

A project proposal for research
to be conducted within the Hawaiian
Islands National Wildlife Refuge

Submitted to

The United States Department of Interior
Bureau of Sport Fisheries and Wildlife
Fish and Wildlife Service

Title

An investigation of green turtle (Chelonia sp.) populations
of French Frigate Shoals, Northwestern Hawaiian Islands.

Principal Investigator

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Duration

Continuing - April 1974 to April 1975. Anticipate requesting
permission to conduct similar investigations through 1978.

Objectives

1. To continue an intensive tagging study of nesting turtles at East Island, French Frigate Shoals during the 1974 nesting season. Data from the 1973 study have indicated East Island to be the site of greatest nesting activity within the atoll. Comprehensive information collected at this location will further provide a basis for defining parameters of the entire colony. Included in this phase of the work will be the accumulation of data on length-width frequencies, re-nesting intervals and locations, fecundity and emergence, site selection and nesting behavior.

2. To obtain data on the number of green turtles utilizing other nesting locations (Tern, Trig, Whale-Skate, Gin and Little Gin Island) during the 1974 season. In addition, intensive sampling of those animals nesting on Whale-Skate, the second most utilized island within the atoll,

will be made at periodic intervals in order to determine if parameter differences exist between East and Whale-Skate Island turtles.

3. To conduct further investigations on the incidence of basking and its relationship to nesting on the islands under surveillance. In depth observations will be made on this unique behavioral trait in order to accurately define and describe emergence, quiescence, retreat and other thermoregulatory patterns associated with the basking habit.

4. To obtain information on green turtle mating habits and their relationship to subsequent basking and nesting location preferences. Observations will be made to either confirm or reject the theory postulated during 1973 that at the onset of the mating season males arrive within the atoll in advance of females. Information will also be obtained on the cyclic reproductive patterns of males in order to determine if breeding by this sex takes place each year.

5. To make determinations on the degree of predation by small sharks, ghost crabs and birds on newly hatched turtles.

6. To collect additional data on egg fertility and embryo and hatchling mortality within nests at several select locations. Substrate information will also be gathered to identify those characteristics conducive to high productivity.

7. To carry out periodic land and aerial surveys several times throughout the year in order to establish the presence and size of resident green turtle populations; to determine seasonal migration patterns both in and out of the atoll, and to examine for the presence of marine turtle species other than Chelonia that may be nesting at other times of the year.

Justification

Pressures from man continue to increase on marine turtle colonies throughout the world. In order to obtain knowledge on the Hawaiian Archipelago green turtle (Chelonia sp.) colony, a preliminary intensive investigation was conducted on nesting and basking populations occurring at French Frigate Shoals, Northwestern Hawaiian Islands during 1973. A summary report on the significant results of this work accompanies this proposal.

Because French Frigate Shoals is the last remaining congregated nesting site of the green turtle in the Hawaiian Archipelago, and because Hawaiian green turtles comprise the last intact colony in the United States and possibly the only one in the world that can be completely managed under one nation's jurisdiction, it is imperative that continued studies be carried out at this location in order to gather data that will aid in the formulation of a sound long range management program. This is particularly important in view of the fact that mature animals found at French Frigate Shoals migrate to coastal waters of the major inhabited Hawaiian Islands where they are unprotected from both commercial and private exploitation.

Results obtained from the 1973 investigation have been instrumental in demonstrating the need for marine turtle protection within waters under State jurisdiction. Proposed protective measures are presently under consideration by the Hawaii State Department of Land and Natural Resources, but it is unknown at this time whether or not these restrictions, if enacted, will provide the necessary protection to ensure future viability in the Hawaiian Archipelago colony.

Because cyclic reproductive patterns are exhibited by female green turtles, intensive studies need to be conducted at the nesting site over a number of years in order to examine the entire nesting colony. Although nesting occurs most frequently in other areas of the world at three year intervals, both two and four year cycles are not uncommon. The reproductive patterns of the French Frigate Shoals colony are unknown. Due to cyclic reproduction, additional studies at the nesting site will, in essence, be examining completely different populations. Census data, as well as length-width frequencies will need to be collected on these animals in order to accurately define parameters for the total colony. This data will, in part, allow for the confirmation or adjustment of determinations previously made on the total size of the nesting colony.

