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HAWAIIAN MONK SEAL AND GREEN TURTLE RESEARCH ON LISIANSKI ISLAND, 1987

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

NOAA Technical Memorandum NMFS

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ABSTRACT

The endangered Hawaiian monk seal, *Monachus schauinslandi*, and threatened green turtle, *Chelonia mydas*, on Lisianski Island in the Northwestern Hawaiian Islands were studied during 1-4 June and 5-29 August 1987. Data were collected on haul out, reproduction, and factors affecting survival. Monk seal census counts excluding pups of the year ranged from 77 to 112 seals ($\bar{x}$ = 93) during 7-27 August. There were 125 individual seals identified. At least 19 pups (12 males, 6 females, and 1 of unknown sex) were born in 1987. Two of three observed parturient females were identifiable from previous years. At least eight seals moved between Lisianski and Laysan Islands since the 1986 field season. Minimum first-year survival of tagged 1986 pups was 90%. At least 13 seals sustained injuries. A pup of unknown sex died as the result of entanglement, and two other seals bore newly acquired entanglement scars. Three pups of the year disappeared during the field season, and five dead seals were found. Census counts of basking turtles ranged from zero to five turtles ($\bar{x}$ = 2). One turtle was identified by a tag applied in a previous field season, and 34 excavation pits were found. One dead turtle was found. Scat, spew, and necropsy samples were collected. In addition, 140 items of net and fishing debris were sampled and destroyed.

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INTRODUCTION

Lisianski Island (lat. 26°02'N, long. 174°00'W) in the Northwestern Hawaiian Islands is a major haul-out and pupping area used by the endangered Hawaiian monk seal, *Monachus schauinslandi*, and is also a feeding, basking, and nesting area of the threatened green turtle, *Chelonia mydas*. The National Marine Fisheries Service began a research program on Lisianski Island in 1981, establishing research camps for 3 wk to 6 mo annually to monitor and aid in the recovery of this monk seal population. Recent research findings are presented in DeLong et al. (1984) for 1981; Stone (1984), Johanos and Henderson (1986), and Kam (1986) for 1982; Johanos and Kam (1986) and Kam[1] for 1983; Alcorn et al. (1988) for 1984 and 1985; and Westlake and Siepmann (1988) for 1986.

For the 1987 field season, the primary objective was to continue research conducted at Lisianski Island since 1982: conduct seal and turtle censuses; monitor seal reproduction and tag all weaned pups; continue individual photographic and scar card identification of seals; monitor injuries and deaths; perform necropsies; resight tagged turtles and monitor turtle nesting; collect scat, spew, and necropsy samples; and sample and destroy debris capable of entangling seals and turtles. This report summarizes the data collected during the 1987 field season.

MATERIALS AND METHODS

A field camp was established during 1-4 June and 5-29 August 1987 on Lisianski Island, which is located within the Hawaiian Islands National Wildlife Refuge. Its geology, flora, fauna, and history are described in detail in Clapp and Wirtz (1975). The island perimeter was divided into 49 sectors as described by Stone (1984) (Fig. 1); these same sectors have been used to record locations of seals and turtles on the island for all data collected since 1982. The itinerary of the 1987 Lisianski Island fieldwork is presented in Appendix A.

Individual Seal Identification

Individual seals were identified daily by tags or natural markings on an opportunistic basis, and they also were classified by sex and size. Procedures for seal identification and size classification are described in detail in Stone (1984). All pups were tagged with a green, plastic Temple Tag[2] on each hind flipper (Gilmartin et al. 1986) as soon as possible after weaning. Scars and other natural markings were sketched on a scar card for each seal, and these cards were revised and updated throughout the field season to maintain a current

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[1]Kam, A. K. H. 1985. Green turtle research on Lisianski Island, 1983. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-85-11, 11 p.

