

NOAA Technical Memorandum NMFS



AUGUST 1988

**HAWAIIAN MONK SEAL AND GREEN TURTLE
RESEARCH ON LISIANSKI ISLAND, 1984 AND 1985**

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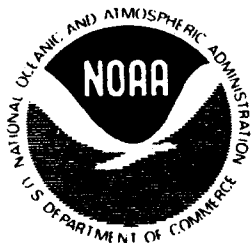
NOAA Technical Memorandum NMFS

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**U.S. DEPARTMENT OF COMMERCE
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ABSTRACT

The Hawaiian monk seal, *Monachus schauinslandi*, and the green turtle, *Chelonia mydas*, at Lisianski Island were studied during 2 July-6 August 1984 and 17 June-20 July 1985, as part of ongoing research to monitor and aid the recovery of these species. In 1984, beach counts excluding pups ranged from 55 to 82 seals ($\bar{x} = 68.1$). Fifteen weaned pups were tagged. An additional pup was found dead; six injured seals were seen. Ten tagged turtles from previous studies were resighted, 7 turtles were newly tagged, and 91 turtle pits were found. Fourteen seal scats, 4 spews, and 71 lines or net debris were sampled. In 1985, beach counts excluding pups ranged from 58 to 95 seals ($\bar{x} = 79.1$). Fourteen of the 15 pups had weaned and were tagged. Eight injured seals were seen. Eleven previously tagged turtles were resighted, 6 were newly tagged, and 78 pits were located. A total of 9 seal scats, 5 spews, and 84 lines or nets were sampled.

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INTRODUCTION

Lisianski Island in the Northwestern Hawaiian Islands is one of eight recorded haul-out and pupping sites of the endangered Hawaiian monk seal, *Monachus schauinslandi*, and is also a feeding, basking, and nesting area for the threatened green turtle, *Chelonia mydas* (Fig. 1). To study both species, the Southwest Fisheries Center (SWFC) Honolulu Laboratory, National Marine Fisheries Service (NMFS), has established field research camps on Lisianski Island annually from 1981 to the present (DeLong et al. 1984; Stone 1984; Johanos and Henderson 1986; Johanos and Kam 1986; Kam 1986; Kam¹). Monk seal research is authorized under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, with the intent of monitoring and aiding in the recovery of the species. Our report describes the findings of the 1984 and 1985 studies.

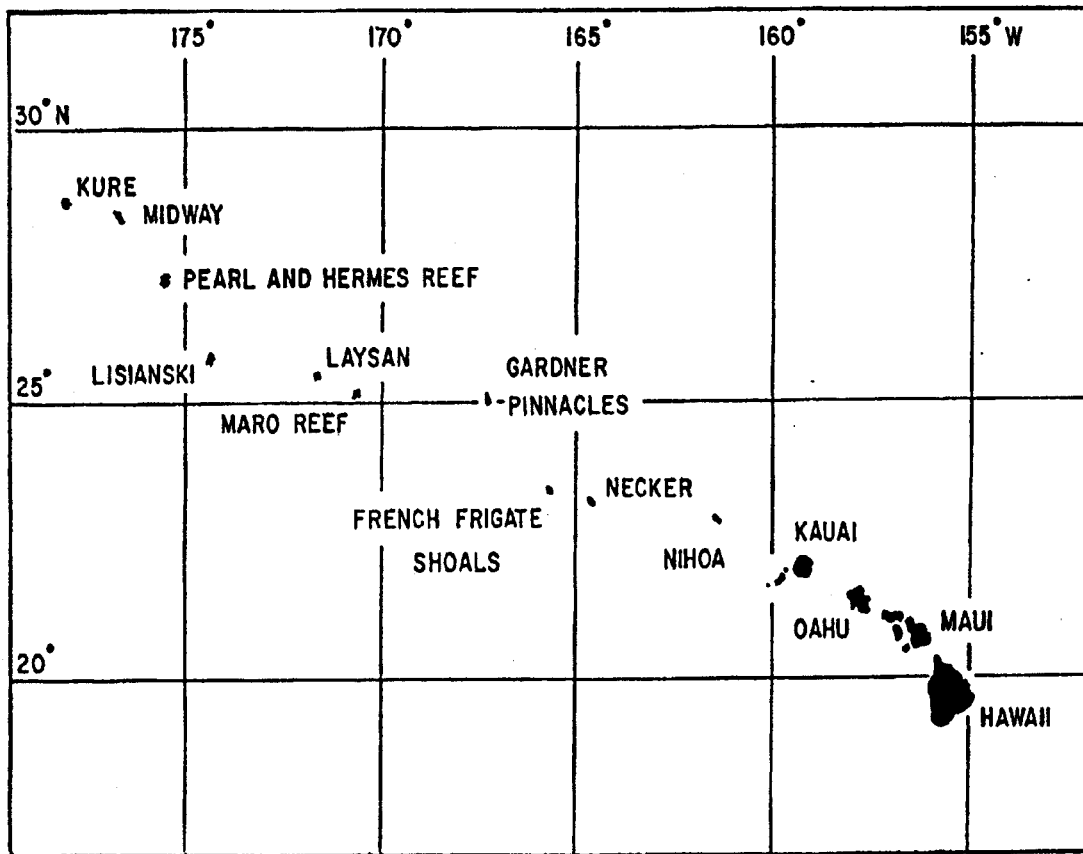
MATERIALS AND METHODS

Hawaiian monk seals and green turtles were studied on Lisianski Island, 2 July-6 August 1984 and 17 June-20 July 1985 (Appendix A). Two-person field camps were established near the Hawaiian Islands National Wildlife Refuge sign on the west side at the entrance cove. Specific objectives in 1984 and 1985 were to 1) conduct seal and turtle censuses every 2 d; 2) monitor seal reproduction and tag all weaned pups; 3) monitor seal injuries and deaths; 4) tag and resight turtles and monitor nesting; 5) collect seal scats, spewings, and necropsy samples; and 6) inventory and sample net debris capable of entangling seals and turtles. In addition, multiple censuses of seals were conducted on 5 d in 1984.

