1980s FFS

January 29, 1988 F/SWC2:GHB

Mr. Ken McDermond
U.S. Fish and Wildlife Service
P.O. Box 50167
Honolulu, HI 96850

Dear Ken,

Enclosed are the excerpts from two RFI (Radio Frequency Interference) handbooks that I promised to send you. A possible "cure" appears to be adding a capacitor, or line filter, to each of the fluorescent light fixtures. For starters, this could be tried with a single fixture to see what happens. I'm surprised that the company contracted to install the lighting system wasn't aware of filters being available on "special order" from the lamp distributors.

Since interference from fluorescent lights wasn't a major problem with your other SSB radios, it seems reasonable to assume that the interference-rejection circuitry of the Stevens SRA-222 may be deficient. This can be easily tested if you send one of your older radios back up to Tern, as you suggested. If the basic problem is indeed in the design of the Steven's radio, I don't believe there's much you can do about that.

Call me if I can be of any additional help. This is an interesting (and important!) problem.

Sincerely,

George H. Balazs
Zoologist

Enclosure

cc: Ken Niethammer (enclosures also sent)

GHB:gr

bcc: GHB
HL

February 23, 1988 F/SWC2:GHB

Mr. Ken McDermond
U.S. Fish and Wildlife Service
P.O. Box 50167
Honolulu, HI 96850

Dear Ken,

Here is a summary on the results of my inquiries to find a solution for the SSB radio frequency interference (RFI) problem being experienced at Tern Island.

Thin Light, the manufacturer of the 24 volt, 20 and 40 watt fluorescent fixtures in service at Tern Island, recommended that I call Filter Concepts Inc. (FCI) in southern California at (714) 545-7003 (2624 Rouselle Street, Santa Ana, CA 92707). Thin Light told me in a telephone conversation that they were aware of their fixtures causing interference to AM broadcast band radios, but claimed they had not received complaints regarding SSB transceivers.

I subsequently had two lengthy telephone conversations with Mr. Jerry Daunt, electrical engineer and owner of FCI. Most of his company's business is aimed at alleviating computer generated RFI, some of which involves government contracts. Nevertheless, he was knowledgeable about the fluorescent light fixture problem, most of which is due to poorly designed, cheaply manufactured 24 volts products for the recreational vehicle (RV) market. Based on the results of the "fixture isolation" test he suggested be performed at Tern Island, he felt that the main source of RFI comes from conduction back to the battery power supply which then radiates from all wiring in the building. The other route of RFI, which apparently is not as serious at Tern Island (based on the test) is oscillating radiation directly from the fixture. This latter problem, according to Mr. Daunt, will be far more difficult to eliminate and may require copper window screen surrounding each fixture. The former RFI problem, however, can be corrected by installing properly designed filters on each fixture. He quoted me a one-day lab charge of $600 for "research and development" of the filters, and estimated that the cost to make each filter would be $20. In order to do this work, he would need a 20 and 40 watt fixture from Thin Light for testing.

As I mentioned in my letter of January 29, I still strongly suspect that the RFI-rejection circuitry of the Stevens 222 is less efficient than your previous SSB radios. I would, therefore, still recommend sending one of the older radios back to Tern Island for testing.

I hope that this information will be helpful in restoring Tern Island communications to full function capacity, especially in regard to emergency and other unscheduled calls from NMFS field camps.

Sincerely,

George H. Balazs
Zoologist

cc: Ken Niethammer

GHB:gr

bcc: GHB
HL

COPY

February 20, 1989

To: Tern Island Files

From: Tern Island Staff

SUMMARY OF 1986, 1987, AND 1988 GREEN TURTLE STUDIES
AT TERN ISLAND, FRENCH FRIGATE SHOALS

During 1986, the U.S. Fish and Wildlife Service in cooperation with the National Marine Fisheries Service began to monitor green turtle (Chelonia mydas) nesting activity at Tern Island, French Frigate Shoals. The general objectives of this multi-year study are to monitor nesting and hatching phenologies, hatching success, and avian and ghost crab predation of hatchlings.

The Tern Island facilities are staffed year-round by FWS employees and volunteers. This year-round presence makes studies of seasonal nesting and hatching phenologies more practical than at other locations (i.e. East Island) where the logistics of operating 8 or 9 month field camps become formidable. Another major consideration in conducting turtle research on Tern Island is related to the condition of the seawall. The Tern Island seawalls will need to be replaced, removed, or left to continue rusting away. Information on green turtle use of Tern Island (nesting and hatching phenologies, location of nests, numbers of turtles nesting on Tern Island, numbers of hatchlings produced, and etc.) will be an important consideration in making a decision on the fate of the seawalls.

This document contains a summary of 1986 and 1987 nesting and hatching phenologies and hatching success data. Copies of the raw data for those years can be found in the "Summary of 1986 and 1987 green sea turtle nesting and hatching success studies at Tern Island". In addition to the above, this document contains a summary and copies of the 1988 green turtle study data which covers nesting and hatching phenologies, nesting female tag identifications, hatching success, and great frigatebird (Fregata minor) predation of turtle hatchlings.

STUDY AREA

Tern Island (Lat. 23° 52' N, Long. 166° 17' W) is found on the northwestern rim of French Frigate Shoals (FFS), about 500 miles west-northwest of Honolulu, Hawaii. During World War II, the Navy enlarged the original 11 acre islet into a 37 acre island that could accommodate aircraft. From 1952 to 1979, the U.S. Coast Guard operated a LORAN transmitting station at Tern Island. Since 1979, the U.S. Fish and Wildlife Service has occupied Tern Island for the purposes of managing the Hawaiian Islands National Wildlife Refuge, performing research, and assisting other agencies in research projects.

About 3000 ft. of Tern Island's south-facing shoreline provides easy access and good substrate for nesting green turtles. Most of the remaining shoreline consists of exposed seawall or rocky beaches. The exposed seawall prohibits access to the island while rocky beaches do not provide suitable nesting substrate.

METHODS

Research techniques used during 1986, 1987, and 1988 to determine nest locations and hatching success were similar. See the "Summary of 1986 and 1987 green sea turtle nesting and hatching success studies at Tern Island" report for a more detailed account of methods used in those years. The following methods were used during the 1988 nesting season.

To locate nests, identify nesting females, and monitor hatching: beaches of Tern Island were patrolled between 26 April (first nest laid) and 9 December (last nest hatched). While females were coming ashore to nest, patrols were conducted 4 or 5 times nightly (about every 2 hours). After nesting activity ceased, nest sites were checked at sunset and/or in the early morning hours for evidence of hatching. To eliminate as much disturbance as possible to the Hawaiian monk seal (Monachus schauinslandi) and seabird populations, these patrols were limited to the beach zones (at night, most seals "haul out" and are in the interior, vegetated zone of the island). Turtle observers entered the interior vegetated zone only when following tracks of turtles coming ashore.

Nest Locations

Locations of nests were determined by either observing the turtle nesting or by observing the physical characteristics of the turtle's diggings. Usually, a successful nesting attempt can be differentiated from "false pits" by the distinctive evidence of back-filling or covering of the nest. Also, after completing a nest the turtle will normally return directly to the ocean. Locations of nests were recorded on appropriate maps and data forms. Each nest was given a study number and each site was physically marked by placing a stake with the appropriate nest number 150 cm inland of the nest.

Nesting Female Identification

During 1986 and 1987, turtle identification was limited to turtles encountered on the twice nightly patrols (1 hour after sunset and at sunrise). In 1988, we attempted to identify as many of the turtles nesting on Tern Island as possible. Our goal was to identify the female responsible for each nest. To achieve this goal the beaches were patrolled throughout the night (4 or 5 patrols nightly). An effort was made to read any existing tags on each turtle encountered. If the turtle was not tagged, tags

were applied. A curved carapace length and any distinguishing physical characteristics were recorded for each turtle. After a turtle had been identified, a temporary 1988 study letter or number was spray painted on the carapace. This painted identification expedited re-identification of this turtle on subsequent visits to Tern Island, reducing both disturbance to the turtle and effort required from the researcher. Identification, tagging, or any other activity that would disturb the turtle was not done while the turtle was excavating a nest or laying eggs. These activities were done either before nesting or after egg laying.

Tags were applied to either the primary sites (proximal locations on the front flippers) or secondary sites (further out on the front flippers). We tried to ensure that at least two well applied tags were on each turtle. Tags were provided by National Marine fisheries.

Hatching Success

Hatchling emergence was monitored by observing each nest site starting about 50 days after eggs were laid. Almost all "hatching" nests can be detected on the day the hatchlings emerge by watching for pre- and post- emergent pit formations and tracks of hatchlings. If a nest had not "hatched" within 90 days, the nest was excavated and contents analyzed. (Throughout several years of study, mean incubation length for FFS nests has been between 63 and 68 days; extremes have been 54 to 88 days.)

Two to three days after "hatching", nests were excavated to determine clutch size and hatching success. We determined the number of succesfully emerged hatchlings by counting hatched egg shells. The remainder of the nests contents were categorized as follows: unsuccessful eggs (infertile and/or rotten), dead embryos (1/4, 1/2, and 3/4 developed), dead fully developed hatchlings, and live hatchlings trapped in the nest. Any trapped hatchlings were released the following night. After analysis, all nest materials were returned to the excavated pit and buried. The "trapped in the nest" category should be further defined as the number of hatchlings that remained in the nest after two or three days; some of these hatchlings might have eventually managed to emerge on their own.

As in previous years, several nests were found where only the date the eggs were laid or date of hatchling emergence was known. The mean incubation length was used to calculate the missing parameter so that those nests could be included in the nesting and hatching phenologies. Nests with calculated parameters are labeled as such in Appendix A.

Great Frigatebird Predation On Turtle Hatchlings

The diet of great frigatebirds (GRFR) was checked during peak

turtle hatchling emergence to determine whether GRFRs are a major predator of hatchlings at French Frigate Shoals. Stomach contents of adult, juvenile, and nestling GRFRs were analyzed during September 1989. Stomach contents were obtained by inducing regurgitation by pumping salt water into the GRFR's stomachs.

RESULTS

Three nests were laid on the northeastern sandspit. The shape and position of this sandspit changed during the nesting season. When the nests located on the sandspit became exposed or in danger of being exposed, they were transplanted to other locations on the sandspit. Because of this human intervention, data pertaining to incubation period and hatching success of these nests were not included in the following analysis. However, these nests were included in the hatching and nesting phenologies and nest location data. Data pertaining to the incubation and hatching success of these three nests (nests 31, 44, and 56) are included in Appendix A.

Nesting and Hatching Phenologies

During 1988, green sea turtles nested between 26 April and 1 October and nests hatched between 8 July and 9 December (Figure 1.). For comparison to previous years, Figures 2 and 3 show the nesting and hatching phenologies of 1987 and 1986 respectively. Tables 1, 2, and 3 show a monthly breakdown of nesting and hatching activity on Tern Island during 1988, 1987, and 1986; respectively.

Nest Locations

In 1988, 88 nests were located on Tern Island. All but four of these nests were located on the south-facing shoreline. The exceptions were one nest at Shell Beach and 3 nests on the northeastern sand spit (Figure 4). During 1987 and 1986, all nests were located on the south-facing shoreline of Tern Island (Figures 5 and 6, respectively). More detailed locations for the 1988 nests can be found in Appendix B.

Identification of Nesting Turtles

During 1986 and 1987, identification of nesting turtles was limited to those encountered during twice nightly beach patrols. In 1988, the number of beach patrols were increased in order to try to identify as many of the nesting turtles as possible. Two confirmed nesters were identified in 1986, nine in 1987, and 24 in 1988 (Table 4). An additional 10 turtles were observed digging on Tern Island during the 1988 season, but nests were not confirmed for these turtles (Table 4). Even with the increased

effort, we failed to identify nesting females at 16 of the 88 nests (18.2%). Most likely, these 16 nests were laid by females that were identified on other nesting excursions so the total number of turtles using Tern Island is probably quite accurate.

Number of Nests/turtle

Data on the number of nests per nesting female are incomplete because of 2 factors. First, as mentioned previously, females laying 16 of the nests were not identified. Secondly, 22 of the 34 females observed on Tern Island were also observed on either Whaleskate or East Islands. However, an incomplete summary of sightings (all sightings of these turtles from Whaleskate and East Islands have not been included; these data are at NMFS Honolulu Office) shows that almost all turtles attempted to nest between 3 to 7 times during the season, with most nesting 5 to 7 times (Appendix C).

Nesting Activity On Tern Island

The increased effort in identifying nesting turtles did result in more turtles being identified. However, increased nesting activity (based upon the number of nests on Tern Island) is probably responsible for a major increase in the number of females identified. Each of the last three years have shown a marked increase in nests: 23 in 1986, 48 in 1987, and 88 in 1988.

Nesting Turtles Trapped By Man-made Obstructions

In 1988, one nesting female became entrapped between the two seawalls just east of the boat-shed. This turtle was quickly located and released and subsequently nested. No turtles became entrapped in 1987; however, in 1986, Tern Island personnel found and released four adult female turtles that had become entrapped while attempting to nest.

Incubation Periods

Incubation periods (days to hatchling emergence at the surface) were calculated for all nests which had both lay and "hatching" dates. Mean incubation periods for 1988, 1987, and 1986 were 63.2, 63.0 and 67.6; respectively (Table 5). During the three years of Tern Island work, the minimum and maximum incubation periods have been 53 and 85 days, respectively. This wide range of incubation periods cannot be explained by genetic differences in nesting females, as the incubation periods of nests by the same female in the same year show a similar wide range of values. For example, one female laid nests that hatched at 56, 61, 63, 66, and 76 days. Another possible factor is nest site characteristics. When incubation periods of nests within 10 meters of the beach crest (point where the beach starts sloping to the sea) were compared to periods of nests greater than 10 meters from the

beach crest, we found significant differences (at p=0.07 level, TTest) in mean incubation lengths: 64.7 (SD=5.73, 57 nests) and 58.7 (SD=3.90, 19 nests) days, respectively. This is a gross comparison as many factors are probably involved: moisture and organic contents of nesting substrate, elevation above sea level, if the nest site is in a shaded area, nest chamber depth, and etc.

Clutch Size

In 1988, we found a mean clutch size of 96.8 eggs with a range of 54 to 146 eggs (Table 6). Respective mean clutch sizes for 1987 and 1986 were 85.6 and 86.7 (Tables 7 and 8, respectively). The minimum and maximum number of eggs in a clutch for these two earlier years were 36 and 119.

Hatching Success

Nest success data for individual nests can be found in Appendix A for the 1988 nests. Data for individual nests from 1987 and 1986 can be found in the previous year's report " Summary of 1986 and 1987 green sea turtle nesting and hatching success studies at Tern Island". A summary of hatching success parameters for the three years of work at Tern Island can be found in Table 6. Tables 7, 8, and 9 contain individual year summaries for 1988, 1987, and 1986; respectively.

During 1988, 82 of the 85 nests produced hatchlings (data from the three northeastern sandspit nests were not included)(Table 7). Individual nest success ranged from 0 to 100%. The percent of eggs that hatched (defined as the number of eggs that produce hatchlings that made it out of the nest alive) has ranged from 75.4 to 84.8, during the three years (Table 6). A total of 11,410 hatchlings have entered the ocean from Tern Island nests the last three years. The percent of hatchlings found trapped (still in the nest upon excavation) was 10.8 and 10.9 for 1987 and 1986, respectively and 6.5 in 1988. Nests were excavated the day after hatchling emergence in 1987 and 1986, while nests were excavated two to three days after hatchling emergence in 1988. Next year, we plan to excavate nests five days after hatchling emergence to see if "trapped" hatchlings do eventually make it out of the nest three, four, or five days after initial emergence. If in fact this is the case, we should see a further reduction in the percent of trapped turtle hatchlings next year. The percent of bad eggs (rotten or infertile) has remained relatively constant during the last three years: 12.2 to 15.2% (Table 6.)

Great Frigatebird Predation of Turtle Hatchlings

Between 12 and 28 September, stomach contents of 150 great frigatebirds (50 each: adults, juveniles, and nestlings) were

analyzed to determine the extent that turtle hatchlings are preyed upon by this seabird species. As can be seen in Table 1 and Figure 1, September was chosen because it was the peak month of hatchlings emergence (41% of the nests hatched). Another 45% of the nests had already hatched in July and August. Turtle hatchling densities in and around French Frigate Shoals was most likely at its highest level during September.

The number of GRFRs at French Frigate Shoals (most of them are on Tern Island) usually peaks during late August and September coinciding with peak turtle hatchling emergence. During September, several counts put the GRFR population at about 15,000 birds (40% adults, 55% juveniles, and 5% nestlings).

Identifiable foods were found in 110 of the 150 birds sampled (40 adults, 36 juveniles, and 34 nestlings). Stomach contents of these birds are listed in Table 10. No evidence of any turtle hatchlings appeared in any of the samples. Based upon these data, it seems that GRFRs at French Frigate Shoals do not prey heavily on turtle hatchlings.

Often, "wrong way" turtle hatchlings are observed on the Tern Island runway in the daytime. No seabirds have been observed trying to take these hatchlings, even though thousands of birds are overhead. Ruddy turnstones (Arenaria interpres) have been observed feeding on dead turtle hatchlings; however, none have been observed pursuing live hatchlings. Occasionally, a dead turtle hatchling will be found on the roof of one of the Tern Island buildings, or in a shrub under a seabird nesting colony. These hatchlings could be evidence that an occasional hatchling will be taken, or they may be hatchlings that were stranded on the runway, subsequently died, and then were picked up by a bird who then lost interest in the dead hatchling and dropped it.

COMMENTS

Green turtle nesting and hatching activity on Tern Island seemed to be a good indicator of activity throughout French Frigate Shoals. The first nest on Tern occurred about a week before nests were detected on East or Whaleskate Islands and nesting activity seemed to end at about the same time on all islands, late September or early October. It will be interesting to compare seasonal changes in turtle nesting phenology to changes in avian breeding phenologies to see if there is any correlation.

Continued monitoring green turtle nesting on Tern Island will allow us to delve deeper into their breeding biology. In addition to developing better databases for the topics already discussed, we can also examine topics such as: clutch size in subsequent nests from the same female (does it remain fairly constant?), hatching success of subsequent nests from the same female, hatching success of nests laid early in the season compared to ones laid in mid-season or at the end of the season, relay intervals within a season, re-nesting cycles, and etc.

Table 1. Nesting and hatching phenology of green sea turtles at Tern Island, French Frigate Shoals, 1988.

Activity	Month									Total
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Nesting	2(2.3)[1]	10(11.4)	26(29.5)	34(38.6)	13(14.8)	2(2.3)	1(1.1)	-	-	88
Hatching	-	-	-	13(15.3)	24(28.2)	35(41.2)	11(12.9)	1(1.2)	1(1.2)	85

[1] Number of nests (% of total nests).

Table 2. Nesting and hatching phenology of green sea turtles at Tern Island, French Frigate Shoals, 1987.

Activity	MONTH								Total Number Of Nests
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Nesting	1(2)[1]	8(16)	18(36)	15(30)	6(12)	2(4)			50
Hatching			1(2)	8(17)	17(35)	14(29)	6(13)	2(4)	48

[1]Number of Nests (% of Total Nests)

Table 3. Nesting and hatching phenology of green sea turtles at Tern Island, French Frigate Shoals, 1986.

Activity	MONTH								Total Number Of Nests
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Nesting		8(35)[1]	7(30)	6(26)	2(9)				23
Hatching				6(26)	9(39)	6(26)	2(9)		23

[1] Number of Nests (% of Total Nests)

Table 4. Green sea turtles identified on Tern Island, French Frigate Shoals during the 1986-88 nesting seasons. Tag numbers followed by a R or L denote tags in the primary tag site on the right or left flipper. A R or L followed by a parenthesis denotes a tag placed in a secondary tag site; the numbers inside the parenthesis relate to the location of the tag.

1986 Confirmed Nesters

3268R
9896?

1987 Confirmed Nesters

3354L & 3358R	6866R & 6865L
9740R & 9742L	9741R & 9745L
9743L	9747R & 9746L
9750R & 9749L	8106R & 8107L
8216R	

1988 Confirmed Nesters

3120R & 3119L	3268R & 10361L
6041R & 9355L	6374R & 6373L
6867R & 6868L	6870R & 6869L
6872R & 6871L	9771R & 9770L
10261R & 10259L & 10260R(3-4)	10266R(3-4) &10259L
10267R & 10264L &10263R(1-2)	10268R & 10354L
10269R & 6875L(3-4)	10273R & 10272L
10303R & 10302L	10350R
10351R & 10274L	10353R & 10352L
10355R & 10356L	10360R & 10359L(3-4)
10362L	10369R & 10368L
10370R & 10364L	10398R & 10397L

1988 Turtles observed digging on Tern Island but without a confirmed nest

6179R	6355R & 6354L
10231R & 10230L	10270R &10271L
10330R & 10335L	10349R
10358R & 10357L	10374R
10415R(3-4) & 10416L	10530R & 10529L(3-4)

Table 5. Incubation periods[1] of green sea turtle nests monitored on Tern Island, French Frigate Shoals, 1986-88.

Year	Mean	# Nests	Range	SD	SE
1986	67.6	19	60-83	-	-
1987	63.0	34	54-85	-	-
1988	63.2	76	53-76	5.91	0.68

[1]As used here, incubation period is the time (in days) from when eggs were laid until the first hatchlings emerged.

Table 6. Hatching success of green sea turtles at Tern Island, French Frigate Shoals, 1986-88 seasons.

Year	# Nests	Total # Eggs	Hatched(%)[1]	Trapped(%)	Dead - stage of development Full(%)	3/4(%)	1/2(%)	1/4(%)	Bad Eggs(%)
1986	23	1969	1670(84.8)	214(10.9)	5(0.3)	----------53(2.7)[2]-------			241(12.2)
1987	48	4161	3137(75.4)	448(10.8)	88(2.1)	120(2.9)	110(2.6)	76(1.8)	630(15.2)
1988	85	8232	6603(80.2)	534(6.5)	79(1.0)	179(2.2)	141(1.7)	95(1.2)	1135(13.8)

[2] All partially developed hatchlings were lumped together in 1986.

[1] This category consists of all hatchlings that made it out of the nest alive (escaped on their own and trapped)

Table 7. Hatching success summary of 85 green sea turtle nests at Tern Island, French Frigate Shoals, 1988.

Item	Total	% of total eggs	$\bar{x}$ (range)	SD	SE	# nests with item	% nests with item
Eggs	8232	100.0	96.8(54-146)	17.99	1.95	85	100.0
Alive Hatched	6603	80.2	77.7(0-124)	28.15	3.05	82	96.5
Escaped unassisted	6069	73.7	71.4(0-114)	27.27	2.96	82	96.5
Alive-trapped	534	6.5	6.3(0-68)	11.35	1.23	55	64.7
Dead:							
Fully Dev'd	79	1.0	0.9(0-20)	2.53	0.27	26	30.6
3/4 Dev'd	179	2.2	2.1(0-16)	3.15	0.34	47	55.3
1/2 Dev'd	141	1.7	1.7(0-19)	3.03	0.33	42	49.4
1/4 Dev'd	95	1.2	1.1(0-10)	2.11	0.23	29	34.1
Bad eggs	1135	13.8	13.4(0-114)	22.28	2.42	81	95.3

This category includes both rotten and infertile eggs.

Table 8. Hatching success summary of 48 green sea turtle nests at Tern Island, French Frigate Shoals, 1987.

Item	Total	% of Total Eggs	$\bar{x}$ (Range)	# Nests with item	% Nests with item
Eggs	4,161	100.0	86.7 (36-117)	48	100.0
Alive hatched	3,137	75.4	65.4 (0-102)	46	95.8
Escaped unassisted	2,655	63.8	55.3 (0- 96)	46	95.8
Alive-trapped	448	10.8	9.3 (0- 38)	37	77.1
Alive with yolk sac	34	0.8	0.7 (0- 11)	6	12.5
Dead					
Fully dev'd	88	2.1	1.8 (0- 12)	22	45.8
3/4 dev'd	120	2.9	2.5 (0- 11)	31	64.6
1/2 dev'd	110	2.6	2.3 (0- 19)	27	56.3
1/4 dev'd	76	1.8	1.6 (0- 23)	17	35.4
Infertile	61	1.5	1.3 (0- 14)	15	31.3
Rotten	569	13.7	11.9 (0- 67)	43	89.6

Table 9. Hatching success summary of 23 green sea turtle nests at Tern Island, French Frigate Shoals, 1986.

Item	Total	% of Total Eggs	$\bar{x}$ (Range)	# Nests with item	% Nests with item
Eggs	1,969	100.0	85.6 (63-119)	23	100.0
Alive hatched	1,670	84.8	72.6 (30-112)	23	100.0
Escaped unassisted	1,456	73.9	63.3 (21-109)	23	100.0
Alive-trapped	214	10.9	9.3 (0- 60)	21	91.3
Dead					
Fully dev'd	5	0.3	0.2 (0- 1)	5	21.7
1/2 to 3/4 dev'd	53	2.7	2.3 (0- 11)	17	73.9
Infertile or Rotten	241	12.2	10.5 (0- 48)	22	95.6

Table 10. Stomach contents of nestling, juvenile and adult great frigatebirds collected from Tern Island, French Frigate Shoals, during September 1988.

Prey	Combined (110 birds)		Adults (40 birds)		Juveniles (36 birds)		Nestlings (34 birds)	
	N(%)[1]	% Occur.[2]	N(%)	% Occur.	N(%)	% Occur.	N(%)	% Occur.
Fishes	541(89.4)	95.5	220(97.8)	100.0	135(97.8)	97.2	186(76.9)	88.2
Filefish	412(68.1)	66.4	194(86.2)	77.5	108(78.3)	75.0	110(45.5)	44.1
Flying fish	82(13.6)	18.2	6(2.7)	5.0	20(14.5)	16.7	56(23.1)	35.3
Tuna	4(0.7)	1.8	3(1.3)	2.5	1(0.7)	2.8	-	-
Unident.	43(7.1)	18.2	17(7.6)	20.0	6(4.3)	8.3	20(8.3)	26.5
Squid	64(10.6)	15.5	5(2.2)	5.0	3(2.2)	5.6	56(23.1)	38.2

[1] N = number of food items in that category (% of the total number of food items).
[2] % Occur. = the percentage of birds that contained that prey type.

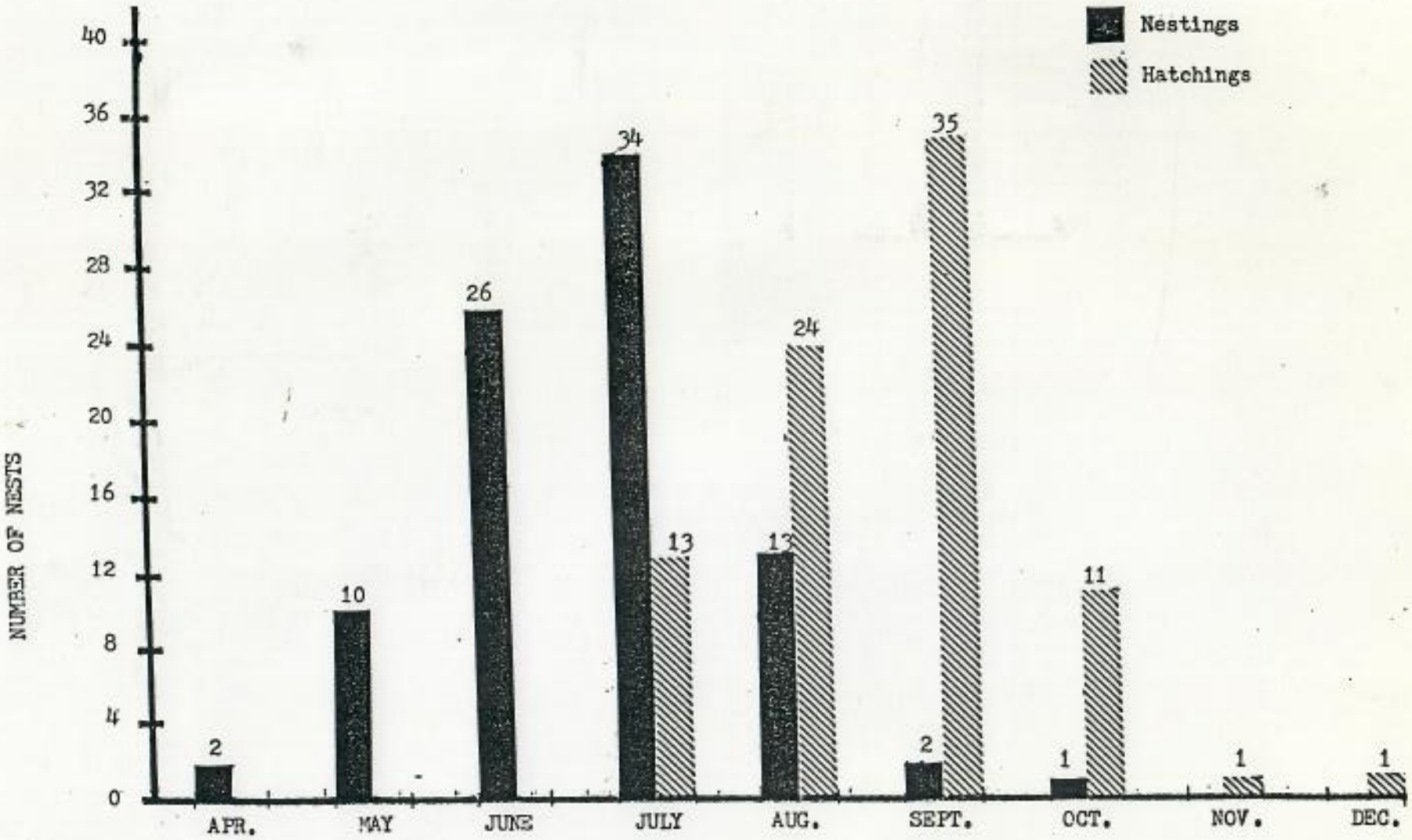


Figure 1. Hawaiian green sea turtle nesting and hatching at Tern Island, French Frigate Shoals, 1988. Eighty-eight nests were observed. The first and last were layed on 26 April and 1 October, respectively. Eighty-five of these nests hatched; the first on 8 July and last on 9 December.

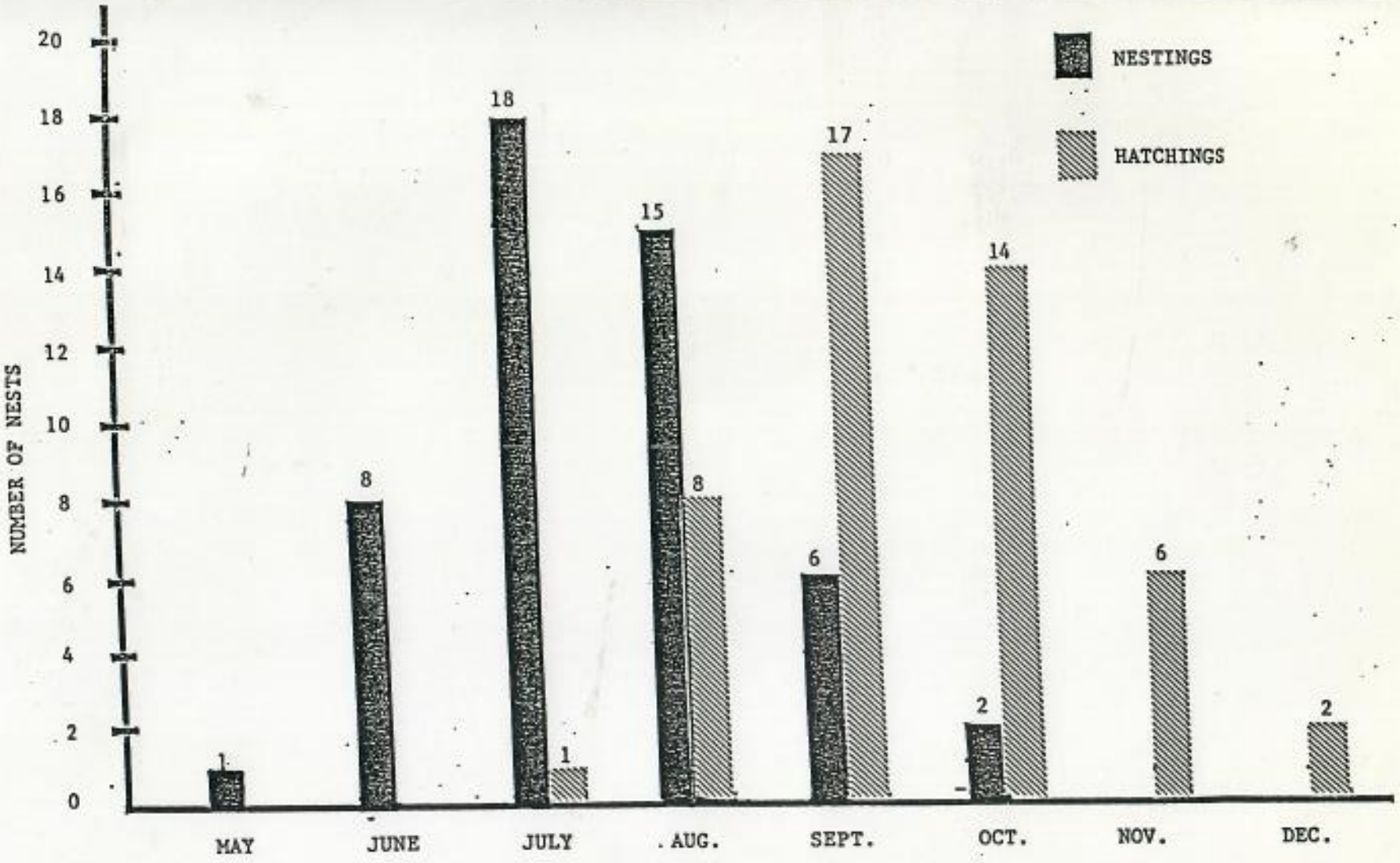


Figure 2. Hawaiian green sea turtle nesting and hatching at Tern Island, French Frigate Shoals, 1987. Fifty nests were detected. The first and last nests were layed on 25 May and 20 October, respectively. Forty-eight nests hatched; the first on 29 July and last on 26 December.

