MAC GREEN TURTLE PROJECT ACTIVITIES REPORT - JULY 1976 TO JULY 1977

by
George H. Balazs
Hawaii Institute of Marine Biology

University of Hawaii at Manoa

Hawaii Institute of Marine Biology
P.O.Box 1346 • Coconut Island • Kaneohe, Hawaii 96744
Cable Address: UNIHAW

MEMORANDUM

August 1, 1977

To: Mr. Hideto Kono
Interim State Marine Affairs Coordinator
Office of the Governor

From: George H. Balazs
Jr. Marine Biologist
& Principal Investigator
Green Sea Turtle Management Study
Task Order No. 118

Subject: PROJECT ACTIVITIES REPORT FOR THE MONTHS OF JULY 1976 TO JULY 1977

I. Brief Project History and Objectives

The 1976 State Legislature appropriated funds to the Marine Affairs Coordinator for a green sea turtle management study to be conducted in Hawaiian waters. Funding for part of the Principal Investigator's salary was made available through the Research Corporation of the University of Hawaii starting in July 1976. Funds for equipment, supplies, travel and other project needs for year one became available in September 1976 (see press release, Appendices A and B).

The overall objective of this study is to develop basic biological 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 less than adult size 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. Further information on the project's specific objectives is contained in Appendices C and Y.

It is important to emphasize that this is a *field intensive* project which requires the Principal Investigator to spend extended periods at various locations throughout the 1600 mile long Hawaiian chain engaged in survey, capture and tagging activities. It is also important to note that a significant portion of the research being undertaken is unique in that it has not been previously carried out for other marine turtle populations. The results derived will therefore be viewed with considerable interest by the international scientific community, as well as by fishery and wildlife managers in Hawaii.

II. Project Staffing

The Principal Investigator has received 50% of his salary from funds that have thus far been released by the Marine Affairs Coordinator. In addition, a student research assistant under the partial auspices of the University of Hawaii's Marine Option Program is presently employed in the project. Experienced fishermen and other individuals knowledgeable of Hawaiian turtles serve periodically as paid consultants.

III. Summary of Activities

A. All necessary Federal and State permits have been obtained for authorization to conduct the research program.

B. At the Principal Investigator's request (Appendix D), a total of 19 Federal, State and private agencies was formally notified by the Marine Affairs Coordinator of the project's initiation and asked to provide assistance on a mission congruent basis. A representative sample of the letters sent to these agencies appear as Appendices E and F; samples of the supportitive responses received appear as Appendices G through K.

In the same context of fostering public awareness of the project and soliciting cooperation, the Principal Investigator has appeared as a guest lecturer on 16 occasions for ocean-oriented recreational clubs, community service groups, and other organizations (see Appendices L and M for sample acknowledgements). In conjunction with written correspondence to numerous other organizations and individuals, the project has been established on a sound foundation with a network of Archipelago-wide informants providing data on the occurrence and activities of turtles. This has been facilitated in part through the use of specially prepared sighting report forms (Appendix N). Additionally, several of the more sophisticated cooperative monitoring programs implemented include aerial spotting of turtles by pilots of the 22 TASS Intelligence Squadron of Wheeler Air Force Base, the Barber's Point Coast Guard Air Station, and the Aviation Support Facility of the Hawaii Army National Guard.

C. A superior turtle identification tag constructed from the highly corrosion resistant alloy, Inconel 625, has been developed in collaboration with the National Band and Tag Company (Newport, KY) especially for the Hawaiian research program.

D. Preliminary underwater surveys and tagging expeditions have been conducted at select locations on Oahu, Hawaii, Kure, Midway and French Frigate Shoals. Preliminary low level reconnaissance flights in rented small aircraft have been made of the coastal areas of Oahu, Molokai, Lanai, Kauai and Niihau. Findings of immediate importance have been communicated to the appropriate agencies and individuals (Appendices O through R).

E. A methodology has been successfully developed for the use of large mesh nets in the live-capture of green turtles for research purposes (Appendix S).

F. A non-injurious technique has been successfully developed for the acquisition of food samples from the stomachs of live green turtles.

G. A comprehensive reference collection of preserved material has been assembled for use in identifying the species, numbers and sizes of turtles recovered from shark predation. Cooperative research on the predator-prey relationships of sharks and turtles has been established with Dr. L. Taylor of the Waikiki Aquarium and Mr. Gary Naftel of the Easy Rider Corporation (Appendix T).

H. Cooperative assistance has been provided to Sea Life Park Inc. with respect to the nesting and hatching of captive green turtles in an artificial environment. Results of these activities have been disseminated internationally to other researchers of marine turtles (Appendix U).

I. Fibroepithelial tumors which occur on Hawaiian green turtles with some degree of regularity have been collected and submitted to specialists at the Smithsonian Institution for analyses and evaluation.

J. A cooperative program of data collection has been established with researchers of the monk seal in the Northwestern Hawaiian Islands. Information acquired during the course of field activities by each respective program is being exchanged at periodic intervals (Appendix V).

K. As a service to the Pacific community, an honorary short-term consultancy assignment was accomplished between February 21 and March 12 for the South Pacific Commission (Appendix W). The resulting confidential report entitled, South Pacific Commission Turtle Project-A Constructive Review and Evaluation with Recommendations for Future Action, has been provided to the Marine Affairs Coordinator under separate cover.

L. The Principal Investigator and Dr. G. Causey Whittow of the University of Hawaii's Physiology Department have jointly received a $3,660. grant from the National Geographic Society to study over the next two years the thermal ecology of land basking Hawaiian green turtles. This sub-project represents a valuable addition to the overall management study in progress.

Using funds anticipated from the Marine Affairs Coordinator for matching purposes (Appendix X), complementary financial support has been obtained from the University of Hawaii's Sea Grant Program for the fiscal years 1977 to 1979. A copy of the Principal Investigator's Sea Grant Proposal and budget appear as Appendix Y. Funds to be received beginning September 1977 will be used mainly to support 50% of the Principal Investigator's salary. It should be noted that Sea Grant (UH) placed a $20,000 annual limit on the project's budget due apparently to constraints in their overall program. This amount must also include the 47% indirect overhead costs charged by the University of Hawaii.

IV. No problems in the successful accomplishment of this project can be foreseen at the present time.

It is respectfully requested that funds amounting to $20,000 (as indicated by MAC memo, Appendix X) be released to RCUH at this time for year two, 1977-1978, of the project.

A budget for the judicious expenditure of these funds is presented as follows.

RCUH Budget Category		Use	Amount
01	Salaries	50% of the Principal Investigator's salary and 6 months salary for research assistant	$ 12,132
02	Fringe Benefits		2,266
03	Equipment	additional shark gun & back-up SCUBA regulator	200
04	Supplies	replacement turtle nets, anchors, buoys, line, additional tagging gear, camping gear, charts, photographic materials	800
05	Travel	intrastate air fare, per diem, outer island vehicle rental	1,550
06	Consultants	local fishermen and knowledgeable SCUBA divers	750
07	Publications	graphics and prints	75
08	Other	small aircraft rental, lab users fee, telephone calls, University vehicle mileage	1,250
09	Overhead		951
	TOTAL		$ 19,974

V. It is also requested that within the next few weeks, the Marine Affairs Coordinator send short letters of recognition to the following organizations acknowledging the continuing valuable assistance which they are providing to this project. Similar additional letters to other organizations will be requested as the project progresses.

22 TASS Intelligence Squadron
c/o Master Sergeant H. Edwards
1373E Wiliwili Circle
Wheeler Air Force Base
APO San Francisco, CA 96515

(for aerial spotting of turtles during regular missions)

Lt. Colonel Paul Phillips
Hawaii Army National Guard
Aviation Support Facility, Bldg. 829
Wheeler Air Force Base
APO San Francisco, CA 96515

(for aerial spotting of turtles during regular missions)

Rear Admiral James Moreau
Commander, 14th Coast Guard District
300 Ala Moana
Honolulu, HI 96850

(for transportation on Coast Guard aircraft, Loran Station support and aerial spotting of turtles)

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GEORGE R. ARIYOSHI
GOVERNOR

JOHN P. CRAVEN, PH. D., J.D.
MARINE AFFAIRS COORDINATOR

FOR IMMEDIATE RELEASE

STATE OF HAWAII
MARINE AFFAIRS COORDINATOR
OFFICE OF THE GOVERNOR
P. O. BOX 2840
HONOLULU, HAWAII 96803

September 9, 1976

STATE SPONSORS "SURVIVAL STUDY" OF GREEN SEA TURTLE

How can the people of Hawaii continue to enjoy that popular ocean delicacy, the green sea turtle, while also making sure that the species continues to survive in adequate numbers?

The answer to that question will be sought via a three-year management study of the green sea turtle that begins this month. Funded by the State of Hawaii, via the Marine Affairs Coordinator in the Governor's Office, the study will be conducted by George H. Balazs, of the Hawaii Institute of Marine Biology. He is regarded as the State's leading expert on sea turtles.

A special Legislative mandate calling for the green turtle study was included in the supplementary budget passed by the Legislature and signed by the Governor this year. The study has long been a concern of Senator Jean King and the Senate Committee on Ecology, Environment and Recreation, which she heads.

Some of the study's more important objectives are:

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 (HIMB), 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 who have information about Hawaiian sea turtles will be encouraged to contact Mr. Balazs by calling HIMB.

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 State 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 a rate that alarmed many marine biologists. Available evidence indicates that the population was reduced considerably. A thorough biological understanding of the population is necessary to ensure the survival and perpetuation of this native resource for the benefit of future generations, which is the ultimate objective of the State study.

Saturday, September 11, 1976 Honolulu-Star-Bulletin

Hawaiian green-sea turtles with a seal.

Green Sea Turtle Study Will Begin This Month

A three-year management study that begins this month will pinpoint concentrations of the Hawaiian Green Sea Turtle in State waters and in the more remote areas of the Leeward chain.

The study in the Leeward Islands beyond Kauai will complement a joint State-federal resource assessment survey of the area scheduled to begin later this year.

Other survey objectives include determining the distribution and abundance of algae used as food by the Hawaiian green sea turtle.

The purpose of the study is to insure that adequate numbers of the Hawaiian green sea turtle, a popular ocean delicacy, will continue to survive.

George H. Balazs of the Hawaii Institute of Marine Biology will conduct the State-funded study.

He will attempt to determine the rate of growth and age of this turtle at sexual maturity under natural conditions.

This type of information on the green turtle is virtually nonexistent, he said.

The study also will cover the reproductive potential, as well as mortality factors limiting the population.

These turtles are known to travel 500 miles or more to French Frigate Shoals in the Leeward chain for mating.

Many of the adults spend most of their lives feeding on algae or limu in Hawaiian waters.