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

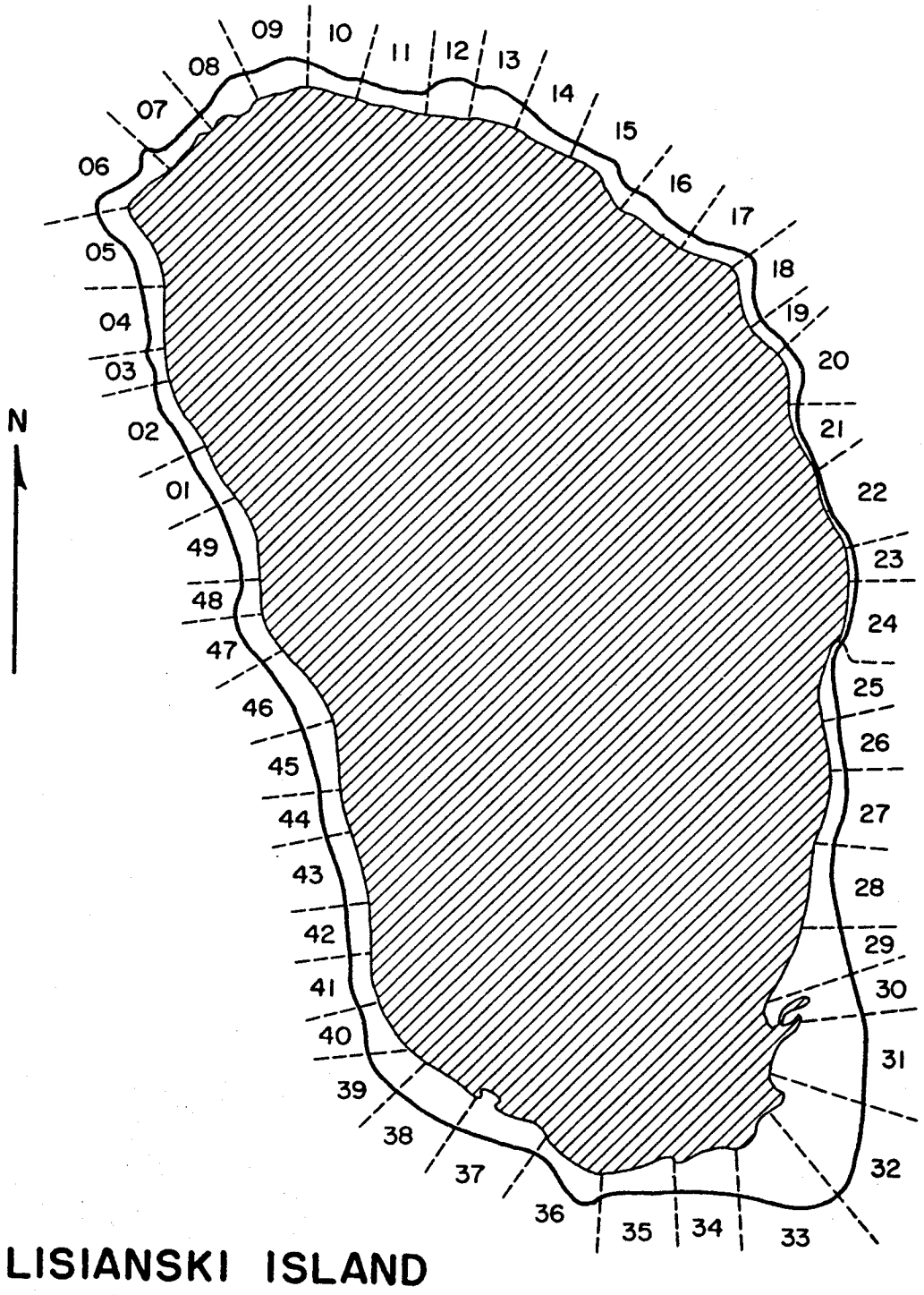

Figure 1.--Map of Lisianski Island showing 49 sectors.

file. Scars and natural markings were photographed to facilitate future identification of these animals; the photographs were added to the individual seal identification file begun in 1982. All individual seals mentioned in this report are referred to by permanent identification (ID) numbers and are directly comparable between islands and years unless otherwise noted.

Censuses and Patrols

The combination of censuses and patrols ensured that the entire island was monitored at least once daily for noteworthy events such as births, deaths, weanings, entanglements, the appearance and progress of wounds and illnesses, the presence of seals marked at other islands, and turtle nesting. Observers minimized disturbance by staying above the beach crest and using vegetation for cover, where possible. Data were recorded on the standard census form (Forsyth et al. 1988) and followed the 1987 coding instructions (Reddy[3]).

