



1970s-1990s FILE FP

National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202-381-5936

24 April 1974

G.H. BALAZS

VIA AIRMAIL

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

and "Migrations"

Dear Dr. Balazs:

I appreciate your inquiry regarding tumors in the marine turtle (Chelonia agassizi) and will send you a copy of our next activities report which is due in about one month. This report will be cumulative for all the Registry's accessions.

The turtle tumors I have examined histologically were composed of papillary epidermis overlying and intermingled with small to very large amounts of hyperplastic fibrous tissue. The tumors are usually well vascularized and frequently show keratosis in the epithelial areas. Extraneous material of plant or animal origin is usually present, eliciting varying amounts of inflammation. I suspect the extraneous biological material initiates the growths but this would have to be proven experimentally.

I hope this information will be helpful and wish you good luck with your work. It sounds like an interesting project and I would enjoy seeing your final report.

Sincerely,

John C. Harshbarger, Ph.D.
Director
Registry of Tumors in Lower Animals

5/75 WAIKIKI



National Museum of Natural History · Smithsonian Institution

WASHINGTON, D.C. 20560 · TEL. 202- 381-5936

29 August 1977

Dr. George H. Balazs
Hawaii Institute of Marine Biology
Post Office Box 1346
Coconut Island
Kaneohe, Hawaii 96744

Dear Dr. Balazs:

Thank you very much for sending us the green turtle (Chelonia mydas) material. It has been accessioned as follows:

RTLA

#

- 1774 - One print of live animal
- 1774.1 - Growth extending out of right posterior lung
- 1774.2 - Huge growth associated with right shoulder area
- 1774.3 - Growth associated with ventral area of esophagus and trachea
- 1774.4 - Growth associated with right lung
- 1774.5 - Growth associated with lower intestine (sacs containing fluid)
- 1774.6
- &
- 1774.7 - Two growths externally, one on each side of neck/head
- 1774.8 - Growth externally on right side of neck

Dr. Harshbarger will write you in regard to this case as soon as possible after his return from Europe on 16 September.

Sincerely,

Phyllis M. Schellenger
Registrar
Registry of Tumors in Lower Animals

RTLA 1767

TEAR OUT ACCESSION SHEET

PLEASE SUBMIT TO:

Dr. John C. Marshbarger
Registry of Tumors in Lower Animals
National Museum of Natural History
Room W216-A
Smithsonian Institution
Washington, D.C., 20560, USA

DATE RECD. _____
CONTRIBUTOR'S NO. _____
RTLA NO. _____
USNM NO. _____
NIH HISTOPATH NO. _____

COMMON NAME Green Turtle FAMILY Cheloniidae
PHYLUM Chordata GENUS Chelonia
CLASS Reptilia SPECIES mydas
ORDER Chelonia

CATEGORY: NEOPLASM INFLAMMATION _____ INFECTION _____ PARASITIC _____ TOXIC _____
DEVELOPMENTAL _____ TRAUMATIC _____ NORMAL _____ OTHER _____

CONTRIBUTOR (NAME & ADDRESS):
George H. Balazs
Hawaii Institute of Marine Biology
P.O. Box 1346
Kaneohe, HI 96744

COLLECTOR (NAME & ADDRESS):
same

ITEMS SUBMITTED (QUANTITY):

GROSS MATERIAL 6 PHOTOGRAPHS _____
SLIDES _____ REPRINTS _____
BLOCKS _____ OTHER _____

ORIGIN OF ANIMAL: MARINE FRESHWATER _____ ESTUARINE _____ TERRESTRIAL _____

WHERE COLLECTED Kailua Beach, Island of Oahu- animal died several hours after washing up on beach- very weak and emaciated

DATE COLLECTED 4/25/77 SEX F AGE unknown STAGE OF LIFE CYCLE adult-small eggs
present

HOW KILLED unknown (possible starvation) FIXATION formalin

GROSS DESCRIPTION neoplasms on both eyes, lower jaw and right limb - neoplasms were located directly on eyes thereby undoubtedly reducing vision considerably

MICROSCOPE DX _____

COMMENTS (e.g., possible exposure to chemical pollutants or infectious agents, incidence and duration of this condition in the population, etc.)

a series of color transparencies can be provided upon request-
I would estimate that approximately 5% of the adult females observed at the
colonial breeding grounds of French Frigate Shoals have neoplasms. However, most
are small or are located in a position where they probably do not hinder normal activities.
(Please use reverse side, if more space is needed)

Hawaiian

11/18/78

TEAR OUT ACCESSION SHEET

PLEASE SUBMIT TO:

Dr. John C. Harshbarger
Registry of Tumors in Lower Animals
National Museum of Natural History
Room W216-A
Smithsonian Institution
Washington, D.C., 20560, USA

DATE RECD. _____
CONTRIBUTOR'S NO. _____
RTLA NO. _____
USNM NO. _____
NIH HISTOPATH NO. _____

COMMON NAME hawksbill turtle FAMILY Cheloniidae
PHYLUM Chordata GENUS Eretmochelys
CLASS Reptilia SPECIES imbricata
ORDER Chelonia

CATEGORY: NEOPLASM ? INFLAMMATION _____ INFECTION _____ PARASITIC _____ TOXIC _____
DEVELOPMENTAL _____ TRAUMATIC _____ NORMAL _____ OTHER _____

CONTRIBUTOR (NAME & ADDRESS):

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

COLLECTOR (NAME & ADDRESS):

same

ITEMS SUBMITTED (QUANTITY):

GROSS MATERIAL 1 PHOTOGRAPHS _____
SLIDES _____ REPRINTS _____
BLOCKS _____ OTHER _____

ORIGIN OF ANIMAL: MARINE FRESHWATER _____ ESTUARINE _____ TERRESTRIAL _____WHERE COLLECTED display animal in sea turtle pond at Sea Life Park Inc., Makapuu, HawaiiDATE COLLECTED 9/78 SEX male AGE 5yr, 7mon STAGE OF LIFE CYCLE approaching sexual maturityHOW KILLED cause of death unknown FIXATION 10% formalinGROSS DESCRIPTION tissue mass associated with mesenteries of intestines

DIAGNOSIS - "NORMAL" FAT

MICROSCOPE DX _____

COMMENTS (e.g., possible exposure to chemical pollutants or infectious agents, incidence and duration of this condition in the population, etc.)

post mortem examination revealed that the animal contained massive quantities of fat- this was undoubtedly due to the high fat content frozen fish that were fed to the turtle over the past two years.

W. SAMOA

(Please use reverse side, if more space is needed)

March 25, 1978

TEAR OUT ACCESSION SHEET

RTLA
1883

LOU
HERMAN
TURTLES

PLEASE SUBMIT TO:

Dr. John C. Harshbarger
Registry of Tumors in Lower Animals
National Museum of Natural History
Room W216-A
Smithsonian Institution
Washington, D.C., 20560, USA

DATE RECD. _____
CONTRIBUTOR'S NO. _____
RTLA NO. _____
USNM NO. _____
NIH HISTOPATH NO. _____

COMMON NAME green turtle FAMILY cheloniidae
PHYLUM chordata GENUS chelonia
CLASS reptilia SPECIES mydas
ORDER chelonia

CATEGORY: NEOPLASM INFLAMMATION _____ INFECTION _____ PARASITIC _____ TOXIC _____
DEVELOPMENTAL _____ TRAUMATIC _____ NORMAL _____ OTHER _____

CONTRIBUTOR (NAME & ADDRESS):
George H. Balazs
Hawaii Institute of Marine Biology
P.O. Box 1346
Kaneohe, HI 96744

COLLECTOR (NAME & ADDRESS):
same

ITEMS SUBMITTED (QUANTITY):

GROSS MATERIAL one plastic bag containing PHOTOGRAPHS _____
one specimen, two vials
~~SLIDES~~ each containing one thin layer REPRINTS _____
BLOCKS biopsy OTHER _____

ORIGIN OF ANIMAL: MARINE FRESHWATER _____ ESTUARINE _____ TERRESTRIAL _____ S-278 x 22 1/4

WHERE COLLECTED Hawaiian Islands, however animal had been held in captivity for an 70.8cm
unknown period of time, probably exceeding five years. straight carapace 27-7/8"
curved carapace 22-1/4"

DATE COLLECTED 3/21/78 SEX likely AGE unknown STAGE OF LIFE CYCLE young adult
HOW KILLED alive female FIXATION gross tumor-20% formalin; biopsy-see reverse

GROSS DESCRIPTION large fibrous growth on ventral side of left front limb;
biopsy taken before surgical removal; bleeding stopped after short period;
turtle was subsequently tagged and released offshore of Diamond Head,
Island of Oahu.
vial labeled No. 1 contains biopsy from tumor surface
vial labeled No. 2 contains biopsy from surface of "stalk" or
attachment site of tumor

MICROSCOPE DX _____

COMMENTS (e.g., possible exposure to chemical pollutants or infectious agents, incidence and duration of this condition in the population, etc.)
large fibrous growth is being sent in separate large package which
may not arrive for several weeks

(Please use reverse side, if more space is needed)

fixative for biopsy:

20cc 8% glutaraldehyde stored under N₂
20cc filtered sea H₂O
S-collidive } several drops of each to buffer
1.0N HCL }
solution to final pH 7.4

RTLA 1774

TEAR OUT ACCESSION SHEET

PLEASE SUBMIT TO:

Dr. John C. Harshbarger
Registry of Tumors in Lower Animals
National Museum of Natural History
Room W216-A
Smithsonian Institution
Washington, D.C., 20560, USA

DATE RECD. _____
CONTRIBUTOR'S NO. _____
RTLA NO. _____
USNM NO. _____
NIH HISTOPATH NO. _____

COMMON NAME Green Turtle FAMILY Cheloniidae
PHYLUM Chordata GENUS Chelonia
CLASS Reptilia SPECIES mydas

ORDER Chelonia
CATEGORY: NEOPLASM INFLAMMATION _____
weight- 175lbs (light for a Chelonia this size)
INFECTION _____ PARASITIC _____ TOXIC _____
DEVELOPMENTAL _____ TRAUMATIC _____ NORMAL _____ OTHER _____

CONTRIBUTOR (NAME & ADDRESS):
George H. Balazs
Hawaii Institute of Marine Biology
P.O. Box 1346
Kaneohe, HI 96744

COLLECTOR (NAME & ADDRESS):
same

ITEMS SUBMITTED (QUANTITY):

GROSS MATERIAL 8 PHOTOGRAPHS one print of live animal
SLIDES _____ REPRINTS _____
BLOCKS _____ OTHER _____

ORIGIN OF ANIMAL: MARINE FRESHWATER _____ ESTUARINE _____ TERRESTRIAL _____
WHERE COLLECTED off of Waikiki Beach, Island of Oahu, Hawaii

DATE COLLECTED May 1975 SEX F AGE Unknown STAGE OF LIFE CYCLE adult-small eggs present
HOW KILLED barely alive when frozen FIXATION formalin

GROSS DESCRIPTION bottles are labeled as to neoplasm number- 1) extending out of right posterior lung; 2) right shoulder area, both external and internal; 3) associated with ventral area of esophagus and trachea; 5) associated with lower intestine (sacs containing fluid); 4) associated with right lung; 6 & 7) one externally on each side of neck/head; 8) externally on right side of neck. Enclosed photograph shows neoplasms 2, 7 and 8.

Animal was found in surf at Waikiki Beach, unable to dive and very weak. Posterior of animal was very buoyant, floating very high out of water. After several days in captivity, no signs of improvement were noted and animal was frozen. Dissection took place on ~~XXXXXX~~ 7/19/77. Intestines were devoid of food matter.

COMMENTS (e.g., possible exposure to chemical pollutants or infectious agents, incidence and duration of this condition in the population, etc.)
unknown

TEAR OUT ACCESSION SHEET

PLEASE SUBMIT TO:

Dr. John C. Harshbarger
 Registry of Tumors in Lower Animals
 National Museum of Natural History
 Room W216-A
 Smithsonian Institution
 Washington, D.C., 20560, USA

DATE RECD. _____
 CONTRIBUTOR'S NO. _____
 RTLA NO. _____
 USNM NO. _____
 NIH HISTOPATH NO. _____

COMMON NAME hawksbill turtle FAMILY Cheloniidae
 PHYLUM Chordata GENUS Eretmochelys
 CLASS Reptilia SPECIES imbricata
 ORDER Chelonia

CATEGORY: NEOPLASM INFLAMMATION _____ INFECTION _____ PARASITIC _____ TOXIC _____
 DEVELOPMENTAL _____ TRAUMATIC _____ NORMAL _____ OTHER _____

CONTRIBUTOR (NAME & ADDRESS):

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

COLLECTOR (NAME & ADDRESS):

same

ITEMS SUBMITTED (QUANTITY):

GROSS MATERIAL 1 PHOTOGRAPHS _____
 SLIDES _____ REPRINTS _____
 BLOCKS _____ OTHER _____

ORIGIN OF ANIMAL: MARINE FRESHWATER _____ ESTUARINE _____ TERRESTRIAL _____

WHERE COLLECTED held in captivity at the Waikiki Aquarium for an unknown period of time, possibly as long as 10 years

DATE COLLECTED Nov 1976 SEX F AGE unknown STAGE OF LIFE CYCLE young adultHOW KILLED bitten extensively by seal FIXATION formalin

GROSS DESCRIPTION neoplasm associated with small intestine immediately adjacent to stomach; metal fragment is in growth and may be the causative agent

DIAGNOSIS: IMMUNE REACTION TO FOREIGN OBJECT

MICROSCOPE DX _____

COMMENTS (e.g., possible exposure to chemical pollutants or infectious agents, incidence and duration of this condition in the population, etc.)



National Museum of Natural History · Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202- 381-5936

22 September 1977

Dr. George H. Balazs
Hawaii Institute of Marine Biology
University of Hawaii at Manoa
Post Office Box 1346
Coconut Island
Kaneohe, Hawaii 96744

Dear Dr. Balazs:

Thank you very much for sending us four, 35 mm color transparencies of the green turtle case (RTLA 1767). We will return the originals after they have been duplicated.

Sincerely,

Phyllis M. Schellenger

Phyllis M. Schellenger
Registrar
Registry of Tumors in Lower Animals



National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202-381-5936

6 March 1978

Dr. George H. Balazs
Hawaii Institute of Marine Biology
University of Hawaii at Manoa
Post Office Box 1346
Coconut Island
Kaneohe, Hawaii 96744

Dear Dr. Balazs:

KAWAHOE
BY
JUVENILE
KAILUA
WAIKIKI

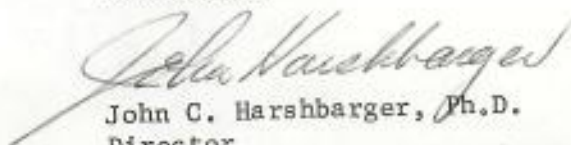
The skin lesions on the three green sea turtles, Chelonia mydas, that you sent us (July 1977 - RTLA 1767; August 1977 - RTLA 1774; and January 1978 - RTLA 1856) are similar to the fibropapillomas previously reported from this species. The epidermis proliferates and forms pegs which extend into the dermal connective tissue. Concomitantly, dermal papillae containing connective tissue, vascular channels, and associated melanophores grow between the epidermal pegs to provide nourishment. The surface epidermis produces abundant layers of keratin and occasionally trapped cells within the dermis form pearls or epidermal cysts containing concentric rings of keratin. Subsequent enlargement results to an increasing extent to expansion of the fibrous component so that the larger tumors are mostly a monotonous field of fibrocytes with some interspersed melanophores and a few epidermal pegs near the surface. Invasion of the underlying muscle does not occur. I am sending a set of microscope slides, some of which are more revealing than others due to the orientation of the cut or the age and condition of the growth. Some blocks of tissue were so hard and friable, that we could not get sections at all. Probably the best slide is the one of the eyelid tumor in specimen RTLA 1856. I am also enclosing xerox copies of some of the published cases of these growths. As you can see, some have been associated with leeches, others with barnacles, and still others have contained plant material. This has led to considerable speculation that the tumors can be initiated by foreign organic material. However, there was little, if any, evidence of foreign material in any of your green sea turtle lesions. The similarity of these lesions to human warts suggests that they might have a viral etiology even though intranuclear viral inclusion bodies have not been seen. It would be interesting to look for viruses with an electron microscope. The tissue blocks for electron microscopy should have at least 1 dimension no more than 1 mm thick. They should be biopsied or immediately necropsied from the prickle cell layer of the epidermis of early growths and placed immediately in 3-5% glutaraldehyde in water buffered to pH 7.4 with sodium phosphate buffer or in sea water adjusted to pH 7.4.

A. P.

The hawksbill turtle, Eretmochelys imbricata, from the Waikiki Aquarium (RTLA 1816) is composed of collagenous fibrous tissue and waves of inflammatory cells. I think your suspicion that the metal object found within the growth was the cause is probably accurate. It probably penetrated the intestinal wall and the released proteins elicited a chronic cellular immune response. The orderly rows of vacuoles crisscrossing the fibrous tissue in several areas (also in RTLA 1774), which might be mistaken for fat, are freezing artifacts. This lesion is a granuloma -- not a neoplasm.

I appreciate your sending us this material and I regret that I was so tardy in writing you about the earlier cases. Part of the delay was due to the hard friable nature of the exposed growths, especially when frozen, which made the first blocks of tissue virtually impossible to section and by the time I realized I was not going to get sections and cut new tissue blocks, several months had already elapsed. Hopefully, my replies will be more prompt in the future.

Sincerely,



John C. Harshbarger, Ph.D.

Director

Registry of Tumors in Lower Animals

Enclosures - as stated



National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202-381-5936

6 March 1978

Dr. George H. Balazs
Hawaii Institute of Marine Biology
University of Hawaii at Manoa
Post Office Box 1346
Coconut Island
Kaneohe, Hawaii 96744

Dear Dr. Balazs:

The skin lesions on the three green sea turtles, Chelonia mydas, that you sent us (July 1977 - RTLA 1767; August 1977 - RTLA 1774; and January 1978 - RTLA 1856) are similar to the fibropapillomas previously reported from this species. The epidermis proliferates and forms pegs which extend into the dermal connective tissue. Concomitantly, dermal papillae containing connective tissue, vascular channels, and associated melanophores grow between the epidermal pegs to provide nourishment. The surface epidermis produces abundant layers of keratin and occasionally trapped cells within the dermis form pearls or epidermal cysts containing concentric rings of keratin. Subsequent enlargement results to an increasing extent to expansion of the fibrous component so that the larger tumors are mostly a monotonous field of fibrocytes with some interspersed melanophores and a few epidermal pegs near the surface. Invasion of the underlying muscle does not occur. I am sending a set of microscope slides, some of which are more revealing than others due to the orientation of the cut or the age and condition of the growth. Some blocks of tissue were so hard and friable, that we could not get sections at all. Probably the best slide is the one of the eyelid tumor in specimen RTLA 1856. I am also enclosing xerox copies of some of the published cases of these growths. As you can see, some have been associated with leeches, others with barnacles, and still others have contained plant material. This has led to considerable speculation that the tumors can be initiated by foreign organic material. However, there was little, if any, evidence of foreign material in any of your green sea turtle lesions. The similarity of these lesions to human warts suggests that they might have a viral etiology even though intranuclear viral inclusion bodies have not been seen. It would be interesting to look for viruses with an electron microscope. The tissue blocks for electron microscopy should have at least 1 dimension no more than 1 mm thick. They should be biopsied or immediately necropsied from the prickle cell layer of the epidermis of early growths and placed immediately in 3-5% glutaraldehyde in water buffered to pH 7.4 with sodium phosphate buffer or in sea water adjusted to pH 7.4.

KANEOHE
BIRD
JUVENILE

KANOA

These good

waitiki

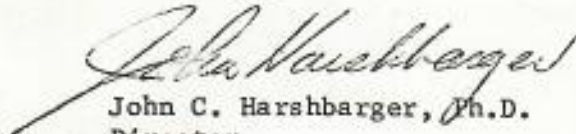
BARNACLE?
PLANT
MATERIAL?
Ref?

*

The hawksbill turtle, Eretmochelys imbricata, from the Waikiki Aquarium (RTLA 1816) is composed of collagenous fibrous tissue and waves of inflammatory cells. I think your suspicion that the metal object found within the growth was the cause is probably accurate. It probably penetrated the intestinal wall and the released proteins elicited a chronic cellular immune response. The orderly rows of vacuoles crisscrossing the fibrous tissue in several areas (also in RTLA 1774), which might be mistaken for fat, are freezing artifacts. This lesion is a granuloma -- not a neoplasm.

I appreciate your sending us this material and I regret that I was so tardy in writing you about the earlier cases. Part of the delay was due to the hard friable nature of the exposed growths, especially when frozen, which made the first blocks of tissue virtually impossible to section and by the time I realized I was not going to get sections and cut new tissue blocks, several months had already elapsed. Hopefully, my replies will be more prompt in the future.

Sincerely,



John C. Harshbarger, Ph.D.
Director
Registry of Tumors in Lower Animals

Enclosures - as stated



National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202- 381-5936

6 February 1980

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

Dear George:

Thank you very much for the 35 mm color transparency of the green turtle fibropapilloma (RTLA 2097; your #2828) to complement the tissue you sent earlier. The tissue was the best fixed for that type of lesion that we have ever received and we really appreciate your effort. Please note the clarity of the nuclei and the distinctness of the prickle cell boundaries in the enclosed microslide. The tissue on this microslide, by the way, is an excellent example of the various features of these tumors including the thickened epidermal layer sending pegs into the underlying connective tissue, the epidermal pearls with cores of keratin, some of which have fallen out, and the highly collagenous fibrous connective tissue containing foci of inflammation, especially around vessels. Peripherally, in the connective tissue, are several multicellular bodies reminiscent of parasites. I still think the high frequency with which foreign material is found in these tumors may be indicating that these lesions are exuberant reactions to foreign bodies rather than neoplasms. However, their resemblance of warts sways me the other way to suspect they are viral neoplasms. As you know, neither our electron micrographs nor those of several other labs have shown any virus, but the definitive study has not been done.

For the time being our work on these tumors has been shelved in deference to more pressing projects. We are happy to have this good material available for when we can get back to it.

I am sorry you were not able to visit us on your last trip to Washington. Keep us in mind for another time.

From all of us,

Best personal regards,

John C. Harshbarger, Ph.D.
Director
Registry of Tumors in Lower Animals

Enclosure - as stated



University of Hawaii at Manoa

Hawaii Institute of Marine Biology
P.O.Box 1346 • Coconut Island • Kaneohe, Hawaii 96744
Cable Address: UNIHAW
March 14, 1978

Dr. John C. Harshbarger
Director
Registry of Tumors in Lower Animals
National Museum of Natural History
Smithsonian Institution
Washington, D. C. 20560

Dear Dr. Harshbarger:

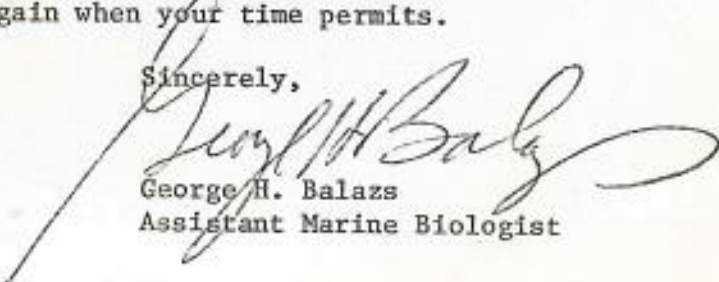
Many thanks for your comprehensive and interesting letter of 6 March 1978 concerning the fibropapillomas and granuloma from Hawaiian sea turtles which I submitted to your laboratory. It is indeed fortunate that a division such as yours exists where material can be analyzed and cataloged.

As I have mentioned before, tumors are not uncommon in Hawaiian turtles. As the principal researcher of these animals, I am frequently asked what causes such growths and if the flesh from an afflicted animal is safe to eat. The information contained in your letter, as well as the reprinted articles, provide some insight on the answers to these questions. With respect to your suspicions of a viral etiology, I wonder if you are willing and able to undertake such an examination should I once again obtain a live, heavily afflicted animal? If you are agreeable, we can arrange to be in contact by telephone at the proper time to ensure that the samples are prepared and shipped in the proper manner.

In your letter you referred to the skin lesion papillomas, however, I am wondering what information you may have on the internal and somewhat different appearing growths accessioned as RTLA 1774.1, 1774.3, 1774.4 and 1774.5? Also, concerning RTLA 1856, it appeared to me that some of the growths infiltrated the bones of the carapace. Was this found to be the case? RTLA 1856 was a very small and presumably young specimen. Have you previously seen such extensive growths in this size of a green turtle? To what extent did the tumors penetrate into the eyes (see my comments on accession form)?

Once again, thank you for your attention to this matter. I look forward to hearing from you again when your time permits.

Sincerely,


George H. Balazs
Assistant Marine Biologist

GHB:md



National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202-381-5936

4 April 1978

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

Dear Dr. Balazs:

The two vials containing glutaraldehyde/sea water-fixed biopsies from a large, fibrous growth on the ventral side of the left front limb of a green turtle, Chelonia mydas, arrived today and was accessioned as RTLA 1883. Dr. Sing Chen Chang, the Registry's Electron Microscopist, will epon embed this material within the next two weeks. However, it will be a month or so before he can examine it with the electron microscope.

LOU
HERMAN
3/21/78

Thank you very much for contributing this case. As soon as we receive the growth you are sending separately, we will let you know.

Best regards,

Phyllis M. Schellenger

Phyllis M. Schellenger

Registrar

Registry of Tumors in Lower Animals



National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202- 381-5936

9 May 1978

Dr. George H. Balazs
Hawaii Institute of Marine Biology
University of Hawaii at Manoa
Post Office Box 1346
Coconut Island
Kaneohe, Hawaii 96744

Dear Dr. Balazs:

We were delighted to receive the large, fibrous growth from the left forearm of a Chelonia mydas specimen. This material and the glutaraldehyde fixed biopsies you sent earlier were accessioned as RTLA 1883. The biopsies have been Epon embedded and thick sections, stained with H & E, were prepared. We are currently studying the thick plastic sections at the light microscope level and will examine thin sections with the electron microscope later. Meanwhile tissue samples of the growth are being histologically processed.

