

**Working Group Meeting on Health Issues of Captive Reared
Hawaiian Green Turtles
March 8, 2001**

Results of a meeting hosted by:
Southwest Fisheries Science Center
Honolulu Laboratory
National Marine Fisheries Service
2570 Dole Street, Honolulu, Hawaii 96822-2396

Prepared by: Robert C. Braun DVM MS
Veterinary Medical Coordinator Consultant

Background

In May 2000, seven of 10 two-year old captive bred and reared green turtles were found to have oral lesions. Subsequently at a separate facility 17 of 18 green turtles of similar age were also found to have similar oral lesions. There may be as many as 60 green turtles involved. Additional groups of captive reared turtles from this same facility will soon be examined. Grossly, these lesions were most commonly found on the soft palate and tongue. The lesions ranged from mild singular, irregular, circumscribed plaques to multiple, coalescing, large, 5 mm, erosive and/or catarrhal plaques on the soft palate and tongue. Over the last nine months observations suggest a "waxing and waning" of these lesions.

Limited biopsies of these oral lesions have resulted in histopathological reports describing lymphocytic, plasmacytic stomatitis with some microgranulomas and perivasculitis. In two samples trematode eggs (Spirorchidae) were found. Wet mount cytology was negative for motile organisms. Two turtles had blood samples cultured which grew *Alpha Streptococcus sp.* and *Enterococcus sp.*

Consensus Differential Diagnosis
(using a DAMN IT group discussion approach)

Degenerative: No evidence, except erosion in hard palate of turtle called "Higgins"
Anomalous: None suggested
Metabolic: None suggested
Nutrition: No evidence as primary etiology, but cannot be ruled out a secondary or a predisposing to lymphocytic stomatitis
Neoplastic: None suggested

- Infectious:** Findings which are suggestive: Morphology and histopathology of lesions, waxing and waning, transmissibility/contagious, bacterial culture results
Types of infectious etiologies considered:
Viral - herpes, pox
Bacterial – cultured species, chlamydia
Fungal – potential marine fungi
Parasitic – less likely. Dr. D. Mader in conversation with Dr. G. Levine related cases of stomatitis in marine turtles caused by parasites (trematodes).
- Immunologic:** Potentially contributory but not likely primary. Potential for stress immunosuppression resulting from crowding
- Iatrogenic:** None suggested
- Inherited:** Check genetic diversity
- Traumatic:** None suggested
- Toxic:** None Suggested

Action list for Consensus Differential Diagnosis

Infectious Etiologies

Viral

- ***Observation:** All captive reared green turtles should be examined at an increased frequency to clarify: temporal trends (“waxing and waning”), lesion morphology, and location of lesions in oral cavity. This would apply to all turtles at Sea Life Park (SLP) as well as all others at other institutions. Initially an interval of seven to ten days would be appropriate and modified based on findings.
- ***Comprehensive necropsy** including relevant testing, based on current knowledge of this disease. Trigeminal ganglia and other nerve tissue would be best for herpesvirus diagnosis.
- ***Exposure trial.** After establishing through sustained examination that the fifteen year 2000 hatchlings at SLP are not grossly affected, a well designed exposure trial to include a subset of this group being exposed to active cases of this disease. This could establish transmissibility and provide an optimum diagnostic opportunity. Three important considerations are: 1) Establishing that the year 2000 hatchlings are not affected. 2) Turtles not involved in exposure to affected turtles must be maintained in strict isolation as a control group. 3) Preparation completed for a comprehensive necropsy and associated testing prior to beginning the trial.

- Send plasma samples for LETV ELISA testing from affected turtles from the SLP adult group, Mauna Lani juvenile turtles, SLP juvenile turtles, stored plasma from previously released SLP reared juveniles, and stored plasma from wild turtles. Samples should be sent blind with respect to the investigating laboratory not knowing the sex, age, origin or clinical condition of the turtle. Some samples should be split and sent as separate samples.
- Observe response of affected turtles to anti-herpetic drug(s) such as Acyclovir
- Environmental exposure trial of unaffected turtles to specific habitats where turtles were known to be affected.
- Immune suppression trial involving the administration of a drug(s) to suppress the immune system for the purpose of creating recrudescence of a viral disease such as herpes.

