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PROPOSED RESEARCH STUDY OF MARINE TURTLE POPULATIONS

IN THE HAWAIIAN ISLANDS

BY: George H. Balazs
Hawaii Institute of Marine Biology

In conjunction with the proposed protective limitations on the capture of marine turtles within the State, it is hereby requested that \$45,000 in funds be provided for a 3 year research study dealing with the management of marine turtle populations in the Hawaiian Islands. Such an investigation of this Central Pacific colony is particularly critical at this time due to the fact that overexploitation of marine turtle resources is widespread throughout the world. This makes it imperative that as much knowledge as possible be obtained on Hawaii's turtles to determine whether or not additional protection is necessary to ensure their continued viability and existence. Hawaii's green turtle population may very well comprise the largest remaining nesting colony left in the United States.

The initial objectives of the proposed study are:

1. To determine the present size of the green turtle population. Included would be the collection of much needed additional data on migration, nesting occurrence both within and between seasons, and length-weight frequencies of individuals. This would be accomplished by implementing an intensive tagging program at several selected nesting sites in the Hawaiian Islands National Wildlife Refuge. Such a project would be carried out in close cooperation with the Bureau of Sport Fisheries and Wildlife to ensure that adequate safeguards are taken against disturbing other delicate wildlife present in the area.
2. To investigate the movement of adult and sub-adult populations between the various feeding areas found around the major islands. This would involve the capture, tagging and subsequent recapture of individuals in the grazing habitats. Assistance from the Division of Fish and Game and the National Marine Fisheries Service would greatly expedite this phase of the project.
3. To determine which types of algae and in what proportions are utilized as food. This would be accomplished by the systematic examination of stomach contents from turtles caught by commercial fishermen.
4. To devise and implement a computer program study which will statistically analyze all records relating to turtle catch that are presently on file at the Division of Fish and Game.

The expertise, personnel, facilities and equipment to direct and carry out these objectives exists within the framework of the Hawaii Institute of Marine Biology. The project would thus represent a teamwork effort on the part of Hawaii's scientific community to study a valuable indigenous resource.

BREAKDOWN OF NON-SALARY EXPENDITURES
IN PROPOSED MARINE TURTLE STUDY

by G. H. Balazs
 Hawaii Institute of Marine Biology
 P. O. Box 1346
 Kaneohe, Hawaii 96744

YEAR 1

Objective 1.	Investigate adult and sub-adult grazing populations found around major islands.	
	Twenty (20) days of ship time (using 50' trawler which is available to HLMB for charter)	2,200
	Equipment and supplies (nets, charts, tags, food, etc.)	790
	Subtotal	2,990
Objective 2.	Determine the present size of the breeding population by an intensive tagging program at a selected nesting site (East Island) in the Hawaiian Islands National Wildlife Refuge.	
	Equipment and supplies (2-way radio, 2 outboard motors, 5-man inflatable boat, camping equipment, portable toilet, tags, food, etc.)	4,360
	6-round trips (Honolulu-Tern Island) for 3 persons. Transportation by U. S. Coast Guard	900
	Subtotal	5,260
Objective 3.	Determine the types of algae and other foodstuffs utilized by turtles in Hawaiian waters.	
	Finders Fee	500
	Shipping costs	200
	Laboratory analyses (physical and chemical)	500
	Subtotal	1,200

Objective 4. Carry out a computer program research study using existing marine turtle records.

Computer time	425
Supplies (cards, etc.)	75
Subtotal	500

Objective 5. Periodic reports based on project activities and findings.

Publication costs	200
Subtotal	200

TOTAL	\$10,150
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YEAR 2 and YEAR 3

A cost of \$7,950 has been determined for each of the years 2 and 3. Several initial purchases made during year 1 (outboard motors, inflatable boat, camping equipment) will need to be made only once, thus accounting for the lower non-salary expenditures during these subsequent years.

EXPENDITURES FOR PROPOSED MARINE TURTLE STUDY ^{1/}

by G. H. Balazs
 Hawaii Institute of Marine Biology
 P. O. Box 1346
 Kaneohe, Hawaii 96744

Phase 1 - 3-year duration with funding level at \$50,000.

YEAR 1

Salaries: 1-Principal Investigator - 1/4 time	\$3,500
3-Technical Assistants - 1/4 time	3,000
Equipment, supplies and research costs	10,150
Subtotal	16,650

YEAR 2

Salaries: 1-Principal Investigator - 1/4 time	3,625
5-Technical Assistants - 1/4 time	5,000
Equipment, supplies and research costs	7,950
Subtotal	16,575

YEAR 3

Same as Year 2	
Subtotal	16,575
TOTAL	\$49,800

^{1/} Values were calculated assuming the author to be the principal investigator and the Hawaii Institute of Marine Biology to be the center of operations.

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IN PROPOSED MARINE TURTLE STUDY

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1974-75

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

George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346
Kaneohe, Hawaii 96744

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, renesting 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 carspace 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) 413.10 Provision requested
from the Bureau of
Sport Fisheries and
Wildlife

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

Portable 2-way radios (3) \$ 480
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 of Sport Fisheries and Wildlife

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.

