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THE GREEN TURTLE, *Chelonia mydas*, AT LAYSAN ISLAND, LISIANSKI ISLAND, AND PEARL AND HERMES REEF, SUMMER 1982

Alan K. H. Kam

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Region

NOAA Technical Memorandum NMFS

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CONTENTS

Page

Introduction 1
Materials and methods 2
Results and discussion 8
Laysan Island 8
Tagging effort 8
Nesting activity 8
Census of basking and swimming turtles 14
Pearl and Hermes Reef 23
Tagging effort 23
Nesting activity 23
Census of basking and swimming turtles 28
Lisianski Island 32
Tagging effort 32
Nesting activity 32
Census of basking and swimming turtles 32
Emergent hatchling success rate 46
Acknowledgments 49
Literature cited 49

LIST OF TABLES

Page

1. Carapace length and width of adult female green turtles at Laysan Island, 1982 9
2. Carapace length and width of adult male green turtles at Laysan Island, 1982 10
3. Measurements from immature green turtles on Laysan Island, 1982 11
4. Tag recoveries of green turtles made on Laysan Island, 1982 12
5. Numbers of green turtles basking and swimming at Laysan Island 1982 16
6. Numbers of green turtles basking and swimming at Laysan Island, 1982 17
7. Numbers of green turtles basking and swimming at Laysan island, 1982 18
8. Numbers of green turtles basking and swimming at Laysan Island, 1982 20
9. Tag recoveries of green turtles at Pearl and Hermes Reef, 1982 24
10. Adult female green turtles tagged at Pearl and Hermes Reef, 1982 25
11. Adult male green turtles tagged at Pearl and Hermes Reef, 1982 26
12. Juvenile and subadult green turtles tagged at Pearl and Hermes Reef, 1982 27
13. Numbers of green turtles basking and swimming at Southeast and North Islands, Pearl and Hermes Reef, 1982 31
14. Adult female green turtles tagged at Lisianski Island, 1982 33
15. Adult male green turtles tagged at Lisianski Island, 1982 34
16. Immature green turtles tagged at Lisianski Island, 1982 35
17. Tag recoveries of green turtles at Lisianski Island, 1982 38
18. Numbers of green turtles basking and swimming at Lisianski, Island, 1982 41
19. Numbers of green turtles basking and swimming at Lisianski Island, 1982 43
20. Numbers of green turtles basking and swimming at Lisianski Island, 1982 45
21. Results of six egg clutches excavated and examined at Lisianski Island following emergence of hatchlings 46

LIST OF FIGURES

Page

1. Hawaiian Archipelago, North Pacific Ocean 2
2. Laysan Island, Northwestern Hawaiian Islands 3
3. Pearl and Hermes Reef, Northwestern Hawaiian Islands 4
4. Lisianski Island, Northwestern Hawaiian Islands 6
5. Locations of 12 nest sites recorded on Laysan Island, June 1982 13
6. Sector map of Laysan Island, 1982 15
7. Average weekly count of green turtles swimming and basking during the day on Laysan Island, 15 March to 30 June 1982 22
8. Locations of nine excavations (●) on the western coast of Southeast Island, Pearl and Hermes Reef, 2-6 July 1982 29
9. Locations of 13 excavations (●) on the northern coast of North Island, Pearl and Hermes Reef, 2-6 July 1982 30
10. Location and dates of 23 excavations on Lisianski Island, May-August 1982 40
11. Sector map of Lisianski Island, 1982 47
12. Average weekly number of green turtles observed basking on Lisianski Island, 8 July-13 September 1982 48

ABSTRACT

During the spring and summer of 1982, green turtle populations were studied at three sites in the Northwestern Hawaiian Islands: Laysan Island, Pearl and Hermes Reef, and Lisianski Island. A total of 149 individuals (54 adult females, 26 adult males, and 69 immature animals) were identified with metal tags. Of these, 108 turtles were newly tagged, and 41 turtles were seen with tags from previous studies.

On Laysan Island between 16 March and 30 June, 30 turtles were identified. Of six animals resighted from previous years, two were remigrations in that they first appeared at Laysan, nested at French Frigate Shoals (FFS), and reappeared back on Laysan. A total of 45 excavated pits were discovered and marked. Two animals were monitored during nest excavation and egg deposition. Census counts during the day and at night indicated low numbers of basking animals.

On Pearl and Hermes Reef between 2 and 6 July, 27 turtles were individually identified; census counts indicate at least 35 were present. Eleven turtles were recorded as tag recoveries with one adult female previously observed nesting at FFS, appearing at Pearl and Hermes Reef, a minimum distance of 560 nmi. A total of 22 pits were found on Southeast Island and North Island. No turtles were found nesting during night surveys. Highest counts of basking turtles at both Southeast Island and North Island were made at night.

On Lisianski Island between 17 March and 13 September, 92 turtles were identified. Twenty-four animals were recorded from previous years; five of these reflect long-distance migrations. Nesting began on 28 May and the last nest was completed on 14 August. A total of 47 pits were found on the island. Only six egg clutches were found and 72% of the hatchlings had apparently emerged to the surface. The greatest incidence of basking behavior occurred at night.

INTRODUCTION

The green turtle, Chelonia mydas, can be found throughout the 2,450 km Hawaiian Archipelago (Fig. 1). At the southern end are the eight main islands (Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau) whose nearshore waters host assemblages of feeding turtles. To the northwest are smaller islands and atolls which constitute the Northwestern Hawaiian Islands (NWHI). On these shores and shallow water reefs, green turtles can be observed feeding and basking. Hawaiian green turtles regularly exhibit basking or resting behavior on land in the NWHI, as a means of conserving energy and probably as a strategy to avoid shark predation (Whittow and Balazs 1982). Almost all of the green turtles nesting in the archipelago occur in the NWHI.

As part of the 1982 National Marine Fisheries Service (NMFS), Marine Mammals and Endangered Species Investigation studies, field camps were established on Laysan Island (15 March-30 June 1982), Pearl and Hermes Reef (2-6 July 1982), and Lisianski Island (17 March-13 September 1982). Research activities centered on the Hawaiian monk seal, Monachus schauinslandi, an endangered marine mammal, and the green turtle, a threatened species. This report will present turtle information gathered at the three study sites.

Laysan Island is a coral island approximately 2.3 km long and 1.4 km wide with a central shallow lagoon (Fig. 2). It is 815 nmi northwest of Honolulu, and its closest neighbor is Lisianski Island, located 110 nmi to the east.[1] A well-vegetated zone lies behind the sandy beaches and during the wetter season crowds the lagoon shoreline. The western and northwestern sides of the island exhibit an extensive fringing reef and a boat channel entering the northwest cove area providing access to the island. The eastern and northeastern sides of this land are exposed to the predominantly northeast trade winds. A line of sand dunes ring the northeastern part of the island. To the east and southeast, a shallow shelf extends over 60 m from the sandy beach to the reef drop-off. Another unique geologic feature is a 2-m high upraised limestone ledge bordering the ocean on the southwest. Climatology and vegetation is described in Ely and Clapp (1973).

Pearl and Hermes Reef is a coral atoll open at the southwest corner (Fig. 3). The reef system is approximately 31 km long and 18 km wide at its broadest point (Amerson et al. 1974). It lies approximately 1,050 nmi northwest of Honolulu, and its closest neighbor is Midway, 95 nmi to the northwest. Four islands within the atoll have established vegetation, (North, Southeast, Grass, and Seal/Kittery) while the three others (Sand, Bird, and Little North) are shifting sandbars created by currents and wave action.

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[1]Distances between islands provided by the U.S. Coast Guard, Aids to Navigation Office, 300 Ala Moana Boulevard, Honolulu, HI 96850, April 1985.

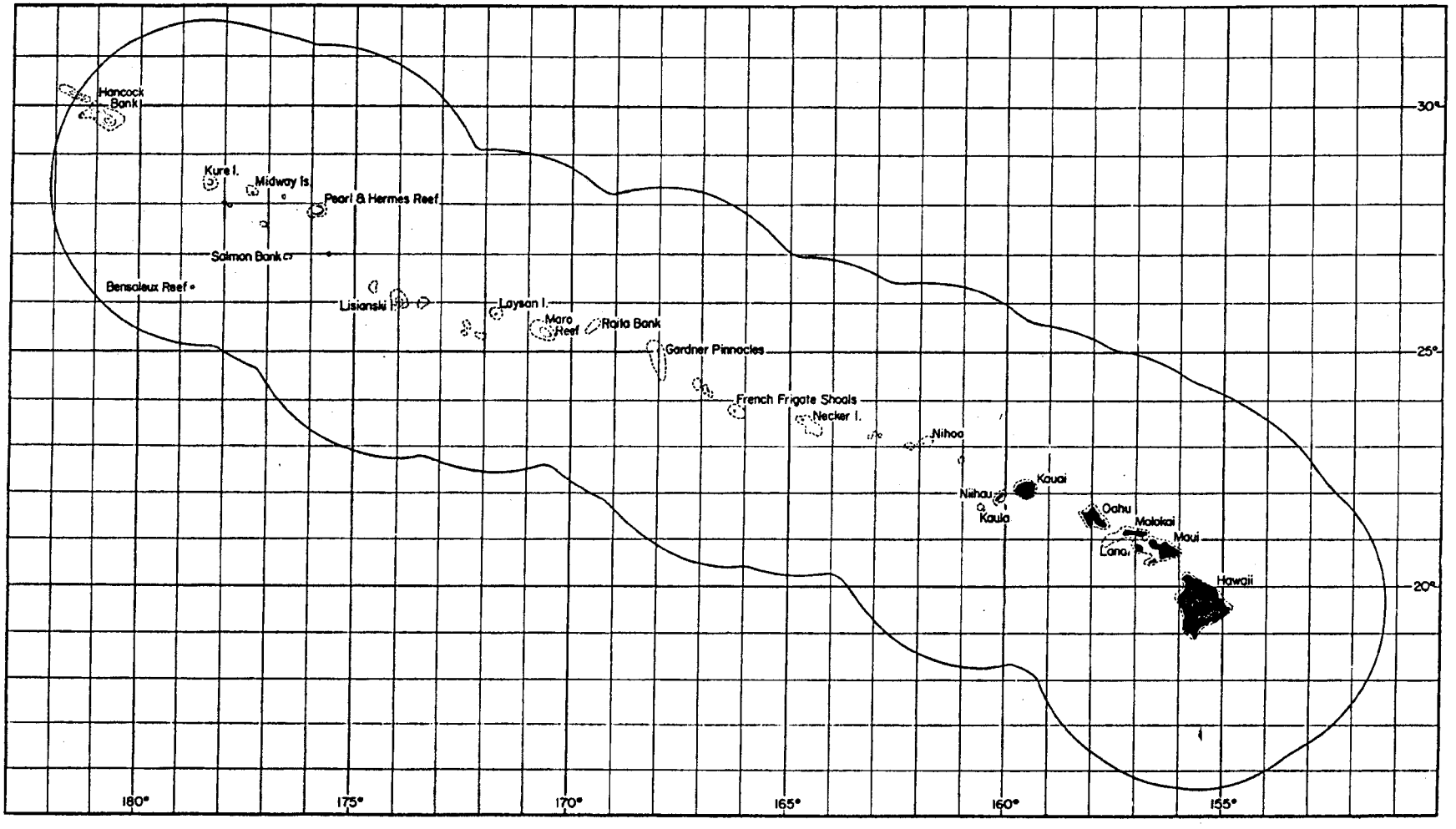

Figure 1.--Hawaiian Archipelago, North Pacific Ocean.