Censuses

Seal and turtle censuses ($N = 11$) were conducted every other day on Lisianski Island from 7 to 27 August, starting at 1300 Hawaii standard time and lasting for 2.0-2.5 h. Two observers began in sector 1 and proceeded in opposite directions until they met on the other side of the island. Observers alternated direction of travel on each census. On census days, tagging was not done until after the census, and seal areas were not visited for at least 3 h prior to the census period. All seals with 50% or more of their body out of the water were recorded on census. Known resightings of the same individual in a single census were not included in the census totals. Census protocol is outlined in Johanos and Kam (1986).

Patrols

Twenty-six patrols were conducted during the two field camps to tag and identify seals. Patrols were conducted once or twice daily by one observer from 1 to 4 June and on 6 August. From 8 to 26 August, morning and evening patrols (duration, 1.5-3.5 h each) were conducted each noncensus day, starting at 0900 and 1600, respectively. Patrols were carried out in the same fashion as the censuses. Four of the evening patrols were conducted by only one observer.

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[3]Reddy, M. L. Population monitoring of the Hawaiian monk seal, *Monachus schauinslandi*, and captive maintenance program for female pups at Kure Atoll, 1987. Manuscr. in prep. Southwest Fisheries Center Honolulu Laboratory, National Marine Fisheries Service, NOAA, 2570 Dole Street, Honolulu, HI 96822-2396.

Collection of Samples

Samples collected included necropsy specimens, scats and spews, and debris capable of entangling seals and turtles. For each dead seal or turtle recovered, an external examination was made, photographs taken, and external measurements and observations recorded. Seal and turtle skulls were flensed and staked until completely dried, and a humerus was collected from each dead turtle. If the death was recent, an internal examination was made, and blood, tissue, organ, parasitic, and stomach content samples were collected. Detailed descriptions of necropsy procedures and sample collection are in Wolke and George (1981) and Winchell[4] . Scats and spews were collected from seals of known size class or sex, following the methods in Alcorn (1984). All nets, lines, ropes, and other debris capable of entangling seals were sampled and destroyed, following the methods in Johanos and Kam (1986).

RESULTS AND DISCUSSION

Monk Seals

Census Counts

Census counts excluding pups of the year ranged from 77 to 112 seals ($\bar{x} = 93$); census counts including pups of the year ranged from 83 to 118 ($\bar{x} = 99$). Census summaries by size and sex class are in Table 1. Identified individuals were placed within their assigned size class, whereas unidentified seals retained the size classification given by the census observer.

Individual Identification

A summary of the individuals identified on Lisianski Island in 1987, by sex and estimated size class, is in Table 2. These seals represent only part of the population because an unknown number of seals were not identified. In all, 125 individuals were identified by tags or distinctive natural markings; 103 of these were originally identified during previous field seasons, 19 were pups of the year, and 3 were newly identified on the basis of scars. In addition, 19 temporary identification numbers were assigned.

Reproduction

Pup Production.--At least 19 pups (12 males, 6 females, and 1 of unknown sex) were born in 1987 (Table 3). Sixteen pups (3 nursing and 13 weaned) were present when the field season began. All 13 weaned pups were tagged before the end of the June field camp.

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[4]Winchell, J. M. 1986. Field manual for phocid necropsies (specifically *Monachus schauinslandi*). Unpubl. manuscr., 20 p. Southwest Fisheries Center Honolulu Laboratory, National Marine Fisheries Service, NOAA, 2570 Dole Street, Honolulu, HI 96822-2396.

Table 1.--Hawaiian monk seal census counts for Lisianski Island, 1987 (M = male, F = female, and U = unknown).