The island perimeter had been divided into 49 sectors for the 1982 study (Stone 1984). Sector boundaries were clearly marked by natural landmarks and small plastic poles, and were used for subsequent studies. The entire perimeter of the island was circuited one to four times daily. Frequent coverage made it possible to obtain good resight data; seals and turtles spend extended times at sea and might otherwise be missed. Frequent coverage also made it possible to closely monitor births, weanings, and injuries.

The 1984 and 1985 seal studies were observational except for the tagging of weaned pups. Artificial bleach marks were not applied; however, some seals that were bleached in 1983 after molting (Johanos and Kam 1986) still retained those bleach marks in 1984.

¹Kam, 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.



HAWAIIAN ARCHIPELAGO

NORTH PACIFIC OCEAN

Figure 1. — Map of Hawaiian Archipelago, showing location of Lisianski Island.

Identifying Individual Seals

Individual seals were identified when possible by scars, natural markings, and by bleach or tags applied during previous studies. Emphasis was placed on identifying parturient females. Limited effort went into identifying other seals because the 1984 and 1985 field seasons were short (i.e., 1 mo) and most seals were not identifiable by bleach marks or tags. Photographs of scars were taken on an opportunistic basis, with emphasis placed on adult females. Weaned pups were tagged on both hind flippers with green Temple Tags² (see Gilmartin et al. (1986) for pup tagging procedure).

Censuses

Beach counts of seals and turtles were conducted on every other day, 5 July-4 August 1984 and 19 June-17 July 1985. These alternate day censuses commenced at 1300 Hawaii standard time and lasted approximately 1.5-2.0 h each. Two persons censused, starting simultaneously from the boundary between sectors 1 and 49 (Fig. 2) and proceeding in opposite directions around the island perimeter until they met (usually in sectors 22-28). Observers traded the directions traveled every census. Data recorded on census forms (Alcorn and Buelna³) included seal births, weanings, injuries, and deaths. Seal haul-out areas were not visited at least 3 h prior to the census, and tagging was not done until after the census was completed. See Stone (1984) for a description of size classes into which seals were assigned, and Johanos and Kam (1986) for additional census protocol.

1984 Special Census Series

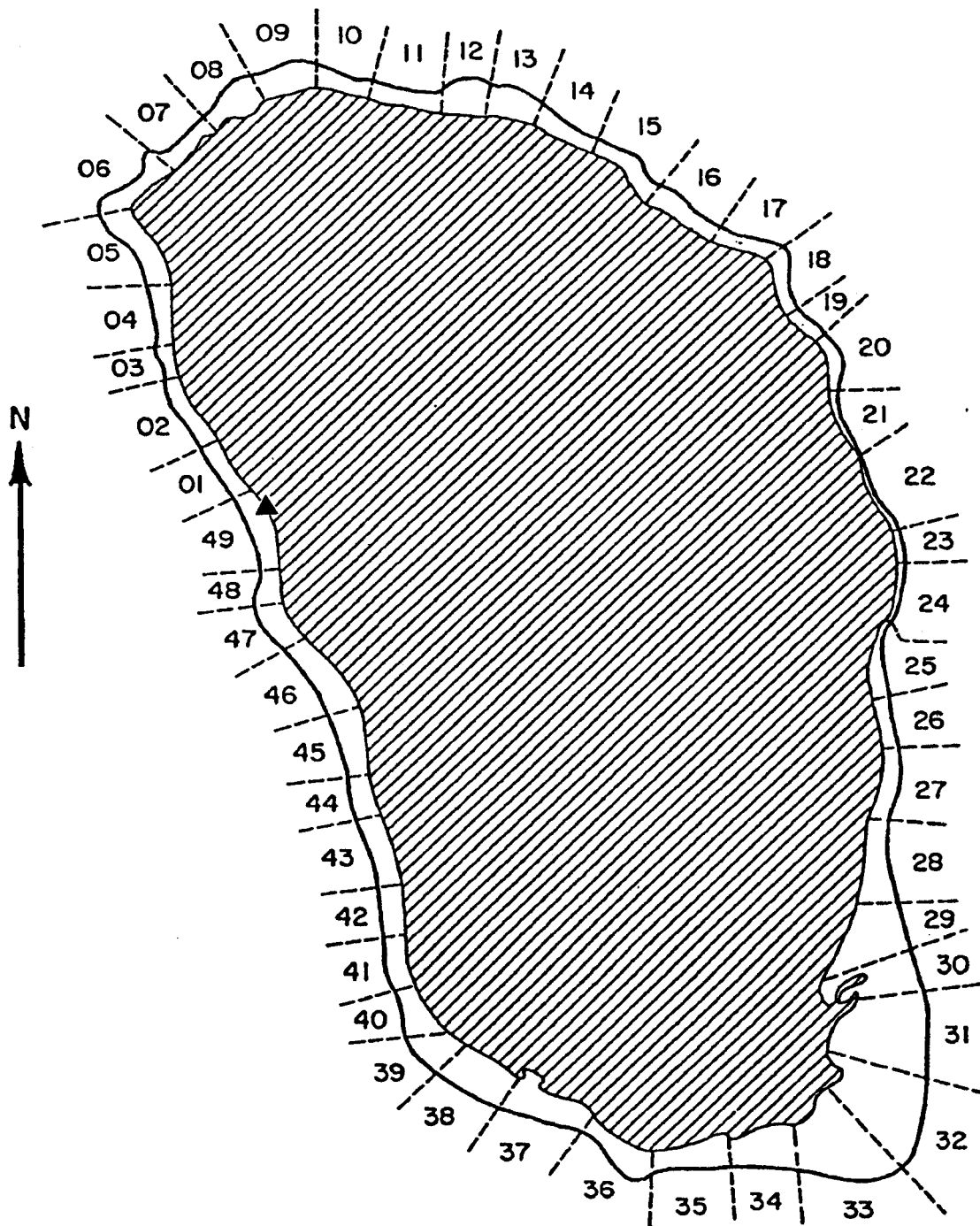
Four censuses per day were conducted on five dates (15, 17, 19, 21, 23 July) to provide seal haul-out data throughout the day to confirm whether early afternoon is an appropriate seal census time and to develop a correction factor for censuses performed at other than peak daylight haul-out hours. Turtle sightings also were recorded. Findings from these censuses will be reported elsewhere.