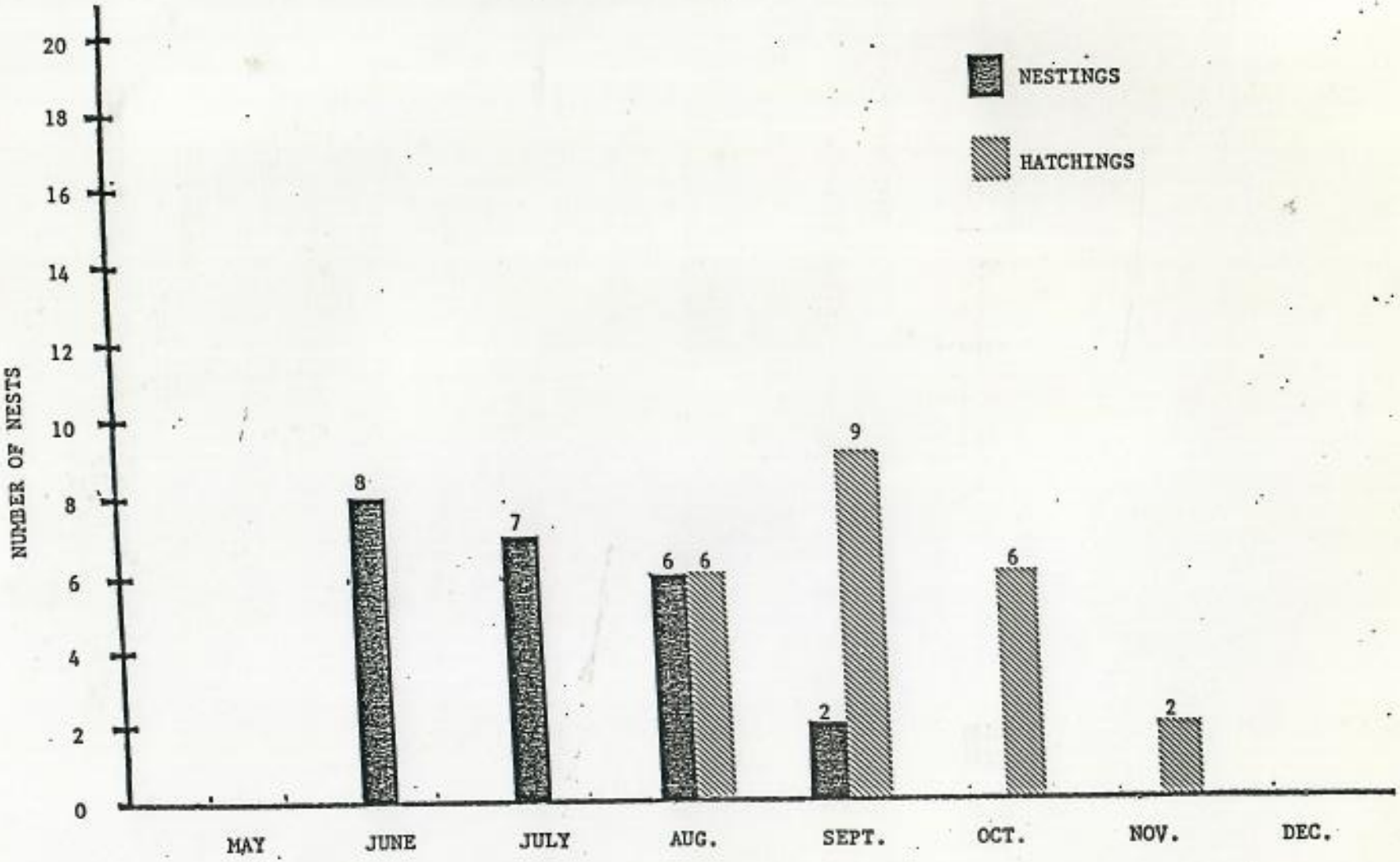
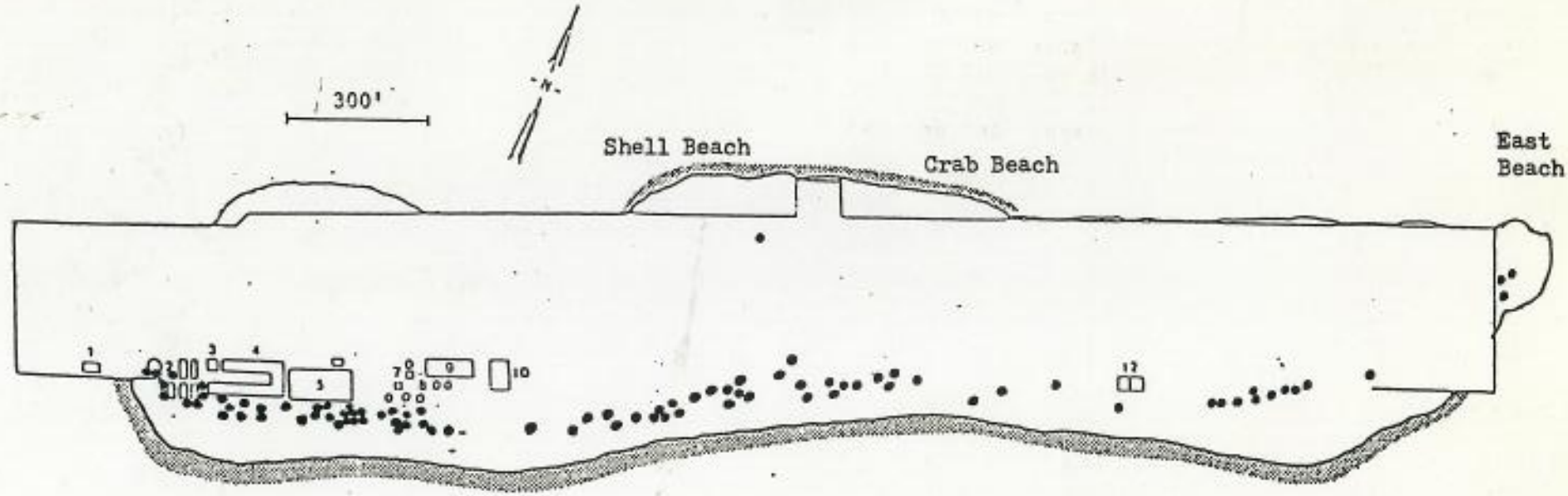


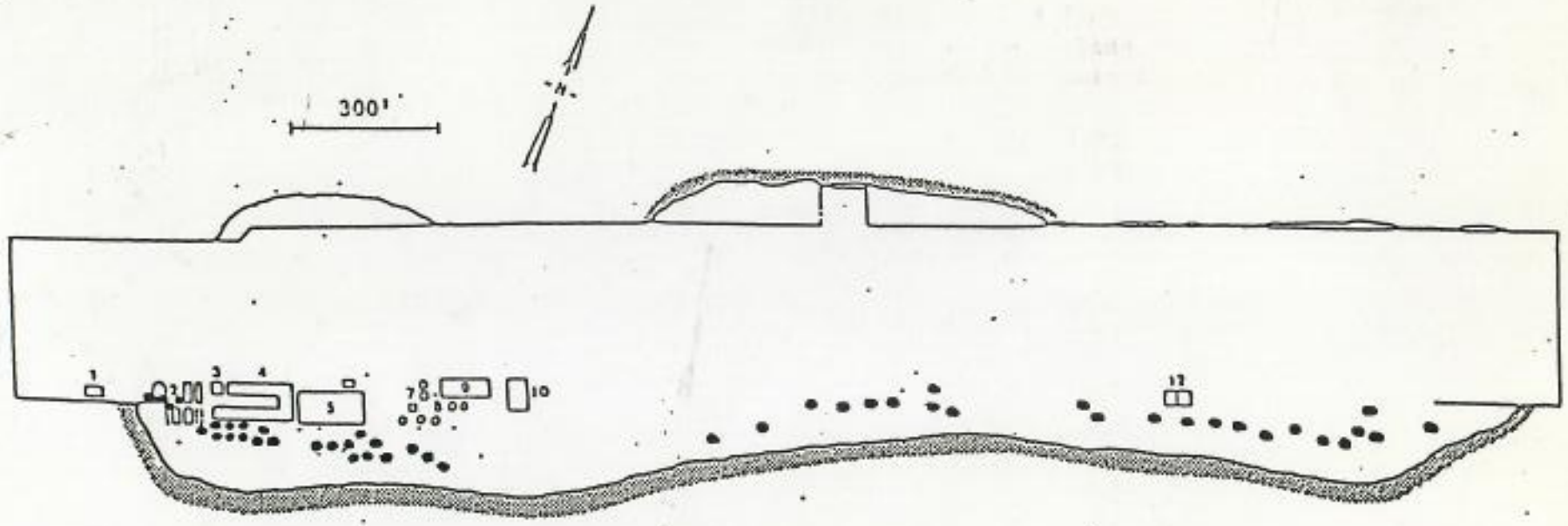
Figure 3. Hawaiian green sea turtle nesting and hatching at Tern Island, French Frigate Shoals, 1986. Twenty-three nests were found. The first and last nests were layed on 6 June and 22 September, respectively. All 23 nests hatched; the first on 15 August and last on 16 November.

Figure 4. Locations of 88 green sea turtle nests found on Tern Island, French Frigate Shoals, 1988.



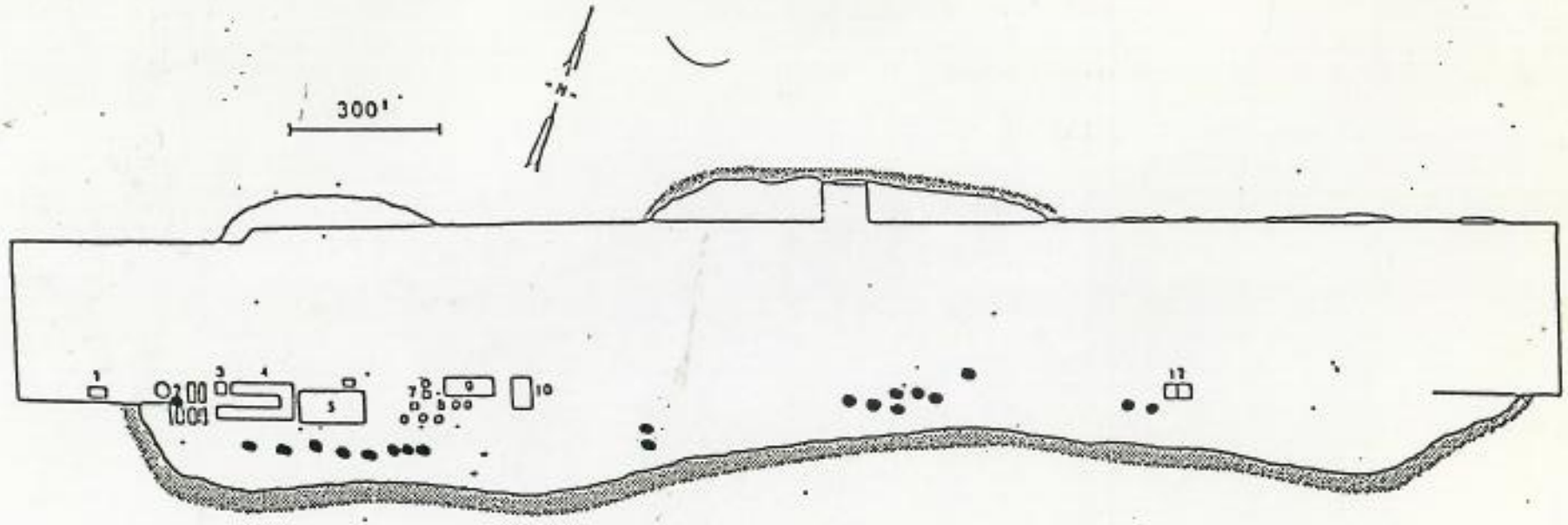
1. Boat House
2. Fuel Oil Storage Tanks
3. Garage
4. Barracks-Subsistence Bldg.
5. Recreation Court
7. Pump House
8. Fresh Water Tanks
9. Signal Power Bldg.
10. Old Signal Power Bldg.
12. Storage Buildings

Figure 5. Locations of 48 green sea turtle nests found on Tern Island, French Frigate Shoals, 1987.



1. Boat House
2. Fuel Oil Storage Tanks
3. Garage
4. Barracks-Subsistence Bldg.
5. Recreation Court
7. Pump House
8. Fresh Water Tanks
9. Signal Power Bldg.
10. Old Signal Power Bldg.
12. Storage Buildings

Figure 6. Locations of 20 green sea turtle nests found on Tern Island, French Frigate Shoals, 1986.



1. Boat House
2. Fuel Oil Storage Tanks
3. Garage
4. Barracks-Subsistence Bldg.
5. Recreation Court
7. Pump House
8. Fresh Water Tanks
9. Signal Power Bldg.
10. Old Signal Power Bldg.
12. Storage Buildings

APPENDIX A

RAW DATA

TTURT:DBF 11/23/88
JLM
#81

GREEN SEA TURTLE

NEST FORM

Island: TERN

Year: 1988

unmarked
unmarked
UNMARKED

Nest #	Nest Date	Time	Location EW	Location NS	Turtle Tag #s	Paint #	# False Pits	Hatch date	Time	# Incubation Days	Stake Position	Comments
X 1	4/26	before 0700	825	56	?	None	0				140cm inland of Nest	
X 2	4/30	0100	558	48	6867 R 6868 L	None	1				"	
X 3	5/02	<0700	49	37	?	None	0				"	
X 4	5/06	0330	518	47	6869 L 6870 R	None	1				900m inland of Nest	
X 5	5/14	0140	363	38	6867 R 6868 L	A Blue	Ø				140 cm inland of nest	
X 6	5/14	0110	821	50	6871 6872	B	0				1400m inland of Nest	Tumors
X 7	5/19	12am-2am	737	56	10259 L 10260 R	C	Ø				5 FT inland of nest	
X 8	5/19	12am-2am	736	56		NONE	Ø				5 FT inland of nest	
X 9	5/20	350am	453	24	[illegible]	D	6				5 FT. inland of nest	
X 10	[illegible]	10pm – 3am	569	55	[illegible]	F	1				[illegible]	[illegible]
X 11	5-29	[illegible]	631	37	[illegible]	R	2				[illegible]	Probable nest Stake 5 FT inland of nest
X 12	5-30	2130	169	51	6374 R 6373 L	yellow J (0)	0				3 FT inland of Nest	
X 13	6-2	[illegible]	867	22	[illegible]	C K	0				3 FT inland of nest	
X 14	6-2	[illegible]	856	26	[illegible]	D	2				5 FT inland of nest	
X 15	6-03	1:00am	718	54	10264 L 10263 R 10267 R	E blue	1				4 ft. inland of nest	
X 16	6-03	1:45am	794	54	10268 R	L Blue	0				5ft inland from nest	
X 17	6-03	4:30am	494	39	9770 L 9771 R	I Blue	2				8ft inland [illegible]	
X 18	6-06	12:34	754	52	6867 R 6868 L	F [illegible] blue	0				5' inland of nest	
~~19~~	~~6-08~~	~~3:27am~~	~~East~~	~~Beach~~	~~6875 L 10269 R~~	~~M~~	~~6~~	No Nest			~~5' from [illegible]~~	
X 20	6-13	3:45am	818	40	6871 L 6872 R	B	6+?				4' inland	
X 21	6-13	4:00am	211	47	6373 L 6374 R	(yellow J) O	0				3' inland	
X 22	6-13	12:15am	707	37	10292 L 10293 R	P	2				5' inland	
X 23	6-14	4-6am	484	41	9770 L 9771 R	I	1				3' inland of Nest	Probable nest
X 24	6-16	0300	862	30	3268	Q	0				4ft east of nest	Probable nest
X 25	6-16	0047	366	48	9355 L 6041 R	R	3				4' inland [illegible]	Eggs seen

TTURT88.DBF
JUM 11/23/88
#81

GREEN SEA TURTLE

NEST FORM

Island: TERN

Year: 1988

Nest #	Nest DATE / Time	Location EW	Location NS	Turtle Tag #s	Paint #	# False Pits	Hatch date / Time	# Incubation Days	Stake Position	Comments
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO NEST			[illegible]	[illegible]
(27)	6-18 [illegible]	697	50	[illegible]	[illegible]	[illegible]			4ft inland	Probable nest - Probably 2nd Turtle
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(29)	6-19 [illegible]	[illegible]	44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(30)	6-19 AM?	307	38	?	?				4FT inland	Probable nest
31	6-19 AM?	114	45	?	?	No Nest			Not Staked	Probable nest - [illegible]
(32)	6-[illegible] [illegible]	East Beach			I Probable				3FT north of nest	Probable nest - Probable Blue J
(33)	6-20 0130	734	55	6867R 6868L	A	0			5 FT inland	Good nest
34	6-20 [illegible]	821	40	10236R 10267R	E	NO NEST			4FT inland	Probable Nest
(35)	6-26 1215	845	41	6871	B	0			2FT inland	Probable nest
(36)	6-26 0100	715	52	6869	D	1			4½ FT inland	Far side nest
(37)	6-26 0400	474	40	9770	I	5			4½ FT inland	Probable nest
(38)	6-27 05:50	480	44	6374R 6313L	O	3+			4 4ft inland	Probable nest
(39)	6-28 0130	137	48	3120R 3119L	H	2			4 ft inland	Probable nest
P1	6-29 [illegible]	189	45		NO NEST					Possible Nest - Too far
(40)	6-29 11:30 PM	161	52		T				4ft inland	Far side nest
(41)	6-29 AM?	867	22	?	?				4ft to W	Probable nest / track (R)
(42)	7-2 2AM	806	54		L ?				3ft inland	Probable nest
(43)	7-2 2AM	733	56		A				4ft inland	Probable nest
P2 P3	7-2 4AM	444	44		R/C ?	No Nest			No Stake	Possible nest
(44)	7-2 8AM	Eroded			J/S				5ft inland	Far Side nest
(45)	7-3 AM?	169	52		C?				4ft inland	Probable nest
(46)	7-3 8:17	831	37	9755L (L) 6041 (R)	R				6 ft inland	Probable nest
(47)	7-3 8:35	735	56	10239R (L) 10760 (R)	W				4 ft inland	
(48)	7-5 8:30AM	448	44	10264R 6875L (3-4)	M				4 ft inland	Probable NEST

3120

JLH #81

GREEN SEA TURTLE

NEST FORM

Island: TERN Year: 1988

Nest #	Nest Date / Time	Location EW	Location NS	Turtle Tag #'s	Paint #	# False Pits	Hatch date / Time	# incubation Days	Stake Position	Comments
49	7/9 4AM	531	52		I	3			4ft inland	[illegible] nest
P3	7/9 AM?	710	59	?	?	0			No Stake	
50	7/9 5AM	474	35		E?	5			[illegible]	[illegible] nest
51	7-9 6AM	432	36	6374 R	O	-			4ft inland	Probable 12 ft [illegible]
52	7-11 5AM	394	26		H	—			4FT inland	Probable ↗ stake
53	7/13 12:30am	445	37	10352 L 10353 R	T	—			6ft inland	[illegible]
54	7/13 450	514	47		Y				4FT INLAND	EGGS SEEN
55	7/14 10[illegible]	692	62		L				4FT inland	Possible
56	7/15 12[illegible]	East Beach			J				3ft [illegible]	Probable
57	7/15 2AM	627	60		Q?				4Ft [illegible]	Probable nest
58	7/16 2AM	752	50		Z	2			4FT inland	Probable
P4	7/16 4AM	709	58		R?				No stake	Possible
~~P5~~	~~7/15 AM?~~	~~268~~	~~46~~	?		No Nest			~~No stake~~	~~Possible 2 pits [illegible]~~
59	7/17 0300	58A	[illegible]	10302 L 10303 R	Yellow V	Trace of White on Yellow			4FT INLAND	For Sure - white paint #?
60	7/17 1130	432	35		M				4FT INLAND	Probable
~~61~~	~~7/17 9[illegible]~~	~~492~~	~~44~~	10364 L	Blue I	I	NO NEST		~~2ft inland~~	Probable
62	7/17 [illegible]	436	51		[illegible]				3ft [illegible]	Probable
63	7/11 3AM	36	130		W				4ft [illegible]	Probable
64	7/20 [illegible]	455	32	1771 R 1772 L	I				stake 2FT west	[illegible] N [illegible]
65	7/21 between 2 & 5AM	750	51		?				4ft inland	unknown Possibly U
~~66~~	~~7/23 ~0100~~	~~631~~	~~62~~		E		NO NEST		~~4ft inland~~	~~Probable~~
67	7/24 0500	125	49		O				4ft inland	Probable
~~P6~~	~~7/23 0530~~	~~332~~	~~38~~		Maybe blue R	NO NEST			2FT MAKAI	Possible nest - [illegible] her [illegible] back [illegible]
68	7/25 0530	695	62		Maybe B				2ft Inland	
69	7/25 0430	518	46		H				3ft. Inland	

A-3

JLM #81

GREEN SEA TURTLE

NEST FORM

Island: TERN FFS

Year: 1988

Nest #	Nest Date / Time	Location EW	Location NS	Turtle Tag #s	Paint #	# False Pits	Hatch date / Time	# Incubation Days	Stake Position	Comments
70	7/26 1215	406	33	10352L 10353R	T	2			4FT inland	For Sure
~~71~~	~~7/29 0430~~	East Beach			~~I~~	~~?~~	No Nest		~~4FT inland~~	~~Probable~~
72	7/28 1000	761	56	10397L 10398R	Yellow 84	?			4FT inland	For Sure
73	7/29 1230	707	56	10354L	L	?			4FT inland	For Sure
74	7/29 1215	516	50	9355L	R	?			4FT inland	For Sure
~~75~~	~~7/29 1130~~	526	43	10365L 10366R	~~Z~~	~~3~~	NO NEST		~~4FT inland~~	~~Probable~~
76	7/30 [illegible]	188	45	?	?	4			4FT inland	Probable MAybe White Nest
77	8/01 0115	404	35	9770L	I	3			4FT inland	Probable Nest
78	8/03 1245	401	28	?	? "U"	0			☆ 4FT MAYBE	Probable Nest
79	8/04 0130	795	54		W	1			4FT inland	Probable
80	8/04 0130	742	58		C	1			4FT inland	Probable
81	8/06 0400	680	67	10368L 10369R	3	2			4FT inland	Probable
~~83~~	~~8/08 70100~~	~~82~~	~~41~~	6373L	~~O~~	~~4~~	NO NEST		~~4FT inland~~	~~Probable~~
82	8/08 70100	420	35		?	6			4FT inland	Probable
~~77~~	~~8/06 ?~~	536	48		H	3	No Nest		~~2FT MAYBE~~	MAYBE at 558 53
84	8/11 0500	776	44	10397L	Yellow 84	2			4FT inland	For sure nest
85	8/11 0300	478	37	9355L	R	4			3FT Maybe	Probable
~~87~~	~~8/04 ?~~	~~68~~	~~62~~		~~?~~	~~0~~	NO NEST		2FT inland	?
86	8/15 0200	142	49	10350R	Yellow 29	4			4FT inland	Probable
87	8/17 0130	811	42	10359L	W	3			4FT inland	For Sure
~~89~~	~~8/14-8/16~~	Shell Beach		?	?	~~2~~	WASHED OUT 11/5		4FT Inland	MAYbe
88	8/21-0145	746	54	10353R	T	3			4FT inland	Probable
~~89~~	~~9/22-0500~~	~~354~~	~~34~~	~~10360L~~	~~3~~	~~3~~	NO NEST		~~4FT inland~~	~~Probable~~
90	8/24 1230	525	47	9355L	R	2			2FT inland	For Sure
~~91~~	~~8/27 ?~~	Shell Beach		?	?	3			4FT inland	Probable

NEST FORM

Island: Tern

Year: 1988

Nest #	Nest Date / Time	Location EW	Location NS	Turtle Tag #s	Paint #	# False Pits	Hatch date / Time	# Incubation Days	Stake Position	Comments
~~92~~	~~8/29 0400~~	~~448~~	~~34~~	~~10370R 10364L~~	~~#1~~	1	NO NEST		4FT inland	
93	9/03 2020 Called	846	41		(V?)	0?	10/30 1930 2030		2FT inland	Possible Valve 10365R 10366L
94	9/12 0150	476	37	10370R 10364L	#1			*2FT MAKAI		
95	10/1 0630	211	46			4	12/9/88 PM		4FT inland	did not see turtle PROBABLE

A-5

TTURTSB.DBF
JLM 11/25/08 #81

GREEN SEA TURTLE

HATCHING SUCCESS FORM

Island: TERN Year: 1988

Nest #	Hatch date/Time	pre-hatch pit	Total Eggs	"Alive" Hatched	Alive: Escaped unassisted	Alive: Trapped OK	Alive: Trapped Yolk	Dead but developed: Full	Dead but developed: 3/4	Dead but developed: 1/2	Dead but developed: 1/4	Bad Eggs: Infert	Bad Eggs: Rotten	Comments
2	7/8 PM	?	67	35	35	—	—	1					31	
1	7/12 ? PM	?	128	53	27	26			16	19	5		35	Rotten eggs Trapped lots of turtles
6	7/15 930 PM	Yes	109	109	100	9								
3	7/16-17? AM	Yes	114	89	85	4			3		2		20	
4	7/18 930 PM	Yes	85	74	73	1		1	2				8	
9	7/17-18?	?	97	95	71	24			2					Large rocks tra... Min.
7	7/24 PM-AM	NO	109	83	82	1		1	1	1			23	
11	7/27 900 PM	Yes	100	91	74	17		1	4				4	Turtles. Trapped 4 and Large coral debris
14	7/27 9:30 PM	?	91	73	44	29		3	10	1			4	Turtles TRAPPED UNDER Large coral debris
5	7/29 10:00	Yes	77	76	76	—							1	pre hatch pit formed 24 hrs before
8	7/29 8:45	Yes	128	122	114	8							6	Pre hatch pit formed 2 days before hatch
12	7/29 9:15	Yes	105	72	69	3		2	3	6			22	Pre hatch pit formed 2 days before hatch
13	7/30 AM-AM?	?	119	103	98	5		2	2				12	
16	8/01 9:15	Yes	101	85	79	6		1	10				5	
17	8/02 AM-AM	NO	124	107	94	13		-	6	3	4		4	About 25 more came out second night
10	8/02 AM-AM	NO	54	51	50	1			1				2	
24	8/08 PM-AM	Yes	111	104	36	68			2	1	1		3	Several Large roots [illegible]
18	8/09 10PM	Yes	95	81	52	29	—	1	6	10	6	C	11	Large rock
27	8/10 1030PM	NO	102	89	60	29		3	1	3	1		5	A few Fist sized Rocks
UNMARKED	8/13 930-1000	?	95	89	84	5		3	2				1	Large ... 8.0 X 34
29	8/14 ?	Yes	102	80	70	10			9	6	2		6	
22	8/17 915	?	106	92	92	—			3	2	3		6	
23	8/18 915	Yes	118	111	107	4			-	1	-		6	
21	8/18 930	Yes	118	91	86	5			9	7	2		9	
20	8/19 915	Yes	104	100	95	5			1			2	1	

JLH #81

HATCHING SUCCESS FORM

Island: TERN FFS **Year:** 1988

Nest #	Hatch date / Time	pre-hatch pit	Total Eggs	"Alive" Hatched	Alive: Escaped unassisted	Alive: Trapped OK	Alive: Trapped Yolk	Dead, but part. developed: Full	3/4	1/2	1/4	Bad Eggs: Infert	Rotten	Comments
41	8/23 ?	?	121	115	109	6			4				2	
36	8/25 2030-2000	NO	97	41	40	1		3	2	2	2	2	45	
30	8/25 2030-2000	NO	104	88	87	1		.1	9	1	1		4	
33	8/26 1100	Yes	71	70	68	2							1	R. trapped near surface
35	8/27 2AM-0700	Yes	89	85	68	17			1			1	2	1 out alive near surface
45	8/27 945PM	yes	78	65	53	12			1	3	2		7	Trapped - under 2 big rocks
42	8/28 2000-2100	yes	99	93	90	3					1		5	most trapped
46	8/29 0200-0700	yes	100	96	89	7				1			3	[illegible]
40	8/30 8-9:30 PM	Yes	90	75	72	3			1	3	5	1	5	Shallow pit [illegible]
37	8/31 8-915PM	Yes	106	98	95	–			2		3		3	
39	8/31 930 PM	Yes	67	60	60			1	1	3			2	
38	9/1 8-10PM	Yes	109	102	108	–				1				
32	9/03 7-9PM [illegible]	NO	See nest 7 comment	22	14	8	–	–	1	–	–	–	–	Nest moved twice
25	9/03 7-9PM [illegible]	Yes	97	66	63	3		3	7	10			11	
?	9/04 7-9PM [illegible]	Yes	93	89	87	2							4	Place [illegible] location [illegible] 233-52
43	9/06 845PM	Yes	83	79	79	–							4	
47	9/06 ~915PM	NO	97	84	41	3			2			1	10	[illegible]
P3	9/07 ~930PM	NO	93	84	79	5			1	5	1		2	
52	9/11 PM? PM	Yes	84	92	82								2	
57	9/11 PM? PM	NO	129	110	110				1	2	3		13	
50	9/12 PM-PM	?	92	55	53	2				4	6	4	23	[illegible]
63	9/13 8-9PM	NO	96	73	73	1				1	2		20	
44	9/15 8-915	Yes	104	72	61	11	–	20	5	–	–	–	7	–
64	9/14 930	NO	146	124	73	51		9	7	4			2	emerg. two [illegible]
55	9/14 8-1130 PM	Yes	84	83	80	3			2	2			2	

Not marked (beside nest ?); Transplanted twice (beside nest 44)

A-7

HATCHING SUCCESS FORM

JLM B91

Island: TeRN FFS

Year: 1988

Nest #	Hatch date / Time		pre-hatch pit	Total Eggs	"Alive" Hatched	Alive Escaped unassisted	Trapped OK	Trapped Yolk	Dead but part. developed Full	3/4	1/2	1/4	Bad Eggs Infert	Rotten	Comments
49	9/15	930-1200	NO	113	106	73	33		2	1	2	2			Coral rubble
Unmarked Nest	9/15	12-2 AM	?	89	49	49			1	1	4	7	1	26	425X36 location [illegible]
51	9/16	10-1230	NO	116	70	66	4		3	11	13	9		10	[illegible]
62	9/16	8-9PM	Yes	101	91	85	6			1	4		1	4	
P4	9/16	8-9AM	Yes	80	78	66	12							2	Another 10 was at the surface - Not counted at all
48	7/18	8 PM	No	104	57	56	1				3	6	1	27	
53	9/19	10:12pm	NO	104	98	97	1		1					5	
15	8/07	?	?	87	33	33	-			3	2			49	
56 (struck through)	9/23	good approximate	date	78	36	—	—	—	3	5	—	—	—	34	Dug up Late 2 days before hatch because beach erosion
60	9/23	0100 0700	NO	117	78	78			1					38	
69	9/23	2000 2300	—	58	57	56	1							1	
54	9/23	2000 2300	—	86	72	61	11		4	2				7	
58	9/24	9PM	[illegible]	95	2	2								93	Bad Nest
73	9/25	9PM [illegible]	YES	82	76	76	0	0	0	0	1	2		3	
67	9/25	[illegible]	—	114	103	99	4		0	0	1	0		10	root trapped 4 hatchlings
68	9/26	9PM 11PM	—	63	59	59	[illegible]	[illegible]	[illegible]	2	0	[illegible]		2	
76	9/27	8:30[illegible]	YES	85	55	53	2	[illegible]	5	3	4	10	1	10	
78	9/27	[illegible]	?	82	67	55	12		1	7				7	Turtles trapped in old buried branches
70	9/30	[illegible]	YES	109	105	105								4	
59	9/29	[illegible]	NO	104	92	92	0	0	0	2	2			3	
[illegible]	9/30	[illegible]	YES	106	100	100					2			4	
81	10/5	7:30[illegible]	YES	70	51	43	8		1	2	6	4		6	On 10/9 went to dig [illegible] (stopped digging)
77	10/6	6:45PM	YES	109	104	103	1		1			1		1	
74	10/6	7:00PM	NO	108	105	105	.				2			1	
80	10/11	7:45PM	NO	76	73	72	1				1			2	

