	Te	1/28	J	M	YG80	laceration	r. neck	0.5	1.0x0.5	fresh	Unknown
88b						laceration	r. mouth	0.5	1.0x0.5	fresh	Unknown
89	Te	2/17	A	F		circular	l. lateral	1.0	7.5x7.5	fresh	P-c.c.shark
90a	Te	7/21	A	F	Y580	other	neck	0.5	30.0x0.5	fresh	K-net
90b						laceration	neck	1.5	3.0x1.0	fresh	K-researcher
91a	Te	7/17	A	F	Y586	gaping	dorsal	2.5	14.0x8.0	fresh	P-adult male
91b						gaping	dorsal	1.5	6.0x3.0	fresh	P-adult male
91c						abrasions	r. lateral	0.5	6.0x0.5	fresh	P-adult male
92	Te	6/30	A	F	Y366	lacerations	dorsal	0.5	5.0x0.5	fresh	P-adult male
93	Te	7/06	A	F	Y543	laceration	vent. ant.	1.0	6.0x0.7	fresh	Unknown
94	Te	7/09	S	M	Y485	laceration	r. head	1.0	3.0x0.5	fresh	P-lg.shark
95	Te	7/10	S	F	YN18	laceration	mid-dorsal	0.5	7.0x0.5	fresh	P-adult male
96	Te	7/15	A	F	Y532	laceration	l. hindflip.	1.0	2.0x1.0	fresh	P-seal bite
97a	Te	7/25	A	F	Y536	gaping	dorsal	2.0	9.0x6.0	old	P-adult male
97b						lacerations	right mid	1.0	4.0x1.5	recent	P-adult male
98	Te	7/22	A	M	X83	lacerations	l. head	1.0	9.0x1.0	fresh	P-seal bite
99	Te	7/19	A	F	Y526	laceration	dorsal	0.5		fresh	P-adult male
100	Te	7/20	A	M	Y330	laceration	dorsal	0.5		fresh	P-seal bite
101	Te	7/27	A	F	Y308	laceration	dorsal	0.5	12.0x0.5	fresh	P-adult male
102	Te	7/27	A	F	Y614	lacerations	mid-dorsal	0.5	10.0x0.5	fresh	P-adult male
103	Te	7/25	A	F	Y612	lacerations	mid-dorsal	0.5	7.0x0.5	fresh	P-adult male
104	Te	7/30	A	F	Y227	lacerations	mid-dorsal	0.5	12.0x0.5	fresh	P-adult male
105	Te	7/29	A	M	X61	circular	dorsal ant.	1.0	7.0x7.0	fresh	P-c.c.shark
106	Te	7/30	A	F	Y629	lacerations	l. head	1.0	4.0x0.5	fresh	P-lg.shark

Table 19.--Continued.