Patrols

Circuits (patrols) of the entire island were made one or more times daily on noncensus days. Times at which these patrols were conducted varied. During patrols, all weaned pups

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

³Alcorn, D. J., and E. K. Buelna. The Hawaiian monk seal on Laysan Island, 1983. Manuscr. in prep. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396.



LISIANSKI ISLAND

Figure 2.— Map of Lisianski Island showing 49 sectors and the campsite (▲).

were checked for tags so that those newly weaned or coming ashore after time at sea could be tagged as soon as possible. Effort was made to read and record all seal tags so that survival rates of pup cohorts could be determined. As in the censuses, the island was monitored for seal births, weanings, injuries, and deaths. Data were recorded on the census form (footnote 3).

Turtle Research

Turtle sightings during censuses were recorded on the same census form used for seals. In addition to the censuses, a few night patrols were conducted to look for basking and nesting turtles. Turtles without tags were tagged, and when possible, additional tags were applied to turtles with single or loose tags. In 1985, some turtles were also marked with acrylic spray paint, a temporary form of nonintrusive identification lasting 2-3 wk. An inventory was made of all turtle pits that appeared to have been dug during the respective nesting season.

Collection of Specimens and Debris

Seal scats and spews were collected and processed, and debris capable of entangling seals and turtles was inventoried and sampled prior to burning (see Alcorn (1984) for detailed methodology).

RESULTS AND DISCUSSION

Monk Seals

Census Data

During the alternate day censuses ($N = 16$) in 1984, beach counts excluding pups ranged from 55 to 82 seals ($\bar{x} = 68.1$), and counts including pups ranged from 61 to 90 ($\bar{x} = 75.3$) (Appendix B). During the alternate day censuses ($N = 15$) in 1985, beach counts excluding pups ranged from 58 to 95 seals ($\bar{x} = 79.1$), and counts including pups ranged from 64 to 105 ($\bar{x} = 88.9$) (Appendix B).

Reproduction

Sixteen births (10 males, 5 females, and 1 of unknown sex) were recorded in 1984 (Table 1): 15 live pups (2 nursing and 13 weaned) and 1 dead pup were present when the field season began. All 15 live pups weaned before research ended and were tagged.

Fifteen births (6 males, 9 females) were recorded in 1985: 14 pups (4 nursing and 10 weaned) were present when the field season began and 1 was born during our stay and was still nursing in July when the field camp departed (Table 1). The 14 pups that weaned prior to the end of research were tagged.

Table 1.—Summary of pups born at Lisianski Island prior to 3 July during the 1984 field season and prior to 23 June during the 1985 field season (F = female, M = male, and U = unknown).

Pup ID	Tag No.		Sex	Date tagged	Measurement at tagging ^a		Wean date	Mother ID
	Left	Right			AG	SL		
1984								
GT02	T02	T01	M	7/5	--	133	--	--
GT04	T04	T03	M	7/5	--	120	--	--
GT06	T06	T05	M	7/5	--	--	--	--
GT08	T08	T07	M	7/6	--	130.5	--	--
GT10	T10	T09	M	7/6	--	136 ^b	--	--
GT12	T12	T11	M	7/6	--	133	--	--
GT14	T14	T13	F	7/6	--	119	--	--
GT16	T16	T15	M	7/6	--	126	--	--
GT18	T18	T17	M	7/6	--	133	--	--
GT20	T20	T19	F	7/9	106	127	7/8	G103
GT22	T22	T21	F	7/11	--	132	--	--
GT24	T24	T23	M	7/11	--	137	--	--
GT26	T26	T25	F	7/13	--	--	--	--
GT28	T28	T27	F	7/13	119	132	7/13	T25F ^c
GT30	T30	T29	M	7/25	--	133	--	--
01LIS84	--	--	U	--	--	--	--	--
1985								
GK00	K00	K01	F	6/18	--	116 ^d	--	--
GK02	K02	K03	M	6/18	--	120 ^d	--	--
GK04	K04	K05	F	6/19	89	122	--	--
GK06	K06	K07	F	6/19	93	121	--	--
GK08	K08	K09	F	6/20	89	118	--	--
GK10	K10	K11	M	6/24	--	--	--	--
GK12	K12	K13	M	6/26	110	128.5	6/26	--
GK14	K14	K15	M	6/26	--	120 ^d	--	--
GK16	K16	K17	M	7/2	111	116	6/27	--
GK18	K18	K19	F	7/3	--	131 ^d	--	--
GK20	K20	K21	F	7/5	110	130	7/4	G104
GK22	K22	K23	F	7/8	--	127	--	--
GK24	K24	K25	F	7/13	--	--	--	--
GK26	K26	K27	F	7/18	108 ^e	134	7/15	G101
--	--	--	M	--	--	--	--	G103 ^f