JCM #81

HATCHING SUCCESS FORM

Island: TERN

Year: 1988

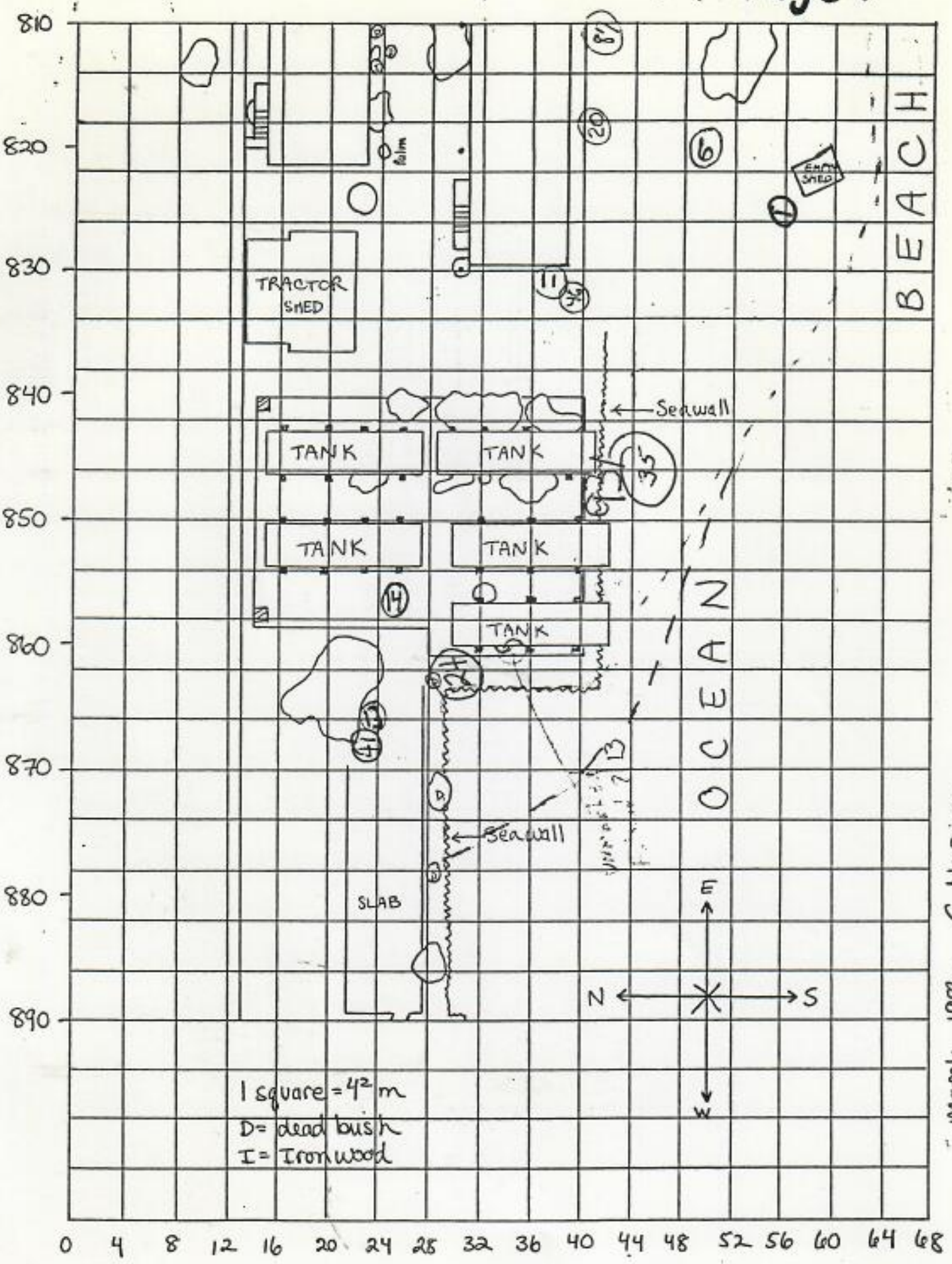
Nest #	Hatch date/Time	pre-hatch pit	Total Eggs	"Alive" Hatched	Alive: Escaped unassisted	Alive: Trapped OK	Alive: Trapped Yolk	Dead but developed: Full	Dead but developed: 3/4	Dead but developed: 1/2	Dead but developed: 1/4	Bad Eggs: Infert	Bad Eggs: Rotten	Comments
87	10/14 1930h	YES	111	109	104	5			1				1	2 found under house dead coral rubble pecked
86	10/18 1900h - 0630h	NO	68	56	56				4	1	3		4	wet sand
88	10/19 1845	YES	85	82	82								3	
82	10/6 1900	NO	112	107	107						2		3	MARKED 83 ON TAG BUT #2 ON MAP
90	10/25 1900 - 0610	NO	104	96	96				4	1.			3	
T65	BETWEEN ? 9/14 & 10/21	NO	57	51	51						2		4	dug up after 90 days
93	10/30 1830 2030	YES	119	113	108	6							5	2 nights to hatch SEE BACK
72	NO HATCH	—	114										114	water inundated nest
84	NO HATCH	—	102										102	18" deep
91	EST 1st week in November	?	78	4	4								74	coral substrate
94	NO HATCH	—	58										58	
85	UNKNOWN OCT	?	109	108	108								1	
95	12/9/88.	?	103	85.	81	4				5			13	sand wet

A-9

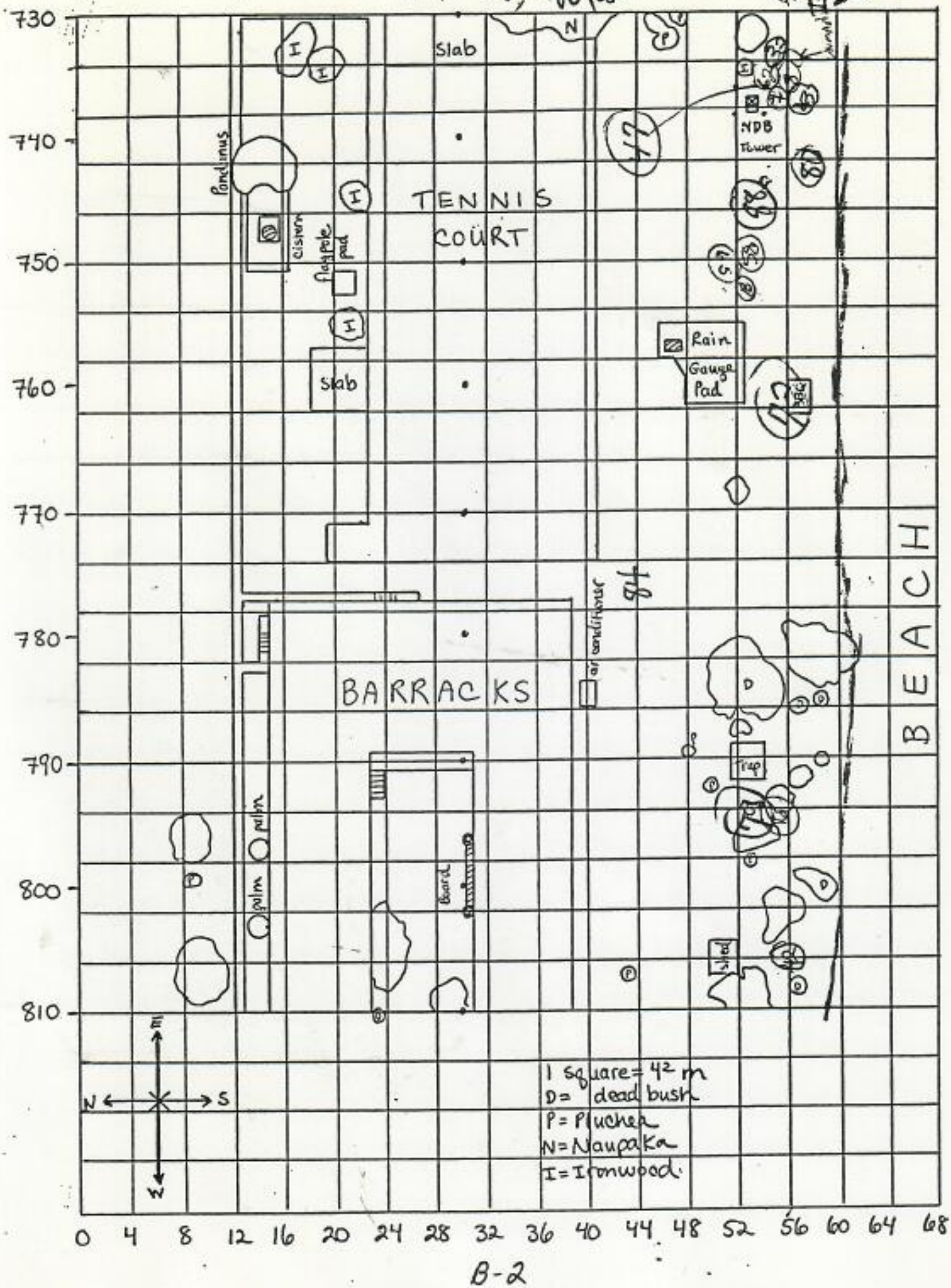
APPENDIX B

NEST SITE LOCATIONS

SECTOR 1,6,11,14,20,35,93 Page 1



SECTOR 79, NESTS 7, 9, 16, 33, AA, 45, 79, 80, 88, 96, 172



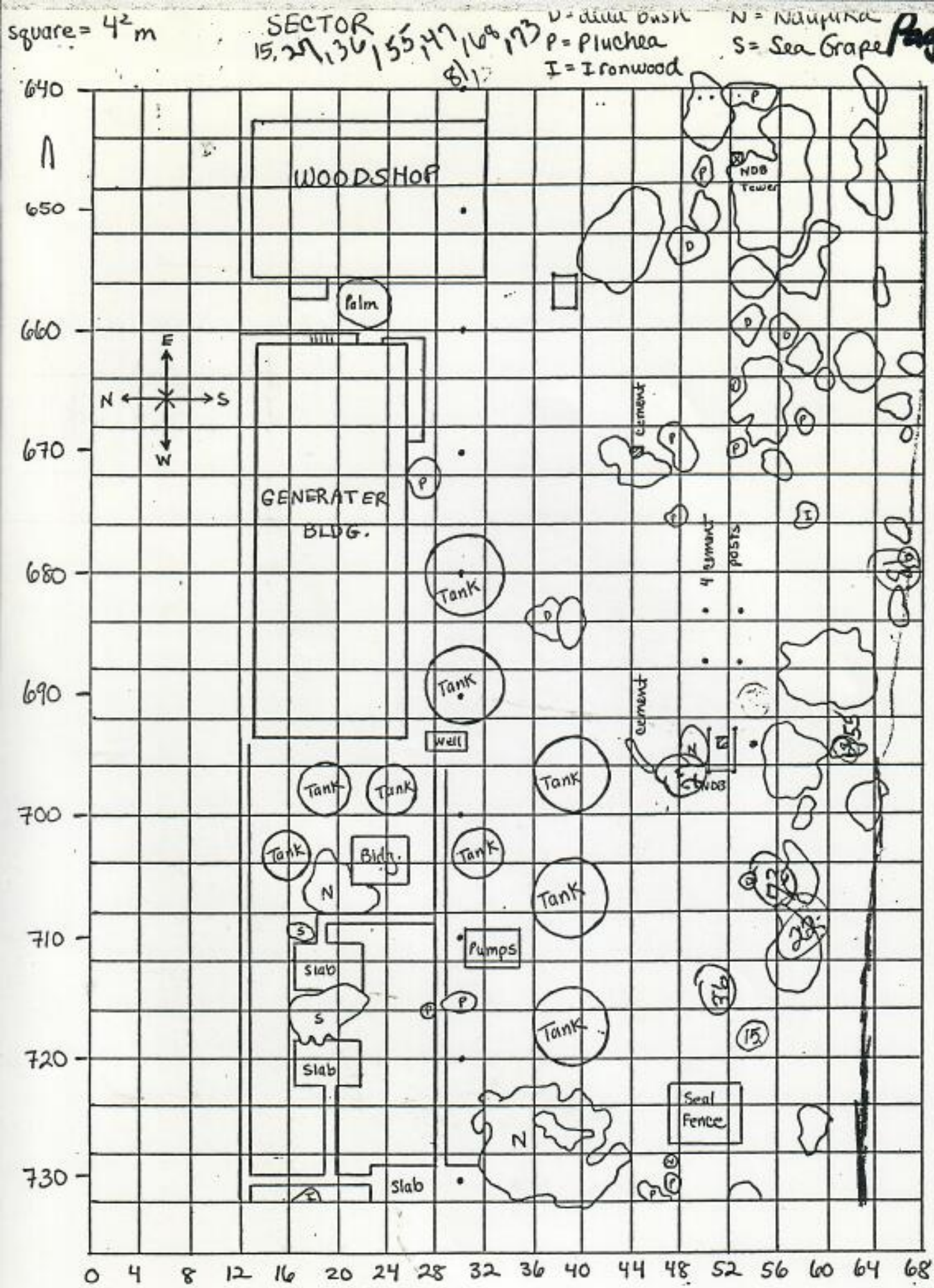
B-2

March 1986 G. Narum

square = 4^2 m

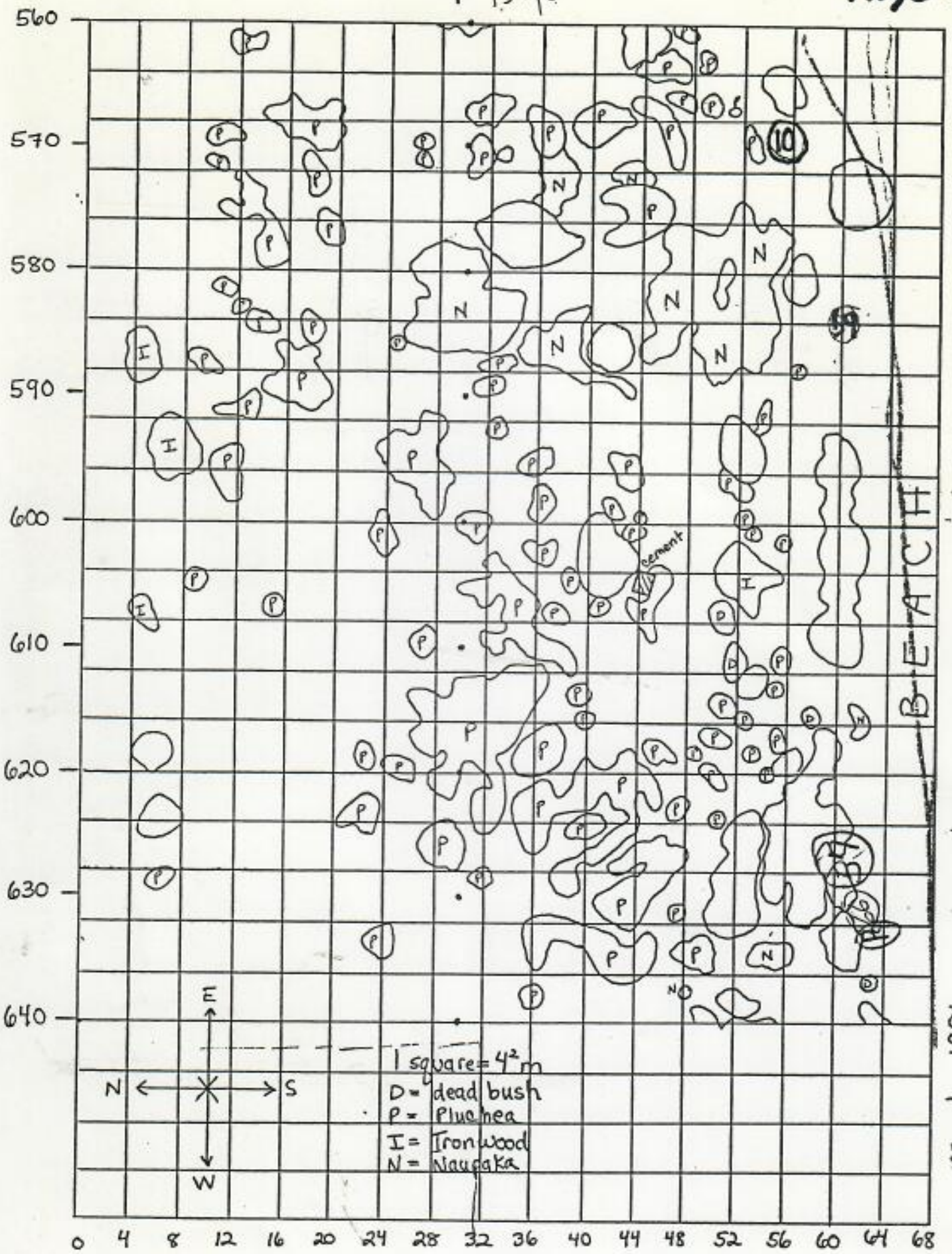
SECTOR 15, 29, 36, 155, 147, 168, 173

D = Dillenia bush
P = Pluchea
I = Ironwood
N = Naupaka
S = Sea Grape

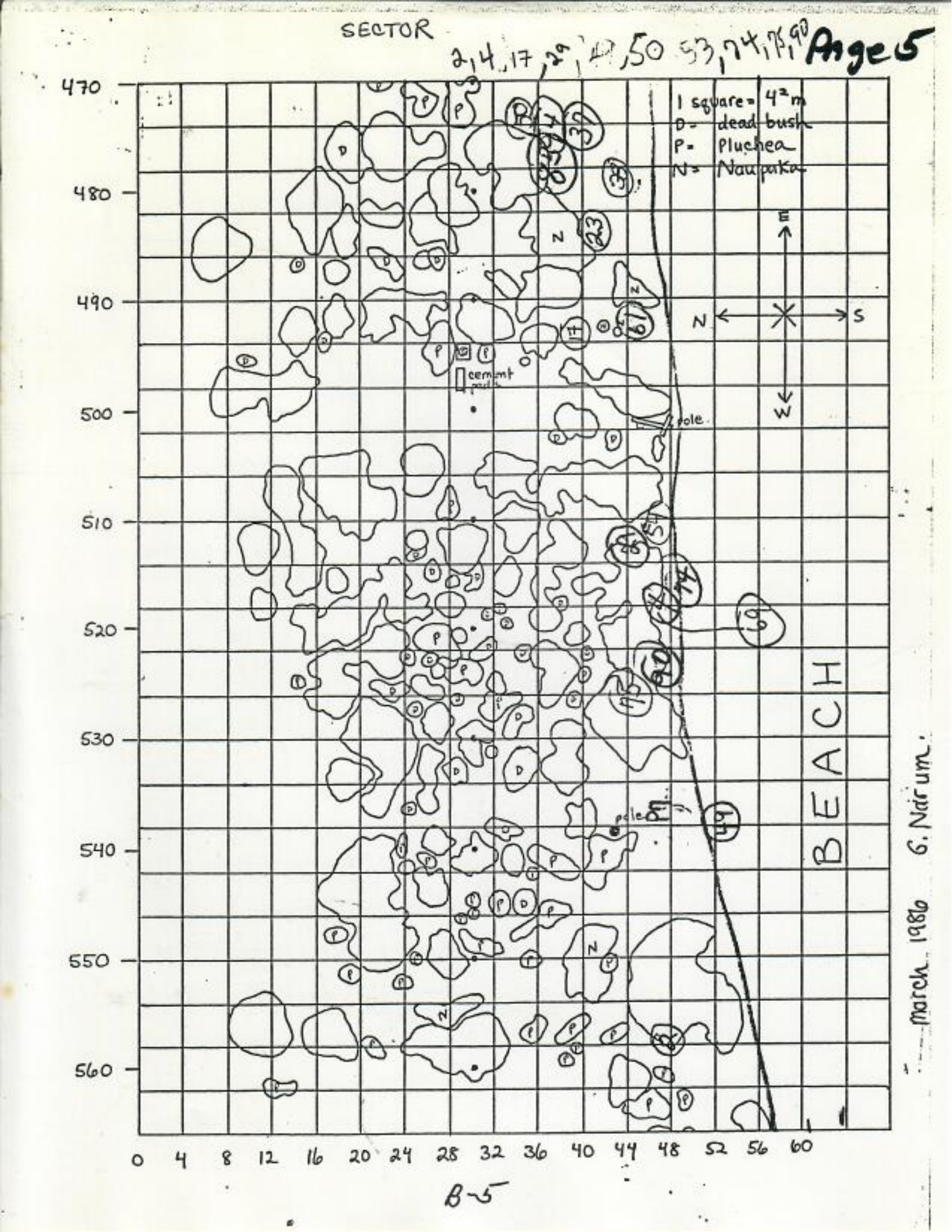


G. Narum
March 1986

SECTOR #10, 57, 59, 166

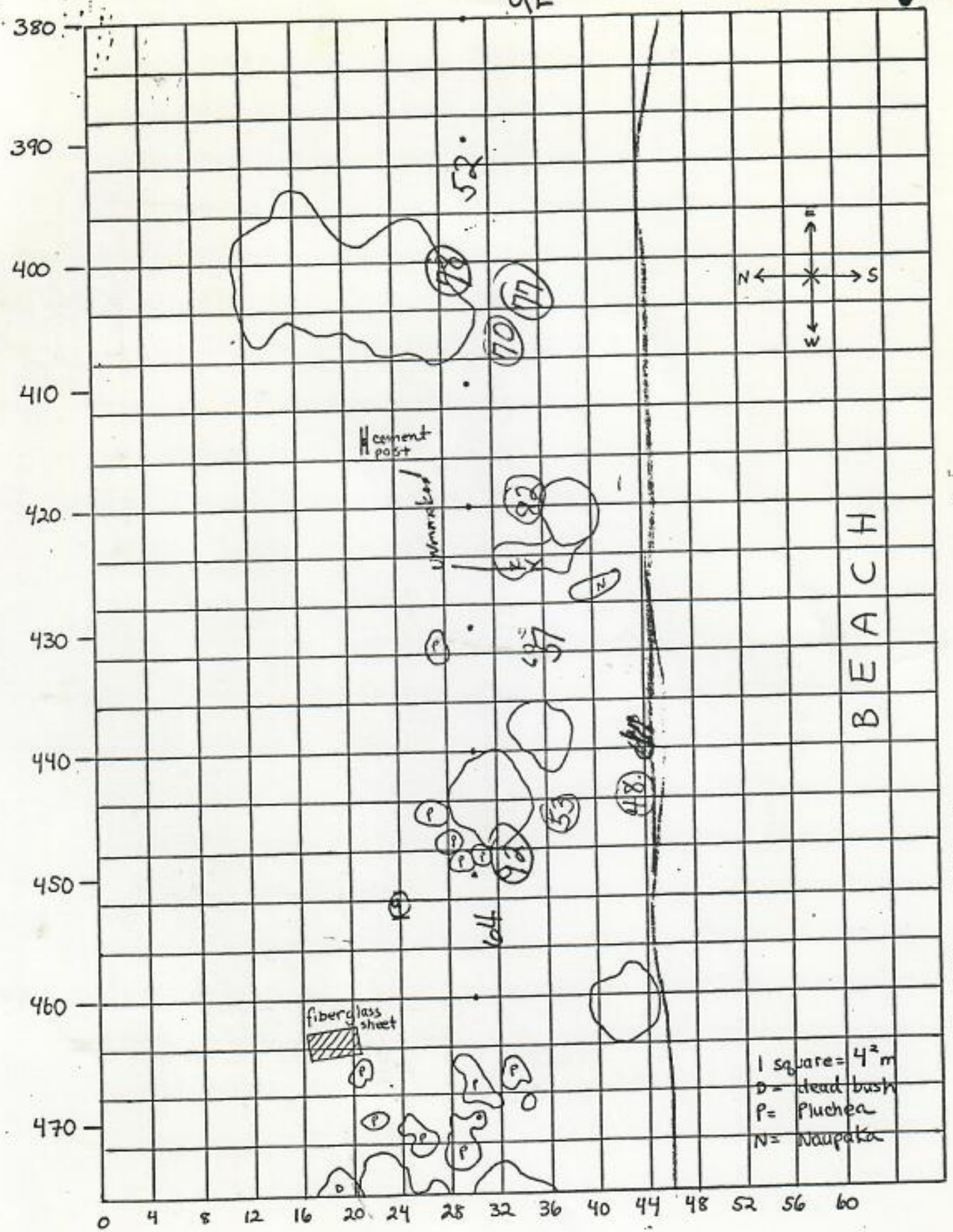


March 1986 G. Narum


SECTOR
2, 4, 17, 29, 40, 50 53, 74, 75, 90
Page 5
1 square = 4² m
D = dead bush
P = Pluchea
N = Naupaka
E
N
S
W
cement pad
pole
pole
BEACH
470
480
490
500
510
520
530
540
550
560
0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60
B-5
March 1980 G. Nakum.