LOW
HERMAN
3/21/78

Dr. Harshbarger will write you regarding this case as soon as possible. Thank you very much for your continued interest in the Registry.

Sincerely,

Phyllis M. Schellenger

Phyllis M. Schellenger
Registrar
Registry of Tumors in
Lower Animals



University of Hawaii at Manoa

Hawaii Institute of Marine Biology

P.O.Box 1346 • Coconut Island • Kaneohe, Hawaii 96744

Cable Address: UNIHAW

18 September 1978

Dear Ms. Schellenger:

Enclosed are two copied letters which you wrote to me back in April and May concerning RTLA 1883. I wonder if you could tell me if Dr. Sing Chen Chang has had the opportunity to examine this material with an electron microscope?

Also, I never did receive an answer to my letter of 14 March 1978 which addressed several questions to Dr. Harshbarger. I am wondering if this letter was ever received at your facility (copy enclosed)?

Your assistance in these matters would be greatly appreciated. I am very much interested in the occurrence of tumors in Hawaiian green sea turtles.

Sincerely,


George H. Balazs



NOTHING MENTION ABOUT TUMORS

J. HILLIS MILLER HEALTH CENTER • UNIVERSITY OF FLORIDA •
DIVISION OF LABORATORY ANIMAL & WILDLIFE MEDICINE
P. O. BOX J-6

GAINESVILLE, FLORIDA 32610
Ph. 904/392-2977

December 19, 1980

Dr. George H. Balazs
NMFS
Southwest Fisheries Center
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Dr. Balazs:

For several years I have been consulting with disease problems in juvenile green turtles at Cayman Turtle Farm, B.W.I. Starting at two months of age, almost all turtles will develop a herpesvirus skin disease called "gray patch disease." References for information published on this disease are:

- 1) Rebell et al: A herpesvirus-type agent associated with skin lesions of green turtles in aquaculture. AM.J.Vet.Res. 36:1221-1224. 1975.
- 2) Haines, H. and Kleese, W.C. 1977. Effect of water temperature on a herpesvirus infection of sea turtles. Infec. and Immun. 15:756-759. 1977.

The disease commences as small papules on the eyelids, neck, flippers and carapace that eventually coalesce into patches. Often the lesions ulcerate and eventually become infected with bacterial contaminants. The lesions often become yellow in color. As of yet, there is no effective treatment. Mortality varies from season to season and often lesions regress spontaneously after one year of age. Dr. H. Haines at the University of Miami is currently working on a vaccine.

I have also seen fungal and bacterial infections of the eyelids and flippers that result from abrasions and bite trauma to these structures. In my experience, when a small lesion is created on the eyelids and flippers, turtles will start biting at these areas causing further problems. For bacterial infections, the people at Cayman Turtle Farm often medicate their turtles by adding ampicillin or tetracycline directly to their manufactured turtle chow or suspending it in food prepared with gelatin.

If you have either biopsy specimens of the lesions in 10% buffered formalin or representative tissues from dead turtles preserved in formalin, I would be glad to cut the tissues in and give you a histopathologic evaluation. I think this would be most helpful in exactly pin-pointing your problem.

If I can be of any further help, feel free to contact me.

Sincerely,



Elliott Jacobson, D.V.M., Ph.D.
Division of Laboratory Animal
and Wildlife Medicine

EJ:nlg

December 19, 1980

Dr. George H. Balazs
NMFS
Southwest Fisheries Center
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Dr. Balazs:

For several years I have been consulting with disease problems in juvenile green turtles at Cayman Turtle Farm, B.W.I. Starting at two months of age, almost all turtles will develop a herpesvirus skin disease called "gray patch disease." References for information published on this disease are:

- 1) Rebell et al: A herpesvirus-type agent associated with skin lesions of green turtles in aquaculture. *AM.J.Vet.Res.* 36:1221-1224. 1975.
- 2) Haines, H. and Kleese, W.C. 1977. Effect of water temperature on a herpesvirus infection of sea turtles. *Infec. and Immun.* 15:756-759. 1977.

The disease commences as small papules on the eyelids, neck, flippers and carapace that eventually coalesce into patches. Often the lesions ulcerate and eventually become infected with bacterial contaminants. The lesions often become yellow in color. As of yet, there is no effective treatment. Mortality varies from season to season and often lesions regress spontaneously after one year of age. Dr. H. Haines at the University of Miami is currently working on a vaccine.

I have also seen fungal and bacterial infections of the eyelids and flippers that result from abrasions and bite trauma to these structures. In my experience, when a small lesion is created on the eyelids and flippers, turtles will start biting at these areas causing further problems. For bacterial infections, the people at Cayman Turtle Farm often medicate their turtles by adding ampicillin or tetracycline directly to their manufactured turtle chow or suspending it in food prepared with gelatin.

If you have either biopsy specimens of the lesions in 10% buffered formalin or representative tissues from dead turtles preserved in formalin, I would be glad to cut the tissues in and give you a histopathologic evaluation. I think this would be most helpful in exactly pin-pointing your problem.

If I can be of any further help, feel free to contact me.

Sincerely,

Elliott Jacobson
Elliott Jacobson, D.V.M., Ph.D.
Division of Laboratory Animal
and Wildlife Medicine

EJ:nlg

Proceedings of the 11th International Symposium of
The Princess Takamatsu Cancer Research Fund, Tokyo, 1980

PHYLETIC APPROACHES TO CANCER

Edited by

CLYDE J. DAWE, JOHN C. HARSHBARGER,
SOHEI KONDO, TAKASHI SUGIMURA,
and SHOZO TAKAYAMA

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Virus Associated Neoplasms of Reptiles

Elliott R. JACOBSON

Department of Laboratory Animal and Wildlife Medicine, College of Veterinary Medicine, University of Florida, Gainesville, Florida 32610, U.S.A.

Abstract: Virus particles have been associated with, and incriminated in the pathogenesis of neoplasms in several reptile species. Although there are numerous reports on fibropapillomas in the green turtle (*Chelonia mydas*), electron microscopic evaluation of tissue has failed to demonstrate a viral etiology. Papillomas of wall lizards (*Lacerta muralis*) maintained as a laboratory breeding colony were found by electron microscopy to have three morphologically distinct particles. A C-type RNA virus was found budding from spleen tissue cultures in the 48th and 52nd passage from a Russell's viper (*Vipera russelli*) diagnosed as having a precordial myxofibroma. Electron microscopic examination of an embryonal rhabdomyosarcoma in a corn snake (*Elaphe guttata*) revealed C-type virus particles. Recently, a lymphosarcoma associated with virus-like intranuclear inclusions was reported for a California king snake (*Lampropeltis getulus californiae*). Sarcomatous neoplasms have been experimentally induced in several reptile species inoculated with the Schmidt-Ruppin strain of Rous sarcoma virus.

A variety of spontaneously occurring neoplasms, conforming to all major groups of mammalian neoplasms, have been described for reptiles (1). Additionally, several pigment cell neoplasms unique to reptiles, and other ectothermic vertebrates, have been described (2, 3). A majority of these descriptions are based on animals in zoological collections, and often the species represented are those that are long lived in captivity.

The role of both DNA and RNA viruses in the etiology of specific neoplasms of homeotherms has good historical documentation (4-6). There also is evidence for the support of a causal relationship between a herpesvirus and Lucké's renal adenocarcinoma in the amphibian, *Rana pipiens* (7). Within the last 10 years several virus associated neoplasms have been described for reptiles. Since the class Reptilia resulted in the independent evolution of birds and mammals, work on possible virus etiology of reptile neoplasms may have important implications for understanding the evolution of higher vertebrate oncornaviruses.

Virus associated neoplasms will be reviewed taxonomically for the major groups of reptiles. Both spontaneous and experimentally induced neoplasms will be described. Recent findings, not in press, also will be presented.

Spontaneous Virus Associated Neoplasms

I. Chelonia

There are numerous papers describing papillomas, fibromas, and fibropapillomas in wild caught adult green turtles (*Chelonia mydas*). Multiple large papillomas of the skin and eyes in green turtles were found to consist of arborescent connective tissue papillae covered by a thickened keratinized squamous epithelium (8). Lesions were seen in a 75 kg *C. mydas* at the New York Aquarium, and in 3 of 200 turtles caught off Key West, Florida (9). Papillomas were distributed over the dorsal cervical region, axillae of the hindlegs, eyelids and conjunctivae. These lesions ranged from papillary projections of hyperplastic keratinized epithelium supported by a fibrous core to smooth round fibrous tumors composed of dense connective tissue covered by a thickened epithelium. In a subsequent study, more than half the specimens of approximately 250 tumors were found to contain trematode eggs (*Haplotrema constrictum*) in the dermis of the growths (10). The authors believed the eggs were deposited in the vascular bed of the tumor by migrating trematodes. Leeches (*Ozobranchus branchiatus*) also were found attached to the fibropapillomas (11). Although many examples of papillomas and wart growths are known in mammals to have a virus etiology, electron microscopy has failed to demonstrate associated particles in *C. mydas* papillomas.

Recently, a slowly increasing incidence of papillomatosis has been studied in a breeding group of *C. mydas* raised in mariculture in the Cayman Islands, British West Indies. The history suggested an infectious agent etiology, possibly a virus. Papillomas were found growing from the conjunctiva, palpebrae, cervical integument and integument in the axis of the forelimbs and hindlimbs. The papillomas were first noted in several wild caught adults, and over the last few years developed in farm reared turtles previously free of gross lesions. Leeches (*Ozobranchus* sp.) commonly parasitized the papillomas and histologic examination of biopsy specimens revealed trematode eggs in dermal capillaries. The eggs were believed to be from the spirorchid trematode, *Laeradius laeredi*, found in the heart and great vessels (12).

Biopsy specimens were cut in 1 mm cubes, fixed in 2.5% glutaraldehyde, then fixed in 1% OsO₄ and embedded in epoxy resin. One-micron sections of the epoxy-embedded material were examined by light microscopy following staining with toluidine blue. Ultrathin sections were placed on copper grids, stained with uranyl acetate and lead citrate, and examined with an electron microscope.

By light microscopy, epithelial cells within the prickle-cell layer were hypertrophied, with enlarged nuclei commonly containing two nucleoli. As of yet no viral particles have been demonstrated by electron microscopy.

Cell free extracts of papillomatous tissues were prepared by suspending ground biopsy specimens in phosphate buffered saline followed by millipore filtering. Ex-

tracts were injected both intradermally into the palpebra and intracoelomically into 2 weeks old *C. mydas*. Turtles will be examined every month for the presence of developing papillomas. Additionally, the adult female originally biopsied received 5.0 cc of a wart vaccine (20% suspension) derived from papillomas treated with 1.0% formalin. The progress of this turtle will be followed.

2. *Squamata: Lacertilia*

There are numerous reports describing papillomas in lacertid lizards. Raynaud and Adrian presented a detailed report on the distribution of papillomas in wall lizards (*Lacerta muralis*) maintained as a breeding colony (30-40 in a large terrarium measuring 6x3 m) (13). The papillomas ranged in diameter from 2-20 mm, and numbered 2-25 per individual. In females the papillomas were most commonly found in the caudal lumbar area of the body, in the vicinity of the tail base; papillomas were rarely found around the head. In males, the papillomas had a dorsocranial distribution, around the base of the head. Both males and females never had papillomas associated with ventral-scales. The authors associated the distribution to the reproductive behavior whereby males inflict bite wounds on females at the base of the tail, and combative behavior between males during which males inflict bite wounds at the base of the neck of other males. Histopathologic examination of papillomas showed hyperkeratosis and hyperplasia of epidermal cells. The nucleus of epidermal cells was often hypertrophied with margination of chromatin material and intranuclear inclusions. Papillomas submitted for electron microscopy revealed 3 morphologically distinct virus particles resembling herpesvirus, reovirus, and papovavirus. Thus, there was good evidence for a virus etiology, and future transmission studies should confirm this possibility.

3. *Squamata: Ophidia*

A C-type virus (105-110 nm) demonstrated by electron microscopy to be budding from spleen tissue cultures in the 48th and 52nd passage, from a Russel's viper (*Vipera russellii*) diagnosed as having a precardial myxofibroma represented the first oncornavirus associated with reptilian neoplastic cells (14). Although no virus particles were demonstrated by electron microscopy in the primary tumor tissue, the authors suggested that the virus producing cell line originated from cells of the tumor metastases present in the spleen's vascular compartment. The cultured splenic cells were aneuploid, and karyotyping confirmed their origin from the viper. The viper agent closely resembled the avian leukosis virus in its mature extracellular form. DNA polymerase has been found in this reptilian C-type virus (15, 16). Structures resembling A-particles also have been observed in paranuclear inclusions in this C-type particle producing viper cell line (17).

Electron microscopic examination of an embryonal rhabdomyosarcoma from a corn snake (*Elaphe guttata*) revealed particles resembling C-type viruses of avian and mammalian origin in size, shape, and site of formation (18). This represented the first report describing the morphogenesis of C-type virus particles within the primary tumor tissue of a poikilothermic vertebrate.

In a recent study (19), a laboratory bred and laboratory reared male California

king snake (*Lampropeltis getulus californiae*) was found to have a palpable mass within the coelomic cavity. The snake died following excision of the mass and histopathology of all major organs (except muscle and brain) resulted in a diagnosis of lymphosarcoma. Approximately 70% of lymphocytes, which infiltrated all major organs, contained small to large eosinophilic intranuclear inclusions. Electron microscopic examination of these inclusions demonstrated them to be large, uniformly electron-dense granular structures surrounded by a less dense region. These structures did not appear to be nucleoli. Aggregates of intracytoplasmic circular structures that measured 50 nm were seen in several cells. Their location, formation into aggregates, and appearance by transmission electron microscopy suggested them to be virus particles. Formalin fixation precluded good ultrastructural detail and categorization into a virus family. The relationship of the intranuclear inclusions, if any, to the intracytoplasmic particles remains unclear.

Experimentally Induced Neoplasms

There are limited studies on experimentally induced neoplasms in the class Reptilia with all of the work coming from one laboratory. Several species of adult reptiles were inoculated subcutaneously, intramuscularly, and intracoelomically with chicken sarcoma material induced in chickens with the Schmidt-Ruppin strain of Rous sarcoma virus (20). Out of 5 tortoises (*Testudo horsfieldi*) 4-5 years old, two died within 14-18 days after an intrathoracic inoculation. Tumor masses were recovered from the thorax, where the tumor cells had penetrated the thoracic musculature. In one of two snakes (*Erix tataricus*) several slowly growing tumor nodules developed one month following inoculation, and resembled the original chicken Rous sarcoma. The second snake developed a large intrabdominal tumor following a second inoculation. The inoculation of adult *Natrix natrix*, *N. tessellata*, *Agama caucasica*, and *Varanus griseus* did not lead to the development of tumors. The results of this work added reptiles to the list of animals known to be susceptible to the oncogenic effects of Rous sarcoma virus. Karyologic studies demonstrated that the tumors developed from reptile cells. Tumors were induced in chickens by suspension of snake tumor cells. Since this virus in mammals generally induces tumors only in newborn animals, the authors believed that reptiles appeared fairly sensitive to the virus and thus are comparable to birds. In a subsequent experiment (21) the lizards *Eremias velox* and *Gymnodactylus fedteschenkovi* were also found to be susceptible to the virus. This list was further increased to include *Agama sanguinalenta*, *A. erythrogastera*, *Eremias persica*, *E. grammica*, *Eumeces taeniolatus*, and *Agkistrodon blomhoffii* (22). Younger animals were more susceptible to the tumorigenic effects of the virus compared to older animals. Further, the authors stated that a decrease in environmental temperature led to an inhibition of reptile tumor development.

Following acclimation to a temperature of 32°C and an 8 hr light, 16 hr dark photoperiod, 20 *Anolis carolinensis* received a subcutaneous injection of a cell free extract of Schmidt-Ruppin strain of Rous sarcoma virus in the proximal part of the hindleg and within the coelomic cavity. The lizards were maintained for 3 months, at which time no external gross lesions were noted, nor were microscopic lesions

noted on light microscopic examinations. Results of this experiment indicated that cell free extracts of Schmidt-Ruppin strain of Rous sarcoma virus were not tumorigenic in *A. carolinensis*. Environmental conditions (temperature and photoperiod) may have been a factor influencing the response of the lizard to injected virus.

ACKNOWLEDGMENT

The author would like to acknowledge Dr. Jack Gaskin, Department of Preventive Medicine, University of Florida, for his work on green turtle papillomatosis presented in this paper.

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National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202-357-2647

15 January 1981

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

Dear George:

Thank you very much for your terrific report on the green turtle. I have asked Dr. Elliott Jacobson to keep you informed of his tumor studies. His latest theory is that they represent an exuberant fibrous response in the dermis to eggs from trematodes infecting the heart. They hope to test that in the Spring.

Sincerely,

John C. Harshbarger
Director
Registry of Tumors in Lower Animals

April 3, 1981

F/SWC2:GHB

Dr. Elliott Jacobson
Health Center Animal Resources
Department
P. O. Box J-6
University of Florida
Gainesville, FL 32610

Dear Dr. Jacobson:

A copy of your letter to Jim Brock, dated March 19, has been passed on to me.

Your analysis of the lesions on our captive green turtles certainly supports the general impression I have had for some time now: that is, biting, abrasions, and stress create injuries that are prone to bacterial infection. The white lesions contrast with the surrounding dark skin, thereby serving as a focus for more biting. The cure for the problem is basically one of better management—greater care in feeding, seawater exchange, and applying medication at early signs of injury. Your letter will be most valuable in developing such policies.

As you will recall from John Marshbarger's correspondence, I am interested in the etiology of tumors on sea turtles. They are a fairly common sight on Hawaiian green turtles. Have you made any recent findings on this interesting problem? John mentioned that tumors were starting to show up at the turtle farm on Cayman Island. Do you feel that there is an infectious agent involved?

Again, many thanks for reviewing the material that Jim Brock sent to you. Your assistance is greatly appreciated.

Sincerely,

George H. Balazs
Fishery Biologist

GHB:vi

bc: Balazs
HL

Balazs



J. HILLIS MILLER HEALTH CENTER • UNIVERSITY OF FLORIDA •
DIVISION OF LABORATORY ANIMAL & WILDLIFE MEDICINE
P. O. BOX J-6

GAINESVILLE, FLORIDA 32610
Ph. 904/392-2977

April 9, 1981

Dr. George H. Balazs
National Marine Fisheries Service
Southwest Fisheries Center
Honolulu Laboratory
P. O. Box 3830
Honolulu, Hawaii 96812

Dear Dr. Balazs:

I am glad to hear that we are in agreement on the juvenile green turtle skin lesions. As with so many things concerning captive reptile problems, good management practices are often the key to successfully rearing and breeding these animals.

The green turtle papilloma problem appears to be quite an interesting disease. Over the last year I have been working with a virologist, Dr. Jack Gaskin, on the papilloma problem in adult green turtles at Cayman Turtle Farm. We have taken several biopsies and have made homogenates for injection back into hatchling turtles, screened tissues by electron microscopy and have attempted isolation of possible viral agents in cell culture. As of yet there is no evidence for a viral etiology. The one thing we do see consistently with the papillomas is the presence of spirorchid trematodes eggs within dermal capillaries. A paper describing the adult parasites on the heart and associated great vessels is enclosed. I am presently assembling a paper on the pathology associated with these eggs in visceral sites and it is my opinion that these parasites are important pathogens for green turtles in the Cayman Islds. Currently it is my belief that these eggs may be the responsible agent for the papillomas. Antigens released through the egg wall probably incite a tremendous inflammatory response which in the skin is seen as a dermal fibrous tissue response. Indeed a major component of the papilloma is the dermal connective tissue.

After I finish the paper on systemic pathology I will be assembling the papilloma paper incriminating the spirorchid eggs. Actually Smith and Coates suggested this years ago. Final proof will come when we can inject eggs recovered from adult parasites back into turtles and actually induce the papillomas.

Dr. George H. Balazs
April 9, 1981
Page -two-

Please let me know your feelings concerning my opinions for I am
always eager to learn from those active in this fascinating field
of reptile disease.

Sincerely,

A handwritten signature in blue ink that reads "Elliott Jacobson". The signature is written in a cursive style with a large, stylized "E" and "J".

Elliott Jacobson, D.V.M., Ph.D.

EJ:ck

Greiner, E.C., Forrester, D.J.
and Jacobson, E.R. 1980

Helminths of
mariculture-reared
green turtles from
Grand Cayman, B.W.I.

Proc. Helminthological
Society of Wash.

47, 142-144

April 27, 1981

F/SWC2:GHB

Dr. Elliott Jacobson
J. Hillis Miller Health Center
Division of Laboratory Animal
and Wildlife Medicine
P. O. Box J-6
Gainesville, FL 32610

Dear Dr. Jacobson:

I appreciated your letter of April 9th describing some of your important findings with respect to the generation of papillomas in green turtles. I am afraid that there is very little more that I can offer in the way of information on this problem in Hawaiian waters. I believe that I sent you a copy of my National Marine Fisheries Service green turtle "synopsis." Pages 20-22 of this report contain some discussion of the subject, based almost totally on the results of Dr. Harshbarger's analyses of preserved specimens. I don't believe that evidence of trematode eggs was detected in this material.

If it would be beneficial to your work, I can plan to excise, preserve, and ship to you the next case of tumor material that comes to my attention. Dead and stranded turtles afflicted with tumors are a fairly regular occurrence here in Hawaii. On the average, I have the opportunity to salvage such material about once in every 2 months.

I look forward to hearing from you again when your time permits. In the meantime, I will write to John Harshbarger and ask him about the possible presence of trematode eggs in our Hawaiian specimens.

Sincerely,

George H. Balazs
Fishery Biologist

GHB:vi

bc: Balazs
HL

Balazs

November 21, 1980

F/SWC2:GHB

Dr. Elliott R. Jacobson
Division of Laboratory Animal
and Wildlife Medicine
College of Veterinary Medicine
University of Florida
Gainesville, Florida 32610

Dear Dr. Jacobson:

It is my understanding that you are currently conducting disease tests on a group of young ridley sea turtles obtained from the NMFS Galveston Laboratory. If my information is correct, the problem is one of progressively increasing lesions around the eyes and certain areas of the flippers and neck.

We are experiencing similar problems in a group of 2-month old green turtles being reared in captivity here in Hawaii. The treatment described by Ross Whitham in a note published several years ago does not seem to be effective. We would therefore greatly appreciate any suggestions that you can offer for experimental treatment.

Thank you in advance for any assistance that you may be able to provide in this matter.

Sincerely,

George H. Balazs
Fishery Biologist

bc: Balazs
HL

GHB:iht



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WASHINGTON, D.C. 20560 • TEL. 202-357-2647

22 October 1981

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

Dear George:

Need X
Thanks a lot for the interesting article by Harry Whitten in the "Honolulu Star-Bulletin" on green turtle papilloma. I am mentioning your specimen with a lung tumor, i.e., RTLA 1774, in my section of a chapter for a CRC Book: "Comparative Respiratory Tract Carcinogenesis".

With best regards,

John C. Harshbarger, Ph.D.
Director
Registry of Tumors in Lower Animals

Balazs

January 17, 1983

F/SWC2

Dr. Elliott Jacobson
Division of Laboratory Animal
and Wildlife Medicine
University of Florida
P. O. Box J-6
Gainesville, Florida 32610

Dear Dr. Jacobson:

Since you last wrote to me in April 1981 (copy attached) we have continued to regularly see green turtles with papillomas here in the Hawaiian Islands. Nearly every month a new report is received, and I am uncertain if the incidence is actually increasing, or if more people are taking the time to report their observations. Many of the turtles with papillomas that we are able to examine are moribund or freshly dead.

In view of this continuing problem, and the inability on my part to tell people what is responsible for these growths, I am anxious to learn what advances you may have made in your own research. If you have any new publications or reports available on this subject, I would certainly appreciate receiving copies. Also, I would like to obtain a reprint of the paper you wrote with E. Greiner and D. Forrester (1980) entitled "Helminths of mariculture-reared green turtles from Grand Cayman BWI."

Again, thank you for your help and advice.

Sincerely,

George H. Balazs
Fishery Biologist

Enclosure

GHB/11

bc: Balazs ✓
HL



**J. HILLIS MILLER HEALTH CENTER
COLLEGE OF VETERINARY MEDICINE**

Department of Special Clinical Sciences
and

Health Center Animal Resources
Box J-6
Gainesville, FL 32610

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Exotic Birds
Reptiles
Ph. (904) 392-2977

January 24, 1983

Mr. George H. Balazs
Fishery Biologist
N.M.F.S.
Honolulu Laboratory
P. O. Box 3830
Honolulu, Hawaii 96812

Dear Mr. Balazs:

Enclosed is a reprint of the paper you requested.

Unfortunately I have made little progress on the etiology of the papillomas since I corresponded with you in April, 1981. Since that time I have had little contact with disease problems at Cayman Turtle Farm and unfortunately have not been able to pursue any further the papilloma problem. I still feel the disease is most likely a response to Spirorchid trematode eggs and not of viral etiology.

Sorry I can't be of any further help with this most interesting problem.

With best regards,

Elliott Jacobson, DVM, PhD
Assistant Professor

EJ:ck
Enclosure



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COLLEGE OF VETERINARY MEDICINE**

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and
Health Center Animal Resources
Box J-6
Gainesville, FL 32610

Laboratory Animals
Zoo Animals
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January 24, 1983

Mr. George H. Balazs
Fishery Biologist
N.M.F.S.
Honolulu Laboratory
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Sorry I can't be of any further help with this most interesting problem.

With best regards,

Elliott Jacobson, DVM, PhD
Assistant Professor

EJ:ck
Enclosure



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20 December 1983

Dr. George H. Balazs
Honolulu Laboratory
Southwest Fisheries Center
NOAA
U.S. Department of Commerce
P. O. Box 3830
Honolulu, Hawaii 96812

Dear George:

Thanks for the article and your new address. I worry about being quoted out of context, but I think most people put this type of information in perspective when they read it.

I am sorry you never heard from Jacobson. Enclosed is a xerox copy of his 1981 paper. The lesions spread through the Cayman Island farmed turtles like an infectious disease.

Seasons Greetings and best wishes for the New Year!