^a AG is axillary girth, measured around the body behind posterior origin of the foreflippers; SL is standard length, measured in a straight line from nose tip to tail tip.

^b Straight length measurement from nose to tip of hind flippers; pup was small.

^c This seal was bleached 165 on Lisianski Island in 1982; seal 165 in the 1982 Lisianski Island report (Stone 1984) and seal 25F in the 1982 Laysan Island report (Alcorn 1984) are the same animal.

^d These measurements were not taken at tagging because of difficulty in restraining the pup; they were estimated later by measuring adjacent to soundly sleeping pups.

^e Because of continuous movement by the pup, 108 cm is an estimate.

^f Pup's date of birth is 22 June 1985. All other pups were born prior to 17 June; dates of birth are unknown.

The number of pups in 1984 and 1985 appears to be well below that in 1982 (28 pups; Johanos and Henderson 1986) and 1983 (25 pups; Johanos and Kam 1986). Because the 1984 and 1985 field seasons were short and most pups were weaned before the seasons began, it is difficult to ascertain whether low pup numbers are due to low pup production, high mortality, or some pups not being sighted or being mistaken for juveniles. Pup production may have been low because the adult female population may have decreased; six adult females are known to have emigrated during the studies (see section on interisland movement). It is doubtful that some pups were not seen, because they rarely stay offshore for longer than 2 wk during the first 5 mo after weaning (Henderson⁴). Only one or two untagged, small seals were indistinguishable between older weaned pups and small juveniles in 1984 and 1985; this alone could not account for the low numbers. There were no obviously parturient females when research ended.

Identification of Parturient Females

Both adult females (G103 and T25F) with nursing pups when observations began in 1984 were identified from scars. This was the first year T25F was known to pup on Lisianski Island; she pupped on Laysan Island in 1982 (Alcorn 1984), 1983 (footnote 3), and 1985 (Johanos and Austin 1988). In 1985, five adult females were seen with nursing pups; three of these adults were identified (G101, G103, and G104).

Interisland Movement

Thirteen individual seals are known to have moved from or to Lisianski Island between July 1983 and 20 July 1985 (Table 2). All movement was between Lisianski and Laysan Islands, a distance of 110 nmi. Eight of these seals made a one-way trip, and five made round trips or greater during this period. There were nine seals known to be lost from the Lisianski population due to interisland movement; six of the nine were adult females.

Tagged Pups

All 15 pups tagged in 1984 and 14 in 1985 were resighted during the field season in which they were tagged, and tags were still present when the pups were last seen. All living pups seen were tagged with the exception of one, which was still nursing when research ended in 1985.

Resightings of pups at Lisianski Island in 1985 included 11 pups tagged in 1982, 20 pups in 1983, and 14 in 1984 (Table 3). All 3 of the 1983 tagged pups that disappeared in

⁴J. R. Henderson, Southwest Fisheries Center Honolulu Laboratory, National Marine Fisheries Service, NOAA, Honolulu, HI 96822-2396, pers. commun., December 1985.

Table 2.—Interisland movement of Hawaiian monk seals to and from Lisianski Island in 1984 and 1985 (size: A = adult, S = subadult, and J = juvenile; F = female and M = male).^a

ID	Tag No.		Size	Sex	Movement from		Movement to		Comments
	Left	Right (color)			Location	Date last seen	Location	Date first seen	
GS45			S	M	Lisianski	8/7/83	Laysan	4/1/84	
GJ31			S	F	Lisianski	7/26/83	Laysan	4/12/84	
GA10			A	F	Lisianski	8/6/83	Laysan	4/13/84	
T57F			A	F	Lisianski	7/28/83	Laysan	4/16/84	
G130			A	F	Lisianski	7/30/83	Laysan	4/28/84	
G027	027	028 (green)	J	F	Lisianski	7/31/84	Laysan	10/25/84	Lisianski 1982 pup
GS86			A	F	Lisianski	Summer 1984	Laysan	3/25/85	
T25F ^b			A	F	Lisianski	Summer 1984	Laysan	6/18/85	
G055	A55	A56 (green)	J	F	Lisianski	7/23/84	Laysan	8/2/84	Lisianski 1983 pup
					Laysan	8/6/84	Lisianski	6/19/85	
GA59			A	F	Lisianski	7/24/83	Laysan	3/30/84	Pupped on Laysan in 1984
					Laysan	4/2/84	Lisianski	7/15/85	
T08F ^c			A	F	Lisianski	7/24/83	Laysan	4/20/84	
					Laysan	6/15/84	Lisianski	8/1/84	
					Lisianski	Summer 1984	Laysan	3/3/85	
TA34	A34	A33 (tan)	J	M	Laysan	7/21/83	Lisianski	7/3/84	Laysan 1983 pup
					Lisianski	Summer 1984	Laysan	4/19/85	
G065	A65	A66 (green)	S	M	Lisianski	Summer 1984	Laysan	6/2/85	
					Laysan	6/2/85	Lisianski	6/21/85	