Bacterial

- Repeat blood cultures.
- Design a trail of empirical antibiotic treatment of oral lesions and/or positive blood cultures.
- Include bacterial cultures as part of a comprehensive necropsy of affected turtles.

Parasitic

- Follow up on conversations with Dr. D. Mader regarding trematode etiologies for oral lesions in turtles and institute appropriate fecal examination.
- Employ enzymatic digestion of tissues gathered at necropsy for analysis of trematode eggs.

Genetic Influence:

- Determine the number of captive born turtles in the adult breeding population of SLP. To the extent possible try to determine if any of these F2 animals are active in breeding.

Recommendations:

- Clarify regulations regarding pre-Act and progeny of pre-Act turtles with regard to: 1) Euthanasia, 2) Translocation to and from SLP, within Hawaii, between Hawaii and the mainland and between two mainland institutions, and 3) Handling and removal of eggs. (Elizabeth Sharpe-FWS will check on these items and provide answers to the group)
- Strict quarantine of animals and equipment relevant to marine turtles. Restrict movement of turtles while formulating an action plan. No further release of turtles until such actions are proven safe and of benefit to wild populations.
- All captive reared green turtles should be examined at an increased frequency, to clarify: temporal trends, lesion morphology, and location in oral cavity. This would apply to all turtles at SLP and all other institutions including year 2000 hatchlings at SLP, turtles in the adult lagoon, "Bill" (a hawksbill) in the reef tank, Kahala Mandarin Oriental Hawaii Hotel, Maui Ocean Center, Waikiki Aquarium, Dallas World Aquarium, Brookfield Zoo, Minnesota Zoological Gardens, and Oklahoma City Zoo.
- Limit accrual of turtles at SLP. This would include the hatchling production. Reduce collections to the number of animals that the Park has sufficient resources to care for.
- Hold a meeting to develop a diagnostic plan. Expedite implementation of diagnostic plan.
- Determine routes of water system (inflow and outflow). Amend quarantine as appropriate.

Attachment 1.

Working Group Meeting on Health Issues of Captive Reared Hawaiian Green Turtles
March 8, 2001

Sponsored by:

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

Location: Jefferson Hall, Sarimanok Room (208)
East-West Center
Hawaii Imin International Conference Center
1777 East-West Road
Honolulu, Hawaii 96848

Time: 8:30 a.m. - 4:30 p.m.

Host:

George H. Balazs
Marine Turtle Research Program
Honolulu Laboratory, Southwest Fisheries Science Center
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822-2396
(808) 983-5733 cell: (808) 286-2899
Fax: (808) 983-2902
e-mail: gbalazs@honlab.nmfs.hawaii.edu

Facilitator:

Samuel Pooley, PhD
Honolulu Laboratory, Southwest Fisheries Science Center
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822-2396
(808) 983-5320
Fax: (808) 983-2902
e-mail: spooley@honlab.nmfs.hawaii.edu

Veterinary Medical Coordinator:

Robert Braun DVM MS
75-222 Malulani Drive
Kailua-Kona, Hawaii 96740
Pager: (808) 252-9259
e-mail: rbraun@lava.net

List of Participants:

Danny Akaka, Jr.
Mauna Lani Resort
73-4397 Pa'iaha Street
Kailua-Kona, Hawaii 96740
(808) 885-6622
Fax: (808) 881-7000
e-mail: dakaka@maunalani.com

Sandie Patton
Mauna Lani Resort
68-1310 Mauna Lani Drive #101
Kohala Coast, Hawaii 96743
(808) 881-7045
Fax: (808) 885-5360
e-mail: spatton@maunalani.com

Dave Eckert
DLNR-Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawaii 96813
(808) 587-0113
Fax: (808) 587-0115
e-mail: c/o Richard_L_Sixberry@exec.state.hi.us