Sincerely,

John C. Harshbarger
Director
Registry of Tumors in Lower Animals

Enclosure - as stated

Chuhart, L.

3/13/84

I'm glad that you continue to be interested in the tumors on green turtles. In answer to your question, no, I have never seen the slightest trace of an epithelioma on a loggerhead. I'm virtually certain they don't occur on loggerheads in this region. I wish that we could manage to continue our net-capture work in the Indian River throughout the year but that has not been possible so far. Last summer we captured 21 juvenile green turtles at our primary site (the area around Sebastian Inlet) and recaptured a few of the loggerheads that we had captured and tagged in the summer of 1982. We had only captured two green turtles in 1982 (one had tumors) so there was little potential for recapture of afflicted animals, in order to assess the growth of tumors or the effects on the animals. There is no telling whether or not we can recapture some of those little green turtles in the summer of 1984, but more than 50% of those captured in '83 had the growths. Our last day of netting was 8 September and I would suppose we'll start up again about 15 May. We do have photographs of virtually all of the green turtles captured thus far, including, of course, those with tumors. We have seen some pretty ugly ones (I don't have any prints as yet but will get some and send them along) and we definitely have not seen anything like the "beauty" in the photo you enclosed. As a matter of fact we have never seen epitheliomas on any adult. I believe this is the basis of Ross Witham's belief that the growths are eventually debilitating. If he is right then it is a very serious problem for this important population of juvenile, east coast green turtles. I like to think that it is a slowly growing population but have no real proof of that as yet. The other side of the argument is that these things may be like warts on humans. One outgrows them. That is to say, our bodies gradually develop a resistance to the causative virus and they disappear. The presence of the things on your adults argues against that and their apparent absence from adults here on the Atlantic coast could mean either that juveniles that acquire them don't survive or that they gradually develop resistance to the virus. Remember also that we don't really see all that many adult green turtles. I may count 50 or so green turtle nests between Melbourne Beach and Sebastian Inlet but I only see four or five of the turtles. Ross Witham almost never sees a nesting adult either. So there are a lot of questions, including the one about the actual causation: "Is it really viral?" I believe Elliot Jacobson (UF, Gainesville) thinks they may be some sort of immune response to trematode eggs circulating in the bloodstream (don't quote me on that one, I can't remember exactly what he said, but he does doubt that the cause is viral).

I am pleased that you are concerned about this because the problem needs all the attention we can give it. I can't seem to get anyone around here to pay much attention. I need to find the time to put together a proposal (probably in cooperation with some local vet if I can find one who is interested) to begin to look at the problem systematically. I have so many other things going that I don't know when that may happen. We will definitely be working on the Indian River near Sebastian again this summer but the level of activity will depend on the funding support I can round up between now and then. As I said, planning and arranging this workshop is taking virtually all of my non-teaching time so I'll probably end up scrounging for small amounts of money from local and "non-traditional" sources. I should be in a good position to (in terms of time and preliminary data) prepare several proposals during the upcoming academic year. I hope so. Right now though, the summer of 1984 does not look too bright.

I hope things continue to go well for you in the land of pineapples. I very much admire your willingness to correspond and communicate and will do my best to reciprocate. Lets keep in touch on this tumor thing. Maybe we can rattle a few chains and focus some attention on it. Regards.

L. M. Ehrhart



Associate Professor

FORM CD-14 (2-76) Prescr. by DAO 214-2 TRANSMITTAL SLIP	U.S. DEPT. OF COMM.	DATE 26 March 86
TO: George B.	REF. NO. OR ROOM, BLDG. F/SWCR	
FROM: Barbara S.	REF. NO. OR ROOM, BLDG. F/SEC11	
ACTION		
<input type="checkbox"/> NOTE AND FILE <input type="checkbox"/> NOTE AND RETURN TO ME <input type="checkbox"/> RETURN WITH MORE DETAILS <input type="checkbox"/> NOTE AND SEE ME ABOUT THIS <input type="checkbox"/> PLEASE ANSWER <input type="checkbox"/> PREPARE REPLY FOR MY SIGNATURE <input type="checkbox"/> TAKE APPROPRIATE ACTION	<input type="checkbox"/> PER OUR CONVERSATION <input type="checkbox"/> PER YOUR REQUEST <input type="checkbox"/> FOR YOUR APPROVAL <input checked="" type="checkbox"/> FOR YOUR INFORMATION <input type="checkbox"/> FOR YOUR COMMENTS <input type="checkbox"/> SIGNATURE <input type="checkbox"/> INVESTIGATE AND REPORT	

COMMENTS:

thought you might be interested in this too.
 It was good to see you again in Georgia... best regards - Barbara



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Fisheries Center
Miami Laboratory
75 Virginia Beach Drive
Miami, FL 33149

25 March 1985 F/SEC11:BAS

L.M. Ehrhart, Ph.D.
University of Central Florida
Department of Biology
P.O. Box 25000
Orlando, FL 32816

Dear Doc:

For your information and records, I just came across a stranding record from North Carolina that described what appears to be another case of papillomas (or something similar), but the turtle is reported as a Caretta. The animal stranded on 23 October 1985 at Oak Island, NC. It was recorded as a positive identification, measurements were CLOC 101.6 cm and CWOC 88.9 cm. Tumors were described as around both eyes, at the insertion of the left front flipper and at the insertion of both rear flippers.

I cannot comment on the reporter's ability to identify species, but NC has few strandings of Chelonia. They reported three for 1985 (no papillomas noted and all clearly immature). I thought this would be of interest to you as it is not only a loggerhead, but an apparent adult as well. I believe the stranding data base may be able to provide information on the incidence of papillomas in stranded turtles reported through the network. We can talk about that sometime if you're interested.

Are we officially calling this condition papillomatosis, or did someone just decide to make that one up? I copied this to George Balazs for his records as well. It was good to see you in Georgia. Best regards and keep in touch.

Sincerely,

Barb

Barbara A. Schroeder
Biologist

cc: F/SEC11 - Joseph Powers
F/SWC2 - George Balazs ✓





UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Fisheries Center
Miami Laboratory
75 Virginia Beach Drive
Miami, FL 33149

25 March 1985 F/SEC11:BAS

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University of Central Florida
Department of Biology
P.O. Box 25000
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Barb

Barbara A. Schroeder
Biologist

cc: F/SEC11 - Joseph Powers
F/SWC2 - George Balazs ✓





UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Fisheries Center
Miami Laboratory
75 Virginia Beach Drive
Miami, FL 33149

25 March 1985 F/SEC11:BAS

L.M. Ehrhart, Ph.D.
University of Central Florida
Department of Biology
P.O. Box 25000
Orlando, FL 32816

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Sincerely,

Barb

Barbara A. Schroeder
Biologist

cc: F/SEC11 - Joseph Powers
F/SWC2 - George Balazs ✓



check my FIMD file

8-16-85

Bill-

I feel we need to look at some of our stranded, tumor-infested turtles from the standpoint of organochlorine pesticide accumulation.

It's not been done thus far. Dave searched around, but can't find anyone to do it "free". However, the local analytical lab, INALAB, will do a broad-spectrum for 12 of these compounds - giving exact levels for each found. They will do it for \$450 per sample, 15% discount for 5 or more samples.

Liver tissue would be the likely site of accumulation.

Could we get funds for 2-3 samples? A few of our fresh-frozen turtles on hand now are good candidates of analysis.

W

SB

See me -
with ✓

FORM CD-14 (2-76) Prescr. by DAO 214-2		U.S. DEPT. OF COMM.	DATE 1/15/86
TRANSMITTAL SLIP			
TO:	<i>George Palocz</i>	REF. NO. OR ROOM, BLDG.	<i>F/SWC 2</i>
FROM:	<i>Vanny Ogren</i>	REF. NO. OR ROOM, BLDG.	<i>F/SEC 5</i>
ACTION			
<input type="checkbox"/> NOTE AND FILE	<input type="checkbox"/> PER OUR CONVERSATION		
<input type="checkbox"/> NOTE AND RETURN TO ME	<input type="checkbox"/> PER YOUR REQUEST		
<input type="checkbox"/> RETURN WITH MORE DETAILS	<input type="checkbox"/> FOR YOUR APPROVAL		
<input type="checkbox"/> NOTE AND SEE ME ABOUT THIS	<input checked="" type="checkbox"/> FOR YOUR INFORMATION		
<input type="checkbox"/> PLEASE ANSWER	<input type="checkbox"/> FOR YOUR COMMENTS		
<input type="checkbox"/> PREPARE REPLY FOR MY SIGNATURE	<input type="checkbox"/> SIGNATURE		
<input type="checkbox"/> TAKE APPROPRIATE ACTION	<input type="checkbox"/> INVESTIGATE AND REPORT		

COMMENTS:
 This was done through
 Regional Office - Lew
 Ehrhart was awarded
 the contract for Phase I.
 Phase II, pathology &
 treatment, have not been
 funded yet.

REQUEST FOR QUOTATIONS
(THIS IS NOT AN ORDER)

Page **1** of **3**

1 REQUEST NO	2 DATE ISSUED 10/16/85	3 REQUISITION/PURCHASE REQUEST NO	4 CERTIFIED FOR NATIONAL DEFENSE UNDER BOSA REG 2 AND/OR DMS REG 1 RATING
---------------------	----------------------------------	--	--

5 ISSUED BY
U.S. Department of Commerce, NOAA
National Marine Fisheries Service
75 Virginia Beach Drive
Miami, FL 33149

6 DELIVER BY (Date)
Six months after statr date

7 DELIVERY

FOB DESTINATION

OTHER (See Schedule)

FOR INFORMATION CALL (Name and tel no) (No collect calls)

8 TO NAME AND ADDRESS INCLUDING ZIP CODE
Dr. Llewellyn Ehrhart
Department of Biological Sciences
University of Central Florida
P.O. Box 25000
Orlando, FL 32816

9 DESTINATION (Consignee and address including ZIP code)

Same as block 5

10 PLEASE FURNISH QUOTATIONS TO THE ISSUING OFFICE ON OR BEFORE CLOSE OF BUSINESS October 29, 1985 **SUPPLIES ARE OF DOMESTIC ORIGIN UNLESS (Date)**

OTHERWISE INDICATED BY QUOTER THIS IS A REQUEST FOR INFORMATION, AND QUOTATIONS FURNISHED ARE NOT OFFERS IF YOU ARE UNABLE TO QUOTE, PLEASE SO INDICATE ON THIS FORM AND RETURN IT. THIS REQUEST DOES NOT COMMIT THE GOVERNMENT TO PAY ANY COSTS INCURRED IN THE PREPARATION OR THE SUBMISSION OF THIS QUOTATION, OR TO PROCURE OR CONTRACT FOR SUPPLIES OR SERVICES

SCHEDULE

11 ITEM NO	12 SUPPLIES/SERVICES	13 QUANTITY	14 UNIT	15 UNIT PRICE	16 AMOUNT
1	<p>See attached Statement of Work</p> <p>Period of Performance: A toatl of six months for the completion of phase I is allowed. A final report will be submitted one month after the completion of the work.</p> <p>Proposals shall include:</p> <ol style="list-style-type: none"> 1. Statement of qualifications 2. Scope of work: rationale, objectives, methodology, deliverables, & schedule. 3. Itemized budget. 				<p>NOT TO EXCEED</p> <p>\$4,000.00</p>

17. PRICES QUOTED INCLUDE APPLICABLE FEDERAL, STATE, AND LOCAL TAXES

DISCOUNT FOR PROMPT PAYMENT _____ % 10 CALENDAR DAYS _____ % 30 CALENDAR DAYS _____ % 30 CALENDAR DAYS _____ % _____ CALENDAR DAYS

NOTE: Reverse must also be completed by the quoter.

18 NAME AND ADDRESS OF QUOTER (Street, city, county, State, including ZIP Code)	19 SIGNATURE OF PERSON AUTHORIZED TO SIGN QUOTATION	20 DATE OF QUOTATION
	21 SIGNER'S NAME AND TITLE (Type or print)	22 TELEPHONE NO (Include area code)

Bidders List

- (1) Dr. Llewellyn Ehrhart
Department of Biological Sciences
University of Central Florida
P.O. Box 25000
Orlando, Florida 32816
Telephone: (305) 275-2970
- (2) Dr. Elliott Jacobson
J. Hillis Miller Health Center
College of Veterinary Medicine
Box J-6
Gainesvill, Florida 32610
Telephone: (904) 392-2977
- (3) Dr. Peter Lutz
RSMAS/BLR
4600 Rickenbackerr Causeway
Miami, Florida 33149
Telephone: (305)) 361-4177
- (4) Dr. Jim Richardson
Georgia Marine Turtle Research Program
Institute of Ecology
University of Georgia
Athens, Georgia 30602
Telephone: (404) 542-2968

Sea Turtle Papillomas Work Statement

Statement of the Problem:

The documentation of large multiple papilloma-like growths on sea turtles in Florida has increased greatly in the last two years. These abnormal growths occur primarily on sub-adult green turtles (*Chelonia mydas*) and are increasingly frequent in the lagoonal waters of the Indian River System in east central Florida. The Indian River System, which includes Mosquito Lagoon and the Indian/Banana Rivers, is a known "developmental habitat" for immature green and loggerhead turtles. Although both species utilize this lagoon habitat and are encountered in relatively equal numbers, the incidence of papillomas on green turtles is disproportionately high. The phenomenon also appears to be a recent affliction. In 1985 about 29% (41 turtles) of the green turtles captured in Mosquito Lagoon displayed papillomas. This "disease" had never been observed in the Lagoon in previous years. In the southern regions of the Indian River approximately 50% of the captured sub-adult green turtles have papilloma growths. There have also been scattered records of papilloma-like growths on green turtles in the Florida Keys and Hawaii.

It is not known if the papillomas are life threatening to sea turtles. Preliminary observations indicate these bulbous papillomas (often referred to as tumors, neoplasms, or fibropapillomas) are distributed on the soft tissue of the neck, inguinal and auxiliary regions. The papillomas also occur in potentially incapacitating areas like the mouth, eyelid, and conjunctivae of the eye. The cause and the characteristics of the papillomas is unknown (i.e. viral, environment, genetic, parasitic, etc.).

Stages of Work

The work is divided into two phases:

Phase 1--To identify the characteristics of the papillomas and the characteristics of the sea turtles they are affecting; and to establish preliminary studies to determine the debilitatory nature of the papillomas.

Phase 2--(Option to Extend). To determine the cause of the papilloma-like growths and to begin studies designed to determine means of treating the disease. Phase 2 is contingent on the availability of funds and Phase 1 results.

Scope of Work (Phase 1):

The project will include the following activities:

- (1) A thorough review of the incidence of papilloma-like growths on sea turtles, with emphasis on wild Florida green turtles. This review should include a literature search and interviews with individuals associated with sea turtles/papillomas.
- (2) The geographic areas of occurrence of papillomas on sea turtles should be identified.

(3) At least five sub-adult sea turtles with papillomas will be captured and maintained under captive conditions to determine the "fate" of the turtles and the papilloma growths. In addition, attempts should be made to recapture tagged sea turtles in areas known to have "diseased" turtles in order to assess papilloma growths in wild turtles.

(4) Papilloma growths will be biopsied and fixed for further analysis (these biopsies would be utilized in Phase 2).

Phase 2: The scope of work for Phase 2 will be based on Phase 1 results.

Period of Performance

A total of six months for the completion of phase 1 is allowed. A final report will be submitted one month after the completion of the work.

Bidders List

- (1) Dr. Llewellyn Ehrhart
Department of Biological Sciences
University of Central Florida
P.O. Box 25000
Orlando, Florida 32816 Telephone: (305) 275-2970
- (2) Dr. Elliott Jacobson
J. Hillis Miller Health Center
College of Veterinary Medicine
Box J-6
Gainesville, Florida 32610 Telephone: (904) 392-2977
- (3) Dr. Peter Lutz
RSMAS/BLR
4600 Rickenbacker Causeway
Miami, Florida 33149 Telephone: (305) 361-4177
- (4) Dr. Jim Richardson
Georgia Marine Turtle Research Program
Institute of Ecology
University of Georgia
Athens, Georgia 30602 Telephone: (404) 542-2968

Proposals shall include:

- (1) Statement of qualifications
- (2) Scope of work: rationale, objectives, methodology, deliverables, and schedule
- (3) Itemized budget

COTR: Paul W. Raymond (FTS 826-3366)
Protected Species Management Branch SER23

REQUEST FOR APPROVAL OF
ADVISORY AND ASSISTANCE SERVICESRequesting Organization: NOAA-NMFS, Southeast Fisheries CenterName and phone number of requesting organization contact: Fred Berry, ^{FTS 350-1295} Protected SpeciesType of proposal: Personnel action
Procurement action CoordinatorPeriod of personnel appointment or contract: 6 Base period12 Base period including
all renewals or optionsAmount of appointment or contract: \$ 4 K base period\$ 9 K total period (5K of which is dependent on availability
of funds... option to extend).

Statement of purpose and need:

The documentation of large multiple tumors on endangered sea turtles in Florida has increased greatly in the last two years. The phenomenon appears to be a recent affliction; about 30% of all captured green turtles (*Chelonia mydas*) display these papilloma-like tumors. It is unknown as to the origin of these growths and many scientists are concerned that they may be life threatening to the sea turtles. It is urgent that preliminary scientific research be initiated to determine extent and cause of this disease.

Abbreviated scope of work:

Phase 1 (\$4K). - To identify the characteristics of the papillomas and the characteristics of the sea turtles they are affecting; and to establish preliminary studies to determine the debilitary nature of the tumors.

Phase 2 (option to extend - \$5K). To determine the cause of the papilloma-like growths and to conduct studies to determine means of treating the disease. Phase 2 is contingent on the availability of funds and Phase 1 results.

It this a continuation of a prior appointment or contract: Yes No

If Yes, explain justification for continuation

Identify any Department MBO which this proposal will support, and explain its impact

Title of MBO: II-7 Protected SpeciesImpact of proposal: Support MBO for Protected Species

Have previous studies of this issue been conducted? Yes ___ No

If yes, describe previous study(ies) and explain why this proposal is necessary.

If the proposal involves sole source or limited competition, is there a complete and detailed justification in the proposal package?

N/A; proposal does not involve sole source or limited competition Yes ___ No ___

Can the proposal reasonably be expected to involve a former Commerce Employee?

Yes ___ No

If yes, explain

Will any of the services be used to aid in influencing or enacting legislation, including the preparation of testimony?

Yes ___ No

Were funds specifically included in your budget for this purpose?

Yes Amount \$ * No ___ * Part of the Sea Turtle Budget (Protected Species)

Is a cost-benefit analysis attached? Yes ___ No If no, explain why.

Impossible to conduct cost-benefit since benefits cannot and should not be justified for threatened and endangered species (green sea turtles are not legally sold or of commercial value in U.S. under E.S.A. of 1973). (Benefits would be to isolate and cure tumors that are occurring on 1/3 the population of greens in FL.)

What amount is shown in the FY 85 budget justification for consulting and related services for your organization in FY 85? ~~XXXXXX~~ \$ None

How much of this amount has been obligated to date? ~~XXXXXX~~ \$ None

Charlie A. Oravetz

for Fred Berry SECx4

12 Sept. 1985

Organization Head or Designee

Date

Joseph W. Angelovic, Deputy Asst. Admin. for Science and Technology, NMFS

9/24/85 Date

William G. Gordon, Assistant Administrator for Fisheries, NMFS

9/24/85 Date

REQUISITION FOR SUPPLIES OR SERVICES

1. Date of Request: 8/27/85
 2. Date Required: <9/30/85
 3. Org. Code: FSW100
 4. Task Number: 8145
 5. Date Received: 8/27/85
 6. Obj. Code: SW100
 7. Task Number: 8145
 8. Object Class: 4100

Requested By: Fred Berry
 Task Manager: Fred Berry
 Lab Approval: [Signature]
 Center Approval: [Signature]
 Proposed Source: BIDDER'S LIST
 Vendor Name:
 Address:
 City: State: Zip:
 Date: 8/28/85
 [Signature]

Item No.	Supplies or Services Requested	Quantity	Unit	Unit Price	Amount
	Sea Turtle Papilloma Research. Identify areas of occurrence of papilloma in US waters. To capture & hold infected specimens to determine progress and fate of the pathology. Phase I. Report: Final Report within one month of completion. Period: 6 months. COTR: Paul Raymond FTS 826-3366 Phase 2 = Option to extend for 6 mos @ NTE \$5000.00 based on results of Phase 1 and fund availability				NTE 4,000.

Contract Number: GS-005
 Purchase Order No.:
 F.O.B. Point:
 Delivery Time Days:
 Terms %:
 Net 30
 Small Business
 Other
 Minority

ADMINISTRATIVE USE ONLY

IMPREST FUND

Date Paid: Subvoucher No./Org. Code: Task No.: Amount Paid: By:

November 7, 1985

F/SWC2:GHB

Dr. Elliott Jacobson
Assistant Professor
J. Hillis Miller Health Center
University of Florida
Box J-6
Gainesville, FL 32610

Dear Dr. Jacobson:

Its been almost two years now since I last wrote to you, so I wanted to reestablish contact and ask if you have pursued any additional research on the etiology of papillomas in green sea turtles. Do you know if this is still a problem at the Cayman Turtle Farm? Here in Hawaii over the past four years our records of stranded turtles with papillomas have ranged from 14 to 27% each year (see enclosure). The growths are typically present on the eyes, neck, inguinal region, and other soft parts. Some of the growths are quite large, >10 cm in diameter.

I would greatly appreciate receiving any new information or publications you may have on this subject. A Hawaiian Sea Turtle Recovery Team has recently been appointed. A renewed interest has therefore developed in identifying in detail all of the various factors limiting the recovery of the population. Many thanks for any assistance you can provide.

Sincerely,

George H. Balazs
Zoologist

GHB/11

bc: HL, Balazs

November 7, 1985

F/SWC2:GHB

Dr. John Harshbarger
Registry of Tumors in
Lower Animals
NHB, Room W216
Smithsonian Institution
Washington, D.C. 10560

Dear John,

Its been quite some time now since we corresponded, so I wanted to take this opportunity to reestablish contact with you. As you may recall, I am now with the National Marine Fisheries Service, having shifted from the University of Hawaii a few years ago. However, I am still involved almost exclusively with research on Hawaiian sea turtles.

We are continuing to routinely see those fibropapillomas on the green turtle, Chelonia mydas. Over the past four years, for which I have fairly comprehensive data, the percentage of turtles seen with these growths has ranged from 15 to 27% (see enclosure). There is no evidence that the incidence is increasing, but the rate gives cause for concern in view of the turtles protected status under the U.S. Endangered Species Act. As before, most of the turtles I see with fibropapillomas have them growing from the eyes, neck, inguinal region, and other soft tissues. Some of the them are quite large (>10 cm in diameter), and all size classes of turtles seem to be equally affected. Some of our worst cases consist of juvenile turtles (35-65 cm in carapace length). I have recently received word that similar growths are now being found on green turtles living in Mosquito Lagoon in east central Florida. Dr. Llewellyn Ehrhart of the University of Central Florida (P. O. Box 25000, Orlando, FL 32816) has described this seemingly new occurrence to me, and sent a few photographs. I gave him your name and address and encouraged him to submit documentation to you. Did he ever contact you? I hope so.

Since we last corresponded, I would be interested to know if you are aware of any new publications or information about the cases of fibropapillomas in sea turtles, or any other closely related group of animals. A formal Recovery Team has recently been appointed for Hawaiian sea turtles. During the coming year we

will try to carefully examine the various factors that limit recovery of the species. Neoplastic growths will certainly be an item on that list.

I look forward to hearing from you again at the earliest time your busy shcedule will permit.

Sincerely,

George H. Balazs
Zoologist

GHB

bc: HL
Balazs



National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560

22 November 1985

Telephone No.: (202) 357-2647

Dr. George H. Balazs
Marine Mammals and
Endangered Species Program
National Marine Fisheries Service
U.S. Department of Commerce
P.O. Box 3830
2570 Dole Street
Honolulu, Hawaii 96812

Dear George:

Thank you for your interesting and informative letter of 7 November. Unfortunately I have no new information on the green sea turtle tumors, but their rapid spread among confined and closely associated animals supports an infectious etiology. The presence of trematode ova lodged in vessels within the tumors supports the idea that these lesions represent an exuberant reactive fibrosis to the parasites rather than a neoplastic condition. One might confirm this by penning diseased animals with disease-free animals, half of which are regularly treated with antihelminthic drugs. I would bet the treated test animals do not get the lesions while the untreated test animals do. If you cannot do such an experiment, maybe Dr. Ehrhart, who has not contacted me, could do it. Good luck!

Meanwhile have a good winter and think of us freezing our butts in Washington!

Sincerely,

John C. Harshbarger, Ph.D.
Director

Registry of Tumors in Lower Animals



SEND TISSUES - EARLIEST POSSIBLE TIME

How preserved?

J. HILLIS MILLER HEALTH CENTER
COLLEGE OF VETERINARY MEDICINE
Department of Special Clinical Sciences
and
HEALTH CENTER ANIMAL RESOURCES
Box J-6
Gainesville, FL 32610-0006

Laboratory Animals
Zoo Animals
Wildlife
Birds
Reptiles
Mammals
Ph. (904) 392-2977

November 25, 1985

Mr. George H. Balazs
National Marine Fisheries Service
Southwest Fisheries Center
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

X
Although I am continuing to do work on diseases of green turtles, all my effort since our last exchange has entailed understanding the etiology of a specific disease in juvenile green turtles at Cayman Turtle Farm seen as severe necrotizing lesions around the glottis and extending into the trachea and lungs. At last, I believe we have the answer for this problem. Our work supports a viral etiology and we will go about to prove this over the next year through further investigations.

Unfortunately, I have not had the opportunity to pursue the green turtle papilloma problem. This disease did not prove to be significant enough for Cayman Turtle Farm to put a lot of time and effort into studying its pathogenesis. However, it is seen sporadically in juvenile green turtles in offshore lagoons on Grand Cayman.