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



University of Hawaii at Manoa

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PROJECT PROGRESS REPORT

April 28, 1978

Task Order No. 151
Hawaiian Green Sea Turtle Management Study

PRINCIPAL INVESTIGATOR: George H. Balazs

OPERATING AGENCY: Hawaii Institute of Marine Biology

FUNDING: MAC 1977-78 \$21,550

NOAA, Office of Sea Grant 1977-78 \$20,000

National Geographic Society 1977-79 \$3,660

MAC FUNDS EXPENDED TO DATE:

1977-78, Task Order No. 151 - \$17,375 as of April 1978

1976-77, Task Order No. 118 - < \$18,360

I. OBJECTIVES

The overall objective of this study is to develop basic biological and ecological information relevant to the wise, long-term management of the native Hawaiian green sea turtle population. Specific objectives include: 1) locating and censusing aggregations of turtles in their nearshore feeding pastures; 2) ascertaining productivity at the sole colonial breeding site of French Frigate Shoals; 3) determining the developmental migrations of immature turtles; 4) gaining information on natural growth rates and ages at sexual maturity; 5) determining food sources used by each size category; and 6) determining the factors which limit the population. Life history information of this nature will be of direct benefit to the State of Hawaii in developing compatible programs of fisheries resource utilization, particularly in waters of the Northwestern Hawaiian Islands.

II. METHODS

Intensive land based and underwater field studies are periodically conducted at various locations throughout both the major and Northwestern Hawaiian Islands. Research activities are focused on population sampling through capture and tagging, as well as direct observations of feeding and breeding activities. In addition, an extensive network of informants comprised of the general public and cooperating military agencies has been assembled to gather information on the locations and activities of turtles.

III. RESULTS

A. Assessments have been conducted of turtle aggregations at Kure, Midway, Laysan, French Frigate Shoals, Necker, Nihoa, Kauai, Oahu, Lanai and Hawaii.

B. Samplings of stomach contents have identified two genera of algae, *Codium* and *Caulerpa*, as major dietary components of turtles at Kure, Midway, French Frigate Shoals and Necker. *Codium*, *Pterocladia* and *Ulva* have been identified as major dietary components of turtles at Oahu and Hawaii. A small but potentially important quantity of animal material (jellyfish and tunicates) has also been identified in a significant number of samplings.

C. Recoveries of immature turtles tagged at Kure, Midway and French Frigate Shoals have thus far indicated natural growth rates of not more than 1/16" in carapace (upper shell) length per month. Recoveries at the Island of Hawaii have thus far indicated natural growth rates of not more than 1/8" in carapace length per month.

D. Fibroepithelial tumors from Hawaiian turtles have been analyzed by specialists at the Smithsonian Institution and determined to be not caused by foreign organic agents such as leeches, barnacles and plant material. Additional specimens are being evaluated by electron microscopy to determine if a viral etiology exists.

E. Pathology of relatively high incidence involving an unknown form of limb necrosis has been discovered in immature turtles at Kure.

F. An analysis of results obtained from the experimental release of captive-reared Hawaiian green sea turtles for stocking purposes has indicated that such procedures may not be an effective means of conservation.

IV. DISCUSSION

A. Significant Events and Accomplishments

1. A 27 page preliminary report on the ecological aspects of the Necker green turtle aggregation has been prepared and distributed.

2. A report covering the known aspects of terrestrial critical habitat for sea turtles under U.S. jurisdiction throughout the Pacific has been prepared and distributed.

3. A report dealing with the Hawaiian hawksbill sea turtle has been prepared and distributed.

4. The Principal Investigator has served as a guest lecturer on eight occasions for ocean-oriented and community service groups in order to maintain public awareness of the project and solicit cooperation.

5. The Principal Investigator has been appointed to serve a three year term on the six member advisory Marine Turtle Specialist Group of the International Union for Conservation of Nature (Switzerland). This has resulted in part from international recognition of the State's role in encouraging and supporting research of Hawaiian sea turtles.

6. The Principal Investigator has been awarded a rank promotion within the faculty (untenured) of the University of Hawaii. This advancement was based to a large extent on the scope and quality of research conducted under the MAC green sea turtle project.

7. The Principal Investigator has been requested by the Director of the Honolulu Laboratory of the National Marine Fisheries Service to attend an intra-agency meeting on national sea turtle management in Bay St. Louis, Mississippi between 8-12 May 1978. All expenses for this travel will be paid by the National Marine Fisheries Service.

8. A comprehensive 340 reference bibliography of the Hawaiian monk seal has been assembled and published in collaboration with Dr. G. C. Whitton of the Kewalo Marine Laboratory, Pacific Biomedical Research Center. Monk seals and Hawaiian green sea turtles utilize portions of the same habitat, therefore information developed for one species will to some extent be of direct benefit to the other.

B. Setbacks or Problems Encountered

The conduction of suitable field studies has often made it necessary for the Principal Investigator to spend longer than expected periods at locations where the required activities are physically demanding and at times hazardous. In addition, travel to some of the remote areas in the North-western Hawaiian Islands has not been available as originally projected.

C. Project Schedule

The third scheduled year (1978-79) for this project will be crucial in that the pool of tagged turtles established, both immatures in the feeding pastures and adults at the breeding grounds, will be particularly amenable to answering basic biological questions (growth, migrations, productivity, mortality) through tag recoveries. Due to the reasons stated above in B, and

the fact that Sea Grant counterpart support for the project did not start until September 1977, it is presently felt that additional time may be needed beyond year three in order to bring the project to a successful conclusion.

V. SUMMARY/CONCLUSIONS

A. Conclusions Based on Research Performed

A significant portion of the research undertaken in this project is unique in that the activities and techniques have not been previously carried out on other sea turtle populations. Much of the initial field work has therefore been of a developmental and experimental nature. However, it is now possible to conclude that the procedures being utilized are sound and thoroughly capable of providing the desired results.