SECTOR 1/52, 15', 15', 77

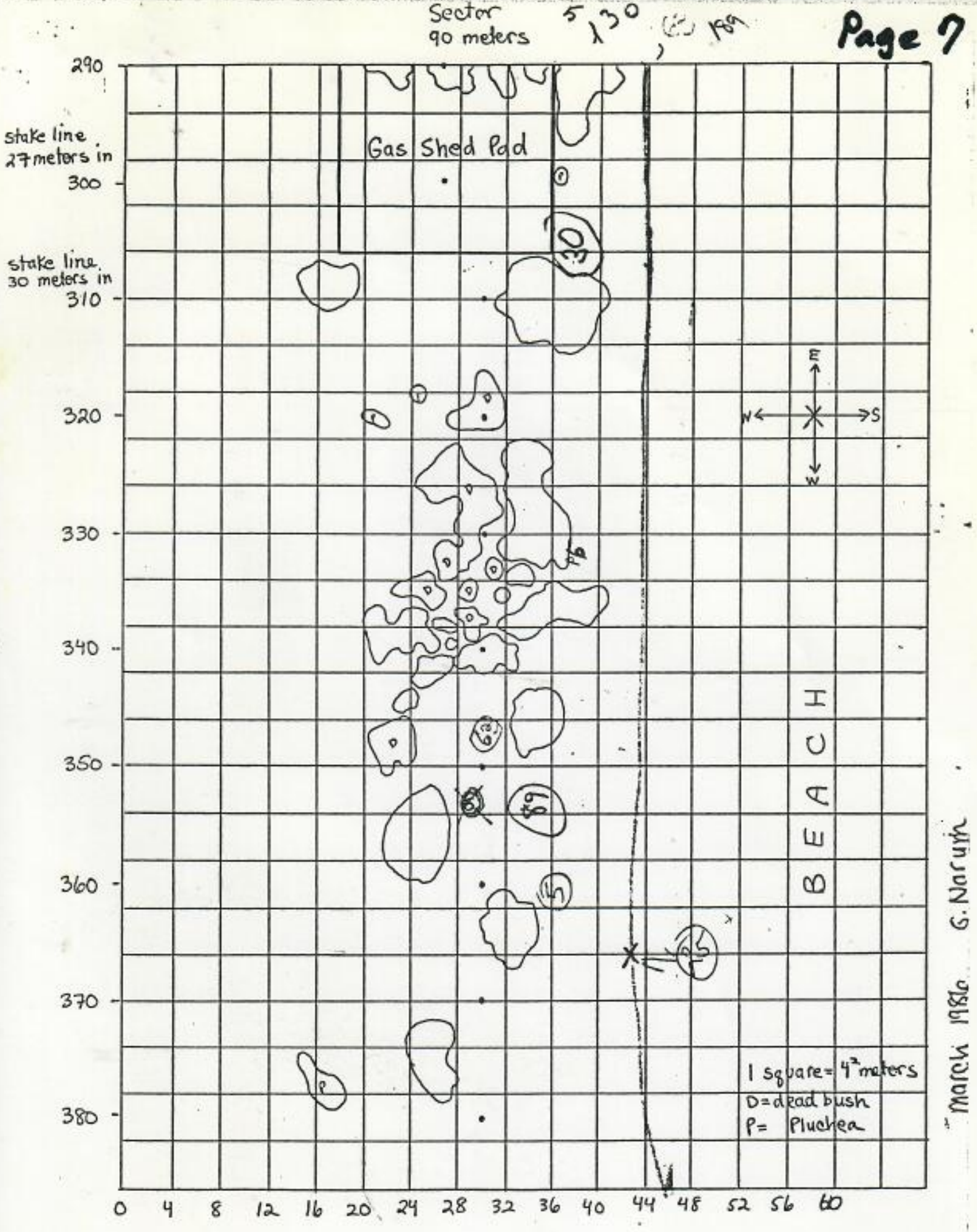
92



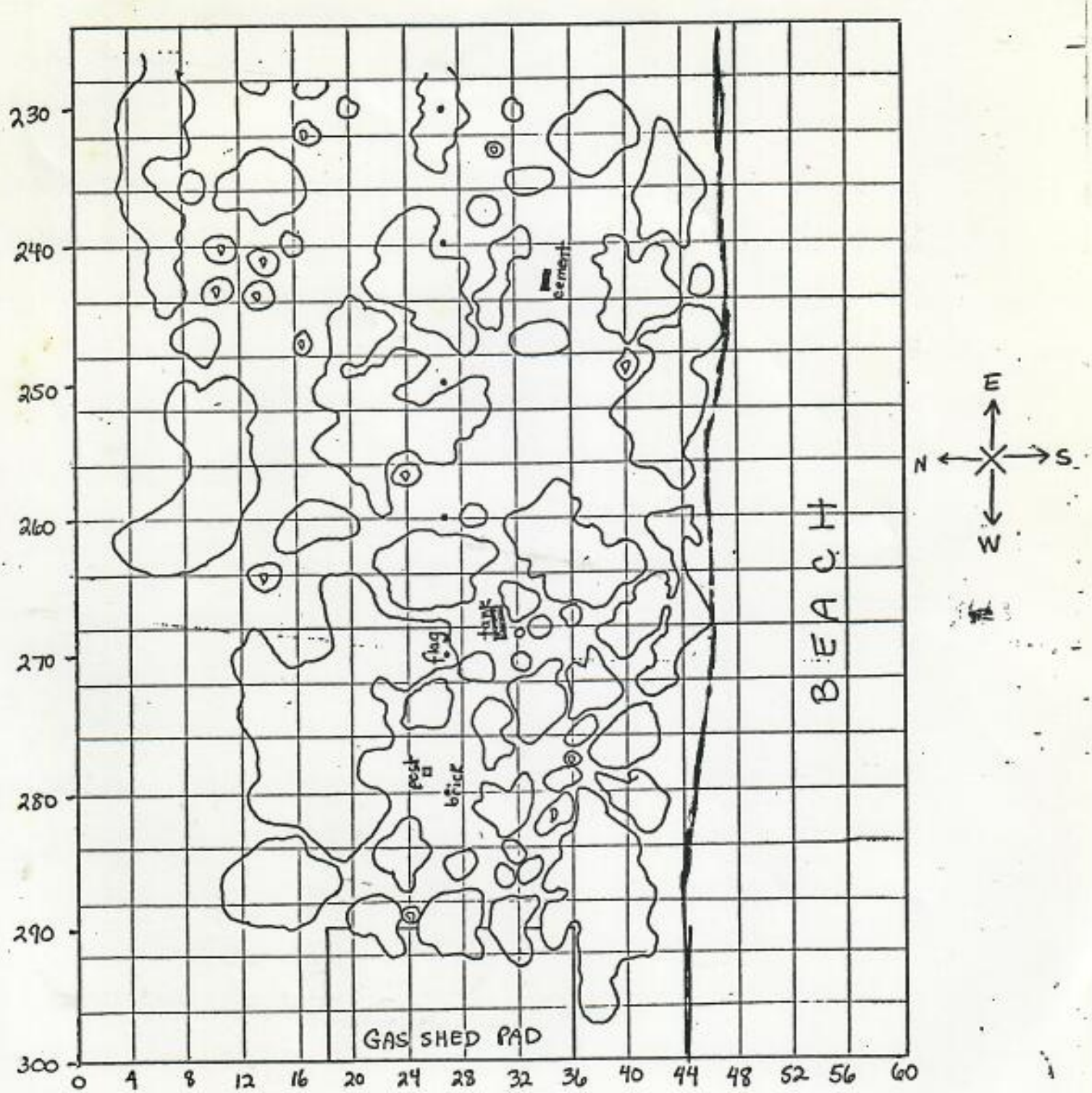
G. Narum

March 1986

B-6



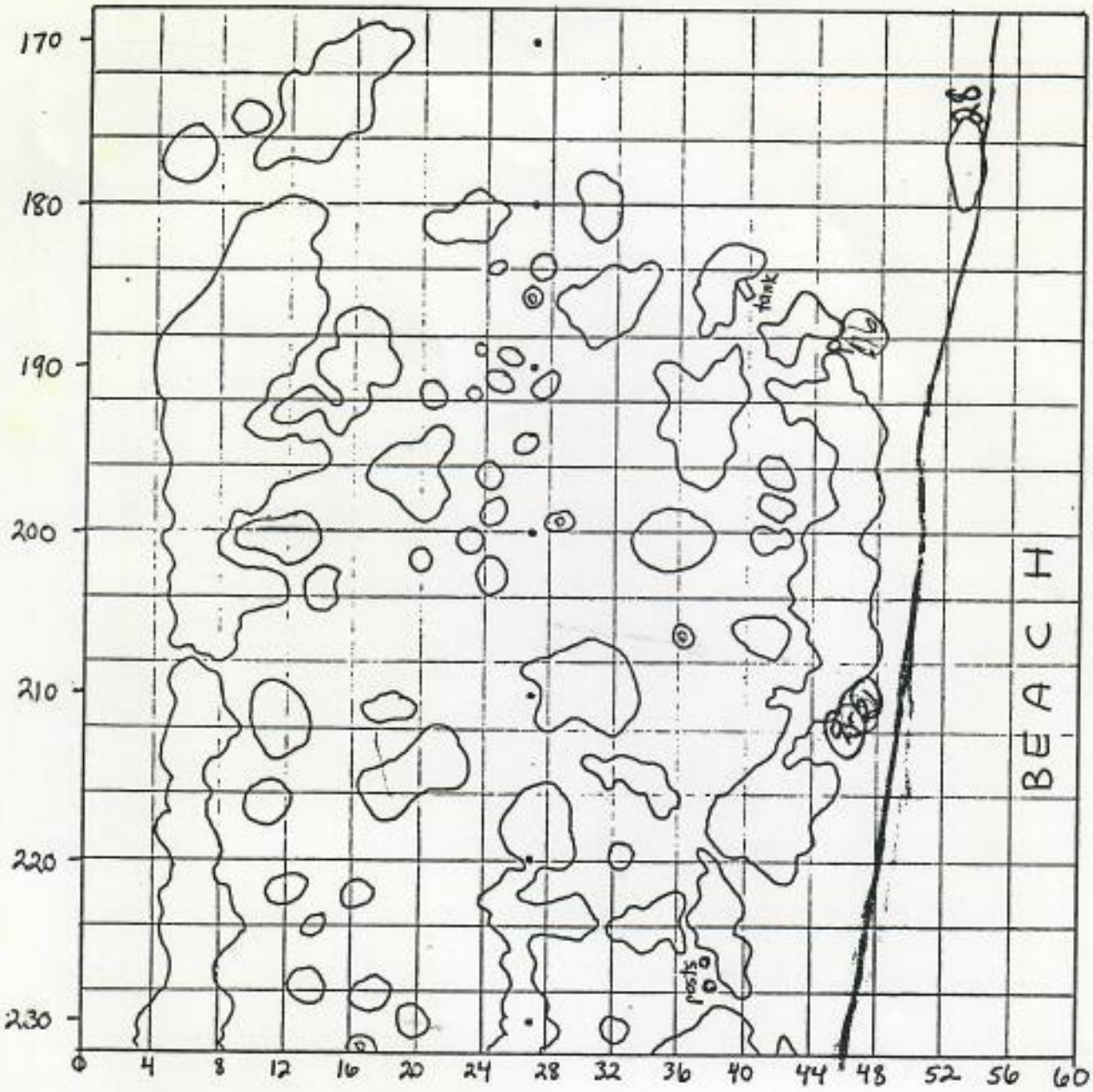
March 1986 G. Narum

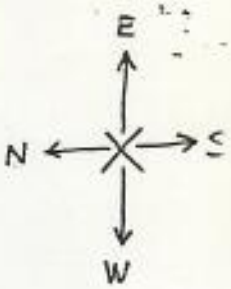


SECTOR A
60 meters long

1 square = 4² meters
D = dead bush

21,25

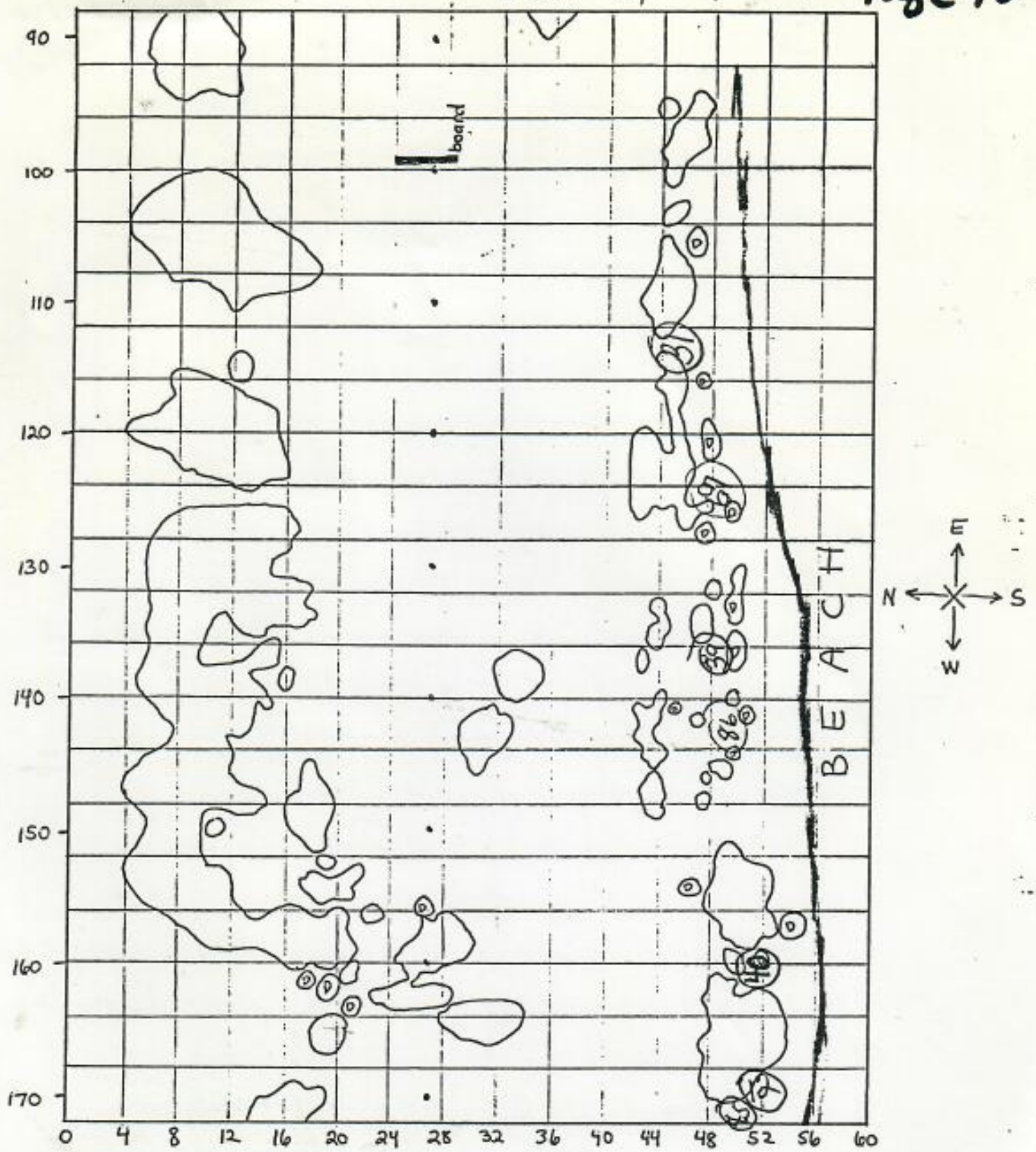




SECTOR B
60 meters long

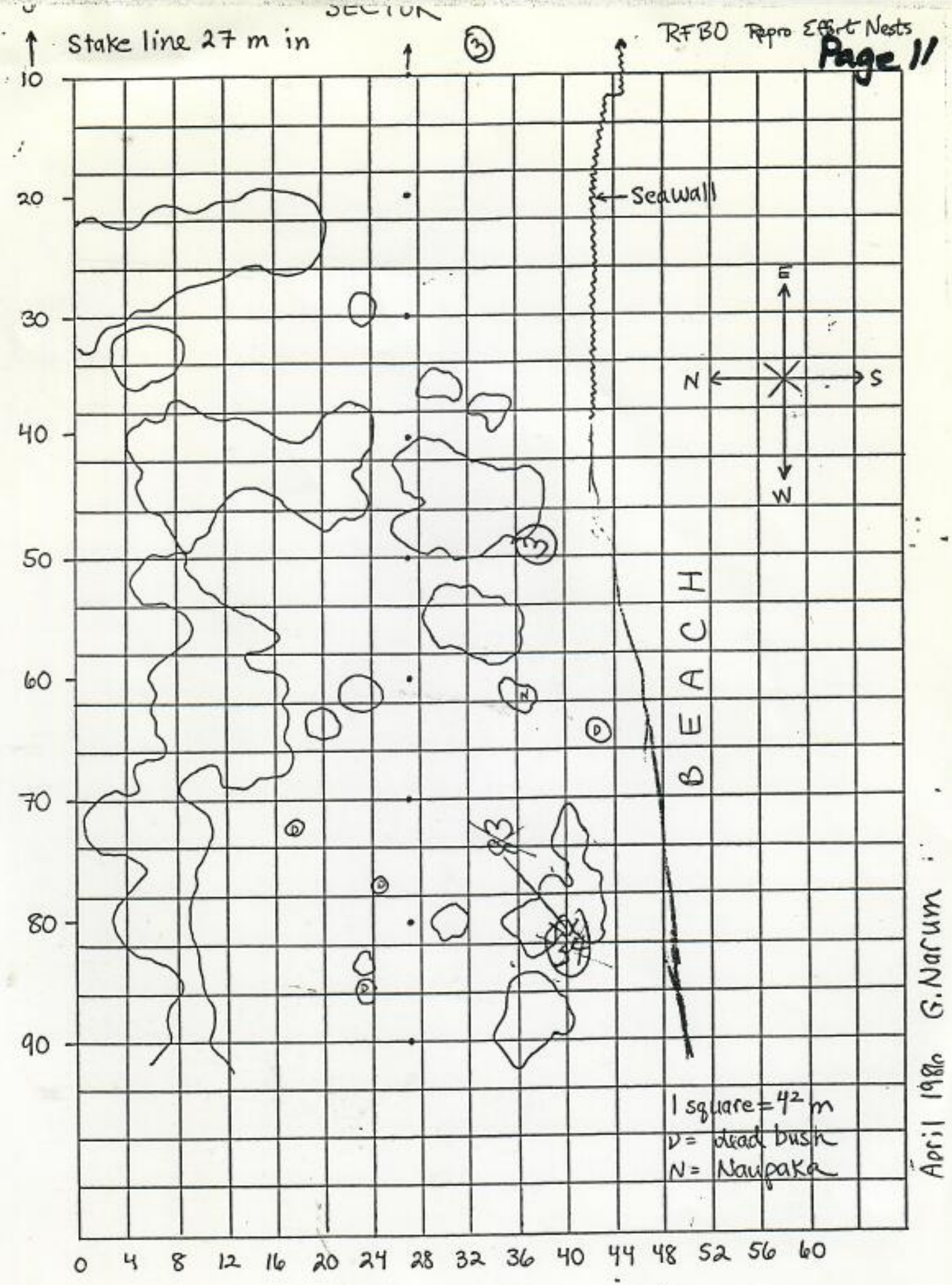
1 square = 2^2 meters
D = dead bush

Nests 12, 39, 140, 169, 186



SECTOR C
80 meters long

1 square = 2^2 meters
D = dead bush


SECTOR
Stake line 27 m in
RFBO Repro Effort Nests
Seawall
N
S
E
W
BEACH
1 square = 4² m
D = dead bush
N = Naupaka
April 1980 G. Narum
10
20
30
40
50
60
70
80
90
0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60

APPENDIX C

NUMBER OF NESTS PER NESTING FEMALE

Green Sea Turtle Study

YEAR: 1988 ISLAND: TERN

Turtle ID	April	May	June	July	Aug.	Sept.	Oct.
10236R 6867R A 6868L	N	N W	N N	N			
6871L 6872R B		N N	N N	X P			
10259L 10260R C 10261R		M	N XX	N XP	N		
6869L 6870R D		N M	N N	X			
10263R 10264L E 10267R			N P WS N	XP N			
6179R G			WS N, WS N, WS N	WS P			
3119L 3120R H			WS N, N	N N	P		
9770L 9771R I			N N N	XP M	P		
10351R 10274L J			X N	N XN N	WS N		
10268R 10354L L			N XX	R XP N			
6875L 10269R M			N WS XX	N XP	WS P		
10271L 10270R N Also white 115			East XP, East XN	East XN, East XN, East N	East P, XP		
6373L 6374R O Also Yellow J			N M N	P N	P		
10272L 10273R P			N		WS P		
10361L 3269 Q			N	N XP			
9355L 6041R R			N	M XP N	P N		
10352L 10353R T			N	XXN N	P		
10337L 10358R U				X P	P, East XP		
10355R 10356L V				XX X	WS P, WS XXP	Tern N	
10359L 10360R W				N N	N N		
X				X			
10374R Y Also white 2V3				XN X	East N		
10362L Z				XXP N			
Yellow V WS			WS N, WS N, WS XX	Tern N, Tern X			
White 8			X				
White 102			X				
10364L 10370R 1 Also Yellow 114 & Yellow 89				WS XP	WS N, WS XP, Tern N	M	
10415R (3-D) 10416L 2 No Tags Yellow 97				Tern AN WS	WS N		
Yellow 84 10397L 10398R				P N	N		
White 185 10230L 10231R				East N, Tern X	WS XX		

Green Sea Turtle Study

YEAR: 1988 ISLAND: Tern

Turtle ID	April	MAY	JUNE	JULY	Aug.	Sept.	Oct.
#3 10284L 10314R					P P		
Yellow 29 10355R					P		
White 199 10330R					XXX		
Yellow 25 10349R					X		
Yellow 17 10355 to 3330R				XX	X X		

16 March 1989

MEMORANDUM FOR: G. Balazs, W. Gilmartin, T. Gerrodette, G. Boehlert

FROM: J. Wetherall JAW

SUBJECT: 1989 Green Turtle Nesting Surveys

On 9 March I met here with Stewart Fefer and Ken McDermond to answer questions they had about the model to estimate green turtle nesting populations at French Frigate Shoals.

Fefer and McDermond voiced their concerns about improving estimates of the model's underlying parameters, as was called for in the recovery plan. I stated my agreement on the importance of firming up estimates of these parameters, and the value of saturation surveys. I explained my plan for updating the model based on the 1988 data, and told them that the big job of data editing, entry and verification was nearly completed (in fact, Lucille has finished the data entry). I also told them of my plan to do the Monte Carlo studies of the model's performance, as was also recommended in the recovery plan. This work would shed some light on the model's sensitivities to uncertainty about the various parameters and provide some guidance on survey design.

They sketched out their field plans for 1989, which included a repeat of saturation surveys on East Island and Tern Island. They also stated a desire to repeat the saturation coverage of Whale-Skate. We discussed the matter of seal and turtle disturbance there. I stated my view that it was basically a value judgement and not something that had an easy analytical answer. I suggested that between the two extremes of collecting no data and having zero disturbance, and collecting maximum data but having maximum disturbance there was middle ground where possibly a short-term survey could be done with an acceptably low level of disturbance. I suggested that if they wanted to consider this they should look at the data on turtle and seal activity to provide some factual basis for a decision. I said I had no way of assessing the disturbance factor myself. I stated that one of the reasons for doing surveys on Whale-Skate was to verify the assumption that had been made in the recovery plan (based on George's accummulated info) that East Island accounted for about 55% of each year's nesting population at French Frigate. Since the 1988 saturation survey seems to have confirmed this figure, there was less need to cover Whale-Skate again, particularly considering the disturbance factor.

They provided me with a copy of data and an internal FWS report on the Tern Island work for 1986-1988. They stated their view that this work was providing valuable information on nesting frequency, success, etc., which would improve estimates of hatchling production. Such work was also recommended in the recovery plan.

They indicated their concern about a breakdown in communications last summer and their desire to patch things up and come to an agreement about

what work should be done, who has what roles, etc. I said I agreed this was important and that I would convey all this to you all.

Yesterday, McDermond called me to say they were probably not going to do anything on Whale-Skate in 1989, instead channeling their resources into East Island and Tern Island. He wanted to know whether this was acceptable from a statistical standpoint. I said that given the tentative results from the 1988 survey on Whale-Skate they could certainly justify not doing a survey there this year.

However, they apparently plan to repeat the intensive study of nesting frequency per turtle, nesting success, affect of substrate, etc., on Tern Island. I told McDermond there was some concern about the impacts of very intensive work of this kind. I was able to say this because George was sitting right there; he had just been pointing out these concerns to me. As George said, although extensive surveys of nesting females on East Island and Tern Island are valuable and may cause minimal disturbance, the more intensive work could have some bad effects.

I think some formal mechanism has to be set up for implementing the recommendations of the recovery plan with regard to monitoring. A small inter-agency group could be formed to clarify the monitoring objectives and constraints, establish a survey and research strategy, develop and review field plans, and evaluate results on a regular basis.

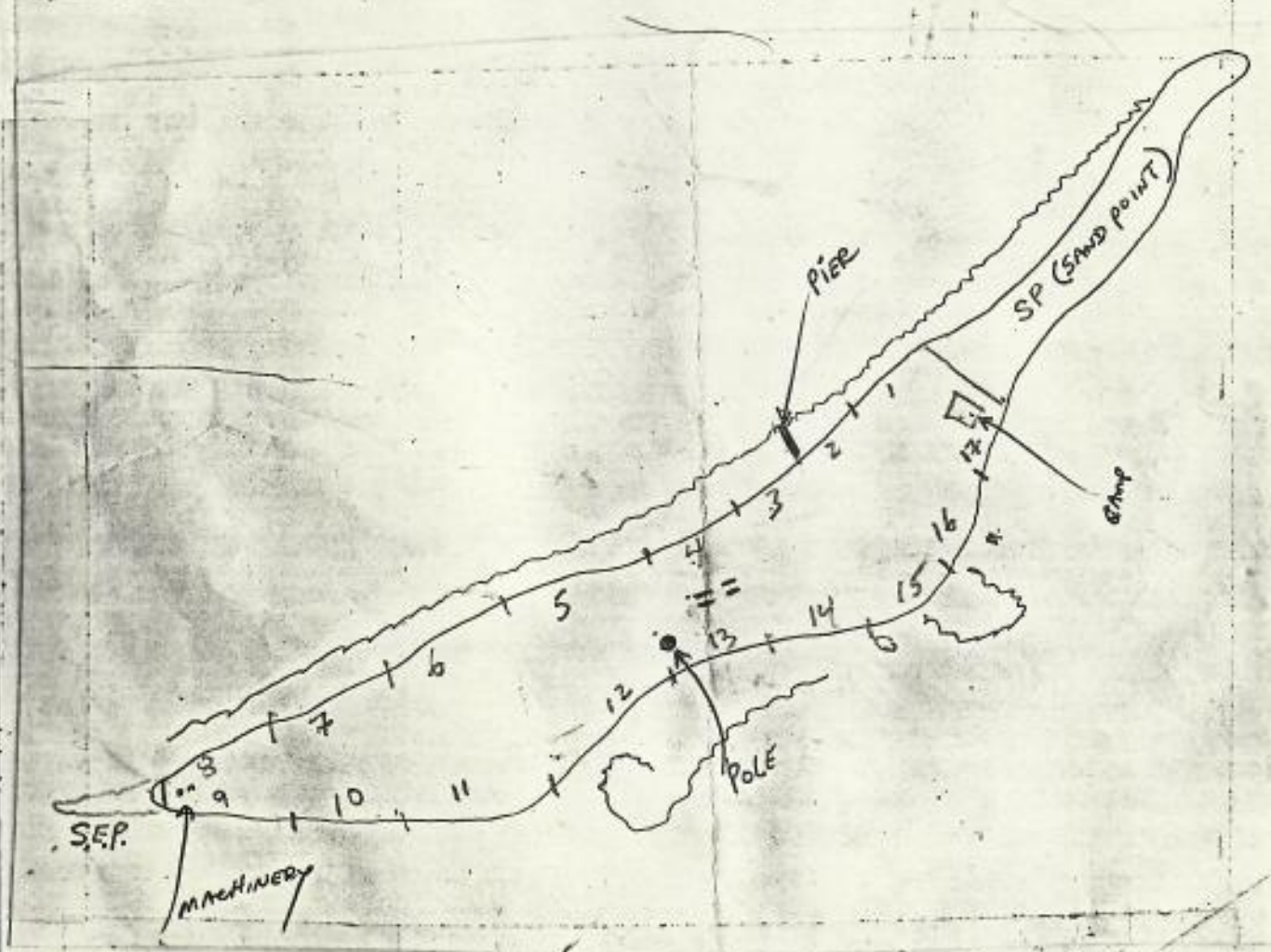
NOTES

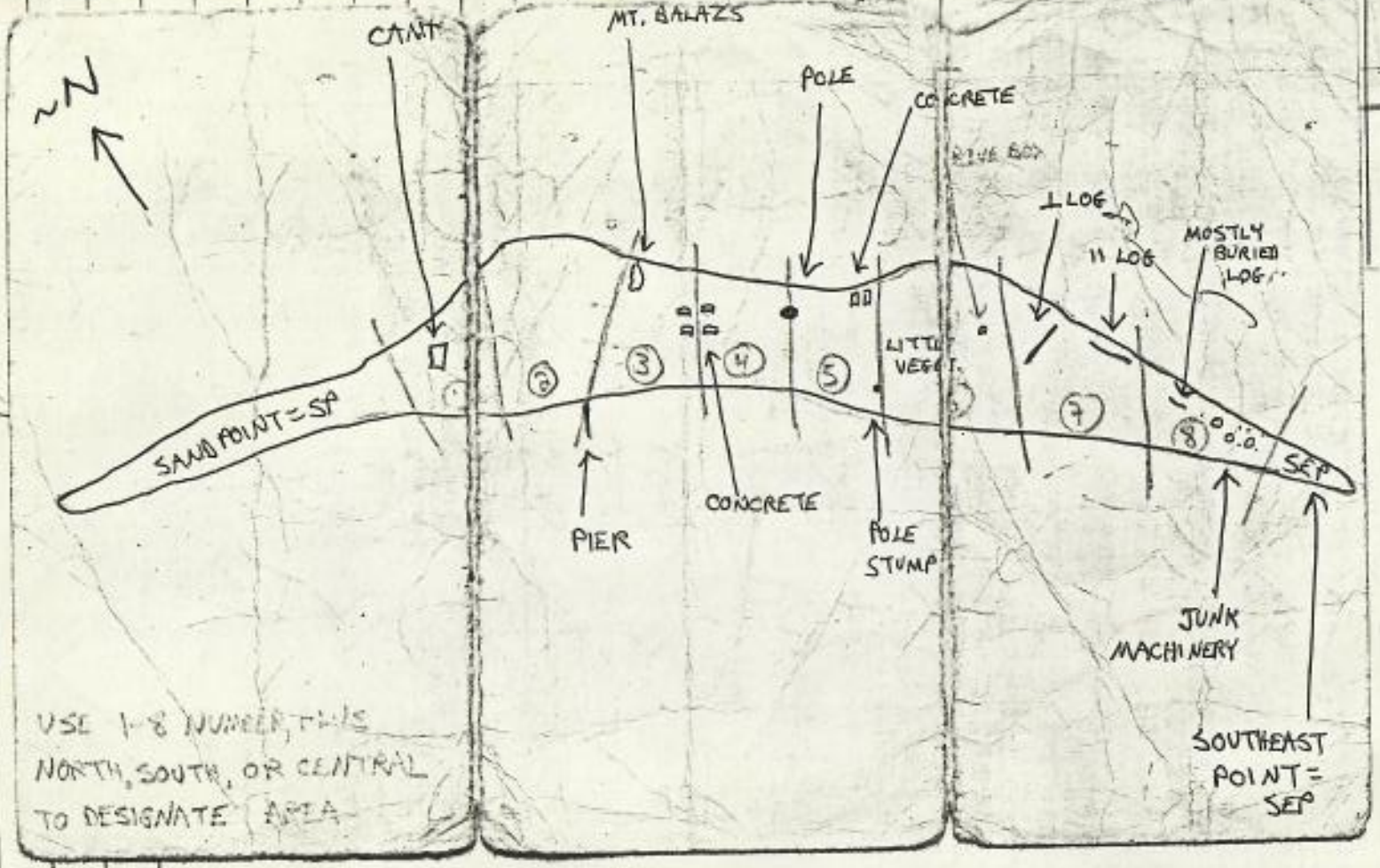
(1) WHEN CHECKING FOR OLD TAGS, OR APPLYING NEW TAGS, MAKE NOTE OF TAG "SCARS" (i.e. LUMP IN TISSUE) OR MISSING PIECES OF TISSUE WHICH SUGGEST LOSS OF TAGS.

SP = Sand Point (WEST)

S.E.P. = South East Point (everything Southeast of machinery)

AREA 1 THROUGH 17 = ~~Approx. 200 yard~~ 50 ? AREAS STARTING COUNTER-CLOCKWISE FROM CAMPSITE MAINLY USEFUL FOR RELOCATING TURTLES YOU SEE DURING EACH WALK-ABOUT.




N
CANT
MT. BALAZS
POLE
CONCRETE
⊥ LOG
11 LOG
MOSTLY BURIED LOG
SAND POINT = SP
PIER
CONCRETE
POLE STUMP
JUNK MACHINERY
SOUTHEAST POINT = SEP
USE 1-8 NUMBERS, THIS NORTH, SOUTH, OR CENTRAL TO DESIGNATE AREA

NUMBER OF ADULT FEMALE GREEN TURTLES NESTING ON EAST ISLAND

Night # / 1988 DATE pm/am	Total Number Ashore to NEST	(New) How Many First Seen?	Estimated Number Successfully Nesting	Turtle taggers initials	Of the turtles first seen (new), Number of Resighted turtles with Longterm Tag Recoveries	
1 Sun 5/15 - PM Mon 5/16 AM	8	8	5	GB	5	(62%)
2 Mon 5/16 pm - Tues 5/17 am	5	3	3	HF GHB	2	(66.6%)
3 Tues 5/17 - Wed 5/18	4	3	2	VG GHB	0	(0)
4 Wed 5/18 - Thurs 5/19	3	3	2	GN GB	2	(66%)
5 Thurs 5/19 - Friday 5/20	6	4	5	GN/GB	2	(50%)
6 Friday 5/20 & Sat. 5/21	2	0	1	GN	0	
7 Sat 5/21 - Sun 5/22	4	3	2	GN	2	
8 Sun 5/22 - Mon 5/23	7	6	4	GN	4	
9 Mon 5/23 - Tues 5/24	7	4	2 (ques. PN 32)	GN	2	

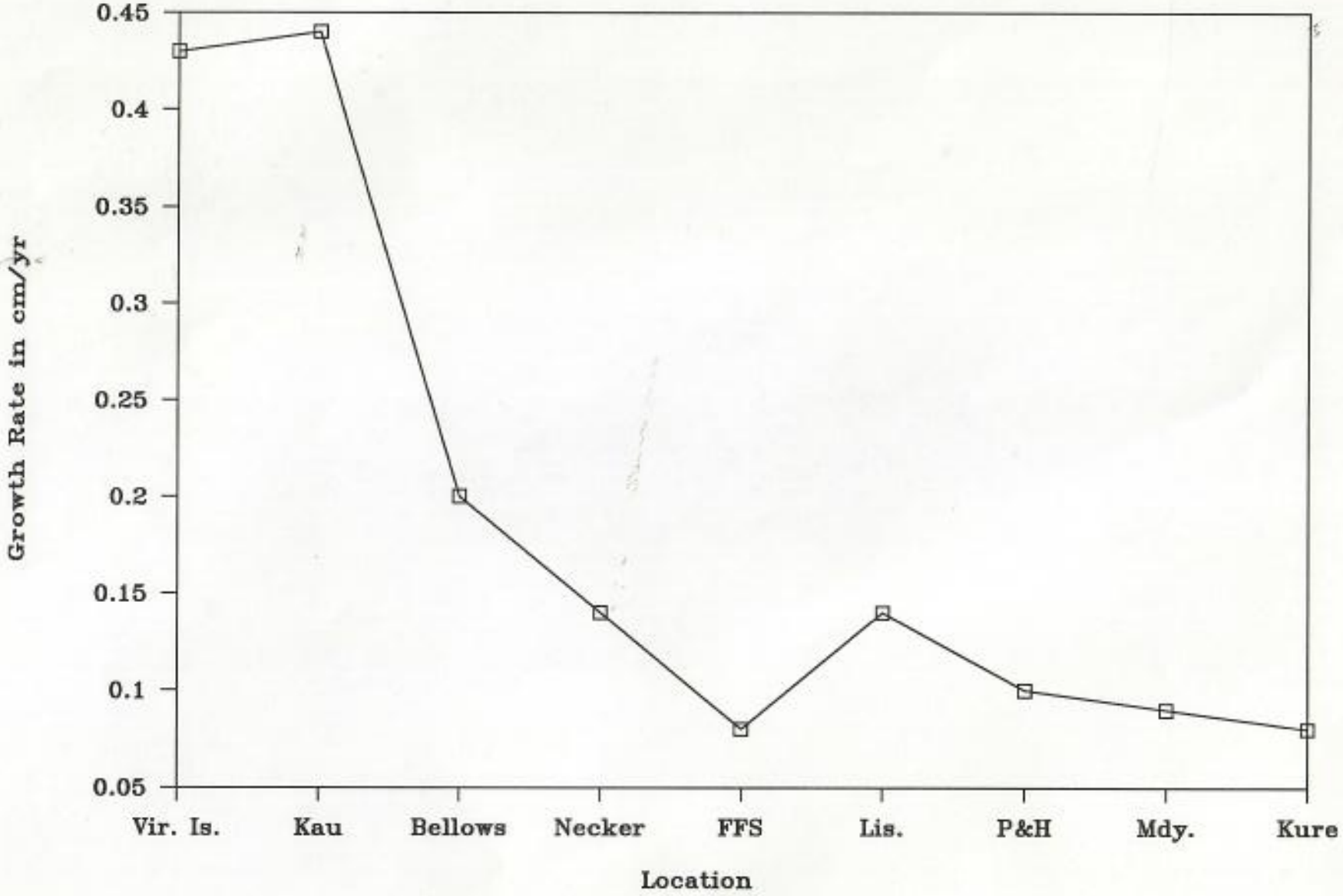
Manuscript #	Author(s)	Title	Date tagged or tagged	Age	Sex	Tag No.(s)	L/R Flipper
207	Kridler (cont)	HMS Data 1970					
			8/21/70	P	F	939	one tag
				P	F	976	B
				P	F	977	B
				P	F	978	B
				P	F	979	B
			8/21/70	SA	F	A71	B
				SA	M	A72	B
				SA	F	A78	B
				SA	M	A229	B
				J	M	A245	B
				SA	F	A318	B
				SA	F	A827	one tag
				SA	F	A834	" "
				SA	M	A836	" "
				SA	M	A841	" "
		Turtles	8/21/70	J	F	395	
				J	F	399	
				J	F	400	
				J	F	924	
				J	F	925	
				J	F	995	
				J	F	999	
				J	F	1000	
			4/13/70	P	M	743	B
				P	F	744	B
				P	F	745	B
				P	M	746	B
				A (dead)		141	
				U		A140	
				A		A170	
				Y		A173	
				A		A184	
				A		A286	
				A		584	
				A		588	
				Y (dead)		A667	
213	Woodside + Kramer	A Report on a Survey Trip to the HI NWR, 1961	3/7/61	U	U	MS77	
			3/7/61	U	U	MS54	
219	Bowlby + Seaggens	HMS at Kure Atoll 1982	4/11/82	P	F	051/029	L, R
			5/12/82	P	F	031/030	L, R
			5/24/82	P	F	032/033	L, R
			7/21/82	P	M	110/107	L, R