UNIVERSITY OF HAWAII
Hawaii Institute of Marine Biology

MEMORANDUM July 20, 1976

To: Howard Pennington
Deputy Marine Affairs Coordinator

From: George H. Balazs
Jr. Marine Biologist

Subject: THE THREE YEAR HAWAIIAN GREEN TURTLE MANAGEMENT STUDY

A. BRIEF HISTORICAL STATEMENT OF THE PROJECT

Management oriented studies of Hawaii's native green sea 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. Separate 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 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 resource.

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.

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

C. KINDS AND LEVELS OF ACTIVITIES TO BE UNDERTAKEN

1. Locate and inventory concentrations of animals in algal feeding pastures around the major islands.

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

3. Analyze and interpret existing and future turtle catch statistics and interview fishermen.

4. Conduct land and aerial reconnaissance surveys to locate any reproduction which may still occur in the major islands.

5. Continue seasonal intensive nesting studies at French Frigate Shoals.

6. Survey at periodic intervals other sites in the Northwestern Hawaiian Islands.

7. Conduct tag and recapture studies of juvenile animals at Midway and Kure Atol in cooperation with resident personnel.

D. NEED FOR THE PROJECT AND THE BENEFITS DERIVED

Both the Department of Land and Natural Resources, U. S. Fish and Wildlife Service and the Hawaii State Legislature have long recognized and reiterated the need for an in-depth green turtle study, particularly in waters adjacent to the major islands. Unfortunately, the absence of financial support has, up until this time, prevented the establishment of such a project.

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 survival and perpetuation of this unique native resource.

E. PERSONNEL AND FINANCIAL REQUIREMENTS

Because of the nature of the project's activities, it will be necessary to expend the appropriated $50,000 over a three year period. Funds will basically be used for: 1 project leader (1/2 time); 1 student helper; periodic consultants (resident turtle fishermen); tagging capture equipment; small boat charter; and outer island travel. A detailed budget for project year one is included in a separate memorandum.

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, the Honolulu laboratory of the National Marine Fisheries Service and the Marine Options Program is anticipated.

F. SUMMARY STATEMENT

Sufficient biological information must be available to both State and Federal agencies 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.

mk

University of Hawaii at Manoa

Hawaii Institute of Marine Biology
P.O.Box 1346 • Coconut Island • Kaneohe, Hawaii 96744
Cable Address: UNIHAW

July 27, 1976

To: Howard Pennington
Marine Affairs Coordinator

From: George H. Balazs
Jr. Marine Biologist

This is to express my gratitude to your office for the funding commitment that will at long last permit the initiation of intensive green sea turtle studies throughout the Hawaiian Islands. As you know, the importance of this work, both for the survival of the species and the benefit of man, has been stressed by numerous parties on many occasions over the past years. I am sure that all those interested in this matter will be pleased to learn of the decisive action that has been taken.

It is my belief that one of the best ways to start this project is to actually make its existence known to State and Federal agencies that either have an interest in sea turtles or have the potential for aiding in my research. I would like to suggest that in the near future it would seem appropriate for your office to write a brief memorandum to these agencies. This would serve the dual purpose of interagency information and a request, where possible, for assistance and/or cooperation. I have taken the liberty of composing a draft memorandum along these lines in order to give you an example of what I feel may be appropriate and beneficial. Your consideration of this suggestion would be appreciated.

I found our meeting of July 22 to be informative and pleasant. I am sure that a better understanding was gained of the problems faced in both of our respective jobs. As the project progresses, I would like to meet with you at periodic intervals in order to continue our good lines of communication.

GHB:md

GEORGE R. ARIYOSHI
GOVERNOR

JOHN P. CRAVEN, PH. D., J.D.
MARINE AFFAIRS COORDINATOR

STATE OF HAWAII
MARINE AFFAIRS COORDINATOR
OFFICE OF THE GOVERNOR
P. O. BOX 2840
HONOLULU, HAWAII 96803

August 24, 1976

Captain D. H. Fischer
Commanding Officer
Naval Station, Midway Island

Dear Captain Fischer:

This letter will introduce Mr. George H. Balazs, of the Hawaii Institute of Marine Biology.

The Marine Affairs Coordinator (Governor's Office, State of Hawaii) has assigned Mr. Balazs the responsibility of carrying out a three-year scientific management study of the Hawaiian green sea turtle. This is an important phase of an upcoming, long-range survey of all the marine resources of the Northwestern Hawaiian Islands. This survey involves the National Marine Fisheries Service and the Federal Fish and Wildlife Service, as well as State agencies.

Any assistance the Navy might be able to offer Mr. Balazs in connection with those aspects of his study which involve Midway would be most appreciated.

Many thanks in advance for any cooperation that you are able to offer Mr. Balazs in carrying out this important scientific study.

Aloha and mahalo

Howard Pennington

HOWARD PENNINGTON
Acting Marine Affairs Coordinator

HP:ht

GEORGE R. ARIYOSHI
GOVERNOR

JOHN P. CRAVEN, PH. D., J.D
MARINE AFFAIRS COORDINATOR

STATE OF HAWAII
MARINE AFFAIRS COORDINATOR
OFFICE OF THE GOVERNOR
P. O. BOX 2840
HONOLULU, HAWAII 96803

September 15, 1976

Rear Admiral James W. Moreau
Commander, 14th Coast Guard District
677 Ala Moana Boulevard
Honolulu, HI 96813

Dear Admiral Moreau:

This letter is to inform you that the Office of the Marine Affairs Coordinator has recently initiated funding of a three-year study of the Hawaiian Green Sea Turtle. The work will be carried out by Mr. George Balazs, Jr., Marine Biologist with the University's Hawaii Institute of Marine Biology. Attention will be focused on locating and surveying aggregations of turtles around the major inhabited islands as well as remote areas in the Leeward chain.

This project is an important phase of a long-range survey of all the marine resources of the Northwestern Hawaiian Islands. This survey involves the National Marine Fisheries Service and the Federal Fish and Wildlife Service, as well as State agencies.

In order to achieve a high level of project effectiveness, cooperation is being solicited from State and Federal agencies with the potential for providing assistance. Such assistance is only being requested where it would be of no direct cost, and conducive to each agency's own particular mission. Assistance may take the form of logistics support, use of equipment, consultation with personnel, access through Federal or State lands, and other activities as deemed appropriate and desirable. In this respect, Mr. Balazs will be contacting you in the coming months. Where possible, your cooperation with his work will be greatly appreciated.

Aloha and mahalo

HOWARD PENNINGTON
Acting Marine Affairs Coordinator

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDER (oan)
Fourteenth Coast Guard District
677 Ala Moana
Honolulu, Hawaii 96813

10570
Ser 32423

1 OCT 1976

Mr. Howard Pennington
Acting Marine Affairs Coordinator
Office of the Governor
P. O. Box 2840
Honolulu, Hawaii 96803

Dear Mr. Pennington:

This is to acknowledge receipt of your letter of 15 September 1976.

I have instructed my staff to assist Mr. Balazs as necessary in his continued studies of the Hawaiian Green Sea Turtle on a mission-congruent basis.

Transportation arrangements may be made with Chief Warrant Officer Lee of my Comptroller staff at telephone 546-5523.

If we may be of any further assistance, feel free to contact LTJG Ramsey of my Operations staff at 546-7130.

Sincerely yours,

J. W. CAFFREY
Captain, U. S. Coast Guard
Commander, Fourteenth Coast Guard District
Acting

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

DIVISIONS:
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FISH AND GAME
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

October 5, 1976

MEMORANDUM

TO: All Division of Fish and Game Biologists, Enforcement Officers and other Field Personnel

FROM: Michio Takata, Director, Division of Fish and Game

SUBJECT: Assistance to Dr. George H. Balazs in his Marine Turtle Study

This is to advise that Dr. Balazs is currently engaged in a State-wide marine turtle study to develop much needed data concerning the biology and other aspects of the life history of our marine turtles. During the course of his study he might want to contact and personally interview you in order to obtain what information you might have concerning locations and numbers of marine turtles.

Further, for his in-water (SCUBA) and shoreline surveys at a number of locations on each island he might be seeking your assistance in guiding him to remote areas and in providing transportation support involving our boats and vehicles.

Please assist him to the fullest extent that your programs and schedules will feasibly permit. The information being developed by Dr. Balazs will be extremely useful to us, particularly with respect to the management of the green sea turtle.

Michio Takata

MICHIO TAKATA

MT:rfm

cc: George H. Balazs

HEADQUARTERS
FOURTEENTH NAVAL DISTRICT
BOX 110
FPO SAN FRANCISCO 96610

IN REPLY REFER TO:
48A:FWD:cdg
Ser 2679

17 NOV 1976

Mr. Howard Pennington
State of Hawaii
Marine Affairs Coordinator
P.O. Box 2840
Honolulu, Hawaii 96803

Dear Mr. Pennington:

Thank you for your letter of 29 September 1976 addressed to Pacific Division, Naval Facilities Engineering Command which informed the Navy of the appointment of Mr. George Balazs who will conduct a study of the Green Sea Turtle in Hawaiian waters.

Where feasible, we will assist Mr. Balazs in this worthwhile study. It is requested that future correspondence regarding Navy assistance with the project be addressed to Captain R. P. Nystedt, District Civil Engineer, Headquarters Fourteenth Naval District, Box 110, FPO San Francisco 96610.

We look forward to receiving information essential to the preservation and management of the Green Sea Turtle species.

Sincerely,

R. P. NYSTEDT
CAPTAIN, CEC, USN
DISTRICT CIVIL ENGINEER
BY DIRECTION OF THE COMMANDANT

DEPARTMENT OF THE NAVY
PACIFIC MISSILE RANGE FACILITY
HAWAIIAN AREA
BARKING SANDS
KEKAHA, KAUAI, HAWAII 96752

7003/HCB:pak
5750
Ser 2343
24 NOV 1976

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

Dear Mr. Balazs,

In regard to your letter of November 12, 1976, this facility will be most happy to cooperate in your endeavors to gather information on sea turtles in the Kauai area.

The sea turtle sighting report forms will be placed on our weapons recovery boats and aircraft. Additionally, the forms will be provided to the senior Diving Officer whenever there are any diving missions in the local area. We will be providing similar information on humpback whales to your colleague, Dr. Lou Herman.

I would be very pleased to meet with you on your forthcoming trip to Kauai.

Sincerely,

R.C. JONES
Captain, U.S. Navy

UNITED STATES MARINE CORPS
MARINE CORPS AIR STATION
KANEOHE BAY, HAWAII
FPO SAN FRANCISCO 96615

IN REPLY REFER TO:
A/JHM/jet
1700
8 Dec 1976

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

Dear Mr. Balazs:

I am in receipt of your letter of November 30, 1976 with the forms for reporting sightings of green sea turtles. The forms will be distributed to the following organizations which I believe would be most likely to make such observations:

Station Operations and Maintenance Squadron
Commanding Officer - Phone #257-2716

Hawaii Laboratory, Naval Undersea Center
Director - Phone #254-4444/4311

Scuba Club
President (Master Sergeant Ed Quinn) - Phone #257-2228

We will be happy to assist you in surveying coastal areas of the Marine Corps Air Station. For purposes of coordination, please contact Mr. Tom Cajski, phone #257-3522.