Field No.	Islet[a]	Date	Size class[b]	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension(cm.)[f]		Condition	Cause[g]
								Depth	LxW/Diam		
107	Ea	7/21	J	F	YG44	part. amp.	l. hindflip.		3.0x3.0	fresh	P-lg.shark
108a	WS	8/04	A	F	Y545	lacerations	r. mid	1.0	6.0x1.0	recent	P-lg.shark
108b						laceration	l. ant.	1.0	4.0x1.0	fresh	P-lg.shark
109	Te	8/09	A	F	Y543	laceration	dors. head	1.0	5.0x2.0	fresh	P-lg.shark
110	Te	8/09	A	F	Y327	laceration	dors. post.	0.5	6.0x0.5	fresh	P-adult male
111	Te	8/07	A	F	Y180	laceration	dorsal	0.5	12.0x0.5	fresh	P-adult male
112	WS	8/09	A	F	Y465	laceration	r. post.	1.5	5.0x1.0	recent	Unknown
113	Te	8/09	A	F	Z90	gaping	mid-dorsal	2.0	3.0x3.0	recent	P-adult male
114	WS	8/09	S	M	YL47	laceration	vent. head	1.0	10.0x0.5	fresh	P-lg.shark
115	WS	8/09	A	F	Y559	laceration	r. h. f.	1.5	4.0x0.7	fresh	P-lg.shark
116	Di	8/08	S	F	YN58	gaping	dorsal	12.0	90.0x45.0	fresh	P-adult male
117a	Te	8/18	A	F	Y279	gaping	mid-dorsal	7.0	60.0x20.0	fresh	P-adult male
117b						part.amput.	r. foreflip.		15.0x13.0	fresh	P-lg.shark
117c						gaping	r. post.	2.0	15.0x8.0	recent	P-lg.shark
118	Te	8/13	A	F	Y624	lacerations	post. vent.	1.0	4.0x0.5	fresh	P-lg.shark
119	Te	8/13	A	F	Y272	lacerations	ant. vent.	0.5	2.0x0.5	fresh	P-lg.shark
120	WS	5/08	A	F	Y625	circular	mid-vent.	1.5	diam.4.0	fresh	P-c.c.shark
121	Te	8/16	S	F	Y392	gaping	r. eye	2.0	3.0x2.0	fresh	P-lg.shark
122	Te	8/16	S	F	Y347	part.amput.	l. foreflip.		5.0x3.0	fresh	P-lg.shark
123	Te	8/16	S	M	YN96	laceration	vent. neck	2.0	10.0x2.0	fresh	P-lg.shark
124	Te	8/20	A	F	Y266	lacerations	post. left	0.5	5.0x0.5	fresh	P-adult male
125	Di	8/15	A	F		gaping	post. left	1.5	20.0x7.0	recent	P-lg.shark
126	Di	8/15	S	U		laceration	left head	1.0	6.0x2.0	fresh	Unknown
127	Te	8/27	A	M	X88	lacerations	l. foreflip.	0.5	6.0x2.0	recent	P-lg.shark
128	Te	8/27	S	M	YF05	gaping	snout	2.0	7.0x5.0	fresh	P-lg.shark
129	Te	8/27	S	M	YN90	gaping	mid-dorsal	2.0	30.0x10.0	recent	P-adult male
130	Te	8/22	A	F	Y145	lacerations	post. dors.	0.5	10.0x0.5	fresh	P-adult male
131a	Te	8/24	A	M		gaping	ant. vent.	2.0	17.0x1.5	fresh	P-lg.shark
131b						lacerations	ant. vent.	1.0	4.0x0.5	fresh	P-lg.shark
132	Te	8/24	A	F	Z93	lacerations	mid-left	0.5	8.0x0.5	fresh	P-adult male
133	Te	8/26	A	F	Y103	gaping	vent. neck	2.0	18.0x6.0	fresh	P-lg.shark
134	Te	8/26	A	F	Y272	lacerations	dorsal	0.5	8.0x0.5	fresh	P-adult male

Table 19.--Continued.

Field No.	Islet[a]	Date	Size class[b]	Sex[c]	ID No.	Injury type[d]	Location on body[e]	Dimension(cm.)[f] Depth	Dimension(cm.)[f] LxW/Diam	Condition	Cause[g]
135	Te	7/13	A	M	X75	laceration	l. hindflip.	0.5	9.0x1.5	fresh	P-lg.shark
136a	Te	8/27	A	M	Y116	gaping	ant. vent.	2.0	10.0x2.0	fresh	P-lg.shark
136b						gaping	l. foreflip.	3.0	7.0x2.0	fresh	P-lg.shark
136c						lacerations	post. vent.	1.5	7.0x1.0	fresh	P-lg.shark
137	Ea	8/28	J	F	Y515	gaping	mid-right			fresh	P-lg.shark
138	Di	8/31	S	M	YN63	gaping	mid-vent.	1.5	10.0x8.0	recent	P-adult male
139	Tr	8/29	J	M	YG49	lacerations	l. foreflip.	1.5	3.0x1.0	fresh	P-lg.shark
140	Te	8/30	S	F	Y411	gaping	ant. vent.	3.0	10.0x3.0	fresh	P-c.c.shark
141	Te	9/02	A	F	Y030	lacerations	dorsal	0.5	10.0x0.5	fresh	P-adult male
142a	Te	9/02	A	F	Y244	gaping	r. hindflip.	2.0	4.0x2.0	fresh	P-lg.shark
142b						part.amput.	l. hindflip.		7.0x6.0	fresh	P-lg.shark
143a	Te	10/12	S	M	Y418	lacerations	r. neck	1.2	12.0x1.2	fresh	P-lg.shark
143b						lacerations	r. hindflip.	1.2	4.0x1.0	fresh	P-lg.shark
144	Tr	5/30	A	F	Y638	gaping	r. lateral		20.0x2.0	healed	P-lg.shark
145	Te	9/11	A	F		gaping	post.dors.	3.0	14.0x6.0	fresh	P-lg.shark
146	Te	11/07	A	U		gaping	mid-dors.	1.0	29.0x5.5	fresh	P-adult male
147	Te	11/14	A	F		laceration	r. hindflip.	0.5	5.2x1.0	fresh	Unknown
148	Te	11/28	S	M		laceration	hindflippers	1.5	11.0x1.0	fresh	P-lg.shark
149a	Te	11/28	A	M	Y448	gaping	l. mid-lat.	4.0	12.0x?	fresh	P-lg.shark
149b						gaping	r. mid-lat.	3.0	15.0x?	fresh	P-lg.shark
150	Te	12/05	S	M		gaping	r. snout	0.5	6.0x2.0	fresh	P-lg.shark
151a	WS	6/02	W	F	YZ00	lacerations	dorsal	1.0	6.0x1.0	fresh	P-adult male
151b						gaping	ventral	1.5	8.0x6.0	fresh	P-adult male
152	WS	6/02	W	M	YZX0	lacerations	dorsal	0.5	6.0x0.5	fresh	P-adult male
153a	WS	6/06	W	M	YZ09	laceration	dorsal	0.5	12.0x0.5	fresh	P-adult male
153b						laceration	ventral	0.5	12.0x0.5	fresh	P-adult male
154a	WS	6/08	W	F	YZ12	lacerations	dorsal	0.5	7.0x0.5	fresh	P-adult male
154b						laceration	l. foreflip.	1.0	3.0x1.0	fresh	P-adult male

