

# Green Sea Turtle Nesting Summary Tern Island, French Frigate Shoals, 1995

By ALLISON  
VEIT

## INTRODUCTION

This document is a summary of green sea turtle (*Chelonia mydas*) nesting activity on Tern Island for the 1995 nesting season. Comparisons are made to studies conducted from 1986-1994. The main objectives for this monitoring were to approximate the number of nests laid as well as the nesting phenology for the season, map nest locations, excavate and release trapped hatchlings, determine clutch size, incubation period and hatching success of confirmed nests and check for entangled or entrapped adult turtles.

The work done since 1992 is a reduction of past monitoring efforts by refuge staff (see Niethammer 1991 report). It may be advisable to duplicate the more extensive monitoring effort in the future for comparative analysis.

## STUDY AREA

Tern Island (23° 52'N, 166° 17'W) is located on the Northwestern edge of French Frigate Shoals, an atoll 490 nautical miles from Honolulu. Tern Island is approximately 3000 feet long by 120-200 feet wide, encased on the West, North and East sides by a sheet pile sea wall. The majority of nesting occurs on the south beach. There are two small coral rubble/sand beaches on the north side that allow limited access to nesting turtles. There is also a continually shifting sand beach located at the East end of the Island, see map.

## METHODS

Dawn nest walks were conducted throughout the nesting and hatching season (May through December). These walks took 45 to 90 minutes to complete depending on nesting/hatching activity. Turtle nesting activity occurs primarily from sunset to sunrise, therefore, direct visual evidence of nesting (eggs seen or "pattycaking") was rarely seen. Nests were defined somewhat subjectively based on the type of diggings and tracks seen; evidence of a "backfill" with tracks leading directly back to the water was the strongest indication of a nest. The southern half of Tern Island has been mapped on a grid system: 10 meters increments East to West and 4 meters increments North to South. Nests were numbered and staked 1.5 meters inland from the nest, and the location was approximated on the above mentioned grid map. Any nests laid in an area of shifting sands (East Beach or either end of South Beach) were moved to a more stable beach area. Pre- and post-hatch pits were also noted during the morning walks. The emergence of hatchlings was indicated by a distinct depression in the sand, a post-hatch pit. The nests were excavated three days following

discovery allowing hatchlings four nights to emerge. In some cases nests were not excavated after four nights due to seal activity in the area. Any trapped hatchlings found were removed and released after dark the same day they were found. A nest was confirmed as hatched when it was excavated as a post-hatch pit and egg shell fragments and/or trapped hatchlings were found. Only nests that indicated signs of hatching, a post-hatch pit, were excavated. Nest contents were examined and counted to estimate clutch size and hatching success. The clutch size was determined by counting shell fragments, undeveloped eggs and fully and partially developed eggs. Hatching success was calculated by dividing the number of eggs that hatched by the total number of eggs laid. Appendices A was the data sheet used to record nesting information for the 1995 season.

## RESULTS & DISCUSSION

The first known nest for the 1995 season was laid on 2 May, the last known nest was laid on 30 September. The first known hatching occurred on 27 July, the last known hatching occurred on 19 December (Table 1). There were an estimated 282 nests laid during 1995. Two hundred and fifty-one possible nests were identified and staked and 31 unmarked nests were discovered throughout the season. These unmarked nests were found through hatching evidence seen during morning walks. Of the 251 staked nests, 121 were confirmed hatched. Including the unmarked nests, the total number of confirmed nests was 152. The mean incubation length for 116 of the hatched nests was 68.6 days with a range of 44 - 88 days. Nest contents were not examined for 13 of the 152 confirmed nests due to seal activity. The mean clutch size for 139 of the nests was 88.5 eggs with a range of 40 - 168 eggs per nest. Hatching success for these nests was 81.8 (Table 2). Hatching success was also estimated for the 1993 and 1994 seasons by using mean clutch size data from the 1986-1991 and 1995 nesting data. (Tables 2 and 3). Of the 152 nests excavated, 93 had trapped hatchlings (61% of nests; range 1 - 21 per nest). A total of 329 trapped hatchlings were recovered and released during 1995. A comparison of the confirmed nests from 1986-95 is illustrated in Figure 1. The methods used for the 1986-91 Neithammer study were different than those used in 1992-95. The Neithammer study found a higher percentage of nests laid on the island due to the intensity of the follow-up procedures, excavating every staked nest. In 1992-95, only nests with post-hatch pits were excavated. Due to seals, nesting turtles and bird activity, pre- and post-hatch pits became rapidly obscured. It is highly likely that hatching evidence was missed on some nests during the past four seasons.

Throughout the months of July, August and September disoriented turtle hatchlings were occasionally found and removed from the runway.

There were no entangled turtles seen on Tern Island during the nesting season. However, six adult turtles were aided and one was found dead on Tern Island during the nesting season. Following are the descriptions of the individual situations:

On 18 June an untagged adult female turtle was found overturned on Crab Beach. Tracks indicated that she had tried to climb over the seawall and toppled over. The turtle was immediately righted and appeared unharmed as she quickly returned to the water.

On 19 June a dead adult female turtle was found wedged between the double seawall at the east end of Tern Island. The turtle was apparently swept through a hole at sea level in the outer seawall by strong waves. Aluminum grating covers the entire top portion of the double wall, ruling out the possibility that the animal fell into the cavity. The sands of East Beach continually shift along the entire east end of Tern, resulting in the occasional exposure of the eroded seawall which resembles a picket fence. The gaps in the wall are not wide enough for a turtle to access unless the animal was turned on its side. The body was torn open in the process of removing the carcass, releasing fully developed eggs. It appeared the turtle had been dead for at least 24 hours when found and powerful waves had heavily damaged the carcass. The curved carapace measured 99 centimeters.

1995  
On 23 June an adult female turtle was removed from the runway and released on South Beach. The animal had accessed the island from South Beach at meter marker 416, crossed the runway, dug a body pit on the north side, and was proceeding to wander aimlessly on the runway. Tags already present were: W866 LFL, W867 RFL. New tags placed on the turtle were: F630 LFL, F629 LHF, F628 LHF. An additional left front tag was attached due to the poor condition of the primary tag site.

On 28 June two adult female turtles were found just south of the runway on the east side of the woodshop. Both animals were guided back to South Beach. The first turtle had a small tumorous growth on the lower portion of the left eye. Tags placed on the animal were: F633 LFL, F632 RFL. Tags placed on the second animal were: F634 LFL, F635 RFL.

On 1 July a tagged adult female turtle was found crossing the runway. The tracks indicated that the turtle accessed the island at Shell Beach. The turtle was tagged and released on South Beach. The tags were as follows: F636 LFL and F637 RFL. On 3 July, the same turtle was found on the runway heading in a westerly direction. It appeared to have accessed the island from South Beach. The turtle was removed and released on South Beach. The turtle did not return to the water as normally observed but remained on the beach. Several hours later the turtle was found dead. A necropsy was performed and the results were sent to the NMFS Lab in Honolulu.

On 5 July a tagged adult female turtle was found along the seawall approximately 100 meters from the east end of the island. Her tracks indicated that she accessed the island at Shell Beach and traveled along the seawall. The turtle was released on South Beach. The turtle was previously tagged and moto-tooled indicating that she had been marked on East Island during turtle camp. The ID #s were as follows: moto-tool #: 166, A218 RFL, A217 LFL, G231 RHF, G229 LHF, A357 L3,4.

Comments only -  
not a tag #  
**ACKNOWLEDGEMENTS**

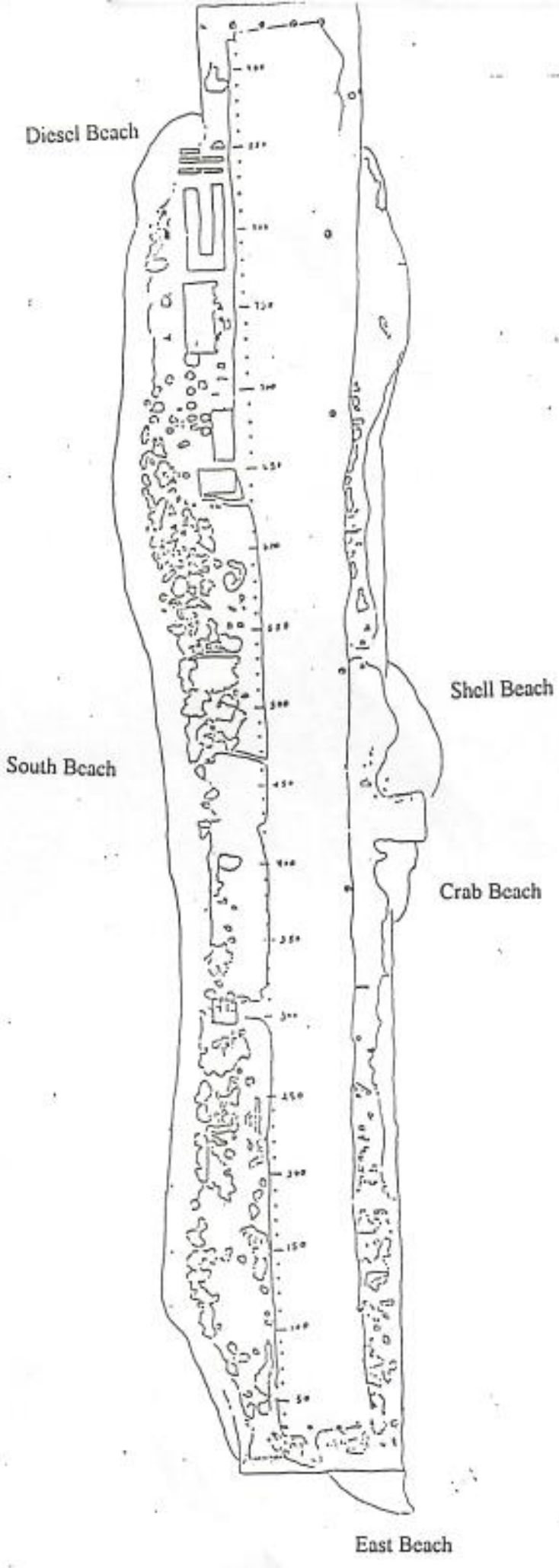
Thanks to the following volunteers and paid staff who contributed to data collection during the 1995 season: Steve Barclay, Anthony Viggiano, Allison Veit, Kim Berger, Nick Palaia, Kellie Mitsue Takimoto, Yonat Swimmer, Suzanne Romain, Grace Hubenthal, Susan Tobias, Todd Carpenter and Leona Laniawe. This report was prepared by Allison Veit.

Nesting Tern  
FFS

Nesting  
"

Nesting  
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Steve  
Barclay - FWS



**Table 1: Dates for the first and last nests laid and hatchling emergences for green turtles on Tern Island, French Frigate Shoals, Hawaii, 1986-95.**

YEAR	LAY DATES		HATCHLING EMERGENCES	
	FIRST	LAST	FIRST	LAST
1986	6 June	22 September	15 August	16 November
1987	25 May	20 October	29 July	26 December
1988	26 April	1 October	8 July	9 December
1989	28 April	28 September	19 July	27 December
1990	9 May	25 September	13 July	17 December
1991	29 April	3 September	11 July	5 November
1992	27 April	11 October	20 August	22 January
1993	8 May	14 September	15 July	10 November
1994	4 May	5 September	25 July	11 January
1995	2 May	30 September	27 July	19 December

**Table 2: Hatching success of green turtle nests at Tern Island, FFS, 1992-1995, calculated as a percentage by dividing the number of eggs hatched by the total number of eggs laid. Italicized % show estimates of nest contents by using the mean clutch size data from the 1986-1991 and 1995 nesting seasons.**

CATEGORY	1992	1993	1994	1995
Number of Confirmed Nests	81	51	69	152
Number of Eggs	<i>7,371</i>	<i>4,641</i>	<i>6,279</i>	12,041*
% Hatched Emerged	no data	<i>82.1</i>	<i>83</i>	<i>79.0*</i>
% Hatched Live-left in nest	<i>5.2</i>	<i>5.3</i>	<i>6.4</i>	<i>2.5*</i>
% Hatched Dead-left in nest	no data	<i>1.7</i>	<i>1.0</i>	<i>0.3*</i>
% Total Hatched		<i>89.1</i>	<i>90.4</i>	<i>81.8*</i>
% Unhatched Developed	no data	<i>2.4</i>	<i>0.5</i>	<i>5.6*</i>
% Unhatched Undeveloped	no data	<i>8.5</i>	<i>9.1</i>	<i>12.6*</i>
% Total Unhatched		<i>10.9</i>	<i>9.6</i>	<i>18.2*</i>

\*Number based on the contents of 139 nests.

**Table 3: Data from green turtle nests at Tern Island, FFS, 1992-1995. No data indicates data was not collected for that category for that year.**

CATEGORY	1992	1993	1994	1995
Number of Confirmed Nests	81	51	69	152
Number of Eggs	no data	no data	no data	12,041*
# Hatched Emerged	no data	no data	no data	9,514*
# Hatched Live-left in nest	385	244	403	294*
# Hatched Dead-left in nest	no data	78	64	37*
# Unhatched Developed	no data	113	29	675*
# Unhatched Undeveloped	no data	396	572	1,521*

\*Number based on the contents of 139 nests.

### Confirmed turtle nests-Tern Island,FFS

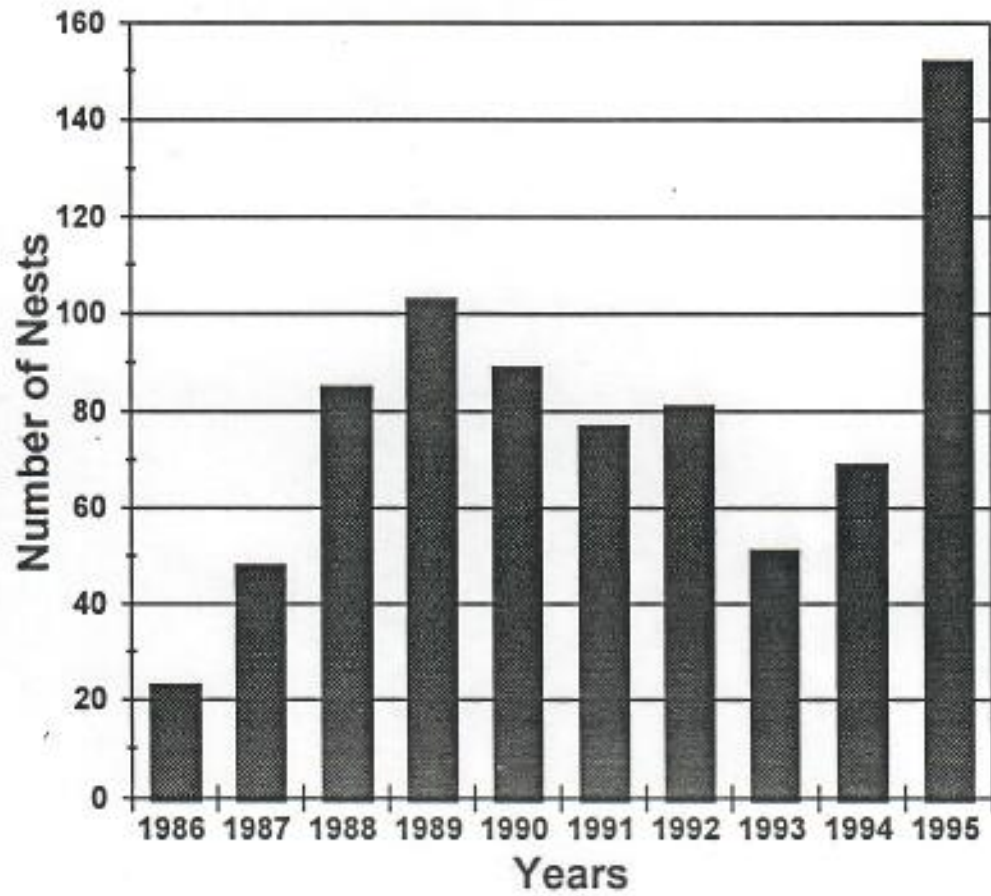


Figure 1: Comparison of confirmed hatched turtle nests from 1986-1995








29 September 95

George -

Thank you very much for allowing me the opportunity to assist you over at East Island. That was such a wonderful experience for me. Not only did I learn a lot, but it was also nice to get to know you and spend time with someone who loves turtles as much as I do. Thank you also for sending me the packet of turtle information. It all looks very interesting, I can't wait to read through it! The Honu book is great as well, what beautiful artwork!

I have already read through the SOP's for the turtle camp. It all sounds very exciting. As you know I am extremely



interested in working for you  
during the 1996 turtle camp.  
I really enjoyed camping  
over there at East Island  
and doing my "turtle walks"  
at night. I think I could  
do an excellent job for  
you. Please send me an  
application if one is needed, and  
keep me informed as  
the season draws closer.

I look forward to talking  
with you again. I will be in  
Honolulu on November 17 for a  
few days. If you are back from  
Samoa maybe we could meet  
for lunch?

Take care and thanks again  
for the wonderful experience.

♡ Kimberly

October 12, 1988

F/SWC2:GHB

MEMORANDUM FOR: William G. Gilmartin, Leader, Marine Mammals and  
Endangered Species Investigation

FROM: George H. Balazs, Zoologist

SUBJECT: Additional health considerations relating to  
environmental contaminants at French Frigate  
Shoals

This memo provides additional background information to the concerns that were raised in my earlier memo of May 26, 1988. Until recently, I had forgotten about this particular matter, described as follows.

While at French Frigate Shoals this past May, the Refuge Manager had implemented a policy of requiring the fumigation of all clothing, personal possessions, food packages, and items of any sort that were to be taken from Tern Island to East Island. The prescribed method of fumigation was to place the gear in one of the decommissioned walk-in refrigerators and set off an insecticide can ("bug bomb") with the door left sealed for 2-3 h. I have two serious concerns about this policy if, indeed, it is a continuing requirement by the U.S. Fish and Wildlife Service (USFWS). First and foremost, the exposure of clothing and other possessions to insecticides imposes a chemical hazard to personnel that is surely inappropriate. These chemicals are highly toxic, as evidenced by the warning labels on the aerosol cans being used. Upon arrival at East Island, there is no adequate method of thoroughly washing clothes to rid them of chemical residue if, indeed, any manner of washing can ever entirely eliminate them. My second concern, which is more a historical commentary, is that there are probably as many, or more, exotics already established on East Island as there are on Tern Island. This, of course, resulted from years of Coast Guard occupation at East Island. I have personally had ID's carried out on such interesting creatures from East Island as dry-wood termites and brown-widow spiders.

The bottom line here, in my opinion, is that any "fumigation" policy "required" by the USFWS must not expose personnel to hazardous agents. In order to be certain that a health risk is not being imposed, I recommend that fumigation procedures be detailed in any future refuge permit we are issued, and that the procedure be certified as "approved" by O.S.H.A.

GHB:vi  
bc: Balazs  
HL

May 26, 1988

F/SWC2

MEMORANDUM FOR: F/SWC2 - William G. Gilmartin  
FROM: F/SWC2 - George H. Balazs  
SUBJECT: Environmental contaminants at French Frigate Shoals

During my recent visit to French Frigate Shoals, I conducted a brief radiological survey on Tern and East Islands using the Heath kit "Radiation Alert Monitor 4" previously purchased for our work at Johnston Island. No levels above normal background radiation were found on East Island. However, on Tern Island a site was identified in the abandoned Loran transmitter building with a level 4-5 times above background (approximately 100 counts per minute). The source was a broken vacuum tube in one of the power amplifier units. As you may know, this equipment was smashed by vandals shortly after the Loran station was shut down in 1978. Numerous vacuum tubes and other components of the radio equipment were broken. In view of this preliminary finding, and the potential hazard of radioactive particles being inhaled, I feel it would be prudent to place the transmitter room "off limits" to our personnel. Ideally, a comprehensive survey by radiation safety experts should be done in the room and accepted clean-up procedures implemented as needed.

During our initial briefing about Tern Island by the Refuge Manager Ken Niethammer, it was stated that asbestos fibers had been found in the facility's fresh water supply. Instructions were given to only drink water from the filtered tap. The level of asbestos contamination was not known, nor was it entirely clear whether or not the filter system removed 100% of the fibers. Also, it was not clear if any risk was involved in showering with asbestos contaminated water. In view of these apparent unknowns germane to the health safety of our personnel, I recommend that steps be taken to obtain reliable, professional answers. A good starting point would be to obtain copies of the most recent chemical analyses conducted on the Tern Island water. Presumably this is being carried out by the Fish and Wildlife service on a routine monitoring basis.

The question of possible PCB contamination from transformer oil in Tern Island's soil and ground-water lenses, first raised by Rick Vetter, has apparently still not been answered by the Fish and Wildlife Service.