Sincerely,

J. H. MILLER
Colonel, U. S. Marine Corps
Commanding

Copy to:
SOMS
NUC
Scuba Club
PWD

University of Hawaii
Waikiki Aquarium

2777 Kalakaua Avenue Honolulu, Hawaii 96815 Phone 923-9741 923-4725

October 27, 1976

Mr. George Balaza
c/o HIMB Coconut Island
P.O. Box 1346
Kaneohe, Hawaii 96744

Dear Mr. Balaza,

The Waikiki Aquarium Education Staff wishes to thank you for talking to our Docent training class this semester.

The Docents truly appreciate the opportunity to discuss areas of marine science with the experts.

Through helping our Docents you have contributed greatly toward the understanding of the marine world by the general public as our 35 Docents will be expected to guide over 21,000 school children through the Aquarium this year.

Sincerely,

Leighton Taylor

Dr. Leighton R. Taylor
Ms. Sara Peck

LT:aw

DEPARTMENT OF DEFENSE
DEPENDENTS SCHOOLS
GEORGE CANNON SCHOOL
FPO SAN FRANCISCO 96614

PACIFIC

8 June 1977

Dr. John Bardach, Director
Hawaii Institute of Marine Biology
P. O. Box 1346
Kaneohe, Hawaii 96744

Dear Dr. Bardach:

This is in recognition of the outstanding workshops and conferences conducted by George H. Balazs during his recent stay on Midway Island.

On Friday, 27 May, an assembly was held for grades 5-12; that afternoon we had a faculty in-service on Eastern Island. On Tuesday, 31 May, two sessions were held with primary children. All of these events were extremely effective. George's professionalism and ability to adjust to wide differences in ages and backgrounds was remarkable. It was truly a fine educational experience for all concerned.

If there is any way that any of us can be of assistance to you or to George, don't hesitate to call on us.

Sincerely,

KENNETH F. RHEA, Ph.D.
Principal

KR:bs

cc: George Balazs

SEA TURTLE SIGHTING REPORT

(Please return to: George H.Balazs;
Hawaii Institute of Marine Biology;
P. O. Box 1346; Kaneohe, HI 96744;
Tel. 247-6631)

Observation made by:_____

Address & Tel. No. (optional):_____

Date:_____ Time:_____ Location (indicate on chart):_____

Observation made from:___shore;

____boat; or while ____skin ____SCUBA diving.

Estimated size (shell length):_____

Turtle seen on: ____surface; or at depth of approx. ____ft. Distinguishing characteristics (species I.D. if known, long tail, shell color, tags, injuries, etc.):

_____

_____

Other comments:_____

_____

THANK YOU FOR YOUR COOPERATION

SEA TURTLE SIGHTING REPORT

(Please return to: George H. Balazs, Hawaii Institute of Marine Biology; P. O. Box 1346; Kaneohe, HI 96744; Tel. 247-6631)

Observation made by:_____

Address & Tel. No. (optional)_____

Date:_____ Time:_____ Location (indicate on chart):_____

Observation made from:_____shore; ____boat; or while ____skin ____SCUBA diving.

Estimated size (shell length):_____

Turtle seen on:_____surface; or at depth of approx. ____ft. Distinguishing characteristics (species I.D. if known, long tail, shell color, tags, injuries, etc.):

FRENCH FRIGATE SHOALS

_____

_____

Other comments:_____

_____

_____

THANK YOU FOR YOUR COOPERATION

SEA TURTLE SIGHTING REPORT

(Please return to: George H. Balazs, Hawaii Institute of Marine Biology; P. O. Box 1346, Kaneohe, HI 96744; Tel. 247-6631)

Observation made by:_____

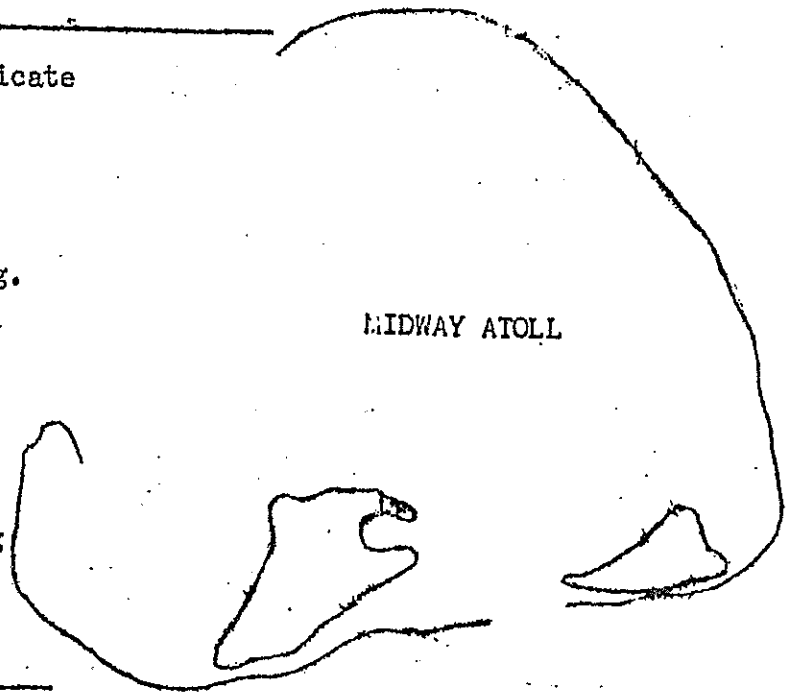
Address & Tel. No. (optional)_____

Date: _____ Time:_____ Location (indicate on chart):_____

Observation made from:____shore; ____boat; or while ____skin ____SCUBA diving.

Estimated size (shell length):_____

Turtle seen on: ____surface; or at depth of approx. ____ft. Distinguishing characteristics (species I.D. if known, long tail, shell color, tags, injuries, etc.):



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Other comments:_____

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____boat; or while ____skin ____SCUBA diving.

Estimated size (shell length):_____

Turtle seen on: ____surface; or at depth of approx. ____ft. Distinguishing characteristics (species I.D. if known, long tail, shell color, tags, injuries, etc.):

_____

_____

Other comments:_____

_____

THANK YOU FOR YOUR COOPERATION

University of Hawaii at Manoa

Hawaii Institute of Marine Biology
P.O.Box 1346 • Coconut Island • Kaneohe, Hawaii 96744
Cable Address: UNIHAW

September 28, 1976

To: Michio Takata, Director
Division of Fish and Game

Eugene Kridler
Endangered Species Coordinator
U. S. Fish and Wildlife Service

Matt Dillon
Senior Enforcement Agent
U. S. Fish and Wildlife Service

From: George H. Balazs
Jr. Marine Biologist

During a recent trip to the Island of Hawaii I was able to document and compile factual information on the successful nesting of a hawksbill turtle (Eretmochelys imbricata). In view of this species' "endangered" classification, I thought that it would be useful to your respective agencies to receive a summary report on this rare occurrence.

On July 4, August 1 and August 23 the tracks and excavations of a sea turtle were noted on a black volcanic sand beach situated three miles northwest of Cape Kumukahi, Hawaii. This relatively isolated strip of sand extends for only approximately 150 yards and is locally known as Orr's Beach. On September 23 and 24, I visited this beach as a guest of the adjacent residents (Mr. and Mrs. J. B. Orr) in order to inspect and evaluate the turtle excavation sites. Based on the locations and appearances, I tentatively concluded that only one excavation (August 23) had resulted in the successful deposition of eggs. Overlying sand at this site was carefully removed so as to barely expose the top of the clutch. The small diameter (approximately 1 3/8") of the eggs observed indicated to me that the genus involved was Eretmochelys rather than Chelonia (green turtle). Taking into consideration the temperature of the underlying sand, as well as the incubation times required for hawksbill clutches laid on a similar black sand beach (Punaluu) in 1974 and 1975, I estimate that hatchlings will emerge from the nest during the last week of October. During the ensuing weeks until emergence, Mr. and Mrs. Orr and other concerned residents intend to watch over the clutch in an effort to prevent

Memo to Michio Takata
Eugene Kridler
Matt Dillon

September 28, 1976
Page 2

disturbance by either human or animal factors. As an additional safeguard against attracting adverse attention to the clutch, I have recommended that it would be best not to make a public announcement of this nesting occurrence at the present time.

I anticipate being on the Big Island during early November. Upon my return, I will provide your agencies with information on the outcome of the emergence.

GHB:md

University of Hawaii at Manoa

Hawaii Institute of Marine Biology
P.O.Box 1346 • Coconut Island • Kaneohe, Hawaii 96744
Cable Address: UNIHAW

January 12, 1977

MEMORANDUM

To: Michio Takata, Director
Division of Fish and Game

From: George H. Balazs
Jr. Marine Biologist, HIMB

One of the early important findings of my green turtle surveys around the major islands is the identification of an aggregation of subadults in waters adjacent to the new reef runway. In view of the relatively small area involved, this could very well turn out to be the densest concentration of turtles around the Island of Oahu. The discovery was originally made by aerial spotting, however, I am now in the process of initiating underwater surveys of the area in order to obtain information of a more detailed nature. Questions that immediately arise in this interesting case are; 1) has the landfill construction of the runway destroyed valuable turtle feeding habitat, or has the construction somehow actually created environmental conditions attractive to turtles? In other words, were turtles previously concentrated in this area? and,2) what effects, if any, will aircraft have on the turtles when the new runway is placed in service about one year from now? Hopefully we will eventually be able to answer these important questions.

My purpose in communicating this information to you at such an early date is twofold. First, I thought you would find it quite interesting. Normally there is a tendency to think of turtle aggregations today being principally located in remote areas, rather than virtually at our backdoor. Second, I thought you might want to alert your enforcement division of this finding so as to guard against any possible abuses.

I will pass on further information to your division as it becomes available.

GHB:ec

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

DIVISIONS:
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FISH AND GAME
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

January 24, 1977

Dr. George H. Balazs
Jr. Marine Biologist
University of Hawaii
Hawaii Institute of Marine Biology
P. O. Box 1346 Coconut Island
Kaneohe, Hawaii 96744

Dear George:

Thank you for your memorandum of January 12, 1977 relating your observation of an aggregation of subadult turtles in waters adjacent to the new reef runway.

Upon referral of this information to members of my staff, I was apprised that turtles of about 20" in carapace length were commonly observed in the area of the Fort Kam (Hickam AFB) to the Kalihi Channel prior to the development of the new reef runway. However, no "dense" concentrations of turtles were noted.

In any case, your discovery is most encouraging and seems to be worth pursuing in view of the current considerations being given the Green Sea Turtle species. The Enforcement Branch of this Division has been apprised of the situation and will be on the lookout for violations to our Regulation 36, relating to the protection of marine turtles.