B. Expected Completion of Project

Year two of the project (1977-78, Task Order No. 151) will be completed as scheduled with a notable number of significant accomplishments. However, some additional time may be needed beyond year three in order to bring the project to a successful conclusion.

C. Pertinent Comments

1. The project is being conducted solely by the Principal Investigator and one Biological Assistant. The Principal Investigator does not have a salary base at the University of Hawaii, therefore funds for this purpose must be derived from the MAC and Sea Grant awards. This amounts to approximately \$10,700 or 50% from each source, including the cost of State Fringe Benefits.

2. Of the \$21,550 award from MAC for 1977-78, \$1,078 represented overhead cost paid to RCUH.

3. The MAC award has been and will continue to be used as state matching funds to obtain financial support from the federal Office of Sea Grant. Of the \$20,000 Sea Grant award for 1977-78, \$4,677 represented overhead cost which was paid to the General Fund of the State of Hawaii.

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PROJECT PROGRESS REPORT

February 28, 1978/9

Task Order No. 173

Hawaiian Green Sea Turtle Management Study

PRINCIPAL INVESTIGATOR: George H. Balazs

OPERATING AGENCY: Hawaii Institute of Marine Biology

FUNDING: MAC 1978-79 - \$20,504
UH Sea Grant College Program 1978-79 - \$13,815
National Geographic Society 1977-79 - \$3,660
IUCN/New York Zoological Society (funding for travel to
international meetings) - 1978-79 - \$2,500

MAC FUNDS EXPENDED TO DATE: Task Order No. 173 - \$10,476

I. OBJECTIVES

The overall objective of this study is to develop basic biological and ecological information relevant to the wise, long-term management and conservation of the unique Hawaiian green sea turtle population. Specific objectives include: 1) locating and censusing aggregations of turtles in their nearshore feeding pastures; 2) ascertaining productivity and population trends at the sole colonial breeding site of French Frigate Shoals; 3) determining the developmental migrations of immature turtles; 4) gaining information on natural growth ages and ages at sexual maturity; 5) determining the food sources used by each size category; and

6) determining the factors that limit the population. Life history information of this nature will be of direct use and benefit to the State of Hawaii in developing compatible programs of fisheries resource utilization, particularly in waters of the Northwestern Hawaiian Islands. The recent designation of all U. S. populations of green sea turtles as "threatened" increases the need to gather this management-oriented information.

II. METHODS

Intensive land based and underwater field studies are periodically conducted at various locations throughout both the major and Northwestern Hawaiian Islands. Research activities are focused on population sampling through capture and tagging, as well as direct observations of feeding, basking and breeding activities. In addition, an extensive network of informants comprised of the general public and cooperating military agencies has been assembled to gather information on the locations and activities of turtles.

III. RESULTS

- A. A series of lengthy and comprehensive field studies has provided basic life history information on turtle aggregations occurring at Necker, French Frigate Shoals, Laysan, Lisianski, Pearl and Hermes Reef, Midway, Kure, Oahu, Lanai and the Big Island (Hawaii).
- B. Natural growth rates of immature turtles in resident pastures at French Frigate Shoals and Midway/Kure have been determined for

periods of up to 37 months in the wild. Rates of growth, as measured by straight carapace length, have ranged from only .01 to .21 cm per month. At the Big Island off the Kau District, rates of growth have ranged from .38 to .52 cm per month.

- C. Comprehensive food studies, involving samplings of stomach contents, have identified two genera of algae (*Codium* and *Caulerpa*) as major dietary components of turtles residing in the Northwestern Hawaiian Islands. In the major islands, *Pterocladia*, *Codium*, *Amansia* and *Ulva* have been found to be principal sources of food.
- D. Monitoring of the breeding assemblage at French Frigate Shoals has indicated that approximately 250 adult females were present during the 1978 reproductive season.

IV. DISCUSSION

A. Significant Events and Accomplishments

1. An overview paper has been published in an internationally distributed newsletter covering the results of research to date on natural growth, food sources and migrations ("Growth, food sources and migrations of immature Hawaiian *Chelonia*" *IUCN/SSC Marine Turtle Newsletter*, Volume 10, 1-3).
2. A paper has been published on aspects of terrestrial critical habitat for sea turtles in the Hawaiian Islands and other areas under U. S. jurisdiction in the Pacific region ("Terrestrial critical habitat for sea turtles under United

States jurisdiction in the Pacific region" *'Elepaio*,
Volume 39, 37-41.

3. A paper has been published on the results of preliminary algae collections made at select sites in the Leeward Islands ("Marine benthic algae collected from Kure Atoll, Maro Reef and Necker Bank, Northwestern Hawaiian Islands" *'Elepaio*, Volume 39, 110-111).
4. A paper has been published on the ecological aspects of a hawksbill turtle (*Eretmochelys imbricata*) recovered dead from a gill net in Kaneohe Bay ("A hawksbill turtle in Kaneohe Bay" *'Elepaio*, Volume 38, 128-129).
5. A note has been published describing efforts to tattoo young Hawaiian green turtles as a secondary system of individual identification ("Tattooing green turtles" *IUCN/SSC Marine Turtle Newsletter*, Volume 8, 3).
6. A report has been prepared dealing with sea turtles at Kahoolawe ("Sea turtles of Kahoolawe Island: A preliminary survey" November, 1978, 21 pp).
7. A paper dealing with stomach sampling techniques for green turtles has been submitted for publication ("Field methods for sampling the dietary components of green turtles *Chelonia mydas*" *Herpetological Review*).
8. A paper dealing with loggerhead turtle parts recovered from a tiger shark at Kure has been accepted for publication ("Loggerhead turtle recovered from a tiger shark at Kure Atoll" *'Elepaio*).