TAGGING INFO

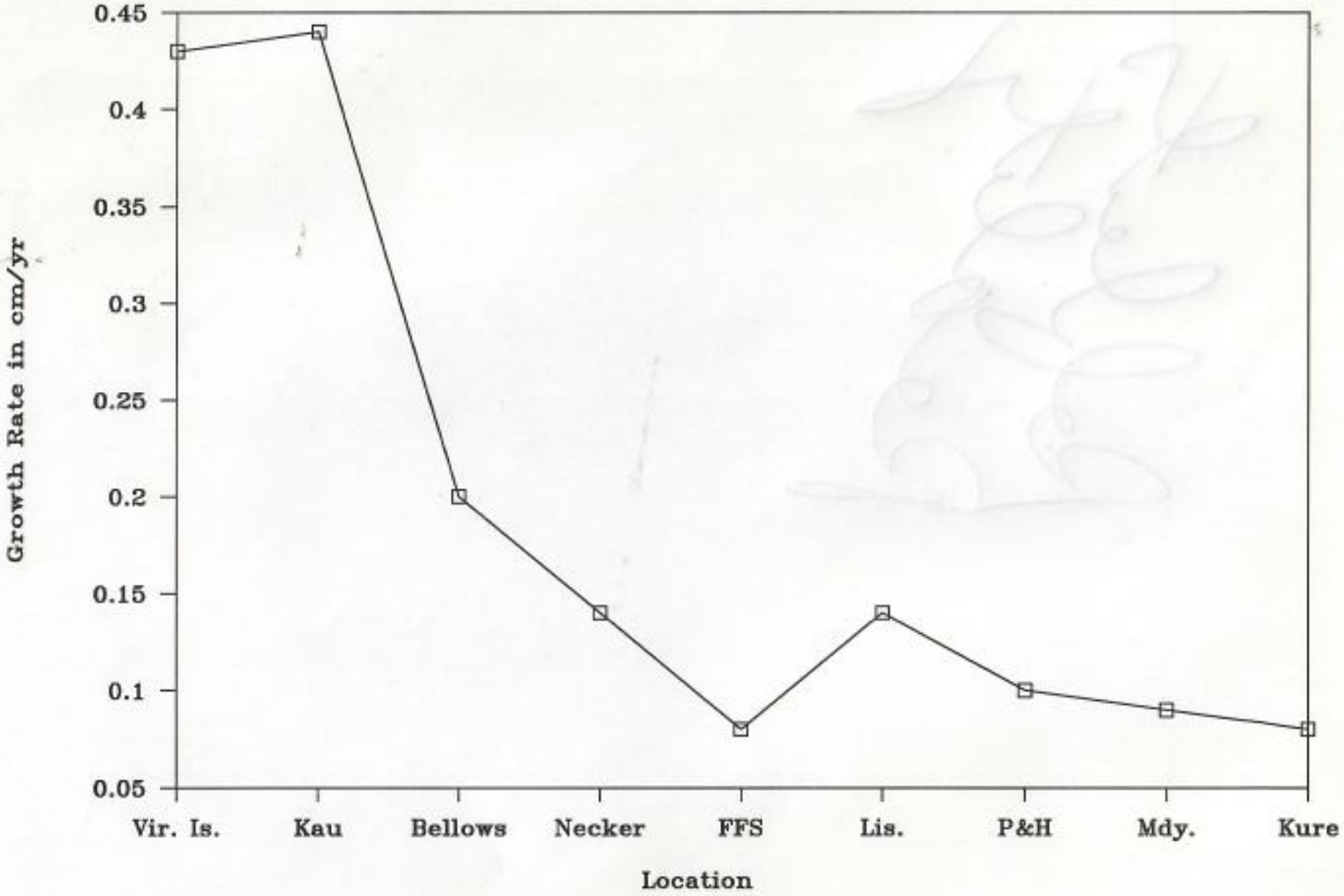
done 10/25/84 RW

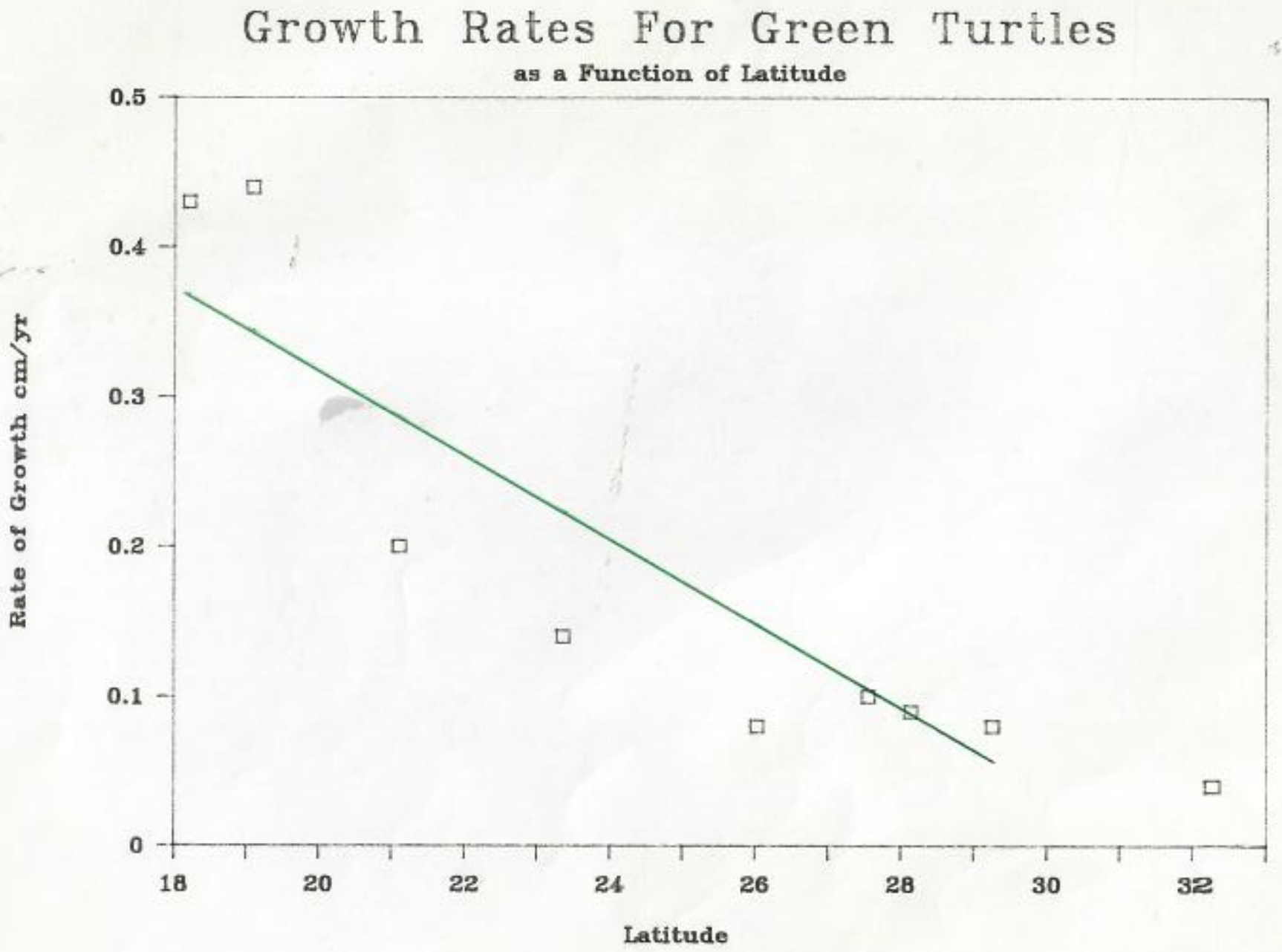
Manuscript #	Author(s)	Title	Date sighted or tagged	Age	Sex	Tag No.(s)	L, R, B flipper
228	Fiscus, C.	Voyage to Laysan	2/27/77	A	F	931	B
178	Delong et al.	Survey of HMS pops.	3/20/76	SA	M	A686	
				SA	M	A923	
				SA	M	A1098	
				SA	F	A754	
				A	F	A905	
			3/26/76	SA	M	A1018	B ?
			3/29/76	A	U	A938	
			4/1/76	SA	U	A1011	
154	Wirtz, W.	Pop. dynamics of Tidewater toll Vmnt of the HMS	Tagged 9/63 → 7/65	2AF, 7SAF, 3SAM, 2JU released			169-182
				5AM, 5AF, 8SAM, 6SAF, 2SAU, 1JM;			2-5, 11, 13-21
				4AM, 4AF, 16SAM, 4SAF, 4SAU, 1JM; 32-68			
			Total	28AM, 27AF, 13SAM, 23SAF, 3SAU; 69, 12, 69-166			
				56AM, 78AF, 75SAM, 95SAF, 24JM, 32JF; 200-411			
207	Kridler	H.I.S Data 1970	3/22/67	P	F	A94	
			5/23/67	P	F	A104	
			7/6/67	Y	F	A140	
			7/7/67	SA	F	A142	
			7/8/67	A	M	A170	
			9/22/67	Y	M	A278	
			9/27/67	Y	F	A283	
			3/22/68	Y	M	A338	
			9/20/68	A	F	A546	
			3/27/70	P	F	A565	
			5/17/70	P	M	930	B
				P	F	931	B
				P	M	932	B
				P	F	933	B
				P	U	934	B
				P	F	935	B
				P	F	936	B
				P	F	937	B
				P	M	938	B
				P	M	940	B
				P	F	941	B
				P	M	942	B
				P	M	943	B
				P	F	944	B
				P	M	945	B
				P	F	946	B
				P	F	947	B
				P	F	948	B
				P	M	949	B
				P	F	950	B
			5/17/70	SA	M	51	
				A	U	MS 54	
				SA	M	199	B
				SA	M	200	B
				SA	M	378	one tag left
				SA	M	705	" " "
				SA	F	716	" " "
				SA	M	804	" " "
				SA	F	818	" " "
				SA	M	825	" " "
	Green Sea Turtle		tagged 5/63 resighted 22		U	1011	

Growth Rates For Green Turtles

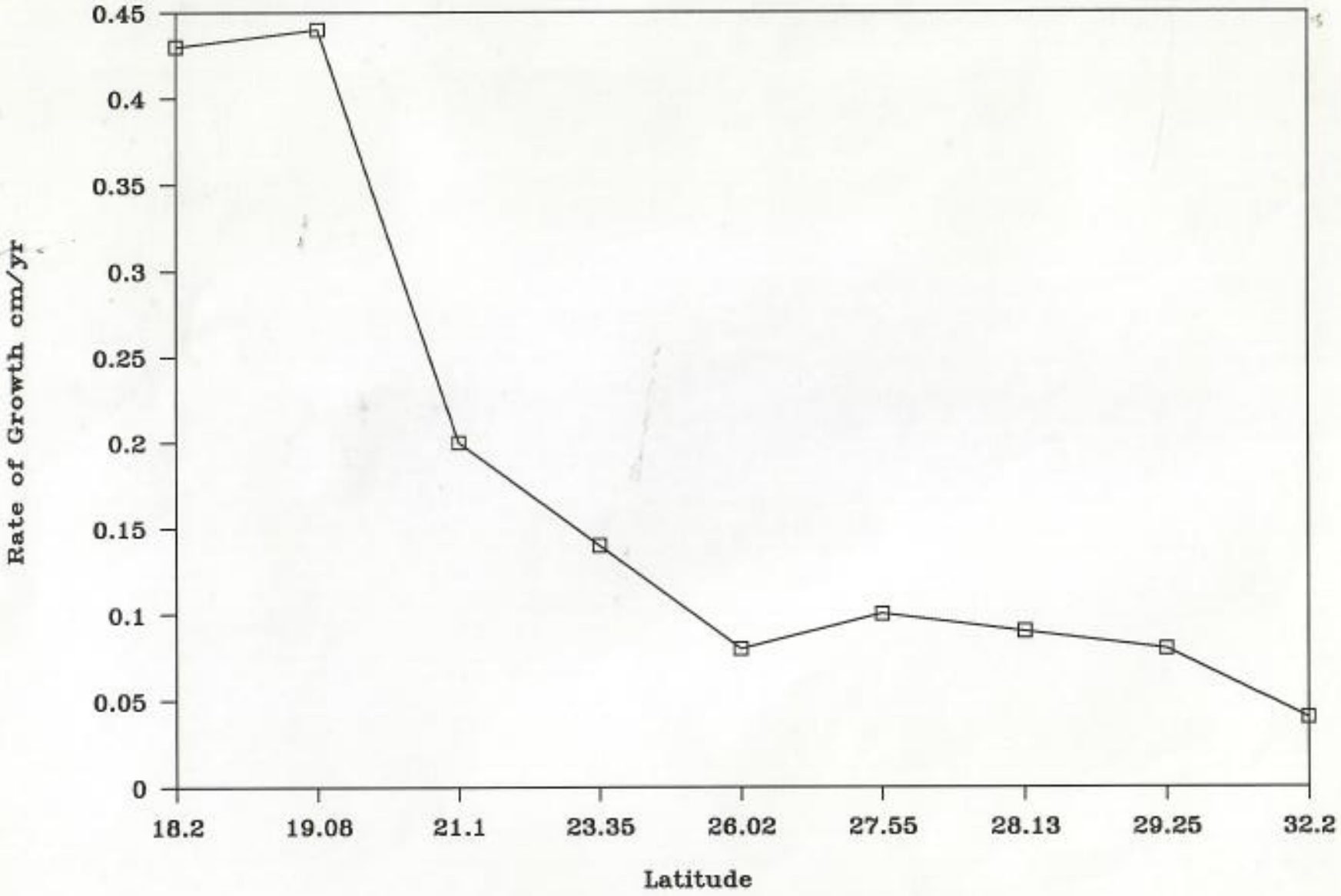


Growth Rates For Green Turtles




Growth Rates For Green Turtles
as a Function of Latitude
Rate of Growth cm/yr
0.5
0.4
0.3
0.2
0.1
0
18
20
22
24
26
28
30
32
Latitude

Growth Rates For Green Turtles



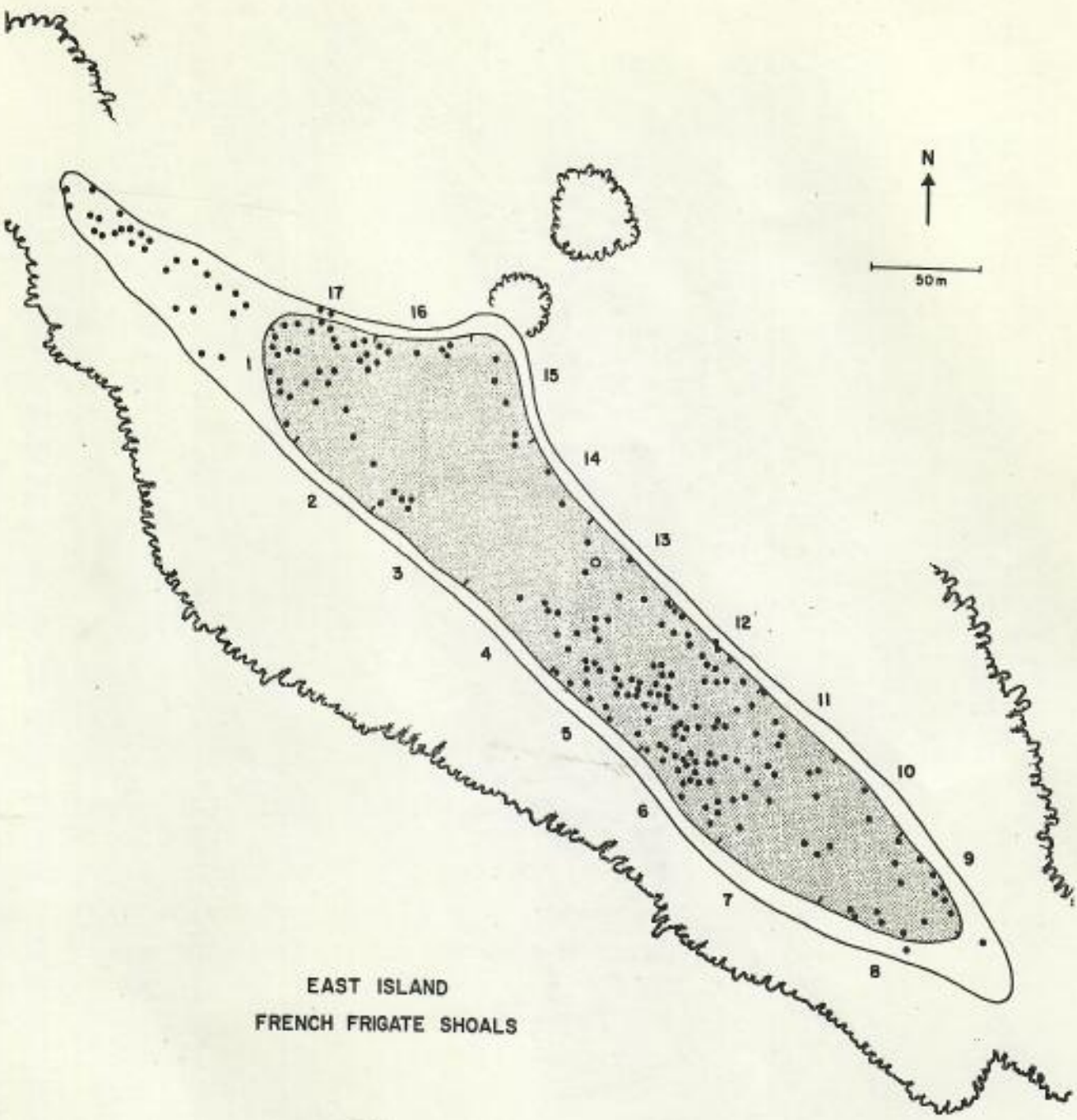


Figure 6. Locations of 220 nests recorded on East Island from June to August of 1974. The numbers on the island's perimeter identify the 17, 50-m long nesting areas that have been established for reference purposes.

OBJECTIVES OF YOUR TURTLE WORK AND METHODS TO USE

OBJECTIVE **I.** TO DETERMINE THE NUMBER AND IDENTITY OF FEMALES NESTING EACH NIGHT ON EAST ISLAND.

THE FEMALES UP TO NEST ON ANY ONE NIGHT WILL CONSIST OF TWO COMPONENTS: a.) TURTLES THAT I HAVE "HANDLED" ALREADY THIS SEASON AND MARKED WITH EITHER YELLOW OR GREEN PAINT; AND b.) TURTLES THAT I HAVE NOT HANDLED AND, THEREFORE, ARE BEING SEEN FOR THE FIRST TIME NESTING THIS SEASON.

TO ACCOMPLISH THIS OBJECTIVE, YOU MUST MONITOR NESTING ACTIVITY (THREE OR FOUR TIMES EACH NIGHT BY WALKING AROUND THE ISLAND RECORDING TURTLES' PRESENCE, AND "HANDLING" THOSE THAT FALL UNDER "b" CATEGORY ABOVE. SUGGESTED TIMES TO GO OUT ARE 9:30 pm, 12:30 am 3:30 am and if needed 6 am. EACH TRIP OUT WILL LAST 45 MIN TO 1¼ hours, depending how many

YOU ARE NOT EXPECTED, NOR SHOULD YOU, GO OUT AT NIGHT WHEN ITS RAINING. WAIT TILL THE RAINSHOWER COMPLETELY PASSES. IF IT RAINS HARD ON AND OFF FREQUENTLY ALL NIGHT, JUST SKIP THAT NIGHT! GET A GOOD NIGHTS SLEEP INSTEAD!

THREE TIMES A NIGHT WILL BE ADEQUATE ONCE YOU BECOME EXPERIENCED. MORE THAN FOUR TIMES A NIGHT IS UNNECESSARY AND, IN FACT, CAN BE COUNTERPRODUCTIVE AND EVEN HARMFUL BY PUTTING TOO MUCH PRESSURE/DISTURBANCE ON THE TURTLES, MONK SEALS & SEABIRDS TOO.

TURTLES are present. NESTING IS LIGHT THIS YEAR. ONE NIGHT I HAD "0". THE BEST NIGHT I HAD 8. TURTLES THAT HAVE BEEN PREVIOUSLY MARKED WITH YELLOW OR GREEN PAINT NEED ONLY BE RECORDED, NOT HANDLED. IF THE NUMBER IS LEGIBLE, RECORD IT. IF NOT, JUST WRITE THE COLOR AND PERHAPS YOUR "BEST GUESS" as to what the number is. IF THE TURTLE HAS NO VISIBLE PAINT, IT NEEDS TO BE HANDLED BY YOU. THIS IS BY FAR, THE MOST IMPORTANT PIECE OF YOUR WORK. FIRST, IF THE SHELL IS DRY ENOUGH, USE YOUR IVORY PAINT TO PUT AN ALPHABET LETTER ON EACH SIDE. NEXT, CHECK FOR THE PRESENCE OF A TAG OR TAGS USING ONLY THE ONE-CELL (AA) FLASHLIGHT PROVIDED. THIS WORKS EXCELLENT BY HOLDING IT IN YOUR MOUTH, WHEN NEEDED. YOU ONLY NEED TO READ ONE TAG WITH CERTAINTY, IF SEVERAL TAGS ARE PRESENT. HOWEVER, IF IT'S EASY TO DO SO (MEANING THE TURTLE "LETS YOU READ THEM"), READ AS MANY TAG NUMBERS AS YOU CAN. THEY ARE RARELY CONSECUTIVE NUMBERS. IF YOU CAN ONLY READ ONE NUMBER, THEN NOTE HOW MANY TAGS THE TURTLE HAS TOTAL. WE NEED THIS INFO TO COMPUTE TAG SHEDDING RATES. IF YOU CAN'T READ ANY OF THE TAG NUMBERS BECAUSE ENCRUSTING CORALLINE ALGAE OR OTHER FOREIGN MATERIAL ON THE TAG, USE THE POCKET KNIFE PROVIDED, OR OTHER APPROPRIATE METAL OBJECT, TO SCRAPE THE TAG AND EXPOSE THE NUMBER. NOTE - THERE IS A LOT OF BEHAVIORAL DIFFERENCE BETWEEN TURTLES. SOME WILL SIMPLY NOT LET YOU FOOL AROUND WITH THEIR TAGS. THEY WILL RESPOND IN A WILD MANNER. JUST DO THE BEST YOU CAN WITHOUT GETTING YOURSELF HURT BY THE TURTLE. WATCH THAT

THEY DON'T GRIND THEIR SHELL AND FLIPPERS AGAINST YOUR ANKLES AND FEET (NOTE BANDAGES ON MY LEGS NOW FROM NOT HEEDING THIS WARNING!)

TO HELPER IN READING TAG NUMBERS ACCURATELY, I SUGGEST YOU FAMILIARIZE YOURSELF WITH HOW EACH NUMBER IS FORM (THEIR STYLE). STUDY NUMBERS AS THEY ARE PRINTED ON THE NEW TAGS.

IF NO TAGS ARE PRESENT ON THE TURTLE, THEN AT LEAST ONE, AND IDEALLY TWO, NEED TO BE APPLIED. IT TAKES PRACTICE TO DO THIS CORRECTLY, QUICKLY AND SAFELY. DEMONSTRATION AND INSTRUCTION WILL BE GIVE 6/23-6/24 ON EAST. AGAIN, THE EASE OF TAGGING DEPENDS HEAVILY ON THE BEHAVIORAL DISPOSITION OF THE TURTLE. THE KEY THOUGHT IS ALWAYS SAFETY TO YOURSELF. THEY ARE STRONG, POWERFUL ANIMALS THAT ARE CAPABLE OF DOING DAMAGE WITH THEIR FLIPPERS AND BODY. ALSO, FLIPPER CAN AND DO THROW SAND WITH INCREDIBLE STINGING FORCE, A "BLAST" IN THE FACE AND EYES IS AN UNPLEASANT EXPERIENCE (I KNOW!).

IF YOU SIMPLY CAN'T GET A TAG ON AN ANIMAL, DON'T BE OVERLY CONCERNED. THE PAINTED NUMBER FOR OUR NIGHTLY CENSUS WORK IS ALMOST AS IMPORTANT AS TAGGING. AND I AM SURE YOU WILL ALWAYS BE ABLE TO APPLY THE PAINT WITH NO PROBLEMS.

IF ANY TAGS TEAR OUT ON YOU, OR FOR SOME OTHER REASON ARE RUINED, PLEASE DON'T THROW THEM AWAY. RECORD THE NUMBERS IN THIS BOOK AND RETURN THEM TO ME.

THE STAGE OF NESTING THAT THE TURTLE IS INVOLVED IN WILL ALSO, TO A LARGE EXTENT, DETERMINE HOW EASY IT MAY BE TO TAG. THE "BEST" TIME TO AT IS WITHIN 5-15 MINUTES AFTER THE EGGS HAVE BEEN

DEPOSITED AND THE HIND FLIPPERS ALONE ARE PULLING SAND OVER THEM. SHE IS THE LEAST IMMUNE TO DISTURBANCE AT THIS TIME. I NEVER APPLY THE TAGS WHILE EGGS ARE BEING DROPPED. THIS COULD CAUSE HER TO "SHUT-DOWN" AND CEASE. HOWEVER, IT IS AN EXCELLENT TIME TO APPLY PAINT WHILE EGG LAYING IS HAPPENING. ALSO, TO INSPECT HER OVER CAREFULLY WITH THE SINGLE-CELL LIGHT LOOKING ESPECIALLY FOR:

1. Tumors on the eyes, neck, front flippers close to the body, chin, or anywhere else visible.
2. Any signs of fresh amputations or mutilations (usually from shark attack).
3. Any signs of old and completely healed amputations.
4. Anything else that seems noteworthy to document.

NOTE - THE SINGLE-CELL FLASHLIGHT BATTERY MUST BE CHANGED FAIRLY REGULARLY (APPROX. EVERY 3rd NIGHT) AS IT DRAINS FAST, MAKING IT TOO DIFFICULT TO SEE THINGS YOU NEED IT FOR (I.E.- TAG NUMBERS).

WHILE THE TURTLE IS LAYING EGGS (ACTUALLY DEPOSITING THEM), IT IS ALSO AN EXCELLENT TIME TO MEASURE THE CURVED CARAPACE LENGTH WITH THE TAPE PROVIDED. SINCE YOU MAY NOT ENCOUNTER TURTLES VERY OFTEN ~~ACTUALLY~~ THAT ARE RIGHT IN THE PROCESS OF LAYING EGGS, I DON'T EXPECT YOU TO MEASURE VERY MANY TURTLES. IT IS VERY HARD TO MEASURE A TURTLE WHEN IT IS OUT AND MOVING AROUND.

MONITORING A FULL NIGHT'S NESTING IS A PRIME OBJECTIVE. TO GO OUT JUST ONCE OR TWICE TO CHECK ON TURTLES UP NESTING CAN PROVIDE GOOD INFORMATION, BUT THIS IS NOT

NEAR AS VACUABLE AS "COMPLETE COVERAGE" (3 or 4 TIMES OUT, SPACED PROPERLY) OF A NIGHT'S NESTING. ALSO, CONSECUTIVE NIGHTS OF COMPLETE COVERAGE MONITORING ARE OF GREATER VALUE. FOR EXAMPLE, YOUR SCHEDULE COULD BE 4 OR 5 CONSECUTIVE NIGHTS ON EAST IS. DOING COMPLETE COVERAGE, AND THEN 2 OR 3 NIGHT BACK AT TERN IS. RESTING UP, GETTING A SHOWER, AND EATING SLIGHTLY BETTER FOOD. YOU DEVISE THE SCHEDULE THAT SEEMS BEST FOR YOUR WORKING ABILITIES. ALTHOUGH THE USE OF THE BOAT IS PRIMARILY FOR ACCOMPLISHING THE REQUIREMENTS OF THE MONK SEAL RESEARCH, HOWEVER THERE SHOULD BE SOME ACCOMMODATION OF YOUR NEEDS AND WISHES.

IF YOU WANT, YOU CAN STAY ON EAST IS. ALONE WHEN THE OTHER TWO GO BACK TO TERN IS. FOR OVERNIGHT STAYS. HOWEVER, TO DO THIS YOU MUST PLAN AHEAD AND BRING AN EXTRA HAND-HELD RADIO SO YOU CAN MAKE 8 AM RADIO CHECKS WITH TERN IS. WHILE ALONE. SEE RICK. MAKE SURE THE RADIO IS FULLY CHARGED (I.E. RADIO ON THE CHARGER FOR SEVERAL HOURS - AND PREFERABLY FOR OVERNIGHT. NOTE THE RED AND GREEN INDICATOR LIGHTS ON THE CHARGER DON'T WORK. A RED LIGHT MAY BE ON, BUT THE RADIO WILL NEVERTHELESS BE FULLY CHARGED IF IT HAS BEEN ON LONG ENOUGH. SEE RICK).

CONCERNING OCCASIONAL TRIPS THE SEAL PEOPLE WILL BE MAKING TO DISTANT ISLANDS (SHARK, DISAPPEARING AND GINS) TO COUNT SEALS: I WOULD PERSONALLY RECOMMEND AGAINST YOUR GOING. IN MY VIEW, THERE ARE SAFETY CONSIDERATION IN FAVOR OF NOT GOING, UNLESS YOU FEEL YOU ARE VERY WELL SKILLED IN SMALL BOAT HANDLING AND RELATED MARINE TALENTS. FOR ONE THING, THREE PEOPLE IN THE BOAT, VERSUS TWO,

DISAPPEARING IS 16 MILES SOUTH TERN, T. VERY SOUTHERN LIMIT OF THE ATOLL.

TAKES MORE GASOLINE. AND GASOLINE IS NOT IN ABUNDANT SUPPLY HERE. ANOTHER FACTOR IS THAT IF A BIG PROBLEM OCCURS (I.E. MOTORS WON'T WORK, BOAT DRIFTS OUT TO SEA) TWO PEOPLE ADRIFT WITH LIMITED FRESH WATER IS A BETTER SITUATION THAN THREE PEOPLE ADRIFT.

USE YOUR OWN JUDGEMENT IN THIS MATTER, BUT THAT'S MY ADVISE TO YOU.

ALL OF THE ECOLOGICAL DIVERSITY FOUND AT FRENCH FRIGATE SHOAL IS REPRESENTED ON TERN, WHALE-SKATE AND EAST ISLAND. DISAPPEARING, SHARK AND GINS VIRTUALLY BARREN SAND BARS.

YOU SHOULD AND WILL BE VISITING WHALE-SKATE. IT IS USUALLY STOPPED AT FOR SEAL WORK WHEN TRAVELING EITHER TO OR FROM EAST IS. WHALE-SKATE IS AN ATTRACTIVE, INTERESTING ISLAND WHICH YOU WILL ENJOY SEEING.

WHEN THE SEAL PEOPLE GO TO THE DISTANT ISLANDS, PLEASE ASK THEM TO TELL YOU THE NUMBER OF TURTLES SEEN BASKING ASHORE, AND ALSO IF PAINT IS PRESENT ON ANY OF THEM. RECORD THE INFORMATION IN THIS BOOK.

OBJECTIVE 2. TO COUNT AND RECORD THE IDENTITIES OF TURTLES BASKING ALONG THE SHORELINE OF EAST ISLAND (WHALE-SKATE TOO, WHEN YOU VISIT THAT ISLAND).

The best time to do this count is between 3 pm and 6 pm, but other times as schedule permits will be O.K. Most turtles on East bask at the Southeast end of the island. An occasional one will haul out elsewhere. Take 45 minutes to walk around the island to do this CENSUS. RECORD IN THIS BOOK THE DATE, TIME AND NUMBER SEEN. ALSO ENTER THE PAINTED NUMBERS SEEN, OR THE PRESENCE OF PAINT AND COLOR.

MALES, AS YOU KNOW, HAVE A VERY LONG, LARGE TAIL. IF YOU ARE ABLE TO DISTINGUISH THEM, RECORD AS SUCH. NORMALLY THIS IS NOT POSSIBLE WITHOUT GETTING VERY CLOSE AND BEHIND THEM. YOU SHOULDN'T DO THIS. WHEN WALKING AROUND THE ISLAND YOU SHOULDN'T GET SO CLOSE TO BASKING TURTLES AS TO DISTURB THEM, CAUSE THEM TO MOVE DUE TO YOUR PRESENCE AND RETURN TO THE SEA. AT TIMES THEIR EYESIGHT SEEMS VERY GOOD OUT OF WATER., MUCH BETTER THAN WHAT IT'S REPORTED TO SUPPOSE BE IN THE SCIENTIFIC LITERATURE.

ONE COUNT OF BASKING TURTLES PER DAY WILL BE FINE WELL YOU ARE ONE EAST ISLAND. IF YOU WANT TO DO TWO PER DAY, THAT WILL BE FINE TOO.

YOU SHOULD NOT ATTEMPT TO TAG OR READ TAGS ON BASKING TURTLES.

ALSO NOTE THAT IT IS NOT UNCOMMON FOR A TURTLE OR TWO TO "BASK" ALONG THE SHORE AT NIGHT. DO NOT CONFUSE SUCH ANIMALS WITH THOSE OUT TO NEST. BASKING TURTLES NEVER GO MUCH ABOVE THE HIGH TIDE MARK. BASKING TURTLES STAY IN ONE PLACE MOTIONLESS FOR LONG PERIODS. TURTLES HAULING OUT TO NEST ARE ~~ALSO~~ ALMOST CONSTANTLY IN-MOTION OR ON THE MOVE.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center Honolulu Laboratory
2570 Dole St. • Honolulu, Hawaii 96822-2396

July 23, 1987 F/SWC2:GHB

MEMORANDUM FOR: F/SWR1 - Gene Nitta

THRU: F/SWC2 (AM) - William G. Gilmartin
Richard S. Shomura

FROM: F/SWC2 - George H. Balazs

SUBJECT: The Regional Director's memo of January 20, 1987 concerning Hawaiian sea turtle recovery

I recently reread the above memo and remembered item No. 6, "Publicity," where you were asked to work with myself and the enforcement branch to "develop quarterly press releases focusing on major aspects of the [sea turtle] Recovery Plan, or other important [sea turtle] issues." Since we have not done so, I suggest that we get together in the very near future to institute this directive. The subject of "habitat protection" might be a good topic for the initial news release. Another possibility is where and how to report turtle strandings, legal protection both alive and dead, and the importance of scientists documenting and doing autopsies on the dead stranded turtles.