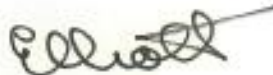
Within the last 2 years, papillomas have also been seen for the first time in green turtles in lagoonal waters of the Indian River in east central Florida. Recently, NMFS distributed a request for quotation to study this problem, with the first part directed toward studying the progression of lesions in turtles and the second part concerned with histopathology and etiology. Although I submitted a proposal for the first part, Lew Ehrhart at the University of Central Florida, is the ideal person to do this study. I hope to more effectively compete for the 2nd part of this study, which I am ideally suited to do. I already have a veterinary student with a strong background in electron microscopy who will do the work for her senior research project.

Although my initial histological and electron microscopical work with these lesions did not support a viral etiology, and suggested the lesions were a response to trematode eggs in dermal vessels, I really need to do a

Page 2
November 25, 1985
Mr. George H. Balazs

better job evaluating lesions at different stages of development. I have just concluded studies with an outbreak of papillomas in a captive herd of African elephants and was able to demonstrate virus only at a specific developmental stage of the papilloma. Thus, I need to get the earliest recognizable papillomas in green turtles and concentrate on these lesions first. It would be easy to biopsy such lesions with minimal harm to turtles. If you are interested in sending me some samples, I will try and at least get the histology done. However, my funds right now are quite limited and will have to generate some outside money to do the electron microscopy. Let me know your thoughts and if you are interested, I will start the paper work to get a permit for the tissues.

With best regards,



Elliott R. Jacobson, DVM, PhD

ERJ/wa

- Larry
- Harshbarger
- Bill/LMOA

Page 2
 December 20, 1957
 Mr. George W. Johnson

Letter for evaluation is being prepared in different stages of development. I have just reviewed studies with an emphasis on population in a large part of Africa. Elements and was able to demonstrate that only a few of the developmental stages of the population. That I need to get the entire population to give better and concentrate on these factors. It would be easy to study such factors with initial data on population. If you are interested in seeing the results of this study, please let me know. I would be glad to send you a copy of the study. It is not yet finished and will have to be revised. I am sure you will be interested in it. Let me know what you think and I will send the paper work to get a better idea of the situation.

With best regards,

Bill LMOA

Bill LMOA, Director, ILO, 1957

1957

December 11, 1985

F/SWC2:GHB

Dr. Elliott R. Jacobson
J. Hillis Miller Health Center
College of Veterinary Medicine
University of Florida
Box J-6
Gainesville, FL 32610-0006

Dear Elliott:

Many thanks for your quick response to my inquiry about work on the papilloma problem in green turtles. I was pleased to learn of your continuing interest. With ample instructions, I would be delighted to send you biopies from early developmental stages of papillomas in our Hawaiian greens. However, this may not be possible until next June when the nesting season starts at French Frigate Shoals. Most of the affected turtles I come into contact with as strandings here in the main islands are already dead or have only the large older-appearing papillomas, but send me preservatives and instructions now so I'll be prepared when the right turtle becomes available.

I may have already told you that several years ago John Harshbarger at the Smithsonian did electron microscopy on a new growth biopsy I sent him. No viruses were found. One of my earlier reports mentioned this small study (excerpt enclosed). I was interested to learn that juvenile greens with papillomas are sporadically being seen around Grand Cayman. I wonder if this originates from the farm's captive stock, or have papillomas been previously recorded there from the wild? Are the farm's stock being regularly treated with an antihelminthic drug?

Again, thank you for bringing me up-to-date on the status of your work. It is long overdue that we get to the bottom of this papillomas problem. I'm prepared to help you, and my counterparts in NMFS Southwest Region, in whatever way necessary.

Sincerely,

George H. Balazs
Zoologist

cc: G. Balazs
HL

Southeast Regional Office
9450 Roger Boulevard
St. Petersburg, FL 33702

January 27, 1986

F/SER23:PWR:dep

Dr. Lew Ehrhart
Department of Biological Sciences
University of Central Florida
P. O. Box 25000
Orlando, FL 32816

Dear Lew,

Enclosed are several letters from Dr. George Balazs, Dr. John Harshbarger and Dr. Elliott Jacobson regarding their correspondence on the incidence of fibropapillomas on juvenile green turtles (Chelonia mydas). These letters were forwarded to me by Larry Ogren who was curious as to whether you were attempting any of the test treatments suggested by Dr. Harshbarger in your studies on green turtle papillomas. I told him I didn't know, but would forward the letters on to you. You may want to contact Dr. Harshbarger and discuss with him how to biopsy these papillomas for later etiological studies. Balazs has indicated to me that Dr. Harshbarger gave him rather explicit directions on how to biopsy these papillomas. It is my understanding that a biopsy at an early stage of development may be quite useful (see Jacobson letter). Do you have any biopsies yet?

Also, Balazs plans to attend the upcoming sea turtle conference in Georgia. Perhaps among the group of us we'll be able to stimulate further interest on this unknown and potentially dangerous phenomenon. He told me that he was going to bring slides of afflicted Hawaiian green turtles for comparison with your Florida "diseased" turtles. Should be interesting.

I have enclosed some additional papers from Australia that may be helpful in your papilloma literature search.

Sincerely yours,

Paul W. Raymond
Fishery Biologist
Protected Species Management Branch

Enclosures

6th Annual Workshop on
Sea Turtle Biology and Conservation
19-21 March 1986
Maverly, Georgia

INCIDENCE OF FIBROPAPILLOMAS IN
HAWAIIAN GREEN TURTLES

By

George H. Balazs
Southwest Fisheries Center Honolulu Laboratory
National Marine Fisheries Service, NMFS
Honolulu, Hawaii 96822-2396

ABSTRACT

Neoplasms identified by the Registry of Tumors in Lower Animals (RTELA) as fibropapillomas are being commonly found on green turtles in the Hawaiian Islands. From 5 to 10% of the nesting females seen each year at French Frigate Shoals have these epithelial growths which range from a few millimeters to 30 cm in diameter. They most frequently occur on the neck, eyes, flippers, jaw, tail, and sometimes even in the mouth. Fibropapillomas have been recorded in turtles from 45 cm juveniles to adult males and females over 85 cm. However, thus far none have been found in the 35-45 cm range, the minimum size at which recruitment to benthic habitat takes place in Hawaii.

During 1986, 29% of the 56 stranded turtles examined throughout Hawaii had fibropapillomas. Local divers and fishermen regularly report seeing green turtles with "tumors" in coastal foraging pastures and at underwater sleeping areas. A considerable increase in these sightings is believed to have occurred over the past 20 years.

Fibropapillomas in green turtles were first described in the scientific literature in the late 1930's. Three out of 200 green turtles (60 to 200 lb) examined in 1937 at Key West, Florida, had these growths. Since the RTELA (located at the Smithsonian Institution) began accepting specimens in 1965, fibropapillomas from green turtles have been verified from the Florida Keys (RTELA 12 & 65) and Hawaii (RTELA 121, 1767, 1774, 1856, 1883 & 2097). Several neoplasms from Cayman Turtle Farm have recently been submitted but as yet have not been cataloged or histologically identified. Immature green turtles in east central Florida have been reported by Lew Shurt to recently show a high incidence of similar fibrous growths. Thus far, no other species of sea turtle except for the green turtle has been documented with fibropapillomas.

Fibropapillomas on Hawaiian green turtles can result in reduced vision, disorientation, blindness, physical obstruction to normal swimming and feeding, and an apparent increased susceptibility to parasites by the marine leech, *Coelobranchia branchiata*. Our available evidence also suggests that fibropapillomas can cause severe emaciation, increased predation by tiger sharks and humans, and probably a reduced ability to successfully migrate and breed. Entanglement in fishing line and other gear also appears to be more likely in turtles afflicted with these growths.

The etiology of fibropapillomas in green turtles remains unknown. Possible causes that have been suggested include an immune reaction to trematode ova, secretion of hirudin by marine leeches, virus, excessive solar radiation, chemical pollutants that impair the immune system, stress, and a genetic predisposition to neoplasia. Biopsy material from fibropapillomas on two Hawaiian green turtles were sent to the RTLA for electron microscopy, but no virus was found.

The growth rate of fibropapillomas has been documented in two Hawaiian green turtles. A nesting female with no signs of neoplasia when first seen was recovered 3 years later in an emaciated state with a large fibropapilloma along the dorsal base of its tail. Another apparently healthy tagged turtle, an adult male, had numerous growths, including a large mass in the axilla, when seen again just 2 years later. The fact that relatively small turtles can be heavily afflicted with fibropapillomas indicates that growth can occur fairly fast under certain conditions.

The experimental treatment of fibropapillomas in Hawaii has included surgical removal and stramulation. Neither procedure proved satisfactory due to the large number of growths often present, their highly vascular nature when large, and the apparent presence of nerve bundles that transmit pain, especially in growths associated with the eyes. There is no evidence to suggest that fibropapillomas in Hawaiian turtles may spontaneously cease or diminish.

The Hawaiian population of green turtles is geographically isolated and relatively small, consisting of only a few hundred females nesting annually at French Frigate Shoals. A recovery team has recently been appointed to formulate a plan to rehabilitate the population. The occurrence of fibropapillomas is viewed as one of several problems that urgently need to be addressed through additional research.



April 1, 1986

F/SWC2

Ms. Barbara A. Schroeder
Southeast Fisheries Center
Miami Laboratory
National Marine Fisheries Service, NOAA
75 Virginia Beach Drive
Miami, FL 33149

Dear Barbara,

Thank you for sending me a copy of the letter you recently wrote to Lew Ehrhart concerning records of tumors on stranded turtles.

If there is any possible way that the incidence of tumors on stranded turtles can be extracted from your network data, I would certainly encourage you to undertake this task. As I reported at the Georgia workshop, in 1985 29% of our stranded turtles in Hawaii had fibropapillomas (a specific type of tumor). We are very concerned about this occurrence, particularly in view of the fact that many of our resident fishermen feel certain an increase has taken place in recent years. For comparative purposes, as well as a status report on disease in your own region, it would certainly be worthwhile to know the magnitude of this problem in your area.

If there is any way I can help, please do not hesitate to contact me.

Sincerely,

George H. Balazs
Zoologist

cc: Lew Ehrhart
Fred Berry
Joseph Powers
Larry Ogren
Paul Raymond
Balazs ✓
HL



National Museum of Natural History • Smithsonian Institution
WASHINGTON, D.C. 20560

7 April 1986

Telephone No.: (202) 357-2647

Dr. George H. Balazs
Zoologist
Honolulu Laboratory
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
U.S. Department of Commerce
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

Thank you very much for the interesting letter and abstract. I had already heard from Jack Frazier that you had put in a strong "plug" for the Tumor Registry. That is greatly appreciated and worth at least a free lunch next time you are in D.C. I was amazed at how many people attended that workshop. Enclosed are all the 35 mm color transparencies I have. Copy what you like. Unfortunately, gross transparencies for RTLA 12 and 651 were not received, but some black and white prints are available, if they would be useful.

Thank you, also, for green sea turtle tissues received in two jars on 1 April. Our accession number is RTLA 3572.

With best regards,

John C. Harshbarger, Ph.D.
Director
Registry of Tumors in Lower Animals

Enclosures

*Returned
5/5/86*



State of Florida
DEPARTMENT OF NATURAL RESOURCES

DR. ELTON J. GISSENDANNER
Executive Director
Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard, Tallahassee, Florida 32303

BOB GRAHAM
Governor
GEORGE FIRESTONE
Secretary of State
JIM SMITH
Attorney General
GERALD A. LEWIS
Comptroller
BILL GUNTER
Treasurer
DOYLE CONNER
Commissioner of Agriculture
RALPH D. TURLINGTON
Commissioner of Education

April 09, 1986

George H Balazs, Zoologist
National Marine Fisheries Service
Southwest Fisheries Center
Honolulu Laboratory
P. O. Box 3830
Honolulu, Hawaii 96812

Dear George,

Enclosed are copies of the slides, you requested. The subject of fibropapilloma is generating some interest. I know of two people presently looking in to funding research projects. I hope they succeed, for there is currently little information on its occurrence, in the Florida Keys green population. My information is sketchy at best. Prior to 86, I filed only two strandings, for greens with papilloma, one in 83 and one in 85, out of a total of six stranding since 82. Since the start of 86, I have filed nine strandings of greens, five with papilloma. All of the above stranding, except two, were found bay side. I am aware of a number of other strandings, with papilloma, filed by other organizations, and will try to check their back reports.

I have talked to a number of local people, who have lived here for years. One common name for papilloma is "Boxwart". One person even said it did not effect the taste of the meat either. Again, it is said that there are more found bay side.

George, I'll keep checking into these type reports, as time permits, and let you know what I find out.

Sincerely,

Pat Wells
Pat Wells, Park Manager
Lignumvitae Key State Botanical Site

PWW

cc: Joe Knoll, Chief of Park Operations, Region II
Mike Murphy, District VIII Manager
Renate Skinner, District VIII Biologist
Ross Witham
file

It shall be the policy of the state to conserve and protect its natural resources and scenic beauty..."
—Florida Constitution, Article II, Section 7.

The Real Florida



CAYMAN TURTLE FARM (1983) LTD.

9 April 1986

Mr. George H. Balazs
National Marine Fisheries Service
Southwest Fisheries Center
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii
96812
U.S.A.

Dear George,

I don't imagine I can add much to what Kim told you. The first incidence of fibropapillomas at the farm was in a few individual adults which had been purchased for breeders in Mexico in 1976 and 1977. Around 1979-80 a few of the farm bred and reared breeding animals were found to have developed the wart-like growths. None of the younger, immature animals have been observed to develop the warts at the farm. On a few of the animals the warts were surgically removed but for others the warts spontaneously disappeared over the course of a year. At the present time none of the turtles on the farm have fibropapillomas.

As you know we have been releasing hatchling and yearling farm bred turtles into local waters since 1980. Several two and three year old turtles caught in the enclosed Sounds have been observed to have growths. In a tag and recapture study we did last September and October 4 such animals were observed. There have been no observations of our released turtles having warts if the turtle has lived along the open coast line. It would therefore appear to us that the warts are associated with living in an enclosed, sound-like environment. Jelly fish such as Cassiopeia are one food item that is common in the sounds but not common along the open coast although I sure there are several other environmental differences.

To my knowledge no virus was ever isolated from the wart tissues we sent to U. of Florida. If I remember correctly, Jack Gaskin, the virologist at U. of Florida told me that they had isolated a virus from warts on a Loggerhead.

I hope the above information will be of some use to you. It would certainly be nice if the cause of this problem could be determined.

Sincerely yours,
CAYMAN TURTLE FARM (1983) LTD.

P.O. BOX 645, GRAND CAYMAN, CAYMAN ISLANDS, BRITISH WEST INDIES
TEL 809 949-3894 CABLES: TURTLE TELEX: CP4257



United States Department of the Interior
FISH AND WILDLIFE SERVICE

Branch of Ecology
Museum of Southwestern Biology
University of New Mexico
Albuquerque, New Mexico 87131

505:766-3903

21 April 1986

Dr. George H. Balazs
National Marine Fisheries Service
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

Even before I got your abstract on polyps, I had intended to send you the enclosed slides. This is one of two L. olivacea that I watched being butchered on the beach at Manta, Ecuador. The other was normal with no sign of polyps or growths. I might have a sample of the polyp-like growths if you have a need for it. I recall collecting barnacles from one of the specimens and a tissue sample may be in the same container. I'll check on this.

To my knowledge, this specimen is the only turtle with this condition that I have seen, but since I have not handled the thousands that you or others have, this may mean that the condition is common.

Thanks for the note.

Sincerely,

Thomas H. Fritts
Leader, Herpetological Studies Project

Enclosure



GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES

Department of Conservation and Cultural Affairs

DIVISION OF FISH AND WILDLIFE
101 ESTATE NAZARETH
ST. THOMAS, VIRGIN ISLANDS 00802

April 30, 1986

Dr. George Balazs
Southwest Fisheries Center
Honolulu Laboratory - NMFS
Honolulu, Hawaii 96822 - 2396

Dear George:

Thank you for the abstract on fibropapillomas in Hawaiian green turtles. They sound very similar to the growths that I have encountered on several green turtles here in the Virgin Islands. To date I have captured well over 200 green turtles and have only seen these growths on three turtles. It is interesting that, of the three turtles I have found with these growths, all were caught on the same day in the same location (a small bay on a small island off the southeast corner of St Thomas). The turtles ranged in size from 20.0 to 40.5 kg (53.4 to 68.8 cm in length). The growths were observed on the soft parts of the flippers, the neck and in the corners of the eyes. The largest growth measured was 1.7 cm in diameter. All three turtles appeared to be very healthy and active. I shall be doing more work in that bay in the near future and hope to recapture these turtles. I will let you know if I do and what has transpired with their growths since initial capture.

You mention the apparent increased susceptibility to marine leech infestation on turtles with papillomas. I found no external leeches on the individuals I observed with the growths. I have however, found what I guess are leeches on other greens with no signs of growths. If you have any information on leeches I would be interested in it.

I would have liked to discuss this with you in Waverly but beurocracy won again. Thanks again for the abstract and publication list.

Sincerely,

Ralf H. Boulon, Jr.
Endangered Species Coordinator

RHB:af

TEAR OUT ACCESSION SHEET

PLEASE SUBMIT TO:

Dr. John C. Marshburger
Registry of Tumors in Lower Animals
National Museum of Natural History
Room W216-A
Smithsonian Institution
Washington, D.C., 20560, USA

DATE RECD. _____
CONTRIBUTOR'S NO. _____
RTLA NO. _____
USNM NO. _____
NIH HISTOPATH NO. _____

COMMON NAME GREEN TURTLE FAMILY _____
PHYLUM _____ GENUS CHELONIA
CLASS _____ SPECIES MYDAS
ORDER _____

CATEGORY: NEOPLASM INFLAMMATION _____ INFECTION _____ PARASITIC _____ TOXIC _____
DEVELOPMENTAL _____ TRAUMATIC _____ NORMAL _____ OTHER _____

CONTRIBUTOR (NAME & ADDRESS):

George BALAZS

COLLECTOR (NAME & ADDRESS):

SAME

ITEMS SUBMITTED (QUANTITY):

GROSS MATERIAL 1 VIAL w/6 growths PHOTOGRAPHS AVAILABLE

SLIDES _____ REPRINTS _____

BLOCKS _____ OTHER _____

ORIGIN OF ANIMAL: MARINE FRESHWATER _____ ESTUARINE _____ TERRESTRIAL _____WHERE COLLECTED ALIVE - STRANDED ATHALEWA, OAHU, HAWAIIDATE COLLECTED 5-7-86 SEX ? AGE ? STAGE OF LIFE CYCLE SUBADULTHOW KILLED BIOPSY FIXATION 10% FORMALINGROSS DESCRIPTION STRAIGHT-LINE CARAPACE LENGTH - 66.8cmANIMAL STILL ALIVE AND BEING HELDIN CAPTIVITY AT NMFS FACILITY. GROWTHSTILL PRESENT ON LEFT EYE, AND ALSOON TONGUE WHICH PARTIALLY BLOCKSRESPIRATION. SURGICAL REMOVAL MAY BE TRIED.

MICROSCOPE IX _____

COMMENTS (e.g., possible exposure to chemical pollutants or infectious agents, incidence and duration of this condition in the population, etc.)

NEOPLASMS CUT FROM NECK AND FRONTFLIPPERS. 5 SIMILAR SAMPLES SENT TODR. FRED SMITH, UNIV. GEORGIA.

Southwest Fisheries Center
Honolulu Laboratory
2570 Dole Street
Honolulu, HI 96822-2396

May 7, 1986 F/SWC2:GHB

Dr. Fred G. Smith
College of Veterinary Medicine
University of Georgia
Athens, GA 30602

Dear Fred,

Enclosed with this letter is a vial containing six small neoplasms I removed this morning from a live 67 cm green turtle that recently stranded on the north shore of Oahu. Several larger growths were also present, including one on the left eye and dorsum of the tongue. This latter mass of tissue is partially blocking respiration through obstruction of the glottis. Otherwise, the turtle is in reasonably good condition. We are currently holding it in a seawater tank here at our facility. However, if the tumor in the mouth continues to grow, the animal is surely doomed. I have no plans for releasing it back into the wild in its present condition. One possibility would be to surgically remove the growth, but this would require general anesthesia and a volunteer veterinarian capable of doing such an operation. I will be looking into this possibility.

I would appreciate hearing from you in the near future to learn of the status of your grant proposal. I hope you were able to submit your request before the deadline, which I believe was May 1.

Best regards.

Sincerely,

George H. Balazs
Zoologist

Enclosure

cc: Balazs
HL



J. HILLIS MILLER HEALTH CENTER
COLLEGE OF VETERINARY MEDICINE
Department of Special Clinical Sciences
and
HEALTH CENTER ANIMAL RESOURCES
Box J-6
Gainesville, FL 32610-0006

Laboratory Animals
Zoo Animals
Wildlife
Birds
Reptiles
Mammals
Ph. (904) 392-2977

May 8, 1986

George H Balazs
National Marine Fisheries Service
Southwest Fisheries Center
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:


I've been able to recruit a veterinary student (experienced in electron microscopy) to work on the papillomatosis problem in green turtles. She is most interested in starting the project this summer but the main problem I face right now is to get some minimal funding to do this study. My department head is constantly on my back to get money to support my research projects. Unfortunately when it comes to work on reptile disease, not much money is available. I would like to inquire if any money would be available from NMFS to really pursue this problem properly so that we can finally get a good idea of the pathogenesis of this disease problem and not continue doing it piecemeal. For a few thousand dollars I am sure we can do it properly. Although this amount of money is a drop in the bucket when it comes to research funding here at the U. of Fl., still it will make what I am doing more acceptable to the administration. Please let me know if some support would be possible.

As far as collecting and fixing tissues to be sent to me, inclosed is a recipe for a formalin/glutaraldehyde mixture which is good for both light microscopy and e.m. I would send it from here, but it needs to be kept refrigerated. Once tissues are fixed, the fixative is stable for several months at room temperature. An ideal tissue:fixative volume ratio is about 1:10. Tissues should be sectioned into small pieces and only one biopsy specimen should be placed in each vial. Try and sample lesions at different stages of growth; make sure you get the earliest possible lesions. Get both central portions and peripheral portions bordering normal skin. Label all vials clearly and make sure biopsy sites are indicated. Make sure the samples also include dermis.

page 2

As soon as I get the go ahead from you, I will apply for a permit for receiving the samples.

With best regards,

A handwritten signature in cursive script, appearing to read "Elliott R. Jacobson". The signature is written in dark ink and is positioned above the typed name.

Elliott R Jacobson, DVM, PhD

Large volumes of this fixative may be conveniently prepared.

1. Fill a 6 1/2 gallon container (calibrated to 22,000 ml) approximately half full of tap water
2. Add one pound (454 gm) $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$ (sodium phosphate monobasic) and stir until dissolved
3. Add 1000 ml of stock NaOH solution (411.2 gm per 4000 ml tap water) and mix well
4. Dilute to the 22,000 ml mark with tap water
5. Add 2,440 ml of 40% formaldehyde and mix well

The formaldehyde fixative is stable at room temperature and gives satisfactory results both at light and electron microscopic levels.

2. 4% commercial formaldehyde-1% glutaraldehyde prepared with a 200 m. osM phosphate buffer



It has been recommended that the concentration of glutaraldehyde should not exceed 1% when used in combination with formaldehyde and that the osmolality of the buffer be about two-thirds isotonic strength (Penttila et al, 1974). The final buffer osmolality of this fixative is 176 m. osmoles which is within the satisfactory range.

The fixative is prepared as follows:

1. 16 g $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$
 - 0.27 g NaOH
 - 88 ml H_2O
 - 10 ml 37-40% formaldehyde (Fisher F-79 is suitable)
 - 2 ml 50% glutaraldehyde (Fisher Biological grade)
- pH 7.2

Large volumes may be conveniently prepared.

1. Fill a 6 1/2 gallon container (calibrated to 17,160 ml) approximately half full of tap water
2. Add half pound (227 gm) of $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$ (sodium phosphate monobasic) and stir until dissolved
3. Add 2,089 ml of 2.52% NaOH (kept as stock solution)
4. Dilute to the 17,160 ml mark with water
5. Add 1950 ml of 40% formaldehyde
6. Add 390 ml of 50% glutaraldehyde

This fixative is not stable at room temperature. Over a period of 4 to 8 weeks the pH falls 0.2-0.3 units and the solution becomes cloudy due to formation of a precipitate. If used at this stage the fixative gives satisfactory results for light microscopy but some deterioration of ultrastructural preservation is noted. To prevent this, the fixative should be stored at 4°C, where it is stable for approximately 3 months.

The fixative gives excellent results at light and electron microscopic levels. The superior cross-linking features of glutaraldehyde are retained giving high quality ultrastructural preservation while the concentration of glutaraldehyde is sufficiently low not to significantly obscure the PAS reaction due to the introduction of free aldehyde groups. Paraffin embedded tissues are easy to cut and are not brittle if processed in alcohols and chloroform. We have however intermittently experienced brittle tissue blocks when processed in a Technicon schedule using acetone and xylene.

No special techniques need to be adopted when fixing surgical specimens for combined light and electron microscopy using these fixatives. Tissue sections are fixed by immersion at room temperature and should not exceed 3 mm in width. The minimum fixation time recommended is 6 hours. Tissues can remain in the fixatives without changing the solution for 12 months (probably much longer) without deterioration of ultrastructural preservation.

When formaldehyde and glutaraldehyde are used in concert, glutaraldehyde fails to penetrate as far as the formaldehyde component. Also formaldehyde fails to penetrate as far as it does when used alone (see table below). Therefore, if ultrastructural studies are planned in advance, it is advisable to fix 1 mm thick slices of tissue for electron microscopy and larger pieces for routine light microscopy. However, satisfactory ultrastructural preservation occurs at the periphery of large tissue blocks and very thin slivers may be shaved from the surface layer and prepared for electron microscopy.