9. A comprehensive bibliography of the Hawaiian monk seal has been published as a technical report (No. 35) of the Hawaii Institute of Marine Biology. This has recently been updated and will be republished in the near future by the University of Hawaii Sea Grant College Program.
10. A comprehensive bibliography of sea turtles in the Hawaiian Islands is in draft form and will be submitted for publication in the near future.
11. A paper has been published on observations of parasites and ulcers found in a monk seal at French Frigate Shoals ("Parasitic ulceration of the stomach in a Hawaiian monk seal (*Monachus schauinslandi*)" Whittow and Balazs, 'Elepaio, Volume 38, 83-84).
12. A paper has been published covering observations of a shark seen feeding on a monk seal at French Frigate Shoals ("First record of a tiger shark observed feeding on a Hawaiian monk seal" 'Elepaio, Volume 39, 107-109).
13. An invitational ad hoc meeting of the IUCN Marine Turtle Specialists Group was attended in Toronto, Ontario to formulate international research strategies. All travel expenses were paid by IUCN/WWF of Switzerland.
14. An invitational meeting on sea turtles convened by NMFS was attended at the National Space Technologies Laboratory, Mississippi at the expense of the NMFS, Washington, D.C.

15. Lectures on the Northwestern Hawaiian Islands and the Hawaiian green sea turtle research project were presented to audiences throughout the state on seven different occasions. This was in conjunction with a marine lecture series sponsored by the University of Hawaii Sea Grant College Marine Advisory Program, the Waikiki Aquarium, the State Office of the Marine Affairs Coordinator, and the Hawaiian Academy of Sciences.

B. Setbacks or Problems Encountered

The conduction of suitable field studies continues to make it necessary for the Principal Investigator to spend longer than expected periods of time at geographical locations where the required activities are physically demanding and are frequently hazardous. The availability of travel to remote areas of the Leeward Islands has, however, been enhanced by the charter arrangements made by the MAC office with the Easy Rider Corporation.

C. Project Schedule

Research being conducted under Task Order No. 173 (1978-1979) is on schedule, with significant contributions being made to our knowledge of the biology and ecology of the Hawaiian green turtle population.

V. SUMMARY/CONCLUSIONS

A. Conclusions Based on Research Performed

Research results and conclusions to date are contained

within the numerous publications and reports authored by the Principal Investigator . Copies of this material have been, and will continue to be, forwarded to the MAC office and other agencies having interests in the wise management and conservation of Hawaii's marine biological resources.

B. Expected Completion of Project

In conjunction with the State, NMFS, FWS and Sea Grant fisheries investigations of the Leeward Islands, a reduced level of funding (\$8,317) has been requested from the MAC office for use as matching funds for Sea Grant Year 12 (1979-1980). The increased research in the Leeward Islands during Year 12 by workers of other disciplines will significantly benefit the Principal Investigator's efforts to gather and interpret ecological information on the Hawaiian green turtle population.

C. Pertinent Comments

1. The project is being conducted solely by the Principal Investigator with the immediate help of one Biological Assistant. The Principal Investigator does not have a salary base at the University of Hawaii, therefore funds for this purpose must be derived from Sea Grant and MAC funds.
2. Support of this project by the MAC office has made it possible to develop within Hawaii an authoritative source of information on sea turtles that can be drawn upon internationally, but most importantly by island nations of the Pacific region (see memorandum to MAC office dated 19 January 1979).



University of Hawaii at Manoa

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PROJECT PROGRESS REPORT

March 31, 1980

Task Order No. 173

HAWAIIAN GREEN SEA TURTLE MANAGEMENT STUDY

PRINCIPAL INVESTIGATOR: George H. Balazs

OPERATING AGENCY: Hawaii Institute of Marine Biology

FUNDING: MAC 1978-80 - \$29,237
UH Sea Grant College Program 1979-80 - \$21,853
IUCN/WWF/NYZS/UH-ORA/NMFS (International Scientific Meetings)
1979-80 - \$4,200

MAC FUND EXPENDED TO DATE: \$23,560

I. OBJECTIVES

The overall objective of this study is to develop basic biological and ecological information relevant to the wise, long-term management and conservation of the unique Hawaiian green turtle population. Specific objectives include: 1) locating and censusing aggregations of turtles in their nearshore feeding pastures; 2) ascertaining productivity and population trends at the sole colonial breeding site of French Frigate Shoals; 3) determining the developmental migrations of immature turtles; 4) gaining information on natural growth rates and ages at sexual maturity; 5) determining the food sources used by each size category; and 6) determining the factors that limit the population. Life history information of this nature will be of direct use and benefit to the State of Hawaii in developing compatible programs of fisheries

resource utilization, particularly in waters of the Northwestern Hawaiian Islands. The 1978 designation of all U. S. populations of sea turtles as either "threatened" or "endangered" increases the need to gather this management-oriented information.

II. METHODS

Intensive land based and underwater field studies are periodically conducted at locations throughout both the major and Northwestern Hawaiian Islands. Research activities are focuses on population sampling through live capture and tagging as well as direct observations of feeding, basking and breeding activities. In addition, an extensive network of informants comprised of the general public and cooperating military agencies has been organized to gather information on the whereabouts and activities of turtles.