[a]Island: Te = Tern, Ea = East, WS = Whale-Skate, Tr = Trig, Di = Disappearing, Ro = Round, Sh = Shark, and LG = Little Gin.

[b]Size class: A = adult, S = subadult, J = juvenile, and W = weaned pup.

Table 19.--Continued.

[c]Sex: F = female, M = male, and U = unknown.
[d]Injury type: amput. = amputation, lacer. = laceration, lg. = large, part. = partial, and punct. = puncture.
[e]Location: ant. = anterior, dors. = dorsal, flip. = flipper, later. = lateral, l. = left, post. = posterior, and r. = right.
[f]Dimension: LxW = length by width, Diam. = diameter. A single number indicates a diameter.
[g]Cause: K = known, P = probable.

Table 20.--Deaths and removals in 1990 and 1991.[a]

Death No.	Death date[b]	Island found[c]	ID No.	Size	Sex	Probable cause of death
			1990			
01FFS90	3/30/90	Te	YU34	J	M	Emaciation
02FFS90	3/31/90	Te	Y497	J	F	Unknown
03FFS90	1/29/90	Te		A	M	Unknown
04FFS90	5/06/90	Ea	YGX7	P	M	Unknown
05FFS90	5/07/90	Tr	YU36	J	M	Unknown
06FFS90	3/01/90	Te		A	M	Shark bite
07FFS90	3/27/90	Ea		S	M	Unknown
08FFS90	5/07/90	Di	Y438	A	M	Unknown
09FFS90	5/08/90	Ea	YF51	J	F	Emaciation
10FFS90	2/12/90	Ea	YF71	J	M	Unknown
11FFS90[d]	6/23/90	WS	YGX9	W	M	Drowning
12FFS90[d]	7/29/90	Ea	YGX8	P	F	Crushed
13FFS90[d]	8/09/90	WS	YG57	W	M	Drowning
14FFS90	2/05/90	Te	YGX3	P	U	Unknown
15FFS90	1/11/90	Te	YGX1	P	U	Unknown
16FFS90	2/17/90	Te	YGX2	P	U	Unknown
17FFS90	3/09/90	Te	YGX4	P	M	Unknown
18FFS90	3/22/90	Te	YGX5	P	U	Unknown
19FFS90	3/27/90	Te	YGX6	P	U	Unknown
20FFS90	1/04/90	WS	YN02	J	M	Unknown
21FFS90	10/11/90	Tr	YN99	J	M	Emaciation
22FFS90	11/25/90	Te	YGXA	P	M	Unknown
			1991			
AFFS91	1/17/91	WS	YZXM	P	U	Unknown
01FFS91	1/22/91	Te	YZXA	P	U	Unknown
02FFS91	2/04/91	Te	YZXB	P	M	Unknown
03FFS91	2/06/91	Te	YZXC	P	M	Unknown
04FFS91	2/13/91	Te	YZXD	P	F	Crushed
05FFS91	2/22/91	Tr		A	M	Unknown
06FFS91	2/22/91	WS		A	M	Unknown
BFFS91	3/13/91	Te	YZXN	P	F	Unknown
07FFS91	3/16/91	Te		A	M	Old age
08FFS91	3/17/91	Te	YZXE	P	F	Unknown
09FFS91	3/30/91	Ea		J	F	Shark bite
10FFS91[d]	4/29/91	Ea	YZXF	P	M	Unknown
11FFS91	5/11/91	Ea	YZXG	P	M	Unknown
12FFS91[d]	5/08/91	WS	YZXH	P	F	Unknown
13FFS91	6/02/91	WS	YZ00	W	F	Unknown
14FFS91[d]	6/02/91	WS	YZX0	W	M	Drowning
15FFS91[d]	6/06/91	WS	YZ09	W	M	Drowning
16FFS91[d]	6/08/91	WS	YZ12	W	F	Drowning
17FFS91[d]	6/13/91	WS	Y267	A	M	**Removed** (Euthanized)
18FFS91[d]	6/13/91	Te	YL88	S	M	Unknown