^aThe data are from the following sources: Laysan 1983 (text footnote 3), 1984 (Johanos et al. 1987), and 1985 (T. C. Johanos, Southwest Fisheries Center Honolulu Laboratory, National Marine Fisheries Service, NOAA, Honolulu, HI 96822-2396, pers. commun., September 1984); Lisianski 1983 (Johanos et al. 1986).

^bLaysan seal T25F was bleached 165 on Lisianski in 1982; therefore, 25F in the 1982 Laysan report (Alcorn 1984) is the same seal as 165 in the 1982 Lisianski report (Stone 1984).

^cLaysan seal T08F was bleached A83 on Lisianski in 1982; therefore, 08F in the 1982 Laysan report (Alcorn 1984) is the same seal as A83 in the 1982 Lisianski report (Stone 1984).

Table 3.—Number of pups born and tagged at Lisianski Island 1982-84 and resighted through 1985.^a Numbers in parentheses equal the number of males, females, and unidentified sex, respectively.

Year tagged	Known births (No.)	Pups tagged (No.)	Tag resightings by year		
			1983	1984	1985
1982	28 ^b (16, 11, 1)	13 (7, 6)	11 ^c (5, 6)	10 (5, 5)	11 ^d (5, 6)
1983	25 ^e (7, 18)	24 (6, 18)		21 ^d (6, 15)	20 (6, 14)
1984	16 ^f (10, 5, 1)	15 (10, 5)			14 (9, 5)

^aBirth and tag data are from the following sources: 1982 (Johanos and Henderson 1986) and 1983 (Johanos and Kam 1986).

^bThis total includes two dead nursing age pups.

^cOf the 1982 pups, 24 were resighted: 11 of these were tag resightings, and 13 were untagged seals identified by bleach marks applied in 1982.

^dThis includes a Lisianski pup resighted on Laysan.

^eThis total includes a dead, nursing age pup.

^fThe exact number of births is unknown because of the short duration of the research camp. This total includes a pup, of unknown sex, whose skeletal remains were found.

the first year were females; this is not surprising because 18 of the 25 pups born in 1983 were females. In comparison, most of the 1984 tagged pups were males, and a male was the only pup that disappeared during the first year.

Death and Injuries

Only one dead seal (a pup) was found, although several injuries were recorded in 1984 and 1985. The pup's skull, bones, and pelage fragments were found in the sector 22 vegetation in 1984; a baculum was not found. Six injuries were seen in 1984 and 10 in 1985 (Table 4). Of these 16 injuries, 9 appeared to have been inflicted by adult male seals, 5 were due to sharks, and 2 were of unknown origin.

Incidental Observations

Pup exchanges, entanglement of seals in debris, and extremely aggressive adult male behavior were not observed at Lisianski Island in 1984 or 1985. This was mainly because the field seasons were short and apparently began after pupping and most breeding had occurred.

Table 4. — Monk seal injuries observed on Lisianski Island in 1984 (2 July-6 August) and 1985 (17 June-20 July) (size: A = adult, S = subadult, J = juvenile; sex: F = female, M = male, and ? = uncertain; and cause: K = known and P = probable).

Date	ID	Size	Sex	Injury type	Cause
1984					
July 5	--	A	F?	Small cuts; scratches on dorsal and postlateral	Adult male (P)
July 15	--	A	?	Long shallow cut (15 cm) on right lateral	Unknown
July 23	--	S	M?	Massive open wound on back ^a	Adult male (P)
July 23	--	J	M	Cookiecutter shark, <i>Isistius brasiliensis</i> , bite on ventral	Shark (K)
July 29	--	A	F	Dorsal wounds ^a	Adult male (P)
July 29	--	A	M?	Laceration on left "hip" ^a	Shark (P)
1985					
June 21	GAI8	A	F	Dorsal scratches, and old scar reopened	Adult male (P)
June 21	GT24	J	M	Right foreflipper almost severed in half	Shark (P)
June 22	G079	J	F	Large dorsal wound, healing	Adult male (P)
June 23	G106	A	F	Dorsal wound reopened, dorsal scratches	Adult male (P)
June 30	--	S	M	Eyes and right nostril covered by flies laying eggs	Unknown
June 30	G033	J	F	Dorsal punctures; tissue strips and swelling ^a	Adult male (K)
July 1	GT06	J	M	Circular open dorsal wound between shoulders	Cookiecutter shark (K)
July 5	--	A	F?	Small dorsal wound	Adult male (?)
July 5	--	A	?	Right foreflipper wound	Shark (P)
July 9	--	A	F?	Small dorsal wound	Adult male (P)

^aInjury appeared to be serious.



Figure 3.—Photographs of subadult male with tapeworm mass extruding from anus.