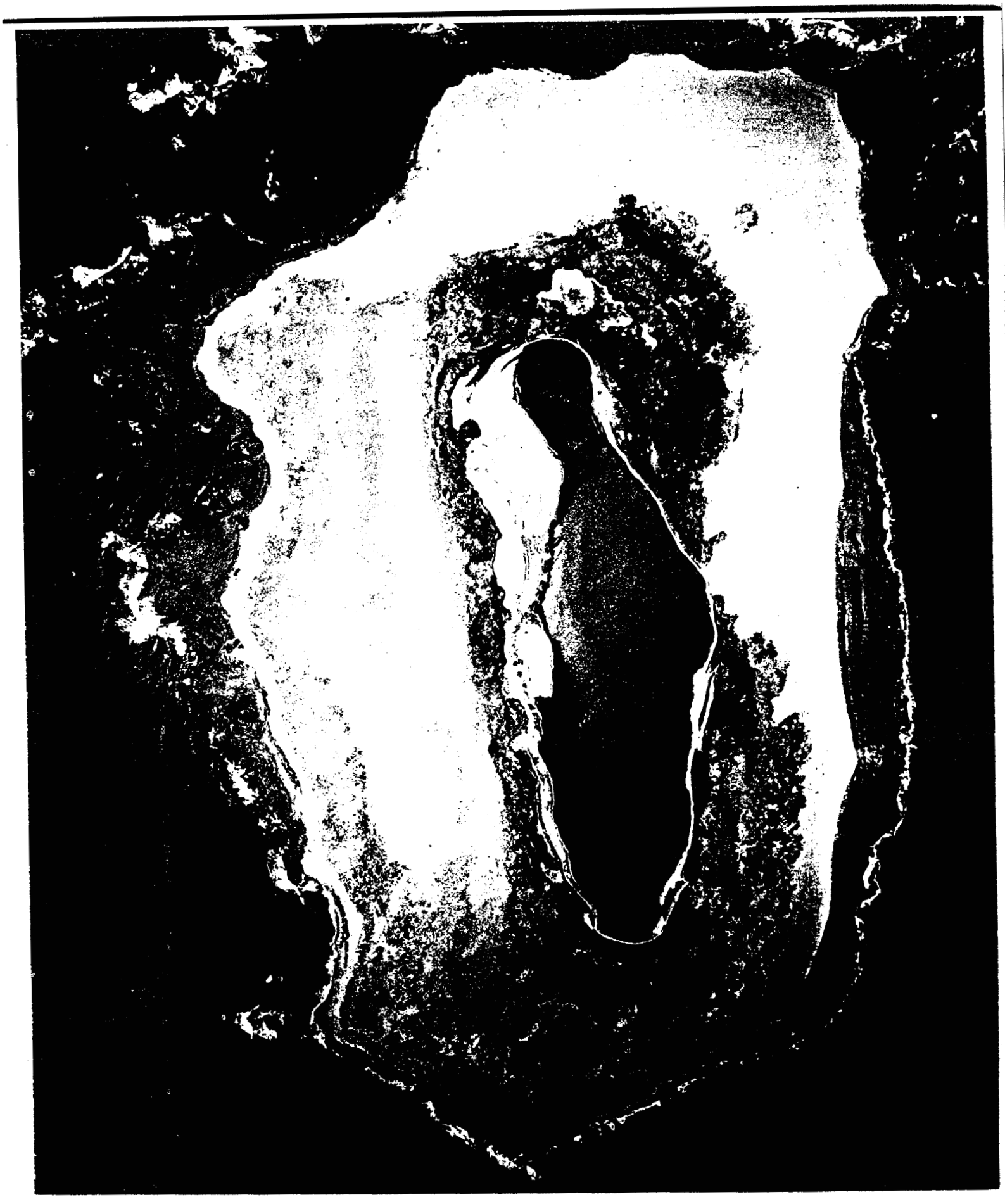

Figure 2.--Laysan Island, Northwestern Hawaiian Islands (U.S. Fish and Widlife Service aerial photo, 1981).

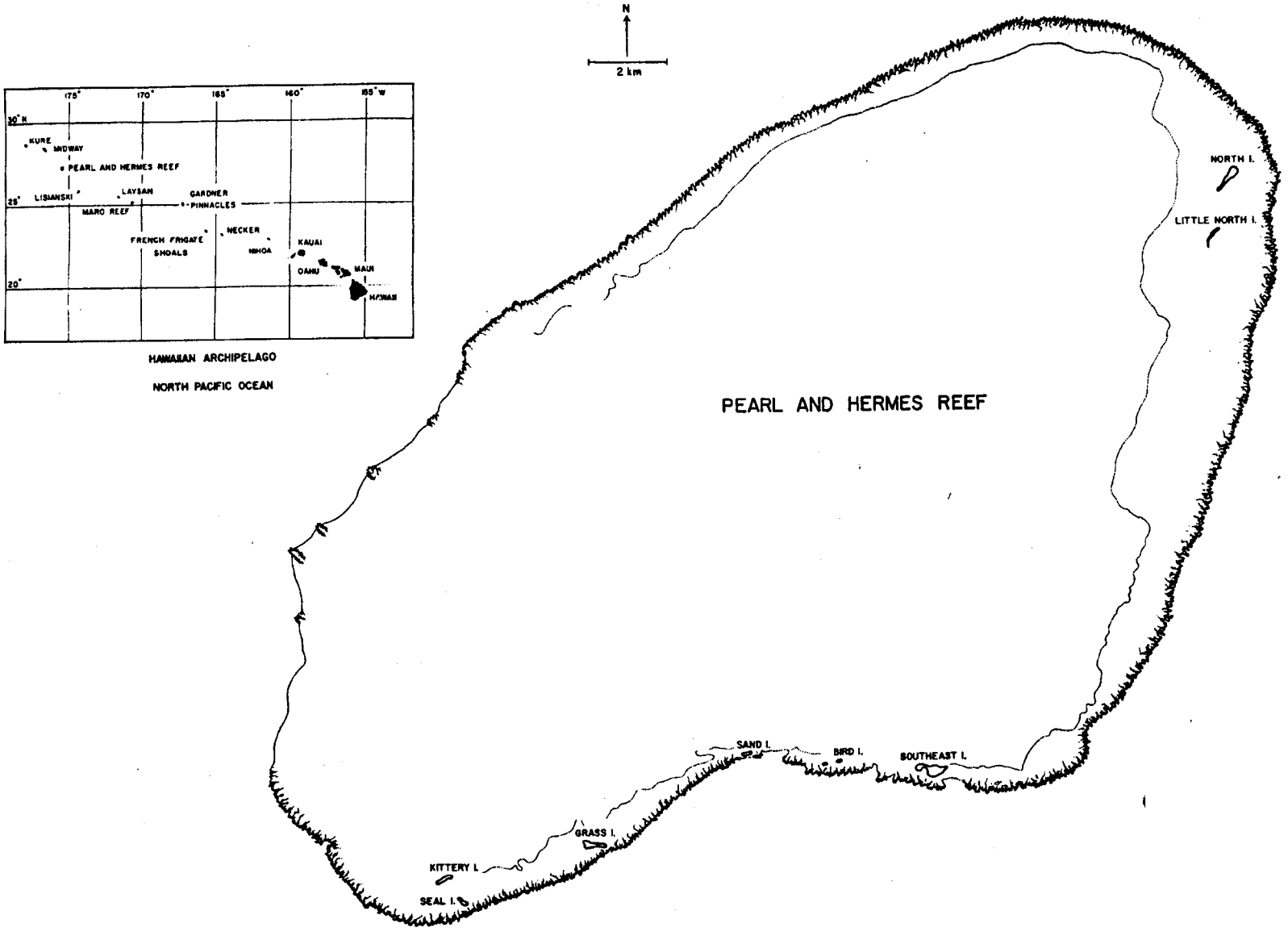

Figure 3.--Pearl and Hermes Reef, Northwestern Hawaiian Islands.

The two major islands where green turtles bask at Pearl and Hermes Reef are North Island and Southeast Island. North Island is located at the northeastern corner of the atoll and is 16 km from Southeast Island. It is teardrop-shaped with the greater bulk of the island oriented toward the north. The island is low with a steep, narrow beach on its north and eastern sides. Southeast Island lies on the southeast portion of the lagoon and the body of the island is oriented east to west. It is cut by a shallow tidal lagoon whose borders are surrounded by a rugged coralline rock platform.

Lisianski Island is a low, sandy island approximately 925 nmi northwest of Honolulu. Its neighbor, 110 nmi to the southeast, is Laysan Island, and 125 nmi to the northwest is Pearl and Hermes Reef. It resembles Laysan Island but has only a central depression instead of a lagoon. Lisianski Island (Fig. 4) is located within an extensive shallow bank, Neva Shoal, which makes access to the island difficult. A boat passage on the western side circumvents the shallow reef system. The field camp was located on the western coast at this passage. Most of the island's coastline is composed of a fine coral sand, although a section along the eastern side is a limestone rock plate. The interior vegetation is primarily bunchgrass, *Eragrostis varibilis*, while the dominant coastal plant is puncture vine, *Tribulus cistoides*.

MATERIALS AND METHODS

Once the base camp was established at all three study sites, identification of basking beaches and feeding aggregations began. Polarized glasses that cut surface glare and binoculars were used to examine all nearshore waterways. Each day the shoreline was inspected at vantage points along the beach slope, turtle sightings were recorded, and behavioral activities were noted.

Census counts were compiled for animals observed swimming (including actively feeding) or basking. At first, surveys were conducted only during the day (0600-1800), but in May as the breeding season approached, night surveys (1801-0559) were initiated. Research conducted by Balazs (1980) indicates the nesting season at French Frigate Shoals (FFS) extends from the middle of May to early August, and this provided direction concentrating more field effort during the night to look for nesting turtles.

Animals were entered into four age-class categories: a) juveniles (posthatching to 65 cm), b) subadults (65-81 cm), c) adult males (>77 cm), and d) adult females (>81 cm). Only in the adult category could the sexes be distinguished. Male turtles have a long prehensile tail (35-45 cm) and a carapace with a minimum straight length of 77 cm. Female turtles have shorter tails (20-25 cm long) and mature at a slightly greater carapace length (Balazs 1980). It was difficult to determine sex when water obscured the animal's tail.

Two procedures were employed for different age-class animals. The first involved approaching immature and large adult basking turtles from the rear. Their front flippers were inspected for tags and the numbers noted

Figure 4.--Lisianski Island, Northwestern Hawaiian Islands (U.S. Fish and Wildlife Service aerial photo 1981).

for future reference. Any gross abnormalities were recorded along with peculiar color patterns from scales or carapace scutes. Straight carapace length and width were measured using aluminum calipers. Curved length and width measurements were obtained using a flexible tape measure. If the turtle had no tags, a metal tag was placed along the trailing edge of the front flipper.

The second procedure involved the capture and handling of juvenile-size turtles. Complete body measurements were taken on juvenile turtles for future growth comparisons. The first measurement obtained was the straight length of the plastron or belly plate (from the intergular scute to the anal scute). Head width was measured between the widest two points of the temporal region of the skull. The length of the tail was measured from the posterior margin of the plastron to the tip of the tail. By turning the turtle over so that it rested on its plastron, carapace measurements could be obtained. Straight carapace length measurements were taken along the midline from the precentral scute (behind the head) to the postcentral scutes (at the tail). Straight carapace width was measured across the carapace at the sixth marginal. Using a tape measure, curved length and width were also obtained.

After the measurements were recorded, notes were taken describing the carapace, i.e., presence of pink coralline alga, scum or seaweed growth, missing scutes, wounds, and color patterns. Scrapings of the red alga, Polysiphonia sp., growing epiphitically on the skin and plastron were taken and saved along with the skin barnacle, Platylepas sp. In some instances, by placing the rolled tape measure at the junction of the upper and lower jaw, the mouth could be examined for food particles.

Turtles were tagged with size 681 Inconel[2] 625 alloy tags to identify individual animals. Special pliers were used to attach one to three tags to the front flippers either proximal to the body (in the flap of soft skin where the front flipper joins the body) or more distally along the trailing edge (Balazs 1982). Placement of tags along the trailing edge permitted faster and easier recognition of tag numbers, minimizing human disturbance.

A temporary identification practice used in conjunction with the numbered metal tag was the application of letters and numbers with aerosol spray paint (DuPont Lucite) on the carapace of basking turtles. Painting with various colors (pastels, darker shades, and white) provided visual recognition of tagged animals at a distance. Reapplication of paint was necessary because the symbols wore off in 3 to 15 days, but this method was effective in preventing unnecessary recapture of previously identified animals.