Table 20.--Continued.

Death No.	Death date[b]	Island found[c]	ID No.	Size	Sex	Probable cause of death
19FFS91	6/17/91	Ea	YZXI	P	M	Unknown
20FFS91	9/ /91	Te	Y128	A	F	Old age
21FFS91[d]	10/12/91	Te	Y418	S	M	Unknown
22FFS91	10/14/91	Te	YZXJ	P	F	Unknown
23FFS91	11/07/91	Te	YZXK	P	U	Unknown
24FFS91	12/12/91	Te	YZXL	P	U	Unknown
28FFS91	08/07/91	Ea	Y634	S	F	**Removed** (Relocated)

[a]A = adult, S = subadult, J = juvenile, W = weaned pup, P = nursing pup, F = female, M = male, and U = unknown sex.
[b]The seals were found dead on this date.
[c]The island abbreviations are: Te = Tern, Ea = East, Tr = Trig, Di = Disappearing, and WS = Whale-Skate.
[d]These seals were necropsied.

Table 21.--Probable seal deaths in 1991 (P = nursing pup).

Field No.	Date last observed	ID No.	Size	Sex	Probable cause of death
25FFS91	5/10/91	YZD1	P	U	Unknown/disappeared
26FFS91	5/18/91	YZD2	P	U	Unknown/disappeared
27FFS91	8/14/91	YZD3	P	U	Unknown/disappeared