Depth of fixative penetration (based on gross color change) and depth of penetration of glutaraldehyde (based on Schiff positivity in tissue sections) in human liver

Fixative in phosphate buffer	Time(hrs)	Gross penetration (mm)	Schiff positivity (mm)
4% formaldehyde		2.5	-
4% formaldehyde- 1% glutaraldehyde	4	2.5	0.8
1% glutaraldehyde		1.0	0.5
4% formaldehyde		9.0	-
4% formaldehyde- 1% glutaraldehyde	24	6.0	1.8
1% glutaraldehyde		1.0	1.0

The tissues are post-fixed in osmium tetroxide and prepared for electron microscopy in routine manner. Prior to osmication the tissues should be diced into 1 mm cubes and washed overnight in buffer. Staining with uranyl acetate en bloc (Farquhar and Palade, J Cell Biol 26 263, 1965) after osmication will increase contrast. If this step is intended it is essential to wash the tissues overnight in a non-phosphate buffer prior to osmication and uranyl staining, otherwise uranyl phosphate will precipitate in the tissues and ruin the thin sections.

The following procedure is recommended for electron microscopy:

1. Fix tissue in 4% formaldehyde - 1% glutaraldehyde (time of fixation depends on size of tissue. 3 hrs is sufficient for a 1 mm thick slice)
2. Dice into 1 mm cubes
3. Wash overnight in 7% sucrose - 0.2M cacodylate buffer, pH 7.2
4. Post-fix 1 hour in s-Collidine buffered 1% OsO₄
5. Soak in uranyl-acetate en bloc stain for at least 1 hour
Overnight soaking is recommended which allows for full penetration of the block by uranyl acetate
Dehydrate and embed for electron microscopy in the routine manner.

Experts link turtle tumors to Indian River pollution

By Ruth Rasche

OF THE SENTINEL STAFF

SEBASTIAN INLET — Scientists studying green sea turtles in the Indian River in Brevard have discovered that more than half of the endangered creatures have fibrous tumors that could be linked to water pollution.

Five young, green sea turtles were captured in the Indian River near Sebastian Inlet six months ago and taken to The Living Seas exhibit at Epcot Center so researchers could study how the growths affect the animals, said Lew Ehrhart, a zoologist at the University of Central Florida.

The turtles will be released back into the river Tuesday morning.

From observing the five turtles, which range in age from 3 to 6 years, scientists found that the tumors don't appear to debilitate the animals, but the growths do cause other problems. The tumors are soft, unlike the rest of the turtle's body that is protected by a leathery covering.

As the turtles move through the water the growths often get scratched and become infected, Ehrhart said. Sometimes the tumors grow over the turtles' eyes and obstruct their vision, or marine leeches attach themselves to the growths, he said.

Some scientists believe the tumors are caused by a virus, but

that has not been proved. The National Marine Fisheries Service is scheduled to do a more in-depth study next year to test this theory, Ehrhart said.

"We don't know for sure but a lot of us think the tumors are due to reduced water quality or some pollutant," he said.

Although green sea turtles in south Florida have had the growths — called box warts — for years, it was not until last year that turtles in Brevard were found with the tumors, Ehrhart said.

Of 130 green sea turtles captured in the Indian River 55 percent had the growths, he said.

Green turtles in the Virgin Islands and Hawaii also have been reported to have the tumors.

"It's a condition that seems to be spreading," he said.

The Indian River is important to green turtles because sea grass beds in the waterway provide food and shelter to juvenile turtles, who live there for the first six years of their lives. Many of the turtles return to nest along beaches in Brevard later.

"The green sea turtle is highly endangered, there are only 300 to 500 adult females left," Ehrhart said.

"The Indian River is crucial to our precious population of green turtles because the juveniles living there are the ones the population is counting on to be breeders in 15 years," Ehrhart said.



FLORIDA TIMES UNION - MAY 12, 1986

Sea turtles again seek haven in Indian River

By Nanette Holland
Staff writer

SEBASTIAN — A century ago, green sea turtles were so plentiful in the Indian River that one fisherman reported that he singlehandedly captured 2,500 in a few months.

Today, researcher Lew Ehrhart counts his blessings if he nets three a day. And those are likely to be covered with tumors whose cause and effect completely mystify scientists.

With a Florida population of only 300 nesting females, green turtles are among the state's most endangered creatures — victims of an international glutony that transformed a clear broth made from the cartilage joining the turtles' upper and lower shells into a gourmet sensation.

Green turtles are so named for the color of their shells when young. Experts consider them the most gentle of all sea turtles, and they are natural long-distance swimmers because of their oval shells and long flippers.

They are different from the more common loggerhead turtles, which have larger heads and brownish, less-oval shells.

Loggerheads eat crustaceans. Green turtles eat tender seagrasses and other marine plants.

Although conservation laws signed by the United States and other nations in the 1950s made it illegal to sell or import green turtle soup and other sea turtle products, green turtles are still paddling dangerously close to extinction in Florida.

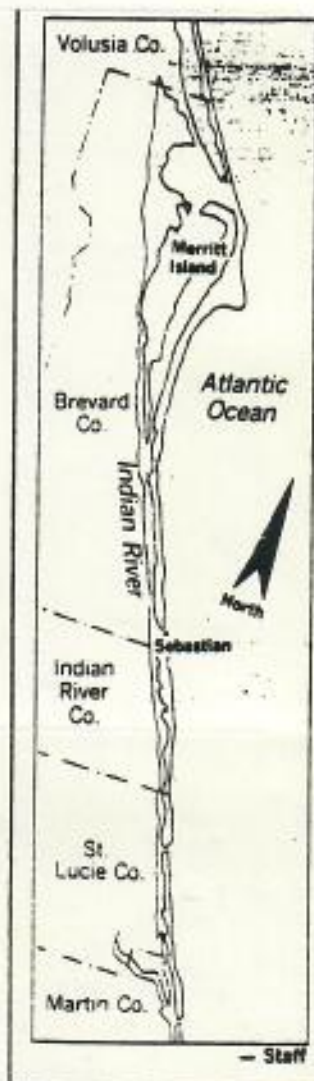
Ironically, one of their last sanctuaries may be the saltwater river where they once were slaughtered by the thousands.

Spanning six East Coast counties (Volusia, Brevard, Indian River, St. Lucie, Martin and Palm Beach), the Indian River is a vast saltwater lagoon separating the mainland from a series of barrier islands. The area's climate is moderate, straddling the line between temperate and tropical conditions, and has produced a biological bonanza unlike any other in the state.

Hundreds of fish species breed and feed in the Indian River. They attract a myriad of bird life, including the osprey, great blue heron and kingfisher. More manatees are found in Brevard and Indian River counties than anywhere else in Florida.

Sea turtles have long been a part of the area's ecological landscape but, until recently, attention was focused main-

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TURTLES (Cont'd)

ly on their nesting activities. Brevard's beaches — particularly a 12-mile stretch at the south tip of the barrier island — serve as the most prolific loggerhead turtle nursery in the western world.

Last summer, 10,000 loggerheads lumbered ashore to lay their eggs at the foot of the dunes.

More amazingly, 281 green sea turtles also left a precious legacy on Brevard's shores. The selection surprised scientists who had placed the preferred maternity ward of the green turtle farther south, near Palm Beach.

Ehrhart, a professor at the University of Central Florida in Orlando, pioneered research that documented the importance of Brevard's beaches to nesting turtles. But deadly winter freezes of the past few years got him thinking about the role the Indian River may play in the turtles' life cycle.

The harsh winters also brought to light the first evidence of tumors on green turtles in the Indian River.

Prolonged exposure to cold water temperatures can kill sea turtles. Their body functions wind down and they float at the water's surface, refusing to eat. Eventually, they die.

Ehrhart and biologists at the Merritt Island Wildlife Refuge in North Brevard spent many recent winters rescuing these "cold-stunned" turtles. They hadn't realized so many turtles lived in the river.

Ehrhart was especially interested in the large numbers of young green turtles they found. He began to suspect that the young greens come to the river when they're 12 months old, feeding and growing for several years in the rich seagrass beds until they mature and venture back to sea.

His desire to study this largely unexplored period of the turtles' life span gained new urgency when baffling tumors of unknown origin began to appear on the turtles found in the river. The tumors, called papillomas, covered the fleshy parts of the turtles' heads, necks and shoulders. Tumors sometimes grew over their eyes.

A few of the turtles were blanketed with the ugly growths, often making it difficult for the animals to eat, see or even swim.

Ehrhart, who has studied dead turtles, hatchlings and nesting turtles, found a new mission that has proved to be his most frustrating.

"I think I'll go to the end of my career and retire and still never know any of the answers," he said recently.

Armed with a small grant from the National Marine Fisheries Service, Ehrhart and one or two graduate stu-

dents spend most of their free time netting turtles in the river. They concentrate on an area near Sebastian, a tiny fishing community on the border of Brevard and Indian River counties.

They have discovered a gold mine, as far as green turtles go. The days when turtle fishermen hauled hundreds of the creatures from the shallow water are long gone, but Ehrhart is ecstatic with his daily "harvests" of two or four greens.

"We hardly ever have a day where we get skunked," he said. "There's no question that the population here is important to the survival of the whole species."

Even more significant, he said, is that while they are beginning to recapture individual loggerheads, they have never caught the same green turtle twice. That means the population of greens in the Indian River may be much larger than anyone expected.

So far, the crew has netted 100 green turtles. All are about dinner-plate size, and Ehrhart estimates they are from 1 to 8 years old. Adult greens can grow to 350 pounds or more.

While only 30 percent of the turtles tagged by Ehrhart in North Brevard had tumors, more than 80 percent of the young greens off Sebastian have the growths, leading experts to wonder if the problem is spreading.

No tumors have been found on adult turtles, and no growths have been reported on any other species of sea turtle except the greens.

Even more puzzling is the parallel discovery by researcher George Balasz of even more hideous tumors on young green turtles in the waters off Hawaii.

Papers presented by Ehrhart and Balasz at a recent sea turtle conference in Georgia convinced University of Florida Professor Archie Carr, the world's foremost authority on green turtles, that the tumors "are a major problem that for some reason shows up in a very definite and spectacular way only in the Indian River system and in Hawaii."

But no one has any idea what long-term effects the growths have, or why they suddenly cropped up simultaneously in populations half a world apart.

Carr, who has studied greens for more than 30 years, has seen only three or four turtles with tumors at his research station in Costa Rica. And while tumors have been recorded on turtles in South Florida and the Caribbean for at least 40 years, they have always been a novelty, not a common occurrence.

Carr worries that the growing numbers of turtles with tumors could signal an epidemic for the species.

"If that's the case, then we're in real trouble," he said.

His concern is echoed by Dr. Fred G. Smith, a professor of veterinary science at the University of Georgia. Smith has examined tumors that were surgically removed from turtles captured by Ehrhart and Balasz.

The growths, especially larger ones, contain nerve fibers that make them painful if rubbed or abraded, he said. Tumors over the eye or in the mouth could prove fatal, since they would prevent the turtle from eating or seeing.

The tumors also may affect the turtle's reproductive ability, he said.

Smith and scientists at the Smithsonian Institution, who also have examined the papillomas, at first thought the tumors were caused by a virus. But lab work failed to turn up such evidence, even though the turtles' growths are similar to those caused by viral infections in other animals.

Much more research is needed before an answer will be found, Smith said, but scientists have narrowed the list of probable causes. Besides a virus, they think the cause could be a parasite, although the type of parasite that produces similar growths in other animals has not been documented in sea turtles.

Scientists also speculate that the papillomas may be the result of a marine leech, although that, too, would be unusual for sea turtles.

The most disturbing explanation is that water pollution, particularly by heavy metals such as mercury, may be triggering the growths.

While that might fit the bill for turtles in the Indian River, where intense development of the shoreline has brought a host of water quality problems, it doesn't account for the growths on Hawaiian turtles.

"One might be tempted to chastise the people of the Indian River and say that it's happening because we're crowding too close to the shore and dumping citrus runoff and sewage there," Carr said. "But how do you account for the occurrence of the tumors in beautiful, clear waters of the mid-Pacific?"

Ehrhart's research involves measuring, weighing and tagging each turtle he captures. Tumors are recorded and in some cases removed from the animal for further examination.

(CONTINUED NEXT PAGE)

TURTLES (Cont'd 2)

Most of the animals are then released, although a few have been transferred to luxury living quarters in "The Living Seas" exhibit at Epcot Center near Orlando.

Ehrhart visits the turtles there every few weeks, observing their behavior and the condition of the tumors. Some have lost tumors, some have gained a few growths, but all appear to be "fat and happy," he said.

Still, the puzzle remains, and the future of the green turtle in Florida could depend on putting the pieces to-

gether. What is happening to the turtles and why is it happening in the Indian River?

Continued research may eventually answer those questions, but Ehrhart's money will run out soon. Balasz in Hawaii faces the same budget crunch.

"What we need is somebody to do exactly what those two are doing right now," Carr said. "They ought to be subsidized for the next 50 years if that's what it takes to find out what is going on with these turtles."

GAINESVILLE SUN
MAY 9, 1986

Apalachicola oysters are hard to come by

By LARRY SCHNELL

Sun staff writer

Oystermen are taking oysters out of Apalachicola Bay this week, but the first harvest is so scant that few restaurants and bars are getting any for the weekend.

Mike Futhey, owner of oyster distributor Ponderosa Seafood Inc., went to Apalachicola Wednesday needing 260 bushels of oysters. He hoped to get at least 50 bushels, but came back to Gainesville without any oysters from the bay that has been closed to oyster harvests since Hurricane Elena destroyed the oyster beds last September. Instead, Futhey brought back Louisiana and Horseshoe Bay oysters.

"I'm really bummed out. But I think it'll straighten out. It's just a matter of time," Futhey said.

How long can oyster lovers wait? Some say there is no reason to wait because equally good oysters are available now.

"It's like wine," said Kevin McGuire, assistant manager at LaFitte's Seafood. "You like burgundy. You prefer one kind but you'll drink many kinds."

Gerald Simmons, assistant manager of Cedar River Seafood & Oyster Bar Inc., said customers don't ask for oysters from a particular area. Instead they look for freshness and quality.

"I think it's just a myth (that Apalachicola oysters are superior)," Simmons said. "Customers demand a good-looking oyster that is fresh."

Andy Shaara, owner of the Purple Porpoise, said he got a supply of Apalachicola oysters for the weekend. He paid more, he said, but won't charge customers more for them.

"They're absolutely beautiful," he said. "They're salty and they're meaty and they're sweet tasting."

Shaara declined to say how he got the oysters. Some restaurant owners would like to know.

The state Marine Fisheries Commission, which prohibited harvests in September, opened the bay to limited harvests on Monday. Harvested oysters must be three inches or longer, and commercial

harvesters can't bring in more than 15 10-gallon containers of oysters in a day, said John Schneider, bureau chief of Marine Resource Regulation and Development.

Futhey, who distributes oysters to many seafood restaurants and raw bars in Gainesville, said prices were so high in Apalachicola that it was uneconomical to buy oysters.

"The oystermen up in Apalachicola think that everybody will (pay more for Apalachicola oysters). But I have my doubts," Futhey said.

Oysters cost 25 percent to 30 percent more than before the hurricane, Futhey said. It is uncertain what impact that price increase would have at restaurants when there are enough oysters to go around, he said.

But will people demand Apalachicola oysters and pay more for them?

Schneider said they ought to. Apalachicola oysters are better than oysters from Louisiana or Texas, states that have provided Florida with many oysters since the hurricane, he said. Oyster lovers should get used to paying more for a superior product, he said.

"There's a lot of people craving them (Apalachicola oysters) right now," Schneider said. "It (the Apalachicola oyster) is worth more than we were getting."

Apalachicola oysters have a better, saltier taste and are a little smaller than Louisiana oysters, which some oyster lovers consider too large, Schneider said.

Until there are enough Apalachicola oysters at a good price — or enough oyster lovers who are willing to seek them out and maybe pay more for them — other oysters will have to do.

Futhey came back with 260 bushels of Louisiana and Horseshoe Bay oysters, which have been the staple oyster in Gainesville since the hurricane. When additional beds in Apalachicola are opened later in the year, Apalachicola oysters may be easier to come by, he said.

May 28, 1986

F/SNC2

Dr. Elliott R. Jacobson
College of Veterinary Medicine
Box J-6
Gainesville, FL 32610-0006

Dear Elliott,

Many thanks for your letter of May 8, 1986 expressing considerable interest in resuming work on the papillomas problem in green turtles. I was pleased to hear from you again about this subject.

As requested I've checked into the possibilities of obtaining a few thousand dollars in contract research money through our agency here in the Southwest Region. I regret to report that existing budget cuts, and threats of more to come, make it unlikely that any funds will be available for this purpose. Nevertheless, I have been advised to renew my request during mid-July in the event that the situation has changed. I will be in touch with you again at that time to inform you of the outcome. Starting tomorrow, I will be at French Frigate Shoals for 4 weeks tagging nesting turtles. Mail will likely be forwarded to me in the event that you want to write to me again during that time.

You can certainly count on me to provide you with tissue samples preserved specifically for electron microscopy. As I've said before, we commonly see turtles with fibropapillomas. In fact, I have one in captivity right now in which a local veterinarian removed a large growth from its mouth. Needless to say, the turtle is breathing much easier now!

In closing, I should mention that to the best of my knowledge no permit will be needed for me to send you tissue sample from our green turtles. The population here in Hawaii is listed as "threatened," a category that allows us considerable latitude in carrying out appropriate research and conservation projects in collaboration with others.

Sincerely,

✓ George H. Balazs
Zoologist

cc: Larry Dgren



GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES

Department of Conservation and Cultural Affairs

DIVISION OF FISH AND WILDLIFE
101 ESTATE NAZARETH
ST. THOMAS, VIRGIN ISLANDS 00802

May 28, 1986

Dr. George Balazs
S.W. Fisheries Center, Honolulu Laboratory
National Marine Fisheries Services
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear George:

Thanks for your letter and MTN note. I think I would like to wait a while and try to recapture the turtles that I had found with the small fibropapillimas before reporting on them. Thanks for offering to include them in your note.

I have also found what appears to me to be leeches on some greens. I have no literature on leeches and was wondering if you had any information that might help me on that.

Thanks again for the note.

Sincerely,

A handwritten signature in cursive script, appearing to read "Ralf".

Ralf H. Boulon, Jr.
Endangered Species Coordinator

RHB:af



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

7-3-86

Your eyes only!

To : George Balazs

From: Paul Raymond F/SER23

Hey George. I believe I've "wrestled" \$4,000.00 out of Fred Berry to fund etiology study on papillomas. It's not confirmed & committed yet, but I should know in the next several days. I'm confident.

I will be COTR and can tell you the work will most likely go to Dr. Jacobson (he is responsive & is most qualified to do work; he has a student lined up to work also).

What happened to these optimistic funding talks w/ F. Smith & Ehrhart and you?
Did Fred follow-up w/ Cancer Instit.?

How's French Frigate Shoals, Larry O. tells me you had a problem w/ ticks.
Take care.

TRANSMITTAL FORM CD-82A (10-67)

PRESCRIBED BY DAO 214-2

U.S. G.P.O. 1983-664-006/1206

P.S. Can you send me a copy of your papilloma abstract?



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, FL 33702

July 3, 1986

F/SER23:PWR:dcp

MEMORANDUM FOR: F/SECx33 - Peggy Solomon
FROM: F/SER23 - Paul W. Raymond *Paul W. Raymond*
SUBJECT: Statement of Work for Research on the Etiology of Green
Turtle Papillomas

Attached is the subject statement of work and a CD-435 form (incomplete). A bidders list is also attached. Please contact me at FTS 826-3366 if further information/paperwork is needed.

Attachments

cc: F/SECx4 - Fred Berry (w/attachments)
F/SER23 - C. Oravetz



The Etiology of Green Turtle Papillomas

Work Statement

Statement of the Problem:

The documentation of large multiple papilloma-like growths on sea turtles in Florida has increased greatly in the last two years. These abnormal growths occur primarily on sub-adult green turtles (Chelonia mydas) and are increasingly frequent in the lagoonal waters of the Indian River System in east central Florida. The Indian River System, which includes Mosquito Lagoon and the Indian/Banana Rivers, is a known "developmental habitat" for immature green and loggerhead turtles. Although both species utilize this lagoon habitat and are encountered in relatively equal numbers, the incidence of papillomas on green turtles is disproportionately high. The phenomenon also appears to be a recent affliction. In 1985 about 29% (41 turtles) of the green turtles captured in Mosquito Lagoon displayed papillomas. This "disease" had never been observed in the Lagoon in previous years.

The papillomas are primarily distributed over the soft tissues of the neck, flippers, and inguinal regions. Papillomas also occur in potentially incapacitating areas like the eye, eyelid, and mouth. A recently completed research project (Phase 1), designed to identify the characteristics of the papillomas and the extent of its affliction, documented over 55% of the sub-adult greens captured since November 1985 in the Indian River System had papillomas. Preliminary studies on the debilitatory nature of the growths have been inconclusive. Papilloma green turtles were kept in captivity for several months and the growths were monitored. In some instances the papillomas continued to spread, while others regressed, and still others remained unchanged.

The cause (etiology) of these fibropapillomas on wild green turtles has not been determined and no treatment of the "disease" has been attempted. Due to the threatened/endangered status of sea turtles, it is essential that the etiology of these tumors be identified. The distribution and documentation of papillomas in various green turtle populations is more widespread than originally thought. Green turtles in Hawaii have an incidence of occurrence of approximately 15-27%, with many of the papillomas in such advanced stages that they are associated with the mortality of the turtles. The enormous size of the papillomas occurring around the eyes undoubtedly diminishes the feeding efficiency. Sub-adult green turtles in the Florida Keys also are being documented with papillomas.

Stages of Work

Phase 1

Phase 1 of the work involved documenting the abundance, characteristics and debilitatory nature of the papillomas. This work has recently been completed by Dr. Lew Ehrhart, University of Central Florida, and a final report is being prepared. Numerous biopsies of the growths have been collected for use in determining the cause of the papillomas (Phase 2). In addition,

Dr. Ehrhart's continued population studies within the Indian River System may result in the availability of additional "diseased" turtles for etiological studies.

Phase 2 The objectives are to determine the cause of the papillomas in wild green turtles and to begin studies designed to treat the growths.

Scope of Work (Phase 2):

- (1) A thorough review of the literature on the etiology of papilloma-like growths on sea turtles.
- (2) A complete blood count and biochemical serum profile for several afflicted and unafflicted wild Florida green turtles.
- (3) A determination of the etiologic basis of the papillomas by analyzing biopsies (preliminary histopathologic, electron microscopic and transmission studies).

Period of Performance:

A total of six months for the completion of Phase 2 is allowed. A final report will be submitted two months after the completion of the work. A scientific paper presentation at an appropriate forum is recommended.

Bidders List:

- (1) Dr. Elliott Jacobson
College of Veterinary Medicine
Box J-6, JHMHC
University of Florida
Gainesville, FL 32610
- (2) Dr. Greg Bossart
Veterinary Reference Lab
3225 North Andrews Avenue
Ft. Lauderdale, FL 33309
- (3) Dr. Fred Smith
College of Veterinary Medicine
University of Georgia
Athens, GA 30602

Proposals shall include:

- (1) Statement of qualifications.
- (2) Scope of work: rationale, objectives, methodology, deliverables, and schedule.
- (3) Itemized budget.

COTR: Paul W. Raymond, F/SER23, Phone: (813) 893-3366, FTS 826-3366

See Instructions - Reverse

Page 1 of Pages

U.S. DEPARTMENT OF COMMERCE PROCUREMENT REQUEST Requisitioner fills in only unshaded blocks	1. INVOICE ADDRESS	A. REQUISITION NUMBER:
		B. READY REQUISITION DATE:

2 RECEIVING OFFICE NO.	3 REFERENCE CONTRACT NUMBER	4 ORDER DATE	5 SOURCE	6 PURCHASE DELIVERY ORDER NUMBER	7 SUR.	C. SF-281
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D. CHECK ONE PURCHASE ORDER DELIVERY ORDER IMPREST FUND CONTRACT OTHER	8. TO: (Seller) See attached Bidders List	9. SHIP TO: (Use Bldg/Room No.—see Reverse for Format)
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10. 1099 TAX	11. EMPLOYER IDENTIFICATION NUMBER (EIN)	E. REQUISITIONER CONTACT PERSON: Paul W. Raymond	TELEPHONE NO. (813) 893-3366
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12 LINE ITEM	13 ACT. CODE	14 DESCRIPTION (Double Space Between Items)	15 BUDGET OBJECT	16 ACC. LINE	17 QUANTITY	18 UNIT ISSUE	19 UNIT PRICE (If Known)	20 ESTIMATED AMOUNT
01		A study to determine the cause of the papilloma-like growths found on wild green turtles (<i>Chelonia mydas</i>) in Florida. Also, study should be designed to begin experimental treatment of the papillomas. (See attached Statement of Work).			1		NTE \$4,000.00	4,000.00

NOT A PURCHASE ORDER

21. F.O.B. POINT	22. DISCOUNT TERMS	23. PROMPT PAYMENT	Sub-Total (This Page)	24. \$ 4,000.00
F. REQUEST DELIVERY BY: 25 July 86	25. DELIVERY DATE:	26. SHIP VIA	27. ESTIMATED FREIGHT	TOTAL

I certify that funds are available and that the above items are necessary for use in the public service.		29 ACC. LINE	30 BUREAU CODE	31. ACCOUNTING CLASSIFICATION	32. DISTRIBUTION	33. AMOUNT
G. TITLE OF REQUEST AUTHORIZING OFFICIAL	TELEPHONE					
SIGNATURE	DATE					
TITLE OF REQUESTER	TELEPHONE					
Charles A. Oranetz SIGNATURE NMP/SERO	(813) 893-3366 DATE 3 July 86					

Chief, Protected Species Mgt. Branch

H. CLEARANCES AND REMARKS

July 8, 1986

F/SNC2

Mr. Paul Raymond
National Marine Fisheries
Service, NOAA
Regional Office
9450 Noger Boulevard
St. Petersburg, Florida 33702

Dear Paul,

Thank you for sending me information on your green turtle papilloma "work statement." I appreciate knowing what you have planned for addressing this potentially important disease in the Southeast Region. Unfortunately, no money has become available in our area to work on the same problem in the Hawaiian green turtle population. I wonder if it would be possible for your work statement to formally include the study of tumor tissue from Hawaii? It seems to me that this would be an excellent opportunity for interregional cooperation on a research problem of common concern.

As requested, I have enclosed copies of my correspondence with Drs. Fred Smith and Elliot Jacobson, which were exchanged since the Georgia workshop. I am also sending a final draft of my note for Marine Turtle Newsletter. Nat Fraser has agreed to publish it as soon as agency approval is obtained, which will be forthcoming very soon.