During the 1973 study only eight animals were identified that had been formerly tagged, however, several hundred individuals have been marked at this location over the past six years. Subsequent investigations may well encounter greater numbers of these tagged animals and permit full utilization to be made of data previously collected by U. S. Fish and Wildlife personnel.

Procedures

Research methods utilized during the 1973 study proved highly successful and, in general, the same basic procedures will be carried out during subsequent studies. The practical experience derived from being closely associated with the French Frigate Shoals ecosystem for extended periods of time allowed for the adjustment and refinement of data collection techniques. Procedures that will be followed in order to fulfill

each of the project's objectives are outlined as follows:

1. East Island tagging study -

A small campsite will be re-established on East Island and investigators will commute between this location and the Tern Island facility as necessary for supplies, rest and rotation of duty. Seventeen previously designated areas which comprise the vegetated portion of East Island and each extend for approximately 50 meters will again be located and marked with identifying stakes. Activity during the major portion of the nesting season (June - July or as indicated through preliminary observations) will be intensively monitored by conducting surveys at two hour intervals during each night. During each survey tracks from emerged animals will be recorded and followed inland to determine incidence of unsuccessful pits and/or stage of nesting. Temporary identification will be made by numbering each animal's carapace with spray paint. When the latter cover-up stages of nesting are observed, body measurements will be taken and permanent identifying tags attached. In order to eliminate disruptions to normal behavioral patterns, animals will not be turned over for tagging purposes unless absolutely essential to the collection of critical data. Egg counts will be made on those animals found to be at a nesting stage conducive to such observations and several such nests will be permanently marked for future location.

Physical and mental stress incurred to the researchers from the rigorous data collecting schedule (in excess of 80 hours per week) will be minimized by maintaining three individuals at any one time in the

area, two of which will carry out intensive nightly duties on East Island while the third person will act in a support capacity on Tern Island. Rotation of assignments will allow for adequate rest, and give each individual the capacity to remain within the atoll for two consecutive weeks before returning to Honolulu. Tours of research duty for longer than two weeks are not deemed feasible due to University commitments and financial responsibilities on the part of research assistants that will be helping the principal investigator on this project.

2. Utilization of other islands by nesters -

Daytime surveys of the islands Trig and Whale-Skate will be made every second day in order to record the incidence of nesting pits at these locations. Similar surveys will be conducted on Gin and Little Gin at six day intervals or as weather conditions permit. Pits on Tern will be monitored periodically by that person acting in a support capacity. New pits that are recorded during each survey will be marked for future recognition. At ten day intervals one individual will carry out a night survey of Whale-Skate using the same methods as previously described for East Island.

3. Incidence and observations of baskers -

In conjunction with the regular daytime nesting pit surveys, observations on the incidents of basking animals will also be recorded. A similar survey will also be conducted regularly on East Island. Baskers which possess permanent tags and no painted numbers will be approached for identification using non-disruptive techniques developed during the previous study.

In order to make careful observations on the basking behavior of individual animals, a small tent with observation ports will be situated adjacent to a heavily used basking area at the southeast end of East Island. This facility will also be useful during night surveys for shelter from the frequent rain showers which occur at the atoll.

4. Mating habits -

Surveys will be conducted over a six day period during the first week of May to collect data and make observations on copulation and sex ratios. Samples of basking animals on each island will be marked with spray paint in order to determine inter-island movements, mating frequencies, and subsequent nesting activity. Baskers bearing tags from previous years will be approached for identification.

5. Predation on hatchlings -

Commencing the second week of July, baited hooks suspended from floats will be set at two-day intervals at select locations off East and Whale-Skate Island in order to sample the stomach contents of small sharks which are abundant in those areas. As conditions permit, observations will be made on the emergence of hatchlings from select nests to record degree of predation by ghost crabs and birds.