FIGURES

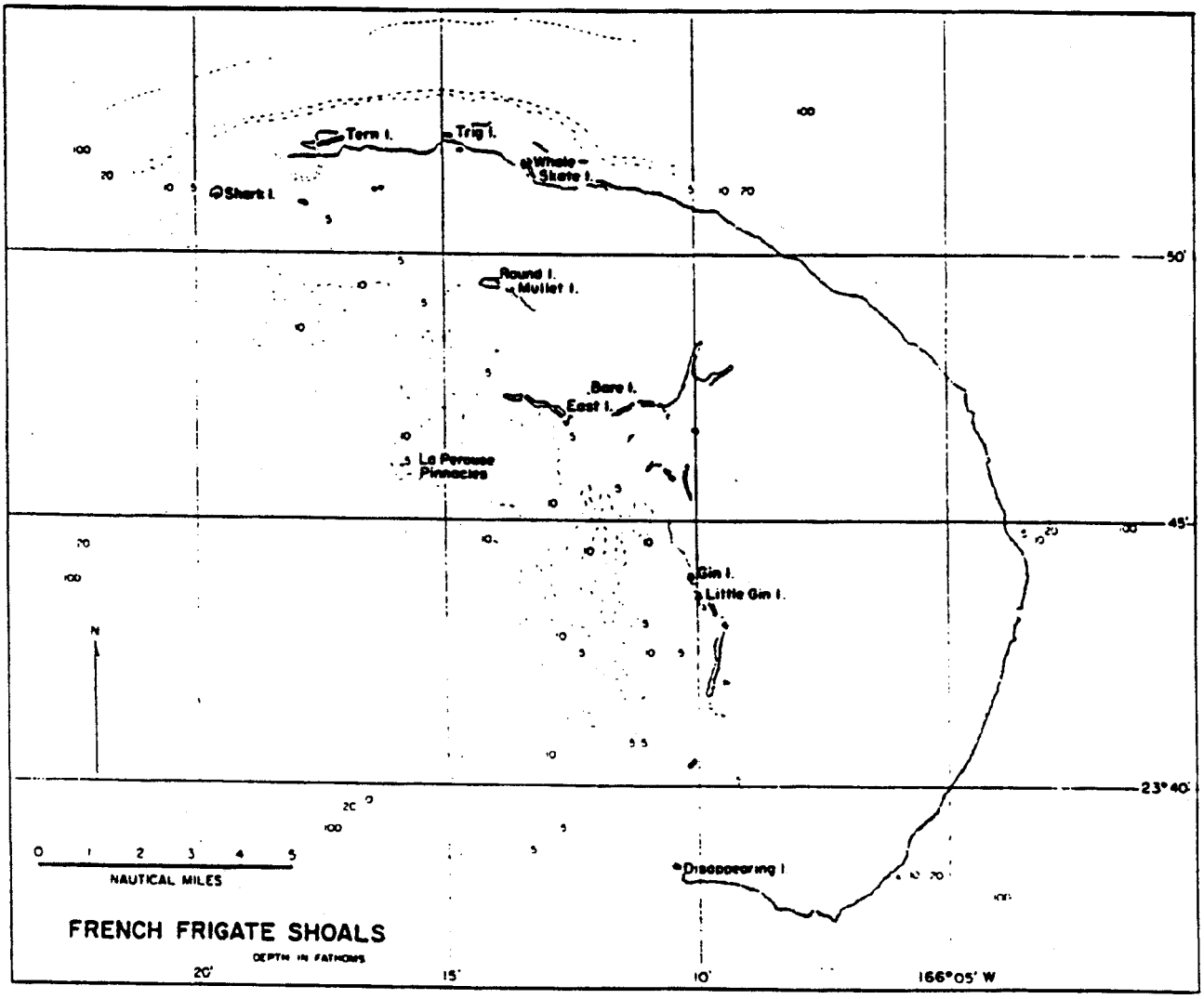

Figure 1.--Permanent islands at French Frigate Shoals.