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

Algal collections were made where turtles were observed feeding above shallow reef flats and beside coral heads to identify food resources. In addition, several juvenile turtles were captured while they fed, and the algae they had in their mouths documented benthic foraging areas. On Lisianski Island, because of the higher incidence of juvenile turtles, a large scoop net was employed to capture the animals. Turtles were approached while they fed or rested in shallow waters and a net was dropped over them. Another method involved catching the turtle by hand as it swam along the shore.

At all of the islands, each new excavation pit made by an adult female turtle attempting to nest was recorded and marked for easy reference so they would not be recounted. When egg deposition was observed for a turtle during night surveys, the nest pit was monitored during its incubation period. Following the hatching of a nest pit, the pit was dug up to examine hatchling success rate and to bring any late hatchlings to the surface.

RESULTS AND DISCUSSION

Laysan Island

Tagging Effort

From 16 March to 30 June 1982, 30 green turtles were identified on Laysan Island--24 animals were tagged during the present study while 6 were tag resightings. Of these 30 turtles, 13 were adult females (43%), 7 were adult males (23%), and 10 (33%) were either juveniles or subadults (see Tables 1-3). Tag recoveries were animals previously tagged by the U.S. Fish and Wildlife Service and the Hawaii Institute of Marine Biology, University of Hawaii.

Information regarding the six tag resightings is presented in Table 4. Of these, four female turtles, No. 3580, 5096, 5363, and 986 are tag recoveries that document movement from breeding grounds to foraging areas. In two instances, a minimum one-way distance of 325 nmi was traversed from FFS to Laysan Island. Two turtle resightings (No. 3580 and 986) are remigrations in that they were first seen at Laysan, later were observed at FFS, and then in 1982 reappeared on Laysan (Balazs 1983). There were no indications through these tag recovery data that turtles from other island populations, aside from FFS, utilize the beaches or nearshore waters of Laysan Island for basking and feeding.

Nesting Activity

The first turtle nesting excavation occurred on 25 May, and the last nesting observation was made on the morning of 30 June, before the field camp was transferred to Lisianski Island. A total of 12 nest excavations were documented, composing 45 individual pits (Fig. 5).

Two turtles were monitored for their entire time on land during nesting and actual egg deposition. The number of eggs deposited were 97 (No. 5908) and 116 (No. 5925). Of interest is that turtle No. 5908, after crossing the

Table 1.--Carapace length and width of adult female green turtles at Laysan Island, 1982.

Date 1982	Tag No.				Measurements (cm)			
					Straight		Curved	
					Length	Width	Length	Width
19 Mar.	5894				86.3	--	--	--
20 Mar.	3580				91.4	73.9	98.9	92.4
21 Mar.	5888	5889			92.4	72.9	--	--
3 Apr.	[1]5096				89.0	--	--	--
7 Apr.	5899				84.5	--	88.9	--
8 Apr.	5900	5917	5918		95.0	--	102.0	--
29 Apr.	5904				82.8	--	89.4	--
30 Apr.	5906				94.3	--	--	--
6 May	5908	5920	5921		92.0	72.5	99.0	91.5
7 May	5909	5924			90.0	--	95.0	--
18 May	[1]5363	5913			92.1	71.8	99.5	91.5
18 June	5922	5925	5926	5927	91.6	72.3	98.0	95.2
22 Apr.	986	1152			--	--	--	--

Straight length
N = 13
Range = 84.5-95.0
Mean = 90.1
SD = 3.8

Straight width
N = 5
Range = 71.8-73.9
Mean = 72.7
SD = 0.8

[1]Tag recovery.

Table 2.--Carapace length and width of adult male green turtles at Laysan Island, 1982.

		Measurements (cm)			
		Straight		Curved	
1982	Tag No.	Length	Width	Length	Width
17 Mar.	5878 5882 5883	89.1	69.3	--	--
26 Mar.	5905	90.8	--	96.8	--
27 Mar.	5893 5923	86.2	--	--	--
28 Mar.	5916 5919	84.2	--	--	--
14 Apr.	5907	84.3	--	94.5	--
10 May	5910	83.0	--	86.0	--
29 May	5914 5915	89.0	69.8	--	--

Straight length
N = 7
Range = 83.0-90.8
Mean = 86.7
SD = 3.0

Table 3.--Measurements from immature green turtles on Laysan Island, 1982.

			Measurements (cm)						
			Straight		Curved				
1982	Tag No.		Length	Width	Length	Width	Plastron length	Head width	Tail length
16 Mar.	5876	5877	44.2	37.3	47.0	42.3	37.5	7.3	5.5
19 Mar.	5880	5881	64.1	51.8	68.2	61.1	51.8	9.5	12.5
21 Mar.	5884	5885	41.5	36.5	44.9	41.9	34.0	6.8	7.5
21 Mar.	5886	5887	61.5	50.0	64.4	52.2	49.0	8.5	14.1
21 Mar.	5890	5891	49.5	38.5	51.7	46.4	38.5	7.2	9.3
28 Mar.	5895	5896	48.2	40.2	51.2	46.8	39.6	7.5	8.0
31 Mar.	5897	5898	50.2	40.2	52.9	49.5	40.4	8.2	11.2
4 Apr.	2633	2634	56.1	45.0	60.8	55.0	45.4	8.8	12.5
8 Apr.	[1]T265	5901	77.3	--	--	--	--	--	--
17 May	5911	5912	67.2	54.3	73.2	70.0	53.5	9.5	17.0

Straight length
N = 10
Range = 41.5-77.3
Mean = 55.7
SD = 11.2

Straight width
N = 9
Range = 36.5-54.3
Mean = 43.8
SD = 6.7

[1]Tag recovery.

Table 4.--Tag recoveries of green turtles made on Laysan Island, 1982 (FFS = French Frigate Shoals).

Date of resighting 1982	Tag No.		Sex	Measurements (cm) Straight Length	Measurements (cm) Straight Width	Site of original tagging and other resightings
20 Mar.	3580		Female	91.4	73.9	Basking on Laysan Is., 1978. Nesting on East Is., FFS, June 1980.
3 Apr.	5096		Female	89.0	--	Nesting on East Is., FFS, June 1981.
4 Apr.	2633	2634	(Juvenile)	56.1	45.0	Basking on Laysan Is., 28 June 1978.
8 Apr.	T265	5901	(Subadult)	77.3	--	Laysan Is., July 1978.
18 May	5363	5913	Female	92.1	71.8	Basking at Whale-Skate, FFS, June 1981.
22 Apr.	986	115	Female	--	--	Laysan Is., September 1966 and observed basking at Whale-Skate, FFS, 21 May 1975 and 30 June 1980.

Figure 5.--Locations of 12 nest sites (●) recorded on Laysan Island, June 1982 (U.S. Fish and Wildlife Service aerial photo, 1981).

sand dune system of northeast Laysan, deposited her eggs in a nest 600 m inland from the water. Balazs (1980) documents the nesting and eventual death of a turtle that became disoriented after traveling 285 m inland to nest on Laysan in 1978. The 800-m wide sand dune system of the northeast coast may present a geographic hazard to nesting turtles searching for the firmer ground in the vegetation zone. Fifteen days later during her second nesting attempt, this animal appeared on the opposite side of Laysan Island. She had traveled a minimum of 2.8 km (along the coast) to find a new nesting area at the extreme southern tip of the island by the shipwreck (in Sector 15, Fig. 6), but no egg deposition was recorded at this time. Because the field camp was moved from Laysan Island on 30 June, no hatching was observed.

Census of Basking and Swimming Turtles

From 16 March to 30 June 1982, daily records were kept on green turtles observed basking and swimming at Laysan Island (see Tables 5-8). The highest counts of basking and swimming turtles were observed during March (range 0-11), and then decreased in April (range 0-9) and May (range 0-7). As the breeding season peaked in June, the lowest numbers were seen (0-3). Data collected on the breeding assemblage at FFS in June (Balazs 1980, 1983) show that adult turtles from islands to the northwest are migrating there to mate and nest at this time. This would account for the lower numbers seen on Laysan Island during June. Figure 7 graphs this gradual decreasing trend for animals seen at Laysan Island.

On Laysan Island all size categories of green turtles were observed basking, but only at specific coral sand beaches. Although sand beaches margin most of the island, areas along the southern and southeastern coast (Sector 9-16) were not used for basking. This can be due to the broad upraised portions of reef of this coast that limit access to the beaches. A 50-m section of beach, composed of coarse coral and shells eroded from the offshore reefs in Sector 2, was used consistently by turtles. It afforded them easy access to a low, sloping beach and deep water 2 m from shore. During days of inclement weather, turtles were seldom found basking. Night surveys were conducted in May and June, and nocturnally basking animals were occasionally encountered (Tables 7 and 8).

Turtles were observed in Sector 17 feeding on algae growing on the submerged wave-eroded limestone 30 m offshore. Up to six juveniles and subadults utilized this feeding area at one time. Algal samples were obtained here.[3] The list follows.

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[3]Algal samples were identified by Dennis J. Russell, Seattle Pacific University, May 1983.

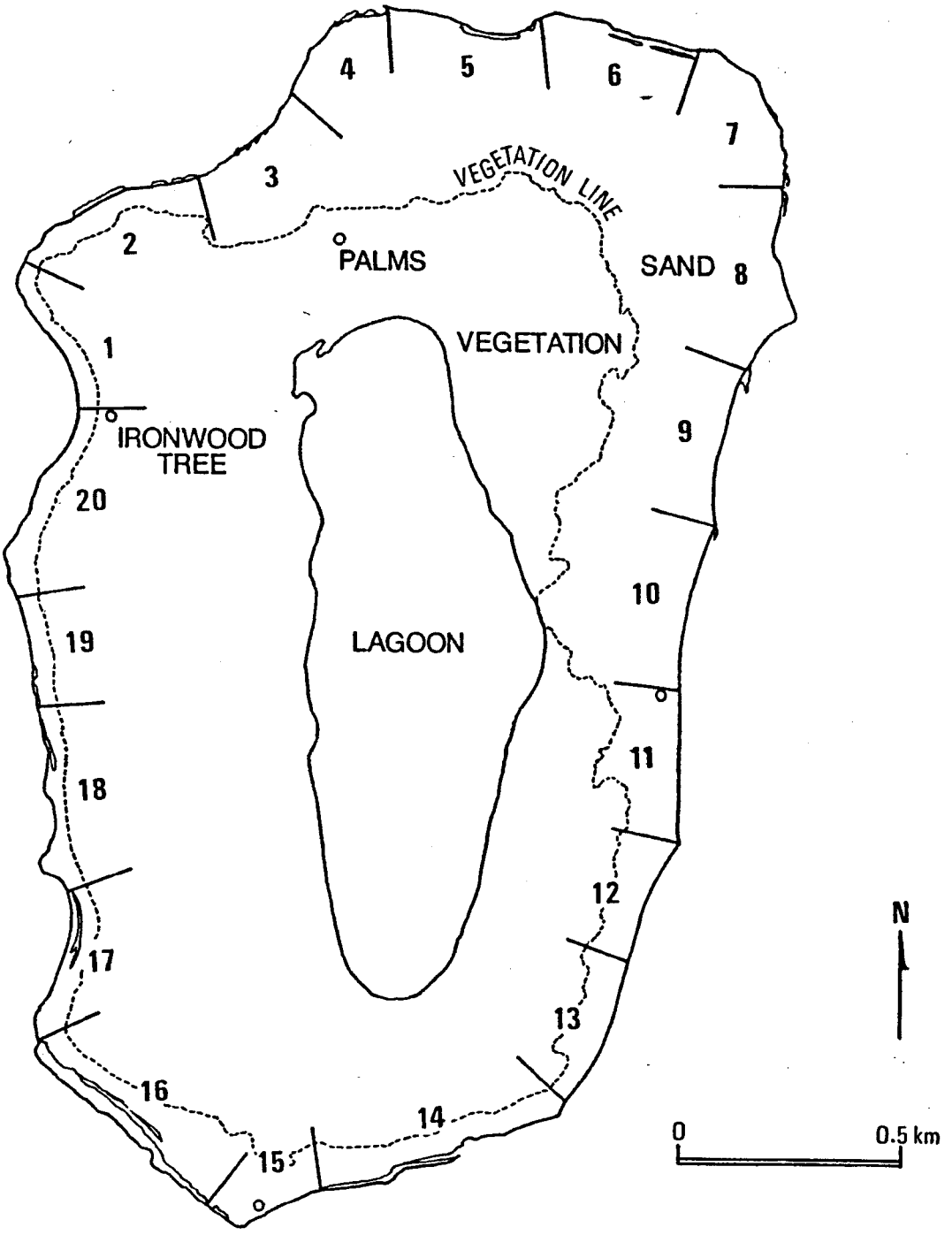

Figure 6.--Sector map of Laysan Island, 1982.