A subadult male was seen July 1984 with a large mass of tapeworms extruding from the anus (Fig. 3). This seal was 100% molted and appeared healthy. Tapeworm infestation is not rare, as indicated by a similar observation of a live adult male seal at French Frigate Shoals (footnote 4) and by worms found in digestive tracts during necropsies. Large masses of tapeworms also have been found on beaches associated with monk seal scats, and Dailey et al. (1988) report finding eggs and proglottids in fresh fecal material.

Green Turtles

Seventeen individual turtles were identified by tags in 1984: 10 turtles tagged in previous studies were resighted (Table 5), and 7 turtles were newly tagged (Table 6). Additional tags were put on three of the turtles tagged in previous studies (Table 5).

Thirty individuals were identified in 1985: 11 turtles tagged in previous studies were resighted (Table 5), 6 turtles were newly tagged (Table 6), and 13 turtles were identified solely with paint.

In 1984, 91 pits (dug in nesting attempts) were found. In 1985, 78 pits were found, and copulation was seen in the water throughout the 1-mo research period. The lowest number of pits was found on the east side (Appendix C), and none in sectors 21-23, which has an exposed coral shelf along the shoreline. The majority of the pits were in the vegetation or at the vegetation line. The number of pits reported here should be considered a minimum number because any pit that did not appear fresh, and thus was possibly from the previous year, was not counted.

Evidence of hatching, deaths, and recent injuries was not seen. An adult male turtle was seen with a tumor at the base of the right foreflipper.

Materials Collected

From seals of known size or sex or both, 14 scats and 4 spews were collected and processed in 1984, and 9 scats and 5 spews in 1985. A total of 51 lines and 20 nets or nets with line – all capable of entangling seals and turtles – accumulated on land from August 1983 to July 1984. A total of 58 lines and 26 nets or nets with line accumulated from August 1984 to July 1985. Analysis of these samples is ongoing and will be reported elsewhere.

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Table 5.—Green turtle tag recoveries at Lisianski Island in 1984 and 1985. Parentheses indicate that an additional tag was applied at the time of resighting (sizes: A = adult, J = juvenile, and I = immature; sex: M = male, F = female, and ? = uncertain).

Tag No.		Date	Sector	Size	Sex	Carapace measurement (cm)			
						Straight		Curved	
Left	Right					Length	Width	Length	Width
1984									
2956		8/3	05	I	?	61.8	--	--	--
(8564)	(8563)								
2960		7/22	25	A	F	--	--	--	--
3554		7/12	27	A	F	--	--	--	--
5947	5830	7/31	26	I	?	50.9	--	--	--
(8560)									
	5835	7/6	04	I	M	--	--	--	--
6325	5854	7/8	25	I	?	--	--	--	--
(8557)	6483	7/12	20	I	?	49.6	--	--	--
	6757	7/12	26	I	?	77.9	--	--	--
6762		7/22	30	A	F?	--	--	--	--
6781		7/28	27	A	M	--	--	--	--
1985									
(8656)	5848	6/24	04	A	M	--	--	--	--
6324	?854	6/26	26	I	?	61.2	51.1	--	--
6317	6316	6/27	04	I	?	51.5	42.0	--	--
6762		6/28	29	A	?	--	--	--	--
(8660)	-- ^a	6/30	41	A	F	--	--	--	--
6279	6280	7/3	43	J	?	46.2	36.6	48.0	40.5
(8667)	5828	7/7	27	J	?	52.1 ^b	39.05	54.0	46.5
6767		7/14	05	I	?	--	--	--	--
5936		7/15	33	A	F	--	--	--	--
2961	-- ^a	7/16	27	A	F	--	--	--	--
6782		7/19	20	I	?	--	--	--	--

^aTag present but unable to read number.

^bMeasurement to the notch; all other lengths presented here are to the tip.

Table 6.—Green turtles newly tagged on Lisianski Island in 1984 and 1985 (size: A = adult, I = immature; sex: F = female, M = male, and ? = uncertain).

Tag No.		Date	Sector	Size	Sex	Carapace measurement (cm)			
Left	Right					Straight		Curved	
						Length	Width	Length	Width
1984									
8551	8552	7/8	32	A	F	--	--	--	--
8555	8554	7/8	49	A	F	91.6	--	--	--
	8556	7/10	26	A	M	82.0	--	--	--
8559	8558	7/26	02	I	?	46.0	--	--	--
8562	8561	8/1	43	I	?	55.3	--	--	--
8566	8565	8/3	26	I	?	67.9	--	--	--
8568	8567	8/4	16	I	?	44.0	--	--	--
1985									
8663 ^a		7/2	01	A	M	81.0 ^b	--	--	--
8654	8653	6/24	17	A	F	94.0	70.5	--	--
	8655								
8659		6/30	09	A	F	--	--	--	--
	8661	7/2	13	A	M	--	--	--	--
8665	8666	7/7	27	I	?	54.4	43.9	57.0	51.0
	8668	7/7	27	A	M	--	--	--	--

^aTag No. 8651 was added on 23 June 1985 but was subsequently lost. A replacement tag, No. 8663, was added on 2 July.

^bThis length was taken with a flexible tape and is, therefore, approximate.