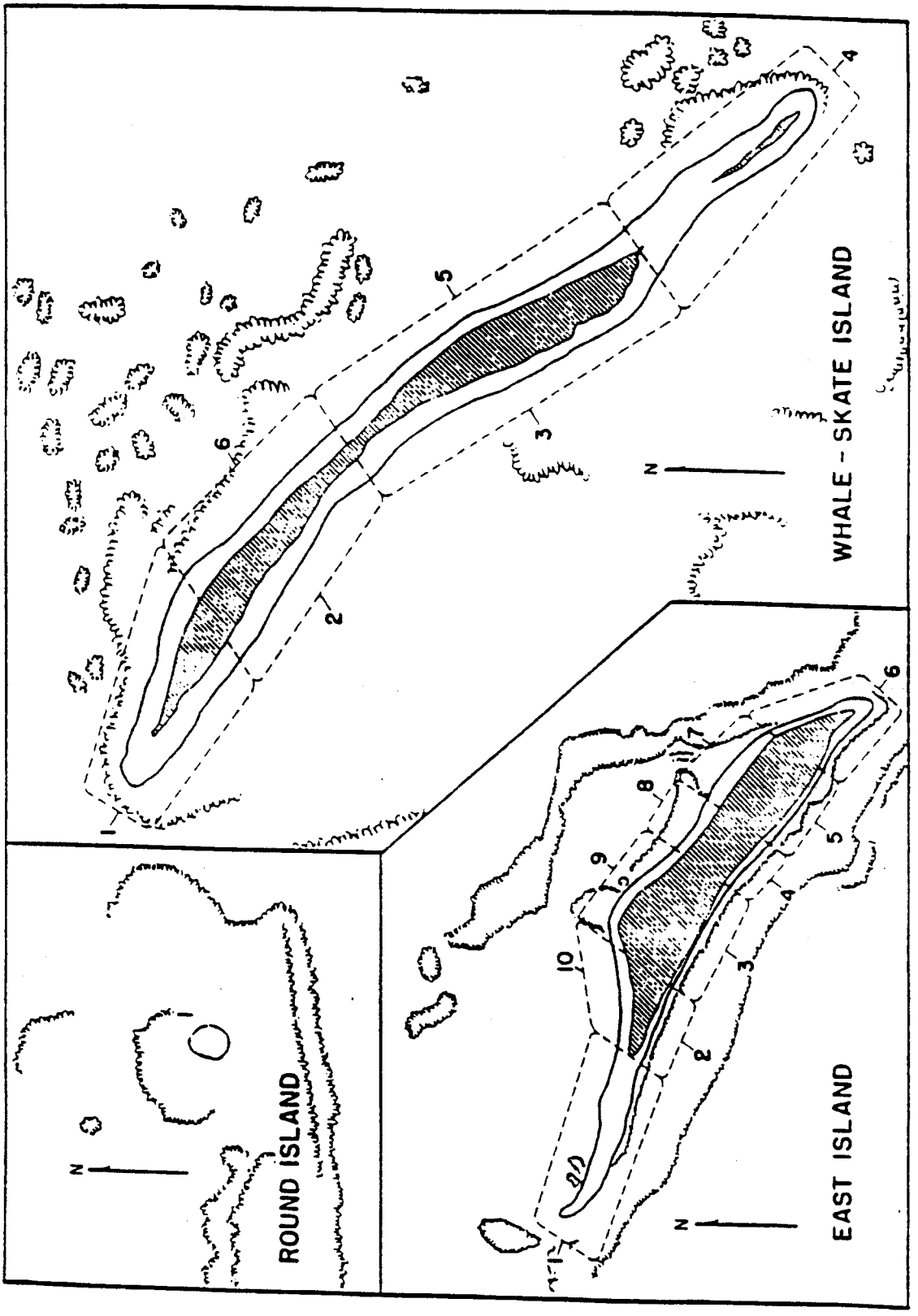

Figure 2.--The major pupping islands; East, Whale-Skate, and Round, divided into sectors used in censuses.