I'll be on annual leave all next week, but will be available to meet with you and Gene Witham the following week (8/4).

cc: Witham

United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD
P. O. BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:

June 15, 1989

George Balaz
NMFS
Honolulu, HI

Dear George,

Enclosed are tags taken from a turtle found dead by Mitch Craig on Gin Island, French Frigate Shoals. Tag numbers are 5403 and 5380. No cause of death could be determined. The turtle had probably died within a week or two of 29 May 1989, the date Mitch discovered the carcass.

originally tagged
6-12-81
Est
N&B

Sincerely,

Kenneth Matthewson
Kenneth Matthewson
USFWS
Tern Island

Need Numbers

From Turtle
Found dead on
Gin Island 5/29/89
Found by Mitch Craig

No cause of
death could be
determined.

You Serve America!

Number of adult female green turtles recorded nesting from 25 May to 18 August 1988 at Whale-Skate Island, French Frigate Shoals (for 74 nights with complete coverage).

Date 1988	Total No. ashore to nest	No. of new females first seen ashore to nest in 1988	Approximate No. depositing eggs	Short-term repeat nesters seen ashore	Long-term recoveries
May					
25	2	2	2	0	0
26	5	5	2	0	1
27	9	4	7	5	2
28	9	6	3	3	1
29	7	2	3	5	0
30	7	3	4	4	1
31	9	4	7	5	0
June					
1	5	4	4	1	2
2	8	5	4	3	1
3	5	2	2	3	0
4	6	4	2	2	1
5	5	3	1	2	1
6	13	5	3	8	1
7	7	2	5	5	1
8	9	1	5	8	0
9	14	3	8	11	0
10	10	4	3	6	1
11	20	4	6	16	3
12	16	4	7	12	1
13	13	2	2	11	1
14	22	2	5	20	4
15	12	3	3	9	3
16	8	4	5	4	0
17	6	4	4	2	2
18	6	0	2	6	0
19	17	9	5	8	2
20	--	--	--	--	--
21	19	1	5	18	0
22	21	2	12	19	0
23	19	0	9	19	0
24	17	1	5	16	0
25-27	--	--	--	--	--
28	7	0	2	7	0
29	10	3	6	7	0
30	13	2	5	11	0

Just ignore these "no data" periods - I'll explain it in the caption

Table a.--Continued.

Date 1988	Total No. ashore to nest	No. of new females first seen ashore to nest in 1988	Approximate No. depositing eggs	Short-term repeat nesters seen ashore	Long-term recoveries
July					
1	7	1	4	6	0
2-5	--	--	--	--	0
6	18	0	2	18	0
7	19	2	9	17	0
8	18	2	7	16	1
9	9	0	5	9	0
10-13	--	--	--	--	--
14	17	2	6	15	0
15	8	0	1	8	0
16	16	1	7	15	0
17	18	0	5	18	0
18	24	3	10	21	0
19	21	2	8	19	0
20	14	1	9	13	1
21	7	1	2	6	0
22	9	0	2	9	0
23	15	0	4	15	0
24	14	0	5	14	1
25	19	4	5	15	0
26	18	4	12	14	1
27	16	2	8	14	0
28	10	1	4	9	0
29	19	2	8	17	0
30	14	2	5	12	0
31	11	1	4	10	0
August					
1	17	9	7	17	0
2	12	2	5	10	0
3	6	0	3	6	0
4	7	1	2	6	0
5	13	0	7	10	0
6	10	0	7	10	0
7	10	2	6	8	0
8	8	0	0	8	0
9	15	0	8	15	0
10	6	1	3	5	0
11	12	0	6	12	0

Table a.--Continued.

Date 1988	Total No. ashore to nest	No. of new females first seen ashore to nest in 1988	Approximate No. depositing eggs	Short-term repeat nesters seen ashore	Long-term recoveries
August					
12	15	0	11	15	0
13	11	0	2	11	0
14	9	0	6	9	0
15	8	1	3	7	0
16	12	0	2	12	0
17	8	1	2	7	0
18	9	0	4	9	0
Total	--	139	364 (2.6%)	--	33 (23.7%)

Number of adult female green turtles recorded nesting from 13 May to 29 August 1988 at Tern Island, French Frigate Shoals (for 106 nights with complete coverage).

Date 1988	Total No. ashore to nest	No. of new females first seen ashore to nest in 1988	No. depositing eggs	Short-term repeat nesters seen ashore	Long-term recoveries
May					
13	2	2	2	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	2	1	2	1	0
19	1	0	1	1	0
20	1	1	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	1	1	0	0	0
25	2	1	1	1	1
26	1	0	0	1	0
27	0	0	0	0	0
28	1	0	1	1	0
29	4	1	1	3	1
30	1	1	0	0	0
31	4	1	0	3	1
June					
1	4	1	2	3	0
2	3	1	3	2	0
3	0	0	0	0	0
4	0	0	0	0	0
5	1	0	1	1	0
6	0	0	0	0	0
7	1	1	1	0	0
8	1	1	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	2	0	2	2	0
13	1	0	1	1	0
14	1	1	1	0	0
15	4	2	1	2	2
16	6	0	0	6	0
17	4	0	2	4	0
18	4	1	3	3	0
19	5	2	2	3	1

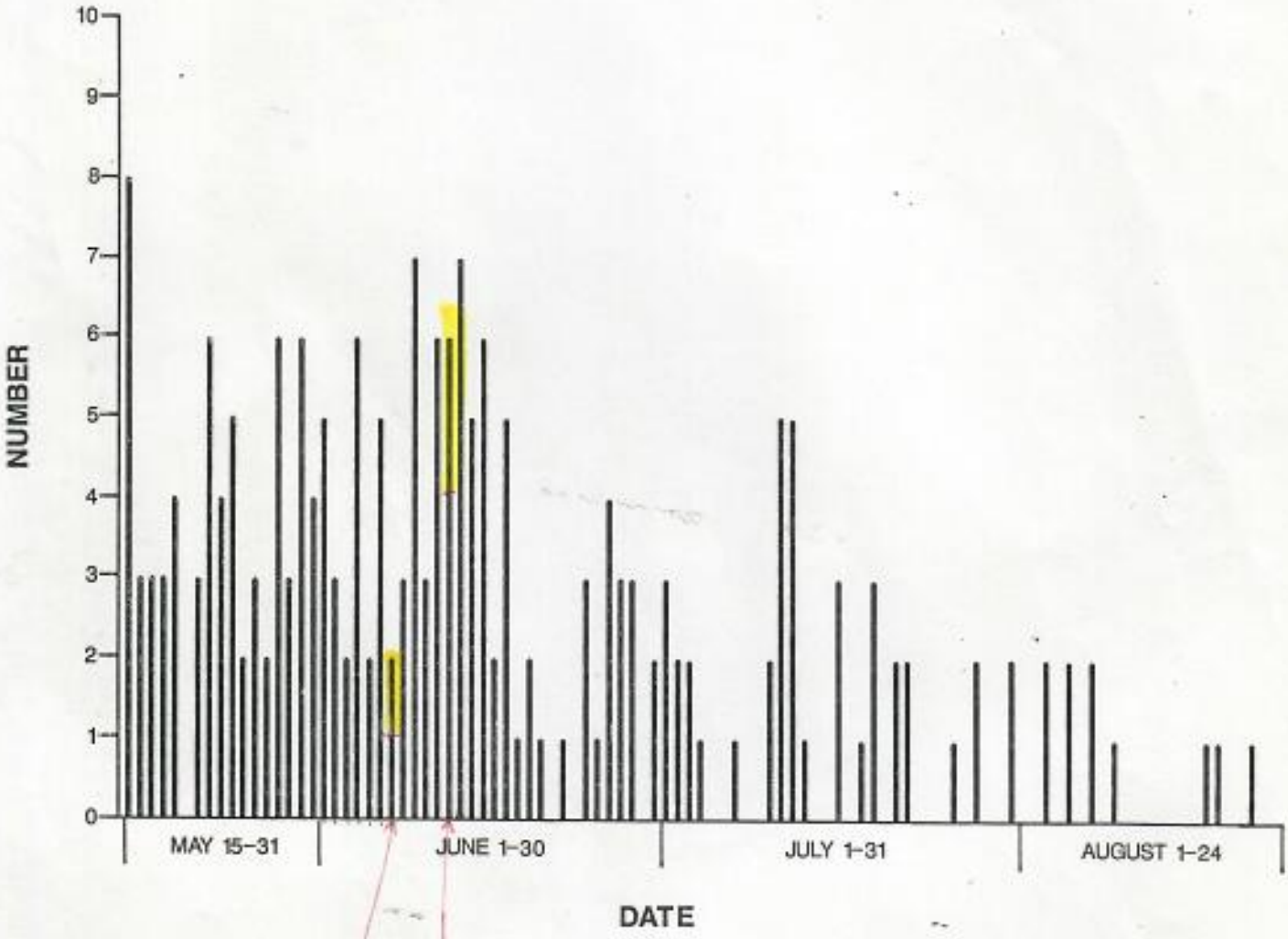
Table b.--Continued.

Date 1988	Total No. ashore to nest	No. of new females first seen ashore to nest in 1988	No. depositing eggs	Short-term repeat nesters seen ashore	Long-term recoveries
June					
20	1	0	0	1	0
21	0	0	0	0	0
22	0	0	0	0	0
23	1	0	0	1	0
24	5	0	1	5	0
25	4	0	3	4	0
26	--	--	--	--	--
27	3	0	0	3	0
28	4	0	2	4	0
29	1	0	0	1	0
30	4	1	0	3	0
July					
1	8	1	2	7	0
2	9	1	1	8	0
3	4	1	2	3	0
4	2	0	2	2	0
5	2	1	0	1	0
6	4	0	0	4	0
7	4	0	0	4	0
8	2	0	1	2	0
9	4	0	1	4	0
10	2	0	0	2	0
11	2	1	1	1	0
12	2	0	1	2	0
13	2	1	1	1	0
14	5	0	2	5	0
15	2	0	2	2	0
16	1	0	1	1	0
17	3	2	2	1	0
18	3	0	2	3	0
19	--	--	--	--	--
20	3	1	1	2	0
21	1	0	0	1	0
22	4	1	2	3	0
23	1	0	1	1	0
24	4	0	2	4	0

Table b.--Continued.

Date 1988	Total No. ashore to nest	No. of new females first seen ashore to nest in 1988	No. depositing eggs	Short-term repeat nesters seen ashore	Long-term recoveries
July					
25	1	0	1	1	0
26	1	0	1	1	0
27	3	0	1	3	0
28	6	1	3	5	0
30	--	--	--	--	--
31	2	0	1	2	0
August					
1	4	0	0	4	0
2	2	0	1	2	0
3	2	0	1	2	0
4	0	0	0	0	0
5	1	1	1	0	0
6	2	0	1	2	0
7	3	0	2	3	0
8	1	0	0	1	0
9	2	0	0	2	0
10	2	0	2	2	0
11	2	0	1	2	0
12	0	0	0	0	0
13	1	0	0	1	0
14	1	0	1	1	0
15	1	0	0	1	0
16	2	0	1	2	0
17	1	0	0	1	0
18	0	0	0	0	0
19	0	0	0	0	0
20	1	0	1	1	0
21	1	0	1	1	0
22	1	0	0	1	0
23	3	0	1	3	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	1	0	1	1	0
28	1	0	1	1	0
29	1	0	0	1	0
Total	--	33	85 (2.6)	--	7 (21.2%)

CORRECTED COPY 12-12-88



June 7 (1 not 2)

June 12 (4 not 6)

note:
204 total, instead of 207

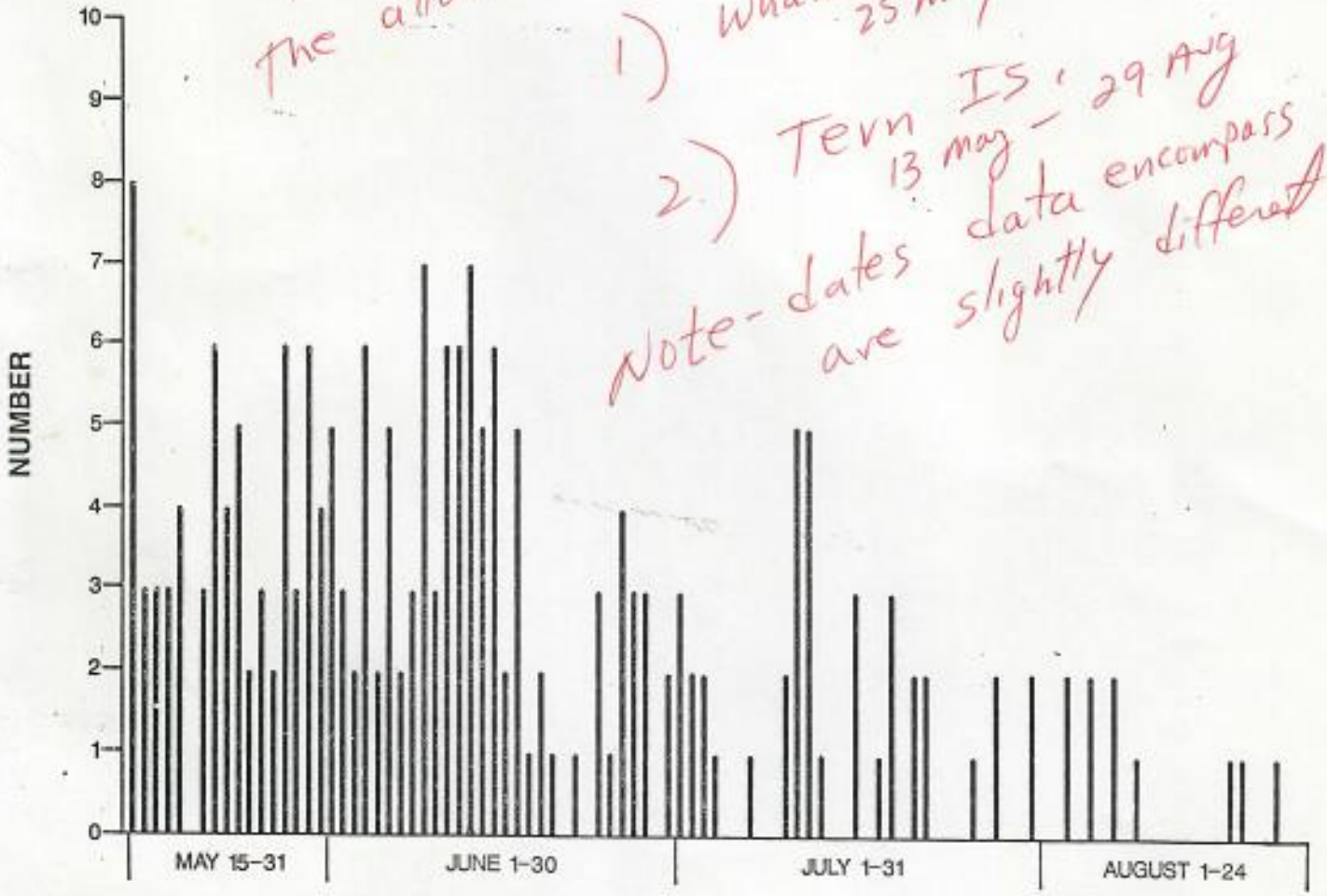
Toms

Please make 2 more graphs like this one, using the attached data

1) Whale-Skate IS, 25 May - 18 Aug

2) Tern IS, 13 May - 29 Aug

Note - dates data encompass are slightly different



Number of new nesting turtles sighted nightly on East Island over a 101 day period from 15 May to 24 August 1988.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

TAKE PRIDE IN AMERICA

MAR 3 1 1989

Dear Bill,

After discussions with yourself, George, Jerry W., Tim G., Stewart, and Ken N., I have made a tentative decision on the direction and level the turtle monitoring should take this season. The enclosed copy of the Green Sea Turtle Study Plan, which I gave to George for review during our last meeting, still appears to be good general guideline to this year's monitoring. The major change will be in the length of the monitoring at East Island. Based mainly on input from Jerry Weatherall, objectives of the Recovery Plan, and our biological opinion we feel that it is important to more fully investigate the parameters used in the population assessment model. Taking into consideration disturbance, dollars, logistics, and intangibles we feel that full season monitoring of turtle nesting on East Island is possible this season and will contribute significantly to refining the parameters. We will start the season with the onset of laying at East Island and will attempt to run through the end of laying in mid September. Our fall back position is to do at least the short term monitoring at East. Logistics will ultimately make the decision for us, but at this time I feel that we can complete the entire season. In addition we would also like to address objective No. 2 in the proposal. In order to find nests for this study walks will be made daily in the morning to mark nest pits for later monitoring for reprosuccess. In addition we may be able to obtain a set of night vision goggles from the Army to use in looking at the ghost crab predation situation. We will discuss this later as it develops.

I just received the tags and applicators from George. Thanks! At this time I am expecting to have Glynnis Nakai and Michael Moser do the monitoring on East Is. If nesting starts earlier than when they arrive in mid May, Vanessa and Craig will be able to begin the work at that time. Vanessa has agreed to help train the volunteers that will be there at that time. Vanessa and Dick declined to work on the project this year. I would be interested in any comments George has on the attached proposal. I have talked to Jerry W. about helping us come up with a good fall back date to stop monitoring if the short term option becomes necessary. Let us know if it would be of value to have Glynnis and Michael meet with George concerning techniques, especially the new paint marking methods.

I have not received your Marine Mammal Permit as required by the Special Use Permit for work on the Refuge this season.

Sincerely,

Ken McDermond
Assistant Refuge Manager
Hawaiian Islands NWR

Proposed 1989 Green Sea Turtle Study
French Frigate Shoals

Objectives:

1. Monitor nesting activity on Tern Island.

2. Continue hatching success analysis on Tern Island nests to determine if man-made debris are trapping hatchlings.

3. Identify turtles nesting on East Island.

Justification:

The future and existence of Tern Island depends on the outcome of investigations into the removal, replacement, or modification of the existing seawall. An important factor in these investigations is the effect a course of action will have on wildlife using Tern Island. During the last few years, Hawaiian green sea turtle nesting activity on Tern Island has apparently been increasing. Data on the number of turtles nesting on Tern Island, location of nests, and duration of the reproductive season (nesting and hatching) are essential to any final decision and scheduling of work.

Forty-plus years of human occupation has left a multitude of man-produced debris buried within Tern Island. The potential for hatchlings being trapped by this debris exists. This will be the third year that nests on tern Island will be excavated to determine the extent of this problem. At the end of this season (1989), we will have looked at between 150 and 200 nests; a large enough sample to allow us to evaluate hatchling entrapment by man-made debris.

East Island has been the location of most green sea turtle research at French Frigate Shoals. Females nesting on East Island have been identified for many years. These data allow researchers to estimate population size, recruitment and loss of nesting females, nesting cycles, and etc. Continuation of this data base is essential to monitoring of the Hawaiian green sea turtle population.

Methods:

Objective 1. On Tern Island, turtle observations will begin with the first nest laid and continue until the last nest hatches. In past years, the nesting season has ranged from the first nest being found in late April to last hatchlings emerging in late December. The date and location of each nest will be recorded.

Nesting females will be identified by reading existing tags or applying tags to untagged females. Curved carapace lengths will also be recorded for each female. Tags will be applied before females begin to excavate nests (while they are moving) or after nesting as they finish covering their eggs. A quick-drying lead-free spray paint will be used to place an identification number on the carapace to expedite identification of turtles already encountered. Nesting activity will be located by patrolling the beaches. To eliminate as much disturbance to the Hawaiian Monk seals and seabird colonies, as possible, these patrols will be limited to the beach zones. (During nights, most seals have hauled out and are in the interior, vegetated zone of the island.) Turtle observers will enter the interior of the island only when tracks of turtles coming ashore are located. The observer's activity will be limited to the vicinity of nesting turtles and all precautions will be taken to reduce disturbance to seals and seabirds.

Objective 2. Hatching of Tern Island nests will be monitored by observing nest sites starting 50 days after the nest was laid. If a nest has not hatched within 90 days, the nest will be excavated and contents analysed (throughout several years of study, mean incubation length for FFS nests have been between 63 and 68 days; extremes have been 53 and 88 days). We feel that by watching for pre- and post-hatching pit formation and tracks of hatchlings almost all hatching nests can be detected. Ther is no need to trap emerging hatchlings! We prefer to do nothing that would disrupt the natural emergence of hatchlings. We will wait 5 days after initial emergence before excavating the nest to determine if any hatchlings were trapped by man-made debris. Excavating the nest will also allow us to record clutch size and hatching success. Hatching success parameters will include the number of infertile or bad eggs, dead or partially developed embryos (1/4, 1/2, and 3/4), dead fully developed hatchlings, live hatchlings trapped in nest, and number of hatchlings that successfully emerged on their own (based upon the number of hatched egg shells in the nest). After analyze, all nest materials will be returned to the excavated pit and buried.

Collecting the clutch size and hatching success data will allow us to examine topics such as: Does the clutch size and hatching success vary between the first, second, third, fourth ... and so on clutches from the same female; Does hatching success vary depending on nest site location (i.e. distance inland); does subsequent nests from the same female have similar incubation lengths or is nest site conditions the major determining factor of incubation lengths; does incubation lengths and hatching success of nests laid at the beginning and end of the season differ from nests laid during the peak of nesting; etc.

Objective 3. Nesting activity on East Island will be monitored for a 6 week period in June - August. The timing of the monitoring period will be determined by when nesting activity begins. If we have a early season as we did in 1988 monitoring

will begin in June. If nesting does not begin until late May or June, East Island monitoring will begin in July and extend into August. During the time East Island is monitored records will be kept on nesting turtles. Turtles will be identified as outlined in methods for Objective 1. Beach patrols will also follow the guidelines described in methods for Objective 1 with the following note: Because East Island is a major pupping site for the monk seal, mom and pup pairs will be encountered. Turtle researchers should not approach turtles nesting in the vicinity of mom and pup pairs. This will mean that some turtles will not be identified; however, during the 6 week monitoring period, chances are that the missed turtle will re-nest and she would probably be identified then.

The turtle camp will be erected at the same location used the last few years. One turtle observer will be stationed on the island at a time (Occasional training periods will require two people). Personnel will be rotated off East Island after a four day stay.

Three database data files will be organized before the 1989 nesting season. These file will expedite data collection, retrieval, and analysis. One file will be for maintaining records of tags, turtle measurement, tumors, physical characteristics and assigned paint numbers. Another will be used to record encounters (i.e. nesting attempts and other sightings). The third data set will be for the Tern Island turtles and will include clutch size, incubation length, nest site parameters, and hatching success data.

Personnel:

The Tern Island portion of the study will require 2 observers from 1 June until 15 September. Turtle activity before and after these dates will be monitored by existing Tern personnel. Two additional observers will be required for the East Island work. These personnel should be at Tern for two months (15 June to 15 August) to allow for last minute adjustments of the East Island observation period.

Equipment and Supplies:

As per attached sheets

Things needed for turtle tagging:

From G. Balaz:
- 3 pair tagging pliers
- 250 tags

From USFWS:
- 6 cans white Zynolyte Speed-E-Namel (dries in minutes and is lead free)
- 2 needle nose pliers
- 2 regular pliers
- 4 small flashlights with rubber handles
- 6 spare bulbs for above flashlights
- 4 good regular flashlights (not the cheap GSA type)

Things needed for the East Island camp:
- Chemical toilet, with two storage tanks
- chemical for above toilet (enough for 2 months)
- 12 rolls white Charmin toilet paper
- Tent: large enough for two cots, preferably one you can stand up in
- Ground Tarp, for the above tent
- tarpaulin to make a canopy over the tent and to make a lanai for shade
- Ropes, posts and stakes necessary to erect tent and canopy
- 3 lawn chairs: 2 regular and one layout type ~~1~~
- 5, 5 gallon water jugs
- 1 camp table(if nothing is available we can make one)
- 2 cots
- 2 sleeping bags
- 1 Coleman lantern } AT TERN ISLAND 11/15/89
- 1 Coleman stove }
- Spare generator, mantles and etc. for lantern
- Propane refrigerator - AT TERN ISLAND 11/15/89
- 6 gallons Coleman fuel
- 3 small bottles propane for refrigerator
- 1 2-3 gallon water thermos

- Fencing and posts to erect camp enclosure (we have NMFS's woven wire and posts. If we can use them- good! If not we will need 100 ft. of wire and 9 fence posts.)

- First-Aid kit - AT TERN ISLAND 11/15/89
- 3 cans Flea & Tick spray
- 8 bottles sun screen
- Shampoo and soap that works in salt water
- Pots and pans for the camp(if not available we can provide from the Tern Island kitchen)

- Food supplies will come from Tern stocks and special orders before and during the study.

Green Sea Turtle Research at French Frigate Shoals

The year-round staffing of Tern Island provides us with an excellent opportunity to gather data pertaining to the breeding biology and population ecology of the Hawaiian green sea turtle. Data on nesting phenology, factors affecting egg incubation length, number of nests per year per nesting female, recruitment and loss of turtles into the nesting population, hatching success, and etc. are needed to effectively monitor the health of this green sea turtle population and to construct management goals.

G. Balaz (National Marine Fisheries Service) has spent many years collecting data on this green sea turtle population and he has done much to further our understanding of this species. Balaz has examined many of the factors mentioned in the above paragraph and it would be unproductive for us to duplicate research already accomplished. Possibly, there are areas where we can contribute research effort to add to our knowledge of the green sea turtle. To determine what these areas are we need to examine what data already exists and where we need additional data. Undoubtedly, more data has been collected than we have copies of at Tern Island. Perhaps, we can have G. Balaz examine the following topics and insert appropriate information as to existing data.

Nesting phenology (from first nest laid to last nest hatched) at French Frigate Shoals. Several seabird species show considerable variation in nesting phenology; it would be interesting to examine green sea turtle nesting to see if seasonal variations can be correlated with variations in sea bird nesting. Possibly, in the future, we will be able to relate phenology variations to changes in environmental conditions.

Existing phenology data:

		Period Monitored		
Year	Location	Start	End	Data: citation or location

Egg incubation length: incubation is used here as time between egg deposition and hatchling emergence. Mean incubation length, range, and standard deviation parameters from different years and locations can be used to determine factors that effect incubation length. For example, preliminary examination of data from Tern Island nests (1987 and 1988) show that nests with the shortest incubation lengths tend to be those further inland. Studies examining how organic and moisture content of the nesting

substrate, nest depth, and other parameters effect incubation temperatures and lengths could add to our knowledge.

Existing incubation length data:

Year	Number of nests	Island	Data-citation or location

Incubation length: incubation lengths at French Frigate Shoals have ranged from 54 to 88 days. Does this range result from environmental factors at the nest site or is there a genetic difference between females? To examine this, incubation lengths of nests from the same female during the same season will have to be examined.

Existing incubation data for multiple nests from one female during the same season:

Year	# of females	# of nests	Data - citation or location

Number of nests per female per year. Nesting needs to be monitored from the first to last nest with females being identified to determine mean number of nests per female. This figure could vary year-to-year so several seasons should be examined. These data could be a good indicator of habitat condition or quality.

Existing nests per female per year data:

Year	location	monitored from: start	end	Data-citation or location

---

Nesting cycles (females). Nesting females will need to be identified yearly for many years to determine what cycles are prevalent. Are these cycles consistent? Do they have any genetic basis? How are they tied in with environmental conditions? These are all questions that can be examined.

Existing nesting cycle data:

Year	location	Number of females identified	Data-citation or location

Hatching success: clutch size, percent of eggs that hatch, and etc. can be examined to determine if environmental conditions resulting from nest location determine the nests success. We can also look to see if early or late nests (within a nesting season) have different hatching successes. Clutch size and hatching success between nests from the same female during the same season should also be examined.

Existing hatching success data:

Year	No of nests	location	Data-citation or location

Population estimates - recruitment and losses: through identifying nesting females yearly and achieving a better

understanding of nesting cycles these parameters can be obtained. The NMFS green sea turtle population model is an ongoing attempt to arrive at these parameters.

Here are some other topics we might be able to contribute to:

Juvenile turtle growth rates: Whenever possible juvenile turtles can be caught tagged and measured. Subsequent recaptures can provide valuable growth data.

Nesting effort on Trig, Little Gin and Gin islands. Visual inspections during the turtle nesting season can give us an idea of nesting intensity.

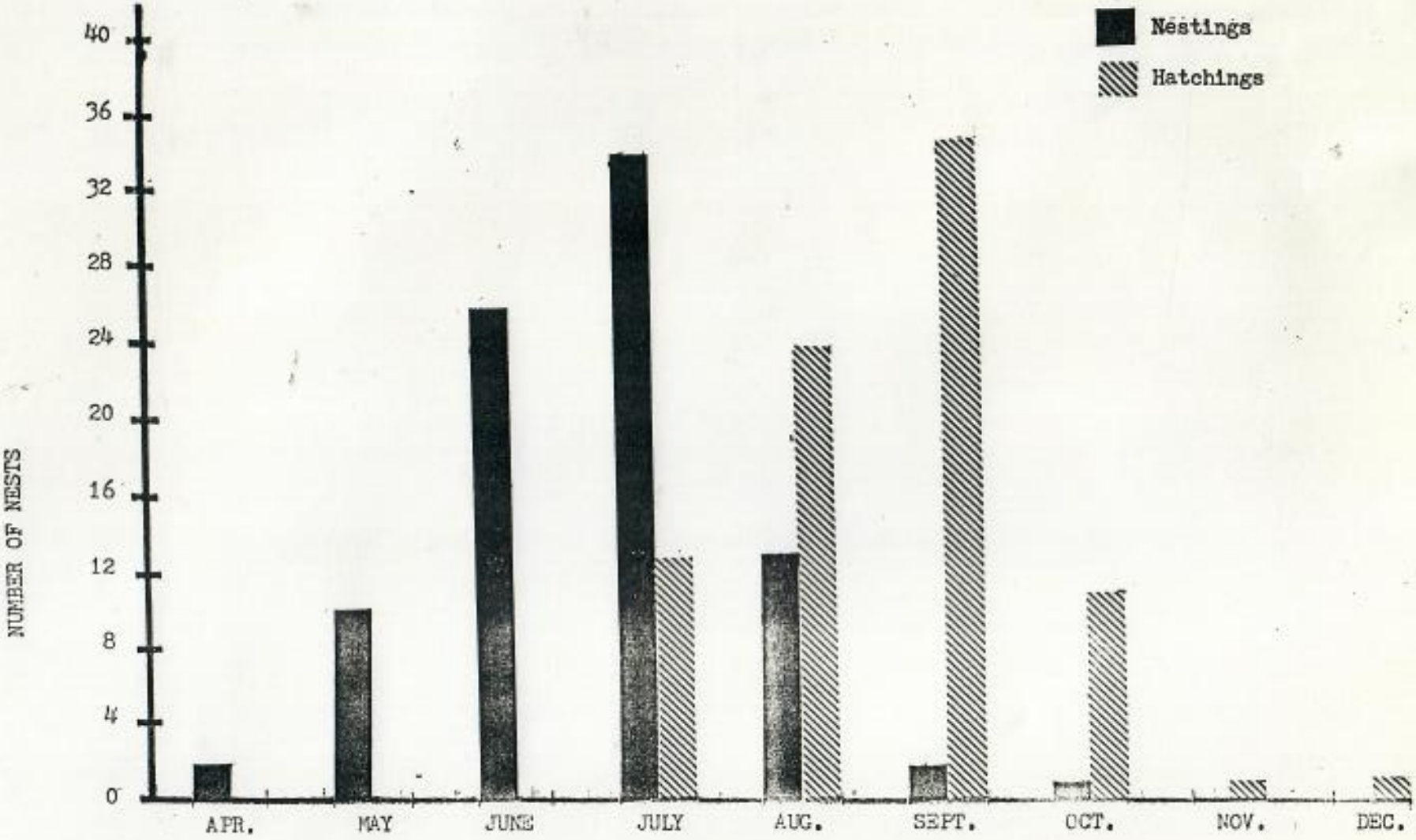


Figure . Hawaiian green sea turtle nesting and hatching at Tern Island, French Frigate Shoals, 1988. Eighty-eight nests were observed. The first and last were layed on 26 April and 1 October, respectively. Eighty-five of these nests hatched; the first on 8 July and last on 9 December.