LITERATURE CITED

- Alcorn, D. J.
1984. The Hawaiian monk seal on Laysan Island: 1982. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-42, 37 p.
- Dailey, M. D., R. V. Santangelo, and W. G. Gilmartin.
1988. A coprological survey of helminth parasites of the Hawaiian monk seal from the Northwestern Hawaiian Islands. *Mar. Mammal Sci.* 4:125-131.
- DeLong, R. L., G. L. Kooyman, W. G. Gilmartin, and T. R. Loughlin.
1984. Hawaiian monk seal diving behavior. *Acta Zool. Fenn.* 172:129-131.
- Gilmartin, W. G., R. J. Morrow, and A. M. Houtman.
1986. Hawaiian monk seal observations and captive maintenance project at Kure Atoll, 1981. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-59, 9 p.
- Johanos, T. C., and S. L. Austin.
1988. Hawaiian monk seal population structure, reproduction, and survival on Laysan Island, 1985. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-118, 38 p.
- Johanos, T. C., and J. R. Henderson.
1986. Hawaiian monk seal reproduction and injuries on Lisianski Island, 1982. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-64, 7 p.
- Johanos, T. C., and A. K. H. Kam.
1986. The Hawaiian monk seal on Lisianski Island: 1983. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-58, 37 p.
- Johanos, T. C., A. K. H. Kam, and R. Forsyth.
1987. The Hawaiian monk seal on Laysan Island: 1984. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-70, 38 p.
- Kam, A. K. H.
1986. The green turtle, *Chelonia mydas*, at Laysan Island, Lisianski Island, and Pearl and Hermes Reef, summer 1982. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-65, 49 p.
- Stone, H. S.
1984. Hawaiian monk seal population research, Lisianski Island, 1982. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-47, 33 p.

APPENDIXES

Appendix A. — Itineraries for the 1984 and 1985 Lisianski Island field camps.

Date	Event
1984	
18 June	D. Alcorn departs Honolulu aboard the NOAA ship <i>Townsend Cromwell</i> .
1 July	<i>Townsend Cromwell</i> arrives at Laysan Island with supplies, embarks R. Forsyth, and departs for Lisianski Island.
2 July	<i>Townsend Cromwell</i> arrives at Lisianski Island. Crew and scientific staff help establish field camp and depart same date, leaving a two-person field camp consisting of Alcorn and Forsyth.
3 July	Lisianski Island research starts.
11 July	Fishing vessel <i>Feresa</i> arrives at Lisianski Island and disembarks a four-person research team (R. Saito, State of Hawaii, Department of Land and Natural Resources, and M. Naughton, S. Fefer, and D. Hu, U.S. Fish and Wildlife Service (USFWS) to conduct bird transects.
14 July	<i>Feresa</i> departs with the USFWS team. The two-person National Marine Fisheries Service (NMFS) camp remains.
15 July	State of Hawaii boat <i>Kila</i> arrives and departs.
21 July	<i>Feresa</i> stops with supplies and departs.
5 Aug.	Lisianski Island research stops, and camp is disbanded.
6 Aug.	<i>Townsend Cromwell</i> arrives at Lisianski Island, picks up NMFS personnel, and departs for Honolulu.
13 Aug.	Alcorn and Forsyth arrive in Honolulu.
1985	
12 June	Alcorn and Westlake depart Honolulu aboard the <i>Townsend Cromwell</i> .
17 June	<i>Townsend Cromwell</i> arrives at Lisianski Island, field camp is established, and <i>Townsend Cromwell</i> departs. Alcorn and Westlake remain on Lisianski Island.
18 June	Formal research commences.
20 July	Research activities cease at approximately 0300. Camp is disbanded, and the <i>Townsend Cromwell</i> arrives to pick up Alcorn and Westlake and departs for Honolulu (via Laysan Island and French Frigate Shoals).
25 July	Alcorn and Westlake arrive in Honolulu aboard the <i>Townsend Cromwell</i> .

Appendix B.—Seal census counts for Lisianski Island, 1984 and 1985 (M = male, F = female, ? = unknown).

Date	Nonpups									Pups						Totals		
	Adult			Subadult			Juvenile			Weaned			Nursing			Nonpup	Pup	Combined
	M	F	?	M	F	?	M	F	?	M	F	?	M	F	?			
1984																		
7/5	25	9	6	8	7	3	8	10	1	3	1	2	0	0	1	77	7	84
7/7	16	9	5	6	4	3	4	5	3	5	2	0	0	1	0	55	8	63
7/9	20	9	0	4	6	2	4	7	8	3	2	2	0	0	0	60	7	67
7/11	21	12	6	7	3	6	5	4	5	5	3	1	0	1	0	69	10	79
7/13	22	6	8	6	6	7	8	6	6	1	2	1	0	0	0	75	4	79
7/15	25	14	7	8	2	4	6	4	1	4	1	1	0	0	0	71	6	77
7/17	30	12	1	7	5	5	3	7	5	5	4	0	0	0	0	75	9	84
7/19	17	10	5	3	3	6	8	4	2	5	5	0	0	0	0	63	10	73
7/21	22	6	5	8	4	6	4	6	1	4	2	0	0	0	0	62	6	68
7/23	12	5	17	3	1	8	2	2	7	1	3	0	0	0	0	57	4	61
7/25	14	2	17	6	3	5	3	1	6	3	2	0	0	0	0	57	5	62
7/27	22	7	13	7	2	6	6	5	5	4	3	0	0	0	0	73	7	80
7/29	30	2	14	7	3	3	7	2	2	4	1	1	0	0	0	70	6	76
7/31	30	9	12	10	5	6	4	5	1	6	2	0	0	0	0	82	8	90
8/2	31	3	9	6	2	7	3	7	3	5	4	0	0	0	0	71	9	80
8/4	26	6	15	3	1	8	6	5	3	6	4	0	0	0	0	73	10	83
1985																		
6/19	10	8	23	7	5	10	2	1	4	0	1	3	0	0	2	70	6	76
6/21	16	12	16	9	8	8	6	4	3	1	1	3	1	1	2	82	9	91
6/23	15	16	16	11	7	7	5	7	3	1	2	3	1	1	3	87	11	98
6/25	21	11	13	9	10	5	6	0	2	1	4	1	1	1	3	77	11	88
6/27	22	16	12	6	5	15	4	5	0	4	2	0	0	1	1	85	8	93
6/29	19	11	17	10	6	13	6	5	2	5	3	0	0	2	1	89	11	100
7/1	20	12	13	15	11	6	7	3	1	5	4	1	0	2	1	88	13	101
7/3	26	15	16	11	8	8	3	7	1	4	3	1	0	2	0	95	10	105
7/5	21	9	15	9	8	7	3	2	1	5	7	0	0	0	1	75	13	88
7/7	23	13	10	17	7	5	6	0	0	4	3	2	0	1	0	81	10	91
7/9	21	12	10	9	8	7	7	5	0	3	5	0	0	1	1	79	10	89
7/11	23	13	9	16	8	7	7	2	2	3	5	0	1	1	0	85	10	95
7/13	21	7	11	5	8	4	8	6	1	4	6	0	1	1	0	71	12	83
7/15	20	6	13	10	5	5	3	2	1	2	3	1	0	0	1	65	7	72
7/17	17	8	6	10	7	8	1	1	0	2	3	0	1	0	0	58	6	64