III. RESULTS

A. A series of lengthy and comprehensive field studies has provided basic life history data on turtle aggregations occurring at Necker, French Frigate Shoals, Laysan, Lisianski, Pearl and Hermes Reef, Midway, Kure, Oahu, Lanai and Hawaii.

B. The mean natural growth rates of immature turtles have been determined as follows: Necker - .14 cm per month; French Frigate Shoals - .08 cm per month; Lisianski - .13 cm per month; Midway - .09 cm per month; Kure - .08 cm per month; Oahu - .20 cm per month; Hawaii - .44 cm per month.

C. Comprehensive food studies involving samplings of stomach contents have identified the following major dietary components: Necker - *Caulerpa racemosa*; French Frigate Shoals - *Codium arabicum*, *Codium phasmaticum*, *Codium edule*, *Caulerpa racemosa*, *Ulva fasciata*, *Turbinaria ornata*, *Spyridia filamentosa*; Lisianski - *Caulerpa racemosa*, *Turbinaria ornata*; Midway - *Codium edule*; Oahu -

Codium arabicum, *Codium phasmaticum*, *Ulva fasciata*, *Ulva reticulata*, *Pterocladia capillacea*, *Amansia glomerata*, *Ahnfeltia concinna*; Lanai - *Amansia glomerata*, *Acanthophora spicifera*; *Sargassum polyphyllum*; Hawaii - *Pterocladia capillacea*.

D. The projected number of years to sexual maturity for 35 cm turtles newly recruited to resident pastures are as follows: Necker - 34 years; French Frigate Shoals - 59 years; Lisianski - 37 years; Midway - 53 years; Kure - 59 years; Oahu - 24 years; Hawaii - 11 years.

E. Monitoring of the breeding assemblage at French Frigate Shoals has indicated that approximately 180 adult females were present during the 1979 reproductive season.

IV. DISCUSSION

A. Significant Events and Accomplishments

1. Two papers resulting from this research program were presented at the World Conference on Sea Turtle Conservation held in Washington, D.C. during November 1979 ("Growth rates of immature green turtles in the Hawaiian Islands" and "Status of sea turtles in the Central Pacific Ocean"). Both of these papers will be published in the Conference Proceedings.

2. Two other papers resulting from this research program were presented at the joint SPC/NMFS workshop on sea turtles held in Noumea, New Caledonia during December 1979 ("Status of marine turtles in U. S. territories of the Central Pacific Ocean" and "Synopsis of biological data on green turtles in the Hawaiian Islands").

3. The Principal Investigator was appointed Deputy Chairman of the IUCN/SSC Marine Turtle Specialist Group.

4. A sea turtle research and management program for Hawaii and the Pacific region is being developed in collaboration with the Honolulu Laboratory of the National Marine Fisheries Service.

B. Setbacks or Problems Encountered

No setbacks or problems are being encountered at the present time.

C. Project Schedule

Research being conducted under Task Order No. 173 (1978-80) is on schedule, with significant contributions being made to our knowledge of the biology and ecology of the Hawaiian green turtle population (i.e. see attached correspondence from Dr. F. W. King).

V. SUMMARY/CONCLUSIONS

A. Conclusions Based on Research Performed

Research results and conclusions to date are contained in the numerous publications and reports that have been authored by the Principal Investigator and regularly forwarded to the Marine Affairs Coordinator.

B. Expected Completion of Project

The project is on schedule and the completion date remains June 1980.

C. Pertinent Comments

Support of this project by the MAC office has made it possible to develop within the State of Hawaii an authoritative source of information on sea turtles. This will benefit both Hawaiian sea turtles, and turtle populations throughout the Pacific region.

PROPOSED PROTECTION FOR MARINE TURTLES

PREPARED BY: George H. Balazs

Recognizing the fact that title to all wildlife belongs to the State in its sovereign capacity, and that the State holds this title in trust for the people of Hawaii, and that the State has a right and an obligation to protect, perpetuate and control wildlife within its boundaries, the following bill for an act relating to the protection of marine turtles is hereby proposed:

1. It shall be unlawful for any person to take, sell, kill, possess, mutilate or in any way disturb any Leatherback (Dermochelys sp.) or Hawksbill (Eretmochelys sp.) in or from the territorial waters of the State of Hawaii.
2. It shall be unlawful for any person to take, sell, kill, possess, mutilate or in any way disturb any green turtle (Chelonia sp.) in or from the territorial waters of the State of Hawaii which surround the Hawaiian Islands National Wildlife Refuge.
3. It shall be unlawful for any person to take, sell, kill, possess, mutilate or in any way disturb any green turtle in or from the territorial waters of the State of Hawaii which surround the major islands (Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai and Niihau) excepting green turtles having a straight line carapace measurement of more than thirty-four (34) inches.
4. It shall be unlawful for any live marine turtle to be held in captivity or transported within or across the boundaries of the State except by special permit which will be granted by the Division of Fish and Game only for educational or scientific purposes. The number of animals held for such purposes by any one person or institution shall not exceed that as deemed reasonable, prudent and necessary by the Division of Fish and Game.
5. Any officer or agent authorized by the Division of Fish and Game shall have authority to execute any warrant to search for and seize any animal or animal product held in violation of sections 1, 2, 3 or 4 of this act. Such material shall be held pending proceedings in any court of proper jurisdiction. Upon the conviction of any person charged with a violation of section 1, 2, 3 or 4 of this act the animal or animal product seized shall be forfeited and either released, offered to a recognized institution for scientific or educational purposes, or destroyed.
6. Any person convicted of violating any section of this act shall be fined not more than \$500 or imprisoned not more than 6 months or both.