GHB:gr

bcc: GHB ✓  
HL



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

December 6, 1988 F/SWC2:GHB

MEMORANDUM FOR: William G. Gilmartin  
FROM: George H. Balazs  
SUBJECT: Recommendations and options for green turtle monitoring and tagging at French Frigate Shoals for the 1989 (year 17) nesting season

This memo is a continuation of the one I prepared for you on September 30, 1988 dealing with the same general topic. In that earlier memo I did not provide specific research recommendations for the 1989 nesting season, with the exception of saying that the scope and intensity of monitoring/tagging should be reduced and more strictly controlled, and a more comprehensive system needs to be instituted for professionally screening volunteers and others sent for isolated turtle work at French Frigate Shoals.

My additional recommendations, along with certain options, are provided in outline form at this time.

1. For the uninhabited islands at French Frigate Shoals, nighttime monitoring of nesting turtles should be confined to East Island, as the essential long-term study site identified in the recovery plan. No nighttime monitoring should be done on Whale-Skate.
2. On Tern Island, nighttime monitoring of nesting turtles should be conducted, but only if proper personnel are available without being overworked, and then only at a level of monitoring that is sufficient to obtain the tagging and census data required (as at East Island).
3. Consecutive nightly monitoring at East Island should be conducted for not less than 30 days, nor more than 60 days, depending upon transportation to and from French Frigate Shoals, and the number of proper personnel available to do the work on a low stress, efficient, effective, and harmonious basis.
4. At least one, and preferably all, of the personnel recruited and/or hired to do the nighttime monitoring at East Island should have a successful record of previously doing this job. Vanessa Gauger, Phil Dye, and Sheila Moriarty rank high on my list in this regard.



5. The person that has overall responsibility for turtle monitoring at French Frigate Shoals in 1989 must have clear authority over all science and research aspects of the project. To be responsible for a project without having authority over it seldom works to anyone's satisfaction, according to a career training seminar I recently attended. For the 1988 NMFS/FWS cooperative monitoring study, we both believed that I was responsible for the work, and had authority over it,---only to discovered when it was nearly over that such was apparently not the case from the FWS perspective.
  
6. Within the limits of my own professional abilities and the financial resources available to me, systematic data on nesting at French Frigate Shoals has been collected each and every year since 1973. Since 1980 this effort has, of course, been housed with NMFS. For 1989, there are three choices available for accomplishing this critical work: a) do it ourselves with minimal help from FWS, as in the past; b) do it in collaboration with FWS, as was first tried this year; and c) inform FWS that we will supply the tags but they will have full responsibility for the work in 1989, as reflected by the recovery plan and the 1978 NMFS/FWS Memorandum of Understanding relating to sea turtles. At this point, I have no clear preference for how it is done (i.e., a, b, or c of the above). Such a choice is heavily dependent on financial and personnel resources and on the prevailing attitude of FWS personnel, both in Honolulu and at Tern Island. Telephone calls I have received in recent weeks have shown little understanding by FWS for the information and views I provided to you in my memo of September 30, 1988.

On a separate but nevertheless related matter, I would like to "reopen", at least on paper, the East Island clean-up project that NMFS initiated and significantly funded, and we both personally labored for a week in 1980. As you know, eight years later the cement chunks that were piled up from demolition of the old USCG foundation still remain on East Island. It was never the intention that this debris stay there, but rather that FWS, as managing authority of the refuge, have it removed through some cooperative plan with a DOD agency. To my knowledge, no plan has ever been formulated or seriously pursued. The history of the clean-up appears to have been completely forgotten at FWS, undoubtedly due to

personnel changes. Instead of viewing the pile of debris as a yet to be completed habitat enhancement project, it is periodically commented, or joked upon, with the negative connotation that NMFS is somehow responsible (indeed should be blamed) for its existence. Something clearly needs to be done to realign this attitude, and finish the project once and for all.

GHB

# TERN ISLAND FIELD STATION FRENCH FRIGATE SHOALS NOVEMBER 1995 MONTHLY REPORT

PACIFIC/REMOTE	PRI	ACT	FY	CC	IN
Complex Manager					
Biologist					
Admin. Suppl. Asst.					
Secretary					
Hi NWR Manager					
Hi NWR Biologist					
Bio. Sci. Tech					
Johnson					
Midway					
Tern					
File TERN Mo Rpt 95					
NMF					

## A. HIGHLIGHTS

- \* Alan Morgan, professional photographer visits Tern Island to photograph refuge wildlife and staff.
- \* Leona Laniawe, wildlife bio-tech with NBS on the Big Island visits Tern Island to assist with station operations.
- \* Lance Lerum, Scott Sullivan and Stanley Boc visit Tern Island to review final plans for the sea-wall project.
- \* The second year of the albatross population structure/survivorship study began.
- \* **Fourteen platter sized turtles wash behind the deteriorating sea-wall.**
- \* Major erosion hits South Beach on Tern Island during a high surf event.
- \* Tern Island's boat dock is damaged severely during a high surf event.
- \* The first WTSH chick of the season fledges.
- \* The first LAAL, RFBO, RTTR and BFAL eggs of the 1996 breeding season were laid.



## B. CLIMATIC CONDITIONS

The average daily high temperature was 79.4°F. with a range of 74.3 to 83.0. The average daily low was 73.4°F. with a range of 66.5 to 77.0. The rainfall total for the month was 5.46 inches, with measurable precipitation occurring on 14 days. The heaviest daily rainfall was 1.42 inches measured on 26 November. The mean barometric pressure for the month was 1015.2 m.b. with recorded high and low pressures of 1021.4 and 1006.4, respectively. There were 19 days where cloud cover  $\geq$  50% was recorded. Maximum and minimum relative humidity were 100% and 66% respectively, with an average of 80.4% for the month. Maximum and minimum wind velocity were 25 kts and 4 kts respectively, with an average of 12 kts.



## **D. PLANNING**

### **5. Research and Investigations**

#### **a. Tern Island Monitoring Studies**

##### **1. Census**

In November mean incubation counts were conducted for the following species: red-footed and masked boobies, brown and black noddies, gray-backed and white terns, great frigatebirds and red-tailed tropicbirds.

During November refuge staff organized the old French Frigate Shoals data. The Data was put into three ring binders in the same format that is currently used. This will allow easier and more efficient access to the data.

##### **2. Reproductive Success Studies**

In November a small number of eggs were laid in both the white tern and red-footed booby plots. The black noddy plots remain fairly active with 108 new eggs during November.

##### **3. Management Studies**

NTR

#### **I. Long-term Albatross Study**

On 26 November the team at Tern Island started the second year of the albatross population structure/ survivorship project. The first sweep through the island was completed on 30 November. The data base which was established last year is currently being updated with the banding history of all the birds encountered last year.

#### **b. Outer Islands Monitoring Studies**

##### **1. Census**

Counts and observations were made by Fish and Wildlife personnel at various islands on the following dates: East Island - 06 and 28 November; Whaleskate Island - 28 November.

**c. Research at French Frigate Shoals Under Special Use Permits in November:**

1. HWN-55884-95: Long term breeding parameters of white terns nesting at Tern Island / Anthony Viggiano

A report is currently being written.

2. HWN-01-95 National Marine Fisheries Service/Hawaiian Monk Seals and Green Sea Turtles/Ragen

NMFS personnel arrived at French Frigate Shoals on 25 October to continue their work with the Hawaiian monk seal under their permit. The monk seal research team departed Tern Island on 18 November.

3. HWN-08-95 75171 Alan Morgan/ Photographer

Visited Tern Island to take photographs of wildlife, habitats and Fish and Wildlife Refuge staff.

**E. ADMINISTRATION**

**1. Personnel**

**a. FWS Personnel**

On 16 November Steve Barclay left Tern Island for his long awaited vacation. Anthony Viggiano was on island all month.

Lance Lerum, a USFWS biologist arrived on 16 November to meet with the two engineers arriving on 20 November. The purpose of this visit was to review and update the plans for the sea wall.

**b. FWS Volunteers**

Allison Veit was on island all month. Two new volunteers, Todd Carpenter and Ann Whiteside arrived on 7 November. On 16 November Leona Laniawe from NBS/Big Island came out to assist with station operations for a month. Kimberly Berger and Suzanne Romain departed Tern Island on the returning flight that same day. Due to family matters Ann Whiteside departed Tern Island on 21 November.

**c. NMFS Personnel/Volunteers**

On 2 November veterinarian Jill Voeks, assisting the monk seal project arrived and Tim Ragen, Alan Kaufman and Greg Marshal departed. The remaining NMFS crew that arrived

at French Frigate Shoals on 25 October to deploy satellite transmitters and "Critter-Cams" departed on 18 November. A NMFS crew is scheduled to return in mid January to retrieve the remaining transmitters.

#### **d. Arrivals and Departures**

02 November - Rainbow 1, NMFS Charter: Up were pilots Bob Justman and Max Alania, Jill Voeks with food and mail. Back were Tim Ragen, Alan Kaufman, Greg Marshall, the flight crew and mail.

07 November - Golden Eagle, FWS Charter: On their way to Laysan the Golden Eagle dropped off Todd Carpenter and Ann Whiteside, the repaired TV, food and misc. supplies.

14 November - Golden Eagle, FWS Charter: While returning to Honolulu the Golden Eagle dropped off Alan Morgan. They took Tern Island's marine debris and recycleables back to Honolulu.

16 November - Rainbow 1, FWS Charter: Up were pilots Bob Justman and Max Alania, Leona Laniawe and Lance Lerum food and mail. Back were Steve Barclay, Alan Morgan, Kim Berger, Suzanne Romain, the flight crew and mail.

1 - 18 November - NOAA/ Townsend Cromwell: Departed French Frigate Shoals after completing assignment with NMFS. Mitch Craig, Frank Parrish, Lance Jeffrey and Kyler Abernathy of NMFS, Birgit Buhleier from National Geographic and wildlife veterinarian Jill Voeks departed on the Cromwell.

20 - 21 November - Rainbow 1, FWS Charter: Up were pilots Bob Justman and Max Alania, Scott Sullivan of Sea Engineering Inc. and Stanley Boc from the US Army Corps of Engineers, food and mail. Back were Scott Sullivan, Stanley Boc, Lance Lerum, Ann Whiteside, the flight crew and mail.

#### **5. Safety**

There were no serious accidents or illnesses on Tern Island during November.

All safety precautions for plane arrivals and departures, small boat operations, and loading and offloading of resupply vessels were followed.

Radio checks with Honolulu Coast Guard Communications Station were continued weekly throughout the month. Reception was generally good. Radio calls to Honolulu office were continued M,W, and F at 0815 hrs. Reception was generally good. Radio calls to Laysan Island were conducted on M and F at 1230 hrs. Reception was generally good.

## 8. Other Items

### a. **Meals**

During November, a total of 686 meals were served to FWS personnel and volunteers, NMFS personnel and volunteers and guests.

#### 1. Permanent Tern Island Staff

<b>Name</b>	<b>Number of Meals</b>
S. Barclay	32
A. Viggiano	90
<b>Total</b>	<b>122</b>

#### 2. Volunteers/Non-Tern Island Staff/Guests

<b>Name</b>	<b>Number of Meals</b>
Allison Veit	90
Kim Berger	32
Suzanne Romain	32
Todd Carpenter	68
Ann Whiteside	43
Golden Eagle personnel	1
Laysan Crew	3
Alan Morgan	8
Lance Lerum	16
Leona Laniawe	44
Townsend Cromwell personnel	5
Engineers	8
Pilots	6
<b>Total</b>	<b>356</b>

#### 3. NMFS Personnel/Volunteers

<b>Name</b>	<b>Number of Meals</b>
Mitch Craig	53
Frank Parrish	53
Birgit Buhleier	53
Jill Voeks	49
<b>Total</b>	<b>208</b>

## F. HABITAT MANAGEMENT

### 1. General

The marine debris collection project continued on Tern Island at 2 week intervals. Debris that could entangle, or otherwise prove a threat to wildlife was either collected or destroyed in place when found on the islands, or in the waters of the refuge.

### 6. Other Habitats

During Late November Tern Island experienced major erosion along South Beach. The erosion was most dramatic on the western portion of South Beach and on Diesel Beach. The sand that was replaced after last years event was removed very quickly. The erosion has progressed approximately 5 meters beyond last years erosion. The last two remaining heliotropes in front of the barracks were severely undercut. The Tern Island staff supported one bush by tying it to a stake anchored further inland. There was a total of 43 black noddy nests; 22 eggs and 21 chicks present when the erosion event started. Most of the nests survived. There was also a white tern egg which was consequently lost. The bushes, though heavily undercut and crooked, remained standing at months' end.

On 20 - 21 November Scott Sullivan of Sea Engineering Inc. and Stanley Boc with the U.S. Army Corps of Engineers visited Tern Island to review the plans for the proposed sea-wall project. Lance Lerum, arrived on 16 November in order to review the updated plans prior to the engineers arrival. This trip served two purposes, one was to familiarize Stanley Boc with the sea-wall project and the second was to review first hand the final draft of the plans. The engineers also walked the island with refuge staff to prioritize the habitat along the north side of the island and to discuss possible sights for staging equipment, housing and surplus materials associated with this project.

### 10. Pest Control

Exotic plant eradication continued on Tern and East Islands. *Cenchrus* was removed whenever found. Special patrols on Tern Island for *Cenchrus* were conducted approximately every 2 weeks, weather and breeding bird population activities permitting. *Cenchrus* patrols on East Island are conducted on most visits by Refuge Staff (1 to 2 times per month).

## G. WILDLIFE

### 2. Endangered and Threatened Species

#### a. Hawaiian Monk Seal

The NMFS/Critter-Cam crew continued to deploy and retrieve the cameras. The seals with satellite transmitters were continuously tracked from the Townsend Cromwell. The Cromwell and the remaining NMFS crew departed the atoll on 18 November. All of the "Critter-cams" were retrieved prior to departure. The satellite/radio transmitter units are scheduled to be retrieved in mid January 1996.

On 17 November a female pup on Round Island was tagged. The axillary girth was 110 cm and length was 130 cm.

#### b. Hawaiian Green Sea Turtle

On 3 November 2 adult turtles were noted basking on South Beach.

During several high surf events from 21 - 23 November and then again on 30 November, 14 platter sized turtles washed over the sea-wall. All but one washed over in the same vicinity, between the 600 - 650 meter marks ( the area across from the generator and woodshop buildings). The sea-wall in this area is very eroded and large gaps have formed allowing turtles to slip over easier. The lone turtle washed over the sea-wall, down by the east end at approximately the 100 meter mark. All of the turtles appeared unharmed. They were tagged and measured prior to being released. The following table lists all turtles captured in November including tag numbers and curved and straight carapace measurements.

DATE	TAG # RFL	TAG # LFL	CCL (cm)	SCL (cm)
21 Nov. 1995	F638	F639	43.4	41
21 Nov. 1995	F640	F641	45.5	42.8
21 Nov. 1995	F642	F643	41.2	39.5
21 Nov. 1995	F644	F645	45.3	42.5
22 Nov. 1995	F646	F647	44.5	42.25
22 Nov. 1995	F648	F649	41.1	39
22 Nov. 1995	F650	F651	49.3	46.5
22 Nov. 1995	F652	F653	42.3	40.5

22 Nov. 1995	F654	F655	49.2	46.5
22 Nov. 1995	F656	F657	49	46.25
23 Nov. 1995	F658	F659	45	42.5
23 Nov. 1995	F660	F661	42.4	40.25
30 Nov. 1995	F662	F663	45.7	43.5
30 Nov. 1995	F664	F665	45.8	42.8

### 3. Waterfowl

#### a. Northern Pintail

Three pintails were sighted on Tern Island throughout most of the month. The last sighting occurred on 19 November.

#### b. Black Brant

On 4 November four immature black brant were sighted on the runway of Tern Island. One of the brant was found dead on 6 November. The three remaining birds have been sighted daily throughout the month.

### 4. Marsh and Water Birds

#### a. Cattle Egret

Two cattle egrets were noted on Tern Island throughout the entire month of November. These two birds are probably the remainder of the four egrets that were sighted during October.

### 5. Shorebirds, Gulls, Terns, and Allied Species

#### a. Laysan Albatross

The first egg of the 1996 breeding season was found on 18 November.

#### b. Black-footed Albatross

The first egg of the 1996 breeding season was found on 8 November.

#### c. Bonin Petrel

Throughout the entire month courtship calls were commonly heard in the vicinity of the barracks during the evenings.

**d. Bulwer's Petrel**

NTR

**e. Tristram's Storm Petrel**

During a census of East Island on 28 November a pair was discovered when their burrow was accidentally caved in. They were unharmed and remained inside the burrow.

**f. Wedge-tailed Shearwater**

On 16 November the first chick of the 1995 breeding season fledged. The island wide chick banding effort was completed in November with a total of 478 chicks banded.

**g. Christmas Shearwater**

NTR

**h. Great Frigatebird**

During a mean incubation count on 14 November, 438 nests were counted: 0 eggs, 438 chicks.

On 20 November several male frigatebirds were seen displaying with partially inflated gular pouches.

**i. Red-tailed Tropicbird**

During a mean incubation count on 26 November, 1 nest was counted: 1 egg and 0 chicks. The egg is the first egg of the 1996 breeding season.

**j. Masked Booby**

During a mean incubation count on 12 November, no nests were found.

On 28 November a pair were noted courting, collecting and arranging nesting material.

**k. Red Footed Booby**

On 9 November the first egg of the 1996 breeding season was found. Later in the month the red-footed boobies were active with collecting nest material and sky pointing.

**l. Brown Booby**

Adult and juvenile birds were sighted roosting on Tern Island periodically throughout the entire month.



**m. Sooty Tern**

Small flocks of adults were still present on Tern Island at the end of November.

On 26 November the egg that was discovered in October hatched and three other eggs in the vicinity are currently being incubated.

**n. Gray-backed Tern**

During a mean incubation count on 2 November no nests were counted. On several occasions throughout the month of November small numbers of gray-backed terns were heard in the evenings flying over Tern Island.

**o. White Tern**

During a mean incubation count on 10 November, 23 nests were counted: 18 eggs and 5 chicks. White terns showed some signs of increased activity during November. Several new nest were found in both the beach and barracks plots.

**p. Brown Noddy**

During a mean incubation count on 1 November, 145 nests were counted: 101 eggs, 44 chicks.

**q. Black Noddy**

During a mean incubation count on 20 November, 2062 nests were counted: 1479 eggs and 583 chicks.

**r. Blue-gray Noddy**

NTR

**s. Shorebirds**

Two shorebird counts were conducted in November:

Species	Census Dates	
	11/10	11/24
Ruddy Turnstone	413	260
Pacific Golden Plover	117	51
Wandering Tattler	2	4
Bristle-Thighed Curlew	1	1
Sanderling	2	4

On 27 November a semi-palmated plover was sighted on the runway of Tern Island.

During November the Tern Island staff started summarizing the data collected from the shorebird counts. This was done in order to analyze the trends of shorebird populations at Tern Island.

**t. Lesser Frigatebird**

A male was seen on 10 November and a female on the 24th. It looks like the lesser frigatebird is working on residentship.

**6. Raptors**

NTR

**7. Other Migratory Birds**

NTR

**9. Marine Mammals**

Endangered Hawaiian monk seals are covered in D.5.c.1. and G.2.a. above.

On 7 November during a seal census a single bottlenose dolphin was sighted between the Gins and Disappearing Island.

**10. Other Resident Wildlife**

Threatened Hawaiian green sea turtles are discussed in D.5.c.2. and G.2.b. above.

**11. Fishery Resources**

NTR

**14. Scientific Collection**

NTR

**15. Animal Control**

NTR

## 16. Marking and Banding

During November, the following numbers of birds were banded:

Species	Age*		Island
	L	A	
LAAL	0	75	Tern
BFAL	0	14	Tern
WTSH	31	0	Tern
BLNO	11	0	Tern
MABO	1	0	East
TOTALS	42	89	Tern
	1	0	East
	-----	-----	
	43	89	FFS

\* L = local and hatch-year birds; A = adult birds

## 17. Disease Control and Prevention

### a. Oiled Birds Sighted During November

NTR

### b. Other

NTR

## H. PUBLIC USE

### 1. General

#### a. Visitors at French Frigate Shoals Under Special Use Permits in November

NTR

**9. Fishing**

NTR

**17. Law Enforcement**

**a. Observations of Fishing Boats and Aircraft in November**

<b>Vessel Name/ Aircraft Type</b>	<b>Date</b>	<b>Notes</b>
C.G C130	8 November	Flew over Tern at ~500ft. Caused major disturbance'. Attempted to contact but no response.

**I. EQUIPMENT AND FACILITIES**

**1. New Construction**

NTR

**2. Rehabilitation**

During November the kitchen was refinished. The walls and ceiling were washed, sanded and painted.

**3. Major Maintenance**

On 24 November the boat dock was torn off, its hinges by high surf. Approximately one third of the dock was broken off, but the majority of it remains intact. The base of the dock was not effected.

**4. Equipment Utilization and Replacement**

**a. Boats and Outboards**

During November a new lift system was installed in the barge.

**b. Tractor & Golf Cart**

NTR

**c. Generators, Pumps and Tools**

During November the boat hoist was replaced with the back-up hoist. The old hoist was showing signs of wear.