We would greatly appreciate your continued efforts to keep us informed of further developments regarding this matter.

Yours truly,

Michio Takata

MICHIO TAKATA, Director
Division of Fish & Game

MT:PK:rfm

COPY

University of Hawaii at Manoa

Hawaii Institute of Marine Biology

MEMORANDUM

June 9, 1977

To: Kent W. Bridges, Assistant Professor
Botany Department

From: George H. Balazs
HIMB

Subject: Occurrence of *Halophila* sp. at Midway

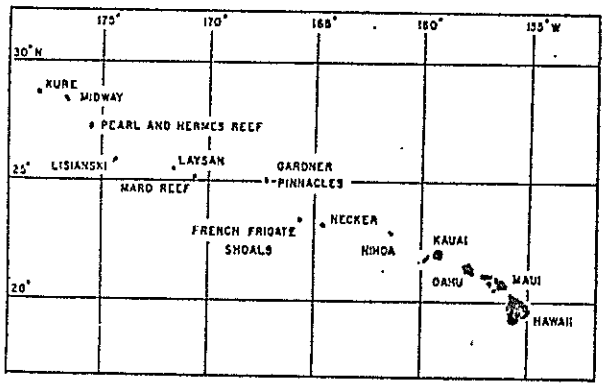
From 25 May to 6 June, 1977 I conducted a series of underwater surveys in the lagoon at Midway for the primary purpose of locating, censusing and tagging green turtles. During the course of this activity, the sea grass *Halophila* was found to occur at two locations. A preserved sample of this material has been enclosed for your inspection and identification. To my knowledge, *Halophila* has not previously been reported from Midway.

The specific sites of occurrence are listed as A and B on the attached chart. Site A consists of a sand and silt bottom with a water depth ranging from 10 to 20 feet. The plants are found in random patches varying from sparse to moderate coverage. Site B comprises a portion of the Navy's inner harbor facility. The bottom substrate is principally silt with a water depth ranging from 20 to 40 feet. I would consider the plant coverage to be very sparse and irregular.

It is interesting to note that no evidence presently exists which indicates that the green turtles at Midway utilize *Halophila* as a food source, such as takes place around Oahu. I will be making additional study visits to Midway during the coming months and will pass on to you any new information which arises on this subject.

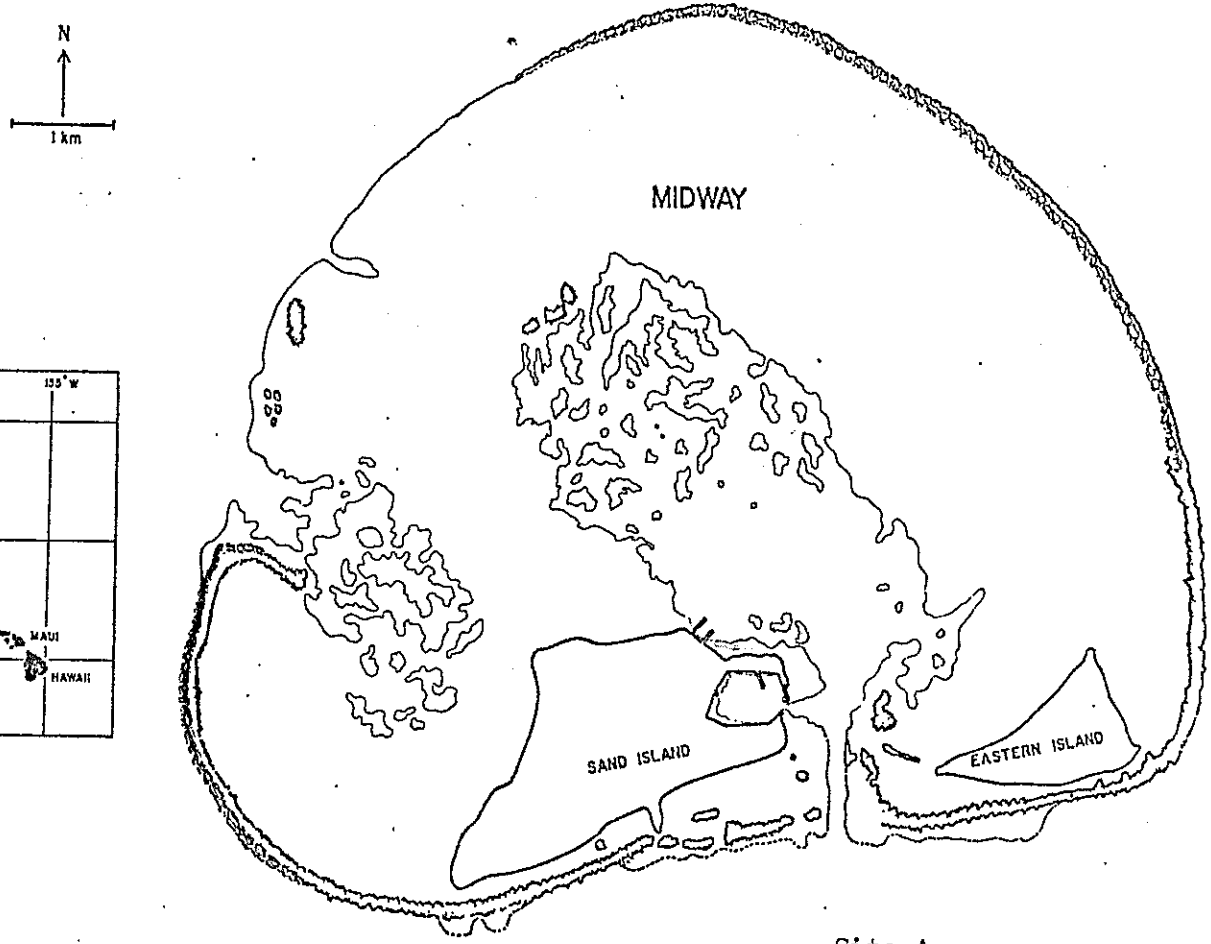
GHB:ec

Encls.



HAWAIIAN ARCHIPELAGO

NORTH PACIFIC OCEAN



Site A-

Site B-

University of Hawaii at Manoa

Hawaii Institute of Marine Biology

MEMORANDUM

June 15, 1977

TO: Mr. Bob Iversen
National Marine Fisheries Service

FROM: George H. Balazs
Hawaiian Green Turtle Management Study

SUBJECT: Occurrence of marine turtles at the Milwaukee Banks

On 2 June 1977, the Taiwanese precious coral harvesting vessel, NO. 2 HAI TIEN, docked for a short time at Midway to obtain medical treatment for an injured crewman. Through a translator, I was able to interview the Captain and several crewmen concerning any observations they may have made of marine turtles in the vicinity of their stated harvesting site of 35°N 174°E. I was informed that on several occasions juvenile turtles of approximately two feet in length had been sighted in areas where the ocean bottom comes to within 300 feet of the surface.

This is the first indication I have had that turtles may utilize shallower portions of banks lying to the Northwest of the Hawaiian chain. There is, of course, the distinct possibility that these turtles are derived from our Hawaiian green turtle population. I would therefore like to ask for your assistance in monitoring, by whatever means appropriate and possible, the occurrence of turtles in such areas. For instance, if there is occasion for your agency to inspect the harvest of a trawler which has operated in the area, perhaps a special inquiry could be made as to observations or incidental catch of turtles.

Thank you in advance for any assistance that you can provide in the matter.

GHB:ec

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
Western Pacific Program Office
P. O. Box 3830
Honolulu, Hawaii 96812

June 22, 1977

FSW1

Mr. George H. Balazs
Hawaii Institute of Marine Biology
University of Hawaii at Manoa
P. O. Box 1067
Kaneohe, Hawaii 96744

Dear George:

Thank you for your memo of June 15 concerning the sighting of marine turtles on the Milwaukee Banks.

We will endeavor to monitor such occurrence whenever the opportunity arises. By copy of this letter, I am sending a copy of your memo to Rear Admiral James Moreau, Commander, 14th Coast Guard District, with a request that any boardings of foreign fishing vessels made by USCG ships in this area keep an eye out for reports of marine turtles seen at sea and also for the occurrence of marine turtles that might possibly have been taken by foreign fishing vessels. Such taking, if it occurs within the U. S. 200-mile fishery conservation zone is illegal and subject to the punitive aspects of the Fishery Conservation and Management Act of 1976.

I will also send a copy to Richard Shomura so that any scientists making cruises to the leewards aboard the Townsend Cromwell will be aware of such occurrences.

Thank you for the information.

Very truly yours,

Bob

Robert T. B. Iversen
Deputy Administrator

cc: Rear Admiral James Moreau (w/cy incoming ltr.)
Richard S. Shomura (w/cy incoming letter)
Wilvan Van Campen, WPRFMC (w/cy incoming ltr.)
E. Nitta, FSW3 (w/cy incoming letter)

REPORT ON THE EXPERIMENTAL USE OF LARGE MESH NETS AS A LIVE-CAPTURE TECHNIQUE IN THE RESEARCH OF HAWAIIAN GREEN TURTLES

prepared for

Mr. Michio Takata, Director

Division of Fish and Game

by

George H. Balazs

Hawaii Institute of Marine Biology

P.O. Box 1346

Kaneohe, Hawaii 96744

CONTENTS

INTRODUCTION

With the exception of ongoing studies in the Hawaiian chain, world-wide research of the life history of marine turtles has thus far focused principally on adult females at their colonial breeding sites. This can be attributed to the importance placed on the reproductive aspect, and to the high level of research efficiency obtainable at such sites where comparatively large numbers of turtles are terrestrially available for tagging and observation.

Although monitoring of the Hawaiian green turtle breeding assemblage at French Frigate Shoals continues to be essential, the major focus of my State (and pending Sea Grant) supported research is on immature turtles occurring in the ocean environment throughout the Archipelago. Objectives of this work include the determination of rates of natural growth, ages at sexual maturity, longevity, and geographical areas of developmental migrations. Such data are basic to understanding the dynamics of a population, however, they are nevertheless virtually nonexistent for any population of marine turtles.

The live-capture of turtles directly from the sea for tagging and observation purposes imposes a number of difficulties and constraints. However, work that I have thus far conducted indicates that problems can be reduced substantially by careful selection of the capturing sites and techniques used. Three basic live-capture methods have been utilized and are listed as follows:

(1) Capture with specially designed long-handled scoops nets, used both from shore and from a small outboard powered boat. This technique has proven most successful at select sites within French Frigate Shoals and Kure Atoll.

(2) Capture by hand, both while free driving and with the use of SCUBA. This is a low efficiency, but nevertheless effective, long term method for tagging immature turtles. To date, it has been used with varying levels of success at select sites around Midway (in cooperation with the Koral Kings Diving Club), Kure, Oahu, Lanai, and Hawaii. Assessments of additional locations in the Hawaiian chain are now in progress.