Table 5.--Numbers of green turtles basking and swimming at Laysan Island, 1982 (J = juvenile, S = subadult, A = adult; D = day 0600-1800; no night censuses in March).

March 1982	Time	Area censued per time period[1]	Swimming			Basking			Total number observed
			J	S	A	J	S	A	
16	D	P	0	0	0	1	0	1	2
17	D	T	0	0	2	0	0	1	3
18	D	P	0	0	0	0	0	1	1
19	D	P	0	0	0	1	1	2	4
20	D	P	0	0	0	0	1	3	4
21	D	T	0	0	1	1	1	1	4
22	D	W	3	1	0	1	0	1	6
23	D	P	0	2	0	0	1	0	3
26	D	T	1	1	2	0	0	2	6
27	D	P	7	0	0	0	0	2	9
28	D	P	6	0	0	2	0	3	11
29	D	W	0	0	0	1	0	1	2
30	D	T	5	0	0	0	3	2	10
31	D	W	1	0	0	0	0	1	2
Average number of animals seen per time period			1.4	0.3	0.3	0.5	0.5	1.5	4.5
Range			(0-7)	(0-2)	(0-2)	(0-2)	(0-1)	(0-3)	(0-11)

[1]P = Partial island patrol, north coast (Sectors 1-9).
T = Total island census (Sectors (1-20).
W = Partial island patrol west coast (Sectors 1-3, 17-20).

Table 6.--Numbers of green turtles basking and swimming at Laysan Island 1982 (J = juvenile, S = subadult, A = adult; D = day 0600-1800; no night censuses in April).

April 1982	Time	Area censused per time period[1]	Swimming			Basking			Total number observed
			J	S	A	J	S	A	
1	D	W	0	0	0	0	0	1	1
2	D	T	0	0	0	0	0	1	1
3	D	P	0	0	0	0	1	2	3
4	D	W	0	1	1	1	0	1	4
5	D	W	0	0	0	1	0	4	5
6	D	P	0	0	0	0	0	2	2
7	D	P	0	2	0	0	1	1	4
8	D	T	2	0	0	0	0	8	10
9	D	P	0	0	0	0	1	2	3
10	D	W	0	0	0	0	0	0	0
12	D	P	0	0	0	0	0	4	4
13	D	W	0	0	0	0	2	0	2
14	D	W	0	0	0	0	0	1	3
15	D	W	0	0	1	0	1	1	3
16	D	W	0	0	1	0	0	3	4
17	D	T	4	0	0	0	0	0	4
18	D	W	0	0	1	0	0	2	4
19	D	W	1	1	0	0	0	3	5
20	D	P	0	0	2	0	0	0	2
21	D	T	0	0	2	0	0	0	2
22	D	W	0	1	0	0	0	2	3
23	D	T	0	1	1	0	0	2	4
24	D	W	2	0	0	0	0	0	2
25	D	W	0	0	0	0	0	0	0
26	D	P	0	1	0	0	0	0	1
27	D	T	0	0	0	0	0	2	2
28	D	T	0	0	0	0	0	2	2
29	D	T	0	0	0	0	0	3	3
30	D	W	0	0	4	1	0	5	9
Average number of animals seen per time period			0.4	0.2	0.4	0.1	0.2	1.87	3.1
Range			(0-4)	(0-2)	(0-4)	(0-1)	(0-2)	(0-8)	(0-10)

[1]P = Partial island patrol, north coast (Sectors 1-9).
T = Total island census (Sectors (1-20).
W = Partial island patrol west coast (Sectors 1-3, 17-20).

Table 7.--Numbers of green turtles basking and swimming at Laysan Island, 1982 (J = juvenile, S = subadult, A = adult; D = day 0600-1800; N = night 1801-0559); only five night circuits in month of May).

May 1982	Time	Area censused per time period[1]	Swimming			Basking			Total number observed
			J	S	A	J	S	A	
1	D	P	0	0	1	0	0	3	4
2	D	W	0	1	2	0	0	3	6
	N	W	0	0	0	0	0	1	1
3	D	T	0	0	1	0	0	5	6
	N	W	0	0	0	0	0	1	1
4	D	W	0	0	0	0	0	3	3
5	D	T	0	0	1	0	0	3	4
6	D	P	0	0	0	0	0	2	2
7	D	T	1	0	0	0	0	4	5
8	D	W	0	2	2	0	0	3	7
	N	W	0	0	0	0	0	1	1
9	D	W	0	0	2	0	0	1	3
	N	W	0	0	0	0	1	1	2
10	D	W	0	1	0	0	0	0	1
11	D	T	0	1	0	0	0	0	1
12	D	W	0	0	1	0	0	0	1
13	D	W	0	1	1	0	0	1	3
14	D	P	0	0	2	0	0	0	2
15	D	T	0	0	0	0	0	1	1
16	D	W	0	0	0	0	0	1	1
17	D	T	0	0	0	0	1	4	5
18	D	P	0	1	0	0	0	4	5
19	D	T	0	1	0	0	0	2	3

Table 7.--Continued.

May 1982	Time	Area censused per time period[1]	Swimming J	Swimming S	Swimming A	Basking J	Basking S	Basking A	Total number observed
20	D	W	0	0	0	0	0	2	2
21	D	T	0	1	0	0	0	3	4
22	D	T	1	0	0	0	0	1	2
23	D	W	0	0	0	0	0	0	0
24	D	W	0	0	0	0	0	1	1
25	D	T	0	0	0	0	1	0	1
27	D	T	0	0	0	0	1	3	4
28	D	W	0	0	0	0	0	3	3
29	D	W	0	0	0	0	0	1	1
	N	W	0	0	0	0	0	1	1
30	N	T	0	0	0	0	0	0	0
Average number of animals seen per time period			0.1	0.3	0.4	0.0	0.1	1.6	2.1
Range			(0-1)	(0-2)	(0-2)	0	(0-1)	(0-5)	(0-7)

[1]P = Partial island patrol north coast (Sectors 1-9).
T = Total island census (Sectors 1-20).
W = Partial island patrol, west coast (Sectors 1-3 and 17-20).

Table 8.--Numbers of green turtles basking and swimming at Laysan Island, 1982 (J = juvenile, S = subadult, A = adult; D = day 0600-1800; N = night 1801-0559).

June 1982	Time	Area censused per time period[1]	Swimming			Basking			Total number observed
			J	S	A	J	S	A	
1	D	W	0	0	0	0	0	0	0
2	D	W	0	0	0	0	0	0	0
	N	T	0	0	0	0	0	2	2
3	D	P	0	0	0	0	0	2	2
	N	T	0	0	0	0	0	3	3
4	D	T	0	0	0	0	0	0	0
5	D	P	0	0	1	0	0	0	1
6	D	T	0	0	0	0	0	2	2
7	D	T	0	1	0	0	0	1	2
	N	T	0	0	0	0	0	0	0
8	N	T	0	0	0	0	0	0	0
9	N	P	0	0	0	0	0	0	0
10	N	T	0	0	0	0	0	0	0
11	D	P	0	0	0	0	0	2	2
	N	P	0	0	0	0	0	1	1
13	D	P	0	0	0	0	0	0	0
14	D	P	0	0	0	0	0	0	0
	N	P	0	0	0	0	0	2	2
15	D	W	0	0	0	0	0	0	0
16	D	P	0	0	0	0	1	0	1
	N	T	0	0	0	0	0	2	2
18	D	T	1	0	1	0	0	1	3
	N	P	0	0	0	0	0	1	1

Table 8.--Continued.

June 1982	Time	Area censused per time period[1]	Swimming			Basking			Total number observed
			J	S	A	J	S	A	
19	D	P	1	0	0	0	0	0	1
21	D	P	0	0	0	0	0	3	3
	N	P	0	0	0	0	0	0	0
22	N	P	0	0	0	0	0	0	0
23	N	P	0	0	0	0	0	0	0
24	D	W	0	0	0	0	0	0	0
25	N	T	0	0	0	0	0	1	1
26	N	T	0	0	0	0	0	0	0
27	D	T	0	0	0	0	0	2	2
28	D	W	0	0	0	0	0	0	0
	N	T	0	0	0	0	0	1	1
29	D	W	0	0	0	0	0	3	3
	N	T	0	0	0	0	0	2	2
30	D	W	0	0	0	0	0	0	0
Average number of animals seen per time period			0.03	0.02	0.03	0.0	0.02	0.05	0.6
Range			(0-1)	(0-1)	(0-1)	0	(0-1)	(0-3)	(0-3)

[1]P = Partial island patrol, north coast (Sectors 1-9) .
T = Total island census (Sectors 1-20).
W = Partial island patrol, west coast (Sectors 1-3 and 17-20).

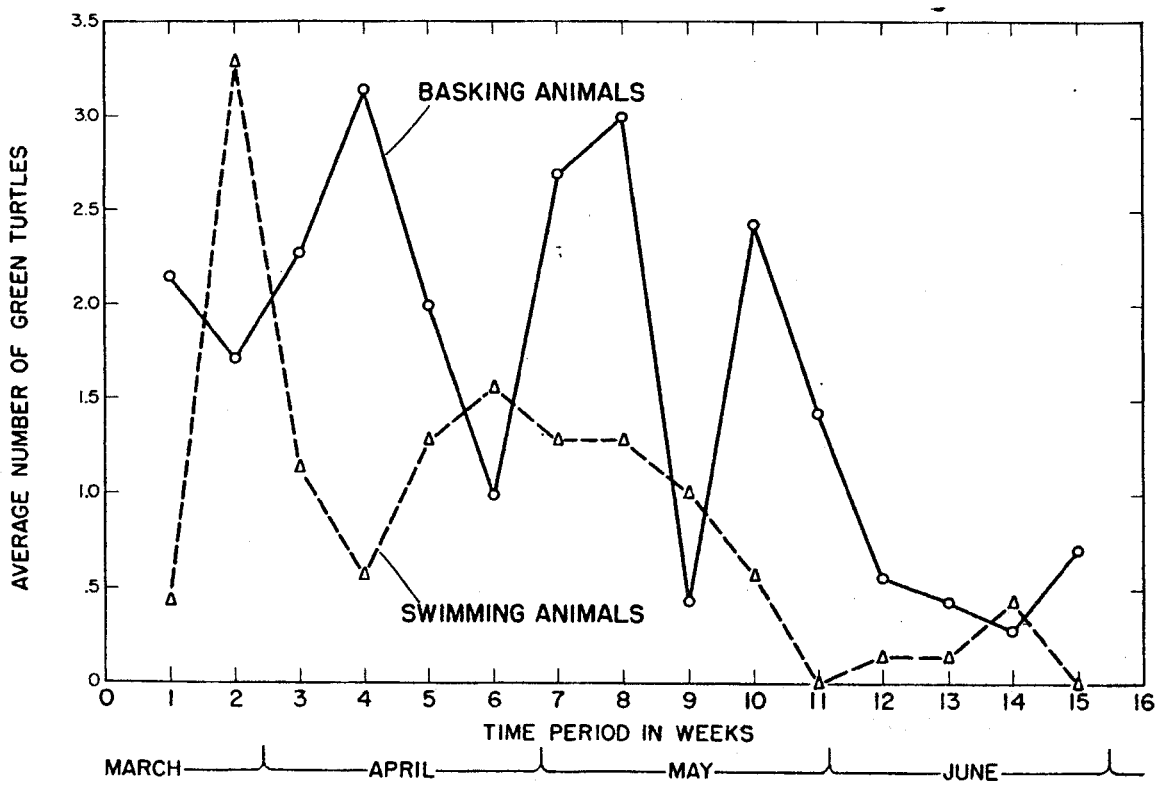

Figure 7.--Average weekly count of green turtles engaged in swimming and basking during the day on Laysan Island, 16 March to 30 June 1982.