Appendix C. – Location of green turtle pits, Lisianski Island, 1984 and 1985.

Sector No.	Date dug	No. of pits	Beach position ^a	Distance to water (m) ^b
1984				
1	<2 July	3	3	4.5
1	<2 July	1	3	6.0
1	<2 July	1	3	15.2
2	<2 July	1	2	3.6
3	<2 July	1	2	4.5
3	<2 July	4	2	3.5
3	<2 July	2	2	3.5
4	<2 July	2	3	7.5
4	<2 July	5	3	10.5
5	<2 July	1	3	13.5
8	<2 July	2	3	27.5
9	<2 July	6	3	7.5
11	<2 July	1	3	12.0
14	<2 July	1	3	7.5
15	<2 July	2	3	9.0
16	<2 July	3	3	15.0
16	<2 July	4	3	7.5
17	<2 July	3	3	10.5
27	<2 July	2	3	9.0
29	<2 July	1	2	33.5
30	14 July	2	3	152.0
31	<2 July	2	2	10.5
31	31 July	1	2	4.5
32	8 July	6	2	3.5 ^c
33	7 July	3	2	4.5
36	21 July	1	2	17.0
38	<2 July	2	3	18.0
38	<2 July	2	3	20.0
41/42	<2 July	1	3	10.5
43	<2 July	2	3	12.0
44	<2 July	1	3	12.0
44	<2 July	1	3	12.0
44	<2 July	1	3	12.0
45	<2 July	6	3	9.0
45	<2 July	1	3	12.0
45	<2 July	1	2	4.5
46	<2 July	1	3	13.5
46	<2 July	4	3	9.0
46	<2 July	1	3	9.0
47	<2 July	1	3	10.5
48	<2 July	1	3	9.0
48	<2 July	2	3	7.5
48/49	<2 July	1	2	7.5
49	<7 July	1	3	24.5

Appendix C. – Continued.

Sector No.	Date dug	No. of pits	Beach position ^a	Distance to water (m) ^b
1985				
2	< 17 June	2	2	7.5
3	< 17 June	1	3	7.5
3	< 6 July	1	3	9.0
4	< 17 June	3	3	10.5
4	< 17 June	2	2,3	7.5
4	< 17 June	4	3	10.6
4	10 July	1	3	7.5
8	< 17 June	2	3	15.0
8	< 17 June	6	3	17.0
8	15 July	1	3	10.5
9	2 July	3	3	12.0
9	2 July	6	3	15.0
9	2 July	4	3	15.0
9	< 17 June	2	3	13.5
10	30 June	3	3	18.0
12	< 17 June	2	3	9.0
15	< 17 June	1	3	10.5
15	< 17 June	1	3	12.0
16	24 June	1	3	7.5
16	17 July	2	3	6.5
16	< 17 June	1	3	17.0
16	< 17 June	2	3	7.5
16	< 17 June	1	3	12.0
18	< 17 June	2	3	9.0
20	< 17 June	1	3	7.5
20	15 July	1	3	7.5
20	< 17 June	1	3	10.5
24	< 17 June	1	3	7.5
26	< 17 June	2	3	18.0
27	< 17 June	1	3	7.5
37	16 July	3	3	30.5
37	1 July	2	3	22.0
41	15 July	1	3	18.0
42	< 17 June	1	3	13.5
45	< 17 June	1	2	3.5
46	24 June	4	3	6.0
46	10 July	3	3	6.0
47	< 17 June	2	3	7.5
49	23 June	2	3	10.5
49	22 June	1	3	9.0

^a1 = edge of water (wet sand); 2 = midbeach (dry sand); and 3 = vegetation zone.

^bDistance is given for pit nearest the water. Rounded to nearest 0.5 m.

^cThe six pits ranged from 3.5 to 30.5 m inland.

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