6. Egg fertility, embryo and hatchling mortality -

During the first week of October surveys will be made on each island to locate nests in which hatching and emergence have taken place. Excavations will be made on each nest to assess the number of undeveloped eggs, dead hatchlings, and partially developed dead embryos. Live

hatchlings found to be entrapped underground will be retrieved and released into the ocean. Terrain descriptions will be made and soil samples taken at each location.

7. Land and aerial surveys -

At three month intervals, the principal investigator and one assistant will conduct land surveys of each island over a six day period. All information pertinent to the presence and activity of turtles within the atoll will be collected. In conjunction with the weekly USCG/FAA logistics flight, and as passenger space permits, an aerial survey of the islands will be carried out by the principal investigator once each month to further census turtle populations.

To ensure the well being of the research team while conducting studies in this remote and potentially hazardous area, all possible safety precautions will be implemented. Radio contact will be maintained at regular intervals with the Tern Island facility. The launch used for interisland travel will be equipped with flare guns, extensive mooring gear, first aid supplies, emergency food and water and reserve gasoline. In addition, an extra outboard motor and spare parts will be carried. The principal investigator will personally supervise and be responsible for all research activity within the atoll.

Close contact will be maintained at all times with U. S. Fish and Wildlife personnel in order to coordinate research activities and disseminate information relative to the progress of the project. At the completion of each major phase of the investigation, data will be compiled and a summary report prepared for the Bureau of Sport Fisheries and Wildlife.

Schedule of proposed research activities (April, 1974 to April, 1975)

<u>Month</u>	<u>Week</u>	<u>Activity</u>
April	1st and 3rd	1-day preliminary aerial survey
May	1st	6-day survey of mating activity
May	4th	Initiation of intensive tagging study and periodic island surveys
July	2nd	Initiation of shark sampling
August	1st	Completion of intensive tagging and survey studies
September	1st	1-day aerial survey
October	1st	6-day survey of egg fertility, hatchling and embryo mortality and overall turtle activity
November	1st	1-day aerial survey
December	1st	1-day aerial survey
January	1st	6-day survey of overall turtle activity
February	1st	1-day aerial survey
March	1st	1-day aerial survey
April	1st	6-day survey of overall turtle activity

Responsibilities and support

Direct financial assistance will be obtained from sources other than the Bureau of Sport Fisheries and Wildlife for all investigations scheduled to take place after April of 1975. Based on the results and accomplishments of the 1973 investigation, a proposal is in preparation for submission to granting agencies interested in supporting green turtle research of this nature. The following support is deemed necessary in order to successfully accomplish the immediate project objectives for the period April 1974 to April 1975.

Air transportation between Honolulu and Tern Island,
French Frigate Shoals Provision requested from the U. S. Coast Guard and Bureau of Sport Fisheries and Wildlife at no direct cost to project

Use of marine laboratory's research facilities, equipment and supplies (extra outboard motors, parts, tools, mooring gear, safety equipment, spray paint, calipers, and photographic materials) Provided by the Hawaii Institute of Marine Biology

Food costs at Tern Island (available through U. S. Coast Guard facilities at a rate of \$4.05 per man per day)

BSFW fiscal year 1973-74 (102 man days)	413.10	Provision requested from the Bureau of Sport Fisheries and Wildlife
BSFW fiscal year 1974-75 (129 man days ending April 1975)	522.45	

Portable 2-way radios (3) \$ 480
Provision requested from the Bureau of Sport Fisheries and Wildlife

Salary for project leader (principal investigator) Provided by the Hawaii Institute of Marine Biology

Compensation for research assistants (can be awarded for either fiscal year 1973-74 or 1974-75) \$ 1,500-Provision requested from the Bureau

Requested as a grant sum for payment to research assistants at a rate of \$75.00 for each week (20 man weeks total) of duty at French Frigate Shoals. Recruitment of University level assistants for this type of intensive research will be facilitated considerably by offering such a cash incentive.

of Sport Fisheries and Wildlife

Total direct cost to the Bureau of Sport Fisheries and Wildlife \$ 2,915.55