Chlorphyta
- Bryopsis pennata
- B. plumosa
- B. hypnoides

Phaeophyta
- Dictyota friabilis
- Turbinaria ornata
- Zonaria sp.

Rhodophyta
- Amphiroa fragilissima
- Asparagopsis taxiformis
- Corallina sp.
- Jania capillacea
- J. micrarthrodia
- Laurencia sp.
- L. cartilaginea
- L. nidifera
- Plocamium brasiliense
- P. sandvicensis
- Turbinaria ornata

Two juvenile turtles were captured by hand, and food samples were saved from their mouths. Two species of green algae were identified: Caulerpa lentillifera and C. racemosa var. peltata (see footnote 3).

Pearl and Hermes Reef

Tagging Effort

From 2 to 6 July 1982, 16 green turtles were tagged with Inconel tags. An additional 11 turtles were tag recoveries. Tag recovery data are presented in Table 9. With the exception of one turtle, all of the tag recoveries represent animals that had originally been tagged and previously resighted at Pearl and Hermes Reef. The exception, turtle No. 3671 (female), is an animal that nested at FFS in 1980 and was recorded basking on Southeast Island in July 1982. The minimum distance this animal traveled is 560 nmi.

Of the 27 turtles marked, there were 12 adult females, 5 adult males, and 10 immature turtles. All of these animals were measured while they basked on the high wet sand of the beach except for one individual captured at night while it was sleeping in shallow nearshore waters off North Island. Carapace measurements for these tagged turtles are presented in Tables 10-12.

Nesting Activity

On 2 July turtle nesting pits were observed at the southwestern corner of Southeast Island. Six excavations were found along the border of the vegetation line, which is composed primarily of Tribulus. The turtle tracks had been partially obliterated by weather, so determination of the exact number of turtles responsible for the activity was not possible. For the

Table 9.--Tag recoveries of green turtles at Pearl and Hermes Reef, 1982.

Date of sighting July 1982	Tag No.	Sex	Island	Originally tagged while basking on
2	5547 5567	M	Southeast	Pearl and Hermes Reef, August 1981.
2	3671	F	Southeast	29 June 1980 nesting East Island, French Frigate Shoals.
2	5541	F	Southeast	Pearl and Hermes Reef, August 1981.
2	A1051 5855	M	Southeast	Southeast Island, Pearl and Hermes Reef, March 1973.
2	323 5862	F	Southeast	Southeast Island, Pearl and Hermes Reef, 15 September 1969.
3	5553	F	Southeast	Pearl and Hermes Reef, August 1981.
4	5599	F	Southeast	Pearl and Hermes Reef, August 1981.
4	5598	F	Southeast	Pearl and Hermes Reef, August 1981.
5	5587	F	North	Pearl and Hermes Reef, August 1981.
5	5589 5590	F	North	Pearl and Hermes Reef, August 1981.
5	T5 5870	F	North	Southeast Island, Pearl and Hermes Reef, 13 March 1972.

Table 10.--Adult female green turtles tagged at Pearl and Hermes Reef, 1982.

Date first observed July 1982	Tag No.		Island	Measurements (cm) Straight Length	Straight Width	Curved Length	Curved Width
2	5856	5857	Southeast	81.5	66.5	87.5	82.7
2	5858		Southeast	85.3	70.4	--	--
2	5861		Southeast	84.3	64.4	91.7	90.6
2	5862	323	Southeast	83.3	69.5	90.2	84.5
2	[1]3671		Southeast	91.2	73.5	--	--
2	5544		Southeast	82.3	66.7	--	--
3	5863		Southeast	93.0	77.1	--	--
3	5864		Southeast	87.1	68.2	93.5	88.6
4	[1]5599		Southeast	82.4	68.4	90.4	88.2
4	5598		Southeast	85.9	70.5	91.1	84.7
5	5870	T5	North	93.5	78.5	100.2	97.5
5	[1]5587		North	90.2	76.1	97.3	94.4

Straight length
N = 12
Range = 81.5-93.5
Mean = 86.7
SD = 4.3

Straight width
N = 12
Range = 64.4-78.5
Mean = 70.8
SD = 4.5

[1]Tag recovery.

Table 11.--Adult male green turtles tagged at Pearl and Hermes Reef, 1982.

Date first observed July 1982	Tag No.	Island	Measurements (cm) Straight Length	Straight Width	Curved Length	Curved Width
2	[1]A1052 5855	Southeast	81.9	--	--	--
2	5860	Southeast	89.6	69.7	95.5	86.3
2	[1]5547 5567	Southeast	89.2	73.1	94.5	90.4
4	5866	Southeast	91.8	71.0	97.7	92.5
5	5869	North	87.4	65.3	91.6	83.0

Straight length
N = 5
Range = 81.9-91.8
Mean = 88.0
SD = 3.7

Straight width
N = 4
Range = 65.3-73.1
Mean = 69.8
SD = 2.9

[1]Tag recovery.

Table 12.--Juvenile and subadult green turtles tagged at Pearl and Hermes Reef, 1982 (S = straight length x width; C = curved length x width; PL = plastron length; Head = head width; Tail = tail length).

Date first observed July 1982	Tag No.	Island	Measurements (cm) Straight Length	Straight Width	Curved Length	Curved Width	Plastron length	Head width	Tail length
2	5859	Southeast	71.6	58.3	--	--	--	--	--
3	[1]5553	Southeast	78.4	66.3	84.4	80.3	--	--	--
4	5865	Southeast	49.2	40.1	51.6	46.2	39.8	7.4	4.0
4	5867	Southeast	63.8	52.8	67.2	61.7	--	--	--
5	5868	North	77.8	62.8	84.0	77.0	--	--	--
4	5871	North	74.2	60.6	--	--	--	--	--
5	5872	North	74.8	58.4	--	--	--	--	--
5	5873	North	65.5	52.4	71.4	65.5	51.3	9.9	13.0
5	[1]5589 5590	North	No measurements						
5	5874 5875	Southeast	60.6	48.4	64.6	48.2	--	9.3	14.5

Straight length	Straight width
N = 9	N = 9
Range = 49.2-77.8	Range = 48.4-66.3
Mean = 68.4	Mean = 55.6
SD = 9.6	SD = 8.0

[1]Tag recovery.

entire time period, no turtles were observed to utilize the sandy beach fronting the nest pit area for basking, and no other areas on Southeast Island were used for nesting. On 5 July, 13 pits were found along the northern and northeastern coast of North Island. They were dug within the vegetation zone of Solanum nelsoni. Searches on the other islets of Pearl and Hermes Reef revealed no indications of excavations. Returning to Southeast Island after spending the night of 5 July on North Island, three newly excavated turtle pits were found beside the southwestern nest area. Separate sets of tracks up to the vegetation and back down to the water indicated that one or possibly two individual turtles dug pits either the night of 5 July or the early morning of 6 July. Figures 8 and 9 identify turtle nest sites on Southeast and North Islands.

Between 2 and 6 July, encompassing 5 days and 4 nights of observations at Pearl and Hermes Reef, no female turtles were observed nesting, and no nest pits had been found to have hatched. The field camp was removed on 6 July, and the research party was relocated to Lisianski Island.

Census of Basking and Swimming Turtles

Turtles that bask at Pearl and Hermes Reef cluster together, whereas those at Laysan and Lisianski Islands are usually some distance from each other. This social behavior often puts individuals in direct contact with their neighbors, touching flippers and carapaces. The close grouping of these animals makes tag number reading difficult. If a single animal becomes alarmed, its sudden movement away from the researcher may stimulate other turtles into motion. Thus, several animals may suddenly desert the high wet sand of the beach to reenter the safety of the water. Usually, these animals will stay in the nearshore waters to emerge at a later time. Therefore, more caution is necessary at Pearl and Hermes Reef in obtaining tag recoveries and applying new tags to animals so that disturbance to basking turtles, other than the one being attended to, is kept at a minimum.

Counts of basking and swimming turtles were recorded for daylight hours (0600-1800) and night (1801-0559) in Table 13. The table reflects data gathered at Southeast Island, and also turtles seen at North and Little North Island on the day and night of 5 July. Basking turtles were not observed on any of the other sandy islets or man-made structures of Pearl and Hermes Reef, although later in the year (30 October) a turtle was seen basking on a shipwreck (Kam 1984). It is common for green turtles to come ashore during the day to bask in the NWHI, however, on Southeast and North Islands, individuals regularly emerged at night. Though only 7 individuals were seen at night at North Island, a maximum of 15 turtles were seen at night on Southeast Island. Adding the maximum numbers obtained at Southeast Island (17 animals) and North Island (18 animals), a count of 35 individual green turtles is obtained. About 16 km of water separates Southeast Island from North Island, and it can be assumed that turtles seen at Southeast Island made no immediate migration to North Island during the short-time interval of the observations. Animals identified at Southeast Island by metal tags and morphological abnormalities were not observed at North Island.

Figure 8.--Locations of nine excavations (●) on the western coast of Southeast Island, Pearl and Hermes Reef, 2-6 July 1982 (U.S. Fish and Wildlife Service aerial photo, 1981).

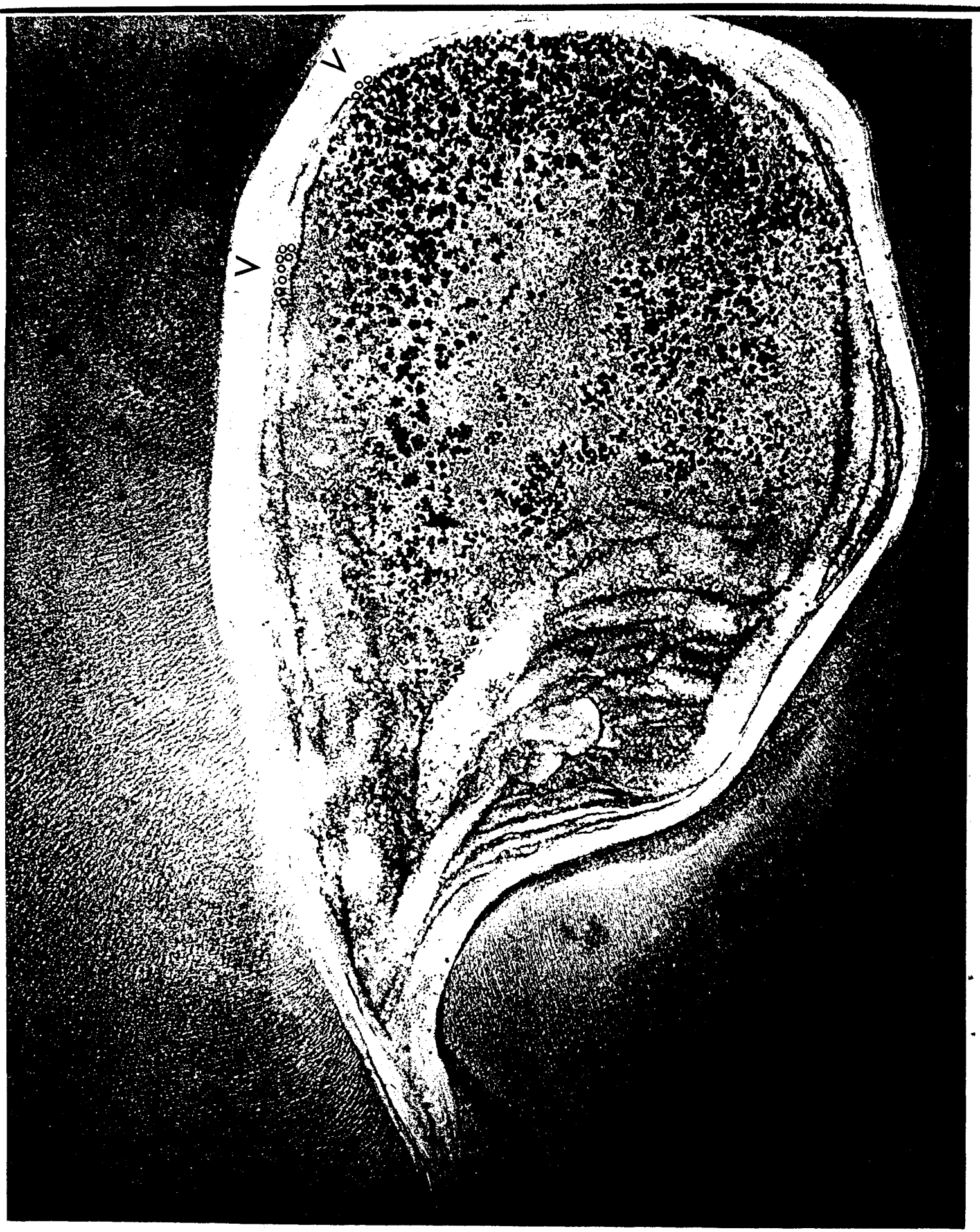

Figure 9.--Locations of 13 excavations (•) on the northern coast of North Island, Pearl and Hermes Reef, 2-6 July 1982 (U.S. Fish and Wildlife Service aerial photo, 1981).