**d. Solar System, and Appliances**

NTR

**5. Communications Systems**

**a. Radios**

NTR

**6. Energy Conservation**

**a. Water**

Fresh water consumption was normal for the population on Tern Island during the month. The salt water system worked well throughout the month. All plumbing and water collection lines were in working order all month.

**b. Power**

The solar system and all generators worked well throughout the month.

**c. Fuel Reserves**

The following fuel reserves were on hand as of the end of November:

Diesel Fuel	2.5	55 Gallon Drums
Propane	6	Large Bottles
	0	Field Camp Bottles
Gasoline (FWS)	11	55 Gallon Drums
(NMFS)	10	55 Gallon Drums
Aviation Fuel	2	55 Gallon Drums

Report prepared by: A. Viggiano

BALANCE

## DAILY TOTALS (PM-AM) FOR ADULT FEMALE GREEN TURTLES NESTING AT EAST IS.

NMFS, HONOLULU LAB  
Marine Turtle Research  
2570 Dole Street  
Honolulu, HI 96822-2396

RETURN

2001

DATE	TOTAL NO. TURTLES UP	NO. OF NEW TURTLES IDed	NUMBER OF NESTS N/P/M	YOUR NAME	COMMENTS
6-4	10	10	0N/1P/0M	AD	1st night training <sup>staff</sup> - not a full night
6-5	21	18	1N/2P/0M	AD	2nd night training - "
6-6	28	19	5N/3P/6M	AD	1st full night
6-7	25	21	2N/1P/5M	AD	George + myself on walks
6-8	<del>40</del> 37	28	2N/0P/9M	GB	1st night GB ALONE. Clear skies - MILD WINDS
6-9	32	19	6N/0P/0M	GB	
6-10	30	14	10N/0P/1M	GB	
6-11	36	24	9N/0P/0M	GB	
6-12	36	19	12N/0P/0M	GB	
6-13	20	8	1N/5P/1M	AD	not a full night, readjusting (sorry)
6-14	27	18	3N/1P/1M	AD	ok, back in the saddle again!
6-15	30	16	3N/3P/2M	AD	moons getting smaller and later, miss the light
6-16	35	15	3N/0P/5M	AD	getting 2nd nesters
6-17	37	4	5N/5P/3M	AD	rainy and windy
6-18	28	2	3N/2P/3M	AD	more seals than usual esp. weeners. few seals
6-19	32	3	2N/3P/3M	AD	lots of squals
6-20	41	6	4N/1P/6M	AD	kinda big night / very tired still plenty seals / need rest
6-21					night off
6-22					night off
6-23	39	7	2N/0P/6M	AD	stormy / heavy rains + wind about 3 complete walks total
6-24	43	9	2N, 0P, 2M	AD	more rain + wind
6-25	48	4	2N, 1P, 6M	AD	here comes the rain again
6-26	36	4	3N, 0P, 2M	AD	mellow night, 1st third nester
6-27	40	2	3N, 4P, 3M	AD	
6-28	26	0	1N, 0P, 0M	AD	squals through the night
6-29	29	1	0N, 0P, 4M	AD	
6-30	28	4	1N, 3P, 3M	AD	
7-1	23	0	0N, 0P, 1M	AD	got sick, not a full night



## TERN ISLAND TURTLE NESTING S.O.P.'s

MARCH 1994

The following are the standard operating procedures for monitoring Hawaiian green sea turtle (*Chelonia mydas*) nesting activity at Tern Island.

### Preparation

A good indicator of the beginning of turtle nesting season is when the first turtle tracks are seen above the beach berm. The timing for this event is usually mid-April to mid-May (the first nest in 1992 was found on 27 April; the first nest in 1993 was on 8 May). When this happens it is time to get together the data sheets and turtle stakes needed for the season.

A small scale (1 inch = 10 meters), sectional Tern Island south side vegetation map (G. Narum, March 1986) is prepared for mapping nest locations. The map is in 10 sections and can be found in the files under the "Study Maps" section. Prepare the map by aligning the grid lines and taping the sections together east to west. This map will become useful in locating nest locations after turtle hatching begins. The "Green Turtle Nest/Hatching Success Form ed.II" is the other form used to keep track of nest #, lay date, hatch date, etc. (see Appendix A). This can also be found in the files under the "Green Sea Turtle" section. A large compartmented metal clipboard works well to keep everything in one place for remainder of the season.

The best turtle stakes for Tern Island (not true for East Is.) are made from 1" x 2" x 8 cut into about 2.5 foot long stakes. These are relatively easy to carry yet strong enough not to break (generally) when used as a back scratching post by seals.

### Turtle Nesting

Nesting activity usually begins soon after sunset. An individual turtle may come up two or three nights in a row and dig many "false pits" before completing a nest. One female can lay up to five nests in a season, averaging around 90 eggs per nest (range of 35 - 150). Incubation periods range between 50 - 100 days with the mean over the last eight years ranging between 62 - 71 days. The following is the sequence of turtle nesting activity once the animal has crawled above the berm and reached a suitable location:

- 1) Digging a Body Pit - the turtle uses all four flippers to dig a shallow pit (a few inches to a couple feet deep) in which she fits her body before digging an egg chamber. Turtles commonly dig "false pits".
- 2) Digging an Egg Chamber - this is the chamber in which the eggs will be placed. It is cylindrical and approximately 12 - 18 inches in width and 12 - 20 inches in depth. The turtle uses her hind flippers to carefully scoop out sand to make this chamber.



3) Laying Eggs - after completion of the egg chamber, eggs are laid inside. This usually takes between 1 - 1.5 hours.

4) Pattycaking - after the eggs are laid, the turtle will carefully fill the egg chamber with sand using her hind flippers. She will then "patty cake" the top until it is firm.

f) Backfill-- after the eggs are covered, the nest is then covered with sand using her foreflippers. The turtle slowly moves forward (3 - 6 feet) while throwing soil or sand behind using a rapid swim stroke with her front flippers. The result is a backfill which usually looks like an elongated mound of soil/sand (picture a large, freshly dug grave - it is the only example I could think of). At one end of this elongated mound will be a pit which usually has distinct cut marks from the swim stroke action of the front flippers on the edge away from the backfill. The mound (backfill) will also be softer than the surrounding substrate. The size of the backfill can vary but is usually pretty distinct and recognizable for what it is.

#### Nest Walks Before Hatching Begins

8:30 Morning nest walks/searches are conducted everyday throughout the nesting and hatching season on all Tern Island beaches. If the walks are finished before 9:00 AM, there is less chance of turtle tracks and pre- or post-hatch pit obliteration by monk seal and bird activity. Seals generally move above the beach berm during the late afternoon or early evening hours. They will move back down towards the water line sometime during the following morning. Approximately 90-95% of the turtle nests will be on the south beach, that is also where most of the seals will be so start there first and get it over with. Always remember disturbance to the seals is unacceptable.

The items needed on these walks are: 1) a small notebook for notes; 2) 2-3 stakes and a heavy tipped waterproof marker; and 3) ~~a 2 lb. hammer~~. When a nest is found, approximate the location of the egg chamber (usually 1-3 feet in front of the beginning of the mound) and drive the stake into the ground 4 feet inland leaving about 1 foot above ground. If stake placement four feet inland is not possible then use the "Comments" section of the Nesting Form to note the location. Nests are numbered sequentially in the order they are found; put the nest number on the stake. Approximate the nest location using bushes and/or manmade structures in the notebook for later transferal to the map. Be sure to fill out the data sheet and map every morning soon after the walk while the memory is fresh.

For data recording purposes, a backfill = a nest; evidence of a "backfill" with tracks leading directly back to the water is the strongest sign of a nest without actually seeing the eggs laid. Sometimes, a turtle will still be up after daylight, care should be taken not to disturb her. To check her activity, take a wide berth and come up low, directly behind the turtle. If a turtle is up after daylight it may have a damaged rear flipper. Turtles with damaged rear flippers will sometimes dig inadequate egg chambers and end up destroying many of the eggs when covering them with sand. Assistance in digging may be given to the turtle. Lie down flat, directly behind the turtle and scoop out sand as the turtle rests. Be careful not to touch the turtle or let it see you. Once the

turtle starts laying eggs it will be a little less susceptible to disturbance. However, this is not a carnival event. Do not allow the whole Tern Island troop on the beach to witness this event; 1 - 2 people may be acceptable depending on the circumstances and location. \*\*\* (See Appendix B for photos - need photos of 1) male and female tracks with direction of travel obvious, 2) scape - beginning of a false pit, 3) a couple variations of false pits with beginning of egg chamber, and 4) Backfill) \*\*\*

#### Nest Walks After Hatching Begins

After 50 days, nests should be checked for pre- or post-hatch (emergence) pit formations and tracks of hatchlings. A pre-hatch pit is an inverted cone in the sand approximately 3-6 inches across and 3-6 inches deep. The pit is caused by the hatchlings emerging from their shells and moving towards the surface. The settling sand forms an inverted cone. Pre-hatch pits are usually difficult to find. They are sometimes easy to confuse with ghost crab diggings, footprints from yesterday or bird prints. Remember the sand sinks to fill the open spaces below so if there are raised edges around the perimeter it is not a pre-hatch pit. Once the hatchlings emerge from the sand, a post-hatch pit is formed. This is usually an obvious settling of sand taking up the space that was filled by the hatchlings before they emerged. Look for tracks. When a post-hatch pit is found, record the nest as hatched. ~~The following morning (allow another night to pass)~~ the nest should be carefully excavated using shallow bites with a shovel. Count the number of trapped hatchlings, place them in a bucket and put the bucket in a dark place inside the barracks building (the fourth freezer of the freezer room is a good spot - the hatchlings will scurry around for awhile but will usually settle down after a short period of time). Record the number of dead hatchlings found and the number of rotten eggs encountered. Make sure the diameter of the excavation is wide enough to account for angled upward travel in any direction by the hatchlings. If you encounter a large number of hatchlings and no apparent reason for their entrapment then that is probably a pre-emergence pit or the second wave of hatchlings waiting for dark (sometimes the nest hatches over the course of two or three nights). If this is the case, quickly cover the hatchlings back up and watch the area for about 10 minutes to make sure none emerge. Never release hatchlings during daylight hours (they will become fish bait), always wait until an hour or two after sunset and then release them along the beach. Hatchlings are attracted to light, if they are to be released near the barracks building then shut off all lights and leave them off for 10 minutes or so to allow the hatchlings some distance from the island. Make sure they make into the water and don't wash back up. Keep a watchful eye on the ghost crabs until the hatchlings are well into the water (we are awaiting the purchase of a high powered, pneumatic pellet gun with retractable stock, an infrared night scope and laser sight capabilities).

It may be necessary to excavate a nest site later in the day due to the presence of seals in the vicinity at that time of the morning. In fact, this is the case probably 75% of the time. Nearby sleeping seals will almost always wake up with that kind of activity.

3 days  
later.  
Total of  
4 nights

by hand

and  
number  
of partially  
developed  
turtles.

### Nest Relocation

If a nest is found on the east beach or either end of the south beach (within 20 meters) it must be relocated to a more stable area due to shifting beach position in these areas. It is important to relocate the nest as soon as possible the morning of discovery. After the embryos begin to implant on the yolk they are highly susceptible to movement disturbance. If they are ripped from the yolk after implantation - it is a dead egg. Shovel down to the egg chamber, then use hands to uncover the eggs and gently place them in a bucket. The area west of the Gas Pad is a good relocation area - easy to dig and emerging hatchlings will not be affected by building lights. Pretend you are a turtle - dig a wide hole about two feet deep, then dig a egg chamber and gently place the eggs inside. Cover the eggs and tamp the fill, then finish filling the rest of the hole. Make a note in the "Comments" section that this is a relocated nest.

### General

Nest stakes will be knocked over and occasionally lost; use the map to locate the approximate location. A few unknown nests will be discovered throughout the hatching season by finding pre- or post-hatch pits. These should be treated as any other nest. List them on the Nest Form as UM 1 (unmarked), UM 2, etc.

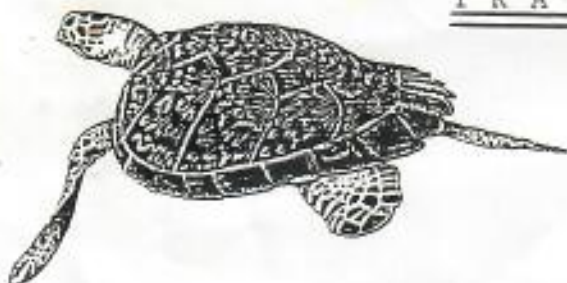
One evening walk is done along the south side of the barracks building to the eastern edge of the tennis court somewhere between 9:00 and 10:00 PM. The purpose of this walk is to check for hatchlings attracted to the light of the building. If any are found, take them to the water and release them. This is usually not a serious problem.

*George - This is our  
working SOP with  
a few modifications  
written in the margin.*

*Thanks for your interest.*

*Stew*





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

Commercial: (808) 943-1221  
Telefax: (808) 943-1290

TELEFAX FOR: MARC WEBBER USFWS

DATE: 4 OCTOBER 95

FROM: GEORGE BALAZS

TELEPHONE EXT: 943-1240

NUMBER OF SHEETS TRANSMITTED (including this page) ONE

MESSAGE: Marc- I am faxing you regarding Kimberly Berger at FFS. If she continues to hold interest, I believe she will make an excellent worker for the East Is. summer monitoring program. I was very impressed with her dedication, motivation, and endurance for work during my short time up there 22-25 Sept. Thank you for recommending her.

If her volunteer time permits, there are several important things relating to turtle research that she could do now- while the opportunities of the hatching season are still available. One such activity was relayed to you a few days ago by my assistant, Shawn. That involves the relatively easy activity of taking measurements of normally appearing excavated hatchlings at Tern. The straightline carapace length (using a small caliper), and curved carapace length using a flexible tape, are what I need. However, I am not certain that the small caliper used for hatchlings is still at Tern. If not, when is the next flight that would allow me to send a new caliper? note- measurements on a 100 or more hatchlings- representing several different nests- would be ideal.

My other suggestion for important work Kimberly could undertake right now involves gathering information on the level of mortality happening to hatchlings on East Is. as the result of the "weed jungle" I observed there, in combination with shearwater burrows. The tangle of vegetation presents a formidable task for hatchling to pass through. How many get hopelessly trapped/exhausted and die when the sun heats them up? How many fall down or crawl down shearwater burrows and die there? Kimberly could gather information on this subject during several hour day trip to East, in combination with other work FWS is doing. I recommend systematic searching of the tangled vegetation counting and collecting dead hatchlings (and releasing any found alive). Also, it would be important to carefully excavate a sample of abandoned burrows and record findings of hatchlings. And lastly, an identification of the different types of weeds present, and relative abundance (sketch-mapped distribution) would be worthwhile.

A small study like this, conducted now, would at least give us some idea if the suspicions I have reasonably developed on sources of hatchling mortality have any merit. We need to know in order to quantify sources and levels of mortality, and plan for possible future investigation.

I have no idea if Kimberly's current volunteer work load will allow her to pursue the above. All I can say is that she is a motivated person to carry it out, and that the work has merit and can only be pursued now- without having a 12 month delay (assuming that blooms of weeds like this are a seasonal occurrence).

In closing I should express gratitude to Steve and to Nick for there outstanding assistance and friendly nature during my recent trip. Many thanks to them, and to you. Best regards, George

1995- THE YEAR OF THE SEA TURTLE IN THE PACIFIC  
A SPREP Regional Marine Turtle Conservation Programme initiative



[28] From: William Gilmartin 10/3/95 7:12AM (842 bytes: 15 ln)  
To: George Balazs  
Subject: Re[2]: NWHI study

----- Message Contents -----

FYI, we collected no jacks of any spp, just menpachi and labrids.

Bill- I asked Ed if they collected any ulua on their recent trip. Above is his answer. I guess the ones taken mimic the diet of the seals. Too bad the seal couldn't catch and eat the ulua. geo. **Something to ask ED:** With the drop in general fish abundance at FFS, is the ulua popul likely crashing (as a top predator) or is their diet so varied that their #'s may be holding...in other words a disprop. high no. of ulua now that may be even more voracious feeders...taking even more hatchlings than in earlier years??

[25] From: William Gilmartin 9/28/95 1:41PM (2115 bytes: 26 ln)  
To: George Balazs  
Subject: Re: ulua harvest

----- Forwarded -----

From: William Gilmartin 9/28/95 1:40PM (1952 bytes: 26 ln)  
To: Jeffrey Polovina  
cc: Timothy Ragen, William Gilmartin  
Subject: Re: ulua harvest

----- Message Contents -----

Jeff: I'll look at Sudekum et al. soon and think about this some more and get back to you with my thoughts on it. Early in the 80s the Monk Seal Rec. Team considered the suggestion of shark fishing to reduce attacks (presumed at that time, with little info, to be a problem). The primary concern as best I can recall, in addition to the lack of good evidence for a direct shark problem, was the unknown impact on the FFS ecosystem and the proposal was vetoed for this reason. If your idea has merit, I think the Rec Team would have to be convinced that the ulua take would not be significantly disruptive to the ecosystem, which you believe is the case as I read your note (presumably you can show this?). More later. -Bill

Tim, Bill, The monk seal presentation at the program review conveyed very powerfully the dire situation of FFS monk seals. Perhaps its time to re-consider the idea of harvesting uluas at FFS. Each large ulua consumes 150 kg/yr. The FFS ulua population is in the tens to hundreds of thousands. The reduction of 500 to 1,000 ulua by 6 volunteer sports fishermen over a one month period would hardly be a slaughter of the the ulua but could reduce prey consumption by 75-150 tons/yr. The evidence I've seen suggests uluas and seal are competing for the same prey. Seems like it's time to consider some pro-active measures. Perhaps a large head start program at FFS would be more appropriate.

[23] From: Shawn Murakawa 9/28/95 7:54AM (1409 bytes: 18 ln)  
To: George Balazs  
Subject: Re[2]: Ulua

----- Forwarded -----

From: George Balazs 9/27/95 7:50AM (1254 bytes: 18 ln)  
To: Jeffrey Polovina  
cc: Shawn Murakawa  
Subject: Re[2]: Ulua

----- Message Contents -----

Jeff- I'm very interested in following up on this in some manner. What reading of Jim's would you recommend to me? Also, when you say other islands, do you mean ones within refuge boundries? Are ulua being collected, even in small numbers, now or in the recent past at any of those other islands? I think the time is approaching that we finally collaborate on areas of common interest! thanks, geo.

Goerge, our fish work at FFS is only periodic censuses of fishes at patch reefs and reef flats. We have collected fish on the current cruise for monk seal feeding experiments but those collections are all outside of FFS - at other islands. For a while I was proposing a major ulua harvesting experiment to reduce the population of a major competitor to juvenile seals but logistically it would be extremely difficult. Apart from the historical work by Jim Parrish on ulua diets at FFS, I'm not aware of any other ulua collection





**U.S. DEPARTMENT OF COMMERCE**  
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*US FISH & WILDLIFE SERVICE*

TELEFAX FOR: MARC WEBBER

DATE: 1 Sept. 93

FROM: GEORGE BALAZS

TELEPHONE EXT: 943-1240

NUMBER OF SHEETS TRANSMITTED (including this page) 2

MESSAGE:

MARK- THE TWO SATELLITE TRANSMITTERS WE DEPLOYED AT FRENCH FRIGATE SHOALS ARE WORKING PERFECTLY, WITH POSITIONAL DATA BEING RECEIVED ON A DAILY BASIS. THUS FAR, HOWEVER, BOTH TURTLES ARE STILL IN THE IMMEDIATE VICINITY OF EAST ISLAND. APPARENTLY THEY WILL BE LAYING ONE OR MORE CLUTCHES OF EGGS BEFORE EMBARKING ON THEIR HIGH-SEAS MIGRATION. IF ANYONE AT TERN MAKES A VISUAL SIGHTING OF THESE ANIMALS, PLEASE LET ME KNOW THE DATE, TIME AND PLACE.

WHILE AT EAST ISLAND I WITNESSED SOMETHING THAT HAS NEVER BEFORE BEEN DOCUMENTED AT FRENCH FRIGATE SHOALS. DURING THE NIGHTTIME, WITH 1/2 MOON, I SAW "FEEDING FRENZIES" INVOLVING ULUA PREYING ON HATCHLINGS ENTERING THE WATER. THIS TOOK PLACE ALL ALONG THE SANDY NORTHWESTERN SIDE OF THE ISLAND, FROM ABOUT WHERE THE BOSTON WHALER USUALLY ANCHORS, EXTENDING TO THE NORTHWEST. I COULD IDENTIFY ULUA, UP TO PERHAPS 30 LBS, BUT THERE ALSO MAY HAVE BEEN SMALL SHARKS PERSENT. DURING A ONE HOUR PERIOD THAT I MADE OBSERVATIONS, I FEEL FAIRLY CONFIDENT THAT NO HATCHLING ENTERING THE WATER SURVIVED. THE FISH WERE CONSTANTLY PATROLLING UP AND DOWN, EASILY SEEN BY THE AVAILABLE MOONLIGHT. IF FISHING GEAR HAD BEEN AVAILABLE TO ME, I WOULD LIKED TO HAVE LANDED SEVERAL TO DETERMINE EXACTLY HOW MANY TURTLES EACH FISH WAS EATING. GIVEN THAT THIS HAS BEEN ONLY A MODEST YEAR FOR NESTING, I HAVE SOME REAL CONCERN FOR THE LEVEL OF PREDATION I SAW (WHICH TO MY KNOWLEDGE HAS NEVER BEEN SEEN BEFORE AT THIS SITE). IN ORDER TO GET SOME IMMEDIATE ADDITIONAL INFORMATION ON THIS SUBJECT, I WANT TO SUGGEST THAT CHRIS OR SOMEONE AT TERN CATCH A FEW OF THOSE FISH AND EXAMINE THE STOMACHS. PRESUMABLY THIS COULD JUST AS EFFECTIVELY BE DONE DURING THE DAYTIME AS AT NIGHT. I'LD BE HAPPY TO DISCUSS THIS FURTHER WITH YOU BY TELEPHONE.