William Puleloa
DLNR-Division of Aquatic Resources-Molokai
P.O. Box 1857
Kaunakakai, Hawaii 96748
(808) 567-6696
Fax: (808) 567-9014
e-mail: puleloa@aloha.net

Colleen Henson
 U.S. Fish and Wildlife Service
 300 Ala Moana Boulevard, Room 3-122
 P.O. Box 50088
 Honolulu, Hawaii 96850
 (808) 541-3441
 Fax: (808) 541-3470
 e-mail: colleen_henson@fws.gov

Pi'i Laeha
 Mauna Lani Resort
 P.O. Box 385131
 Waikoloa, Hawaii 96738
 (808) 881-7065
 Fax: (808) 881-7000
 e-mail: plaeha@maunalani.com

Gregg Levine DVM
 Sea Life Park Hawaii
 41-202 Kalaniana'ole Highway #7
 Waimanalo, Hawaii 96795
 (808) 259-2535
 Fax: (808) 259-7373
 e-mail: glevinedvm@aol.com

Yuanan Lu PhD
 Retrovirology Research Laboratory
 PBRC-University of Hawaii
 3675 Kilauea Avenue
 Honolulu, Hawaii 96822
 (808) 732-7702
 Fax: (808) 735-7544
 e-mail: ylu@pbrc.hawaii.edu

Robert Morris DVM
 Makai Animal Clinic
 420 Uluniu Street
 Kailua, Hawaii 96734
 (808) 262-5780
 Fax: (808) 262-0658
 e-mail: gturtle@aloha.net

Wayne Nielson
 Sea Life Park Hawaii
 41-202 Kalaniana'ole Highway #7
 Waimanalo, Hawaii 96795
 (808) 259-7933
 Fax: (808) 259-7373
 e-mail: slpwayne@aol.com

G. "Paka" Nishimura
 Sea Life Park Hawaii
 41-202 Kalaniana'ole Highway #7
 Waimanalo, Hawaii 96795
 (808) 259-2533

Fax: (808) 259-7373
 e-mail: slppaka@aol.com

Marc Rice
 Hawaii Preparatory Academy
 65-1692 Kohala Mountain Road
 Kamuela, Hawaii 96743
 (808) 881-4004
 Fax: (808) 881-4003
 e-mail: mrice@hpa.edu

Elizabeth Sharpe
 U.S. Fish and Wildlife Service
 300 Ala Moana Boulevard, Room 3-122
 P.O. Box 50088
 Honolulu, Hawaii 96850
 (808) 541-3441
 Fax: (808) 541-3470
 e-mail: Elizabeth_Sharpe@fws.gov

Richard Sixberry
 DLNR-Division of Aquatic Resources
 1151 Punchbowl Street, Room 330
 Honolulu, Hawaii 96813
 (808) 587-0097
 Fax: (808) 587-0115
 e-mail: Richard_L_Sixberry@exec.state.hi.us

Martin Wisner
 Mauna Lani Resort
 P.O. Box 223
 Kapaau, Hawaii 96755
 (808) 885-6622
 Fax: (808) 881-7000
 e-mail: mwisner@maunalani.com

Thierry Work DVM
 USGS-BRD National Wildlife Health Center
 Honolulu Field Station
 P.O. Box 50167
 Honolulu, Hawaii 96850
 (808) 541-3445
 Fax: (808) 541-3472
 e-mail: thierry_work@usgs.gov

Marilet Zablan
 U.S. Fish and Wildlife Service
 300 Ala Moana Boulevard, Room 3-122
 P.O. Box 50088
 Honolulu, Hawaii 96850
 (808) 541-3441
 Fax: (808) 541-3470
 e-mail: marilet_zablan@fws.gov

Attachment 2.

List of Literature Supplied to Meeting Participants

Working Group Meeting on Health Issues of Captive Reared Hawaiian Green Turtles
March 8, 2001

Sponsored by:

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

Balazs, G.H., S.K.K. Murakawa, D.M. Parker, and M.R. Rice.

In Press. Adaptation of captive-reared green turtles released into Hawaiian coastal foraging habitats, 1990-99. *In* Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation, Orlando, Florida, 4 p.