Table 13.--Numbers of green turtles basking and swimming at Southeast and North Islands, Pearl and Hermes Reef, 1982 (D = day, 0600-1800; N = night, 1801-0559).

July 1982	Time	Swimming			Basking			Total number observed
		Juvenile	Subadult	Adult	Juvenile	Subadult	Adult	
2	D	0	0	1	0	1	8	10
	N	0	2	0	0	0	13	15
3	D	0	0	1	0	0	1	2
	N	0	0	2	0	0	15	17
4	D	0	0	2	1	1	5	9
	N	0	0	2	0	0	4	6
5[1]	D	1	0	2	0	1	12	16
	N	0	1	10	0	3	4	18
6	D	0	0	3	0	1	3	7
Average number of animals seen per time period		0.1	0.3	2.3	0.1	0.7	6.5	10
Range		(0-1)	(0-2)	(0-1)	(0-1)	(0-3)	(0-15)	(0-18)

[1]Census counts at North Island only.

Lisianski Island

Tagging Effort

From 17 March to 13 September 1982, while a research field camp was on the island, a total of 92 green turtles were identified by metal tags. Of this total, 68 animals were newly tagged and 24 individuals represent tag recoveries. A breakdown of the size and sex-class of the identified animals reveals 29 adult females (32%), 14 adult males (15%), and 49 immature turtles (53%) (Tables 14-16).

Of the 24 turtles identified as previously tagged (Table 17), 5 of these reflect long distance migrations. They are female turtles Nos. 1292, 1298, 2664, and 3554, and male turtle No. 465. Two turtles, No. 1298 and 3554, originally tagged on Lisianski, were observed at FFS, and again reported on Lisianski in 1982. The minimum round trip distance traveled by these female turtles is 870 nmi. Turtle No. 1298 was seen nesting in 1976 and 1980 at FFS. It has not been documented whether she had visited Lisianski during the interim years between the nesting endeavors, nor has she been observed to nest on Lisianski. The three other migrations document a minimum one-way distance of 435 nmi traveled from FFS to Lisianski. The 19 other tag recoveries found on Lisianski are animals that had originally been tagged at Lisianski and observed again in 1982. Of these, female turtle No. 1014, originally tagged in 1963 and seen basking in 1982, 20 years and 3 months later, is the longest interval between tag resightings.

Nesting Activity

Nesting at Lisianski in 1982 began on 28 May and ended on 14 August. The peak nesting period was July when 13 excavation sites were recorded, constituting 32 separate pits. For the nesting period from May to June, there were 23 excavation sites involving 47 pits (Fig. 10). The pits were dug usually <20 m from the water in the vegetation zone of Eragrostis and Tribulus.

Four turtles were discovered laying eggs during night censuses, and two of these had been observed 2 days earlier digging exploratory nest pits without egg deposition. It took an average of 1 h and 34 min (n = 4, range = 1 h 12 min to 1 h 45 min) for the turtle to complete its nesting and return to the ocean. An average of 24.5 min (n = 4, range = 14-39 min) was required to complete egg deposition. The turtles that were involved were No. 5850, 5941, 6285, and an untagged animal. The number of eggs deposited within the egg chambers were 109, 69, 99, and 102, respectively.

Census of Basking and Swimming Turtles

Daily censuses were initiated on 8 July. Numbers of green turtles observed during censuses are presented in Tables 18-20. All size-classes of turtles exhibited basking behavior, the adult animals were usually higher on the wet sand of the beach slope. The maximum count for basking animals during the day was six, found between Sectors 21 and 30 (Fig. 11). More basking behavior was found during the night (Fig. 12) especially in Sectors

Table 14.--Adult female green turtles tagged at Lisianski Island, 1982.

Date first observed	Tag No.			Sector	Measurements (cm) Straight length	Straight width
Mar. 21	A494			--	--	--
Mar. 26	1014			5	--	--
Mar. 27	2866			27	--	--
Mar. 28	3554			--	--	--
Apr. 1	[1]1298	1299		29	--	--
Apr. 22	[1]1292	1293	5090	2	91.7	--
May 16	5832			3	81.5	--
May 23	[1]2951	6278		26	--	--
June 6	[1]2664	5839		8	82.4	--
June 27	5848	5849		7	85.3	--
June 29	5850	5928		10	92.9	71.1
July 20	5929	5930		26	87.6	69.1
July 20	5931			25	--	65.9
July 21	5936			33	93.5	73.3
July 25	5941	5942		10	85.2	66.5
July 28	5945	6318		3	91.7	74.3
July 30	5946			30	93.8	73.8
Aug. 11	6278			27	90.8	68.3
Aug. 14	6285	6286	6287	11	94.1	72.4
Aug. 17	6291	6328		25	--	--
Aug. 20	[1]T256	6299	6300	26	82.2	66.5
Aug. 21	644	6301		15	89.3	73.7
Aug. 21	[1]T211	6303	6304	26	--	--
Aug. 24	6309			13	--	--
Aug. 30	6323			26	--	--
Aug. 31	6324			25	--	--
Sept. 4	2950			27	--	--
Sept. 6	6329			30	--	--
Sept. 8	399	6330		20	--	--

Straight length	Straight width
N = 14	N = 11
Range = 81.5-94.1	Range = 65.9-74.3
Mean = 88.7	Mean = 70.4
SD = 4.6	SD = 3.3

[1]Tag recovery.

Table 15.--Adult male green turtles tagged at Lisianski Island, 1982.

Date first observed 1982	Tag No.	Sector	Measurements (cm) Straight length	Straight width
Mar. 21	[1]T259 2958	--	77.2	61.4
Mar. 28	[1]430 6290	--	85.2	--
June 5	5835	4	84.1	--
June 5	5837	3	88.9	--
June 5	5838	3	86.5	--
June 5	5840	15	84.0	--
June 6	[1]465 5940 6327	15	84.0	--
June 6	[1]878 5846 5847	11	83.0	--
June 29	5851	12	85.1	--
June 30	5853	27	86.8	--
July 27	5943	25	--	--
Aug. 18	6292	25	--	--
Sept. 2	6302	11	--	--
Sept. 2	6326	32	89.3	

Straight length
N = 11
Range = 77.2-89.3
Mean = 84.9
SD = 3.3

[1]Tag recovery.

Table 16.--Immature green turtles tagged at Lisianski Island, 1982.

Date first observed	Tag No.		Sector	Measurements (cm)						
				Straight		Curved		Plastron length	Head width	Tail length
				Length	Width	Length	Width			
Apr. 12	[1]2837	2838	20	--	--	68.0	--	--	--	--
July 15			18	64.4	54.0	70.0	66.0	54.3	9.4	11.0
Mar. 29	[1]2857	858	3	--	--	--	--	--	--	--
Aug. 7			11	54.0	46.0	56.5	52.6	43.3	8.2	10.2
Mar. 21	[1]2859	2860	9	41.5	--	--	--	--	--	--
Aug. 15			10	42.0	35.9	45.0	42.2	33.9	7.1	9.2
July 17	[1]2939	2941	26	74.1	61.0	81.0	74.7	--	--	--
July 25			25	73.8	61.0	80.8	75.9	--	--	--
July 8	[1]2946	947	40	--	--	48.7	42.7	--	--	--
Apr. 27	[1]2959	2960	26	--	--	84.0	--	--	--	--
July 23			25	79.4	63.9	87.0	80.5	--	--	--
Aug. 17			26	79.2	63.3	--	--	--	--	--
Mar. 26	[1]2961	2942	26	--	--	84.0	--	--	--	--
July 23	2943		25	76.8	64.8	84.0	78.7	--	--	--
Apr. 8	5826		16	--	--	--	--	--	--	--
Aug. 4			16	42.9	36.8	45.3	42.6	35.6	7.1	7.2
Apr. 10	5827		43	46.5	--	--	--	--	--	--
Apr. 12	5828		27	51.5	--	53.0	--	--	--	--
Apr. 18	5829		26	--	--	50.0	--	--	--	--
Apr. 19	5830	5947	20	--	--	52.0	--	--	--	--
July 31			20	49.9	41.2	53.8	48.4	40.4	7.9	10.0
May 2	5831		49	45.4	--	--	--	--	--	--
May 17	5833		20	52.0	--	--	--	--	--	--
May 17	5834		20	54.9	--	--	--	--	--	--
June 5	5836		4	39.9	--	--	--	--	--	--

Table 16.--Continued.

Date first observed	Tag No.			Sector	Measurements (cm) Straight Length	Straight Width	Curved Length	Curved Width	Plastron length	Head width	Tail length
June 10	5841			3	76.2	--	--	--	--	--	--
June 17	5842	5944		3	61.4	--	--	--	--	--	--
June 17	5843	6288	6289	4	76.0	--	--	--	--	--	--
July 13				5	76.2	65.2	83.7	80.1	--	--	--
June 26	5844			40	43.6	--	--	--	--	--	--
June 27	5845			20	44.0	--	--	--	--	--	--
June 30	5852			20	69.1	--	--	--	--	--	--
June 30	5854	6325		27	58.5	--	--	--	--	--	--
July 13				26	58.2	48.7	63.6	57.1	--	--	--
July 20	5931			25	--	65.9	83.0	78.2	--	--	--
July 20	5932	5933		6	43.4	35.0	46.7	42.1	34.3	6.9	8.7
July 21	5934	5933		20	43.9	36.5	46.8	41.6	35.4	7.2	7.5
July 24	5939			25	77.3	65.4	82.8	77.2	--	--	--
Aug. 4	5948			13	77.2	60.5	--	--	--	--	--
Aug. 5	5949			26	44.2	35.3	47.2	41.7	35.3	7.0	8.3
Aug. 6	5950			27	73.8	61.2	81.8	74.8	60.9	11.0	19.0
Aug. 11	6276	6277		27	69.3	57.1	74.9	69.1	55.7	10.1	14.2
Aug. 12	6279	6280		45	45.6	36.1	48.3	41.2	37.2	7.0	8.5
Aug. 13	6281	6282		16	59.5	49.3	64.3	59.8	49.4	8.9	14.0
Aug. 14	6283	6284		25	43.5	35.5	47.0	41.6	35.2	6.8	8.4
Aug. 20	6293	6294		10	49.4	41.0	52.4	47.0	40.8	7.5	9.0

Table 16.--Continued.