BEST REGARDS,



from Balazs 1980  
"Synopsis of  
Biological Data"

Although frigatebirds, *Fregata minor*, are among the seabirds present at French Frigate Shoals, they are not known to prey on hatchlings on land or in the inshore waters such as reported in certain other *Chelonia* populations (Hirth 265). Nocturnal emergence undoubtedly serves as a protective mechanism against such predation. Examinations of fecal matter at the nesting and roosting sites of frigatebirds have not resulted in the recovery of laminae or other indigestible particles of hatchlings. This suggests that predation is also not occurring in the pelagic waters surrounding French Frigate Shoals where frigatebirds periodically forage.

During the U.S. Coast Guard tenure at East and Tern Islands, newly emerged hatchlings were regularly disoriented and attracted to artificial lights and possibly vibrations from diesel generators associated with station facilities. Mortalities from thermal exposure subsequently resulted in those hatchlings that were not discovered by Coast Guard personnel and transported to the water.

Predation on hatchlings by carnivorous fishes at French Frigate Shoals does not appear to be significant. It is difficult, however, to assess such impacts within the marine environment. From July to October 1974, 101 ulua, *Caranx ignobilis*, *C. melampygus*; 16 wrasses, *Thalassoma purpuraceum*, *Bodianus bilunulatus*; and 13 gray reef sharks, *Carcharhinus amblyrhynchos*; were captured in the vicinity of East Island to examine stomach and intestinal contents for the presence of hatchlings. Major food items recovered included filefish, *Pervagor pilosoma*, and pieces of unidentified crabs and cephalopods, but no evidence of hatchling predation was found.

Hatchlings that emerge from nests in the center of East Island are coated with particles of humus, while those originating from pure calcareous sand areas along the periphery and at the west end emerge perfectly clean. For an unknown period of time after entering the water, hatchlings coated with humus emit a trail of organic material. It would be of value to know if this provides olfactory cues to potential fish predators, or somehow possibly serves as a deterrent to predation.

The types and levels of predation on hatchlings that emerge from nests at other islands in the northwestern segment of the Hawaiian Archipelago are presently unknown. Both species of ghost crabs as well as many of the same carnivorous fishes are also present at these locations.

Hawaiian *Chelonia* hatchlings that emerged from a captive nest at Sea Life Park on Oahu in 1976 were extensively preyed upon by wild mongoose, *Herpestes auropunctatus*, (Bourke et al. 131). This mammal was first introduced to Hawaii in 1883 and is now present on all of the main islands except Kahoolawe, Lanai, and Niihau.

### 3.3 Juveniles, Subadults, and Adults

#### 3.31 Longevity

There is virtually no information on the life spans of Hawaiian *Chelonia* or marine turtles of any other population. The maximum age obtained could, however, be considerable in view of the findings that turtles at certain resident foraging areas may require more than 59 yr to reach maturity (Table 4).



U. S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Southwest Fisheries Science Center Honolulu Laboratory  
2570 Dole St. • Honolulu, Hawaii 96822-2396  
(808)943-1221 • Fax: (808)943-1290

September 19, 1995 F/SWC2:ghb

Mr. Marc A. Webber  
Refuge Manager, Remote Islands  
Hawaiian Islands National Wildlife Refuge  
P.O. Box 50167  
Honolulu, Hawaii 96850

Dear Marc:

I am writing to provide specific information on the green turtle research activities I hope to accomplish during my forthcoming trip to French Frigate Shoals, September 22-25, 1995. You are already familiar with most of this proposed work. However, there are a few additional items that I wanted you to be aware of and with your approval, if necessary, to add to our NMFS Special Use Permit #55883. The following provides a summary of each research activity.

- 1) Deploy a single satellite transmitter on an adult female green turtle encountered nesting or basking on East Island. Protocol for successful attachment with minimum stress to the turtle will be identical to previous deployments I have carried out at East Island, Rose Atoll, Taiwan, Florida and, most recently, with hawksbills at Kamehame, Kau, Hawaii.
- 2) Obtain small skin biopsies from up to 10 nesting females found at East Island, and from up to 50 hatchlings originating from not more than 25 different nests at East Island, using safe and accepted veterinary procedures. A 6 mm biopsy punch will be used for adults, and a 2 mm biopsy punch will be used for hatchlings.
- 3) Retrieve 12 computerized temperature dataloggers that were buried during early June on Tern Island and East Island. The units will be downloaded to supply substrate temperatures (8x per day since deployment) which are directly related to nest incubation and sex determination of green turtles at French Frigate Shoals.
- 4) Excavate nests to retrieve and release live hatchlings and to examine and enumerate unhatched clutch remains with reference to proximity of nearest temperature datalogger. Excavations will be similar to the effort carried out seasonally by Fish and Wildlife Service personnel on Tern Island. Gonads for histological sex determination will be collected from hatchlings found freshly dead in the excavated nests.



5) Collect small blood samples (less than 0.2 cc) from up to 150 hatchlings originating from not more than 30 different nests using safe and accepted veterinary procedures. The quantity of 0.2 cc or less is within the accepted veterinary-recommended volume of blood that can be taken harmlessly from a sea turtle hatchling. Blood samples will be used to develop a nonlethal sexing technique suitable for hatchlings which will have universal application to sea turtle research and conservation management. At the present time, no nonlethal technique exists for determining the sex of a hatchling turtle.

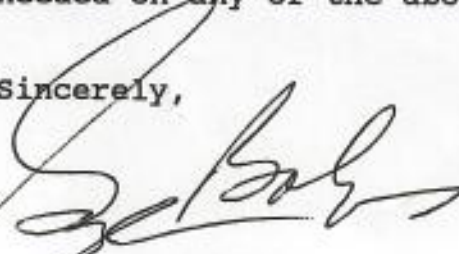
6) Collect a sample of up to 10 ulua (Caranx spp.) by hook and line from the shoreline of East Island for detailed gut analysis of prey items, specifically hatchling turtles. Fish will only be collected if visual or audible evidence is obtained suggesting heavy predation of hatchlings that have emerged from nests in a natural manner (as opposed to excavated nests).

7) Record by video camera the above research activities, as time permits, for non-commercial educational and scientific/NMFS/FWS research purposes. A copy of any footage taken will be made available to FWS, if so desired.

As previously requested by phone, Marc Rice of the Hawaii Preparatory Academy will be accompanying on me on this trip as my research assistant. Marc has been issued formal NMFS invitational travel orders for this purpose.

Thank you for your assistance in making this trip feasible by allowing our return to Honolulu on the flight planned for September 25. Please call me if additional clarification is needed on any of the above topics. Best regards.

Sincerely,



George H. Balazs  
Zoologist and Leader,  
Marine Turtle Research Program



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
Southwest Region  
501 West Ocean Boulevard, Suite 4200  
Long Beach, California 90802-4213  
TEL (310) 980-4000; FAX (310) 980-4018

May 25, 1995 F/SWO33:ETN

Mr. Marc Webber  
U.S. Fish and Wildlife Service  
Hawaiian and Pacific Islands  
National Wildlife Refuge Complex  
P.O. Box 50167  
Honolulu, Hawaii 96850-4984

Dear Marc:

Thank you for meeting with us to discuss the photo-journalism (PJA) request from Doug Bertran and developing a proposed special use permit (SUP) for this activity. I have reviewed the proposed SUP and discussed the issue with Bill Gilmartin, Tim Ragen and George Balazs of the Honolulu Laboratory. Although this does not constitute a Section 7 consultation, the following comments and recommendations are provided in the event that the proposal goes forward as described and consultation will be necessary.

- 1) There is existing footage of albatross predation by sharks at French Frigate Shoals. Both Paul Atkins and Mike DeGruys should have stock footage available. While this would not be original footage, what would be gained by a third film project for this purpose?
- 2) Although Midway was dismissed by the Navy because of space limitations, we believe that a formal request to the Navy could be made through the Fish and Wildlife Service and that option explored once more. The impacts to turtles and monk seals would be orders of magnitude less at Midway for the same purposes, and many more albatross would be present at Midway. Both John Naughton and George Balazs believe that there are enough tiger sharks at Midway to make it worthwhile.
- 3) Should you determine that the proposal has enough merit to consider issuing a SUP for French Frigate Shoals, the following restrictions should be considered in order to comply with the 1986 Biological Opinion for the Hawaiian Islands National Wildlife Refuge Master Plan and the existing Master Plan itself.



- a) All land activities should be limited to Tern Island under the supervision of the Refuge Manager.
- b) No disturbance of monk seal mother/pup pairs should occur.
- c) No scaffolding should be erected near East Island.

Strictly interpreted, the FWS could permit the scaffolding in the waters of French Frigate Shoals near East Island, but would not be within the spirit or intent of restricting activities to Tern Island during the monk seal pupping season.

These recommended restrictions are based on the conservation recommendations of the Biological Opinion and requirements of the Master Plan. These conditions will also mitigate the potential for a "take" of monk seals by this activity which cannot be permitted without a small take permit under section 101(a)(5) of the Marine Mammal Protection Act, as amended.

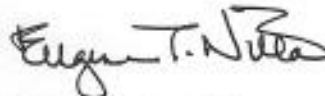
While these conditions may appear to be unduly restrictive, the status of the monk seal population at French Frigate Shoals has changed dramatically over the past 5-6 years. From the mid-1970s to about 1988 or 1989 the monk seal population at French Frigate Shoals was larger than any other island/atoll population, and contributed the largest proportion of reproductive capacity and total pup production to the entire species. Since then the French Frigate Shoals population has experienced a decline in total numbers of animals due to poor pup and juvenile survival and a lowered birth rate. The causes of this are not completely clear, but changes in productivity around French Frigate Shoals have affected other species as well, and may have contributed to this situation. There may be other factors involved, such as fishery interactions, but since the closure of the Protected Species Zone, strong evidence of that has not been evident. While this population may be stabilizing toward a different carrying capacity (K), we are unsure what that level is or when it will occur. Because of these changes, the composition of the French Frigate Shoals population is skewed toward older animals with a paucity of younger animals. We are concerned that this population could follow a course much like the Kure population, which was becoming largely senescent with pup production approaching zero in the 1980s, before recovery actions were instituted.

If past PJA activities have been allowed to occur during the pupping season on islets other than Tern Island within French Frigate Shoals, it may be appropriate to reinitiate consultation on the Refuge Master Plan. The future addition of Midway as a National Wildlife Refuge also highlights the need for consultation. I do not believe that the rules have changed - only the monk seal situation at French Frigate Shoals has deteriorated significantly within the last 5 years.

NMFS recognizes the value of PJA activities that promote education and public awareness of Refuge resources that are not amenable to public viewing. However, we must balance that need with our mandate to conserve and recover Hawaiian monk seals and green turtles, which we believe should have higher priority. The activities proposed by Bertran could disturb the most important monk seal pupping island at French Frigate Shoals. Recent survival rates of pups there are already catastrophically low and such disturbance could further compromise survival of pups through their first year of life. We urge you to reconsider the alternatives that do not involve East Island for this project.

Thank you for the opportunity to provide comments and recommendations. I can be reached at 808/973-2987 should you have any questions or wish to discuss this further.

Sincerely,



Eugene T. Nitta  
Protected Species Program  
Coordinator

[29] From: William Gilmartin 6/20/95 8:57AM (2108 bytes: 30 ln)

To: Mike Laurs

cc: George Balazs, Timothy Ragen, Eugene Nitta, William Gilmartin

Subject: FWS Filming Permit at French Frigate Shoals

----- Message Contents -----

Following much discussion among staff of the Honolulu Lab's Protected Species Investigation, Gene Nitta (SWR-PAO), and the Fish and Wildlife Service (Honolulu office), the FWS has issued a filming permit to Doug Bertram to erect a scaffold structure on the reef adjacent to East I. at French Frigate Shoals to film shark predation on albatross chicks.

In spite of the conditions put on this permit by the FWS, we continue to have strong objections to allowing this project to occur at East I. because the work will occur in early June the peak of monk seal pupping and turtle nesting, footage of this behavior is already available, and the behavior could be filmed at another much less sensitive location. As you are aware, the monk seal population at FFS has declined precipitously during the last 5 years, to less than 1/2 of the numbers in 1990. We believe that permitting further stress on this population, especially for a project such as this at the small primary pupping island, cannot be justified. Gene Nitta's May 25 letter to Marc Webber (FWS), which I am forwarding to you separately, states our collective NMFS case well, however the permit has now been issued for the filming at East I.

For as far back as I can recall we have never so strongly disagreed with the FWS on a permitted activity in the Northwestern Hawaiian Islands. We believe they have shown little regard for the highly sensitive status of the endangered monk seal and threatened turtle by issuance of this permit over our objections. I sincerely hope this action is not an indication of things to come.



East Island Turtle Report, 1994  
 U.S. Fish and Wildlife Service  
 Alyssa E. Ward  
 Susan L. Pultz

PACIFIC/REMOTE	PFB	ACT	FYI	CC	INT
Complex Manager					OK
Biologist					OK
Admin. Support Asst.					S
Secretary					
HI NWR Manager					W
Bio. Sci. Tech.					W
Johnston					
Midway					
Tern					

File 94 turtle data

I. General Monitoring

The 1994 turtle season was a short season consisting of only one month of monitoring. There were 121 nesting green sea turtles (*Chelonia mydas*) identified on East Island during this time as calculated from the ID data.

Turtle Camp began on June 7, 1994 and ended July 7, 1994 consisting of 30 nights of monitoring. Each night consisted of five turtle walks around the island at 21:00, 23:00, 1:00, 3:00, and 5:00 (sunset to sunrise). This meant that no more than two hours lapsed between turtle sightings. Due to the duration between walks, it is possible that some turtles that were up crawling or digging false pits were not seen. However, it is unlikely that those turtles that actually nested were not recorded as being up.

There were 73 possible nests recorded on East Island the short season. Eggs were witnessed for 30 of these nests. Turtles were seen covering egg chambers (patty-caking) for 18 nests and backfilling 25 nests.

II. Data Notes

Moto-tool numbers Z1 through Z117 were used during the 1994 season. The turtle identified as Z77 was also given the ID Z109. All entries for this turtle in the data base should be listed as Z77. ID number Z43 was duplicated. Both turtles were identified by tag number and designated as 43A and 43B in the ID files. There were four turtles this season without a moto-tool identification. These turtles are listed as UK1, UK2, UK3 and UK4 in the both the ID and sightings files. All turtles listed in the ID files have at least one tag. Those turtles in the sightings files listed as UK without an identification number were turtles that were seen up, but, due to their proximity to seals, were not identified.

Identification data is recorded in the DBASEIII file EASTID94.DBF. This includes tag numbers applied and measurements taken for nesting females in the 1994 season on East Island. It also includes tumored turtle information. Sighting information is recorded in the DBASEIII file ESTSIG94.DBF. This file contains the turtle activity for each night of monitoring.

Tags U302-U396 were used on East this season. Tags misapplied and recovered are: U302, U336, U593, U597, U560, U455, U377, U335, U503, U485, U320, U467, U379, U371, U541, U484, U529, U336, U591, U592, U573, U358, U517, U533, U551, U388, U494, U501, U502, U504, U505, U506. Tags lost: U377, U386, U390, U394, U500, U529 and U533.

III. Miscellaneous Notes

- A. Immature turtle was seen basking on the East end of East Island on 7/5/94. No tags were read or measurements taken. It is believed that this is the same immature turtle that has been seen basking in previous years on East Island.
- B. There were six tumored turtles identified during the 1994 season. These were listed as Z26, Z33, Z93, Z105, Z107 and Z116. Tumor information (i.e. location and size) are found in EASTID94.DBF. Three other turtles had grey lumps approximately 1 cm in diameter.

These turtles are Z18, Z50 and Z56 (Z18 had 11 lumps). The lumps did not appear to be tumors, but their positions are listed in the data base.

- C. A mature female turtle was found on the runway on Tern Island on 6/9/94. This turtle was tagged, measured and released. Tag information is as follows:

F619 RHF, F620 LHF, F621 RFL, F622 LFL  
Curved carapace length: 102.5 cm

- D. A significant number of male baskers were seen late into the season. During the first week of July, a minimum of 5 males were seen basking on East island. Isolated males (those removed from other baskers and seals) found basking were tagged and measured. They are recorded as M1-M7 in the file EASTID94.DBF.

- E. Clutch size was collected for ten turtles. One of these turtles was heavily tumored. Data collected was as follows:

Z9:	6/13/94	105 eggs	
Z33:	6/13/94	124 eggs	(heavily tumored)
Z75:	6/19/94	110 eggs	
Z81:	6/20/94	45 eggs	plus 1 spacer
Z86:	6/21/94	82 eggs	plus 2 spacers (Pit too small. Broke at least one egg while covering nest. A few other eggs not covered.)
Z90:	6/21/94	125 eggs	
Z37:	6/29/94	112 eggs	
Z43B:	6/30/94	104 eggs	
Z113:	7/5/94	111 eggs	(nest marked)
Z91:	7/6/94	87 eggs	

[10] From: Eugene Nitta 6/2/95 8:22AM (1151 bytes: 14 ln)  
To: George Balazs  
cc: Timothy Ragen, William Gilmartin, John Naughton  
Subject: Re: Army Corps of Engineers permit

----- Message Contents -----

Isn't an ACE permit needed to anchor structures in coastal waters of Hawaii? Wouldn't that include the scaffolding proposed? I understood that spikes would have to be pounded/drilled into the reef. If that's correct, and if it is to stay in place 10 days OR MORE (prepare for proposed permittee to make urgent appeal for an extention at 10 days, when he hasn't gotten all the filming he wants to get!), then I would think a Corp permit would be necessary. Would is your opinion, Gene? Or does this get into John's realm of things? Thanks, geo.

I guess it would depend on the Corps interpretation of permanent structure or permanent anchor and navigable waters. I am "surprised" that FWS would allow spikes to be drilled or pounded even into dead substrate. You might check with John on the particulars of a Section 10 permit.

*Geo from Maui*

**ORDER FOR SUPPLIES OR SERVICES**

**IMPORTANT: Mark all packages and papers with contract and/or order numbers.**

1. DATE OF ORDER <b>05/04/95</b>		2. REQUISITIONING OFFICE <b>HWN/TERN</b>		3. CONTRACT NO. (If any) <b>OPEN MARKET</b>		4. ORDER NO. <b>12521-5-0216</b>	
5. SHIP TO: (Consignee and address, ZIP code) <b>PACIFIC/REMOTE ISLANDS NWR COMPLEX U.S. FISH &amp; WILDLIFE SERVICE 300 ALA MOANA BOULEVARD, ROOM 5302 HONOLULU, HAWAII 96813 PH: (808) 541-1201</b>				6. MAIL INVOICE IN TRIPLICATE TO: (Add the ZIP code) (See Billing Instructions on Reverse) <b>PACIFIC/REMOTE ISLANDS NWR COMPLEX U.S. FISH &amp; WILDLIFE SERVICE P.O. BOX 50167 HONOLULU, HAWAII 96850</b>			
7. TO: CONTRACTOR (Name, address, and ZIP code) <b>JANA SWIMMER C/O SCHOOL OF NATURAL RESOURCES &amp; ENVIRONMENT UNIVERSITY OF MICHIGAN ANN ARBOR, MI 48109-1115</b>				8. DISCOUNT TERMS <b>NET 30</b>		10. TYPE OF ORDER SF 281 Code <input checked="" type="checkbox"/> <b>A. PURCHASE</b> - Reference your _____	
11. GOVERNMENT B/L NO. <b>N/A</b>				12. F.O.B. POINT <b>DESTINATION</b>		13. PLACE OF INSPECTION AND ACCEPTANCE <b>DESTINATION</b>	
14. SCHEDULE (See reverse for Rejections)							

ITEM NO. (A)	SUPPLIES OR SERVICES (B)	QUANTITY ORDERED (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)	QUANTITY ACCEPTED (G)
1	<b>CONDUCT A STUDY OF HAWAIIAN GREEN SEA TURTLE NESTING ACTIVITY AT FRENCH FRIGATE SHOALS. SEE ATTACHED STATEMENT OF WORK.</b>	1	<b>JOB</b>	<b>2490.00</b>	<b>2490.00</b>	

15. BUSINESS CLASSIFICATION (Check appropriate boxes)

SMALL     OTHER THAN SMALL     DISADVANTAGED 8(a)     MINORITY     WOMAN-OWNED     LABOR SURPLUS     INTER-AGENCY

16. ISSUING OFFICE (Address correspondence to) U.S. FISH AND WILDLIFE SERVICE

**SAME AS BLOCK 6** **2490.00**

17. NAME AND WARRANT NUMBER OF CONTRACTING OFFICER (Typed): **STUART C. SAKURAI, FWS-19017**

18. UNITED STATES OF AMERICA BY (Signature): *Stuart C. Sakurai*

**FOR GOVERNMENT USE ONLY (See Note on Reverse)**

ACCOUNTING LINE NO.	ORGN	FUND	BFY	SUB-ACTIVITY	PROJECT	OBJECT CLASS	DESCRIPTION ITEM NO. (Block 14A)	AMOUNT
	12521		95	1262			<b>ITEMS 1 THROUGH 01</b>	<b>2490.00</b>

## STATEMENT OF WORK

### I. General

This purchase order is being issued for the specific purpose to contract a vendor to conduct a study of Hawaiian Green Sea Turtle nesting activity on East Island at French Frigate Shoals. The study will be conducted during a thirty day period between June 2nd and July 14th 1995. So as to keep data collection consistent with prior studies, a standard operating procedures document will be provided.