	Adult			Subadult			Juvenile			Weaned pup			Total		
Date	M	F	U	M	F	U	M	F	U	M	F	U	Nonpup	Pup	Combined
8/7	25	2	32	4	4	4	3	2	1	4	0	2	77	6	83
8/9	26	6	29	7	7	4	6	2	0	4	3	1	87	8	95
8/11	41	5	18	7	4	3	3	2	0	1	3	3	83	7	90
8/13	42	13	19	4	4	1	3	4	0	3	2	1	90	6	96
8/15	46	8	22	11	2	2	4	5	0	4	2	1	100	7	107
8/17	52	12	24	4	8	3	2	6	1	4	1	1	112	6	118
8/19	36	7	31	9	5	2	2	2	1	3	2	0	95	5	100
8/21	33	7	31	4	4	5	2	2	1	3	2	0	89	5	94
8/23	49	9	16	6	2	7	1	4	1	2	0	0	95	2	97
8/25	44	4	26	5	2	4	3	3	1	3	3	0	92	6	98
8/27	48	4	33	4	3	5	2	4	0	4	0	0	100	7	107

Table 2.--Number of individual Hawaiian monk seals identified on Lisianski Island, 1987, by sex and estimated midsummer size class.

	No. of seals			
Size	Male	Female	Sex unknown	Total
Adult	26	18	0	44
Subadult	23	18	0	41
Juvenile	9	12	0	21
Pup	12	6	1	19
Total	70	54	1	125
Total excluding pups	58	48	0	106

Table 3.--Summary of pups born on Lisianski Island, 1987 (M = male, F = female, and U = unknown).

ID No.	Tag No. Left	Tag No. Right	Sex	Date tagged	Measurement (cm) at tagging[a] AG	Measurement (cm) at tagging[a] SL
GN00	N00	N01	M	6/1/87	89	134
GN02	N02	N03	M	6/2/87	110	144
GN04	N04	N05	F	6/1/87	94	129
GN06	N06	N07	M	6/1/87	116	147
GN08	N08	N09	M	6/1/87	--	131
GN50	N50	N51	M	6/3/87	77	122
GN52	N52	N53	F	6/3/87	95	131
GN54	N54	N55	M	6/3/87	109	131
GN56	N56	N57	F	6/3/87	115	145
GN58	N58	N59	F	6/3/87	122	152
GN60	N60	N61	M	6/3/87	114	144
GN63	N63	N62	F	6/3/87	--	--
GN64	N64	N65	M	6/4/87	119	148
GN11	N11	N10	M	8/6/87	118	128
GN13	N13	N12	M	8/6/87	97	131
GN14	N14	N15	M	8/8/87	110	132
GN17	N17	N16	M	8/9/87	109	145
GN18	N18	N19	F	8/17/87	99	129
GNX1[b]	--	--	U	--	--	--

[a]AG = axillary girth; SL = straight length.
[b]Dead, weaning-sized pup found entangled in a net and line mass.

When the August field camp began, five other weaned pups were found and subsequently tagged. In addition, a dead, untagged pup was found. This pup was of normal weaning size and probably died prior to the June camp but remained undiscovered because of drifting sand. Three tagged weaned pups were not observed during the August camp, but the remaining 15 pups were sighted within the last 10 d of the field season.

Parturient Females.--Two of three observed parturient females were identifiable from previous years. Both of these females (GA01 and GA29) were first identified in 1982 (Stone 1984) and are known to have pupped in 1982 and 1983 (Johanos and Kam 1986). In subsequent years, coverage of the pupping season was incomplete, and many parturient females were not identified. Neither GA01 nor GA29 was observed with a pup in 1984 or 1985 (Alcorn et al. 1988), but GA01 was observed with a pup in 1986 (Westlake and Siepmann 1988).

Table 4.--Interisland movement of monk seals to and from Lisianski Island, 1987 (A = adult, S = subadult, and J = juvenile; M = male and F = female).[a]