(3) Capture with modified large mesh nets set vertically in shallow coastal waters. The use of this method as a research tool had been examined in May 1973 (at N. Kona, Hawaii) prior to adoption of Division of Fish and Game Regulation 36 (Protection of Marine Turtles). Results of the test suggested considerable potential, provided suitable precautions were exercised to avert drowning or physical injury to the turtles. Further evaluation was warranted and necessary, thereby resulting in the field trial experiment upon which this present report is based.

In December, 1976 written application was made to Mr. Michio Takata, Director, Division of Fish and Game, for permission to conduct a five day test on the live-capture of green turtles with large mesh nets. I requested that this trial be carried out with the assistance of a consultant fisherman, Mr. Arnold L. Howard of Punalu'u, Island of Hawaii. Mr. Howard has considerable knowledge of turtles and I have found it beneficial to confer with him on several occassions since making his acquaintance in June, 1974. Authorization for the conduction of the field trial

experiment was subsequently granted by the Department of Land and Natural Resources, Division of Fish and Game, through the issuance of Ammendment No. 1 to my Scientific Collecting (Research) Permit No. 7744. One of the conditions of this authorization was that a report on the test be submitted to the Director of the Division for evaluation prior to continued use of the nets.

EQUIPMENT AND METHODS

The test was conducted using four comparatively short sections of net. Two of these nets were made of cotton and measured 62' by 14' with a 26" mesh, and two were made of nylon and measured 73' by 12' with an 18" mesh. On the nylon nets, a three foot wide section of netting adjacent to the leadlines had been soaked in varathane varnish in order to reduce snagging on the ocean bottom. A large inflated tire innertube fitted with a plywood bottom was used to float the nets during the setting process.

Joined sections of net were laid out once daily over a four day period from May 4-7, 1977. Three of these settings were made at Kaalualu Bay (May 4, 5 and 7) and one was made at Punaluu Bay (May 6). In each instance, one end of the net was anchored close to shore, with the set being made nearly perpendicular to the shoreline. At the specific sites selected, the depth of the water did not exceed the width of the nets and, in most cases, was considerably less. After the nets were laid out, the leadlines were examined (using mask and fins) and positioned in such a manner so as to reduce the possibility of snagging on the ocean bottom. The nets were set at approximately 1600 hours of each day and retrieved between 0530 and 0630 hours of the following day.

RESULTS

A total of 16 captures were made involving 15 green turtles, *Chelonia* (Table 1). Although considerably entangled in the netting, all were recovered alive, tagged and released with no indications of serious injury. Most of the turtles, however, appeared to be moderately fatigued from struggling in the nets, and all had minor signs of net abrasion on their front flippers. Observations made from shore of the nets' floatlines revealed that turtles did not become entangled before sunset (1900 h), and probably not before 2200 hours.

The size distribution of the turtles captured (Figure 1) suggests that the nets, both 18" and 26" mesh, were not selective for any particular size category. None of the animals could be identified as being males.

A turtle measuring 31¼" in straight carapace length that was captured on May 4-5 was recovered on May 7-8 in nets set at the original capture site within Kaalualu Bay. The turtle was released for a second time and appeared to be vigorous and uninjured.

On May 19 an unsigned letter (postmarked Volcano, Hawaii) was received which briefly stated that an 18" turtle had been taken at Kaalualu on May 14. An enclosed tag identified the turtle as having been originally captured and released during the test at Kaalualu on May 5-6.

CONCLUSIONS

Results of this test indicate that the carefully controlled use of large mesh nets is a viable research technique for the capture of marine turtles. This is in agreement with the findings of earlier experimentation with nets conducted in May of 1973. The significant advantage of this capture method is the apparent non-selectivity for any particular size category, thereby permitting uniform sampling of an aggregation of turtles. Such sampling does not appear to be possible by the other capture methods discussed in the Introduction of this report. Another favorable factor in the use of nets is the comparatively high level of efficiency obtained for the research time and effort expended. This may, however, be expected to vary with the locations sampled as well as other variables such as time of year.

The recapture made after an interval of three days suggests that the turtles' experience of being entangled in nets did not stress them to the point of abandoning the area. A similar recapture was made in May of 1973 after an interval of only one day. Such findings also tend to indicate that the turtles did not develop an ability to detect and/or avoid nets.

The precautions that have been identified in this test as being necessary to minimize the possibility of drowning or injury to turtles are listed and discussed as follows:

(1) use of optimal nets - Nets must have a light leadline with the adjacent netting treated with a varnishing agent in order to lessen snagging. The use of small sections of net joined together with quick release knots is particularly favorable for the rapid and efficient retrieval of captured turtles.

(2) careful selection of capture sites - Nets must be laid at sites that are generally free of bottom obstructions (particularly coral), and in water of considerably less depth than the width of the nets.

(3) examination and adjustment of leadlines - After the nets are laid, the leadlines must be visually inspected underwater and adjusted accordingly to reduce the possibility of snagging. In certain cases, potential obstructions must be removed from the area.

(4) monitoring and removal of turtles - Nets must be examined at regular intervals and any captured turtles removed at the earliest feasible time. Turtles which become entangled during the nighttime hours should be removed at first light. Retrieving turtles during darkness imposes serious difficulties as well as dangers to the researchers from biting turtles and self-entanglement in the nets.

Even by observing these precautions, there is still the distinct possibility for an occasional turtle mortality or injury to result. However, the risk of such an occurrence is presently considered to be acceptable when compared to the scope and quality of the information that can be obtained.

The use of nets as a research tool in areas frequented by the public can be expected to attract interest and curiosity. In such cases, it would be essential to explain in practical terms the activity that is taking place and to maintain good public relations by whatever means

appropriate.

It should be noted that the use of large mesh nets for capturing turtles in the Northwestern Hawaiian chain is not considered to be feasible due to the probability of accidentally entangling monk seals.

REQUEST

The results and conclusions from this test support the further use of nets in a research capacity for capturing and tagging turtles. It is therefore requested that permission be granted to conduct additional and longer term capture activities around the major Hawaiian Islands. Such work would be carried out at as yet undetermined sites that are found to be consistent with the criteria set forth in this report. Notification of the specific sites selected would be made to the Division of Fish and Game well in advance of the actual work.

Authorization would also be needed for a research employee, Mr. Alan K. H. Kam, to provide me with assistance in the conduction of additional capture work with nets.

Table 1. Results of test using large mesh nets at Kaalualu and Punalu'u, Island of Hawaii

Date	Location	Settings	No. turtles captured, tagged and released
4-5 May 1977	Kaalualu	2 nylon nets joined	2
"	"	2 cotton nets joined	1
5-6 May	Kaalualu	2 nylon nets joined	3
"	"	2 cotton nets joined	2
6-7 May	Punalu'u	2 nylon nets joined	3
7-8 May	Kaalualu	all 4 nets joined	5 (1 recapture)
Total Captures			16

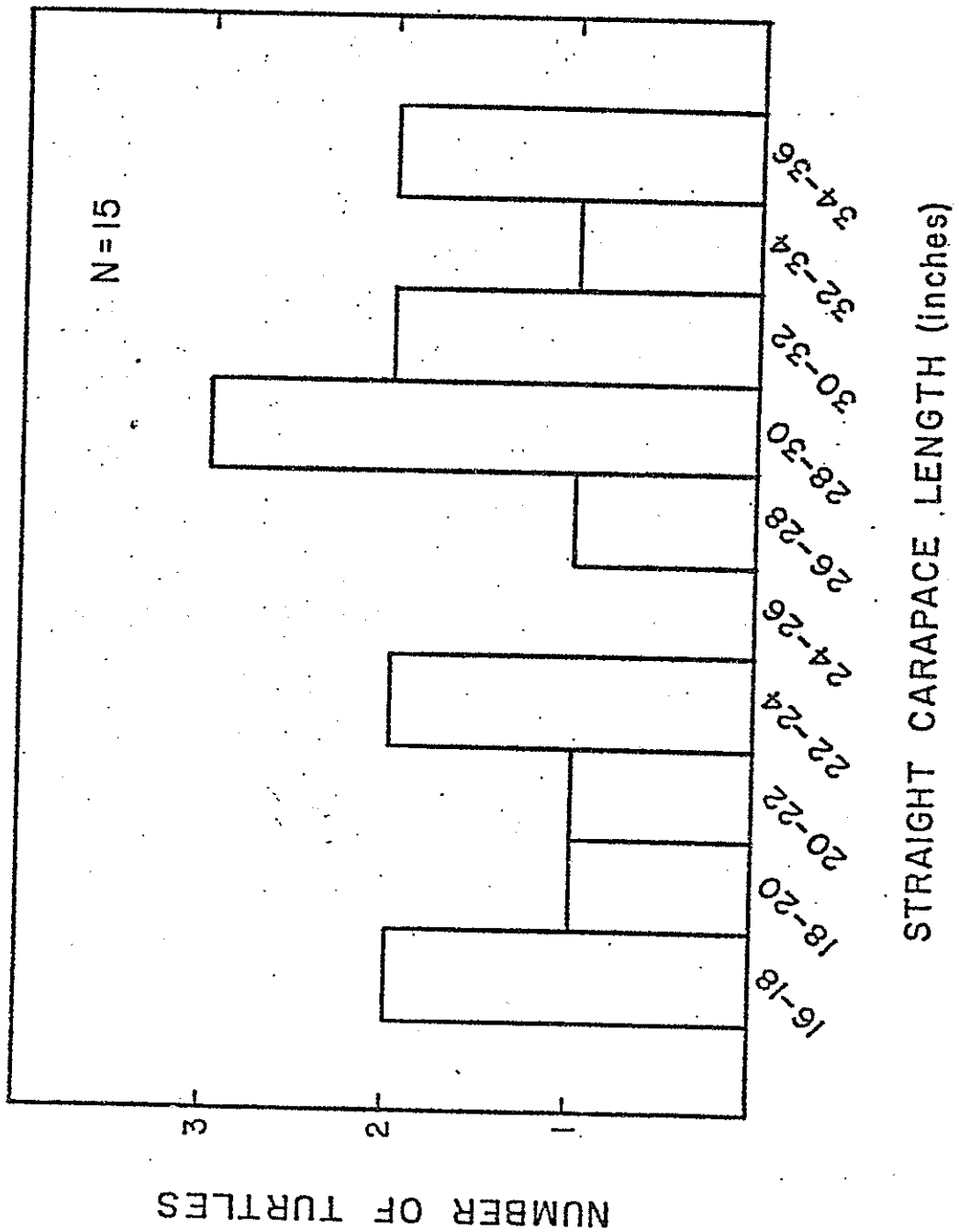


Figure 1. Size distribution of turtles captured in large mesh nets at Kaalualu and Punalu'u, Island of Hawaii

ANALYSES OF TURTLE PARTS RECOVERED FROM SHARK STOMACHS SAMPLED AT PEARL AND HERMES REEF AND FRENCH FRIGATE SHOALS, NORTHWESTERN HAWAIIAN ISLANDS

Internal Summary Report

by

G. H. Balazs
Hawaii Institute of Marine Biology

Introduction

During April and May 1977, shark fishing was conducted at Pearl and Hermes Reef and French Frigate Shoals in conjunction with investigations of shark predation on the Hawaiian monk seal, *Monachus schauinslandi*. Dr. Leighton Taylor and Mr. Skip Naftel are the co-investigators of this research project, with the vessel EASY RIDER being used for capture operations.