PROPOSED PROTECTION FOR MARINE TURTLES

PREPARED BY: George H. Balazs

1. Complete protection shall be provided for Leatherback (Dermochelys sp.) and Hawksbill (Eretmochelys sp.) turtles in all territorial waters of the State of Hawaii.

Justification: Leatherbacks are of little economic value and are rarely seen in Hawaiian waters. Encroachment by man on the few known nesting sites in the world necessitates protection by all governments before excessive reduction in numbers occurs. Hawksbills are officially recognized by the federal government as an endangered species. No Hawksbill or products derived from the Hawksbill may be imported into the United States. Recognition of the fact that these animals are threatened with extinction should be given by the State of Hawaii in the form of complete protection.

2. Complete protection shall be provided for all green turtles (Chelonia sp.) within the territorial waters of the Hawaiian Islands Wildlife Refuge.

Justification: Federal protection of this animal does not extend to the navigatable territorial waters surrounding the reefs and islands in this area. Breeding of marine turtles occurs offshore, sometimes as far out as 1/2 mile. During this time animals are very susceptible to predation by man. Because the Wildlife Refuge is the largest green turtle nesting area left in the United States, protection by the State should be afforded to these animals.

3. Protection shall be provided for green turtles (Chelonia sp.) under thirty-four (34) inches straight line carapace length within the territorial waters surrounding the main Hawaiian Islands.

Justification: Green turtles are recognized as the world's most valuable reptile owing to the many useful products obtained from their carcass. For this reason overexploitation of the resource has occurred in most areas of the world. Research has shown that this migratory animal is slow to recover from such abuses by man. The realization by governments that green turtle numbers are fast declining has led to passage of protective restrictions. Many areas have afforded total protection for green turtles. A size limitation on these animals at this time would assist juveniles in the Hawaiian population in reaching reproductive age. This would ensure a future breeding stock. In addition, the taking of small animals is unsportsmanlike and wasteful in terms of potential edible protein.

4. Restrictions on the holding and transport of live marine turtles. Special permit will be granted only for educational or scientific purposes.

Justification: Transporting live turtles for commercial purposes is often inhumane and a cause of undue suffering by a creature of the wild. Educational and scientific purposes are the only legitimate reasons for holding marine turtles in captivity since as many animals as possible should remain in the natural environment and be free to breed and reproduce.



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Request for the Release of Supplemental Appropriation for
HAWAIIAN GREEN TURTLE RESOURCE MANAGEMENT STUDY

A. Brief Historical Statement of the Project

Management oriented studies of Hawaii's native green turtle population were started at HIMB in 1973 but have thus far been limited to the adult migratory nesting colony which seasonally utilizes French Frigate Shoals. Partial financial support for this work which takes place in the Hawaiian Islands National Wildlife Refuge has been provided by the U.S. Fish and Wildlife Service. Concurrent laboratory investigations under the auspices of the Sea Grant Aquaculture Program have also been conducted on the feasibility of raising green turtles in captivity.

B. Project Objectives and Purposes

1. Overall objectives. To conduct comprehensive life history studies which encompass all size categories of green turtles as they naturally occur throughout the Archipelago. Special emphasis will be placed on assessing the status and utilization potential of those animals inhabiting algal feeding pastures around the major islands. Determining the essential biological facts of the total population will provide a sound basis for the long-term wise management and perpetuation of this valuable food source.
2. Specific objectives.
 - a. To determine the proportion of the population represented by each age group along with their abundance.
 - b. To define the migratory patterns and distribution of each age group.
 - c. To obtain information on growth rate in the wild and the sex ratios present.
 - d. To ascertain the reproductive potential and mortality factors that limit the population.
 - e. To determine the effects of man on the various population parameters.

C. Levels of Project Effectiveness Being Sought

To develop and make available to the Hawaii State Department of Land and Natural Resources and the U.S. Fish and Wildlife Service information necessary for the establishment of an optimum green turtle management program.

D. Kinds and Levels of Activities to be Undertaken

1. Conduct periodic intensive surveys, samplings and taggings at feeding habitat locations around the major islands.

2. Conduct land and aerial reconnaissance surveys to locate any remaining mating and nesting activity in the major islands.
3. Analyze and interpret existing and future turtle catch statistics and interview fishermen.
4. Continue seasonal intensive nesting studies at French Frigate Shoals.
5. Survey at periodic intervals other sites in the Northwestern Hawaiian Islands.
6. Conduct tag and recapture studies at Midway, Kure and Johnston Atolls in cooperation with resident personnel.

E. Need for the Project and the Benefits Derived

Both the Department of Land and Natural Resources and the U.S. Fish and Wildlife Service have long recognized and reiterated the need for an in-depth green turtle study, particularly in waters adjacent to the major islands. The absence of financial support has to date prevented the establishment of such a project. Funds are not presently available through any Hawaii State Department and the inflexibility of ongoing specific task projects that require matching funds prevent HIMB from directly supporting this work. In addition, Federal aid grants for fish and wildlife restoration projects (Dingle-Johnson and Pitman-Robertson Acts) cannot be expended on sea turtles as under the definitions used in the Acts such animals are not classified as being either "fish" or "wildlife".

Most of the world's distinct green turtle populations are experiencing significant declines due mostly to a lack of knowledge on how to best manage the resource. In Hawaii, management does not appear to be complicated by international migratory travels. An excellent opportunity therefore exists to ensure the perpetuation of a supplemental food source, particularly for those people who have been traditionally dependent on the sea.