ID	Tag No.					Movement from		Movement to		
							Date		Date	
No.	L	R	Color	Size	Sex	Location	last seen	Location	first seen	Notes
G054	A15	A16	Green	S	F	Lisianski	8/18/86	Laysan	4/9/87	
						Laysan	6/27/87	Lisianski	8/6/87	Round trip in 1987
GT02	T02	T01	Green	J	M	Lisianski	8/9/86	Laysan	4/13/87	
GT24	T24	T23	Green	S	M	Lisianski	8/22/86	Laysan	6/5/87	Only one sighting
GT30	T30	T29	Green	S	M	Lisianski	8/20/86	Laysan	6/27/87	
GK14	K14	K15	Green	S	M	Lisianski	8/23/86	Laysan	4/9/87	
						Laysan	5/4/87	Lisianski	8/6/87	Round trip in 1987
GK26	K26	K27	Green	J	F	Lisianski	8/23/86	Laysan	4/11/87	Only one sighting
BT10	T11	T10	Blue	S	F	Laysan	5/24/87	Lisianski	6/2/87	
GA41	--	X317	Metal	A	M	Lisianski	7/24/83	Laysan	7/14/87	Round trip sometime
						Laysan	7/15/87	Lisianski	8/24/87	between 1983 and 1987

[a]Data are from the following sources: Lisianski Island 1983 (Johanos and Kam 1986), Lisianski Island 1986 (Westlake and and Siepmann 1988), Laysan Island 1987 (text footnote 5).

Interisland Movement

At least eight seals moved between Lisianski and Laysan Islands since the 1986 field season (Table 4). Four seals born and tagged on Lisianski Island moved to Laysan Island between the 1986 and 1987 field seasons (juvenile female GK26, juvenile male GT02, and subadult males GT24 and GT30). Subadult female BT10, born and tagged at Pearl and Hermes Reef, moved to Laysan Island between the 1986 and 1987 field seasons and then from Laysan Island to Lisianski Island during the 1987 field season. In addition, three seals made a round trip between Lisianski and Laysan Islands. Subadult female G054 and subadult male GK14, both born and tagged on Lisianski Island, moved to Laysan Island

between the 1986 and 1987 field seasons and then returned to Lisianski Island later in 1987. Adult male GA41 was last identified on Lisianski Island in 1983 by bleach and scars (Johanos and Kam 1986), tagged on Laysan Island in 1987 (Becker and Ching[5]), and resighted on Lisianski Island later that year.

Tagged Pups

All known surviving weaned pups of the year were tagged successfully and had retained all tags when last observed in 1987. Table 5 summarizes the number of pups born and tagged at Lisianski Island between 1982 and 1987 and resighted through 1987. Nine seals tagged as pups in 1982, 19 from 1983, 11 from 1984, 12 from 1985, and 18 from 1986 were resighted at least once during the 1987 field season. Minimum first-year survival of tagged 1986 pups was high; 90% were resighted in 1987. Only three seals lost a tag between the 1986 and 1987 field seasons (juvenile female GL36 and subadult males GK02 and GT06); however, some older tags were so abraded that they were unreadable on one or both sides. Thus, it is possible that a few tagged individuals were present but never identified.

Factors Affecting Survival

Injuries.--At least 13 seals were injured during 1987. Injuries resulted from shark attack, adult male aggression, reef, debris, or unknown causes (Table 6). Two circular wounds (15% of total) appeared to have been inflicted by the cookiecutter shark, *Isistius brasiliensis*. Nine injuries (69% of total) were dorsal wounds typical of bites inflicted by adult males during mating attempts. Two minor wounds (15% of total) were probably caused by the animal coming into contact with reef or debris.

Entanglement.--A pup of unknown sex died as the result of entanglement (see section on deaths), and two other seals bore recently acquired entanglement scars around their necks (Table 7). Adult female GA01 was a parturient female in 1986 (Westlake and Siepmann 1988) and 1987. Photographs taken in 1986 and on 2 June 1987 showed no scar, but an entanglement scar was present by 10 August, the first time she was sighted during the second field camp. Weaned female pup GN18 was first identified by her entanglement scar on 14 August and was tagged 3 d later.

Disappearances.--Three pups of the year were not observed during the August camp. Female pup GN52 and male pups GN50 and GN60 were sighted on only 3 June, their tagging date.

Deaths.--Five dead seals were found during the 1987 field season: one adult female, two adults of unknown sex, one juvenile male (GK10), and one pup of unknown sex

[5]Becker, B. L. and P. A. Ching. Hawaiian monk seal research on Laysan Island, 1987. Manuscr. in prep. Southwest Fisheries Center Honolulu Laboratory, National Marine Fisheries Service, NOAA, 2570 Dole Street, Honolulu, HI 96822-2396.