Preliminary examinations of stomach contents by the co-investigators revealed that eight of the sharks captured had been feeding on sea turtles. All of the sharks involved were identified as large tiger sharks (*Galeocerdo cuvieri*). Turtle parts were subsequently made available to me for evaluation with respect to species, numbers, and sizes of turtles represented. Information on the species and numbers of sharks caught as well as details of other items recovered from the stomachs will be presented elsewhere by Dr. Taylor and Mr. Naftel.

Background

It is well-known that in Hawaii and other areas of the world sea turtles are a regular dietary component of tiger sharks (Sarangdhar, 1943; Gudger, 1948, 1949; Ikehara, 1960; Tester, 1969; Fujimoto and Sakuda, 1971). However, with the exception of several earlier examinations which I have made, no systematic

analyses have been conducted of recovered turtle parts in order to gain ecological data relevant to the turtle populations involved. Such analyses have considerable potential for providing information on natural mortality rates by size categories, incidence of turtles at particular locations, carapace colorations, food sources used by the turtles and other important factors. In essence, recovery and analyses of turtle parts from shark stomachs permits access to information that would otherwise be very difficult and in some cases impossible to obtain by other techniques.

Methods

The various turtle parts from each of the eight shark stomachs were visually examined and identified as to particular body structure. Intact parts, consisting principally of scutes (carapace and plastron) and the horny beaks covering the jaws, were measured and compared with specimens from turtles of a known size contained in my reference collection. Estimates were then made of the original sizes of the turtles represented. The number of turtles present in each shark's stomach was determined by the size and incidence of body parts, and variations in the pattern and coloration of scutes.

Findings

Results of the analyses are presented in Table 1. All of the parts were identifiable as having originated from green turtles (*Chelonia mydas*). A maximum of 15 different turtles was found to be present in the eight sharks. The four sharks captured at Pearl and Hermes Reef contained eight turtles, while the four sharks captured at French Frigate Shoals contained seven turtles. A single shark from Pearl and Hermes Reef accounted for five turtles.

The estimated straight carapace lengths ranged from 15 to 37 inches, with three turtles being greater than 32 inches and therefore large enough to have been sexually mature. All three of these individuals were from sharks captured at French Frigate Shoals, the colonial breeding site for Hawaiian green turtles during the months of April to September.

Most of the parts consisted of keratinized structures of epidermal origin, such as scutes and beaks. This suggests that such horny material is more resistant to the digestive processes of tiger sharks than bone and tissue. The length of time that a keratinized structure may be retained in a tiger shark's stomach is an important but unknown factor.

With the possible exception of the distal portion of a left front limb found in shark No. 16, it is logical to conclude that all of the recovered parts represented turtle fatalities. There is, however, the possibility that in some instances mortality may have been unrelated to shark attack and occurred prior to ingestion.

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Table 1. Results of Analyses

Capture location and shark ID no.	Capture date	Turtle parts present	No. turtles represented	Estimated sizes straight carapace length (inches)	Estimated sizes approximate weight (lbs)
Pearl and Hermes Reef					
4	20 April 1977	horny beaks covering jaws; scutes from carapace	5	21	45
				22	60
				22	60
				25	90
				25	90
16	20 April	distal portion of left front limb	1	15	15
20	21 April	portion of carapace and plastron; pelvic girdle	1	16	25
30	23 April	scutes from carapace; portion of rib	1	29	140
Total			8		

Table 1. Continued.

Capture location and shark ID no.	Capture date	Turtle parts present	No. turtles represented	Estimated sizes straight carapace length (inches)	Estimated sizes approximate weight (lbs)
French Frigate Shoals					
54	19 May	scutes from plastron; scale from tail	1	25	90
56	19 May	scutes from carapace	3	21	45
				37	275
				37	275
66	20 May	complete carapace (2); complete head (2)	2	15	15
				16	25
71	20 May	scutes from plastron; rib and vertebrae	1	33	200
Total			7		

Addendum to Analyses of Turtle Parts Recovered
from Shark Stomachs - 20 July 1977 by G. H. Balazs

In conjunction with telemetry studies, additional shark fishing was conducted at French Frigate Shoals during June 1977 by Messrs. Taylor, Naftel and a research associate, Tim Tricas. One of the tiger sharks captured (ID no. 9) was found to contain a juvenile green turtle measuring 16 1/8 inches in carapace length. Except for a severed right front limb, this specimen was recovered intact with little evidence of deterioration from digestive action. In addition, the same shark also contained carapace scutes and partially digested ribs and vertebrae of an adult green turtle estimated to measure 36 inches in carapace length.

Like other data presented in the body of this report, the recovery of only carapace scutes, ribs and vertebrae presents an enigma as to the whereabouts of the remainder of the turtle. Some of the more plausible explanations are listed as follows.

1. Only a portion of the turtle was ever ingested by the shark, with the remainder perhaps being consumed by other sharks.
2. The entire turtle was eaten by the shark, however, pieces were regurgitated either before being hooked or while struggling on the hook.
3. The entire turtle was eaten by the shark and all pieces but those recovered underwent digestive action and passed on along the intestinal tract in an unrecognizable form.

If the keratinized structures are in fact exceptionally resistant to digestion, the last explanation (no. 3) would seem to be the least likely in that only 13 of the 38 carapace scutes (present in *Chelonia*) were found in the shark's stomach. In addition, there were no scutes from the plastron or horny beaks from the jaws. The carapace scutes that were present showed no signs of deterioration from digestion. It is therefore unlikely that structures of the same chemical composition could have undergone such radically different rates of digestion.

University of Hawaii at Manoa

Hawaii Institute of Marine Biology
P.O.Box 1346 • Coconut Island • Kaneohe, Hawaii 96744
Cable Address: UNIHAW

November 12, 1976

MEMORANDUM

To: L. Brongersma
A. Carr
G. S. deSilva
D. Ehrenfeld
H. Hirth
G. Hughes
W. King
N. Mrosovsky
P. Pritchard
I. Uchida

From: George H. Balazs

The purpose of this communication is to inform you of the recent nesting and hatching of captive *Chelonia* at the commercial display facility, Sea Life Park. The attached pages present some of the relevant data collected. In view of the scarcity of such reports, I thought it would be appropriate to disseminate specifics at the earliest possible date. Widespread publicity may possibly result from this occurrence, therefore it will be advantageous for you to be knowledgeable of the facts.

Sea Life Park, located on the Island of Oahu, first opened in 1964 and all turtles on display have been obtained from Hawaiian waters. It is suspected that five of the 12 adult green turtles now at the facility have been in captivity since at least 1967. Unfortunately, no long term records exist on acquisition dates, original sizes, or any other individual details. In December, 1973 I placed identification tags on the turtles and have since been periodically taking measurements, retagging due to corrosion problems, and providing advisory assistance on a cooperative basis.

The history of reproductive activity at Sea Life Park, as I have been able to piece it together, can be summarized as follows.

1. From at least 1967 to December, 1972 turtles were held in a display pool with an accessible artificial sand beach. Sometime between 1967 and 1968 nesting took place on this beach, but no hatchlings resulted.

MEMORANDUM-2
November 12, 1976

2. After December,1972 the turtles were permanently moved to a different display pool with no sand beach. In the spring of 1973 a copulating pair was observed. This was followed within several hours by egg deposition directly into the water by the female involved in copulation. The eggs were removed, rinsed with fresh water and buried in the sand, but development did not take place. A copulating pair was again observed a few days later, but it could not be determined if the same animals were involved. Immediately following copulation, the female was transferred to a pool with a sand beach. Within several hours egg deposition again occurred directly into the water. Attempts to incubate these eggs also resulted in no development.

3. In December, 1973 a small sand beach and sloping exit ramp were built into the turtles' display facility. Those of you (GSd, NM, PP, IU) who have visited with me here in Hawaii will undoubtedly remember seeing this facility.

4. During 1974 and 1975 copulation was not observed, although some minor mating attempts by males may have occurred in 1974, and a few moderate attempts took place in 1975.

5. Active, aggressive attempts by males to copulate were first seen in 1976 at about the same time that emergence and nesting activity started (mid-June). Attempts continued until at least late July, but at no time were turtles observed locked together in actual copulation. I personally saw a number of these attempts, and in each case the female clearly rejected the male.

I would be interested to learn of any comments which you may have on this case. In the next few months, I plan to prepare a short paper on these observations and findings for publication in the Journal of the Hawaii Audubon Society.

GHB:ec

1976 GREEN TURTLE

NESTING ACTIVITY AT SEA LIFE PARK

Summarized by

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

Clutch No.	Date	Activities and findings
	6/18/76	initiation of emergence and excavation on artificial beach
1	7/6	35 eggs found in pond, transferred to styrofoam container; 7/24 examination indicated infertility and decomposition
2	7/12	female #76 deposited 64 eggs in artificial beach, transferred to plastic container; 8/25 examination indicated 20 eggs with small blood spot, remainder infertile
3	7/26	17 eggs found in pond; discarded
4	7/28	female with no tag (light carapace, tattered hind flippers) deposited 107 eggs in artificial beach; clutch divided and transferred into two styrofoam containers; 8/21 examination indicated all infertile
5	8/10	female #2009 deposited 67 eggs in artificial beach; 9/21 examination indicated 3 cm embryo; 10/6 examination indicated 6.5 cm embryo; mongoose destroyed unknown number of eggs 10/25; total of 20 hatchling by 11/3, 5 no development
6	9/20	single hatchling found behind reef tank; 36 shells and 9 infertile eggs found in sand pile, total clutch size-45 ; probably resulted from turtle emerged 7/20; most of emerged hatchlings probably destroyed by mongoose
7	9/20	80 eggs found in pond; infertile; probably resulted from female tagged #2012
8	9/30	female #2009 deposited 114 eggs in artificial beach, transferred to container; 10/24 examination indicated all infertile