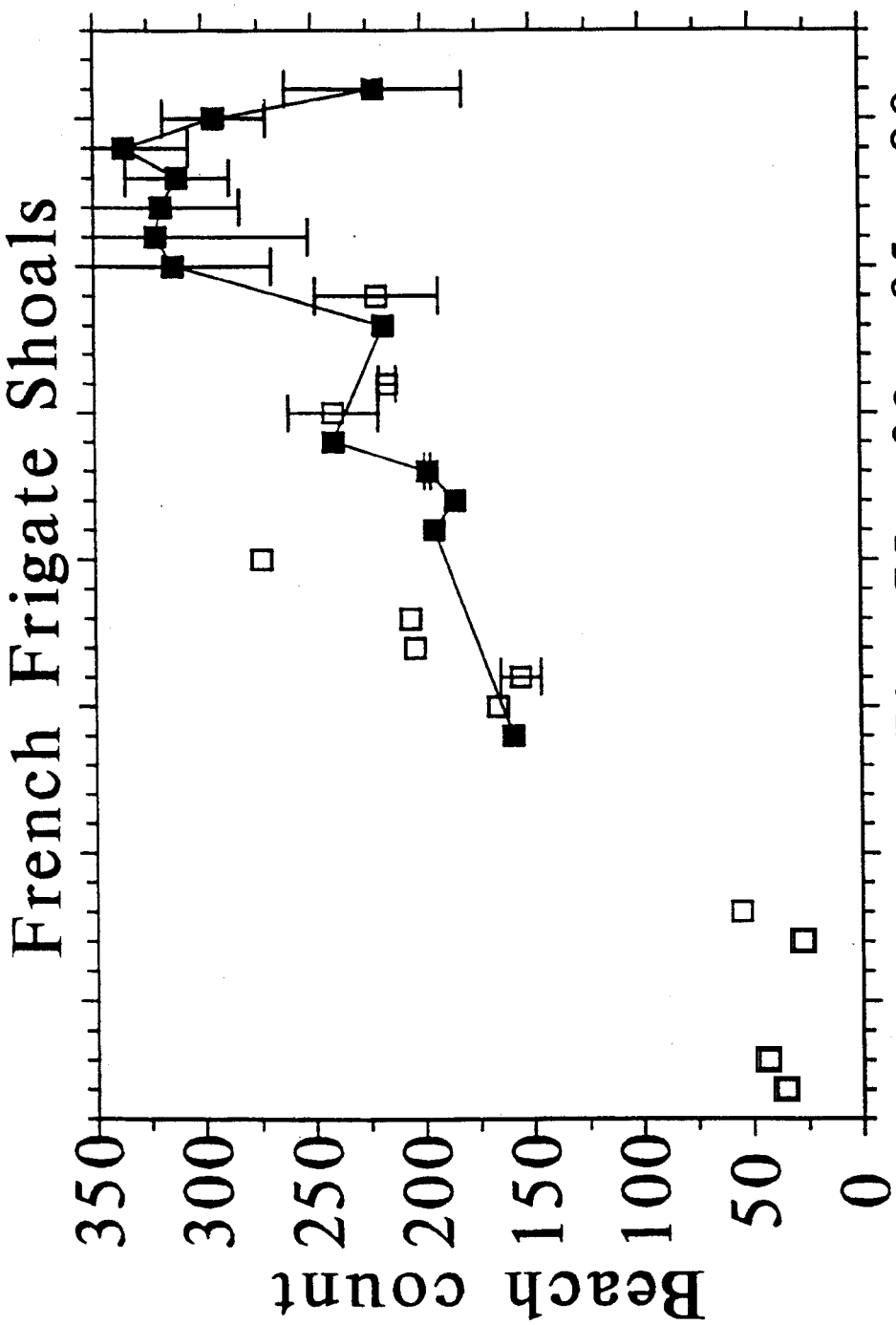

Figure 3.--Beach counts of Hawaiian monk seals at French Frigate Shoals, 1956-91. Filled squares are ground counts. Hollow squares are other counts (may not be directly comparable to ground counts). "I" symbol represents ± 1 Standard Deviation.

APPENDIXES

Appendix A.--Itinerary of fieldwork conducted at French Frigate Shoals in 1990 by the National Marine Fisheries Service.

Date	Event
5/06	B. Becker, L. Hiruki, and R. Morrow arrive via Pearl Pacific Airways (PPA). Research begins.
5/16	Becker, Hiruki, and Morrow depart via PPA.
6/13	L. Laniawe, J. Glueck, and M. Craig arrive via NOAA ship *Townsend Cromwell*.
6/25	Undersized weaned pup YG15 transported to Oahu via F/V *Golden Eagle*.
6/27	Undersize weaned pup YG21 transported to Oahu via PPA.
7/12	Undersize weaned pups YG24 and YG37 transported to Oahu via PPA.
7/22	Average size weaned pups YG10, YG31, YG34, YG41, and YG47 transported to Kure Atoll via *Townsend Cromwell*.
8/14	Craig and Laniawe depart for Oahu via *Townsend Cromwell*.
8/15	Undersize weaned pup YG53 transported to Oahu via PPA.
8/20	Glueck and undersize weaned pup YG55 depart to Oahu via PPA.
9/23	D. Ackerman and W. Curtsinger (National Geographic Magazine) and W. Gilmartin arrive via PPA.
9/29	Ackerman, Curtsinger, and Gilmartin depart via PPA. Research ends.

Appendix B.--Itinerary of fieldwork conducted on French Frigate Shoals in 1991 by the National Marine Fisheries Service.

Date	Event
1/24	W. Gilmartin and V. Honda (NMFS Enforcement) arrive via Pearl Pacific Airways (PPA).
1/26	Gilmartin and Honda depart to Oahu via PPA.
3/28	M. Craig arrives via NOAA ship *Townsend Cromwell*.
3/29	Research begins.
4/18	Craig departs to Oahu via Pearl Pacific Airways.
4/28	Craig, S. Hall and L. Knopper arrive via PPA.
5/03	Undersize weaned pup YZ03 transported to Oahu via PPA.
6/12	Undersize weaned pups YZ10, YZ13, and YZ14 transported to Midway Islands (destined for Oahu) via U.S. Coast Guard vessel *Sassafras*.
6/13	Adult male Y267 euthanized.
6/20	Knopper departs to Oahu via PPA.
6/26	E. Delaney arrives via *Townsend Cromwell*.
7/04	Undersize weaned pup YZ27 transported to Oahu via USCG vessel *Sassafras*.
8/07	Emaciated subadult female Y634 transported to Oahu via PPA with S. Atkinson and J. Pietraszek from the University of Hawaii.
8/19	Undersize weaned pup YZ34 transported to Oahu via PPA.
9/04	Research ends.
9/05	Craig and Delaney depart for Oahu via PPA.