Table 5.--Number of Hawaiian monk seal pups born, tagged, and resighted at Lisianski Island, 1982-87.[a] Numbers in parentheses equal the numbers of males, females, and seals of unknown sex, respectively.

Year tagged	Known births (No.)	Pups tagged (No.)	No. of tags resighted by year				
			1983	1984	1985	1986	1987
1982	28[b] (16, 11, 1)	13 (7, 6)	11[c] (5, 6)	11[d] (5, 6)	11[e] (5, 6)	11 (5, 6)	9 (5, 4)
1983	25[f] (7, 18)	24 (6, 18)		21[e] (6, 15)	20 (6, 14)	19 (5, 14)	19 (5, 14)
1984	16[f] (10, 5, 1)	15 (10, 5)			14 (9, 5)	12 (9, 3)	11[g] (9, 2)
1985	15 (6, 9)	14 (5, 9)				14[e] (5, 9)	12[h] (4, 8)
1986	22[b] (11, 9, 2)	20 (11, 9)					18 (10, 8)
1987	19[f] (12, 6, 1)	18 (12, 6)					

[a]Data for 1982-86 are from the following sources: 1982 (Johanos and Henderson 1986), 1983 (Johanos and Kam 1986), 1984 and 1985 (Alcorn et al. 1988), 1986 (Westlake and Siepmann 1988).

[b]Total includes two dead pups.

[c]There were 24 pups from 1982 resighted: 11 were tagged and 13 were identified by bleach marks applied in 1982 on untagged pups.

[d]Total includes one pup not seen that year at any location but resighted in 1985.

[e]Total includes a Lisianski pup resighted at Laysan Island that year.

[f]Total includes one dead pup.

[g]Total includes three Lisianski pups resighted at Laysan Island that year.

[h]Total includes two Lisianski pups resighted at Laysan Island that year.

Table 6.--Injuries of Hawaiian monk seals at Lisianski Island, 1987 (A = adult, S = subadult, and J = juvenile; M = male, F = female, and U = unknown).

Field No.	Date	Size	Sex	ID No.	Description of injury	Probable cause
1	8/9	J	F	GL02	Ventral gaping wound through skin 1.5 cm^2 x 1-cm deep, anterior of teats. Healing.	Shark
2	8/9	S	F	001	Dorsal gaping wound. Originally about 1 m long; now healing and forming scar. Two areas (2 cm^2 and 5 x 15 cm) still pink and moist.	Adult male
3	8/8	S	F	GK18	Dorsal abscess, 10 x 15 x 5 cm.	Adult male
5	8/7	A	U	011	Dorsal gaping wound. Originally about 50 cm long; now mostly healed. Unhealed area, 10 x 5 cm.	Adult male
6	8/13	A	F	G105	Dorsal gaping wound, 30 x 10 cm. Healing.	Adult male
7	8/8	A	F	G171	Dorsal gaping wound, 1 m x 15 cm. Healing.	Adult male
8	8/8	A	F	007	Dorsal gaping back wound, 10 x 5 cm. Healing.	Adult male
9	8/8	S	M	G058	Dorsal gaping wound, 1 m x 10 cm. Healing. Unhealed area, 10 x 5 cm.	Adult male
10	8/17	A	F	016	Dorsal gaping wound, 25 x 10 cm. Healing. Unhealed area, 9 x 5 cm.	Adult male
12	8/22	A	M	--	Ventral semicircular laceration through skin, 3.5 cm diameter x 2 cm deep.	Shark
14	8/12	S	F	T28	Lateral laceration through skin, 4 cm long.	Reef/debris
15	8/15	A	F	025	Dorsal gaping wound, 15 x 40 cm. Healing.	Adult male
16	8/14	A	M	GA02	Foreflipper scar reopened, 2 x 4 cm.	Reef/debris

Table 7.--Newly acquired scars due to entanglement of Hawaiian monk seals at Lisianski Island, 1987.