1976 GREEN TURTLE NESTING ACTIVITY AT SEA LIFE PARK -2-

Clutch No.	Date	Activities and findings
9	9/30	female #2009 excavated previously unknown incubating clutch in artificial beach; 24 no development, 5 partial development, 3 unknown, 9 viable and advanced development (transferred to container); total clutch size-41; 9 hatched but destroyed by mongoose on 10/26
10	10/15	42 hatchlings found from previously unknown nest in artificial beach; 23 no development, 7 partial development, 6 unknown (insect destruction), total clutch size-78; 8 released 10/30; 25 released 11/8
11	10/30	14 hatchlings found from previously unknown nest in artificial beach; empty shells suggest 25 actually emerged; 44 no development, 3 partial development, total clutch size-73; 7 released 10/30; 2 released 11/8
12	11/2	49 hatchlings found from previously unknown nest in artificial beach; 14 infertile, 5 partial, total clutch size-78; 25 released 11/4; 24 released 11/8
13	11/5	44 hatchlings found from previously unknown nest in artificial beach; 30 infertile, 12 partial, 3 live hatchlings, total clutch size-89; 41 released 11/5
14	11/24	57 hatchlings found by Pearl factory from previously unknown nest in artificial beach; 21 infertile, 3 partial, total clutch size-81; 57 released 11/24
15	11/30	72 hatchlings found from previously unknown nest in artificial beach; 4 infertile, 1 partial, total clutch size-77; 66 released 11/30
16	12/19	40 hatchlings found from previously unknown nest in artificial beach; 17 no development, 2 partial, 1 hatched but dead, total clutch size-60; 60 released 12/19

Total no. turtles in pool - 19
adult hawksbill - 1 female
adult greens - 9 females, 3 males
sub-adult greens - 4 unknown, 2 male

Maximum no. turtles thought to be involved in nestings - 4

1976 GREEN TURTLE NESTING ACTIVITY AT SEA LIFE PARK -3-

Clutch No.	Eggs	No. Hatchlings Produced	% Hatchling Production	No. live Hatchlings Obtained
1	35 (in water)	0	0	0
2	64	0	0	0
3	17 (in water)	0	0	0
4	107	0	0	0
5	67	≥20	≥30	20
6	45	36	80	0
7	80 (in water)	0	0	0
8	114	0	0	0
9	41	9	22	0
10	78	42	54	42
11	73	25	34	14
12	68	49	72	49
13	89	47	53	47
14	81	57	70	57
15	77	72	94	72
16	60	40	67	40
Total	1096	397	-	341

University of Hawaii at Manoa

Hawaii Institute of Marine Biology

MEMORANDUM

June 16, 1977

To: Drs. Karl Kenyon and Bob DeLong

From: George H. Balazs
Hawaiian Green Turtle Management Study

Subject: Observations of internal parasites and food sources of the Hawaiian Monk Seal.

During the course of field work at Kure Atoll on 24 May 1977, I came across the fresh regurgitation from a monk seal which consisted of two large, nearly intact Octopus sp. (transparency enclosed). The surfaces of both of these cephalopods were found to be covered with nematodes, specimens of which are enclosed for your inspection. In 1974 I collected nematodes of a similar appearance from a monk seal regurgitation at French Frigate Shoals. You may also be interested to learn that in 1973 I collected cestodes from the fecal material of a monk seal at French Frigate Shoals. These parasites were examined and identified as Contracaecum turgidum and Diphyllobothrium cameroni by Dr. Gerald D. Schmidt of the University of Northern Colorado. Copies of Dr. Schmidt's earlier letters to me on this subject have been enclosed for your files. One of you (KWK) listed both of these parasites in a 1959 publication. It should be noted that Dr. Schmidt's mention of surgeonfish serving as intermediate hosts for seal parasites was in response to my suggestion of such a possibility. This was based on my repeated observations of schools of surgeonfish following monk seals in shallow water and feeding on evacuated fecal material. I have noted surgeonfish (Acanthurus sp.) in the regurgitations of seals on a number of occasions. An identification of fish recovered from such a regurgitation in February 1975 has been enclosed for your use.

Hopefully this information will be useful to your research. If there are any specific questions about these observations, please feel free to contact me.

CABLE ADDRESS:
"SOUTHPACOM," NOUMEA

SOUTH PACIFIC COMMISSION
POST BOX D.5
NOUMEA CEDEX
NEW CALEDONIA

ADRESSE TELEGRAPHIQUE:
"SOUTHPACOM," NOUMEA

COMMISSION DU PACIFIQUE SUD
BOITE POSTALE D.5
NOUMEA CEDEX
NOUVELLE-CALEDONIE

In reply, please quote PRO 84/9/1

PLEASE ADDRESS REPLY TO
THE SECRETARY-GENERAL

8 July, 1977

Mr. H. Kono
Governor's Marine Affairs
Co-ordinator,
1136 Union Mall
HONOLULU
Hawaii. 96813, U.S.A.

Dear Mr. Kono,

From 21 February to 12 March 1977, at the request of the South Pacific Commission, Doctor George H. Balazs conducted an advisory study of the SPC Marine Turtles Project based in Fiji and the Cook Islands. The purpose of this study was to establish guidelines for the future of the Project and to recommend other possible action in this field.

We wish to express to Dr. Balazs personally and to those who made his services available to us, our deep appreciation of the work he accomplished. Not only did Dr. Balazs scrupulously adhere to the terms of reference assigned to him, but he produced a very fine report containing a comprehensive evaluation of turtle stocks in the Pacific and related conservation problems. We were most impressed by the quality of his work and by the value of the conclusion and recommendations he submitted.

For all this, Dr. Balazs amply deserves our praise and gratitude. Our thanks also go to the Institute of Marine Biology, for agreeing to release Dr. Balazs from his normal professional commitments for the duration of his study. Now that co-operation between the Institute and the SPC has been proved so successful, we shall certainly take the liberty of again calling upon your assistance should similar occasions arise.

Yours sincerely,

Frank Mahony

Dr. Frank Mahony
Acting Secretary-General

cc: Dr. Balazs
Hawaii Institute of Marine
Biology,
P.O. Box 1346

GEORGE R. ARIYOSHI
GOVERNOR

JOHN P. CRAVEN, PH. D., J.D.
MARINE AFFAIRS COORDINATOR

STATE OF HAWAII
MARINE AFFAIRS COORDINATOR
OFFICE OF THE GOVERNOR
P. O. BOX 2840
HONOLULU, HAWAII 96803

November 9, 1976

MEMORANDUM

TO: Ronald Linsky, Director
Sea Grant Program, UH

FROM: Howard Pennington
Acting Marine Affairs Coordinator

SUBJECT: PROPOSAL FOR GREEN TURTLE PROJECT SUBMITTED BY GEORGE BALAZS

Recently this Office was notified by George Balazs that he had submitted a proposal to your Office, for Sea Grant Years 10 & 11. This proposal calls for an expansion of the green turtle studies Mr. Balazs is undertaking for the MAC Office.

I noted that, in the category of "matching funds", Mr. Balazs only claimed MAC matching of $9,812 for the first year; this amount is equal to half of his salary, plus fringes.

Actually, our budget for the next two fiscal years (FY 1977-78, & FY 1978-79), beginning July 1, 1977, calls for twenty thousand dollars ($20,000) a year for the green turtle management studies.

Our budget for the next fiscal biennium has been approved by the State Administration, although it has not yet been appropriated by the Legislature.

It is quite possible, therefore, that MAC funding for this project may be at the level of $20,000 a year, and you may wish to show this figure, rather than the lower one ($9,812) as matching funds, in the event that you should decide to support the Balazs proposal.

√cc: George Balazs - HIMB

TITLE

Survey and Assessment of the Green Sea Turtle Resource of the Northwestern Hawaiian Archipelago (MR/R-2)

PRINCIPAL INVESTIGATOR

George H. Balazs

DURATION

Sea Grant Year 10 through Year 11

MOTIVATION

The State of Hawaii has recently entered into a cooperative agreement with the National Marine Fisheries Service (Department of Commerce) and the Fish and Wildlife Service (Department of the Interior) to conduct a five year survey and assessment of the biological resources of the Northwestern Hawaiian Archipelago (Figure 1). The overall objective of this study is to develop comprehensive information which will provide a sound basis for making wise, long-range management decisions. The Hawaiian green sea turtle (Chelonia mydas) has been identified as one of the major wildlife species in need of intensive investigation.

Consistent with this objective, in September 1976 the State Marine Affairs Coordinator (Office of the Governor) provided funding for the first year of a three year green sea turtle management study which was mandated by the Hawaii State Legislature. The original legislative intent of this study was to focus attention principally on aggregations of turtles adjacent to the major inhabited Hawaiian Islands. Financial support provided for the first year of this work has amounted to 50% of the Principal Investigator's salary and $6,500 for supplies, interisland travel and other expenses. The Principal Investigator was commissioned by the Marine Affairs Coordinator to conduct this research under Task Order No. 118.

In view of the State of Hawaii's recent involvement in the resource survey and assessment of the Northwestern Hawaiian Archipelago, it would be desirable and appropriate to extend the present green sea turtle investigation to a full-time commitment encompassing both the Northwestern as well as the major Hawaiian Islands. This would permit the proper high level of emphasis to be placed on all aggregations of Hawaiian green sea turtles. The known life history of Chelonia indicates that such a study of the total population would be necessary to yield the basic biological information being sought for turtles in the northwestern areas. Like other distinct populations of Chelonia thus far investigated (Carr and Ogren, 1960; Hirth and Carr, 1970; Doumenge, 1972; Carr and Coleman, 1974; Bustard, 1974; Pritchard, 1976) adult Hawaiian green sea turtles periodically migrate for colonial reproduction to a site distant from resident feeding pastures (Balazs, 1976). The sole colonial breeding site in the Hawaiian Archipelago is the centrally located atoll of French Frigate Shoals. Resident feeding pastures, which host both adult and

immature turtles, are located around the major islands as well as in areas to the northwest of French Frigate Shoals. Work thus far conducted by the Principal Investigator suggests that recruitment to these sites involves complex developmental migrations which encompass all areas of the Archipelago.

GOALS

Overall

To determine the essential biological facts of the green sea turtle resource of the Northwestern Hawaiian Archipelago.

Specific (for Years 10 and 11)

1. To locate and census by size category all aggregations of green sea turtles.
2. To define long-distance migratory patterns exhibited by each size category.
3. To gain information on the growth rates of turtles under natural conditions.
4. To formulate a preliminary growth curve that will predict age at sexual maturity.
5. To gain information on daily feeding and basking activities of resident aggregations.
6. To identify the types of food used by each size category.
7. To ascertain seasonal productivity of the breeding colony.
8. To identify by type and level the mortality factors that limit the population.

METHODS

Locate and census

Aggregations of juvenile, sub-adult and adult turtles (as defined by Hirth, 1971) will be located and inventoried by conducting combinations of land, aerial and underwater (SCUBA) surveys.

Low level aerial surveys will be made bi-monthly in conjunction with U. S. Coast Guard fishery patrols using C-130 aircraft.