Data from the 1988 Tern Island green sea turtle study

Statpal - Descriptive Statistics - 1/13/89 17:25 - File: TURTDUMY.STP

Statistics for variable TOTALEGG
Mean: 96.8471 Std. Dev.: 17.9924 Std. Error: 1.9515
Range: 92 Minimum: 54 Maximum: 146
Valid cases: 85 Missing cases: 0

Statistics for variable ALIVEHAT
Mean: 77.6824 Std. Dev.: 28.1544 Std. Error: 3.0538
Range: 124 Minimum: 0 Maximum: 124
Valid cases: 85 Missing cases: 0

Statistics for variable DEAD dead turtles or bad eggs
Mean: 19.1647 Std. Dev.: 23.2875 Std. Error: 2.5259
Range: 114 Minimum: 0 Maximum: 114
Valid cases: 85 Missing cases: 0

Statistics for variable ESCAPED
Mean: 71.4000 Std. Dev.: 27.2660 Std. Error: 2.9574
Range: 114 Minimum: 0 Maximum: 114
Valid cases: 85 Missing cases: 0

Statistics for variable SUCCESS hatching success
Mean: 79.8677 Std. Dev.: 24.6839 Std. Error: 2.6773
Range: 100 Minimum: 0 Maximum: 100
Valid cases: 85 Missing cases: 0

Statistics for variable TRAPPED
Mean: 6.2824 Std. Dev.: 11.3511 Std. Error: 1.2312
Range: 68 Minimum: 0 Maximum: 68
Valid cases: 85 Missing cases: 0

Statistics for variable FULL
Mean: 0.9294 Std. Dev.: 2.5298 Std. Error: 0.2744
Range: 20 Minimum: 0 Maximum: 20
Valid cases: 85 Missing cases: 0

Statistics for variable THREEQUA
Mean: 2.1059 Std. Dev.: 3.1473 Std. Error: 0.3414
Range: 16 Minimum: 0 Maximum: 16
Valid cases: 85 Missing cases: 0

Statistics for variable HALF
Mean: 1.6588 Std. Dev.: 3.0338 Std. Error: 0.3291
Range: 19 Minimum: 0 Maximum: 19
Valid cases: 85 Missing cases: 0

Statistics for variable QUARTER
Mean: 1.1176 Std. Dev.: 2.1067 Std. Error: 0.2285
Range: 10 Minimum: 0 Maximum: 10
Valid cases: 85 Missing cases: 0

Statistics for variable BAD
Mean: 13.3529 Std. Dev.: 22.2848 Std. Error: 2.4171
Range: 114 Minimum: 0 Maximum: 114
Valid cases: 85 Missing cases: 0

incubation length parameters

Statpal - Descriptive Statistics - 1/13/89 17:31 - File: TURTDUMY.STP
Note: Case selection is in effect. Only those cases with values on variable INCULENG greater than 0 will be included in the analysis.

Statistics for variable INCULENG incubation length

Mean:	63.1711	Std. Dev.:	5.9113	Std. Error:	0.6781
Range:	23	Minimum:	53	Maximum:	76

Valid cases: 76 Missing cases: 0 Not selected: 9

Statpal - Regression - 1/13/89 17:35 - File: TURTDUMY.STP
Note: Case selection is in effect. Only those cases with values on variable INCULENG greater than 0 will be included in the analysis.

Dependent variable: INCULENG
Independent variables in the model:
BEACHDIS

Variable	B	Std Error	t Score	2-tail Sig.
Intercept	66.8796	1.0700	62.5026	0.0000
BEACHDIS	-0.4539	0.1074	-4.2274	0.0000

Valid cases: 76 Missing cases: 0 Not selected: 9

Analysis of Variance

Source	SS	DF	MS	F	Sig.
Regression	509.7962	1	509.7962	17.8708	0.0001
Residual	2110.9802	74	28.5268		
Total	2620.7763	75	34.9437		

R-squared = 0.1945
R-squared adjusted for DF = 0.1836

AGENDA

French Frigate Shoals Turtle Monitoring 1989
17 February 1989

Attendees:

Bill Gilmartin, NMFS
George Balaz, NMFS
Stewart Fefer, USFWS
Ken McDermond, USFWS
Craig Rowland, USFWS
~~Lynn Denlinger, USFWS~~

Objectives:

1. Determine scope of effort for 1989 season. What is the ideal?
   Use recovery plan and Weatheralls model description for guide.

   a. Nesting females: what islands? how long? next year?
   b. Hatching success: what islands?
   c. Ghost crab predation.
   d. Evaluate various scenarios and their effects on other resources.
   e. Long term perspectives: Will an intese effort over several years allow us to then revert to a short duration monitoring scheme to evaluate no. of nesters, recruitment, etc.
   f. Recovery objectives.

2. Define roles and responsibilities of cooperators.
   a. Overall responsibility -

   b. Personnel -

   c. Technical expertise -

   d. On site project supervisor -

   e. Data analysis -
      i. Nesting females -
      ii. Hatching success -
      iii. Ghost crab predation -

   f. Writeup -

   g. Supplies -

   h. Transportation -

3. Schedule
   a. Technical Meeting

   b. Personnel arrive in Honolulu

   c. Training

d. Personnel depart for FFS

e. Project Completion

f. Personnel depart FFS for HNL

g. Data analysis

h. Project writeup

QUESTIONS CONCERNING THE EAST ISLAND MODEL AND RECOVERY PLAN

1. ~~Is~~ Are there any data since the 1980 biological synopsis which changes parameters used in the model. For example data collected at Tern over past few may extend nesting and hatching season reported in 1980, also the mean number of clutches per female may be significantly different.

2. Note following pages:

pg. 58 Calls for saturation tagging for several consecutive seasons.
79 female arrival times, # of nests/female, dist. of time intervals clutch size, length of egg laying season/hatchiling emergence.
83 recommends monitoring entire season
92 arrival times and distribution and nesting behavior are noted as major potential source of systematic bias.
parameters have been estimated from very little data
assumed to be constant but may vary from year to year
recommends monitoring nesting over several complete nesting seasons
already covered are not fully covered and are insufficient
93 recommends checking assumptions of Easts importance by conducting complete surveys of other nesting islands at FFS

3. Can recruitment really be measured even after saturation tagging for several years.

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10 February 1989

MEMORANDUM FOR: George Balazs, Bill Gilmartin

FROM: Jerry Wetherall

SUBJECT: Comments on 1989 Green Turtle Nesting Survey Plans

In regard to the subject, some fast comments and a status report:

(1) Marian has finished sifting through the 1988 field logs and has coded and transcribed info on date, time, island, location, activity, scars, and tumors for each turtle encounter. The data are being keyed into a database and verified by DMTS (actually, UH is doing the work). Should be done in a couple of weeks. This database covers all islands surveyed.

(2) The next step with this data is to estimate the various functions that make up the model of residence time. This is the model that allows us to estimate the probability that a turtle will be encountered during any specified survey schedule. The underlying functions (probability distributions) are: the distribution of arrival time, the distribution of number of nesting episodes, the distribution of the interval between successive nesting episodes, and the distribution of the duration of a nesting episode. This is not a trivial exercise, and will take several weeks of sustained work. But it is not essential to have the results right away.

(3) A parallel project, which I have already designed, is to evaluate the entire population estimation method by Monte Carlo simulation. This involves setting up a computer program which will simulate the entire season of nesting, based on the current residence time model, along with a superimposed survey, and run the thing a few hundred times or more (replicates) for each possible survey schedule. In this manner, we can get an idea of what levels of bias and precision are associated with various non-saturation survey scenarios. The results will help in designing a survey to get the best population estimate with a given level of resources, or to find out how much resources are needed to achieve a desired precision or whatever. This job can proceed with the current residence time model, and then be updated when the results from (2) are available. I have not coded this program yet. I can't get to it soon because of other stuff. But I hope to do it in bits and pieces over the next few months.

(4) Another issue is where to place survey effort, and at what level. Because the East Island survey has been the guts of the monitoring effort it should obviously be continued at some level. Saturation surveys are the only way to develop and validate the residence time model. If resources are available, it would be very valuable to repeat the saturation work at East Island (maybe with an earlier start).

As to the other nesting sites, such as Whale-Skate and Tern Island, the question has to do with verifying what fraction of the total nesting occurs on East Island, and how this varies from year to year, so East

Island results can be expanded to the total population. Also, we need to develop independent models of residence time on each island, or see whether the East Island model can be applied everywhere. All of this suggests more surveys on Whale-Skate and Tern. But these don't necessarily have to be done in 1989. The objective is to measure interannual variability. So you could do the surveys any old year, provided the variation was random. But if there is some pattern (cycle), then you would have to do saturation surveys over a consecutive series of years to measure it.

We would certainly benefit from repeats on Whale-Skate and Tern in 1989. However, if monk seal disturbance is a significant problem then the decision is not simply a statistical one. Even if I could make an iron-clad statistical case for repeating the surveys, I couldn't weigh the other factors. It seems that someone should develop a non-disruptive method to assess the relative size of the nesting population, to allow comparable indexing of islands where seal disturbance is a problem.

cc: G. Boehlert

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center Honolulu Laboratory
2570 Dole St. • Honolulu, Hawaii 96822-2396

March 29, 1989 F/SWC2:GHB

Stewart Fefer
Ken McDermond
U.S. Fish and Wildlife Service
Hawaiian Islands National
Wildlife Refuge
P.O. Box 50167
Honolulu, HI 96850

Dear Stewart and Ken,

Enclosed are 380 Inconel tags numbered W-11 through W-400 along with three applicators for use this summer at French Frigate Shoals. = 390

As you know, it is exceedingly important that an accurate accounting be kept of the use of these tages. Such was the case during 1988, and for all previous years. The data record system employed in the past in the field may seem cumbersome but it has nevertheless been effective and very accurate. In addition, it has consistently provided Jerry Wetherall with the data needed for the model. For the 1989 season, I recommend that any changes in record keeping be done with extreme care and caution. It is my view that Vanessa would be the best person to make any modifications for streamlining purposes. I hope that circumstances will allow her, along with Dick, to again be employed in the turtle monitoring effort. This would help to ensure continuity and stability founded on their earlier experiences.

Within the next month I will be able to make a firm recommendation on a practical carapace marking method superior to last years Zylonyte spray paint. Our study at Sea Life Park is producing some interesting results.

Please relay instructions to Tern Island that, once received, only the enclosed W-prefix tags and applicators should be used at French Frigate Shoals. All five-digit tags and applicators currently at Tern should be returned at the earliest convenience.

Sincerely,

George H. Balazs
Zoologist

Note: All bent and unuseable tags should be saved and returned to me.

cc: William Gilmartin

W-401 To W-600 = 200
Sent mid-June to Tern
8/2/89 W601- W700

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P. O. BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:

29 June 1989

George Balazs
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822

Dear George,

Hello from French Frigate Shoals! I hope this letter finds you well and having an enjoyable summer. The sea turtle study at French Frigate Shoals has been ongoing since 3 May 1989 on East Island and Tern Island. We wish to keep you updated on the data coallected as much as possible as well as to obtain any concerns and suggestions you may have at this time.

Mike Moser and myself are the FWS personnel who's main responsibility is the sea turtle study. This is advantageous in maintaining consistency in data collection methods and communications; both of us will be at French Frigate Shoals until the beginning of September.

The schedule is such that each of us spends four nights/five days on East Island and four nights/five days on Tern Island; so when one of us is on East, the other is covering Tern Island. Upon return to Tern Island, the data coallected on East is imputed onto the computer data bases for ease in reference as well as simplicity in compiling all the data at the end of the season. This has worked real well and we are able to have an updated printout of the individual turtle identifications available to us on East Island. Enclosed is a copy of data coallection methods and the essential information to be obtained for individual female sea turtles. Basically, there are three data forms used: 1) Green Turtle Identification Form for Nesting Females; 2) Nesting Female Sighting Form; and 3) Daily Totals -Nesting Green Turtles.

I am enclosing a printout of the data collected on the Green Sea Turtle Identification and a copy of the daily totals for your review and information; this data includes up through 24 June 1989 for East Island only. Up through this date, there have been approximatly 231 individual female sea turtles nesting on East Island - there are a handful of females that were unable to be identified. individual individual of which have been new idenfications (no recovery of In looking at the column for "old" or "new" tags on the turtle I.D., you'll get an idea of the

number of newly tagged turtles.

In reference to the Daily Totals, you'll notice that the average number of individuals up per night is approximately 28! It is really exciting to have so many females up in one night. If you have any specific concerns or questions regarding the data, please feel free to ask and I'll try to answer them as best as possible!

The R/V Kila will be arriving at FFS sometime around the 10 July at which time I will be sending you updated data on the Green Turtle Identification, daily totals as well as a copy of the individual nesting female sighting data collected for East Island. I will also be sending you the W-series tags that were used for practice as well as those that were applied improperly. At that time I will also be able to give you a thorough review/summary of the application and retention of the Ace Hardware Quick-Drying Enamel and the Deco-Rez Primer.

My apologies for not getting this to you sooner. I will have you all caught up with the turtle study after the R/V Kila returns to Honolulu around 13 July!

You should give us a radio call sometime - it would be good to hear from you! I hope you are well, and if you have any concerns regarding any aspects of the turtle study, please do contact us - your input is of great value in the continuation of the research!

Sincerely,

Glynnis L. Nakai

Glynnis L. Nakai

Enclosures

DAILY TOTALS
NESTING GREEN TURTLES
FRENCH FRIGATE SHOALS, 1989

Island: EAST

Date	# Turtles Up	# New Turtles IDed	# Nests	Invest.	Comments
5/03/89	8	8	1 probable	DB	FIRST NIGHT ON EAST - 4 Probable Nest already here from previous nights
					TURTLES APPEAR MORE INTERESTED IN CRAWLING OR RESTING NEAR LIP OF BEACH THAN NESTING
05/04	1 crawl	0	0	DB	Tide [illegible] night
05/05	5	0	4	JF	Rained on & off all night
5/16	3	2	2	JF	[illegible]
5/7	5	3	0	JF	Nice evening no rain. [illegible]
5/8	18	12	3	JF	Busy night, one UID & left a maybe nest How do you record? 4 UID turtles total
5/9	11	3	7	JF	2 turtles not identified, both digging egg pits and then gone upon return.
5/10	10	3	3	JF	1 turtle not identified. In addition, one completed turtlenest found but no turtle
5/11	14	6	6	JF	2 turtles UID one [illegible] I'll classify as a digger.
5/12	7	3	6	JF	One turtle UID nesting (probably). I tag [illegible] I thought [illegible] but didn't have time to read before [illegible]
5/13	5	2	2	JF	One turtle UID crawling. to ESD.
5/14	10	4	6	JF	3 UID Turtles incl 2 probable nests.
5/15	13	7	7	JF	
5/16	12	6	7	JF	
5/17	9	2	3	JF	Mostly crawlers. 3 UID ♀. One was a maybe nest. The other 2 could have been some resting crawlers including 2 UID crawlers ♀
5/18	14	6	4	JF	Includes 1 UID digger
5/19	10	7	1	JF	
[illegible]	17		[illegible]	[illegible]	10 painted, 2 tagged (one questionable)
5/21	11	1	2-N 4-P	CR	
5/22	9	3	1	DB	
5/23	13	13	2	DB	Did 1st walk at 1980 & found 7 turtles
5/24	17	5	3	DB & MM	12 up for first walk at 1915
5/25	27	4	6	MM & GN	1 turtle not ID'ed (CONTINUOUS OBSERVS 7:00 → 7:00)

DAILY TOTALS
NESTING GREEN TURTLES
FRENCH FRIGATE SHOALS, 1989

Island: EAST

Date	# Turtles Up	# New Turtles IDed	# Nests	Invest.	Comments
5/26/89	27	1	10	m.m.	
5/27/89	23	1	6	m.m.	
5/28/89	28	6	9	m.m.	1 nester unmarked, too close to rpt's.
5-29-89	22	6	3	glm	RAIN! ugh... 3 Turts unidentified
5-30-89	19	4	5	glw	low tide in p.m. 4 Turts unidentified
5-31-89	26	3	6	glw	5 Turts unidentified
6-01-89	20	3	6	glw	2 Turts UID.
6-02-89	28	12	5	m.m.	5 w/o paint 3 of which had tags applied
6-03-89	32	3	3	m.m.	many up, few nesters!!!
6-04-89	27	6	13	m.m.	
6-05-89	28	3	10	m.m.	
6-06-89	27	7	4	glw	2 Turts UID.
6-07-89	29	1 New/2 Prev # illegible *	2N, 5M	glw	* no record of tag #s
6-08-89	26	4 New/1 Prev # illegible *	2N, 3M	glw	* no record of tag #s 1/2 moon-↓@ midnite; windy, wet + wild
6-09-89	29	4 2 UID tags	4N, 3M	glw	Good IDea Lael!!! 3 Turts UID.
6/10/89	27	6	1N, 2M, 6P	m.m.	1 unlegible paint, B.P. ∴ w check for tags
6/11/89	34	6	2M, 2P, 3N	m.m.	look-up pt # for w166 (current = 210)
6/12/89	28	3	1P, 1N	m.m.	
6/13/89	37	4	2P, 1N	m.m.	
6-14-89	41	5	4N, 5M	glw	(2 UK) Moon set at 3:15
6-15-89	31	7 total (3 prev. tagged)	6N, 5M	glw	Moon set at 4:00 ; 3 Turts UID
6-16-89	35	4 New 1 Prev #	6N, 1M	glw	* 1 prev. # illegible 2 Turts UID.
6-17-89	34	1	6N, 1M	glw	moon set at ...5:00 ? 1 UK/UID.

DAILY TOTALS
NESTING GREEN TURTLES
FRENCH FRIGATE SHOALS, 1989

Island: _____

Date	# Turtles Up	# New Turtles IDed	# Nests	Invest.	Comments
6/18/89	30	3	2M 2P 2N	✓✓	2 turds painted, need tag ✓ (not incl in # New)
6/19/89	32	3	2M, 5P, 3N	✓✓	
6/20/89	24	1	1M, 2P, 1N	✓✓	1 painted, need tag ✓ (not included in #new)
6-21-89	33	3	2N	MM	
6-22-89	25	1 (1 pt only)	1N, 1M	qw	Kona Storm: rain, wind all night (heavy!)
6-23-89	26	2 (1 was prev pt only)		qw	Water muchos Grey !!
6-24-89	28	1 (1 also w/ pt only)	2N, 2M	qw	
		214			

Green Turtle Identification for Nesting Females — data collected through 6/24/89

Record#	DATE	PAINTID89	COLOR	TAGNO	TAGPOS	NEW_OLD	CARAPACE	TUMORS	TUMORPOS
75	05/15/89		W	6010	L		0.0		
227	06/02/89		S	W157	R	N	0.0	0	
364	06/11/89			W343	L34	N	0.0		
365	06/11/89			W344	R34	N	0.0		
186	05/28/89	#1	S				0.0	0	
2	05/03/89	10		W26	L	N	103.0	0	
3	05/03/89	10		5306	R	O	0.0	0	
4	05/03/89	11		3701	L2	O	102.5		
11	05/05/89	11		3810	R	O	0.0	22	12
12	05/05/89	11		5139	R2	O	0.0		
5	05/03/89	12		9674	L	O	95.0	0	
6	05/03/89	12		9675	R	O	0.0	0	
7	05/03/89	13		W27	R34	N	99.0		
8	05/03/89	14		W28	R	N	98.5	0	
148	05/25/89	14	S	W116	L	N	0.0	0	
9	05/03/89	15		8208	L	O	0.0		
10	05/03/89	16		9281	L12	O	95.5	0	
415	05/18/89	16	W	W77	R34	N	95.5		
458	05/16/89	16	W	W78	R	N	95.5		
13	05/06/89	17		6208	R2	O	0.0		
14	05/06/89	17		3139	L	O	101.5	0	
15	05/06/89	17		6207	L2	O	0.0		
16	05/06/89	17		3161	R	O	0.0		
39	05/09/89	18	W	W42	R	N	0.0	0	
40	05/09/89	18	W	W41	L	N	100.0	0	
41	05/09/89	19	W	W44	L	N	91.5	0	
42	05/09/89	19	W	W46	R	N	0.0	0	
17	05/07/89	20		9712	R	O	0.0		
18	05/07/89	20		9714	L	O	94.0	0	
123	05/22/89	21	W	W87	R	N	100.5	0	
124	05/22/89	21	W	W88	L	N	0.0	0	
19	05/08/89	22		4252	R	O	92.5	0	0
20	05/08/89	22		4251	L	O	92.5	0	0
21	05/08/89	23	W	W29	L	N	100.0	0	0
22	05/08/89	23	W	W30	R	N	0.0	0	
23	05/08/89	24	W	W31	L	N	94.0	0	
24	05/08/89	24	W	W32	R	N	0.0	0	
25	05/08/89	24	W	W33	L34	N	0.0	0	
26	05/08/89	25	W	W36	R	N	0.0	0	
27	05/08/89	25	W	W37	L34	N	91.0	0	
28	05/08/89	26	W	9365	L	O	94.0	0	
29	05/08/89	26	W	9366	R45	O	0.0	0	
30	05/08/89	27	W	---8	L	O	96.5	24	12
31	05/08/89	27	W	9266	R34	O	0.0		
32	05/08/89	27	W	W38	L34	N	0.0		
33	05/08/89	28	W	6058	L	O	103.5	0	
34	05/08/89	28	W	W40	R	N	0.0		
35	05/08/89	29	W	3619	R	O	95.5	0	
36	05/08/89	30	W	6183	R	O	0.0	0	
37	05/08/89	30	W	6192	L	O	100.0	0	
43	05/09/89	31	W	3387	L	O	99.0	0	
44	05/09/89	31	W	W43	R	N	0.0	0	
45	05/09/89	32	W	3616	L	O	99.5	0	
46	05/09/89	32	W	3615	R	O	0.0		
137	05/24/89	32	W	W103	L34	N	0.0	0	
138	05/24/89	32	W	W102	R34	N	0.0	0	
47	05/09/89	33	W	6213	L	O	103.5	0	
48	05/09/89	33	W	W47	R	N	0.0		
49	05/10/89	34	W	W49	R	N	0.0	0	
50	05/10/89	34	W	W48	L	N	96.5	0	
38	05/08/89	35	W	3541	L	O	0.0	0	
51	05/10/89	35	W	3542	R	O	96.0	0	

52	05/10/89	36	W	W52	L	N	96.0	0
53	05/10/89	36	W	W53	R	N	0.0	
54	05/11/89	37	W	W57	L34	N	92.0	0
55	05/11/89	37	W	W58	R	N	0.0	0
430	06/19/89	37	S	W386	L	N	0.0	
56	05/08/89	38	W	4272	R	O	0.0	0
57	05/11/89	38	W	4271	L	O	97.0	0
58	05/11/89	39	W	W59	L	N	96.0	0
59	05/11/89	39	W	W60	R	N	0.0	0
67	05/14/89	40	W	W66	L34	N	94.0	
68	05/14/89	40	W	W68	R34	N	94.0	0
61	05/12/89	41	W	W62	R	N	0.0	0
62	05/12/89	41	W	W61	L	N	101.0	0
333	06/09/89	42	S	6131	L	O	99.0	0
334	06/09/89	42	S	5999	R	O	0.0	0
63	05/12/89	43	W	6256	L2	O	103.0	0
64	05/12/89	43	W	----	L	O	0.0	0
65	05/12/89	43	W	3601	R	O	0.0	0
69	05/14/89	44	W	9765	L	O	93.0	0
70	05/14/89	44	W	9673	R	O	0.0	
60	05/11/89	45	W	3231	L	O	0.0	
66	05/13/89	45	W	W64	R34	N	110.0	0
71	05/14/89	46	W	3432	L	O	100.5	0
72	05/14/89	46	W	3433	R	O	0.0	0
73	05/14/89	48	W	6006	L	O	100.5	0
335	06/09/89	48	S	W319	R	N	0.0	0
76	05/15/89	50	W	----	L	O	99.5	0
77	05/15/89	50	W	6261	R	O	0.0	0
341	05/17/89	50		--75	L34	O	0.0	0
83	05/16/89	52	W	6148	R	O	0.0	0
84	05/16/89	52	W	-271	L	O	95.5	0
384	06/14/89	53	S	W370	L	N	92.0	0
385	06/14/89	53	S	W362	R	N	92.0	0
78	05/15/89	54	W	6001	L	O	104.0	0
79	05/15/89	54	W	6199	R	O	0.0	
80	05/15/89	54	W	----	R2	O	0.0	
340	06/08/89	54	S	6004	R2	O	0.0	0
85	05/16/89	55	W	5438	R2	O	0.0	0
214	05/31/89	55	S	W150	L	N	92.8	0
215	05/31/89	55	S	2816	R	O	0.0	0
81	05/15/89	56	W	8195	L	O	102.5	0
456	05/30/89	56		3444	R	O	101.9	
82	05/15/89	57	W				0.0	
86	05/16/89	58	W				0.0	
88	05/23/89	60	W	W92	R	N	98.0	
89	05/16/89	61	W	W70	R	N	0.0	0
90	05/16/89	61	W	W69	L	N	95.5	0
91	05/16/89	62	W	3377	R	O	0.0	0
92	05/16/89	62	W	3378	L	O	102.0	0
93	05/17/89	63	W	2999	L	O	101.5	0
94	05/16/89	63	W	3002	R	O	102.0	0
95	05/16/89	64	W	W72	R	N	0.0	0
96	05/16/89	64	W	W71	L	N	99.0	0
228	06/02/89	65	W	W170	L	N	100.0	0
229	06/02/89	65	W	W171	R	N	0.0	0
97	05/17/89	66	W				98.5	0
115	05/20/89	66	W	W84	L	N	98.0	0
100	05/19/89	67	W	6191	L	O	97.0	0
101	05/19/89	67	W	W79	R	N	0.0	0
102	05/19/89	68	W	3438	L	O	99.5	0
103	06/01/89	68	W	W81	R34	N	98.9	0
104	05/18/89	69	W	5196	L	O	100.0	0
105	05/18/89	69	W	5197	R	O	0.0	0
106	05/18/89	70	W	3340	R	O	105.0	0
107	05/18/89	70	W	W76	L	N	0.0	0
108	05/18/89	71	W	5368	L2	O	110.0	0

109	05/18/89	71	W	7181	R	O	0.0	0
110	05/23/89	72	W	W97	L	N	93.0	0
126	05/23/89	72	W	W98	R	N	0.0	
230	06/02/89	74	S	W168	R23	N	0.0	0
231	06/02/89	74	S	W169	L	N	0.0	0
111	05/19/89	75	W	9668	L	O	96.0	0
112	05/19/89	75	W	9667	R	O	0.0	0
232	06/02/89	77	S	W161	L34	N	0.0	0
233	06/02/89	77	S	2237	R	O	0.0	0
234	06/02/89	77	S	2235	L	O	0.0	0
235	06/02/89	77	S	3145	R34	O	0.0	0
470	06/02/89	77	S	5305	L2	O	0.0	
248	06/03/89	78	S	W182	R	N	0.0	
260	06/04/89	78	W	W194	L	N	94.0	
113	05/19/89	79	W	3127	L	O	103.5	0
114	05/19/89	79	W	W80	R34	N	0.0	
117	05/20/89	83	W				0.0	
118	05/20/89	84	W	W83	L	N	102.0	0
1	05/03/89	85		9680	R	O	94.0	
261	06/04/89	85	W	9681	L	O	94.0	
119	05/20/89	86	W				0.0	0
236	06/02/89	87	S	W156	L	N	0.0	0
247	06/02/89	87	S	W155	R	N	0.0	0
280	06/05/89	88	W	6111	R	O	98.0	
281	06/05/89	88	W	6091	L	O	98.0	
120	05/20/89	89	W				0.0	
121	05/21/89	90	W	5276	R	O	99.0	0
122	05/21/89	90	W	W86	L	N	0.0	0
127	05/23/89	91	W	W90	R	N	0.0	0
128	05/23/89	91	W	W89	L	N	99.0	0
139	05/24/89	92	W	5317	L34	O	98.0	0
140	05/24/89	92	W	5337	R	O	0.0	0
149	05/25/89	93	S	W113	L	N	93.5	0
150	05/25/89	93	S	W112	R	N	0.0	0
125	05/08/89	94	W	3427	L	O	99.5	0
423	06/18/89	94	S	W381	R	N	0.0	
129	05/23/89	95	W	3756	L	O	98.5	
141	05/24/89	95	W	W104	R	N	0.0	0
130	05/23/89	96	W	W91	R	N	100.0	
338	06/06/89	96	S	2223	L	O	0.0	0
339	06/06/89	96	S	5320	L2	O	0.0	0
151	05/25/89	97	S	W118	R	N	92.0	0
152	05/25/89	97	S	6149	L	O	0.0	0
374	06/13/89	97	W	W355	L	N	94.0	
375	06/13/89	97	W	W356	R	N	94.0	
282	06/05/89	98	W	W200	R	N	96.0	
283	06/05/89	98	W	W199	L	N	0.0	
284	06/05/89	99	W	W304	R23	N	91.0	
285	06/05/89	99	W	W305	L23	N	0.0	
286	06/05/89	99	W	6179	L	O	0.0	
287	06/05/89	99	W		R	O	0.0	
131	05/23/89	100	W	W93	L	N	96.5	
132	05/23/89	100	W	W94	R	N	0.0	
133	05/23/89	101	W	W95	L34	N	94.5	
422	06/18/89	101	S	W380	R	N	0.0	
134	05/23/89	102	W	W96	L	N	95.0	0
135	05/23/89	102	W	W99	R	N	0.0	0
337	06/09/89	102	S	W322	L	N	95.2	0
171	05/26/89	105	S	W126	L	N	0.0	0
172	05/26/89	105	S	W125	R	N	97.8	0
142	05/24/89	106	W	9313	L	O	102.0	0
143	05/24/89	107	W	5192	L	O	102.5	0
144	05/24/89	108	W	W106	R	N	0.0	0
145	05/24/89	108	W	W105	L	N	105.0	0
146	05/24/89	110	W	W108	L	N	84.0	0
147	05/24/89	110	W	W107	R	N	0.0	0

153	05/25/89	111	S	W110	R	N	0.0	0	
154	05/25/89	111	S	W111	L	N	95.0	0	
155	05/25/89	112	S	6021	L	O	97.0	0	
156	05/25/89	112	S	6022	R	O	0.0	0	
157	05/25/89	113	S	3837	R2	O	0.0	0	
158	05/25/89	113	S	5430	R	O	0.0	0	
159	05/25/89	113	S	3213	L	O	100.0	0	
160	05/25/89	114	W	W50	L	N	95.7	0	
161	05/25/89	114	W	W51	R	N	0.0		
162	05/25/89	115	S	9789	R	O	0.0	0	
163	05/25/89	116	S	W115	L	N	101.7	2	3
164	05/25/89	116	S	W117	R34	N	0.0		
165	05/25/89	117	S	W119	L	N	0.0		
166	05/25/89	117	S	6265	R	O	0.0		
167	05/25/89	118	S	W120	L	N	100.0	0	
168	05/25/89	118	S	W121	R	N	0.0	0	
169	05/26/89	119	S	9682	L	O	94.0	0	
170	05/26/89	119	S	9683	R	O	0.0	0	
173	05/26/89	121	S	W124	L	N	0.0	0	
174	05/26/89	121	S	W114	R	N	106.5	0	
175	05/26/89	122	S	7156	L	O	0.0	0	
176	05/26/89	122	S	W128	R	N	97.4	0	
177	05/26/89	123	S	3152	R	O	98.0	0	
352	06/10/89	123	S	W335	L34	N	98.0	0	
136	05/23/89	124		W100	R	N	95.0		
178	05/26/89	124	S	W127	L	N	94.0	0	
179	05/26/89	125	S	3537	L	O	96.0	0	
336	06/09/89	125	S	3369	R	O	0.0	0	
180	05/26/89	126	S	3787	L	O	96.5	0	
459	05/26/89	126	S	3732	L34	O	96.5		
460	05/26/89	126	S	5216	R	O	96.5		
182	05/27/89	128	S	8164	L	O	101.0	0	
183	05/27/89	128	S	5428	R	O	0.0	0	
185	05/27/89	130	S				0.0	0	
181	05/26/89	133	S	W122	L	N	103.4	0	
187	05/28/89	133	S	W123	R	N	103.0	0	
188	05/28/89	134	S	W133	R	N	0.0	0	
189	05/28/89	134	S	W134	L	N	94.0	0	
190	05/28/89	135	S	W137	L	N	0.0		
314	06/07/89	135	S	W315	R	N	98.7	0	
193	05/28/89	137	S	W141	R	N	0.0	0	
194	05/28/89	137	S	W140	L	N	91.0	0	
195	05/28/89	138	S	W143	R	N	0.0	0	
196	05/28/89	138	S	W142	L	N	99.0	0	
197	05/28/89	139	S	W145	R	N	0.0	0	
198	05/28/89	139	S	W144	L	N	94.0	0	
200	05/29/89	141	S				0.0	0	
201	05/29/89	142	S				98.3	0	
202	05/29/89	143	S	9348	L	O	99.1	0	
203	05/29/89	143	S	9363	R	O	0.0	0	
204	05/29/89	144	S	6026	R2	O	93.1	0	
433	06/19/89	144	S	W389	L34	N	0.0		
199	05/28/89	145	S	3245	R	O	99.5	0	
205	05/29/89	145	S	3412	L	O	99.4	0	
206	05/29/89	146	S	3437	R	O	0.0	0	
207	05/29/89	146	S	3-29	L	O	100.0	0	
208	05/30/89	147	S				92.3		
237	06/02/89	147	S	W165	R	N	91.0		
238	06/02/89	147	S	W167	L	N	91.0	0	
437	06/19/89	147	S	W392	R	N	0.0		
74	05/14/89	148	W	W65	R	N	95.0	0	
209	05/30/89	148	S	W54	L	N	95.0	0	
210	05/30/89	149	S	7314	R	O	0.0	0	
211	05/30/89	149	S	7313	L	O	98.3	0	
288	06/05/89	149	S	W306	R23	N	0.0		
289	06/05/89	149	S		R	O	0.0		