Size	Sex	ID No.	Scarred area
Adult	Female	GA01	Neck
Weaned pup	Female	GN18	Neck

(GNX1) (Table 8). Although two and three carcasses were found during June and August 1987, respectively, all probably died prior to the beginning of the field season. The cause of death could not be determined for four of the seals, but the pup probably died because of entanglement in fishing debris. Details related to this death are presented below:

On 8 August, a dead pup (GNX1) of normal weaning size was found in sector 33. The body was almost completely covered with sand and was lying approximately 15 m from the low tide mark on a flat sandy shelf which is covered at high tide. The body was entangled in and partially lying upon a composite net-line mass (collapsed dimensions, 4.5 x 0.44 x 0.15 m. A 4-cm-wide twisted band of net tightly encircled the pup's neck, making escape impossible. It is unknown whether the pup was originally entangled at this location or the net and accompanying carcass were washed ashore from elsewhere.

Table 8.--Hawaiian monk seal deaths at Lisianski Island, 1987.

Necropsy No.	Size	Sex	ID No.	Cause of death
4218[a]	Adult	Female		Unknown
--	Juvenile	Male	GK10	Unknown
01LI87	Pup	Unknown	GNX1	Entanglement
02LI87	Adult	Unknown		Unknown
03LI87	Adult	Unknown		Unknown

[a]National Wildlife Research Center numbering system.

Green Turtles

Census counts of basking turtles ranged from zero to five turtles ($\bar{x} = 2$). An adult female (left tag No. 6762), identified by a tag applied during a previous study, was sighted on 12 August in sector 33.

In 1987, a total of 34 excavation pits were found (Appendix B), most at the vegetation line in sectors 43-47. This number should be considered a minimum because any pit that did not appear fresh, and thus possibly dug the previous year, was not counted.

On 20 August, the mummified carcass of a female turtle was found in sector 20. She was approximately 20 m inland from the edge of the vegetation and had crawled 15 m into a dense stand of naupaka, *Scaevola taccada*. Based on the position of the body, she probably became stuck in the naupaka and could not return to the ocean. She was carrying more than 50 mature eggs.

Samples Collected

Scats and spews from seals of known size and sex were collected and processed in 1987. Organ and parasitic samples were not collected from the dead seals and the turtle because of advanced decomposition. Stomach samples were collected from one seal. Necropsy reports are on file at the Southwest Fisheries Center Honolulu Laboratory of the National Marine Fisheries Service, NOAA. Five seal skulls and one turtle skull and humerus were collected. Samples were collected from the net-line mass in which the pup was entangled. In all, 140 items of net and fishing debris were sampled and destroyed. Analysis of all samples is ongoing and will be reported elsewhere.

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APPENDIXES

Appendix A.--Itinerary of Lisianski Island fieldwork conducted in 1987 by the National Marine Fisheries Service.

Date	Event
6/1	The fishing vessel *Feresa* arrives at Lisianski Island and disembarks T. Gerrodette and cooperating U.S. Fish and Wildlife (USFWS) scientists. Field camp is established. Tagging and daily patrols begin.
6/4	Tagging and daily patrols end. *Feresa* embarks Gerrodette and cooperating USFWS scientists and departs for Pearl and Hermes Reef.
8/5	The NOAA ship *Townsend Cromwell* arrives, disembarks T. Johanos and R. Withrow, and departs for Seamount No. 11. Field camp is established.
8/6	Patrols begin.
8/7	Censuses begin.
8/26	Patrols end.
8/27	Censuses end.
8/29	*Townsend Cromwell* arrives, embarks Johanos and Withrow, and departs for Honolulu.

Appendix B.--Location of green turtle pits, Lisianski Island, 1987.

Sector No.	Date dug	No. of pits	Beach position
1	< 18 Aug.	1	3
8	< 18 Aug.	2	3
43	< 18 Aug.	1	3
43	< 18 Aug.	6	3
43	< 18 Aug.	4	3
44	< 18 Aug.	2	3
45	< 18 Aug.	4	3
45	< 18 Aug.	1	3
45	18 Aug.	2	3
45	< 18 Aug.	1	3
45	< 18 Aug.	6	3
46	< 18 Aug.	3	3
47	< 18 Aug.	1	3

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