### II. Requirements

- A. Due to the remote location and camping alone, field work will be broken up into specific intervals. The periods will be four to five days on East Island followed by four to five days at the Refuge station located on Tern Island.
- B. Contractor will be part of a two person team and will be expected to cooperate in the field with the other team member and employees of the U.S. Fish and Wildlife Service.
- C. While at French Frigate Shoals, all rules, regulations and procedures as stated within the Standard Operating Procedure document must be followed due to safety precautions, proper recording of information, protection of the wildlife and proper methods and activities while operation on a Federal Wildlife Refuge. The resident Refuge Manager will provide information, guidance and answer any questions pertaining to restricted activities, safety and the protection of wildlife.
- D. Contractor will be required to setup and take down camp. The Refuge Manager or designate will inspect camp site to insure that area is left in an acceptable manner.
- E. The study will be reported on a d-BASE computer program that includes all data collected and as described in the established research protocols. All original field data forms and notebooks must be submitted to verify data.

### III. Additional Information

- A. Due to the remote location, transportation will be provided by the Service. Transportation from Honolulu to Tern Island will be by air on a scheduled flight to resupply provision on the island. Transportation to East Island will be by small boat driven by Refuge Personnel.
- B. For communications and safety, the Service will provide transceivers as a requirement for working alone in a remote location.

**IV. Health Problems**

- A. Any injury or sickness should be reported to the Refuge Manager for any necessary action. (The Refuge does maintain medical supplies and can dispense drugs under the direction of a doctor contacted by radio).
- B. In case of a major injury, sickness or accident the resident Refuge Manager will coordinate with the Honolulu office to take appropriate action.

**V. Expenses**

- A. Contractor will take care of own incidental expenses.
- B. Due to the remote location, administrative cost, meals, and housing will be covered by the Refuge. Contractor will be expected to assist with cleaning and cooking as part of agreement.

**VI. Payment**

To receive payment, a proper original invoice must be submitted with the required report. Certification of job completed will be by signature on the back of the purchase order stating item has been received. The Hawaiian Islands Refuge Manager, Pacific/Remote Islands NWR Complex Refuge Manager, or Hawaiian Pacific Islands NWR Complex Field Supervisor are authorized to certify job completion.

**VII. Taxes**

Complete and return the attached W-9

# ORDER FOR SUPPLIES OR SERVICES

Page 1 of 1 Pages

**IMPORTANT: Mark all packages and papers with contract and/or order numbers.**

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9. DELIVER TO F.O.B. POINT ON OR BEFORE (Date)  <b>07/30/95</b>			

11. GOVERNMENT B/L NO. <b>N/A</b>	12. F.O.B. POINT <b>DESTINATION</b>	13. PLACE OF INSPECTION AND ACCEPTANCE <b>DESTINATION</b>
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14. SCHEDULE (See reverse for Rejections)

ITEM NO. (A)	SUPPLIES OR SERVICES (B)	QUANTITY ORDERED (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)	QUANTITY ACCEPTED (G)
1	<b>CONDUCT A STUDY OF HAWAIIAN GREEN SEA TURTLE NESTING ACTIVITY AT FRENCH FRIGATE SHOALS. SEE ATTACHED STATEMENT OF WORK.</b>	1	JOB	2490.00	2490.00	

15. BUSINESS CLASSIFICATION (Check appropriate boxes) <input checked="" type="checkbox"/> SMALL <input type="checkbox"/> OTHER THAN SMALL <input type="checkbox"/> DISADVANTAGED (8(a)) <input type="checkbox"/> MINORITY <input type="checkbox"/> WOMAN-OWNED <input type="checkbox"/> LABOR SURPLUS <input type="checkbox"/> INTER-AGENCY	14(H). TOT (Cont. pages)
--	--------------------------

16. ISSUING OFFICE (Address correspondence to) U.S. FISH AND WILDLIFE SERVICE <b>SAME AS BLOCK 6</b>	2490.00	14(I). GRAND TOTAL
---	---------	--------------------

17. NAME AND WARRANT NUMBER OF CONTRACTING OFFICER (Typed) <b>STUART C. SAKURAI, FWS-19017</b>	18. UNITED STATES OF AMERICA BY (Signature) 
---	---

**FOR GOVERNMENT USE ONLY (See Note on Reverse)**

ACCOUNTING LINE NO.	ORGN	FUND	BY	SUB-ACTIVITY	PROJECT	OBJECT CLASS	DESCRIPTION ITEM NO. (Block 14A)	AMOUNT
	12521		95	1262			<b>ITEMS 1 THROUGH 01</b>	2490.00

8/17

Hi George,

This is the only paper work that Marc sent me re: East Island work. When I received this by mail last Spring, Marc told me to hang onto it. By not sending it back to him, I "accepted" the contract work.

The only other paper work that I did was to write a letter of interest in the job and to send my C.V. to Marc. He has copies of that, as do I.

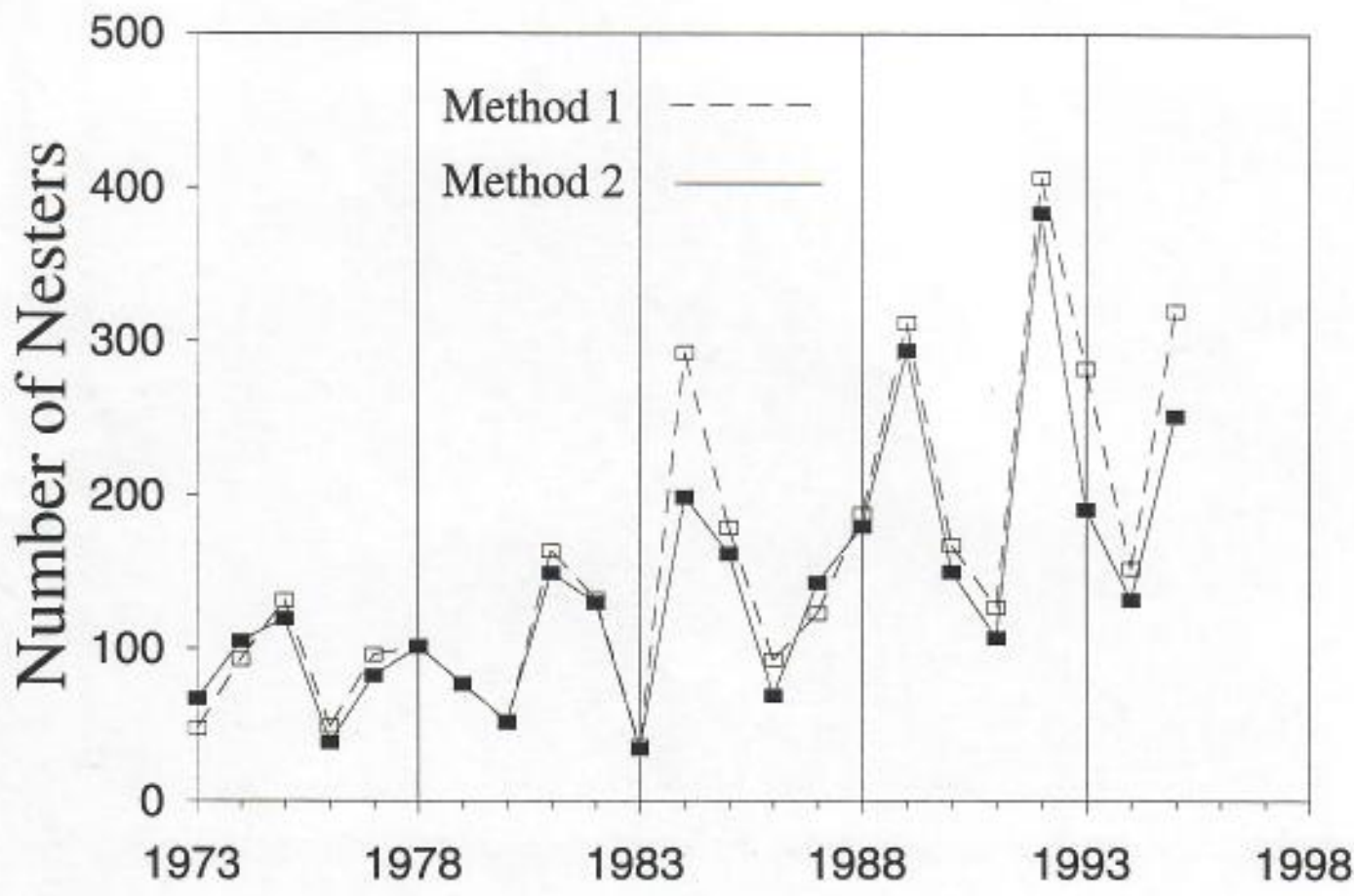
Let me know if you want/need more info. Hope this helps.

Take Care,  
Yonant

YS  
705 Prospect St  
Honolulu, HI 96813

P.S. At the end of the season (~ July 20), I submitted to FWS the final report as well as an invoice.





East Island green turtle nesting population estimates (N)  
 using Method 1 and Method 2  
 (20 July 1995)

Year	Coverage Rate	Method 1 N	Sighting Probability	Method 2 N
1973	3.94	48	0.98	67
1974	4.51	93	0.99	105
1975	2.50	132	0.93	120
1976	0.92	49	0.62	39
1977	0.73	96	0.53	82
1978	1.01	101	0.65	101
1979	1.19	77	0.71	77
1980	1.89	51	0.86	52
1981	1.81	164	0.85	149
1982	1.83	133	0.85	130
1983	1.58	36	0.81	35
1984	1.48	293	0.79	199
1985	1.57	179	0.81	162
1986	1.83	92	0.85	69
1987	1.92	123	0.87	143
1988	7.19	188	1.00	180
1989	7.85	312	1.00	294
1990	7.82	168	1.00	150
1991	7.73	127	1.00	107
1992	7.63	407	1.00	384
1993	2.78	283	0.95	191
1994	2.45	153	0.92	132
1995	2.89	320	0.95	252

NOTE: Method 2 estimates, based on counts of ID'd (tagged) nesters are more accurate than Method 1 estimates, which are based on total counts of nesters ashore.

[31] From: Timothy Ragen 6/23/95 8:54AM (1668 bytes: 33 ln)  
To: George Balazs  
cc: William Gilmartin  
Subject: Re[2]: pups at East Island

----- Message Contents -----

Tim- What about deaths of juveniles?- I understood Mitch (or Amy) to say that 7 dead juveniles had been found so far this year at FFS. Is that correct that's my understanding and what is distribution by island?  
I don't know the distribution.

postnote- Do we now have a copy of the FINAL permit that was issued to the filming crew? I don't have one. We should have it for our files.  
The vessel arrives this morning. geo.

Gene,

Mitch told me that the distribution of pups at FFS this year is as follows.

East	7
Whaleskate	25
Round	5
Trig	8
Tern	5

How does total at this point (through mid June?) match up with past years?

This weekend, I am going to try and do an analysis of the distribution of pups at FFS over the past 6-8 years, and I will let you know what I find. The two things I can tell you now is that East Island is no longer the top pupping site, and that it appears that the difference is due to a severe drop in pupping at that site rather than a significant increase at that site.[???? is this worded right?] I should be able to clarify these statements on monday, after I have looked at the historical data.

Green Sea Turtle Nesting Summary,  
Tern Island, French Frigate Shoals,  
1994

by ANTHONY  
VIGGIANO

INTRODUCTION

This document is a summary of green sea turtle (*Chelonia mydas*) nesting activity on Tern Island for the 1994 nesting season. The main objectives for this monitoring were to approximate the number of nests laid as well as the nesting phenology for the season, map nest locations, excavate and release trapped hatchlings and check for entangled or entrapped adult turtles.

The work done since 1992 is a reduction of past monitoring efforts by refuge staff (see Niethammer 1991 report). It may be advisable to duplicate that more extensive monitoring effort on a regular basis (every 5 years or so) for comparison analysis.

STUDY AREA

Tern Island (23° 52'N, 166° 17'W) is located on the northwestern edge of French Frigate Shoals, an atoll 490 nautical miles from Honolulu. Tern Island is approximately 3000 feet long by 120-200 feet wide, encased on the West, North and East sides by what is left of a sheet pile sea wall. The majority of nesting occurs on the south beach. There are two small coral rubble/sand beaches on the north side that allow limited access to nesting turtles. There is also a continually shifting sand beach located at the East end of the Island. See Figure 1.

METHODS

Morning nest walks were conducted throughout the nesting and hatching season (approximately May through November). Turtle nesting activity occurs primarily from sunset to sunrise, therefore, direct visual evidence of nesting (eggs seen or "pattycaking") is rarely seen. Nests are defined somewhat subjectively based on the type of diggings and tracks seen; evidence of a "backfill" with tracks leading directly back to the water is the strongest sign of a nest. The southern half of Tern Island has been mapped on a grid system: 10 meters increments East to West and 4 meters North to South. Nests are numbered and staked, and the location is approximated on the above mentioned grid map. Any nests laid in an area of shifting sands (East Beach or either end of South Beach) are moved to a more stable beach area. Pre- and post-hatch pit locations are also noted during these morning walks. When hatchlings finally emerge (post-

hatch pit), nests are excavated the morning following discovery and any trapped hatchlings are removed and released after dark. A nest is confirmed as hatched when it is excavated as a post-hatch pit and egg shell fragments and/or trapped hatchlings are found. See the Tern Island Turtle Nesting SOP's for further detail.

## RESULTS & DISCUSSION

There were an estimated 113 nests laid during 1994. Seven were unmarked nests discovered throughout the season. These unmarked nests were discovered through hatching evidence seen during morning walks. The first known nest for the 1994 season was laid on 4 May, the last known nest was laid on 5 September. The first known hatching occurred on 25 July, the last known hatching occurred on 11 January 1995. Of the 107 staked nests, 62 were confirmed hatched. Including the unmarked nests, the total number of confirmed hatched nests was 69. The average incubation length was 66.5 days with a range of 48 - 88 days. Of the 62 nests excavated, 47 had trapped hatchlings (76% of nests; range 1 - 64 per nest). A total of 403 trapped hatchlings were released during 1994. In addition to the 403 trapped hatchlings, 79 pre-emergence stage hatchlings were accidentally dug up and subsequently collected and released.

The number of nests believed to be laid on Tern over the last 9 years is as follows: 1986 - 23; 1987 - 48; 1988 - 85; 1989 - 103; 1990 - 89; 1991 - 77; 1992 - 167; 1993 - 92; 1994 - 113 (1986 - 1991 data from Niethammer 1991 turtle report). Data from 1986 - 1991 are confirmed nests; 1992, 1993 and 1994 are estimates. Due to seals, nesting turtles and bird activity, pre- and post-hatch pits become rapidly obscured. It is highly likely that hatching evidence was missed on some nests during the past three seasons. Therefore, no statements are made concerning hatching success.

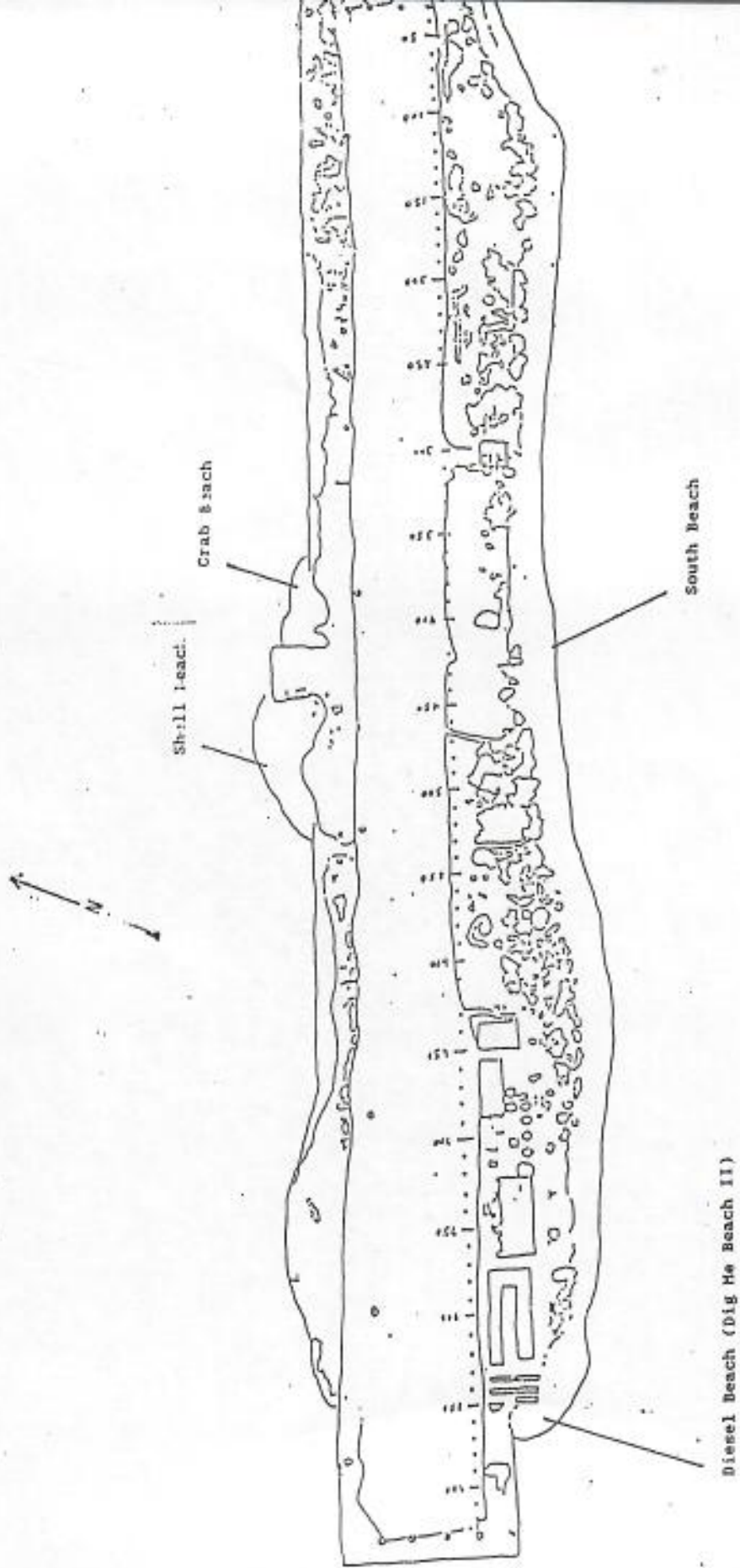
Appendice A is the data sheet used to record nesting information for the 1994 season.

There were no entangled turtles seen on Tern during the nesting season. However, one female turtle was removed from the north side of the runway. The turtle did not appear injured. She was tagged and released on south beach. The tags were as follows: F619 RHF, F620 LHF, F621 RFL, F622 LFL. On another occasion turtle tracks were seen along the north wall to the west of Shell beach. Approximately 12 eggs were found along the turtles path. The tracks indicated that the turtle was most likely washed over the seawall and crawled easterly along the wall until reaching Shell beach.

## ACKNOWLEDGEMENTS

Thanks to the following volunteers and paid staff who contributed to data collection during the 1994 season: Cris Dippel, Steve Barclay, Kellie Mitsue Takimoto and Ann Harding. This report was prepared by Anthony Viggiano.

Figure 1. Tern Island, French Frigate Shoals.





Green Sea Turtle Nesting Summary,  
Tern Island, French Frigate Shoals,  
1992 & 1993.

by  
CRIS DIPPEL

INTRODUCTION

This document is a summary of green sea turtle (*Chelonia mydas*) nesting activity on Tern Island for the 1992 and 1993 nesting season. The main objectives for this monitoring were to: to approximate the number of nests laid as well as the nesting phenology for the season, map nest locations and check for entangled or entrapped turtles. During the 1992 season, we had one of two East Island turtle technician on Tern Island throughout the nesting season. Therefore, more extensive work was accomplished such as installing temporary ID's, tagging females, documenting the number of nesting turtles with tumors seen, and visual confirmation of eggs laid.