Date first observed	Tag No.		Sector	Measurements (cm) Straight Length	Straight Width	Curved Length	Curved Width	Plastron length	Head width	Tail length
Aug. 20	6295	6296	10	41.3	34.5	44.3	39.5	32.7	6.5	8.0
Aug. 20	6297	6298	10	37.4	32.5	40.5	37.8	29.5	6.8	7.0
Aug. 23	6305	6306	10	45.4	38.1	48.4	45.1	35.9	7.8	8.0
Aug. 23	6307	6308	10	42.8	36.2	45.7	41.6	35.2	6.9	7.0
Aug. 27	6310	6311	10	44.8	36.7	47.8	42.5	35.1	6.9	9.4
Aug. 27	6312	6313	10	44.3	37.3	47.3	43.7	35.6	6.9	8.7
Aug. 27	6314	6315	10	49.1	39.9	51.8	47.2	40.2	7.7	9.0
Aug. 28	5316	6317	5	48.4	40.5	52.5	48.6	38.5	7.9	10.3
Aug. 29	6319	6320	2	39.1	32.5	41.6	37.8	32.1	6.3	7.3
Aug. 30	6321	6322	18	45.7	36.0	48.9	43.2	37.0	7.4	9.0
Sept. 11	6331	6332	1	49.9	40.3	52.8	47.5	40.8	7.6	9.0
Sept. 11	6333	6334	1	45.1	35.3	47.9	39.7	36.1	7.3	9.5
Sept. 13	6335	6336	4	43.0	34.7	46.2	40.4	34.0	7.1	8.0

Straight length
N = 45
Range = 37.4-79.4
[2]Mean = 53.5
SD = 12.97

Straight width
N = 35
Range = 32.5-65.9
[2]Mean = 44.9
SD = 11.71

[1]Tag recovery.

[2]If a turtle was measured more than once, the average length for that individual was used in calculating an overall mean and standard deviation.

Table 17.--Tag recovery data for Lisianski Island, 1982.

Date first observed 1982	Tag No.		Sector	Sex	Tag recovery data for basking animals: Locality and date of original tag		Tag recovery data for basking animals: Locality and date of tag recovery
Mar. 21	2859	2860	9	Subadult	Lisianski	7/15/78	Lisianski 7/15/82.
Mar. 21	A494		--	Female	Lisianski	3/26/69	--
Mar. 21	T259	2958	--	Male	Lisianski	7/24/73	Lisianski 7/77, 10/3//8, 5/16/80, 3/21/82.
Mar. 26	2961	2942	26	Subadult	Lisianski	10/2/78	Lisianski 3/26/82, 4/29/82.
Mar. 26	1014		5	Female	Lisianski	2/11/63	Lisianski 5/7/82.
Mar. 27	2866		27	Female	Lisianski	7/21//8	--
Mar. 28	430	6290	--	Male	Lisianski	3/20/67	Lisianski 8/16/82.
Mar. 28	3554		--	Female	Lisianski	3/67	Whale-Skate, FFS 6/8/80 Lisianski 3/28/82.
Mar. 29	2857	2858	3	Juvenile	Lisianski	7/20/78	Lisianski 8/7/82.
Mar. 30	878 5847	5846	46	Male	Lisianski	3/26/69	Lisianski 6/27/82.
Apr. 1	1298	1299	29	Female	Lisianski	3/20/68	East Island, FFS 5/16/71, 7/9/76 (nesting); 6/27/80 (nesting); Lisianski 4/1/82.
Apr. 12	2837	2838	2	Juvenile	Lisianski	7/15/78	Lisianski 7/15/82.
Apr. 22	1292 5090	1293	2	Female	East Island, FFS (nesting)	7/8/76	East Island, FFS 6/15/81 (nesting).
May 23	2951	6278	26	Female	Lisianski	4/73	Lisianski 10/3/78, 3/25/81.

Table 17.--Continued.

Date first observed 1982	Tag No.		Sector	Sex	Tag recovery data for basking animals: Locality and date of original tag		Locality and date of tag recovery
Apr. 2	465	5940	35	Male	Trig, FFS	3/16/67	Lisianski 7/25/82.
June 6	2664	5839	8	Female	East Island, FFS 6/13/78		Lisianski 11/4/82.
July 17	2339	2941	26	Subadult	Lisianski	10/2/78	Lisianski 7/25/82.
July 8	2946	2947	40	Juvenile	Lisianski	10/3/78	--
July 17	2959	2960	26	Subadult	Lisianski	9/19/6	Lisianski 8/13/75, 10/3/78, 5/15/80, 3/21/82.
Aug. 20	T256 6300	6299	26	Female	Lisianski	5/30/73	Lisianski 3/25/81.
Aug. 21	T211 6304	6303	26	Female	Lisianski	9/6/72	--
Aug. 21	644	6301	15	Female	Lisianski	9/26/67	--
Sept. 4	2950		27	Female	Lisianski	4/73	Lisianski 10/3/78.
Sept. 8	399	6330	20	Female	Lisianski	8/21/70	Lisianski 5/30/73.

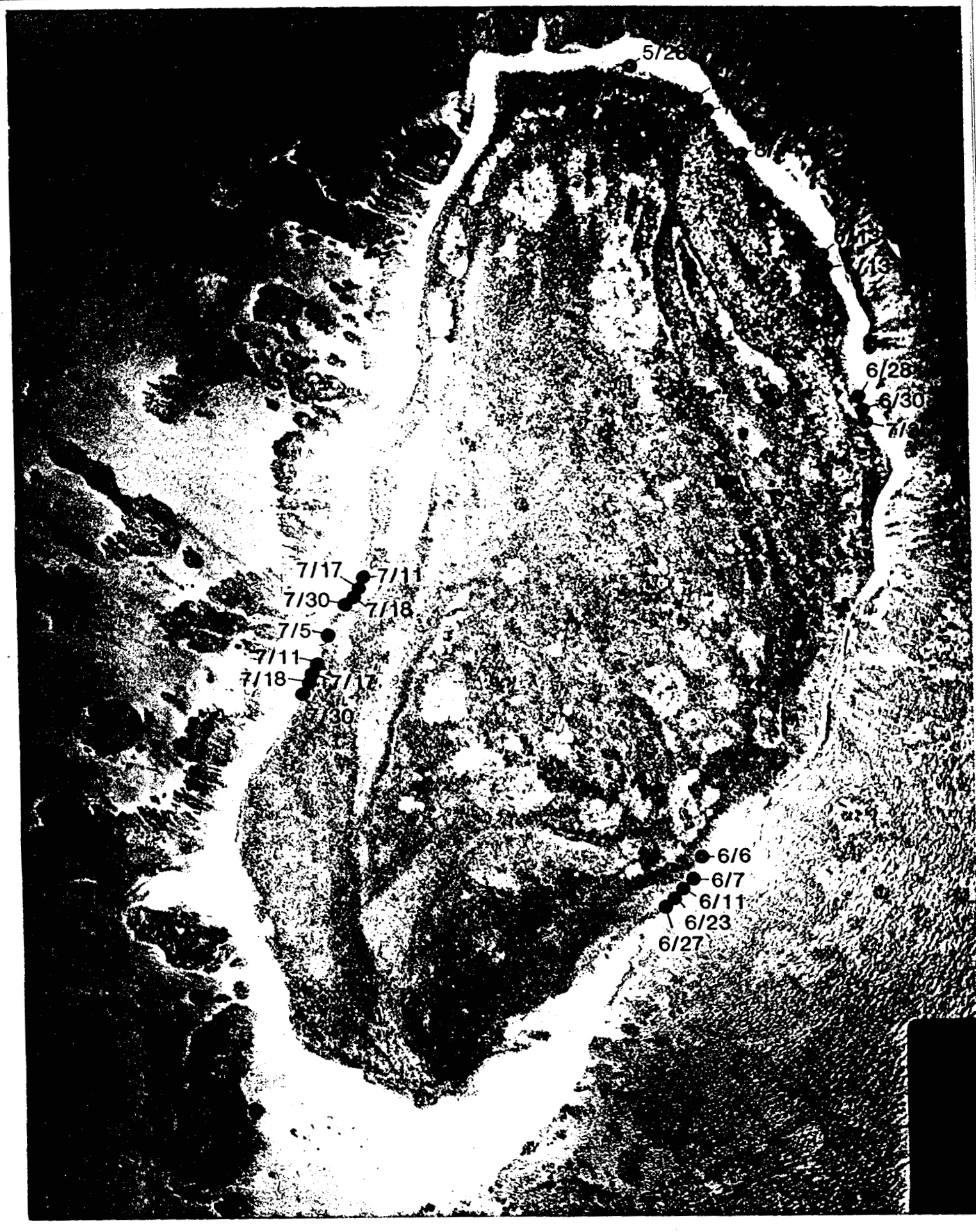

Figure 10.--Location and dates of 23 excavations on Lisianski Island, May-August 1982 (U.S. Fish and Wildlife Service aerial photo, August 1981).

Table 18.--Numbers of green turtles basking and swimming at Lisianski Island, 1982 (D = day 0600-1800; N = night 1801-1559).

July 1982	Time	Swimming			Basking			Total Number observed
		Juvenile	Subadult	Adult	Juvenile	Subadult	Adult	
8	D	3	1	4	0	0	0	8
9	D	0	0	0	0	0	0	0
10	D	6	1	0	0	0	0	7
11	D	13	3	0	0	0	0	16
	N	0	0	0	0	1	3	4
12	D	1	0	0	0	0	0	1
	N	0	0	0	1	0	3	4
13	D	0	0	0	0	0	0	0
	N	0	0	0	1	1	0	2
14	D	0	0	0	0	0	0	0
	N	0	1	0	0	1	2	4
15	D	12	6	5	1	2	0	26
	N	0	0	0	0	1	0	1
16	D	0	0	0	0	0	0	0
	N	0	0	0	0	2	2	4
17	D	0	0	0	0	0	1	1
	N	0	0	0	0	0	1	1
18	D	3	4	3	0	0	0	10
19	D	1	3	5	0	1	1	11
	N	4	0	0	0	1	2	7
20	D	6	1	1	0	0	0	8
	N	0	0	0	0	0	1	1
21	D	8	2	5	1	0	2	18
22	D	3	0	0	0	0	0	3
	N	0	0	0	0	0	1	1
23	D	7	5	4	0	2	0	18
	N	0	0	0	0	2	1	3

Table 18.--Continued.

July 1982	Time	Swimming			Basking			Total number observed
		Juvenile	Subadult	Adult	Juvenile	Subadult	Adult	
24	D	6	0	1	0	0	0	7
	N	0	0	0	0	1	2	3
25	D	4	2	1	0	0	0	7
26	D	10	4	5	0	0	2	21
	N	0	0	0	0	0	2	2
27	D	4	0	0	0	0	0	4
	N	0	0	0	0	0	2	2
28	D	2	3	2	0	0	0	7
	N	0	0	0	0	0	3	3
29	D	1	1	0	0	0	0	2
30	D	18	5	6	0	0	3	32
	N	0	0	0	0	1	3	4
31	D	9	2	0	1	0	1	13
	N	1	0	0	0	1	0	2
Average number of animals seen per time period		2.5	0.9	0.9	0.1	0.4	0.8	5.6
Range		(0-13)	(0-6)	(0-5)	(0-1)	(0-2)	(0-3)	(0-26)

Table 19.--Numbers of green turtles basking and swimming at Lisianski Island, 1982 (D = day 0600-1800; N = night 1801-1559).

August 1982	Time	Swimming			Basking			Total number observed
		Juvenile	Subadult	Adult	Juvenile	Subadult	Adult	
1	D	0	0	0	2	1	0	3
2	D	9	4	0	1	0	1	15
3	D	7	1	0	0	2	2	12
	N	0	0	0	1	1	2	4
4	D	8	0	3	1	0	0	12
	N	0	0	1	1	1	0	3
5	D	17	0	4	0	0	0	21
	N	0	0	0	0	0	1	1
6	D	5	1	2	1	0	2	11
	N	0	0	0	0	1	0	1
7	D	9	5	3	1	0	1	19
	N	1	0	0	0	1	2	4
8	D	0	0	0	0	0	0	0
9	D	6	1	0	0	1	0	8
	N	1	0	0	0	3	3	7
10	D	0	0	0	0	0	1	1
	N	0	0	0	0	1	3	4
11	D	0	0	0	0	1	0	1
	N	0	0	0	0	0	2	2
12	D	8	2	3	0	1	0	14
	N	2	0	0	0	2	1	5
13	D	0	0	0	0	1	0	1
	N	0	0	0	1	0	1	2
14	D	5	3	1	0	0	0	9
	N	0	0	0	1	3	0	4
15	D	0	0	0	0	0	0	0
16	D	8	5	1	0	2	1	17
	N	0	0	0	0	1	4	5

Table 19.--Continued.