Sincerely,

George H. Balazs
Zoologist

Enclosure

cc: Larry Ogren

July 10, 1986

F/SWC2

Dr. Elliott Jacobson
University of Florida
Health Center Animal Resources
J. Hillis Miller Health Center
Box J-6,
Gainesville, FL 43610-0006

Dear Dr. Jacobson:

Seven vials containing tissue from seven small tumors were shipped to you this morning by Express Mail. The material is preserved in buffered 4% formaldehyde-1% glutaraldehyde as you had requested.

All seven tumors were removed yesterday afternoon from the dorsal neck region of a 67 cm live green turtle. This turtle has been in captivity for the past two months. It was originally found on the north shore of Oahu where it had beached itself in a weakened condition. It was experiencing extreme difficulty in breathing. An examination of the oral cavity reveals a large growth surrounding the glottis and extending into the trachea. A veterinarian in private practice volunteered his services to surgically remove the obstruction. The operation was successful, although it is too early to tell if the growth will reappear. The turtle's strength has returned, and it is now eating well.

The tumors that were sent to you were ones that were not taken off during the first operation. I should mention that they were removed with an electrical surgical apparatus that apparently burns and seals the cells as it cuts. Tissue that I submit to you in the future will be removed with a regular scalpel, since I will be doing the work myself.

I look forward to hearing from you as your analysis progresses. More samples will be sent just as soon as they become available to me.

Sincerely,

George H. Balazs
Zoologist



National Museum of Natural History • Smithsonian Institution

WASHINGTON, D.C. 20560 • TEL. 202-

16 July 1986

Dr. R. Erik Martin
Senior Scientist
Applied Biology, Inc.
P.O. Box 974
317 Sun View Drive
Jensen Beach, Florida 33457

Dear Dr. Martin:

Enclosed is an accession form, my evaluation, and a microslide from the green sea turtle tissue you submitted (RTLA 3581). The lesion is histologically similar to all the other green sea turtle fibropapillomas. The surface is infested with leeches and crustacean-like organisms, but I did not see any trematode eggs lodged within the capillaries as in about 70% of the other cases I have seen. There are no inclusions to suggest virus. The cause is unknown, although, the trematode egg theory has some merit.

Thank you very much for contributing this well-fixed tissue to the Registry's collection.

Sincerely,

John C. Harshbarger, Ph.D.
Director

Registry of Tumors in Lower Animals

Enclosures

Accession Sheet

RTLA NO. 3581 Date Rec'd 04/14/86 Date Acc 05/22/86

Contrib. No.
AAH-844

Common name Green sea turtle

Phylum Chordata
Class Reptilia
Order Testudines
Family

Genus Cheloniidae
Species Chelonia
Strain mydas

Contributor MARTIN, R.E.

Material Submitted

An irregular, gray and cream, cauliflower-like growth (3.0 x 3.5 x 2.0 cm); 4 color photographs

Origin of animal: M

Locality: Florida: St. Lucie County, Atlantic coast of Hutch
Inson Island (ca 15 km south of Ft. Pierce Inlet)

Date Coll 1/29/85 - How Killed Released alive

Sex Age Stage Juvenile

Gross description:

Irregular, gray and cream, cauliflower-like growth (3.0 x 3.5 x 2.0 cm). Contributor's: "Turtle emaciated; a few barnacles on left front flipper; anemone on Inframarginal scute--left side; leeches on head, tail, plastron and on tumors located on appendages; leech cocoons covered ca 1/2 of plastron; tumors on neck, left eye, appendages, and axillary, inguinal, and caudal areas."

Comments:Contributor's: "No known or suspected exposure to pollutants; no tar observed on turtle."

RTLA 3581 EVALUATION

Lesion is a large, monotonous, heavily collagenized, fibrous mass with a verrucose surface covered by keratinizing, papillary epidermis. Parasites heavily infesting the surface crevices include blood engorged leeches and crustacean-like organisms. Fluke eggs, which are commonly seen in the capillaries of this type of lesion, are not present. A few mast cells are present, but their significance is not known.

DIAGNOSIS:

Fibropapilloma

John C. Harshbarger:

J. C. Harshbarger

Date:

July 16, 1986

CHELONIA MYDAS - ST. LUCIE PLANT INTAKE CANAL

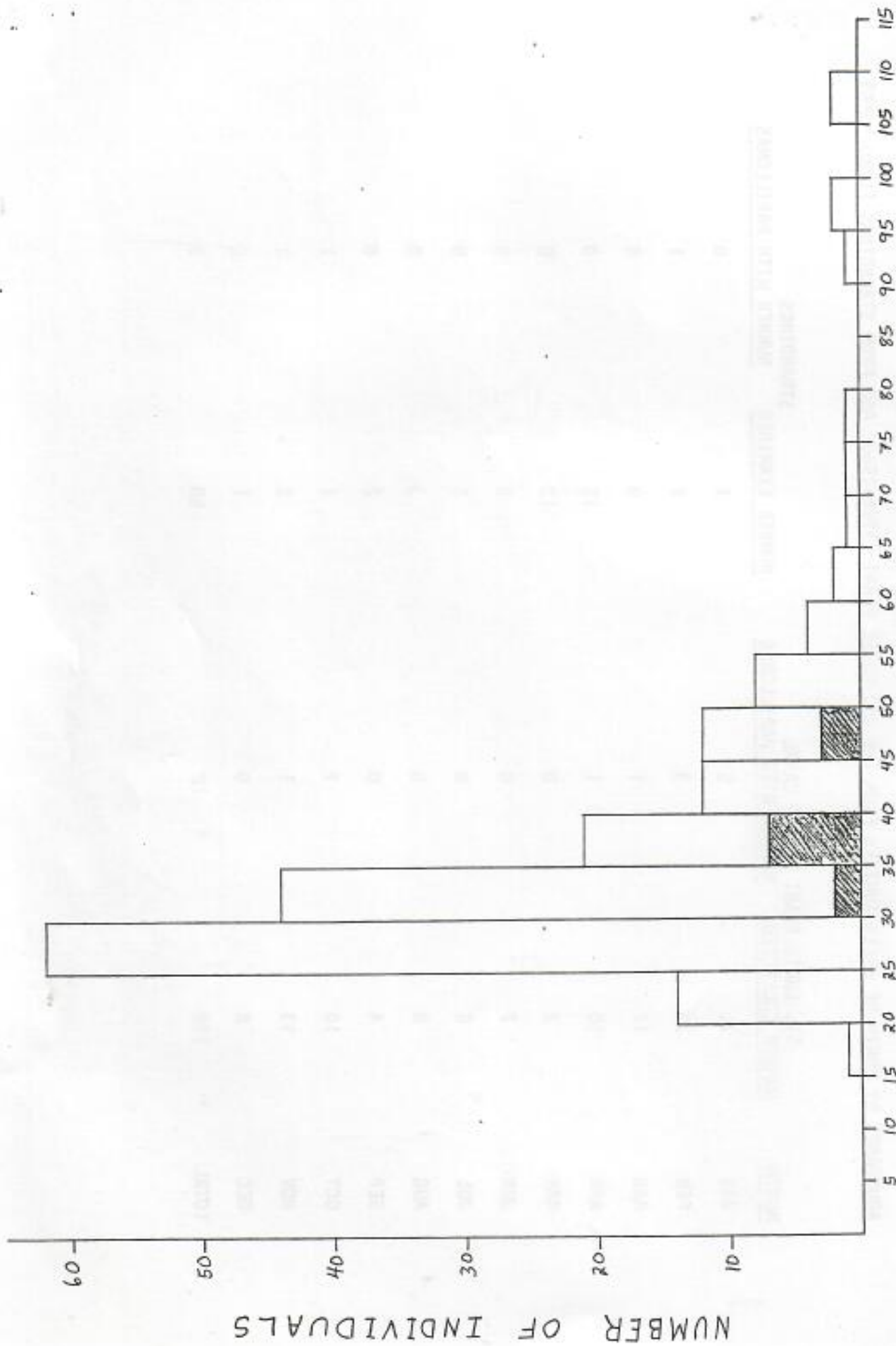
<u>YEAR</u>	<u>NUMBER COLLECTED</u>	<u>NUMBER WITH PAPILOMAS</u>
1976	0	0
1977	5	1
1978	6	0
1979	3	0
1980	10	1
1981	32	0
1982	8	0
1983	23	0
1984	69	6
1985	14	2
1986	22	2
TOTAL	192	12

CHELONIA MYDAS - STRANDINGS

<u>YEAR</u>	<u>NUMBER EXAMINED</u>	<u>NUMBER WITH PAPILOMAS</u>
1980	2	0
1981	4	0
1982	9	1
1983	3	1
1984	5	1
1985	12	0
1986	15	0
TOTAL	50	3

ABUNDANCE BY MONTH OF GREEN TURTLES FROM THE ST. LUCIE PLANT (1976-1986) AND FROM STRANDINGS (1980-1986)

MONTH	ST. LUCIE PLANT INTAKE CANAL		STRANDINGS	
	NUMBER COLLECTED	NUMBER WITH PAPILOMAS	NUMBER EXAMINED	NUMBER WITH PAPILOMAS
JAN	74	5	1	0
FEB	33	3	2	1
MAR	17	1	0	0
APR	10	1	12	0
MAY	2	0	13	0
JUN	7	0	8	0
JUL	6	0	5	0
AUG	8	0	3	0
SEP	4	0	2	0
OCT	10	1	1	1
NOV	13	1	2	1
DEC	8	0	1	0
TOTAL	192	12	50	3



STRAIGHT LINE CARAPACE LENGTH (CM)

Size distribution (SLCL) of green turtles (N=188) removed from the St. Lucie Plant intake canal, 1976-1986. Shaded areas indicate size distribution of green turtles with papillomas.

CHELONIA MYDAS WITH PAPILOMAS

ST. LUCIE PLANT INTAKE CANAL

1. 14FEB77; SLCL=36.0 cm; dead; emaciated; some barnacles; papillomas on eyes and on posterior.
2. 4FEB80; SLCL=35.5 cm; leeches; papillomas on front and rear flippers, eyes, neck, plastron and head.
3. 9JAN84; SLCL=40.0 cm; fair condition; weight normal; few barnacles; no tar; no leeches; papillomas on front and rear flippers, eyes and lower jaw.
4. 13JAN84; SLCL=35.0 cm; good condition; fat; no barnacles; no tar; no leeches; many papillomas on rear flippers and tail, papillomas also on left eye and front flippers.
5. 14JAN84; SLCL=39.0 cm; fair condition; fat; few barnacles; no tar; no leeches; papillomas on eyes, neck, plastron, front flippers and bases of rear flippers.
6. 25JAN84; SLCL=47.0 cm; good condition; fat; few barnacles; no tar; no leeches; papillomas on right eye, neck, bases of front and rear flippers.
7. 7FEB84; SLCL=37.5 cm; fair condition; weight normal; few barnacles; no tar; leeches on neck; papillomas on eyes, plastron, front flippers and bases of rear flippers; photos.
8. 20NOV84; SLCL=46.0 cm; underweight; few barnacles; no tar; papillomas on right eye, neck, front flippers and rear flippers.
9. 29JAN85; SLCL=50.0 cm; poor condition; emaciated; few barnacles; no tar; leeches on head, tail and plastron and on papillomas on all flippers; papillomas on eyes, neck, front and rear flippers and posterior; fishing line wrapped around papillomas; sample of papillomas sent to Registry of Tumors in Lower Animals (see RTLA Accession Sheet and Evaluation); photos.
10. 29APR85; SLCL=38.5 cm; good condition; weight normal; few barnacles; no tar; leeches on papillomas at bases of front flippers and around tail; leech cocoons on plastron; papillomas on bases of front and rear flippers and around tail.
11. 28MAR86; SLCL=32.0 cm; dead; emaciated; partial barnacle coverage; no tar; no leeches; papillomas on eyes, neck, bases of front flippers, plastron and tail; papillomas and epizoa removed and preserved; photos.
12. 23OCT86; SLCL=35.5 cm; good condition; weight normal; three small barnacles on plastron; no tar; no leeches; most and largest papillomas on posterior; smaller papillomas on bases of front flippers, neck and both eyes; photos.

STRANDINGS

1. 19NOV82; Indian River Lagoon near St. Lucie Inlet; SLCL=37.0 cm; poor condition; lethargic; underweight; partial barnacle coverage; no tar; many leeches on ventral surface of turtle; papillomas on head, neck, front and rear flippers and plastron; sample of papillomas sent to Department of Pathology, University of Rhode Island (see URI Animal Pathology Record); photos.

CHELONIA MYDAS WITH PAPILOMAS

STRANDINGS (CONTINUED)

2. 28FEB83; Atlantic coast of Hutchinson Island, 12 km north of St. Lucie Inlet; SLCL= 50.5 cm; fair condition; weight normal; few barnacles; leeches; papillomas on right front flipper and at base of right rear flipper; photos.

3. 29OCT84; west bank of Indian River Lagoon, 1.5 miles north of the Jensen Beach Causeway; CCL= 42.0 cm; dead; open wound on skull; papillomas on neck and bases of front and rear flippers.

Date Submitted

12-6-82

ANIMAL PATHOLOGY RECORD
 DEPARTMENT OF ANIMAL PATHOLOGY
 COLLEGE OF RESOURCE DEVELOPMENT
 UNIVERSITY OF RHODE ISLAND
 KINGSTON, R. I. 02881

Accession No.

M 973

Date Received

Veterinarian

Stanley N. Wampler

Address

1800 N. E. Savanna Rd., Jensen Beach, FL

33457

Phone

Owner

Erik Martin

Address

Applied Biology, 317 Sun View Dr., Jensen Beach, FL 334

Ident.

green sea turtle

Animal

Chelonia

Breed

mydas

Color

Age

juvenile

Sex

Unknown

Weight

Prev. Acces.

Clinical Diagnosis

History and Clinical Summary:

Submitted history: Turtle removed from Indian River near the St. Lucie Inlet (Martin County, FL) on evening of 18 November 1982. Turtle appeared lethargic and somewhat underweight. November 19, 1982 turtle examined by veterinarian who diagnosed the tumor: as viral warts. ~~Multiple~~ numerous tumors primarily on ventral surface of turtle. Leeches were numerous on the ventral surface of the turtle. Weight 10 pounds. SLCL (pre-central scute to notch between post-centrals) = 37.0 cm. CSCL (precentral scute to posterior margin of post centrals) = 39.5 cm. CCW (maximum) = 32.0 cm. Branches on carapace and plastron (3 at 20-30 mm diameter, 40-60 at 5-15 mm diameter); several

Specimen Submitted

Live Animal Dead Animal Tissues

Preservation

Fresh Frozen Fixed Condition of Specimen
When Received at Lab:
good

Biopsy Data

Exact Location

Size

Duration

Encapsulated

YES NO

Lymph node involvement

YES NO

Autopsy Data

Natural Death

Mode of Euthanasia

Time and Date of Death

Time and Date
of Autopsy

Tissues Submitted:

slides a, b: skin growths only

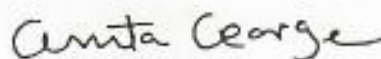
Findings:

small (less than 10 mm diameter) barnacles) were noted on the head and flippers.

Dear Erik: The skin growths are benign. Histologically these papillomas are very similar to the fibroepithelial tumors described by Smith and Coates, 1939, in *Zoologica* 24: 379-387. A viral etiology is probable, although we did not find strong evidence of viral inclusions in the histopathological sections.

If you have an extra photograph of these lesions on the turtle, would it be possible for us to obtain a copy for our records? Thank you for submitting this interesting case.

Sincerely,



Anita George

Diagnoses

Papilloma

Classification

U-13 ✓

Tissues saved Photographs Radiographs

Pathologist

Anita George

Date Prepared

Fee



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, FL 33702

August 4, 1986

F/SER23:PWR:dcp

George Balazs
National Marine Fisheries
Service, NOAA
Honolulu Laboratory
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear George,

Thanks for sending me the green turtle papilloma slides. They are truly devastating. Did I ever tell you that when I've attempted to generate interest on the papilloma problem from the Center (Miami Lab), I've gotten responses such as "Oh, that's just another trendy term that is going around now." Some trend! The attitude is slightly better now, and it appears as if the small etiology contract will go through the paperwork shuffle and be awarded in about 2 weeks. Any luck with stimulating interest/funding from the Southwest Center?

Regarding your request to have the work statement formally include studies on Hawaiian tumor tissue, it could not be done in time. At the time of your request, the paperwork was in Kansas City (CASC Procurement Office). However, when the contract is awarded, I will request that the researcher(s) contact you and incorporate tissue samples from Hawaii. I have already discussed this with Dr. Jacobson. Although the contract is quite small (\$3,980.00), he and Dr. Greg Bossart have shown considerable interest.

I have not received Lew's report yet. It is past due and I expect it any day now. I will be sure to send you a copy. His incidence of tumors (55%) is an accurate statement, but I'm not sure of the "130" greens seems awfully high. However, he is having a banner year catching turtles in the Indian River. He's a hard fella to reach in the summertime and as you know correspondence can be difficult.

Biggest news around here is that we are finally moving forward with draft regulations for mandatory TED use in specific areas along the southeast U.S. Enclosed is some correspondence you may find interesting. There are some difficult times ahead, but I believe it is a positive move by this agency.

As requested, I am sending you a dozen sea turtle award posters.

Sincerely yours,

Paul W. Raymond
Fishery Biologist
Protected Species Management Branch

Enclosures





P.S.

8-4-86

To : George

From: Paul

Re: Award Posters

Ellie Roche, who handles permits here and keeps track of the award posters, has requested that you provide her w/ a list of names of persons receiving the award (for her records). Let me know when you need more.

Just talked w/ Larry O. He is netting quite a few Kemps in the Cedar Key regions of W. Florida. Local fishermen tell him the little greens are often seen w/ growths (they call them turtle warts), but apparently these growths are quite small. I plan to go netting w/ Larry as time allows. I need to maintain some sanity & get in the field!

SINCE NINETEEN HUNDRED



"THE VOICE OF CONSERVATION"

Sally Murphy
Rt. 2, Box 167
Green Pond
South Carolina 29446

September 19 1986

Dear Sally:

Thanks for your letter about the Recovery Team meeting. Let's hope the agencies cough up the necessary money -- I agree with you that it is important that we meet from time to time, and in view of the urgent TED issues this is one of those times.

This morning Lew Ehrhart showed me a young green turtle so encrusted with fibrous papillomas as to be positively frightening. Moreover, it seems there has been a tendency to downplay this papilloma problem in some higher quarters. I believe the problem is a serious one, infesting over 50% of the abundant green turtle population in the Indian River, for example, as well as cropping up sporadically in the Caribbean and regularly in Hawaii. I suggest we add a discussion of the papilloma problem to the agenda for our forthcoming Team Meeting. It is difficult to know exactly what we should do about it, apart from ensuring that funding is available to study the possible causes and development of these pathologies, but for that very reason a "meeting of the minds" is indicated.

I look forward to seeing you in a few weeks time. I expect to be in Costa Rica for 2-3 weeks between now and then, but expect to be around for the Team Meeting.

All best wishes,

Peter C. H. Pritchard Ph.D.

c.c. L. Ehrhart
G. Balazs

N.B. Our Florida Audubon Convention will be Nov 8 and 9 - can our Recovery Team Meeting be finished by evening of Nov 7?

FLORIDA AUDUBON SOCIETY

1101 Audubon Way • Maitland, Florida 32751 • (305) 487-2412



UNIVERSITY OF CENTRAL FLORIDA

DEPARTMENT OF BIOLOGICAL SCIENCES

ORLANDO, FLORIDA 32816 (305) 275-2141

28 September 1986

George Balazs
NOAA, National Marine Fisheries Service
SWFC Honolulu Laboratory F/SWC2
2570 Dole Street
Honolulu, HI 96822-2396

Dear George:

This will have to be brief. I've got a contract progress ^{report} overdue and must spend most of my non-teaching time on that, but the papilloma (fibropapilloma) problem seems to be getting worse and is scaring the hell out of me, so I must devote some time to it. I know that Paul sent you a copy of our final report. I can only say that since the completion of that report, and generally during the last half of the summer of 1986, we have been impressed by the increased severity of the condition in the green turtles we are capturing. We've handled about 100 since the beginning of May and the frequency has remained about the same (ca. 56%), but we're beginning to see some real monsters. If you have a minute, refer to the account of NNW 639 in the report. It was the worst of the five captives we observed in our study but by the time we released it back into the Indian River (at the point of capture) on 1 July its tumors had pretty well healed up (most inflammation and necrosis gone), probably as the result of the "hygienic conditions" at the aquarium. However, when we recaptured this animal one month later (30 July) its condition was significantly worse. Returning it to the natural habitat seemed to cause new growth and, of course, all of the large growths were abraded, inflamed and necrotic. I did not happen to be working on the river that day and so only saw photographs. My students released it because there was little else they could do at the time. Luckily, however, we recaptured the animal again, in mid-September. It was in even worse shape and by this time Elliot Jacobson's little study had been funded and we had agreed to supply six papillomatous greens to be kept at Sea World (Orlando) for that study. We had removed a large growth from the plastron of this turtle on 28 May and sent it to Dr. Harshbarger. By mid September a large papilloma, verrucose and growing, I'm sure, had replaced it. Jacobson has agreed to surgically remove the larger, more incapacitating growths from the turtles before they are released at the end of his study. It may not do much good. At any rate, we have now placed six of our worst cases at Sea World and everything is set for Jacobson to begin.

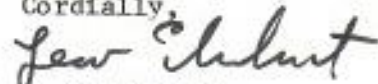
What has alarmed me so much during the second half of the summer is the increased frequency of vision-obliterating growths on the eyes and of turtles with monofilament line entangled in their papillomas. I don't know if you are aware that by the time you and I gave our talks at Waverly a number of the big shots (people we wanted to hear them) had already departed and that there is some sentiment in the agencies that the papilloma ^{problem} is just this year's "buzz word," nothing more than a fad which will go away and be replaced by some other fad next year. Peter Pritchard was not at the Waverly meeting

either and I'm afraid that I have failed, until recently, to apprise Peter of the seriousness of the matter. About 10 days ago I took advantage of the coincidence of having that little green (described above) in captivity at a time when Peter was working at home and drove up to his house with it. He seemed impressed with the "monster" and with the fact that over half of all of our Indian River juveniles are afflicted. You are aware that he wrote to Sally immediately and ask that some discussion of the matter be on the agenda at the Recovery Team meeting coming up on 6-7 November. I'll be there to make the strongest case I can but I could use some support from you. Would you be willing to write to Peter and Sally, as Team Leaders, and express your concern for this matter in the strongest possible terms? I feel that I am at the limits of my ability to contribute much more than to document the frequency and severity of the condition in the population I work with and to supply afflicted animals (or tissues) to others who can do the pathological or epidemiological work that needs to be done. I think we need to bring in some expertise in the areas of wildlife disease, virology and pathology and have those people do some brainstorming. I am pretty much at a loss to answer the question that I hear a lot lately, "Well, what can be done about it?" You know that the money appropriated for Jacobson's study (\$4000) is a pittance and that the problem deserves much more attention than that. Maybe the recovery team can help with that, if it so chooses (and can direct its attention away from Kemp's ridley for a few moments). I don't know. I must try to find time to write to Ralf Boulton and get some input from him. I think it was a real shame that he could not make the Waverly meeting and tell us about the growths he is beginning to see on his Virgin Island greens. I've not had any communication with him since his brief note of almost a year ago. Have you heard from him?

I'm meeting with someone from CEE next week to discuss this problem (and spoke with Mike Weber about it on a trawler testing TEDs at Port Canaveral a few weeks ago) but I have the feeling that that organization, like NMFS, is wearing blinders that direct its vision only to Kemp's ridley. Hope I'm wrong.

I apologize for the way I have rambled from one thing to another in this letter. I don't compose well at the typewriter and didn't have time to write it out first. I've gone on much longer than I intended to and probably have not made some of the points well, but if you can, please write to Peter and Sally before the team meets. I'll try to get Jacobson to make some input as well. Hope all is well with you and your family and that we see you in Florida again one of these days. I'm enclosing some reprints that you may or may not already have. Keep in touch.

Cordially,



L. M. Ehrhart
Professor

**J. HILLIS MILLER HEALTH CENTER
COLLEGE OF VETERINARY MEDICINE**

Department of Special Clinical Sciences
and

HEALTH CENTER ANIMAL RESOURCES

Box J-8
Gainesville, FL 32610-0006

Laboratory Animals
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Wildlife
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Reptiles
Mammals
Ph. (904) 382-2977

October 30, 1986

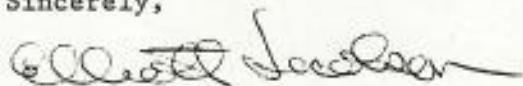
Ms. Sally Murphy
South Carolina Wildlife &
Marine Sources Department
P.O. Box 12559
Charleston, SC 29412

Dear Ms. Murphy:

I have been informed that the U.S. Sea Turtle Recovery Team will be meeting on November 6 and 7th and would like to bring to the attention of the members of the team my concern about the debilitated condition of green sea turtles with fibropapillomas. Recently I have been awarded a small contract by National Marine Fisheries Service to work on the pathology of these lesions and have also worked on an outbreak in adult green turtles at Cayman Turtle Farm, Grand Cayman, BWI, in the Fall of 1980. Although this disease was first noted in the late 1930's, since that time little new information has been generated. Over the last few years there seems to be an increase in the incidence of this disease in certain populations of green turtles and as interest has been generated in this disease, more and more afflicted turtles seems to be turning up by more and more people.

Currently we have 6 affected turtles at Sea World of Florida and have already biopsied these turtles for histopathologic studies. The overall body condition of these turtles was fair to poor and hematologic and serum chemical evaluations indicated that the health status of all of these turtles was extremely poor. We are only starting to appreciate the significance of this disease in individual turtles and there is no doubt in my mind that it potentially may have significant effects on dynamics of certain populations of green turtles. More money needs to be secured for more in depth studies so that we may better understand the basis and significance of this disease in order to develop strategies for controlling it in wild populations.