The work done since 1992 is a reduction of past monitoring efforts by refuge staff (see Niethammer 1991 report). It may be advisable to duplicate that more extensive monitoring effort on a regular basis (every 5 years or so) for comparison analysis.

STUDY AREA

Tern Island (23° 52'N, 166° 17'W) is located on the northwestern edge of French Frigate Shoals, an atoll 490 nautical miles from Honolulu. Tern Island is approximately 3000 feet long by 120-200 feet wide, encased (the term is used loosely) on the West, North and East sides by what is left of a sheet pile sea wall. The majority of nesting occurs on the south beach. There are two small coral rubble/sand beaches on the north side that allow limited access to nesting turtles. There is also a continually shifting sand beach located at the East end of the Island. See Figure 1.

METHODS

Turtle nesting activity occurs primarily from sunset to sunrise, therefore, direct visual evidence of nesting (eggs seen or "pattycaking") is rarely seen. Morning nest walks are conducted throughout the nesting and hatching season (approximately May through November/December). Nests are defined somewhat subjectively based on the type of diggings and tracks seen; evidence of a "backfill" with tracks leading directly back to the water is the strongest sign of a nest. The southern half of Tern Island has been mapped on a grid system: 10 meters increments East to West and 4 meters North to South. Nests are numbered and staked, and the location is approximated on the above mentioned grid map. Any nests laid in an area of shifting sands (East Beach or either end of



South Beach) are moved to a more stable beach area. Pre- and post-hatch pit locations are also noted during these morning walks. When hatchlings finally emerge (post-hatch pit), nests are excavated the following morning and any trapped hatchlings are removed and released after dark. A nest is confirmed as hatched when it is excavated as a post-hatch pit and egg shell fragments and/or trapped hatchlings are found. See the Tern Island Turtle Nesting SOP's for further detail.

## RESULTS & DISCUSSION

During 1992, a full season turtle camp was established on East Island (May - September). Due to the rotational schedule of the turtle tech staff, one tech was always present on Tern Island. This person usually conducted one or two evening turtle walks while on Tern. Thus, they were able to complete a great deal of work not ordinarily done by refuge staff. There was a shortened East Island turtle camp in 1993. The camp was established for the month of June only. Evening walks on Tern Island were not done.

The 1992 nesting season was one of the largest efforts in the last few years at French Frigate Shoals. There were 850 possible nests recorded for East Island that year with 389 individual turtles identified. The number of nests believed to be laid on Tern over the last 8 years is as follows: 1986 - 23; 1987 - 48; 1988 - 85; 1989 - 103; 1990 - 89; 1991 - 77; 1992 - 167; 1993 - 92 (1986 - 1991 data from Niethammer 1991 turtle report. These are confirmed nests; 1992 and 1993 are estimates). Due to seals, nesting turtles and bird activity, pre- and post-hatch pits become rapidly obscured. It is highly likely that hatching evidence was missed on some nests during both seasons. Therefore, no statements are made concerning hatching success.

Appendices A and B are the data sheets used to record nesting information for 1992 and 1993, respectively.

### 1992 Nesting Season

There were an estimated 167 nests laid during 1992. Nineteen were unmarked nests discovered throughout the season. These unmarked nests were discovered through hatching evidence seen during morning walks. The first known nest for the 1992 season was laid on 27 April, the last known nest was laid on 11 October. We regularly had three or four nests laid per night during June, July and August. Eighty-six individual turtles were identified as nesters on Tern Island during 1992; eight of these turtles had tumors. Twenty two turtles were tagged using small metal livestock ear tags. Turtle techs visually recorded 53 nests of varying certainty. Twenty one had actual eggs seen, 10 were turtles seen "patty-caking", the remaining 22 nests were turtles seen "backfilling". Of the 148 staked nests, 62 were confirmed hatched. Including the unmarked nests, the total number of confirmed hatched nests was 81. We have no hatching data on the first 30 nests laid for the season. The average incubation length was 71 days with a range of 57 - 103 days. Of the 81 nests excavated, 52 had trapped hatchlings (64% of the nests; range 1 - 46 per nest). A total of 385 trapped hatchlings were released during 1992.

There were no entangled turtles seen on Tern during the nesting season. However, two turtles were moved back to the beach; one was found crawling in a random manner on the runway and the other was found behind the north seawall. Neither turtle appeared injured by their experience.

#### 1993 Nesting Season

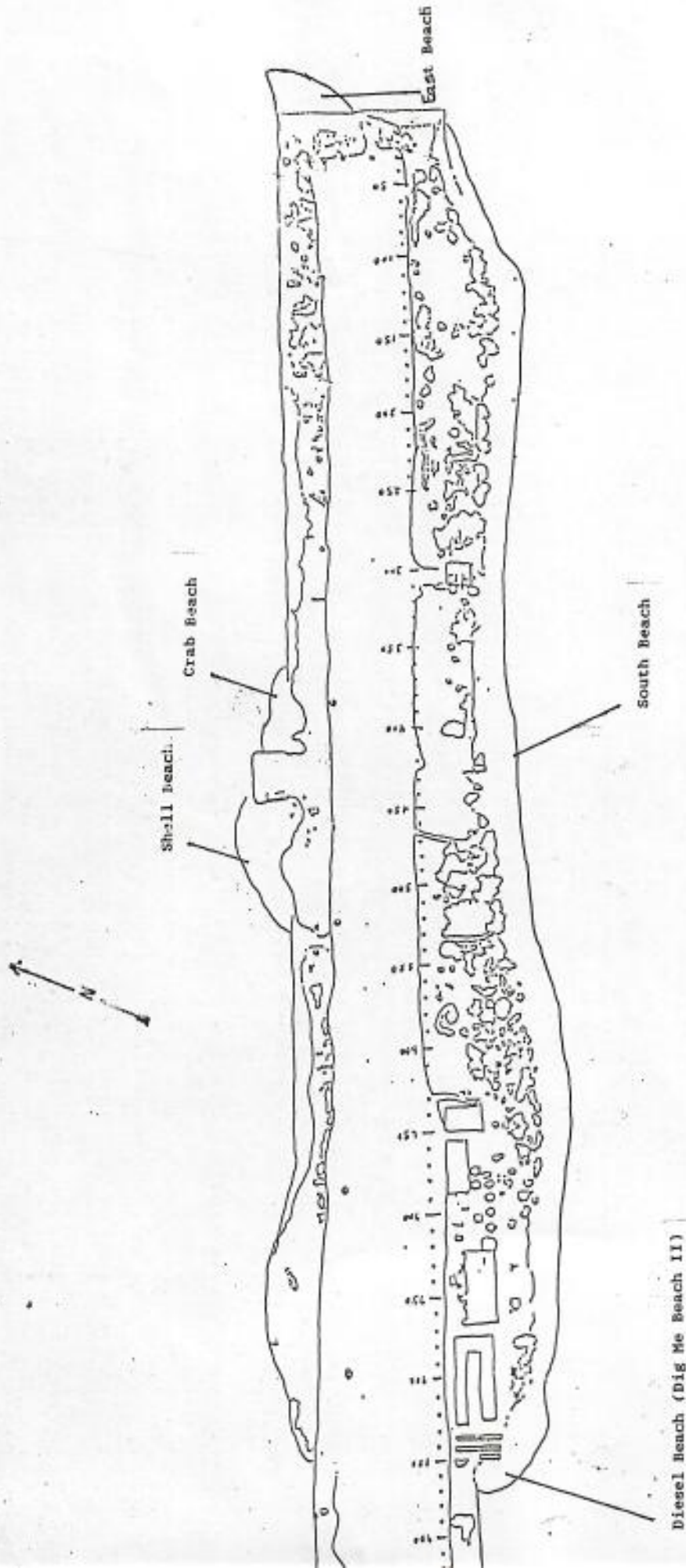
There were an estimated 92 nests laid during 1993. Nine were unmarked nests discovered throughout the season. These unmarked nests were discovered through hatching evidence seen during morning walks. The first known nest for the 1993 season was laid on 8 May, the last known nest was laid on 14 September. The first known hatching was on 15 July, the last known hatch was on 10 November. Nesting activity was much lighter when compared to 1992. Of the 83 staked nests, 42 were confirmed hatched. Including the unmarked nests, the total number of confirmed hatched nests was 51. The average incubation length was 64 days with a range of 51 - 86 days. Of the 51 nests excavated, 37 had trapped hatchlings (73% of nests; range 1 - 51 per nest). A total of 290 trapped hatchlings were released during 1992. One nest was accidentally dug as a pre-emergence pit; 66 hatchlings were removed from that nest and released.

There were no entangled turtles seen on Tern during the nesting season. However, one turtle was removed from the north side of the runway. The turtle did not appear injured. Tracks were seen on the runway on two separate occasions. Both times the turtles appeared to have made leaps of faith - one off the east end and one off the west end of the island.

#### ACKNOWLEDGEMENTS

Thanks to the following volunteers and paid staff who contributed to data collection during the 1992 and 1993 seasons: Jennifer Lynn Megyesi, Marc Webber, Tim Clark, Alyssa Ward, Nina Lisowski, Steve Barclay, Kellie Mitsue Takimoto and Paul Krushelnecky. This report was prepared by Cris Dippel.

Figure 1. Tern Island, French Frigate Shoals.



February 5, 1991

To: Tern Island Files

From: Tern island Staff

Proposed 1991 Green Turtle Research  
East Island, French Frigate Shoals

Following is a quick review of upcoming 1991 turtle research activities at East Island. These activities are based upon the objectives presented by George Balazs and Jerry Wetherall (both of the National Marine Fisheries Service) during a 9 January 1991 meeting between NMFS and FWS personnel. The following objectives have been condensed to include only those factors affecting activities at FFS.

Objectives For East Island Research:

1. Conduct complete season monitoring of East Island nesting activity. Late April or Early May through 15 September if possible.
2. Conduct more extensive fibropapilloma tumor exams on all of nesting females and basking turtles of both sexes at FFS.
3. Assess impacts of fibropapillomas on reproductive output.

Methods:

Following is a brief review of methods that we will be using this summer and questions about methodologies we are unsure of.

Objective 1. We will use the same methods as last year. Two researchers will rotate (4 nights on 4 nights off East Island) throughout the season. Tagging, temporary identification, and data collection and recording methods will remain the same as last year. Glynnis Nakai is developing a "Standard Operating Procedure" for East Island turtle research and camp operation that we should have soon.

Objective 2. Methods and training for fibropapilloma tumor detection should probably be upgraded. I am attaching a copy of the Codes for tumor size and tumor positions as were used last year. Maybe George Balazs would like to refine these to ensure that we get the kind of information he wants. I also recommend the 1991 turtle researchers be shown by Balazs the proper way to make a good exam for tumors before they come out to FFS. Guidelines on what should be done to examine basking males would also be appreciated.

Objective 3. I have ordered enough 2x2s five feet long to mark 60 nests on East Island so that we can compare hatching success and clutch size between tumor-afflicted and tumor-free females. Should 20 nests each from heavily tumor-afflicted, moderately afflicted, and tumor-free females be our goal or would another sampling scheme be more preferable? Should we try to mark nests only during June and July, the peak nesting time, to avoid any complicating factors such as difference in hatching success and clutch size variables between nests early in the season, mid season, and late in the season? We will not be able to get incubation lengths from these nests because most will probably hatch after the turtle camp closes for the season. We will have to go to East Island periodically to check the marked nests. We will have lay dates so we will generally know when to expect nests to hatch but the 53 to 97 day incubation period does not exactly pinpoint expected hatching time.

#### Personnel:

As mentioned before, two researchers will be needed to do the East Island work. Preferably, we would like to have both at FFS from the beginning of the season (late April) to the end (15 September). However, permanent Tern Island staff can fill in at the beginning or end of the season for a few rotations if both researchers cannot be scheduled for the entire season. It is essential to have at least one on hand to attempt to start the camp or to continue the camp as we near the end of the season.

#### Equipment:

We have all necessary field camp equipment at Tern Island for this season (tent, refrigerator, propane, fencing, etc.). Food will be integrated with standard Tern Island orders. We will need tags and applicators.

#### Comments:

If we can get out 1991 turtle researchers to meet with George Balazs to go over tumor examination it would also be beneficial to have George to show them tagging and temporary identification techniques. If transportation is available, George might like to come out to FFS and do some on sight training.

Proposed 1991 Turtle Research  
Tern Island, French Frigate Shoals

Objectives:

1. Monitor nesting and hatchling emergence phenologies.
2. Continue hatching success analysis on Tern Island nests.
3. Tag and identify any nesting females encountered.

The 1991 Tern Island turtle research methods will be the same as in 1990. These methods are described in the accompanying 1990 "Summary of green turtle studies at Tern Island".

(continued)  
Island Codes For The Hawaiian Archipelago

Island	TDPS		NMFS Code
	Data Entry Code	TDPS Code	
Shark	SHAR	1082190	---
Gardner Pinnacles	GARD	1091100	1091100
Maro Reef	MARO	1111100	1111100
Laysan Island	LAYS	1121100	1121100
Lisianski Island	LISI	1142100	1142100
Pearl and Hermes Reef	PEAR	1171100	1171100
Midway Islands	MIDW	1211100	1211100
Kure Island	KURE	1231100	1231100

## Species Codes

Common Name	Scientific Name	TDPS		
		Data Entry Code	TDPS Code	NMFS Code
Turtles	Chelonia	UN (unknown)	UN	8621000000
Green Turtle	Chelonia mydas	CM	CM	8621110101
Hawksbill Turtle	Eretmochelys imbricata	EI	EI	8621110201
Loggerhead Turtle	Caretta caretta	CC	CC	8621110301
Olive Ridley Turtle	Lepidochelys olivacea	LO	LO	---
Leatherback Turtle	Dermochelys coriacea	DC	DC	8621160101

## Size Codes for Tumors

Tumor Size	TDPS	
	Data Entry Code	TDPS Code
Small	1	1
Medium	2	2
Large	3	3

## Tumor Position Codes

Tumor Position	TDPS	
	Data Entry Code	TDPS Code
Left jaw	J1	J1
Right jaw	J2	J2
Left eye	E1	E1
Right eye	E2	E2
Left dorsal of neck	N1	N1
Left ventral of neck	N2	N2
Right dorsal of neck	N3	N3
Right ventral of neck	N4	N4
Left distal of front flipper	F1	F1
Left proximal of front flipper	F2	F2
Right proximal of front flipper	F3	F3
Right distal of front flipper	F4	F4





GREEN TURTLE NEST/HATCHING SUCCESS FORM

Year 1992

page 2 of 6

Island Ten

Nest #	Day date	Location		# of eggs	Match date	Pre-match pit?	Total # of eggs	# hatch	# live hatch	# escape	Developed		Comments
		CV	NS								Full	Part	
29	6/17/92	813	43	?									
30	6/17/92	800	46	12-4									
31	6/17/92	710	50	6/29	8/25-26								
32	6/18/92	741	58	?	~8/24-8								Nestling obs by Turtle walk in one
33	6/19/92	757	53	?	~9/4-9/6								Good backfill, pit, departure.
34	6/20/92	412	25	?									Good backfill/chop - depart
35	6/20/92	643	65	?									
36	6/20/92	707	62	?									
37	6/20/92	747	53	?									
38	6/23/92	798	57	46-0	8/24								relocation from E. beach 187 eggs
39	6/28/92	787	40	7	9/4-9/8								eggs seen
40	6/28/92	160	61	0-270									right by outhouse
41	6/28/92	810	40										
42	6/23/92	817	55		8/27	yes							good backfill
43	6/23/92	700	56		8/16								
44	6/24/92	336	38										
45	6/24/92	100	43	32-0									eggs seen
46	6/24/92				8/28/92								See map or back above crab beach
47	6/27/92	723	64	?									
48	6/27/92	327	34	35-0									Probable nest - turtle still there @
49	6/27/92	811	56										moved from East Beach - 83 eggs
50	4/30/92	730	44										Good fill but on downwind/beach side of term a little
51	7/1/92	503	50	?	9/4-9/8								seen patty cake + fill
52	7/1/92	710	59		9/8								
53	7/3/92	753	55	23-0									
54	7/4/92	106	42	?	9/10								
55	7/4/92	130	46	?									
56	7/4/92	510	62	?									
57	7/5/92	752	64										

0845  
 dug into  
 by turtle  
 on 7/12  
 attract for  
 access for

Inclusion  
 length

69  
 67  
 78

66  
 77

65  
 64

57

67  
 6A

68  
 64

118

# GREEN TURTLE NEST/HATCHING SUCCESS FORM

Year 92

pass 3 of 6

Island Ter

Nest #	Lay date	Location	ID #	Hatch date	Pre-hatch pit?	Total # of eggs	# alive hatch	# traps	# escape	# unassisted	Dead but developed		Frot eggs	Comments
											Full	*		
58	7/5/92	759	51	9/8	Y	3	2				8		eggs seen - not F'd	
59	7/5/92	276	43	9/14	N	46	46						not real sure	
60	7/7/92	64	40	9/16	N	18	18						not real sure	
61		94	47										n/a back fill	
62		392	32											
63		787	60	9/11	N	3	1							
64	7/8/92	136	52	9/18	N	2	2							
65		475	34	9/18	N	0	0							
66		608	62	9/17		10	10						maybe from 7/9/92	
67		802	60	9/14	Y	0	0						eggs seen	
68	7/10/92	600	58	9/19	Y	1	1						VERY nice crack fill	
69		742	46	7/17		3	3						eggs seen	
70		788	52	9/18	N	0	0						no stake - lateral digging in immediate area - not sure if nested	
71	7/11/92	114	46	9/18		5	5						Good fill! departure	
72		722	48	9/14-9/18	N	9/10	9/10						Eggs transplanted to low floor in	
73		840	26											
74	7/12/92	806	56											
75	7/18/92	445	41	9/27										
76	7/16/92	748	56	9/20	N		2							
77	7/16/92	103	42											
78	7/17/92	800	59											
79	7/18/92	494	41											
80	7/19/92	104	51	9/28	N		6							
81	7/19/92	354	57	9/28	N		5							
82	7/19/92	100	47	9/25	N		9							
83	7/20/92	237	45	9/28	Y		7							
84	7/21/92	210	54	9/27	Y		1							
85	7/22/92	488	41											
86	7/23/92	261	41	9/10	N									
87	7/23/92	281	41											
88	7/23/92	243	41											
89	7/23/92	243	41											
90	7/23/92	243	41											

Incubate length

1231

GREEN TURTLE NEST/HATCHING SUCCESS FORM

Island Tern

Year 1992

Nest #	Lay date	Location		ID #	Hatch date	Pre-hatch pit?	Total of eggs	Total # of alive hatchlings	# of traps escape	Dead but developed		# of rot eggs	COMMENTS
		SW	NS							fail	%		
88	7/25/92	693	63		10/3	Y	0	0	0				
89	7/25/92	746	47		10/9	N	0	0	0				
90	7/25/92	726	44		10/5	Y	1	1	0				
91	7/28/92	220	39	U-222	10/5	Y	2	2	0				
92	7/29/92	694	61	A997	10/5	Y							
93	7/30/92	183	52		UNK								
94	7/30/92	830	44										
95	7/30/92	718	60										
96	8/1/92	323	37	7	10/10	Y	4+9	4	4				
97	8/1/92	495	42										
98	8/2/92	495	41		10/20								
99	8/3/92	530	52		10/26	Y	13	13	0				
100	8/4/92	415	36		10/26	Y	1	1	0				
101	8/5/92	796	54		10/10	N	0	0	0				
102	8/5/92	790	54		10/13	Y	0	0	0				
103	8/6/92	658	61		10/9	N	0	0	0				
104	8/7/92	898	41		10/21	Y	2	2	0				
105	8/7/92	424	32		10/21	Y	19	19	1				
106	8/7/92	587	54	U-270	UNK								
107	8/7/92	731	58		10/19	Y	0	0	0				
108	8/14/92	486	41	37-U	10/19	Y							
109	8/14/92	732	57										
110	8/14/92	786	53										
111	8/12/92	367	35										
112	8/14/92	124	50										
113	8/14/92	836	41	65-U	10/31								
114	8/14/92	471	40	?	10/28	Y	1	1	0				
115	8/14/92	754	54	U-355	10/27	Y	0	0	0				
116	8/14/92	838	41	74-U									

Incubation length



see over next couple days up  
10/10, 10/11, 10/19

slimy right over flipper - tracks  
net sure  
white seen backfilling at 1000 hrs

near fern but close look  
eggs on surface  
eggs on surface - 116 or 113 - may rotten egg