August 1982	Time	Swimming			Basking			Total number observed
		Juvenile	Subadult	Adult	Juvenile	Subadult	Adult	
17	D	0	0	0	0	0	0	0
	N	0	0	0	0	1	5	6
18	D	2	2	5	0	0	0	9
	N	0	0	0	0	0	3	3
19	D	1	0	1	0	2	1	5
20	D	4	0	0	0	3	1	8
	N	0	0	0	0	0	5	5
21	D	3	1	1	0	4	0	9
	N	0	0	0	1	0	1	2
22	D	0	0	0	0	0	0	0
23	D	3	0	0	0	1	1	5
	N	2	0	0	0	0	3	5
24	D	0	1	0	0	1	0	2
	N	3	0	0	0	0	0	3
25	D	0	0	0	0	0	0	0
26	D	9	2	0	0	0	1	12
	N	0	0	0	0	0	1	1
27	D	6	0	0	0	0	0	6
	N	6	0	0	0	1	0	7
28	D	3	1	0	1	1	0	6
	N	0	0	0	0	0	1	1
29	D	1	0	0	0	1	0	2
	N	0	0	0	0	0	0	0
30	D	7	0	0	0	0	0	7
	N	0	0	0	0	0	3	3
31	D	0	0	0	0	1	0	1
	N	1	0	0	0	3	0	4
Average number of animals seen per time period		2.2	0.5	0.4	0.2	0.7	0.8	4.8
Range		(0-17)	(0-5)	(0-5)	(0-3)	(0-4)	(0-5)	(0-21)

Table 20.--Numbers of green turtles basking and swimming at Lisianski Island, 1982 (D = day 0600-1800; N = night 1801-0559).

Sept. 1982	Time	Swimming			Basking			Total number observed
		Juvenile	Subadult	Adult	Juvenile	Subadult	Adult	
1	D	0	3	1	0	1	0	5
2	D	0	0	0	0	0	2	2
	N	2	0	1	0	0	0	3
3	D	10	1	0	0	2	1	14
	N	0	0	0	0	0	2	2
4	D	0	0	0	1	1	4	6
	N	2	1	1	0	0	3	7
5	D	0	0	0	0	0	0	0
	N	2	0	0	0	2	1	5
6	D	2	1	2	1	0	1	7
7	D	14	3	4	0	0	1	22
8	D	17	4	3	0	0	1	25
	N	0	0	0	0	1	1	2
9	D	10	3	0	0	0	0	13
10	D	3	0	0	0	0	0	3
11	D	6	1	0	0	0	0	7
	N	2	1	1	0	0	0	4
12	D	0	0	0	1	0	1	2
13	D	13	1	4	0	1	0	19
	N	2	0	0	0	0	0	2
Average number of animals seen per time period		3.3	0.7	0.6	0.1	0.3	0.7	5.8
Range		(0-17)	(0-4)	(0-4)	(0-1)	(0-3)	(0-4)	(0-25)

25-27. Subadult-size turtles were also observed basking on an uplifted calcareous rock plate 30 m offshore in Sector 25. As the tide rose and breaking waves splashed consistently upon these basking turtles, the animals returned to the water.

At Lisianski Island, juvenile turtles were observed feeding and resting in shallow (1 m deep) nearshore waters. In Sectors 6, 10, and 49, 12 juvenile turtles were captured using a scoop net. Another five animals were collected by hand as they slowly swam along the shore. Fresh algal samples were obtained from the buccal cavity of five individuals that were feeding. The samples are in the process of being identified and will help to further document the benthic compositions of pastures for turtles at Lisianski Island. Preliminary results from two samples have identified Gelidium pusillum and Jania capillaces as major components.

Emergent Hatchling Success Rate

Twenty-three excavation sites were investigated to look for eggs that had hatched during the season. By examining the number of eggshells, whole eggs, and mortalities found within the nest, the percentage of hatchlings emerging to the surface was calculated (Table 21). Counts of the egg material remaining in the nest provide a maximum count of 412 hatchlings (72% of all eggs laid) that emerged to the surface from six nests. The nests were laid on: 13 June (Sector 14), 23 June (Sector 27), 27 June (Sector 27), 29 June (Sector 16), 13 July (Sector 14), and 15 July (Sector 10). During examination of the nest pits after hatching, 41 live hatchlings (10% of total that hatched) were discovered slowly making their way out of the egg chamber through the debris following the earlier emergent hatchlings. It is common

Table 21.--Results of six egg clutches excavated and examined at Lisianski Island following emergence of hatchlings.

	Mean	SD	Range
Number of eggs in nest	96.7	17.9	69-118
Percent of eggs hatched	74.3	26.0	35.7-100
Percent dead hatchlings in the nest	2.3	2.6	0-5.9
Percent of eggs with partially developed but dead embryos	10.0	12.1	0-29.9
Percent of eggs with no apparent development (presumably infertile)	15.2	25.3	0-62.5
Percent of hatchlings emerging at the surface	72.0	26.8	35.9-100

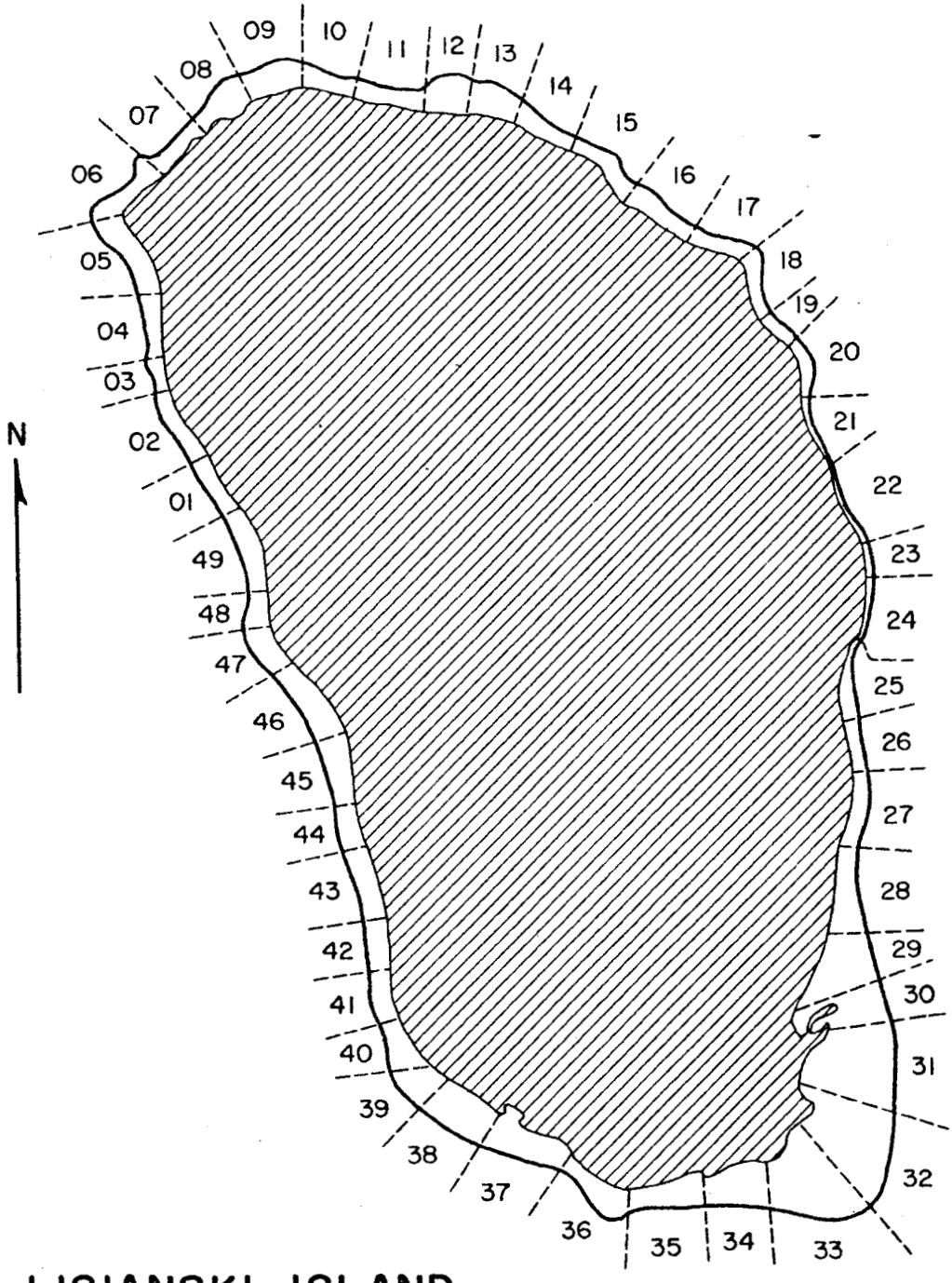

Figure 11.--Sector map of Lisianski Island, 1982.

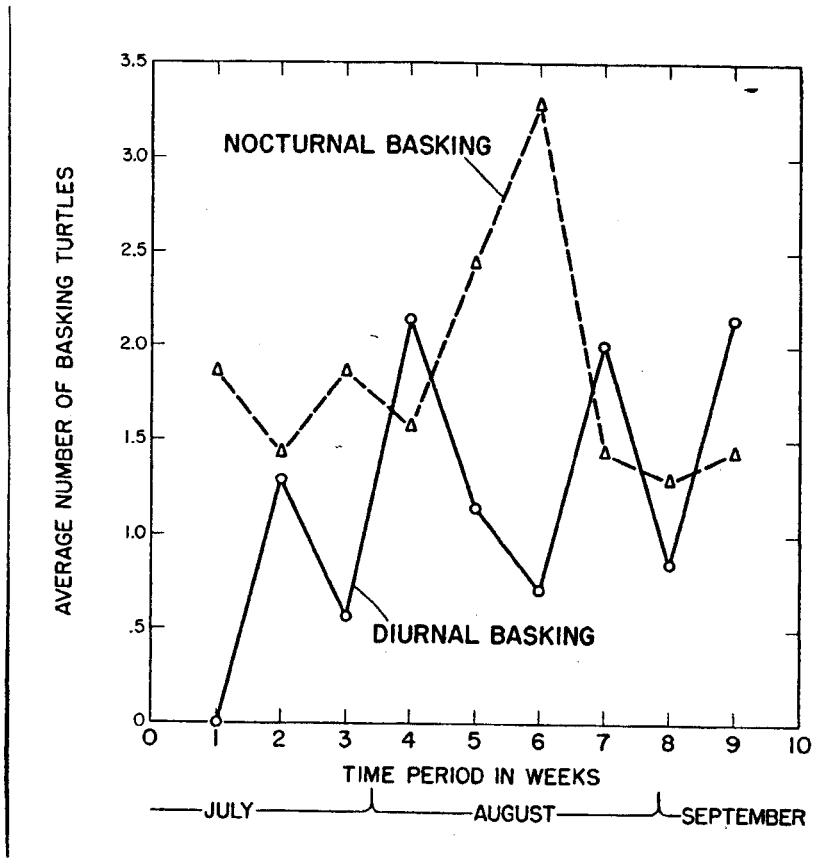

Figure 12.--Average weekly number of green turtles observed basking on Lisianski, 8 July-13 September 1982.

for hatchlings lower in the egg chamber to emerge later in time after the greater portion of the nest has hatched. Although only six nests were inspected, the results of the examination of egg clutches on Lisianski Island are similar to those found at East Island, FFS (Balazs 1980).

There is a distinct possibility that weather conditions and the movement of monk seals into the vegetation while hauling out rendered the marker system inappropriate for labeling an excavation site. Blowing wind and rain filled in the turtle pits, and monk seals regularly hauled out in these convenient depressions, thus obscuring the pit area.

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