F. Personnel and Financial Requirements

Because of the nature of the project, it would be desirable to expend the requested \$50,000 supplemental appropriation over a three year period. 1 Project Leader (1/2 time); 1 Research Assistant (1/2 time); 1 Student Helper; Periodic Consultants (resident turtle fishermen). Other needs include sampling and tagging equipment and outer island travel.

Assistance from the U.S. Fish and Wildlife Service in the form of logistics and equipment support in the Northwestern Hawaiian Islands is expected to continue. Additionally, where feasible, enthusiastic cooperation from the State Division of Fish and Game and the Honolulu laboratory of the National Marine Fisheries Service is anticipated.

G. Summary Statement

Sufficient biological information must be available to both the Department of Land and Natural Resources and the U.S. Fish and Wildlife Service in order to ensure the wise utilization and perpetuation of the unique Hawaiian green turtle resource, the last remaining viable green turtle population in the United States. Although a start has been made in gaining knowledge on the migratory adult nesting colony utilizing French Frigate Shoals (Hawaiian Islands National Wildlife Refuge), information is almost totally lacking on those portions of the population occurring in feeding pastures in State waters around the major islands. Effective management throughout the Archipelago can only take place when an understanding of the dynamics of the total population is achieved.

PROPOSAL FOR A RESOURCE MANAGEMENT STUDY OF THE HAWAIIAN GREEN TURTLE

Funding Request - \$50,000 for a 3-year period

Submitted by George H. Balazs

A. Brief Historical Statement of the Project

Management oriented studies of Hawaii's native green sea turtle population were started at HMB in 1973 but have thus far been limited to the adult migratory nesting colony which seasonally utilizes French Frigate Shoals. Partial financial support for this work, which takes place in the Hawaiian Islands National Wildlife Refuge, has been provided by the U. S. Fish and Wildlife Service. Concurrent laboratory investigations under the auspices of the Sea Grant Aquaculture Program have also been conducted on the feasibility of raising green turtles in captivity.

B. Project Objectives and Purposes

1. Overall objectives. To conduct comprehensive life history studies which encompass all size categories of green turtles as they naturally occur throughout the Archipelago. Special emphasis will be placed on assessing the status and utilization potential of those animals inhabiting algal feeding pastures around the major islands. Determining the essential biological facts of the total population will provide a sound basis for the long-term wise management and perpetuation of this valuable food source.
2. Specific objectives.
 - a. To determine the proportion of the population represented by each age group along with their abundance.
 - b. To define the migratory patterns and distribution of each age group.
 - c. To obtain information on growth rate in the wild and the sex ratios present.
 - d. To ascertain the reproductive potential and mortality factors that limit the population.
 - e. To determine the effects of man on the various population parameters.

C. Levels of Project Effectiveness Being Sought

To develop and make available to the Hawaii State Department of Land and Natural Resources and the U. S. Fish and Wildlife Service information necessary for the establishment of an optimum green turtle management program.

D. Kinds and Levels of Activities to be Undertaken

1. Conduct periodic intensive surveys, samplings and taggings at feeding habitat locations around the major islands.
2. Conduct land and aerial reconnaissance surveys to locate any reproduction which may still occur in the major islands.
3. Analyze and interpret existing and future turtle catch statistics and interview fishermen.
4. Continue seasonal intensive nesting studies at French Frigate Shoals.
5. Survey at periodic intervals other sites in the Northwestern Hawaiian Islands.
6. Conduct tag and recapture studies at Midway, Kure and Johnston Atolls in cooperation with resident personnel.

E. Need for the Project and the Benefits Derived.

Both the Department of Land and Natural Resources and the U. S. Fish and Wildlife Service have long recognized and reiterated the need for an in-depth green turtle study, particularly in waters adjacent to the major islands. The absence of financial support has, to date, prevented the establishment of such a project. Funds are not presently available through any Hawaii State Department and the inflexibility of ongoing specific task projects that require matching funds prevent HDMB from directly supporting this work. In addition, Federal aid grants for fish and wildlife restoration projects (Dingle-Johnson and Pitman-Robertson Acts) cannot be expended on sea turtles as under the definitions used in the Acts such animals are not classified as being either "fish" or "wildlife." A supplemental appropriation made earlier this year by the State Legislature has not resulted in project funding due to reduced allocations to the University.

Most of the world's distinct green turtle populations are experiencing significant declines due mostly to a lack of knowledge on how to best manage the resource. In Hawaii, management does not appear to be complicated by international migratory travels. An excellent opportunity therefore exists to ensure the perpetuation of a supplemental food source, particularly for those people who have been traditionally dependent on the sea.

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F. Personnel and Financial Requirements

Because of the nature of the project's activities, it will be necessary to expend the requested \$50,000 over a three year period. Funds will be used for: 1 project leader (1/2 time); 2 student helpers; periodic consultants (resident turtle fishermen); and tagging equipment as well as outer island travel. A detailed budget is included with this proposal.

Assistance from the U. S. Fish and Wildlife Service in the form of logistics and equipment support in the Northwestern Hawaiian Islands is expected to continue. Additionally, where feasible, enthusiastic cooperation from the State Division of Fish and Game and the Honolulu laboratory of the National Marine Fisheries Service is anticipated.