10/10/92  
10/11/92  
10/19/92

# GREEN TURTLE NEST/HATCHING SUCCESS FORM

Page 5 of 6

Island: TERN

Year: 1992

Nest #	lay date	location		ID #	hatch date	pre-hatch pit?	total of eggs hatch	total of active trap escape	dead but developed		total eggs	* COMMENTS
		BY	NS						full	immature		
117	7/15/92	124	48	67-0	10/22			3			12	flycatcher seen
118	8/16/92	102	44									
119	8/18/92	826	51									
120*	8/19/92	127	44		11/9	N		6				eroded by stake #55 stone HCO by 3 feet
121	8/19/92	307	41		10/31	Y		1				Good backfill, lots of coffee. 07/95. # same stake for 122 a #123 very close together (by scratch mark)
122*		482	43		11/7	Y						
123		482	43		23 Oct	Y						
124	8/20/92	340	36									
125		772	54									
126		773	63									
127	8/21/92	707	60									
128		676	54		10/22			6				probably from 2 days earlier dug up in 12 eggs from nest #52 could be from couple days earlier Good B-fill seen by Turtle walk.
129	8/23/92	454	36		10/27	N		0				
130	8/25/92	190	52									
131	8/25/92	824	53		11/8	Y		28				5 eggs against same B-fill
132	8/26/92	728	49	U-355	11/6	N		0				Good B-Fill seen partly caking
133	8/27/92	435	35	68-0	11/10	Y		1				seen partly caking; back fill left st to Caern
134	8/28/92	181	50									
135	8/28/92	223	40		11/6	Y		4				maybe nest
136	9/1/92	69	40									
137		80	46									
138	9/4/92	827	42									
139	9/4/92	210	37									
140	9/5-9/7	741	47									
141	9/8/92	210	48									
142	9/12/92	225	49									
143	9/13/92	190	42		11/14			5				prob not def. Good B-fill - left right away
144	9/12/92	196	46									
145	9/15/92	883	26									post hatch seen on 11/16 Saw backfilling

18

GREEN TURTLE NEST/HATCHING SUCCESS FORM

Year 1992

page 6 of 6

Island Fern

Nest #	Tag date	Location SV	MS	ID #	Hatch date	pre-hatch pit?	total of eggs	total of live hatch	# of traps escape	dead but developed			Total eggs	COMMENTS
										full	%	†		
146	9/17/92	598	46	64-4										
147	9/29	146	25		11/25			18						Deep in rocky had ground
148	10/11				2/12/93			17			4			
UM 1		57	65		9/27	Y		0						
UM 2		129	50		7/27	Y		19						
UM 3		217	38		10/1	Y		0						
UM 4		805	53		10/2	Y		0						
UM 5		540	47		10/7	Y		0						Rehatch pit seen on 10/5. Rest pit seen on 10/9
UM 6		932	41		10/5	N		1						
UM 7		856	52		10/5	N		0			1			
UM 8		826	43		10/10	Y		6						Some torts hatched
UM 9		1893	43		10/11	N		1			1			
UM 10		72	41		10/17	Y		1			1			
UM 11		59	36		10/17	Y		2						
UM 12		130	46		10/22	Y		1						
UM 13		755	54		10/25	Y		0						
UM 14		77	42		10/25	N		1			1			
UM 15					11/22			1			1			2 found post hatch - 11/23
UM 16		103	56		11/25	N		2			1			6 only found post hatch - hatch date uncertain
UM 17		525	48		11/20	Y		15			2			4+ returned pit, it's reflect only for longer
UM 18		273	42		11/24	N		12			3			found only post hatch, some no eggs, did not reach bottom, kept covering
"		"	"		12/8	N		12			1			

Rehatch pit seen on 10/5. Rest pit seen on 10/9

Some torts hatched

UM 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

2 found post hatch - 11/23  
6 only found post hatch - hatch date uncertain  
4+ returned pit, it's reflect only for longer  
found only post hatch, some no eggs, did not reach bottom, kept covering

2

# GREEN TURTLE NEST/HATCHING SUCCESS FORM

Island TERN

Year 1992

page 1 of 6

Nest #	Lay date	location		ID #	hatch date	pre-hatch # of eggs pit?	total # of alive hatchlings	total # of traps escape curts messes	dead but developed		Total # of eggs	COMMENTS
		BY	NS						fail	%		
N1	04-17	446		34	10-4							EGG GIVEN Left rear flap - sticky
2	05-08	620		61	10-0							eggs seen - 0815 maybe nest backfill
3	05-13	577		52								backfill
4	05-15	754		52	10-4							backfill
5	05-16	138		52	16-4							backfill
6	05-18	243		44								backfill
7	05-21	495		41								backfill
8	05-22	226		41								stored laying 0930
9	05-23	779		51	12-0							eggs observed 0700
10	05-24	818		52	21-4							eggs observed 0350
11	05-25	790		60	25-0							normal size - backfill not egg
12	05-28	612		58								82 eggs - transplant
13	05-29	755		45	21-0							~12 eggs - original size
13A	05-29	794		50	21-0							149 eggs transplanted here from
14	05-31	300		37	?							partly fake + buck fill 0720-0800
15	06-01	352		37	26-0							Good buck fill then deposit
16	06-01	807		57	?							<del>From the nest</del>
17	06-01	848		41								Good buck fill then deposit
18	06-02	742		60	28-0							<del>From the nest</del>
19	06-03	60		31	?							Good buck fill
20	06-03	88		40	?							backfill
21	05-30/01	E. Seawall			?							Went back at 10:30 snow was thick
22	06-04	838		39	?							Flight by the out house + Good backfill
23	06-04	838		39	12-0							E. seawall DUG UP transplanted where
24	06-05				?							Good buck fill; departure
25	06-05	54		37	?							Good bucket fill
26	06-05	532		46	?							T.L. could bottle take
27	06-11	429		32	40-0							Possible - transplanted
28	06-17	473		28	?							noted 64 eggs

includ  
1 eno. 11

out of  
Chr order

off  
sit back  
go it back  
get it done  
15 it up  
K. Dale  
Stuart  
H. C. 11  
RHF-C 11  
2 P.S. 11  
033 5 11  
033 5 11  
033 5 11  
033 5 11  
033 5 11

Fast Bch  
near wall  
a nest

noted 64  
eggs

the carefully  
around  
hatch time!

Questionable  
Maybe not a nest,  
Same comment her to

Good buck fill then deposit  
Flight by the out house + Good backfill  
Good buck fill  
T.L. could bottle take  
Possible - transplanted  
noted 64 eggs

GREEN TURTLE NEST/HATCHING SUCCESS FORM

Island Tern Is

Year 1993

nest #	lay date	location	NS	ID #	hatch date	pre-hatch pit?	total of eggs	total of live hatch turtles	# escape	dead but developed	hatched eggs	COMMENTS	
1	5/8/93	722	56		n.								
2	5/22/93	739	57		7/15	?					3	egg of 7/17 - egg shells Dug up 7/21 found nothing. dug up 8/17 and saw 1 egg of 7/17 Dug up 8/17 and saw 1 egg of 7/17	
3	5/20/93	147	48		7/12	?					7	egg of 7/17 - egg shells Dug up 7/21 found nothing. dug up 8/17 and saw 1 egg of 7/17	
4	5/21/93	342	34								10	saw post pit on 7/17 Saw post pit dug up 25 live. Relocated. this one seen digging 5/28 - pit dug up 7/27. 54 live/9 dead. Relocated.	
5	5/31/93	439	32								1	Dug up 7/27. 54 live/9 dead. Relocated. one dead Hatching. Must be very fresh seen on 6/1 (shell)	
6	5/31/93	787	40								3		
7	6/2/93	125	48								3		
8	6/2/93	715	54								3		
9	6/3/93	564	11								3		
10	6/4/93	412	33		8/14	8/12					3	relocated west/south west of road relocated location Lynn saw eggs deposited -	
11	6/4/93	62	40								3		
12	6/4/93	east	54								3		
13	6/5/93	812	40								3		
14	6/5/93	496	45		8/16						3		
15	6/7/93	948	55								2		
16	6/8/93	445	35								2		
17	6/8/93	779	54								2		
18	6/8/93	796	52								2		
19	6/10/93	90	44								2		
20	6/10/93	657	45		7/30?	7/30?					4	Poss. pre-empt 7/30 Dug up 8/11. Looked like post.	
21	6/11/93	328	26								4		
22	6/11/93	350	41								4		
23	6/16/93	759	54		8/12	8/7					4	Dug up 2/8. Removed 8. Left nest to hatch.	
24	6/21/93	690	50		8/15						2	Dug up 1/7 on 8/12, 4 on 8/25	
25	6/21/93	175	38		8/21						2	Dug up upon 9/9. Relocated the nest	
26	6/23/93	820	52								2		
27	7/4/93	792	53		8/8						2		
28		59	44								2		

Note Date of hole → 75  
70  
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100

note #25 was dug on 9/9. two dead. No cotton. 8 live hatchlings. S.E. Data in slot #25 on sheet is for another nest. #27 total of 11 trapped turtles. many are known to have departed nest due to dig on 9/9.

GREEN TURTLE NEST/HATCHING SUCCESS FORM

Island Ten I

Year 1993

Nest #	Egg Date	Location BY	ID #	Hatch date	Pre-hatch pit?	Total of eggs	Total live hatchlings	# trapped	# escape	Dead but developed			COMMENTS
										full	*	†	
29	7/4/93	316	32										
30	7/9/93	788	60										
31	7/12/93	260	45										
32	7/13/93	757	55	9/15	Y			3					dig out 7 on 9/14 - still pc (none probably laid ~ 4 days ago)
33	7/13/93	541	beak	8/5/93				2					
34	7/14/93	130	50					17			6*		dig up 1 on 9/14 - still pc, 1 dead
35	7/16/93				Y								12 dug post on 9/17 - 2 live, 1 dead
36	7/17/93	747	54	9/15				2			1		5 saw 2 no undeveloped further
37		39	34					7					Dead, Hatched fully developed
38	7/18/93	708	58	8/30 (P)				2			1*		* probably laid 3-4 days ago
39	7/20/93	492	39	9/19				2					12 dig up 1 more hatchling - more dug on 9/26
40	7/21/93	740	43					1					
41	7/21/93	405	31		Y			1					
42	7/21/93	320	36	9/22									
43	7/22/93	742	52	9/27									
44	7/22/93	744	52										
45	7/22/93	745	60										
46	7/24/93	740	56	3 Oct									
47	7/27/93	440	28	9/22	NO			0					12 one dead hatching
48	7/28/93	640	63	10/23/93				8					
49	7/28/93	422	33	10/1	NO			0					The 2 partially developed turtles were in one egg (twins) 9/23 thought I saw foot poked out but fish anything.
50	7/29/93	8A	57										Relocated SW of NDB Tower.
51	7/29/93	745	56	Oct 4				1					Relocated location. Stake is 1ft inland. 9/27 dug - found nothing.
52	8/1/93	501	44	2 Oct									
53	8/1/93	440	38	27 Oct									
54	8/2/93	824	40										
55	8/2/93	582	32	6 Oct									
56	8/3/93	162	51	2 Oct				0					
57	8/4/93	777	53					0					

all 1 was 23  
repped on 9/16 d/s

surface - Crab victim  
\* all dead  
1 dead

Reburied pit  
more dug on 9/26

where in one egg (twins)  
9/23 thought I saw foot poked out but fish anything.

9/27 dug - found nothing inland.

- 18 dug up on 9/23. Saw many more live hatchlings. Reburied pit on 9/26. One live hatching found on 9/26. 15 eggs 1/4 to 1/2 developed.



NOTE - Need category for Hatched turtles found in pit which are dead.

GREEN TURTLE NEST/HATCHING SUCCESS FORM

Island Tern

Year 1993

nest #	lay date	location		ID #	hatch date	pre-hatch pit?	total of eggs	total alive hatch	total trap escape	dead but developed		total eggs	COMMENTS
		EW	NS							fail	+		
57	8/4/93	719	53										
58	8/5/93	427	36		2007			14				6	8 dead hatchlings
59	8/9/93	700	46		0044	✓		9				0	1 dead hatchling
60	8/9/93	Shell			27 Oct			3				3	East side about 20 feet from NW
61	8/9/93	Shell			13 Oct			0				7	East Part about 60 feet from West
62	8/11/93	708	53										
63	8/11/93	290	43										
64	8/11/93	765	49		10/13/93		87	2				22	from East Beach (Mother was stump)
65	8/12/93	638	64										
66	8/19/93	546	53										
67	8/18/93	374	34		19 Oct			2				3	
68	8/13/93	349	87										
69	8/13/93	Shell											
70	8/14/93	747	58										
71	8/14/93	735	50										
72	8/15/93	350	34										
73	8/18/93	780	52		10/15/93		98	6				20	From East Beach 2 dead hatchlings
74	8/21/93	818	50										
75	8/25/93	708	54										
76	8/26/93	736	56										
77	8/26/93	694	64										
78	8/26/93	799	42										
UN9	?	810	40		8/26?			18		4		5	Stake is left towards water.
79	8/27/93	603	57										Dug up 8/26. Saw post-pit.
80	8/28/93	749	52		11/6/93			0				6	1 of the partially developed eggs
81	8/28/93	461	36		30 Oct			2				1	one 9/6 found intact eggs. Reburied
27A	Unknown	790	50									10	transfer from East Beach - p
82	9/8/93	604	58					6		35			had twins
83	9/11/93	307	49										deal was hatched

Two dead hatchlings

had twins  
deal was hatched  
ed. dug second time on  
9/21  
probably laid on  
9/25 9/11

209 UM2 - 9/15 - shell broken - 3 dead in shell (no hatchling)  
35 UM3 - 10/13 out of up. 5 rotten eggs. (Just in of 73 63 hatched) no live or dead hatched

- UM 4 (possibly 72) 1 1/2 ft west of 76 stake. Stake left in place. 4 rotten eggs, 1 live or dead hatchlings. Hatch 10/15/93
- UM 5 (possibly 76. 2 ft East of 76 stake. Stake left in place.) 4 rotten eggs. No live or dead hatchlings. Hatch 10/15/93
- UM 6 (possibly 71. 4 ft west of 76 stake. Stake left in place.) 3 rotten eggs, 1 live hatchling. Hatch 10/15/93
- UM 7 (possibly 76. 1 meter SE of stake 20 live turtles. 12 rotten eggs. Hatch 10/20/93
- UM 8 2 m SW of stake # 44. 6 rotten eggs, 1 partial develop. Dropped hatchlings Hatch 10/22/93
- UM 9 possibly # 78. Pit was 1.5 m ESE of stake. Hatch Date unknown. Suspect ~ 10/26/93. Found 9 rotten eggs, 5 partial developed and two live hatchlings



HATCHING SUCCESS FORM

FOR TUMOR/CONTROL NESTS

Year: 1991

Island: EAST

EXC.	Nest #	Hatch date/Time	pre-hatch PIT	Total Eggs	"Alive" Hatched	Alive		Dead but developed	Bad Eggs	Comments
						Escaped Unassisted	Trapped OK			
7-28	T-1	~7-22-91	?	69	45	16	29	0	4	0
7-28	C-1	~7-22-91	?	105	27	4	23	1	3	5
8-6	T-2	?	8-2-91	86	81	15	64	0	2	0
8-13	*C-2*	8-8-91	8-8-91	116	91	58	33	0	0	19
8-11	T-3	8-5-91	8-4-91	112	81	49	32	0	7	6
8-7	C-3	8-3-91	8-3-91	113	83	21	64	0	4	0
8-11	T-4	8-6-91	8-6-91	91	66	53	13	0	8	3
8-16	C-4	8-12-91	8-11-91	112	60	53	7	0	5	21
8-17	T-5	~8-12-91	8-12-91	113	93	23	70	0	0	14
8-23	C-5	?	8-11-91	118	91	79	14	3	9	10
8-13	T-6	8-9-91	8-9-91	45	43	7	36	0	1	0
8-13	C-6	8-9-91	8-9-91	130	116	62	54	0	2	4
8-17	T-7	8-13-91	8-13-91	99	72	31	41	0	0	20
9-26	C-7	?	?	79	78	78	0	0	0	0
	T-8									
	C-8									
	T-9									
8-26	C-9	?	8-20-91	143	123	67	56	0	2	3
	T-10			93	93	93	0	0	0	0
	C-10			77	71	71	0	0	0	0
	T-11			73	67	67	0	0	0	4
	C-11			710	eggs found					
9-26	T-17			89	82	82	0	0	0	3
9-26	C-17			114	109	86	23	0	0	1
	T-12									Washed out

REC REC REC REC GCS REC GCS REC REC REC REC REC REC GCS JLM REC JLM NTR NTR NTR NS NS

NO NEST FOUND  
 \*50 TRAPPED 4-8" BELOW SURFACE. 3 ALIVE IN 019 FILL  
 \*LEAST 6 EGGS ENCLAV. 0-4 7-17  
 MOST TRAPPED @ BOTTOM.  
 NO NEST found  
 Washed out

GREEN SEA TURTLE

NEST FORM

FOR TUMOR CONTROL NESTS

Year: 1991

Bad eggs

Island: East

Total: <sup>Wade</sup> <sup>Hatch</sup> <sup>OK</sup> <sup>Trooped</sup> <sup>Yolk</sup> <sup>full</sup> <sup>3/4</sup> <sup>1/2</sup> <sup>Y4</sup>

Nest #	HATCH/TIME	Prehatch	Total	Wade	Hatch	OK	Trooped	Yolk	full	3/4	1/2	Y4	Bad eggs
T21			86	83	18	65	∅	1	∅	∅	∅	∅	1
T21													
C25			73	71	60	∅	∅	1	∅	∅	∅	∅	1
T25			58	51	27	24	1	∅	∅	∅	∅	∅	6

JLM  
NTK  
CSA

## FOR NON-TUMOR/CONTROL NESTS

Island: EAST

Year: 1991

EXC.	Nest #	Hatch date/Time	pre-hatch PIT	Total Eggs	'Alive' Hatched	Alive		Dead but developed			Bad Eggs Invert Rotten	Comments			
						Escaped unassisted	Trapped OK	Yolk	Full	1/4			1/2	3/4	
8-6	A	8-2-91	8-2-91	94	36	21	15	0	0	7	3	0	48	EXCAVATED 8-6-91	REC
8-7	B	8-3-91	8-3-91	76	43	24	21	0	2	3	1	0	16	EXCAVATED 8-7-91	REC
8-7	C	8-4-91	8-3-91	89	71	26	40	0	8	0	0	0	8	EXCAV. 8-7-91	REC
8-7	D	8-3-91	8-3-91	92	75	64	7	0	2	3	0	0	13	EXCAV. 8-7-91	REC
	E	8-5-91	8-5-91	87	57	36	21	0	4	18	0	0	8		GCS
	F	8-5-91	8-5-91	70	36	19	17	0	1	0	0	1	32		GCS
	G	8-5-91	8-5-91	107	89	43	46	0	11	2	0	0	3		GCS
	H	8-6-91	8-6-91	117	66	44	22	0	13	7	0	0	5		GCS
8-13	I	8-7-91	8-6-91	105	101	35	66	0	2	0	0	0	2	MOST OF EGGS LOOKED EMACIATED.	REC
8-14	J	?	8-6-91	135	122	51	71	0	1	3	0	3	1	MOST OF EGGS TRAPPED < 8" FROM SURFACE.	REC
	K	?	8-6-91	97	46	21	25	0	1	1	4	7	1		REC
	L	?	8-11-91	115	103	38	65	0	1	3	0	4	0		REC
8-16	M	8-11-91	8-8-91	115	68	19	49	0	10	4	4	7	7	NEST 1' DUE W. OF T-8.	REC
8-18	N	8-12-91	8-12-91	112	112	112	0	0	0	0	0	0	0	1/3 OF OBS. SHELLS WERE OLD + PERFORATED.	GCS
8-18	O	8-12-91	8-12-91	64	36	20	16	0	2	5	2	0	10	OLD EGGS FROM LAST YEAR "NEXT DOOR"	GCS
8-19	P	8-14-91	8-14-91	88	75	36	39	0	1	1	0	0	9	HATCHLINGS ENERGETIC!	GCS
8-19	Q	8-14-91	8-14-91	55	48	2	46	0	3	2	0	0	0	LOTS OF OLD SHELLS, NOT COUNTED.	GCS
8-19	R	8-14-91	8-14-91	136	113	30	83	0	3	10	1	0	4		GCS
8-20	S	8-15-91	8-15-91	97	88	69	19	0	0	2	1	0	1		GCS
8-20	T	8-14-91	8-15-91	114	92	17	75	0	17	1	0	0	1		GCS
8-21	U	8-14-91	8-15-91	152	139	126	13	0	1	5	0	0	3	MOSTLY FINE ORGANICS, SAND, MIXED SM. COBAL RUBBLE	GCS
8-21	V	8-13-91	8-14-91	122	122	122	0	0	0	0	0	0	0	MOSTLY FINE ORGANICS, SAND MIXED SM. COBAL RUBBLE.	GCS
8-23	W	?	8-19-91	146	95	60	35	0	0	0	0	14	0		NTK
8-23	X	?	8-19-91	114	95	86	69	0	1	0	0	0	0		NTK
8-24	Y	?	8-17-91	153	128	86	42	0	0	3	6	9	7		NTK

## NON TUMOR/NON CONTROL NEST

Island: EASTYear: 1991

Nest #	Hatch date/Time	pre-hatch PIT	Total Eggs	"Alive" Hatched	Alive		Dead but part. developed			Bad Eggs Infert/ Rotten	Comments	
					Escaped UNASSISTED	Trapped OK	Full	3/4	1/2			1/4
8-23 AA	?	8-19-91	111	96	88	8	0	0	0	4	2	RELOCATED MUST REC
8-24 BB	?	8-19-91	112	103	18	85	0	7	0	0	0	REC
8-28 CC	?	8-19-91	98	85	71	14	0	4	0	—	8	
8-28 DD	8-18-91	8-18	96	93	7	86	0	1	0	—	2	MATERIALS TRAPPED THROUGHOUT CHAMBER.
8-30 EE	8-23-91	8-23	95	81	18	63	0	0	1	—	6	
8-30 FF	8-23-91	8-23	77	69	38	31	0	1	0	—	7	
8-30 GG	8-23-91	8-23	117	98	47	51	0	16	0	—	3	MOST MATERIALS WEAK.
HH												
II												
JJ												
KK												
LL												
MM												
NN												
OO												
PP												
QQ												
RR												
SS												
TT												
UU												
VN												
WW												
XX												
YY												



United States Department of the Interior

FISH AND WILDLIFE SERVICE  
PACIFIC ISLANDS OFFICE

P.O. BOX 50167  
HONOLULU, HAWAII 96850

December 22, 1989

George Balaz  
National Marine Fisheries Service  
2570 Dole Street  
Honolulu, HI 96822-2396

Dear George:

In regard to the seeds in the guts of dead sea turtles:

SL-36.1: all but two of the seeds in this lot are Ipomoea. They probably are Ipomoea pes-caprae subsp. brasiliensis (L.) Ooststr., but lack the hairs usually found on the seeds of that species. The hairs can be worn off by wave and beach sand action, and perhaps also by movements in the food mass in a turtle's stomach? The bean is a species of Canavalia, I thought it resembled C. rosea (Sw.) DC, but that species has not been found in Hawaiian waters. It might be just an odd C. cathartica Thouars seed, slightly small and with a short hilum. There is a single seed that I could not identify. It looks almost like a miniature kukui, but is only 8 or 9 mm long.