212	05/30/89	150	S	7172	L	O	102.8	0			
213	05/30/89	150	S	7173	R	O	0.0	0			
216	05/31/89	151	S	W146	R	N	93.3	0			
217	05/31/89	151	S	W147	L	N	0.0	0			
98	05/16/89	152	W	9784	L	O	96.0	0			
218	05/31/89	152	S	9783	R	O	96.1	0			
219	05/31/89	153	S	W148	L	N	95.6	0			
220	05/31/89	153	S	W149	R	N	0.0	0			
221	06/01/89	154	S	W152	R	N	0.0	0			
222	06/01/89	154	S	W151	L	N	93.1	0			
223	06/01/89	155	S	5372	R2	O	92.8	0			
224	06/01/89	155	S	2666	L	O	0.0	0			
239	06/02/89	157	S	W159	L	N	96.0	0			
240	06/02/89	157	S	W158	R	N	96.0	0			
226	06/01/89	158	S	W172	L	N	101.0	0			
241	06/02/89	158	S	W173	R	N	0.0	0			
242	06/02/89	159	S	W160	L	N	94.0	0			
243	06/02/89	159	S	W162	R	N	94.0	0			
244	06/02/89	160	S	W174	L	N	93.0	0			
245	06/02/89	161	S	W175	L	N	89.0	0			
246	06/02/89	161	S	W176	R	N	89.0	0			
249	06/03/89	162	S	W177	L	N	101.0	0			
250	06/03/89	163	S				0.0				
251	06/03/89	164	S	W178	R	N	97.0				
252	06/03/89	164	S	W179	L	N	97.0				
253	06/03/89	165	S	W180	L	N	103.0		1		1
254	06/03/89	165	S	W181	R	N	103.0		1		1
255	06/03/89	166	S	3723	R	O	100.0				
262	06/04/89	167	S	W186	R23	N	99.5				
263	06/04/89	167	S	830	L	O	99.5				
264	06/04/89	167	S	5194	R	O	99.5				
256	06/02/89	168	S	W163	R	N	108.0				
257	06/02/89	168	S	W164	L	N	108.0				
258	06/03/89	169	S	W183	R	N	100.0		3		3
259	06/03/89	169	S	W184	L	N	100.0		3		3
265	06/04/89	170	S	W191	R23	N	101.0				
266	06/04/89	170	S	W190	L	N	101.0				
267	06/04/89	170	S		R	O	101.0				
268	06/04/89	171	S	8190	L	O	100.5				
269	06/04/89	171	S	W185	R	N	100.5				
270	06/04/89	172	S	W187	R	N	89.0				
271	06/04/89	172	S	W188	L	N	89.0				
272	06/04/89	172	S	W189	R23	N	89.0				
274	06/04/89	174	S	W155	R	N	109.0				
275	06/04/89	174	S	W156	L	N	109.0				
276	06/04/89	175	S		L	O	103.0				
277	06/04/89	175	S	W192	R	N	103.0				
278	06/04/89	175	S	W193	L23	N	103.0				
87	05/17/89	176	W	3365	L	O	0.0	0			
99	05/19/89	176	W	W82	R	N	92.0	0			
279	06/04/89	176	S	W195	R23	N	92.0				
290	06/05/89	177	S	W303	L	N	100.0		2		5
291	06/05/89	177	S	203	L	O	0.0				
292	06/05/89	178	S	W197	L	N	97.0				
293	06/05/89	178	S	W198	R	N	97.0		1		6
294	06/05/89	179	S				0.0				
295	06/05/89	180	S	W302	L23	N	85.0				
296	06/05/89	180	S	W301	R	N	85.0				
297	06/05/89	181	S	6187	L	O	96.0				
298	06/05/89	181	S	6204	R23	O	96.0				
299	06/05/89	181	S		R	O	96.0				
300	06/06/89	182	S	W307	R	N	102.3	0			
301	06/06/89	182	S	W308	L	N	0.0	0			
302	06/06/89	183	S	5218	R12	O	100.0	0			
303	06/06/89	183	S	5451	L	O	0.0	0			
304	06/06/89	184	S	341-	R	O	0.0				

305	06/06/89	185	S	W310	R34	N	0.0	2	6	
306	06/06/89	185	S	W311	L	N	0.0			
307	06/06/89	186	S	W312	L	N	0.0			
308	06/06/89	186	S	W313	R	N	0.0			
309	06/06/89	187	S	9347	R	O	106.3	0		
310	06/06/89	187	S	9346	L	O	0.0	0		
311	06/06/89	188	S	3381	L	O	96.1	0		
312	06/06/89	188	S	3382	R	O	0.0	0		
313	06/07/89	189	S				101.9	0		
441	06/20/89	189	S	W396	L	N	0.0			
442	06/20/89	189	S	W397	R	N	0.0			
319	06/07/89	190	S				0.0			
315	06/07/89	191	S	W192	R	N	102.0	0		
316	06/07/89	191	S	3217	L	O	0.0	0		
452	06/21/89	191	S	3217	L	O	0.0			
453	06/21/89	191	S	W226	R	N	0.0			
454	06/21/89	191	S	W227	R	N	0.0			
455	06/21/89	191	S	W228	L34	N	0.0			
317	06/07/89	192	S	3221	L	O	0.0	0		
318	06/07/89	192	S	3220	R	O	0.0	0		
320	06/23/89	193	S	3784	R	O	102.6	0		
469	06/23/89	193	S	5275	L	O	102.6	0		
321	06/08/89	194	S	W174	L	O	0.0			
322	06/08/89	195	S	W323	L	N	102.0			
457	06/08/89	195	S	W324	R	N	102.0			
323	06/08/89	196	S	W316	L	N	96.4	0		
324	06/08/89	196	S	W317	R	N	0.0	0		
325	06/08/89	197	S	6036	L5	O	101.8	0		
326	06/08/89	197	S	6035	R5	O	0.0	0		
327	06/09/89	198	S				101.8	0		
328	06/09/89	199	S	3367	L	O	89.9	0		
329	06/09/89	199	S	W318	R	N	0.0	0		
330	06/09/89	200	S	W320	L	N	93.7	0		
331	06/09/89	200	S	W321	R	N	0.0	0		
332	06/09/89	201	S				0.0			
342	06/10/89	202	S	W325	L	N	101.0	0		
343	06/10/89	202	S	W326	R	N	101.0	0		
344	06/10/89	203	S	W327	L	N	101.0	0		
345	06/10/89	203	S	W328	R	N	101.0	0		
346	06/10/89	204	S	W329	L	N	93.0	0		
347	06/10/89	204	S	W330	R	N	93.0	0		
348	06/10/89	205	S	W333	R	N	103.0	0		
349	06/10/89	205	S	W334	R	N	103.0	0		
350	06/10/89	206	S	W331	L	N	103.0	0		
351	06/10/89	206	S	W332	R	N	103.0	0		
372	06/12/89	207	S	W353	L	N	97.0			
373	06/12/89	207	S	W354	R	N	97.0			
354	06/11/89	209	S	W338	L	N	93.0			
355	06/11/89	209	S	W339	R	N	93.0			
356	06/11/89	210	S	W341	L	N	0.0			
357	06/11/89	210	S	W166	R	O	0.0			
358	06/11/89	211	S	W340	L	N	98.0			
359	06/11/89	211	S	W342	R	N	98.0			
360	06/11/89	212	S	W345	L	N	96.5	11	56	
361	06/11/89	212	S	W346	R	N	96.5	11	56	
362	06/11/89	213	S	3250	L	O	93.0	2	6	
363	06/11/89	213	S	W347	R34	N	93.0	2	6	
366	06/12/89	214	S	W348	L	N	90.0			
367	06/12/89	214	S	W349	R	N	90.0			
368	06/12/89	215	S	W350	L	N	106.0	1	3	
369	06/12/89	215	S	73	R	O	106.0	1	3	
370	06/12/89	216	S	W351	L	N	100.0			
371	06/12/89	216	S	W352	R	N	100.0			
376	06/13/89	218	S	W357	L	N	99.0			
377	06/13/89	218	S	W358	R	N	99.0			
378	06/13/89	219	S	7176	R	O	96.0			

379	06/13/89	220	S	W359	L	N	97.5			
380	06/13/89	220	S	W360	R	N	97.5			
381	06/13/89	221	S	W367	L	N	98.0			
382	06/13/89	221	S	W368	R	N	98.0			
418	06/18/89	222	S	W378	L	N	96.0			
419	06/18/89	222	S	W379	R	N	96.0			
383	06/14/89	223	S				0.0			
386	06/14/89	224	S	W371	L	N	95.4	0		
387	06/14/89	224	S	W372	R	N	0.0	0		
388	06/14/89	225	S	6071	L	O	93.1	0		
389	06/14/89	225	S	6072	R	O	93.1	0		
390	06/14/89	226	S				0.0			
391	06/14/89	227	S	3796	L	O	0.0			
392	06/14/89	227	S	5087	R	O	0.0			
393	06/14/89	227	S	5336	R2	O	0.0			
394	06/15/89	228	S				0.0			
116	05/27/89	229	S	W129	L	N	100.0		0	
395	06/15/89	229	S	W130	R	O	98.3	0		
396	06/15/89	230	S	3139	L	O	100.8	0		
397	06/15/89	230	S	6207	L2	O	100.8	0		
398	06/15/89	230	S	6208	R2	O	100.8	0		
399	06/15/89	230	S	3161	R	O	100.8	0		
353	06/11/89	231	S	W336	L	N	94.0		11111	66655
414	06/15/89	231	S	W337	R	O	93.8	0		
184	05/27/89	232	S	W132	R	N	95.0	0		
400	06/15/89	232	S	W131	L	O	93.3	0		
401	06/15/89	232	S	W363	R	N	93.3	0		
402	06/15/89	232	S	W365	R34	N	93.3	0		
225	06/01/89	233	S	W153	R	N	93.0	0		
405	06/15/89	233	S	W154	L	O	93.0			
406	06/16/89	234	S	6223	R	O	0.0			
407	06/16/89	235	S				0.0			
408	06/16/89	236	S	W366	R	N	106.1	0		
409	06/16/89	236	S	W373	L	N	106.1	0		
410	06/16/89	237	S	6156	L	O	101.1	0		
273	06/04/89	238	S	W196	L	N	0.0			
411	06/16/89	238	S	W196	L	O	0.0			
412	06/17/89	239	S	5248	R2	O	103.3	0		
413	06/17/89	239	S	3718	L	O	103.3	0		
416	06/18/89	240	S	W376	L	N	94.0			
417	06/18/89	240	S	W377	R	N	94.0			
191	05/28/89	241	S	W138	L	N	95.0	0		
192	05/28/89	241	S	W139	R	N	95.0	0		
420	05/28/89	241	S	W138	L	N	95.0			
431	06/19/89	241	S	W139	R	O	95.0			
432	06/19/89	241	S	W394	L	N	95.0			
421	06/18/89	242	S				0.0			
424	06/18/89	243	S	W382	L	N	98.0			
425	06/18/89	243	S	W383	R	N	98.0			
426	06/19/89	244	S	W384	L	N	101.5			
427	06/19/89	244	S	W385	R	N	101.5			
428	06/19/89	245	S	W387	L	N	103.0			
429	06/19/89	245	S	W388	R	N	103.0			
434	06/19/89	246	S	W390	L	N	106.0			
435	06/19/89	246	S	W391	R	N	106.0			
436	06/19/89	246	S	W392	R34	N	106.0			
438	06/20/89	247	S	W229	L		0.0			
450	06/21/89	247	S	W229	L	N	96.0			
451	06/21/89	247	S	W230	R	N	96.0			
439	06/20/89	248	S	W395	R	N	105.0			
440	06/20/89	248	S	8169	L	O	105.0			
443	06/21/89	248	S				0.0			
444	06/21/89	249	S				0.0			
445	06/21/89	250	S				0.0			
446	06/21/89	251	S	9787	L	O	101.0			
447	06/21/89	251	S	W398	R	N	101.0			

448	06/21/89	252	S	W399	L	N	95.0			
449	06/21/89	252	S	W400	R	N	95.0			
461	06/22/89	254	S				97.4			
462	06/22/89	255	S				0.0			
463	06/23/89	256	S	W231	L	N	91.7	2	6	
464	06/23/89	256	S	W232	R34	N	91.7	2	6	
465	06/24/89	257	S				0.0			
466	06/24/89	258	S	9671	R	O	104.5	222222	666666	
467	06/24/89	258	S	----	L	O	104.5	222222	666666	
468	06/24/89	258	S	----	L	O	104.5	222222	666666	
403	06/15/89	334	S	3450	L	O	103.7	0		
404	06/15/89	334	S	W364	R	N	103.7	0		

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TURTLE DATA AND DATA FORMS

The following information applies to the 1989 field season at French Frigate Shoals. What data is collected and how it is collected have not been changed. What has been changed is how and where the data will be recorded. These changes are being made to reduce the amount of effort and time needed to record and keep track of turtle identifications and sightings in the field. An additional benefit of this new system is that at the end of the season all data will have been entered into computer databases which will greatly facilitate analysis.

The core of this system is two data sets. One for turtle identification purposes and one for recording sightings. In addition, data sets for recording nest information and hatching success will be maintained for Tern Island nests. Data will be entered on forms designed to facilitate data entry into computer databases.

Following are explanations of the 1989 turtle forms:

Note: To reduce confusion, all activity during a night will be entered on the previous days date. For example, turtles found ashore at 2200 hrs on 5 June and 0100 hrs on 6 June will be recorded as up on 5 June.

Green Turtle Identification Form:

For every turtle identified, each old tag read or new tag applied will necessitate filling out a line on this form. Any repetitive data such as island or date can be signified by a continuation line (see example Green Turtle Identification Form). Carapace length, tumors, and tumor positions only have to be completed once for each turtle. After a turtle is fully identified (temporary paint # assigned, at least two good tags in place, carapace measurement taken, tumors noted, and etc.), each subsequent trip ashore will only have to be logged-in on the Nesting Female Sighting Form.

Data Variables:

Island: East, Tern, etc.

Date: month/day

1989 Paint ID: The spray painted number or letter or other temporary identification.

Color: Temporary ID color

Tag #: Number of tag read or applied

Tag Pos: Tag position - L or R for primary tag site on left and right flippers, respectively. Otherwise put location (examples

34L and 23R mean tag is between third and fourth scales on the left flipper and tag is between the second and third scales on the right flipper, respectively).

New or Old: Put a N in this category if a new tag was applied; an O if an existing tag was read.

Carapace length: curved carapace length in cm.

Tumors and tumor position (two different variables on the data form): See attached page for tumor size and location codes. Both tumor size and location codes are single digits. In the case of more than one tumor at more than one location several codes may be entered into each variable. For example, a tumor input of 1321 and tumor position input of 1146 means that a tumor of size 1 was found a location 1, a tumor of size 3 at location 1, a tumor of size 2 at location 4 and a tumor of size 1 at location 6.

Comments: any pertinent information

Nesting Female Sighting Form

Each time a female is ashore she should be entered onto this form. However, each turtle only has to be entered once a night.

Data Variables

Island: East, Tern, etc.

Date: month/day

1989 Paint ID: the painted on number or letter or other temporary identification

Color: Temporary ID color

Verification Tag #: If there is any doubt as to the temporary ID obtain a tag # to verify the turtles identity.

Sectors: Record the sector(s) of the island that the turtle is in. In the case of a turtle traversing several sectors place a comma between each sectors number. For example: 3,4,13 means the turtle was in sectors 3, 4, and 13.

Time UP and Time Back: These are the times the turtle comes ashore and returns to the sea. We will not be able to record these data with any accuracy - so perhaps we will just record the approximate time the turtle is first encountered. This should be entered as the "Time Up" variable.

Activity: codes are as follow: N=nested (eggs seen), P=probably nested (eggs not seen but all the signs of a successful nesting are present), M=maybe nested (not sure but turtle possibly

nested), X=digging (turtle was digging but did not nest), C=crawling (turtle was ashore but only crawled - no digging). Always enter the highest level of activity only - with N=nested the ultimate level.

Comments: any pertinent information

Daily Totals Form

This form will be kept up-dated so that we can keep our Honolulu offices informed of the level of nesting activity we are encountering.

Data Variables

Date: year/month/day

Turtles Up: Total number of turtles ashore that night

New Turtles IDed: number of turtles identified for the first time

Nests: your best estimate of the number of turtles that successfully nested that night. Should be equal to the total number of Ns, Ps, and Ms on the Nesting Female Sighting Form for that night.

Investigator: the researchers initials

Comments: any pertinent information - weather, full moon, turtles seemed extremely jumpy, and etc.

Copies of the Hatching Success and Nest Forms that will be used on Tern Island are attached. However, we will not go into them at this time. They are pretty much self explanatory and have been used the last three years.

OK, have I got you confused or befuddled? Let's put it all together.

We have just finished a night's work on East Island. It was not a very busy night; but, luckily the turtles that were up allow us to review many of the data recording situations we will experience.

This is what happened: Today is June 30, 1989

We encountered the first turtle at 2115hrs, it did not have a temporary ID and was un-tagged. It had just come ashore and had not started digging. We put two tags on (1003 L and 1002 R), gave it the temporary number 3 (white), measured the carapace and

etc. We returned to the area 1 hour later and found the turtle apparently covering a nest (no eggs seen). After it finished it returned to the ocean.

The second turtle was discovered laying eggs at 2400 hrs. It exhibited a large white 1 on its carapace. Checking our records, we find that this turtle had been fully identified the night before so all we had to record was its location and that eggs were actually seen.

A third turtle was seen at 0100 hrs. No temporary ID was visible and it was too near to a mom and pup pair of seals to examine more closely. We returned an hour later, the turtle was gone after doing a lot of digging. The seals were still nearby so we could not examine the diggings. We made a note to look more closely at the diggings after the seals had moved. The next morning, the seals had left the area and upon examining the diggings we were not sure if the turtle nested or not.

A fourth turtle was located at 0200 hrs. It was just leaving a "false" pit that had caved in. This turtle had no Temporary ID; but, we found it had two tags on its right flipper (5011 R and 5012 34R). We put an additional tag (1005) on the left flipper's primary tag site, gave it temporary # 4, measured the carapace, and etc. A check an hour later showed that this turtle had dug 3 more false pits then returned to the ocean.

A fifth turtle was found at 0330 hrs just as it was beginning to cover its eggs (eggs seen). This turtle had a temporary white 2 on its carapace. Checking the records we found that it was a turtle that was up the night before. However, we only managed to get one tag on it the night before. So we waited for a good opportunity, then put an additional tag on (1006 L), measured, and examined the turtle.

That is all the activity we had.

As we made our rounds, we kept notes in a field notebook on what, where, and when things happened (V. Gauger is developing a field note-taking system that should help us standardize the way field notes are taken.). The next day we updated the turtle data forms using these notes. Attached are sample data forms with our 30 June data entered. Please see if you can go through what happened and understand how these data were entered.

After each 4-day rotation on a island, the computer databases will be updated. After being updated, these data sets will be sorted (by Paint ID and Tag # for the identification data set and by Paint ID for the sighting data set) and printed out to produce quick reference copies of the data for use in the field.

GREEN TURTLE IDENTIFICATION FORM
FOR NESTING FEMALES,
FRENCH FRIGATE SHOALS, 1989

Island	Date	1989 Paint ID	Color	Tag #	TAG Pos	New or Old	Carapace Length	Tumors	Tumor Position	Comments
EAST	06/29	1	W	5677	R	O	95.5	None	—	
	"	1	W	5676	L	O				
	"	2	W	1001	R	N	—	—	—	
	06/30	3	W	1003	L	N	93.0	11	25	
	"	3	W	1002	R	N				
	"	4	W	5011	R	O	98.5	None	—	
	"	4	W	5012	34R	O				
	"	4	W	1004	L	N				
	"	2	W	1005	L	N	95.0	2	2	

NESTING FEMALE SIGHTING FORM
FRENCH FRIGATE SHOALS, 1989

Activity codes: N=nested, P=probably nested, M=maybe nested, X=digging, C=crawling

Island	Date	1989 Paint ID	Color	Verification Tag #	Sectors	Time up	Time back	Activity	Comments
East	06/29	1	W	—	3,6,9	1030	—	X	
		2	W	—	4	0330	—	C	
	06/30	3	W		1,2	2115	-	P	
		1	W		9	2400	-	N	
		Not identified	—		6	0100		P	was digging near a mono pop pair
		4	W		2,3	0200		X	
		2	W		11,12	0330		N	

DAILY TOTALS
NESTING GREEN TURTLES
FRENCH FRIGATE SHOALS, 1989

Island: EAST

Date	# Turtles Up	# New Turtles IDed	# Nests	Invest.	Comments
89/06/29	2	2	1	KRN	
89/06/30	5	2	4	KRN	one turtle was not identified - (digging near a mom & pup pair)

GREEN SEA TURTLE

HATCHING SUCCESS FORM

Island: ______________ Year: ________

Nest #	Hatch date / Time	pre-hatch pit	Total Eggs	"Alive" Hatched	Alive			Dead but part. developed				Bad Eggs		Comments
					Escaped unassisted	Trapped OK	Trapped Yolk	Full	3/4	1/2	1/4	Infert	Rotten	

GREEN SEA TURTLE

NEST FORM

Island: ____________________ Year: __________

Nest #	NEST DATE / Time	Location EW	NS	Turtle Tag #s	Paint #	# False Pits	Hatch date / Time	# incuba-tion Days	stake Position	Comments

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MEMORANDUM

TO: Tern Island Files

FROM: Tern Island Staff

SUBJECT: Monthly Activities Report - June 1989

A. HIGHLIGHTS

- First Bulwer's petrel eggs found
- First wedge-tailed shearwater eggs found
- Black-footed and Laysan albatrosses begin to fledge
- Tiger sharks activity begins on East Island on 15 June
- Film Crews are busy filming throughout the month
- Another under-sized female pup sent to Honolulu's "Head Start" program
- Jerry Leinecke visits French Frigate Shoals

B. CLIMATIC CONDITIONS

The average daily high temperature was 83.0 degrees F. with a range of 85 to 80. The average daily low was 73.6 degrees F. with a range of 70 to 76. The rainfall total for the month was 2.26 inches, with measurable precipitation occurring on 13 days. The heaviest daily rainfall was 0.73 inches on 23 June. The mean barometric pressure for the month was 1019.0 m.b. with recorded high and low pressures of 1022.5 and 1012.3, respectively. There were 6 days where cloud cover greater than 50% was recorded.

E. ADMINISTRATION

1. FWS personnel

Darcy Hu and Ken Niethammer were on Station throughout June. During June, Ken McDermond and Craig Rowland shared duties monitoring and assisting the film crews (Ken the first 12 days and Craig the last 17 days of the month).

Glynnis Nakai and Mike Moser continue their good work monitoring the green turtle nesting. They have been keeping the turtle databases updated as they go. In addition to their excellent work on the turtle studies, both Glynnis and Mike assist on many other projects including bird banding, analysis of bird data (incubation length), bird studies,

housekeeping and etc.

Jerry Leinecke visited French Frigate Shoals on 13 June. During his visit, Jerry was briefed a wide variety of topics: facilities, photo-voltaic system, ongoing biological studies, film crew activities, seawall deterioration and Army Corps of Engineer recommendations, and etc. Jerry also had the opportunity to visit the Smithsonian/FWS field camp on East Island.

2. FWS Volunteers

David Kuwahara is still going strong after 5 months on Tern Island. He continues as primary researcher on the RTTR study as well as assisting with Darcy's RFBO work. David completed the CHSH incubation study this month and has also been helping on many other projects. David also constructed a display case for the coral collection that Jean Kenyon is putting together.

Bob Cummins has assumed primary researcher responsibilities for the FWS and Vanessa Gauger's BLNO studies. During the last half of June, Bob also began learning the RTTR study. He will take over that study upon David Kuwahara's departure in mid July.

Alyce Reuter arrived 30 June. She will take over the FWS and Darcy's red-footed booby studies upon Darcy's departure in July.

3. NMFS Personnel/Volunteers

Mitch Craig remains the primary NMFS person at French Frigate Shoals. He was assisted by Cindy Lorence (NMFS Volunteer) that last two weeks of June.

4. Arrivals and Departures

13 June - FWS flight. Arriving were Craig Rowland (FWS), Jerry Leinecke (FWS), Jeff Marks (FWS), and pilots (Bob Justman and Terry Cockett). Returning to Honolulu were Ken McDermond, Jerry Leinecke, and pilots.

19 June - NOAA ship Townsend Cromwell. Cinthia Lorence (NMFS volunteer) and supplies arrived. Departing French Frigate Shoals was Jeff Marks (FWS) who will spend most of the next two months on Laysan Island studying bristle-thighed curlews.

30 June - FWS flight. Arriving were Alyce Reuter (FWS volunteer) and pilots (Bob Justman and T. Wittbrodt). Returning to Honolulu were Craig Rowland (FWS) Damon Job (Smithsonian), and pilots. Another under-sized female monk seal was shipped

to Honolulu on this flight.

5. Safety/Accidents and Illnesses

There were no serious accidents or illnesses on Tern, during the month of June. All standard safety procedures for plane and vessel arrivals were followed.

7 . Logistical and Technical Support

Tuesday morning radio checks with the Honolulu Coast Guard Communications Station continued as usual at about 0715 hrs. We made contact each time using universal channel 601.

Contact with the Honolulu FWS office continues M, W, and F at 0730 hrs.

The Laysan Island field camp radio contact continues at 1900 hrs M, W, and F. Communications generally have been good.

The East Island camp (Smithsonian/turtle) checks in each night at 2000 hrs. The AM call has been made optional.

Ken McDermond, Craig Rowland, and Mitch Craig supplied support and supervision to the film crews during June. Film work seemed to proceed well. Shark activity at East Island began around 15 June, as predicted. Much of the film crews activity centered around the shark activity at East Island for the last half of the month.

8. Meals

During June, a total of 653 meals were served to FWS personnel volunteers, and guests. An additional 124 meals were served to NMFS personnel from their stores. Also, the eight person film crew team prepared 720 meals from their stores

Permanent Tern Island Staff

Name	Number of Meals
K. Niethammer	90
D. Hu	90
Total	180

Volunteers/Non Tern Island Staff/Guests

Name	Number of Meals
D. Kuwahara	90
C. Rowland	53
K. McDermond	38

M. Moser	90
G. Nakai	90
R. Cummins	90
J. Marks	19
J. Leinecke	1
Pilots	2
Total	473

F. HABITAT

Cenchrus echinatus eradication on Tern Island continues. Wire, netting, and other hazardous debris are continuously collected from French Frigate Shoals islets.

G. WILDLIFE

1. Endangered and Threatened Species

a. Hawaiian Monk Seal

NMFS personnel continued atoll censusing and pup tagging. Another under-sized female monk seal pup was shipped to Honolulu to be added to the "Head Start" monk seal program.

b. Green Turtle

The East and Tern Island nesting-turtle monitoring is proceeding well. Glynnis Nakai and Mike Moser are basically operating on a four-day schedule: Four nights on East then four nights on Tern Island. Both Glynnis and Mike have been checked-out on boat operations and safety procedures. They are primarily responsible for personnel and equipment transfers to and from the East Island camp. While on Tern they, they do at least one turtle-walk each night, enter East Island data into the Turtle study databases, and get supplies organized for their next East Island tour of duty.

2. Seabirds

Black-footed albatrosses began fledging on 19 June. Laysan albatrosses began fledging about a week later. By months end many chicks of both species had fledged.

Red-tailed tropicbird nesting continues. The oldest chicks are approaching fledging size. Again this year hatching and fledging success for this species seems to be real low.

Red-footed booby nesting continues. As with the tropicbirds, eggs are still being laid and the oldest chicks are beginning to fledge.

The Tern Island masked booby chick is doing well. Masked booby chicks on Whaleskate and East Island are beginning to fledge.

Black noddy nesting is slowing down; however, it appears that nesting will continue throughout June at high enough levels to warrant the continuation of the FWS egg count study into July.

Brown noddy nesting continues. Few chicks are making it through the Great Frigatebird gauntlet most BRNO chicks disappear within a couple of weeks of hatching.

The first Bulwer's petrel egg was found in a nest box at the Gas sheds on 1 June. Maybe 8 to 12 pairs of adults have been seen on Tern this year.

The first Wedge-tailed shearwater eggs were found on 8 June. Many eggs were seen during the next couple of weeks.

Great frigatebirds chicks are hatching in force, few new eggs are being laid. Adult and immature frigates are exacting a high toll (consuming nestlings) from nesting BRNO, SOTE, and GRAT.

Sooty Tern egg laying had probably stopped by months end. Many chicks are fledging and some of the remaining eggs were still hatching. Many chicks are being taken by frigates.

Gray-backed tern nesting phenology is similar to that of SOTE. GRAT chicks are also being heavily preyed upon by frigates.

White tern nesting activity is diminishing. Chicks from the main push of egg-laying (March-April) are beginning to fledge.

Christmas shearwater egg have all hatched that are going to hatch. About 25-30 nesting pairs laid eggs this year. Presently, only 3-5 chicks are known still to be alive.

3. Other Birds

Two shorebird counts were conducted in June:

Species	Census Dates	
	6/09/89	6/25/89
Ruddy Turnstone	55	52
L. Golden Plover	6	9
Sanderling	0	0
Wandering Tattler	3	0
Bristle-thighed Curlew	5	2

One adult lesser frigate was seen on the NE corner of Tern

Island on 5 June.

A blue-gray noddy was observed roosting on the generator building and a red-wood water tank on 7 and 14 June, respectively. We do not know if this was two different birds or the same bird; as only the bird on the 14th could be captured and banded.

4. Banding

During June, the following numbers of birds were banded at Tern Island:

Species	Locals	Adults
WHTE	16	3
BRNO	81	-
BLNO	56	-
GRAT	28	-
CHSH	-	-
SOTE	649	-
BGNO	-	1
RFBO	58	2
RTTR	21	-
LAAL	682	-
BFAL	358	-
MABO*	20	-
Totals	1,969	6

Grand Total.....1,975

* Banded on East Island

J. EQUIPMENT AND FACILITIES

5. Systems

a. Water

During the first weeks of June, water rationing was initiated. However, heavy rains in late June eliminated the need for extreme water rationing. At months end water reserves were in very good shape with enough water on had to get through the summer.

b. Power

The backup generator was used to charge the PV batteries on two days (24 and 25 June). Heavy cloud cover on these days prevented full battery charging via the solar array requiring 2 to 3 hrs of auxiliary charging during each of these nights.

c. Radios

All main radios are working fine. Another "Tad" radio speaker-mike has "acted up". This speaker-mike shorts out when exposed to sea-spray. After drying out it will work fine until it gets wet again.

6. Fuel Reserves

The following fuels were on hand as of 1 July, 1989:

Diesel fuel	1650 gallons
Propane	7 large bottles
	2 field camp bottles
Gasoline (FWS)	1 55 gallon drum
Aviation gas (new)	2 55 gallon drums
Aviation gas (old)	1 55 gallon drum
Gasoline (NMFS)	3 55 gallon drums

United States Department of the Interior
FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

August 10, 1989

William G. Gilmartin
Marine Mammal and Endangered Species
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822

Dear Bill,

The turtle monitoring team: Ken Niethammer, Glynnis Nakai, and Michael Moser, will be in Honolulu as of 5 October. Since they will still have the field work fresh in their minds, I think it would be a good time for all concerned parties to get together. Ken Niethammer will only be in town for a week so I would like to schedule this for 9:00 am on 6 October. Please let me know if this will fit into your schedule.

I will ask the French Frigate group to put together an agenda and get it back to me on the 6 September flight. I will distribute this for your additions and information shortly thereafter. I'm looking forward to seeing how things went this year.

Sincerely,

Ken McDermond
Assistant Refuge Manager
Hawaiian Islands NWR

cc: G. Balazs
G. Boehlert
J. Weatherall

United States Department of the Interior
FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

August 10, 1989

Jerry A. Wetherall
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822

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Sincerely,

Ken McDermond
Assistant Refuge Manager
Hawaiian Islands NWR

cc: G. Boehlert
W. Gilmartin
J. Wetherall

Date?

B.C.

5919 record of Layton
extensive TMR & bite

~~Layton~~/KAM
O ~~[illegible]~~ no record of injuries
5919+
~~TSP~~ 5916 3/19/82
2 courses
5/28/82
4/6/82

give me back
excluding FFS

TAGGED miss Piggy?

Wrecking out for 2G...

6904-6908 Argonne

Norman

Terry Walker
Box 31
Haleiwa
96712

2/27/85
Rod Watson
Laysan
6809-6825
6826-6850

3
: USED 6809, 6810, 6811

returned
6812-6825
6826-6850

Check Tag drawer

green
Mag
Book

6809
resite Becker
6/2/87
BASK · Sec 8

♂ 5919 resite DJA
5/21/86
Laysan · Sec 1
Bask

orig April-May-June
1982 Two Gross
Laysan Tagged
also 5916 Tagged