Surveys from land and underwater with SCUBA will be made tri-monthly at the more readily accessible locations of French Frigate Shoals, Midway and Kure Atoll. The schedule for such activities at the far less accessible locations of Nihoa, Necker, Gardner Pinnacles, Maro Reef, Laysan, Lisianski and Pearl and Hermes Reef will be dependent upon transportation made available cooperatively by the National Marine Fisheries Service (Honolulu Laboratory), the Coast Guard and private research vessels to be chartered by the Fish and Wildlife Service. It is anticipated that a minimum of two visits per year to each of these sites will be possible.

Underwater census data will be collected using a modified circle line search technique in which designated areas can be systematically and thoroughly surveyed.

Long-distance migratory patterns

During the course of visits to each of the study areas, as many immature turtles as appropriate and possible will be captured in a non-injurious manner (by hand, scoop net or throw net) and tagged for permanent, long-term identification. The tags that will be used are made of the highly corrosion resistant alloy, Inconel 625. These tags were specially manufactured for the Principal Investigator's research of Hawaiian green sea turtles (Mrosovsky, 1976, 1977).

In addition to the Principal Investigator's own capture activities, guidance and encouragement in the capturing and tagging of turtles on a cooperative basis during the course of recreational diving will be given to resident military personnel at Midway and Kure.

Subsequent recoveries of tagged turtles will provide data on migratory patterns which will be complementary to existing knowledge that has thus far been developed for Hawaii.

Growth rates

Straight and curved carapace measurements as well as body weights will be taken on all immature turtles that are captured and tagged.

Preliminary work on this aspect at French Frigate Shoals and Midway has already resulted in the establishment of a pool of 317 tagged immature turtles. With continued and more intensive capturing activities it is anticipated that a significant number of recoveries can be made over the two year period covered in this proposal.

Except for some early short-term research by Schmidt (1916) in the Caribbean, comparatively little effort has been made to determine the growth rates of naturally occurring immature sea turtles. Carr and Carr (1970) have shown that the growth rate of adult green turtles nesting in Costa Rica is exceedingly slow, averaging 0.25 cm per year.

Formulation of a growth curve

The accumulation of growth data by size category for time of the year and geographical area will ultimately permit the formulation of a preliminary growth curve through curvilinear regression analysis. This will result in a reliable estimation to be made of the minimum and maximum times required to reach sexual maturity. The minimum maturation size in the Hawaiian breeding colony at French Frigate Shoals has been determined to be 82 cm carapace length for females and 75 cm carapace length for males.

Daily movements and activities

A series of direct, intensive observations will be made from land and underwater with SCUBA at French Frigate Shoals and Kure in order to gain preliminary information on daily feeding and basking activities. If determined to be feasible, sonic transmitters will be incorporated in collaboration with tracking research of tiger sharks underway in the Northwestern Hawaiian Archipelago by Dr. L. Taylor and Mr. G. Naftel.

Types of food utilized

Direct feeding observations, examination of mouth contents, and use of a non-injurious stomach probe sampler developed by the Principal Investigator will allow determination to be made of the plant and animal species consumed for food. Multiple samplings will be made by size category and time of the year at each geographically separated study area in order to detect differences.

Analyses will also be made of whole stomach contents of dead turtles recovered from shark predation.

Productivity of the breeding colony

During two three-week periods of the 1978 and 1979 breeding seasons, nesting activity at French Frigate Shoals will be intensively monitored in order to assess the numbers present, reproductive cycles and hatchling production. This will be a continuation of summer research that has been undertaken since 1973 in cooperation with the U. S. Fish and Wildlife Service.

Like nesting colonies of Chelonia in other areas of the world, most turtles involved in a particular breeding season at French Frigate Shoals are present from the onset of that season. The same individuals engage in repeated nestings, at 10 to 15 day intervals, as the season progresses. Two three-week periods of monitoring will therefore provide a reliable indication of the total numbers of nesting animals present.

Incidental reproduction which is known to involve separately nesting females at locations to the northwest of French Frigate Shoals will also be surveyed and quantified during the course of study visits to these areas.

Mortality factors

Mortality of hatchlings in the nearshore waters of French Frigate Shoals will be estimated through direct observations and by samplings of carnivorous reef fishes.

Based on earlier work conducted around the major islands (Tester, 1969; Fujimoto and Sakuda, 1972), shark predation is presently thought to be the only major cause of mortality among post-hatchling turtles in the Northwestern Hawaiian Archipelago. Sharks will therefore be sampled for stomach contents at as many areas as feasible in order to quantify this limiting factor. Cooperate assistance in this work will be obtained from resident military personnel at French Frigate Shoals, Midway and Kure. In addition, stomach contents will be analyzed in collaboration with shark research being conducted by Dr. L. Taylor and Mr. G. Naftel.

Mortality may also result from other natural factors such as disease, food and/or habitat limitations. Analyses of the overall results obtained from this survey and assessment may identify such limitations.

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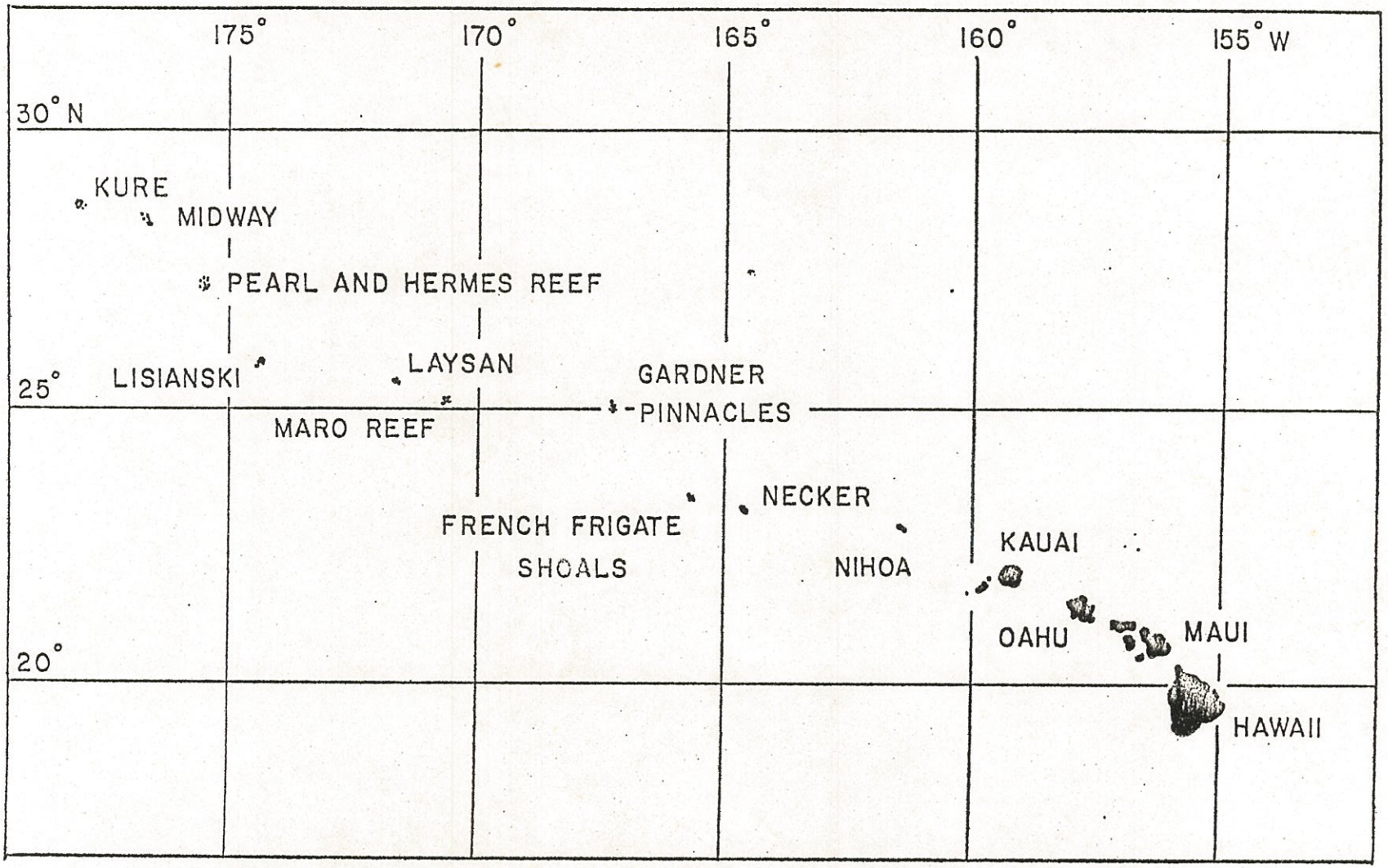

FIGURE. 1

HAWAIIAN ARCHIPELAGO

NORTH PACIFIC OCEAN

SEA GRANT BUDGET 'Y' - Page 75

O.M.B. NO. 41-R2779
EXPIRES: 12-31-73

PROJECT TITLE: Survey and Assessment of the Green Sea Turtle Resource of the Northwestern Hawaiian Archipelago

GRANT/PROJECT NUMBER: MR/R-2

PRINCIPAL INVESTIGATOR(S): George H. Balazs

DURATION (months): 12 months

FISCAL OFFICER SIGNATURE: _____ DATE: _____

A. SALARIES AND WAGES	MAN-MONTHS		SEA GRANT FUNDS	GRANTEE SHARE
1. SENIOR PERSONNEL				
a. (Co) Principal Investigator	6		8,532	8,532*
b. Associates (Faculty or staff)				
Sub Total			8,532	8,532
2. OTHER PERSONNEL				
a. Professionals				
b. Research associates				
c. Research asst.-grad. students				
d. Prof. school students				
e. Pre-Bac. students				
f. Secretarial-clerical				
g. Technical-shop (research assist.)	1 3/4		1,400	
h.				
Total Salaries and Wages			9,932	8,532
B. FRINGE BENEFITS (When charged as direct cost)			2,266	2,240*
Total Salaries, Wages, and Fringe Benefits (A and B)			12,198	10,772
C. PERMANENT EQUIPMENT			2,500**	
D. EXPENDABLE SUPPLIES AND EQUIPMENT				
E. TRAVEL (NMFS turtle meeting to be held in Florida)				
1. Domestic -U. S. and its Possessions (Inc. Puerto Rico) 1.			775	
2. International 2.				
Total Travel			775	
F. PUBLICATION AND DOCUMENTATION COSTS				
G. OTHER COSTS				
1. Computer Costs				
2. MAC Matching				9,228*
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
Total Other Costs				9,228
TOTAL DIRECT COSTS (A through G)			15,473	20,000
INDIRECT COSTS (On Campus Research 47 % of 13,283)			4,668	
INDIRECT COSTS (Off Campus % of)				
Total Indirect Costs			4,668	
TOTAL COSTS			20,141	20,000
ROUNDED TO				

NOAA FORM 90-4 (2-74)

*Marine Affairs Coordinator, State of Hawaii: $20,000 (principal investigator salaries and wages $8,532; fringe benefits $2,240; MAC matching $9,228)

**Permanent equipment: portable SCUBA air compressor $2,500