SL-37.8: Cordia subcordata Lam.

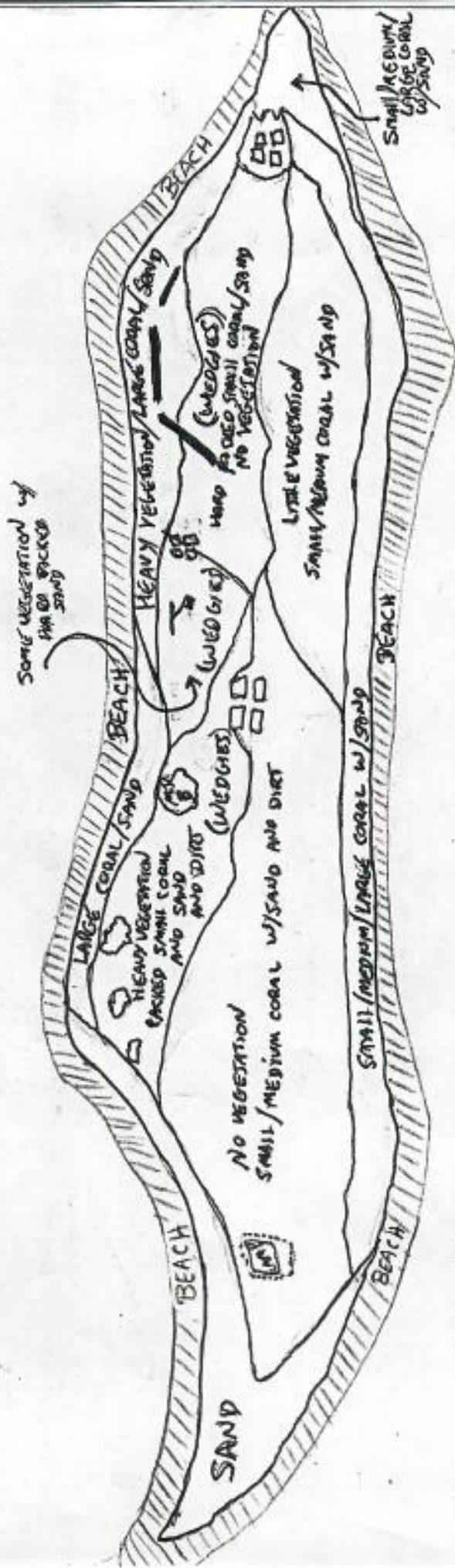
SL-38.3: Canavalia cathartica Thouars is the bean and the other two probably are Coccoloba uvifera (L.) L.

SL-41.4: bits and pieces of flotsam as slivers of wood, plastic, cellophane, pieces of the shell of Janthina janthina (L.), and an object that looks like a small fruit or seed, but I don't recognize it.

Sincerely,

Derral Herbst

EAST ISLAND (AUGUST 1, 1991)  
F.F.S.

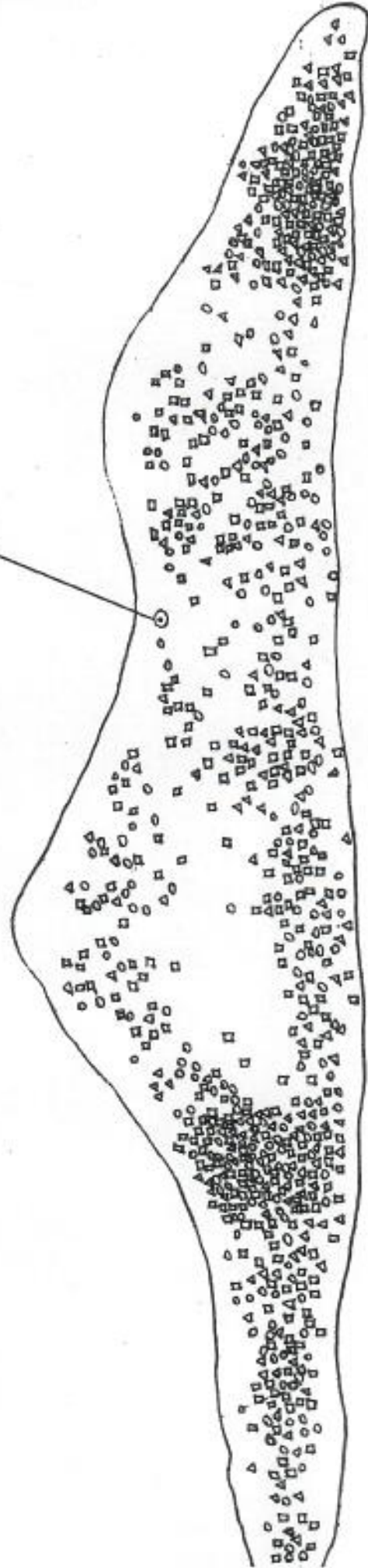


SMALL CORAL = 0.3 cm<sup>2</sup>  
 MEDIUM CORAL = 3.7 cm<sup>2</sup>  
 LARGE CORAL = 7 cm<sup>2</sup>





Pole

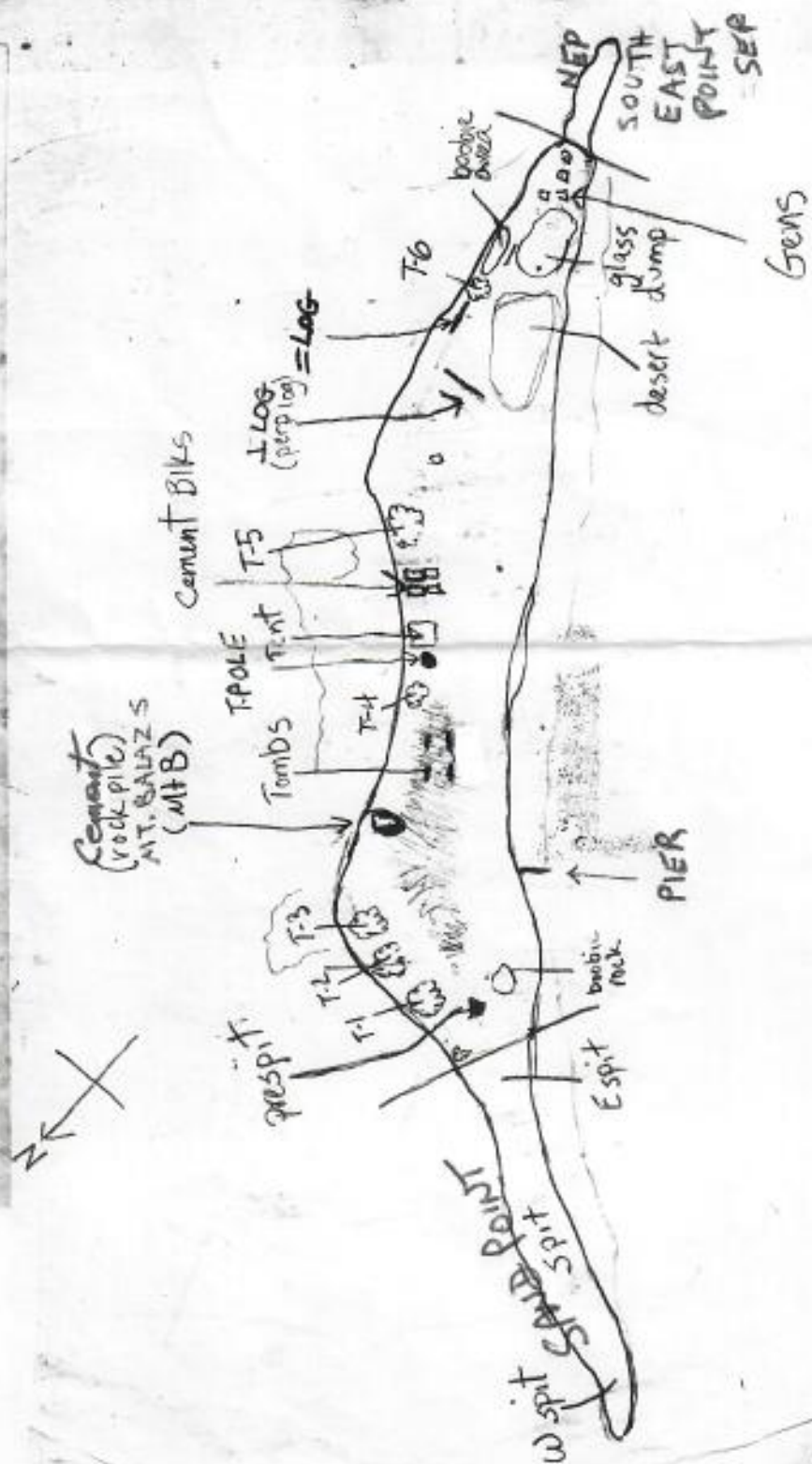


# 2004 MAP OF NESTING

## ACTIVITY

### EAST ISLAND

- O - Nest
- Δ - Pattycake
- - Backfill



USE area names and South of (Sof) as needed

# Daily Totals Form

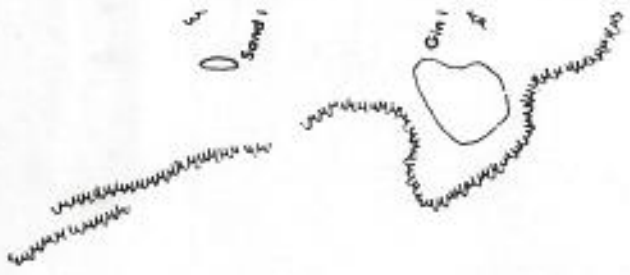
(PM-AM) For Adult Female Green Turtles Nesting At East Island, French Frigate Shoals

Date	Total No. of Turtles Up	No. of New Turtles Up	Number of Nests N/P/M	Your Name	Comments:

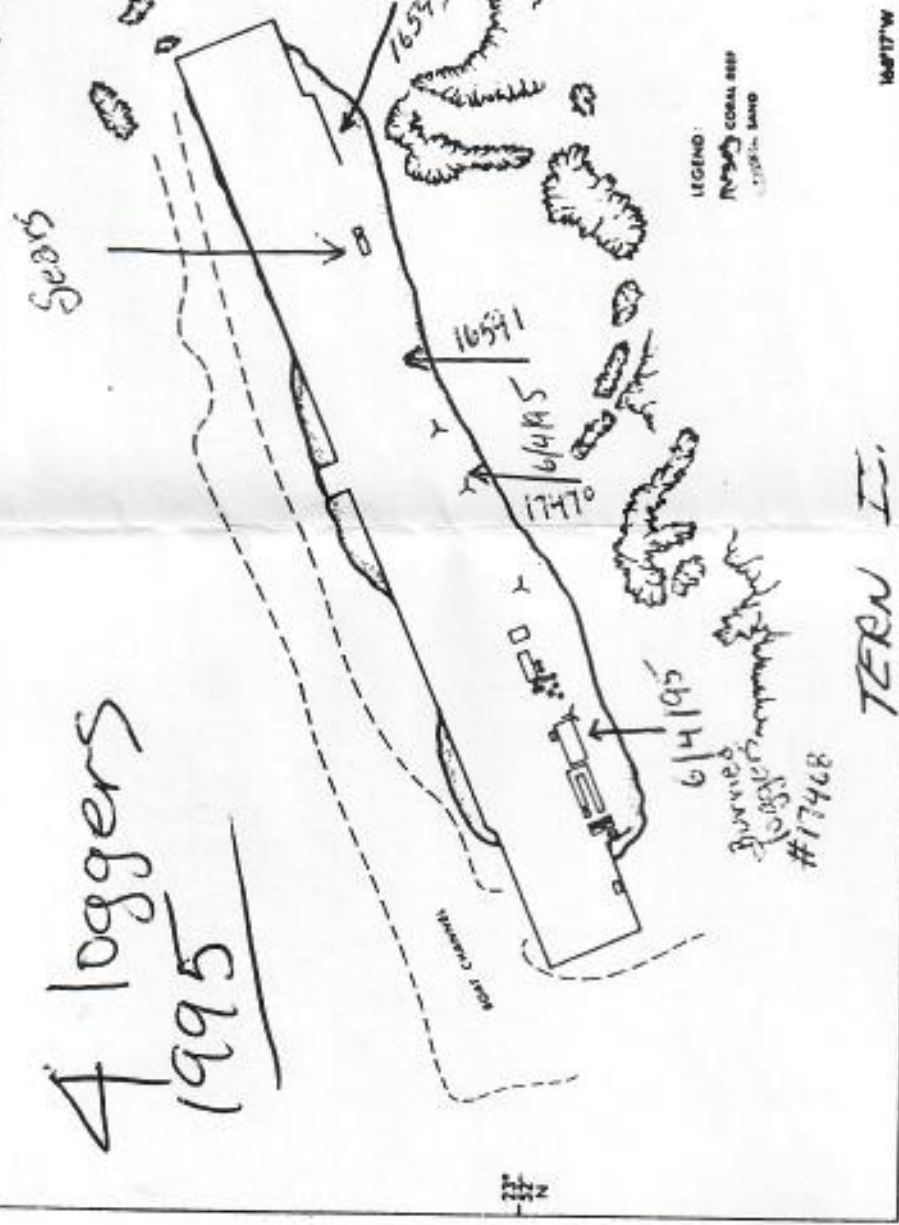
**Photo Record  
East Island FFS, 2003**

Date	Location	Picture #	Description

Marine Turtle Research Program  
PIFSC Honolulu Laboratory  
National Marine Fisheries Service  
2570 Dole Street  
Honolulu, Hawaii 96822-2396



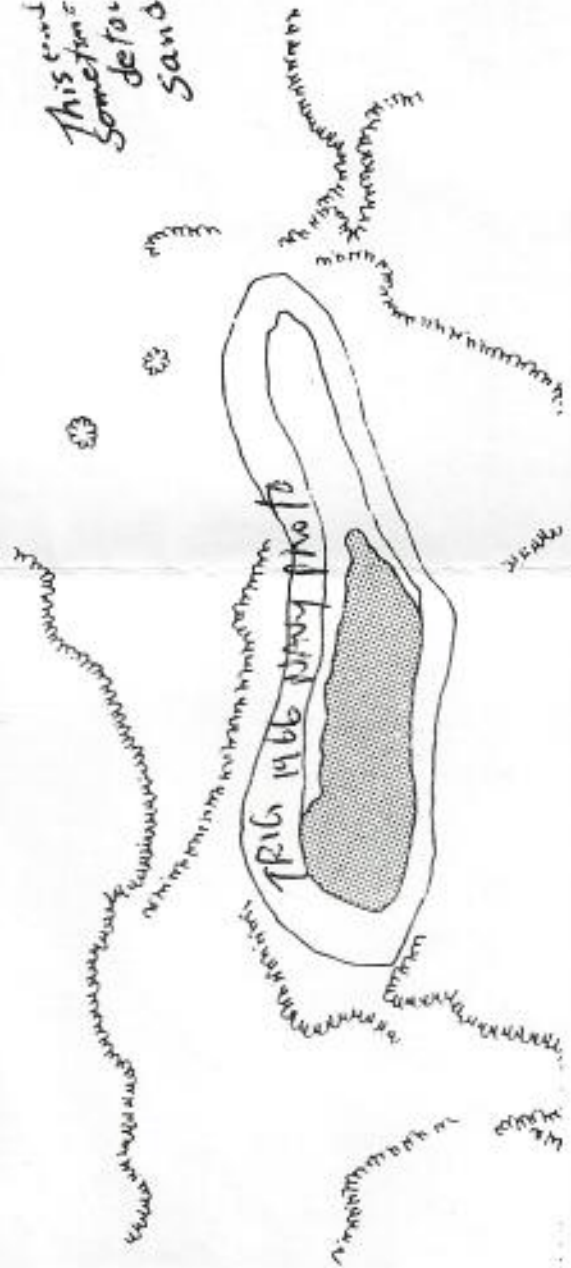
See P. 49



4 loggers  
1995

TERN II

This land is  
somewhat  
detached  
sand bar



Copy to MR. Shtom-AA

A

Six action projects for the enhancement of green turtle nesting habitat at French Frigate Shoals and the possible increase in the numbers of green turtles in the Hawaiian population

by

George H. Balazs

September 1980

1. East Island has 10 concrete foundations from an abandoned U.S. Coast Guard facility which constitute obstructions to turtles and render the habitat unusable for nesting purposes. The largest slab covers 134 m<sup>2</sup>, while the combined area of all 10 slabs is 165 m<sup>2</sup> or 0.4% of the 4.0 ha comprising East Island. The destruction of these slabs could be accomplished using sledge hammers and a portable jack hammer obtained from a rental agency in Honolulu. The resulting concrete rubble could be transported by a small boat to deep water for marine disposal.

Erosion which continues to occur along the northeast shore of East Island has resulted in the loss of 6,000 m<sup>2</sup> of land or 13% of the island since 1948. Over 50% of nesting by green turtles in the Hawaiian Archipelago presently takes place on East Island. It would therefore be desirable to make all remaining areas of the island suitable as nesting habitat.

2. In addition to concrete foundations, East Island also contains considerable abandoned debris in the form of wood, stakes, iron, electrical cables, and antenna ground wire. The removal of these obstructions would further enhance this important nesting habitat.
3. Ghost crabs, Ocypode ceratophthalmus and O. laevis, are known to prey on hatchling turtles at French Frigate Shoals. While this predation is low in comparison to many other sea turtle rookeries, it nevertheless involves an estimated 5% of all hatchlings emerging from nests. Further investigations are necessary, and such work could include an experimental ghost crab control program, ideally on Tern and Whale-Skate Islands where the greatest numbers exist. The experimental elimination of ghost crabs along select beach areas could be accomplished with little adverse impact to other entities by using baited traps and a BB gun.
4. Analysis of natural nests at French Frigate Shoals has found that 76.7% of the eggs in each clutch hatch, but only 70.8% of the eggs yield hatchlings that reach the surface and emerge. The remaining turtles, an average of six per nest, remain hopelessly trapped underground where they eventually die. The excavation, salvage, and release of many of these hatchlings could take place with only a modest effort. In order to measure the ability of these salvaged turtles to survive, small rearing studies could be conducted on Tern Island for periods of 5 to 10 days.

5. At French Frigate Shoals, tiger sharks, Galeocerdo cuvier, are known to prey on resident juvenile turtles, as well as mature adults that seasonally migrate to the area for breeding purposes. Experimental shark fishing conducted at this location during recent years has shown that 31% of the tiger sharks captured had been feeding on turtles. An experimental control program designed to coincide with the turtle breeding season could reduce mortality to turtles and provide further data on the nature and magnitude of this predation.
  
6. Predation on hatchlings by frigatebirds, Fregata minor, has never been recorded at French Frigate Shoals, however, such mortality is known to occur at some sea turtle rookeries. In order to confirm this absence of predation at French Frigate Shoals, a short-term but intensive food sampling program could be carried out concurrent with the peak months of hatchling emergence. If predation is discovered, appropriate experimental management steps could be taken to reduce this loss.