Sincerely,



Elliott Jacobson, DVM, PhD

EJ:dmp

TENTATIVE AGENDA

SEA TURTLE RECOVERY TEAM

NOVEMBER 6 - 7, 1986

ATLANTA, GEORGIA

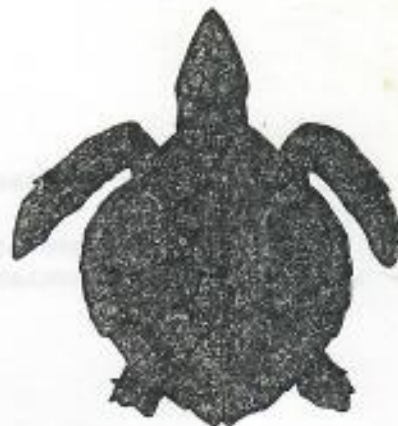
November 6

8:30 a - 10:00 a	Update on recent information from Team members
10:00 a - 10:30 a	Coffee break
10:30 a - 12:00 noon	Headstarting progress report.
12:00 - 1:30 p	Lunch
1:30 p - 3:00 p	Rancho Nuevo and Padre Island Progress Report
3:00 p - 3:30 p	Coffee break
3:30 p - 5:00 p	New Life History Research Program for Kemp's ridley

November 7

8:30 a - 10:00 a	Fibropapillomas in green turtles
10:00 a - 10:30 a	Coffee break
10:30 a - 12:00 noon	Mandatory T.E.D. regulations
12:00 - 1:30 p	Lunch
1:30 p - 3:30 p	Mandatory T.E.D. regulations

Southeast Region Sea Turtle Recovery Team



Dr. Elliott Jacobson
College of Veterinary Medicine
J. Hillis Miller Health Center
Box J-6
Gainesville, Florida 32610-0006

November 11 1986

Dear Dr. Jacobson:

Many thanks for your letter of October 30, which I received on my return from the Sea Turtle Recovery Team meeting in Atlanta. Although I did thus not become aware of your letter until after the meeting, I am pleased to report that I had already put this topic of fibropapillomas on green turtles on the agenda for the meeting, and Lew Ehrhart was present to give us an update on the current situation, the absence of knowledge concerning the cause of this serious condition, and the need for adequate funding in order to undertake a thorough study of the whole situation, from both field and laboratory aspects.

The Team found itself in complete agreement with your closing sentence, that "more money needs to be secured for more in-depth studies so that we may better understand the basis and significance of this disease in order to develop strategies for controlling it in wild populations." The Team itself, of course, has no money to disburse, but would be willing to offer any support it can to efforts by yourself or other qualified researchers to mount a major study of fibropapillomas in wild green turtles. Please let me know if you propose to draw up a research proposal on this subject -- we would certainly urge you to do so -- and we will help in any way we can with recommendations to federal agencies or other funding sources that this topic needs to be investigated fully.

We were aware that these fibropapillomas had already been observed at Cayman Turtle Farm, but no-one on the Team had any details as to how this outbreak was finally resolved, beyond the summary conclusion that it was "no longer a problem." Did all affected turtles simply reach slaughter size and were killed, or were actual cures effected? Was anything learned about how the disease spreads, whether or not it tends to be fatal, what size ranges of green turtles can catch it, and whether other species are also susceptible? It seems that, in Florida, only a single, mild, case of fibropapillomas in any other species than the green turtle has been identified; and since loggerheads and green turtles live together in some numbers in the lagoon in Brevard

Co-Leaders: Peter C.H. Pritchard, Ph.D.
Florida Audubon Society
1101 Audubon Way P.O. Drawer-7, Maitland, FL 32751
(305) 647-2615

Sally Ray Hopkins
South Carolina Wildlife and Marine Resources Dept.
P.O. Box 12559, Charleston, S. Carolina 29412
(803) 795-6350

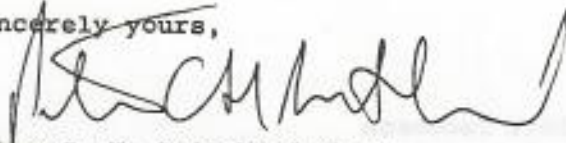
Members: A.E. Dammann, Ph.D.; Otto Florschütz; Charles Futch; Donald Geagan; H.O. Hillestad; Robert Jones; Milton Kaufmann; Ron Odom; Larry Ogren; Glen Ulrich

NMFS Coordinator: Dr. Joseph Sylvester, NMFS, Duval Building, 9450 Koger Boulevard, St. Petersburg, FL 33702, (813) 893-3721

County, this is in itself of considerable interest.

We look forward to further word from you, and hope that, together, we will be able to furnish some insight into this distressful condition.

Sincerely yours,



Peter C. H. Pritchard Ph.D.
Co-Leader

c.c. Sally Murphy
Lew Ehrhart
George Balazs



J. HILLIS MILLER HEALTH CENTER
COLLEGE OF VETERINARY MEDICINE
Department of Special Clinical Sciences
and
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Gainesville, FL 32610-0006

December 12, 1986

Laboratory Animals
Zoo Animals
Wildlife
Birds
Reptiles
Mammals
Ph. (804) 392-2977

George Balazs
NMFS
Southwest Fisheries Center
Honolulu Laboratory
2570 Dole St.
Honolulu, Hawaii 96822-2396

Dear George:

Enclosed is a copy of a letter I recently sent to Peter Pritchard. It should bring you up to date with what I am doing. I plan to get an abstract together and present a paper on my work at the 7th Annual Workshop on Sea Turtle Biology & Conservation at Wekiwa Springs State Park. I hope to have much of the electron microscopy finished at that time and I think the paper should be pretty informative.

Although the biopsy you sent me was loaded with trematode eggs, as mentioned in my letter to Peter Pritchard, none of the biopsies taken from sea turtles collected by Lew Ehrhart, and being maintained at Sea World of Florida, had trematode eggs. So I am back on the track of an elusive virus. At this point in time, this to me is the most logical cause of this disease.

I also am tentatively planning to attend the Annual Meeting of the American Association of Zoo Veterinarians which will be in Hawaii next fall (September or October). I also hope to present a paper on this subject at this meeting. If possible, perhaps we can get together at that time and see who has the most gruesome slides of sea turtle lesions.

Will keep you informed.

With best regards,

Elliott Jacobson, DVM, PhD

EJ:dmp

Enclosure



J. HILLIS MILLER HEALTH CENTER
COLLEGE OF VETERINARY MEDICINE
Department of Special Clinical Sciences
and
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Box J-6
Gainesville, FL 32610-0006

Laboratory Animals
Zoo Animals
Wildlife
Birds
Reptiles
Mammals
Ph. (904) 392-2977

December 12, 1986

Dr. Peter C.H. Pritchard
Florida Audubon Society
1101 Audubon Way
Maitland, FL 32751

Dear Dr. Pritchard:

I was glad to receive your letter supporting the need to do further work on the etiology of fibropapillomas in green turtles. I expect to be finished with my preliminary studies by the end of March, 1987. The thrust of this project is to get some idea as to the etiology of these lesions. As I mentioned in my original letter to you, the amount of money I received from NMFS will give me an opportunity to choose the right direction to go in order to really understand the basis of these lesions. In no way will this money allow me (or any one else unless they are independently wealthy) to conduct a thorough investigation of this disease problem. Biopsies of lesions from green turtles at Sea World have been sent off to a researcher at the University of Illinois who will evaluate them for the presence of papillomavirus. A pathologist at Jackson Laboratories, Bar Harbor, Maine, also will be evaluating tissue sections for papillomavirus antigen. I myself will be pursuing electron microscopic studies on tissue samples in the hope of identifying virus. Before I started this project I had considered trematode eggs released by adults in the heart and great vessels of green turtles as a possible cause of these lesions. In previously evaluated tissue samples from other turtles with the same lesions, I had consistently observed trematode eggs in vessels within the dermis of these lesions. However, representative lesions from the turtles at Sea World are totally free of trematode eggs! So, I am now focusing on a viral etiology. The group of viruses that may be involved is the family Retroviridae. This is a group of tumorigenic viruses known to produce neoplastic growths in a wide variety of animals. Unfortunately, these viruses are extremely difficult to observe in tissue section from the original tumor and tissue cultures will probably be necessary to make a specific diagnosis.

I definitely am interested in pursuing this project to its completion since this disease has perplexed investigators for so long and appears to be a major problem for free-ranging green turtles. This winter I plan to put together grant applications and will see if I can get additional funding from NMFS, Florida Sea Grant, or NSF. What I really need to do is to get enough money to hire a post-doc who can spend all of his/her time on this problem. Further, Lew Ehrhart's studies on monitoring the progression of the disease problem in populations of green turtles also needs continued funding.

If you have any words of wisdom on where to go for further funding, I would appreciate any advise you can give.

With best regards,



Elliott Jacobson, DVM, PhD

EJ:dmp

cc: George Balazs
Lew Ehrhart

Seventh Annual Workshop
on Sea Turtle
Biology and Conservation

Agenda
&
Abstracts

Wekiwa Springs State Park
Florida - 1987

Preliminary Characterization of the Disease
Papillomatosis Affecting Green Turtles at the Indian
River Lagoon System, Florida

WITHERINGTON, B.E. (Dept. of Zool., Univ. of Fla.,
Gainesville, Fla. 32611) and L.M. EHRHART (Dept. of
Bio. Sci., Univ. of Cent. Fla., Orlando, Fla. 32816)

The Indian River Lagoon System, Florida serves as
foregoing ground for an exclusive group of juvenile
green turtles. In 1982, we discovered in this popula-
tion the occurrence of a grossly disfiguring disease
characterized by fibro-epithelial growths or
papillomas. Recently we have had the opportunity to
collect further data on this disease in the wild pop-
ulation and in captive individuals. The frequency of
this disease in the Indian River has remained an
alarming 5%. Correlations of disease frequency and
severity with turtle size indicate that the smallest
(youngest) and largest (oldest) individuals in the
population tend to lack the disease. Recruits enter-
ing the lagoon may require an incubation time prior
to displaying symptoms (growth) while older individ-
uals may acquire some immunity. Comparisons of
condition factor (based on wts. and plastron lengths)
revealed no statistical difference between papillo-
matous and non-papillomatous animals. Observations of
severe infection, limb entanglement, sight obliteration
and emaciation, however, convinces us that sub-
stantial mortality may exist without evidence of
debilitation. Diseased turtles monitored while in
captivity displayed both regressing and newly formed
growths. Diseased turtles recaptured from the wild
on occasion displayed a substantial proliferation of
the disease in a short span of time.

This research was funded through a grant by
NOAA-NMFS order number 40-GENF-6-00601.

1986 Sea Turtle Protection and Nest Monitoring
Program Report - South Beach Nourishment Project

R. E. WOLF, L. P. SHOUP, and W. T. FILES (Environ-
mental Division, City of Boca Raton, Florida 33432)

This report is the post year sea turtle monitoring
update in conjunction with the 1985 South Beach
Nourishment Project in the City of Boca Raton,
Florida. The document is a follow-up to the Nest
Relocation Report during the Year of Nourishment
presented at the 6th Annual Workshop on Sea Turtle
Biology and Conservation.

The primary purpose of the study is to provide the
statistical data, findings, and results of the 1986
South Beach Sea Turtle Protection and Monitoring
Program in order to determine additional conclusions
on the effects of beach nourishment on sea turtle
nesting one year after nourishment.

The 1986 sea turtle nesting activity and hatchling
success results on South Beach indicated that the
nourishment project in the summer of 1985 did not
cause any major adverse impacts on nesting success in
1986, and perhaps the beach restoration enhancements
improved nesting density and success. The diversity
of species, number of nests laid, percentage of
successful nests to emergences, and number of hatch-
lings returned to the ocean all improved in 1986 when
compared to 1985, and nest site selection avail-
ability was increased by the nourishment operation.
The report concludes that the area under study was a
highly productive nesting beach one year after
nourishment, and no major adverse impacts resulting
from the nourishment operation were observed on sea
turtle nesting in 1986.

Functional Changes in the Locomotor
Behavior of Young Sea Turtles

J. WYNEKEN, (Dept. of Ecology, Ethology and
Evolution, University of Illinois, Urbana, IL
61801)

During posthatching ontogeny young sea
turtles undergo dramatic changes in locomotor
behavior. Emergence from the nest and the
crawl to the ocean require hatchlings to
function as terrestrial animals. They then
undergo an abrupt functional switch to become
totally aquatic. The swimming frenzy period
is characterized powerstroking (a lift-based
mechanism of generating thrust) and by
intermittent dogpaddling (a drag-based
mechanism). Observations of hatchling green
and loggerhead turtles show that both use
functionally similar locomotor mechanisms
during both the crawl and the frenzy (when
both must distance themselves from shore).
But, shortly after the frenzy, the mechanisms
diverge. Green turtles continue to employ
the powerstroke as the primary locomotor mode
and infrequently use the dogpaddle.
Loggerheads switch to a rear flipper kick
(drag-based locomotion) as their primary
locomotor mode but occasionally use the
powerstroke and more rarely, the dogpaddle.
The periods when similar locomotor modes are
employed correspond with periods of similar
ecology. Conversely, changes in locomotor
behavior may correspond with differences
between species in their early ecology. As
more information becomes available on the
aquatic ecology of these animals, especially
green turtles, relationships between
ontogenetic changes in function and ecology
may be better understood.

Loggerhead Sea Turtle Nesting Activities on the Central Florida West Coast.

BOFNANN, S. and V.L. WIESE. Note Marine Laboratory, 1600 City Island Park, Sarasota, FL 33577.

Five barrier islands along the central Florida west coast have been monitored from 1982 through 1986 for loggerhead turtle activities. Nesting activities on the islands were evident from May through August, with peak nesting activity from late June through late July. Mean annual nesting densities showed little change from 1982 through 1985. In 1986 there was a threefold increase in nesting densities compared to 1985. Average nesting density over the five year period was 11 nests/km. Percent nesting has remained constant for the study area with a 5-year mean of 55.6%. Mean clutch size has ranged from 97 to 118 eggs/nest over the study period. Mean fertility rates of nests ranged from 41% to 90%, with an overall mean of 79%. Eighty-two females were tagged in 1986, ranging in size from 73-106 cm (over curve length) with a mean length of 88.5 cm. Of those tagged, 13 were re-sighted nesting a second time, and two were re-sighted nesting a third time. Twenty-nine turtle mortalities were recorded during 1986, corresponding with stranding data collected from the previous years. The lengths (over curve) of the 25 adult mortalities ranged from 81 cm to 105 cm, with a mean length of 94.5 cm; the lengths of the four juveniles mortalities ranged from 46 cm to 77.1 cm, with a mean length of 63.2 cm.

Movements, thermal relations and diving behavior of sub-adult loggerhead turtles in coastal waters

J.A. KEINATH and J.A. NUSICK (Virginia Institute of Marine Science, Gloucester Point, VA 23062)

During April, 1986, three loggerhead turtles were trawled off the North Carolina coast, fitted with radio transmitters, released, and monitored intermittently. Two of the turtles spent 15 to 20% of the time at the surface, more than turtles tracked previously in Chesapeake Bay. This may have been due to cooler deep water temperatures off the coast than in the bay. The other turtle spent more than 50% of the time at the surface, possibly attributable to trauma due to trawling or cool temperatures.

One loggerhead, caught in the Potomac River, was fitted with an integrated radio/sonic transmitter and released 63 km off the Virginia coast during August. Forty four hours later the turtle had moved 35 km toward the bay mouth, suggesting homing to its capture range, as we have observed with other loggerheads over-summering in Chesapeake Bay. From reception of radio signals we determined this turtle spent 16% of the time at the water's surface. The sonic transmitter allowed us to sample depth and temperature of the transmitter. The turtle did not dive to the bottom, and the mean transmitter temperature was 21 C. Hydrocasts revealed a strong thermocline at the release point, but inshore water was thermally homogeneous. Diving depth may have been influenced by thermal structure of the water.

Pathologic Studies On Fibropapillomas Of Green Sea Turtles, Chelonia Mydas

E.R. JACOBSON (College of Veterinary Medicine, University of Florida, Gainesville, FL 32610); Joanne Mansell (College of Veterinary Medicine, University of Florida, Gainesville, FL 32610); J.P. Sundberg (Jackson Laboratory, Bar Harbor, Maine 04609); M. Walsh (Sea World of Florida, Orlando, FL 32821)

Six juvenile green turtles, *Chelonia mydas*, with multiple cutaneous fibropapillomas were collected off the central eastern coast of Florida and transported to Sea World of Florida for biopsy of lesions, bimonthly collection of blood samples for complete blood counts and serum chemical profiles, and observations over a 6 month period for progression or regression of lesions. Complete blood counts indicated that all turtles were mildly to severely anemic and serum protein determinations indicated all turtles were hypoproteinemic and hypogammaglobulinemic. On histopathology, fibropapillomas were verrucous in appearance and consisted of a minimal to mildly hyperplastic epidermis overlying proliferative fibroblastic connective tissue. DNA probes failed to demonstrate the presence of papillomavirus antigen and a peroxidase-antiperoxidase technique did not detect group-specific papillomavirus antigens. By electron microscopy, viral-like particles were observed in the cytoplasm of cells within the stratum spinosum. This information suggests that green turtle fibropapillomas may have a viral etiology. Further, complete blood counts and serum chemical profiles indicated that the turtles in this study were markedly debilitated. Although the effects of this disease on populations of *C. mydas* remain unknown, it must be considered life-threatening to affected individuals.

Perspective on the Effects of Oil on Sea Turtles - Physiology and Clinicopathology.

MOLLY LUTCHE, PETER L. LOTS, AND GREGORY D. BOSSART, Division of Biology and Living Resources, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida 33149, and Wildlife Veterinary Center, Miami, FL.

South Louisiana Crude Oil produced changes in ventilation and blood chemistry, induced an immune response involving white blood cells, and appeared to have cytotoxic effects on regulatory systems including the epithelium, gut, and salt gland. Once turtles were cleaned of visible oil, most effects of oil exposure, however, remain completely unknown. Future research must determine the effects of dispersants and other clean-up strategies on sea turtles.



4/30/84

George -

Here is the letter
and paper I told you
about on the phone.

As I said - Jacobsen
told me this virus etiology
in turtles was like a case
he published on with ele-
phants. The paper is marked
on the last page showing he
didn't find the virus -
oh well!

Take care & I will
send you a set of the slides
& a copy of my talk after
the meeting.

Best regards,
Murray



DEPARTMENT OF
SPECIAL CLINICAL SCIENCES

College of Veterinary Medicine
Box 1-6, JHMHC
Gainesville, Florida 32610
(904) 392-2792

THE UNIVERSITY OF FLORIDA

April 14, 1987

Dr. Murray Dailey
SCOSC
California State University
Long Beach, California 90840

Dear Dr. Dailey:

Recently I was informed that you were scheduled to give a talk on green turtle fibropapillomas at the next IAAAM meeting. Off and on since 1980 I have had the opportunity to work on this disease in turtles from the Cayman Islands, the Florida Keys, Hawaii and most recently (with a small grant from NMFS), from an affected population of juveniles in the Indian River lagoon System of east-central Florida. Although I have commonly identified spiriorchid trematode eggs in lesions from Hawaiian, Florida Keys, and Cayman Turtles, no eggs were seen in multiple biopsies of a group of 6 severely affected turtles from the Indian River System. Further, I have identified herpes-like particles in epidermal cells from an affected Hawaiian turtle. This summer I will be focusing on developing techniques for cell culturing both epidermal and dermal components of the tumor and will do ultrastructure studies on this material.

Although for a long time I considered an inflammatory response to trematode eggs in the dermis as a likely explanation for this disease, I no longer do so. A virus (possibly a herpesvirus) is a more likely bet. Detailed work by us has ruled out the presence of papillomavirus genome and antigen in tumor tissue. In some ways this disease resembles a disease I worked up last year in a captive herd of African elephants (see enclosed paper). It took 8 months of biopsying to pick up the right stage where viral multiplication was going on.

Sincerely,

Elliott Jacobson, DVM, PhD

EJ/nr

United States Government
Memorandum

Date: June 24, 1988
To: Files
Subject: June 6, 1988 Green Turtle Papilloma Meeting, UF-Gainesville, FL
From: Region 4 Sea Turtle Coordinator

Participants: Dr. Elliot Jacobson, University of Florida (UF);
Dr. Karen Bjorndal, UF; Dr. Alan Bolten, UF; Walter Conley,
FDNR; Dr. Jean Mortimer, UF; Larry Ogren, NMFS; Earl Possardt,
USFWS; Dr. George Balazs, NMFS (telephone speaker); Dr.
Llewellyn Ehrhart, U.C.F.

Meeting Summary:

A summary of Dr. Jacobson's recent work and conclusions are attached. A challenge study in which 18 juvenile green turtles were inoculated with material from papillomas is in progress and scheduled for termination at the conclusion of one year. No evidence of the disease has been observed after 9 months. Dr. Jacobson believes trematodes are unlikely to be the cause of papillomas since 28 biopsy specimens of fibropapillomas from 6 affected turtles revealed no spirorchid trematode eggs.

Dr. Ehrhart reported on a continued high incidence of papillomas in Indian River green turtles; turtles 35-45 cm have the highest frequency of papillomas with 45-50 per cent of all captured green turtles bearing papillomas during the summer months.

Dr. Balazs continues to find a high incidence of papillomas in Hawaii. Forty-one per cent of the 1987 strandings (112) had papillomas. Some turtles had papillomas in the throat. In one instance where tumors were surgically removed there was regrowth in 3 months. Hawaiian green turtles are heavily infected with trematodes. Dr. Murray Daily, a marine mammal parasite specialist at the University of California, Long Beach will be studying the parasite problem with an \$8,000 NMFS contract.

The possible relationship of contaminants to the disease and contaminant pollution of Indian River and Hawaiian waters were discussed. Dr. Jacobson believes contaminants would not directly cause the disease but might increase the frequency of the disease by possibly acting to suppress the immune system of individual turtles. The St. Johns Water Management District is funding a two year contaminant study of the Indian River which may help identify potential problem contaminants. Dr. Ehrhart reported various studies have found high levels of organochlorines in Indian River

bottle-nosed dolphins. The Fish and Wildlife Service's Patuxent Laboratory may be able to provide some contaminant analysis of green turtles. If possible animals should be compared from the Indian River Lagoon and a "clean" control environment such as the nearshore habitats of southeast Florida.

Dr. Jacobson believes research on the disease will be expensive and longterm because of the extreme complexity of this type of disease (if in fact a retrovirus is involved). He estimated \$50,000 for 5 years might be a good start but lower funding levels would be better than nothing. He believed the highest priority research was to continue to try isolating and identifying the possible viral agent.

The participants agreed to the following as reasonable measures given the funding realities:

1. Contact the St. Johns River Water Management District to determine if the study could include the green turtle in the research design, either by using them as bioindicators for contaminant analysis, or at least by sampling areas where there is a known high incidence of papillomatosis. (Possardt)
2. Contact FWS Contaminants Coordinator and arrange for future shipments of green turtle carcasses to Patuxent Laboratory for contaminant analysis. (Possardt)
3. Explore possibilities for funding Dr. Jacobson to continue his investigations on the etiology of papillomatosis at a minimal level of 10-15 k. (Possardt)
4. Contact Clearwater Science Center to determine if the 36 green turtles being held for the challenge study could be held for up to two years since the latent period for the disease could be longer than one year. (Conley)

Earl E. Possardt

"Make Safety A Family Affair"

Residents warned of sewage contamination

By David White
Advertiser Capital Bureau

Residents should avoid contact with water in Kaneohe Bay and other areas around Oahu that were contaminated by sewage diverted from treatment plants following this week's heavy rains, the state Health Department advised last night.

"As a precautionary measure, we recommend against swimming and water sports in these areas for at least the next 48 hours (through tonight)," state Deputy Health Director Bruce Anderson said.

Warning signs have been posted from Coconut Island to Kaneohe Marine Corps Air Station, around Ala

Moana Beach Park, Enchanted Lake, Palolo Stream and off Kuliouou.

No problems have been reported with drinking water systems, he said.

The wet weather was probably responsible for the rupture of a sewage "force main" linking the Kaneohe and Kailua sewage treatment plants, said George Uyema, chief of the Waste Water Management Division of the city Department of Public Works.

A private contractor began repairing the line Tuesday night.

The city is building a new line between the two plants to replace the 30-year-old force main that has sprung leaks several times in recent months, Uyema said.

Treated effluent from the Kaneohe

sewage treatment plant was diverted through an outfall into Kaneohe Bay instead of being piped to the Kailua plant, Uyema said.

The flow into the Kailua plant was much greater than usual because of rain water that seeped into the sewer system, Uyema said. Some of the sewage processed at the Kailua plant will not receive full secondary treatment, he said.

Uyema said pressure from rain water in the sewers dislodged several manhole covers, primarily in Windward Oahu.

"In this instance, 95 percent of what's bubbling out from under the manhole covers is storm water," Uyema said.

Flood damage: City Public Works Director Sam Callejo spent about an hour and a half yesterday afternoon surveying the inundated areas from a helicopter.

"Kahuku and Laie were worse than I thought they would be," Callejo said. "We had road crews and pumps out there all night working with state crews trying to keep Kamehameha Highway open."

That proved to be futile.

Nonetheless, Callejo said this flood was much different than the one that struck parts of Oahu on Dec. 31, 1987, when a lot more rain fell in a much shorter period.

"The areas that were damaged by that flood were repaired properly,"

Callejo said. "We've been trying our best to keep storm mouths open and boulder basins clear to avoid a repeat of that event."

Radio talk-show chatter to the contrary, Callejo said he believes a joint city-Army Corps of Engineers flood control project in Laie, completed late last year, worked as designed.

"You have to look at the big picture to see how everything ties together. Laie and Kahuku are basically flat, and a lot of the homes in the area were built in a flood plain."

A city damage-assessment team is scheduled to visit the area today and make a more detailed evaluation of how well the project worked, Callejo said.

FROM PAGE ONE...

Health officials warn: Do not go in the water

By Jerome Morison
Star-Bulletin

Sewage overflows have city and state health officials warning residents to stay out of the water in Kaneohe Bay, Enchanted Lake, the Hawaii Kai Marina and Waiananalo through the weekend.