Ballou, J. and A.M. Lyles (co-chairs).

1993. Workshop group report: Risk assessment and population dynamics. *J. Zoo Wildl. Med.* 24(3):398-405.

Beck, B., M. Cooper, and B. Griffith (co-chairs).

1993. Working group report: Infectious disease considerations in reintroduction programs for captive wildlife. *J. Zoo Wildl. Med.* 24(3):394-397.

Cook, R., N. Flesness, L. Munson, and D. Ullrey (co-chairs).

1993. Working group report: Monitoring, investigation, and surveillance of disease in captive wildlife. *J. Zoo Wildl. Med.* 24(3):374-388.

Gilmartin, W., E. Jacobson, W. Karesh, and M. Woodford (co-chairs).

1993. Working group report: Monitoring, investigation, and surveillance of disease in free-ranging wildlife. *J. Zoo Wildl. Med.* 24(3):389-393.

Jacobson, E.R, J.L. Behler, and J.L. Larchow.

1998. Health assessment of Chelonians and release into the wild (Chapter 30). *In* M.E. Fowler and R.E. Miller (eds.), *Zoo and Wild Animal Medicine*, p. 232-242. W.B. Saunders Co., Philadelphia, Pennsylvania.

Kleiman, D. G.

1996. Reintroduction programs (Chapter 29). *In* D.G. Kleiman, M.E. Allen, K.V. Thompson, S. Lumpkin (eds.), *Wild Mammals in Captivity: Principles and Techniques*, p. 297-305. The University of Chicago Press, Chicago and London.

Lu, Y.

2000. Report for viral detection assay. Assay to determine whether virus could be a factor responsible for the disease causing spot-like hemorrhagic lesions in the dorsal throat of green turtles at Sea Life Park, December 4, 2000, 2 p.

Morris, R.A.

2000. Sea Life Park turtles. Examination of two green turtles from Sea Life Park on 7/15/00 at Makai Animal Clinic, 17 p.

Nishimura, G.P., B. Joseph, G. Levine, L. Rostrata, J. Marks, G.H. Balazs, T. Work, R. Morris, R. Braun, D. Akaka, and M. Wisner (attendees).

2000. Turtle meeting at Sea Life Park - June 12, 2000 Minutes, Draft #2 (Final), August 2000, 4 p.

Patton, S., B. Sayce, D. Akaka, and P. Nishimura (principals).

2000. Questions & Answers, Turtle education & release program, Mauna Lani Resort & Mauna Lani Bay Hotel, Final Press Release July 3, 2000, 4 p.

Sea Life Park Hawaii. Documents supplied on March 5, 2001 for meeting.

2000 & 2001. Summaries (4 articles).

2000 & 2001. Lab results (8 articles).

1995-2001. Chronology of events (1 article).

1996-2000. Turtle inventory - locations (1 article).

1996-1999. Higgins - Brookfield Zoo (2 articles).

2000. Higgins - SLPH (1 article).

SSC Re-introduction Specialist Group.

1995. IUCN/SSC guidelines for re-introductions. Approved by the 41st Meeting of the IUCN Council, Gland Switzerland, May 1995, 7 p. <http://www.iucn.org/themes/ssc/pubs/reinte.htm>

Wemmer, C., S. Derrickson, and L. Collins.

1996. The role of conservation and survival centers in wildlife conservation (Chapter 30). *In* D.G. Kleiman, M.E. Allen, K.V. Thompson, S. Lumpkin (eds.), *Wild Mammals in Captivity: Principles and Techniques*, p. 306-314 The University of Chicago Press, Chicago and London.

Wisner, M. G.P. Nishimura, B. Joseph, L. Osborn (attendees).

2001. Mauna Lani site inspection: "Hawaii green sea turtle loan", 1/20-1/21/2001, 6 p. (Submitted by Sandie Patton, Mauna Lani Resort)

Work, T.M.

2000. Diagnostic case report. Pre-release exam on 6/26/00 of green turtles from Sea Life Park that were at the Mauna Lani Hotel, 19 p.