G. Summary Statement

Sufficient biological information must be available to both the Department of Land and Natural Resources and the U. S. Fish and Wildlife Service in order to ensure the wise utilization and perpetuation of the unique Hawaiian green turtle resource, the last remaining viable green turtle population in the United States. Although a start has been made in gaining knowledge on the migratory adult nesting colony utilizing French Frigate Shoals (Hawaiian Islands National Wildlife Refuge), information is almost totally lacking on those portions of the population occurring in feeding pastures in State waters around the major islands. Effective management throughout the Archipelago can only take place when an understanding of the dynamics of the total population is achieved.

Budget for Proposed 3-Year

RESOURCE MANAGEMENT STUDY OF THE HAWAIIAN GREEN TURTLE

Item	Expenditures	
	Yearly	3-Year Total
Salaries and Wages		
Project Leader (1/2 time)	\$7,300	\$21,900
Consultants (turtle fishermen)	1,900	5,700
Student Help	4,300	12,900
	Sub-total	13,500
Equipment and Supplies	1,575	4,725
Outer-Island Travel	500	1,500
Vessel Charter	750	2,250
Aircraft Charter	250	750
Publication Costs	75	225
	Total	\$16,650
		\$49,950

With the Hawaii Institute of Marine Biology as the center for project operations, various laboratory services and equipment will be available to the study at no direct cost. In addition, agencies such as the State Division of Fish and Game, U. S. Fish and Wildlife Service, National Marine Fisheries Service and Marine Options Program (Manoa and Hilo campuses) are anticipated to enthusiastically cooperate in the project, thereby providing additional indirect assistance.

DRAFT PRESS RELEASE

The Marine Affairs Coordinator has provided funds for a management study of the Hawaiian green sea turtle. The study is planned to extend over a three year period, with the budget for the first year amounting to \$15,750.

During the 1975 legislative session \$50,000 was appropriated to the University for a three year green sea turtle study. However, due to fiscal restraints, the funds were never released. The 1976 legislature made a similar \$50,000 appropriation to the Marine Affairs Coordinator, but the Office of Budget and Finance also found it necessary to withhold the allotment because of fiscal cutbacks. The need for a comprehensive management study of the green sea turtle throughout the Hawaiian chain has been long recognized and recommended by scientists as well as state and federal officials. The Marine Affairs Coordinator realizes this fact, therefore in spite of the absence of specific task funds, the project is nevertheless still being initiated by judiciously using the regular fiscal appropriation.

The green turtle management study will be conducted by George H. Balazs, Junior Marine Biologist with the University's Hawaii Institute of Marine Biology located on Coconut Island. For the past four summers Mr. Balazs has conducted a monitoring program of the breeding colony at French Frigate Shoals in cooperation with the U. S. Fish and Wildlife Service. He has also carried out investigations into the feasibility of raising green turtles in captivity as a food source. Because of numerous biological and conservation problems, such an aquaculture plan for commercial purposes was not deemed to be realistic or acceptable at the present time. Several scientific and popular articles have been published based on the results of Mr. Balazs' sea turtle research.

Some of the study's more important objectives are listed as follows:

1. To locate and inventory concentrations of turtles around the major inhabited islands as well as at areas in the more remote Leeward chain. Investigations in the Leewards will serve to complement a joint State-Federal resource assessment survey of the area that is scheduled to begin later this year.
2. To determine the distribution and abundance of algae that is used for food by Hawaiian green turtles.
3. To determine the rate of growth and age at sexual maturity under natural conditions. Factual information on these two aspects is virtually nonexistent for any green turtle population. Several sites in the Hawaiian chain provide exceptional opportunities for gaining this knowledge through tag and recapture studies.
4. To determine the reproductive potential as well as the mortality factors limiting the population.

Although headquarters for the study will be the Hawaii Institute of Marine Biology, work will be carried out in close cooperation with the State Division of Fish and Game, the National Marine Fisheries Service, and the U. S. Fish and Wildlife Service. In addition, members of the general public that have information about Hawaiian sea turtles will be encouraged to contact Mr. Balazs (tel. 247-6631).

Three species of sea turtles occur in Hawaiian waters, the green (Chelonia sp.), the hawksbill (Eretmochelys sp.), and the leatherback (Dermochelys sp.). Of these, the green, or "honu" as it is called in Hawaiian, is by far the most common. Although green turtles occur at a number of other locations around the world, the population native to Hawaii is unique. In addition to being the only population that carries out its entire life cycle in the United States, Hawaiian green turtles have the unusual behavioral trait of crawling out on remote beaches in the Leeward chain and sun basking for hours at a time.

Green turtles are famous for their long distance migrations which are made for breeding purposes. In Hawaii, they are known to periodically travel

distances of 500 miles or more to the small islets of French Frigate Shoals (in the Leeward chain) to mate and lay eggs. Many of these adults spend the greater portion of their lives feeding on algae (limu) that grows in shallow waters around the main inhabited Hawaiian Islands.

Most of the world's sea turtle populations are experiencing significant declines due to habitat destruction, disturbance, and overexploitation for meat, hides, shell and soup stock. In 1974 the Department of Land and Natural Resources adopted a regulation to help conserve the sea turtles found in Hawaii. Under this regulation hawksbills and leatherbacks are fully protected. These two species also receive full protection under the Federal Endangered Species Act of 1973. The taking of green turtles is still allowed in Hawaii but only by permit for home consumption and only if they are 36 inches or more in shell length. Prior to the 1974 State regulation, Hawaiian green turtles were commercially exploited for the restaurant trade at an alarming rate. Available evidence indicates that the population was reduced considerably. A thorough biological understanding of the population must therefore be achieved if we are to ensure the survival and perpetuation of this native resource for the benefit of future generations.