Heavy rains and a broken main caused sewage overflows in those areas, and city public works officials were busy taking water samples for the state Department of Health yesterday.

Water samples will be taken daily until the overflows are stopped.

The state Department of Health should receive some preliminary test results late this afternoon, city officials said.

"We're fixing the force main close to the Kailua treatment plant... We'll probably be working on it over the weekend — at least a couple more days," city Public Works Director Sam Callejo said.

"A lot of it is just the high flows that we're still getting from infiltration because the ground is so saturated," Callejo said.

"Most of the effluent is treated and it is very diluted. As for how long this will continue — we don't know right now."

The state Health Department will make sure the city keeps warning signs posted and continues sampling water, said Charles Oumi, supervisor for the enforcement section of the department's Clean Water Branch.

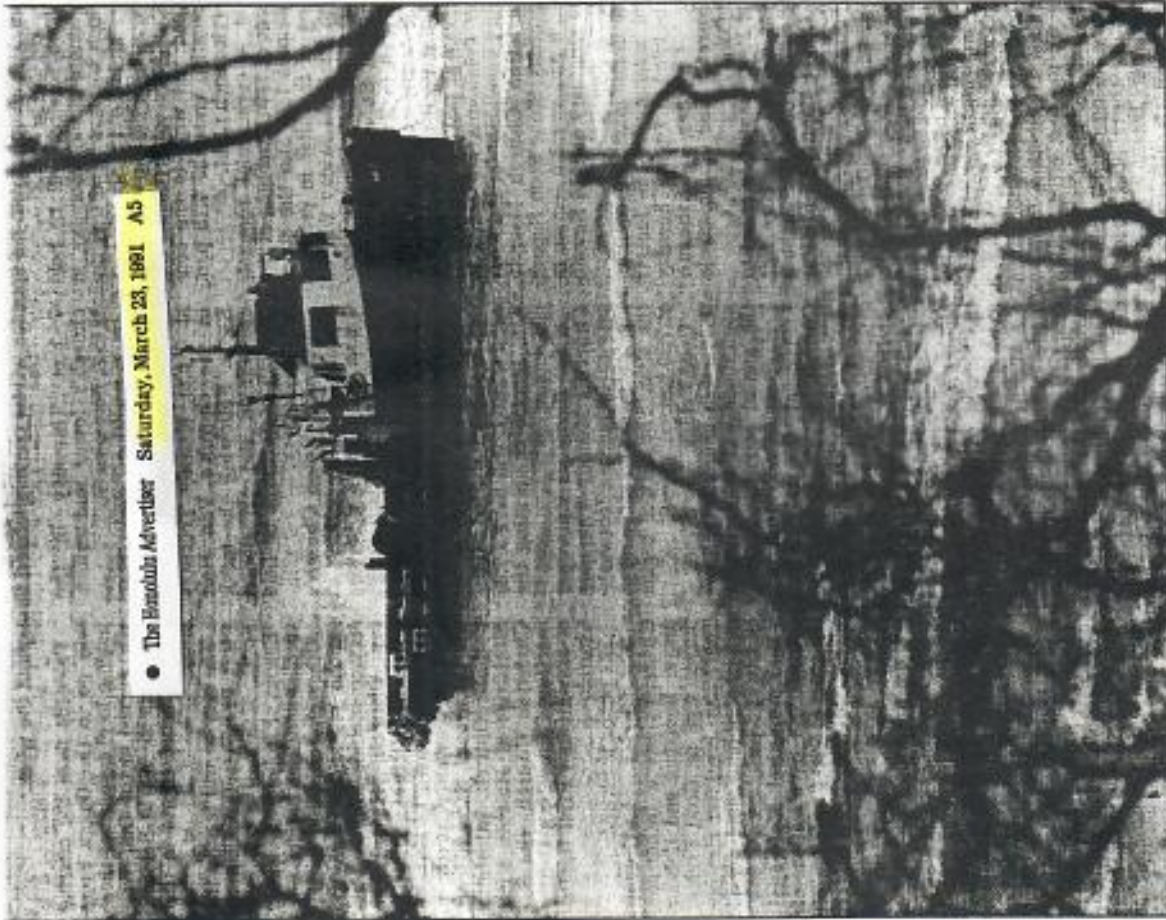
"We want people to stay out of the water. It's just common sense," Oumi said. "We make the determination when there is an 'all clear' and they (the city) can take down the signs. I really can't say when it will be, but I don't think it will be in the next couple of days."

The city had corrected problems in the Hawaii Kai area, but warning signs continued to be posted. Backed-up sewage-injection wells at Waiananalo were overflowing at a rate of 25 gallons a minute yesterday and spilling into the adjacent stream, Callejo said.

"With these rains, not only is there sewage effluent in the waters, but everything else that has been washed down from the rivers and valleys," he said.

"You've got lots of other pollutants in there. It's just best to stay out of the water for now."

• The Honolulu Advertiser Saturday, March 23, 1991 A5



Advertiser photo by Bruce Asato

Tug aground on reef off Diamond Head lighthouse

A tugboat in the background prepares to help pull the tug Nahoa from the reef about 250 yards off Diamond Head lighthouse, where it ran aground about 1 a.m. yesterday. The 60-foot Nahoa, which was leaking from 1,000 to 2,000 gallons of diesel fuel, was to remain on the reef last night after two tow lines snapped about 7:15 last night. The state Health Department said people should not swim in that area or eat fish, shellfish or seaweed from there until the area has been cleaned.

Honolulu Star-Bulletin 6/23/92 A2

Researchers troubled by tumors on turtles

By Tim Ryan
Star-Bulletin

A disabling, life-threatening disease that causes tumors to grow twice the size of a man's fist on endangered Hawaiian green sea turtles has found its way to an isolated, shallow reef off west Molokai.

Federal wildlife officials say the disease has reached epidemic proportions at Palau, where no cases of the disease had been reported before October 1985.

"We're not even close to finding the cause," said George Balazs, leader of the Honolulu Laboratory's Marine Turtle Research Program of the Southwest Fisheries Science Center. "I don't think this is going to be an easy disease to crack."

Palau, about four miles west of the Kaunakakai pier, is bordered by mangrove stands, Balazs said.

In a recent survey, tumors were found in 53 percent of the 121 green turtles captured and examined at Palau, said George W. Boehlert, director of the Honolulu Laboratory.

The disease, known as fibropapilloma, eventually leads to death, officials said.

The scientists do not know what causes the disease, how it spreads, or what its impact will be on the overall recovery of the endangered green sea turtle.

Possible causes being examined are pollutants and blood parasites specific to turtles, Balazs said.

The first case reported at Palau

was in 1985; that was followed by another case in June 1987. Since then, tumor incidence in the area has risen by about 5 percent annually, Balazs said.

Another survey will be done next month to confirm that the disease is as prevalent in the Palau population as recent results indicate, the scientist said.

The disease attacks the soft parts of the turtle; the eyes are particularly vulnerable, he said.

Surgical removal is impractical because of the number of turtles in the wild — about 1,000 in Hawaii — the length of the procedure, and, in some cases, the tumors grow back within months, he said.

Of 171 turtle strandings in Hawaii in 1991, 54 percent showed clear evidence of external tumors ranging from small bumps to double-fist size on eyes and flippers, Balazs said.

A tumor-free turtle was found

2½ years later covered with the massive growths, he said.

The number of tumor-infected turtles found statewide has been increasing, particularly at several points off Oahu, including Kaneohe Bay, Haleiwa Harbor, Hawaii Kai area, including Hanalei Bay.

Several study sites off Hawaii remain tumor-free: Kiholo Bay, Punahoa and Puako on the Big Island.

While most of the tumor-suffering turtles are being found in bays and other enclosed bodies of water surrounded by heavy urbanization, the Molokai site doesn't fit that profile.

Palau is surrounded by undeveloped farm lands, so scientists are investigating whether the turtles' toxin levels are coming from land-based pollutants, Balazs said.

"Molokai is as bad as the worst cases we've had elsewhere," Balazs



George Balazs

Where Sick Turtles Come for TLC

BY MIKE CLARY

Marathon, Fla.

The patient arrived in a panel truck, agitated, bewildered and using her flippers to whack the sides of the plastic swimming pool that held her. She looked terrible. At least 25 bulbous tumors stuck up from around her eyes, mouth and the leathery skin around her shell.

"Actually," said Richie Moretti, turning the 60-pound green sea turtle over on her back, "this one is pretty healthy. I think she might be in the 15 percent we can save."

Moretti, 48, is a former Volkswagen mechanic who moved to the Florida Keys nine years ago after buying a motel next door to a topless lounge. He still runs the Hidden Harbor Motel, but the lounge, called Fanny's, has been converted into what is believed to be the world's only veterinary clinic devoted exclusively to treating endangered sea turtles plagued by a mysterious and debilitating disease.

The disease, called fibropapilloma, causes grotesque tumor masses that are not malignant but usually prove fatal when they grow over the animal's eyes and mouth and hinder feeding. "They literally starve to death," Moretti said.

Up to 60 percent of some green turtle populations found in the Florida Keys and areas of the Caribbean are believed to be affected, according to Elliott Jacobson, a professor of zoological medicine at the University of Florida who is working with Moretti and his partner, Tina Brown. Turtles in Hawaii have also been affected, and the disease is beginning to show up in the warm waters off the coasts of Central America and Australia.

The disease was first reported in 1938, but in the last few years it has "increased in prevalence and distribution, and we don't know why," Jacobson said. His studies found that papilloma is related to the herpes virus.

"It is a devastating, life-threatening problem which could knock out whole populations," he added. "We're seeing it primarily in juveniles, and when they become breeding adults at 15 to 20

years old, they could pass it on through the egg."

For Moretti and Brown, who moved to the Middle Keys from Orlando seven years ago, the turtles have become a costly obsession. "Our plan was to compete in fishing tournaments and take it easy," Moretti said.

Instead, the couple have poured the proceeds from the 21-unit motel and a couple of video rental stores into the nonprofit turtle project. Moretti figures he has spent about \$250,000 to buy the onetime lounge, remodel it and install operating tables, lights, a sterilizer and an anesthetic machine.

The clinic officially opened in June, but since 1985, when a fisherman brought the first injured turtle to them, Moretti and Brown say they have treated more than 350 diseased or damaged animals. Of the dozens with papilloma, most have died, so underweight when found that no amount of tube-fed Gatorade and Nutri-Cal could save them.

The one that had arrived in the panel truck could be an exception.

Brown turns on the garden hose near the marina and scrapes off from the animal's shell masses of yellow eggs laid by marine leeches. Moretti readies a shot of antibiotic. Days later, when the turtle is accustomed to her new surroundings in a salt-water swimming pool, a veterinarian will come by to surgically remove the tumors. This turtle faces at least six months of rehabilitation, Brown said.

Fibropapilloma isn't all sea turtles have to contend with. Collisions with boats and propellers are also frequent. Moretti and Brown have learned to use fiberglass to make repairs to cracked shells and sew up flesh wounds vulnerable to infection.

This turtle also had a deep gash on one flipper and cracks and a dash of blue paint on its shell, evidence of a run-in with a boat hull.

Brown and Moretti have been lauded for their work by the National Marine Fisheries Service and got a mention in a recent issue of National Geographic.

The turtles have also led them to become environmental activists; they have gone to sea to protest the military's use of the Atlantic as a practice bombing range and have sued the U.S. Department of Commerce to halt the harvesting

SEPT 92 . LA TIMES



Florida resident Richie Moretti bathed a diseased sea turtle

BY LOS ANGELES TIMES

of sea grass — prime turtle habitat — in the Sargasso Sea. (Some seaweed is used as protein in animal food.)

Jacobson says that while battling long odds in trying to save individual turtles, Brown and Moretti have been effective in calling attention to a little-noticed plague.

"Government agencies have avoided these kinds of problems, and so it's left to the private sector to provide humane care of these animals," Jacobson said. "This is a global disease, a forerunner of other problems in marine environment. People concerned with the quality of life should be concerned about what's happening with green turtles."

For Brown, a former hairdresser, working with troubled turtles now seems inevitable. "Living here in the Keys, it is impossible to ignore nature, and turtles are a part of it," she said. "Nobody else was doing anything, so we did."

Moretti recalls winning the first two deep-sea fishing tournaments the couple entered, in 1984. "That was satisfying, but lightweight compared to fixing sick animals and returning them to the wild," he said. "I like being needed, and these animals need us. If I could think of any way to enjoy life more, I'd do it."

No action was taken until a councilman pushed the issue

By Jeanne Mariani
Star-Bulletin

4/24/91 HSB

A state Health Department official yesterday acknowledged that the agency overlooked a federal report released in November that revealed fish in Manoa Stream had dangerously high concentrations of lead and other pollutants.

Deputy Health Director Bruce Anderson said the state had been aware of high levels of chlordane in the stream, but didn't take action on the problem until City Councilman Andy Mirikitani brought it to his attention last month.

The November report by the U.S. Fish and Wildlife Service — based on samples taken in 1984 from streams across the country — revealed fish in Manoa Stream had the highest concentration of lead, dieldrin, chlordane and heptachlor epoxide of 117 streams tested nationwide.

After Mirikitani's warning in March, Anderson said he found a letter from the Fish and Wildlife Service dated November notifying the Health Department of the findings.

Only then did the department take fish samples to confirm the report, Anderson said. The samples have been sent to a California laboratory and results are due in three months.

Mirikitani, chairman of the Council's Environment Committee, said the report was brought to his attention by residents worried about pollution in the stream. Mirikitani represents the Manoa area.

"It's something that people have been very concerned about in Manoa and elsewhere," he said. "As soon as I learned about the report I wanted to have the state take immediate action to confirm the report."

“
I believe the
state should
have acted
sooner... given
the seriousness
of the lead
levels and the
potential health
hazards.

”

Andy Mirikitani
Chairman, City Council
Environment Committee

He said he sent a letter to the Health Department in February and received a written response March 27, which stated the department was investigating the lead problem.

"I believe the state should have acted sooner and in a more expedient manner, given the seriousness of the lead levels and the potential health hazards," he said.

Since his inquiry, Mirikitani stressed that Anderson and the Health Department have been "very responsive in helping to resolve this potential health hazard."

The report said the average concentration of lead found in streams nationwide was 0.11 parts per billion, but tilapia in Manoa Stream had 3.95 parts per billion; guppies, 4.88; and Chinese catfish, 1.30.

Waialeale Stream's tilapia and guppies had lead concentrations of about 0.77 parts per billion, the report said. Waialeale Stream, which empties into the West Loch of Pearl Harbor, also had high concentrations of copper, Anderson noted.

He said the state also is testing streams in other urban areas, such as Kalihi Stream, Kaelepulu Stream in Kailua and Waiawa Stream, for similar pollutants.

Meanwhile, the Health Department is urging residents not to eat fish from the streams. Lead in high quantities affects the central nervous system of humans and causes learning disabilities and behavioral disorders, Anderson said.

"The only hazard associated would be long-term exposure. That's people eating tilapia every day for 70 years. When we do our assessment, we look at the worse-case scenarios," he said.

Anderson said that, luckily, Manoa Stream is not heavily fished.

Nevertheless, Mirikitani said he still is concerned about potential health risks.

"It's my understanding that it is not one of the more popular fishing areas, but there are people who do fish in the stream and, therefore, it's very important that this information gets out to the public to warn them of the potential hazard," he said.

Anderson said a new \$35.6 million laboratory, which should be operating within three years, will help the Health Department tackle environmental health problems more efficiently.

4/12/92

ENVIRONMENTAL UPDATE

Tumors still plague Hawaii sea turtles

The grotesque tumors found on a majority of green sea turtles in some Hawaii bays are the animals' top research need, according to an interim recovery plan developed for all Hawaii's sea turtles.

There are plenty of other research needs, but few appear as critical as finding a way to deal with the fibropapillomas, the growths that have spread like an epidemic through the green sea turtle populations of the Hawaiian Island and Florida waters in recent years.

Scientists continue to be stumped by the growths.

"The major thing we know is that we're dealing with a global disease that's being seen in multiple places around the world. In the 1980s it exploded around the world. The reasons for this at this time are unknown," said Elliott Jacobson, veterinarian and professor of wildlife medicine at the University of Florida.

The Hawaii green sea turtles, *honu* in Hawaiian and *Chelonia mydas* to science, declined in numbers through the 1960s, likely because of an increase of fishing for them. In 1974, the state banned commercial fishing for them. In 1978, they were listed by the federal government as a threatened species,



JAN TENBRUGGECATE
Advertiser
Environment Writer

and killing them is now a violation of federal law.

Hawaiian green sea turtles may cruise from Pearl & Hermes Reef in the Northwestern Hawaiian Islands to the Big Island, but most of them return to a sandy islet at French Frigate Shoals, 400 miles west of Kauai, to lay their eggs. A few lay eggs in the main islands.

They live a very long time, and average 25 years of age before they reach sexual maturity, according to the interim recovery plan. The tumors may prevent many from reaching sexual maturity.

The first tumors were spotted in Hawaii in the late 1950s. They were rare through the early 1960s. The numbers rose. In some

See Turtles, Page 2

(over)

Park program disease-free

The green sea turtles at Sea Life Park are, so far, free of the diseases that causes large tumors to grow on their bodies.

The park's captive turtle population is made up of animals collected before turtles were declared endangered, and the offspring of those animals. They are kept apart from the wild turtles that occasionally are brought to the facility.

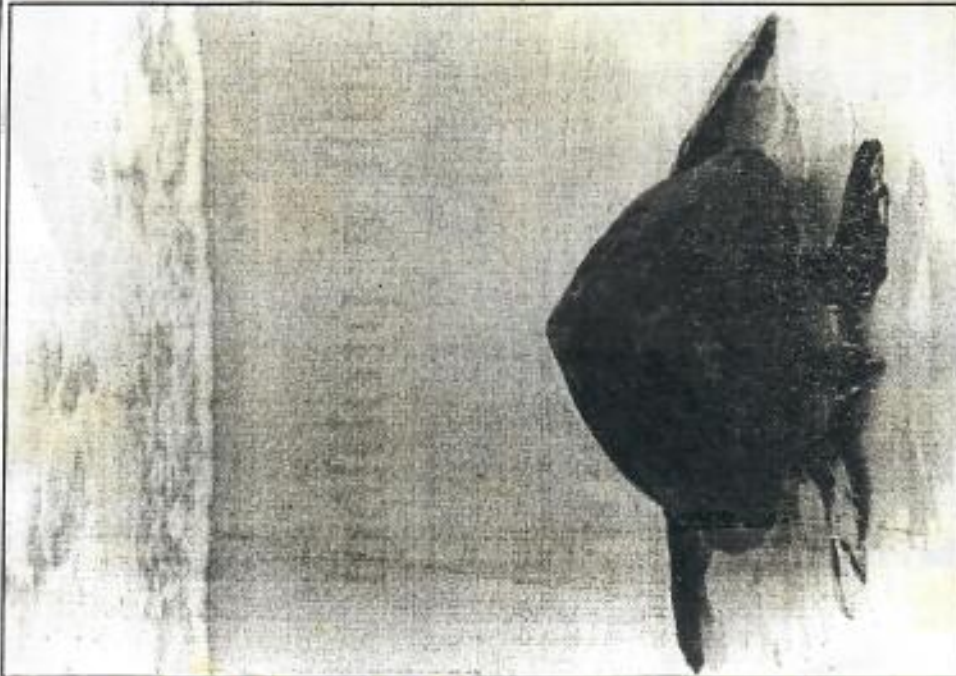
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— Jan TenBruggencate



Advertiser photo by Bruce Asano

A turtle heads for surf on an Oahu beach.

Turtles: Tumors still a problem

FROM PAGE 1

areas, like Kaneohe Bay, half the turtles had fibropapillomas, but other areas, like south Molokai and West Hawaii, remained virtually free of them through the 1980s.

George Balasz, a National Marine Fisheries Service researcher, said it's gotten so bad that in some areas, it is considerably easier to find a diseased turtle than to find a healthy one.

Researchers have found similar differences off the East Coast. More than half the young turtles in Florida's Indian River Lagoon System had tumors, but in the Atlantic Ocean a few miles away, no tumors were found.

Jacobson said the situation is repeated worldwide: Turtles in the open sea tend to be far

less likely to have tumors than those in shallow, nearshore waters.

Researchers have not identified a pest or poison or pollution source that might cause the tumors. They haven't identified virus or bacteria sources. And they have not been able in the laboratory to infect clean turtles using tissue from sick turtles, so they still don't know how the animals get the tumors.

Researchers across the country and at international institutions are studying the problem.

A research plan published last year by the National Marine Fisheries Service cited several reasons for learning more, beyond attempting to control the impact on the threatened sea turtles themselves.

■ They could represent a reaction to a toxic pollutant in

the ocean that we haven't yet identified.

■ There is the potential humans could suffer health hazards associated with them.

■ The visitor industry could be affected if people entering the state's waters repeatedly see turtles carrying ugly tumors.

The pale tumors can appear on the face, in the eyes, under the flippers, in the lungs and elsewhere. They can grow to more than 10 inches in diameter, and can block vision, impede swimming or even choke turtles to death if they grow in their mouths or throats. Many animals have washed up on beaches dying of starvation, too blind to find food, or incapable of swallowing it.

Researchers have tried removing tumors surgically or with lasers, but they often grow back. There are a few

cases of tumors disappearing on their own, but none of these have been seen in Hawaiian turtles.

Scientists have found blood fluke eggs in some of the tumors, but not in others. They have found a herpes virus in some tumors, but have not been able to infect other turtles and have them develop tumors.

One problem with the disease is that there is so little money available to study it. Jacobson said that if you added up all the money available nationwide for the last six years for the study of fibropapilloma in sea turtles, it might add up to \$40,000.

"We certainly are being hampered by that. Funding is not that great and it may never be. We're going to have to peck away at it and see what we can come up with," he said.

Researchers troubled

By Tim Ryan
Star-Bulletin

A disabling, life-threatening disease that causes tumors to grow twice the size of a man's fist on endangered Hawaiian green sea turtles has found its way to an isolated, shallow reef off west Molokai.

Federal wildlife officials say the disease has reached epidemic proportions at Palaaau, where no cases of the disease had been reported before October 1985.

"We're not even close to finding the cause," said George Balazs, leader of the Honolulu Laboratory's Marine Turtle Research Program of the Southwest Fisheries Science Center. "I don't think this is going to be an easy disease to crack."

Palaaau, about four miles west of the Kaunakakai pier, is bordered by mangrove stands, Balazs said.

In a recent survey, tumors were found in 53 percent of the 121 green turtles captured and examined at Palaaau, said George W. Boehlert, director of the Honolulu Laboratory.

The disease, known as fibropapilloma, eventually leads to death, officials said.

The scientists do not know what causes the disease, how it spreads, or what its impact will be on the overall recovery of the endangered green sea turtle.

Possible causes being examined are pollutants and blood parasites specific to turtles, Balazs said.

The first case reported at Palaaau



George Balazs

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by tumors on turtles

was in 1985; that was followed by another case in June 1987. Since then, tumor incidence in the area has risen by about 5 percent annually, Balazs said.

Another survey will be done next month to confirm that the disease is as prevalent in the Palaaau population as recent results indicate, the scientist said.

The disease attacks the soft parts of the turtle; the eyes are particularly vulnerable, he said.

Surgical removal is impractical because of the number of turtles in the wild — about 1,000 in Hawaii — the length of the procedure, and, in some cases, the tumors grow back within months, he said.

Of 171 turtle strandings in Hawaii in 1991, 54 percent showed clear evidence of external tumors ranging from small bumps to double-fist size on eyes and flippers, Balazs said.

A tumor-free turtle was found

2 1/2 years later covered with the massive growths, he said.

The number of tumor-infected turtles found statewide has been increasing, particularly at several points off Oahu, including Kaneohe Bay, Haleiwa Harbor, Hawaii Kai area, including Hanauma Bay.

Several study sites off Hawaii remain tumor-free: Kiholo Bay, Punaluu and Puako on the Big Island.

While most of the tumor-suffering turtles are being found in bays and other enclosed bodies of water surrounded by heavy urbanization, the Molokai site doesn't fit that profile.

Palaaau is surrounded by undeveloped farm lands, so scientists are investigating whether the turtles' toxin levels are coming from land-based pollutants, Balazs said.

"Molokai is as bad as the worst cases we've had elsewhere," Balazs said.

Health/Science



Advertiser photo by Bruce Asato

A turtle heads for surf on an Oahu beach.

4/12/92

ENVIRONMENTAL UPDATE

Tumors still plague Hawaii sea turtles

The grotesque tumors found on a majority of green sea turtles in some Hawaii bays are the animals' top research need, according to an interim recovery plan developed for all Hawaii's sea turtles.

There are plenty of other research needs, but few appear as critical as finding a way to deal with the fibropapillomas, the growths that have spread like an epidemic through the green sea turtle populations of the Hawaiian Island and Florida waters in recent years.

Scientists continue to be stumped by the growths.

"The major thing we know is that we're dealing with a global disease that's being seen in multiple places around the world. In the 1980s it exploded around the world. The reasons for this at this time are unknown," said Elliott Jacobson, veterinarian and professor of wildlife medicine at the University of Florida.

The Hawaii green sea turtles, *honu* in Hawaiian and *Chelonia mydas* to science, declined in numbers through the 1960s, likely because of an increase of fishing for them. In 1974, the state banned commercial fishing for them. In 1978, they were listed by the federal government as a threatened species,



JAN
TENBRUGGENCATE
Advertiser
Environment Writer

and killing them is now a violation of federal law.

Hawaiian green sea turtles may cruise from Pearl & Hermes Reef in the North-western Hawaiian Islands to the Big Island, but most of them return to a sandy islet at French Frigate Shoals, 400 miles west of Kauai, to lay their eggs. A few lay eggs in the main Islands.

They live a very long time, and average 25 years of age before they reach sexual maturity, according to the interim recovery plan. The tumors may prevent many from reaching sexual maturity.

The first tumors were spotted in Hawaii in the late 1950s. They were rare through the early 1960s. The numbers rose. In some

See Turtles, Page 2

Park program disease-free

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Some are raised for release when their shell lengths are 1 to 1½ feet and the animals are 2 to 3 years old. Scientists know very little about the survival rates of hatchlings, and believe older turtles have a much higher chance of making it.

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Turtles: Tumors

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