Tracking the Incidence of the Fibropapilloma Virus in Texas' Green Sea Turtle Population

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Prepared By Environmental Institute of Houston - University of Houston Clear Lake

Tasha L. Metz, Research Scientist
George Guillen, Executive Director
Mandi Gordon, Senior Research Associate

Co-Principal Investigators

Tasha L. Metz TLMetz33@gmail.com
George G. Guillen Guillen@uhcl.edu
Environmental Institute of Houston
University of Houston Clear Lake
2700 Bay Area Blvd
Houston, Texas 77058 (281) 283-3950

Prepared in cooperation with and for the Texas State Aquarium

Leslie Peart LPeart@txstateaq.org
Vice President for Education and Conservation
Flint Hills Resources Center for Excellence in STEM Education
2710 N. Shoreline Blvd.
Corpus Christi, Texas 78402 (361) 881-1218

EXECUTIVE SUMMARY

Texas waters provide essential habitat to 5 protected sea turtle species, including the green turtle (*Chelonia mydas*). Fibropapillomatosis (FP) is a condition in sea turtles likely caused by a herpesvirus and characterized by internal and external tumors that compromise a turtle's ability to swim, see, feed, and escape from predators (Herbst 1994). Although this disease has been extensively documented in Florida and Hawaii green turtles since the 1930's and 1950's, respectively, it was first reported in Texas green turtles during summer 2010 (Tristan et al. 2010). Directed-capture surveys utilizing large-mesh entanglement nets and cast nets were conducted within Texas bays during summer 2014 to assess current green turtle abundance, distribution, and FP occurrence. Entanglement nets were deployed in Matagorda Bay near Port O' Connor, Aransas/Corpus Christi Bays near Port Aransas, and the lower Laguna Madre (LLM) near Port Mansfield and Port Isabel, while cast nets were utilized at the jetties near Port Aransas, Port Mansfield and Port Isabel.

A total of 41 green turtles were captured, with 33 taken during 15.75 km-hrs of entanglement netting (CPUE = 2.09 turtles/km-hr) and 8 acquired via 8.42 hours of cast-netting (CPUE = 0.95 turtles/hr). All green turtles captured were juvenile to sub-adults, with straight carapace lengths (SCL) ranging from 25.2 cm to 65.0 cm (mean = 38.2 cm). In addition, 2 Kemp's ridleys (*Lepidochelys kempii*, 30.7 cm and 37.2 cm SCL) and 1 loggerhead sea turtle (*Caretta caretta*, 78.7 cm SCL) were captured from Matagorda Bay and the LLM, respectively. Overall, 11 of 41 (26.8%) green turtles exhibited FP tumors, with all afflicted turtles collected in the LLM. Tumor scores (TS) were given to all individuals and were categorized based on size, number and location of tumors (Work and Balazs 1999; Hirama and Ehrhart 2007), with 73.2 % of greens having no tumors (TS = 0), 12.2% being mildly afflicted (TS = 1), 7.3% being moderately afflicted (TS = 2), and another 7.3% severely afflicted (TS = 3). Tumors were most prevalent in the 40-49.9 cm (60%, n = 10) and 50-59.9 cm (67.7 %, n = 3) SCL size classes. Additionally, 14 of the 41 (34.1%) green turtles captured in this study were infested by marine leeches (*Ozobranchus* spp.). Leeches were present on 5 of the 11 (45.5%) turtles captured with tumors.

Preliminary genetic analyses of tumor samples were conducted by Joel Anderson at the Texas Parks and Wildlife Department (TPWD) Perry R. Bass Marine Research Lab to identify the particular FP herpesvirus variant infecting Texas' green turtles. Of the 11 biopsy samples collected, 10 were successfully sequenced. All 10 samples were FP variant B, which had previously been observed primarily in the Florida Indian River Lagoon population (Ene et al. 2005). These results indicate a possible link between the Texas foraging population and the east central Florida breeding population, which is supported by previous research in which mixed-stock analysis of Texas green turtles indicated contributions primarily from Florida and Mexico rookeries, with a smaller contribution from Cuba (Anderson et al. 2013).

Factors possibly affecting the occurrence of FP in greens, including environmental nutrient concentrations, presence of tumor-promoting algal species, incidence of marine leeches as vectors of transmission and overall turtle condition, are continuing to be examined. The new emergence of FP in greens utilizing Texas waters provides another opportunity to better understand the etiology of this disease. At the same time, it raises concerns that warrant further investigation as to the disease's impact on continued population growth (Metz and Landry 2013) and the ability to develop response initiatives to contain the spread of this infectious agent.

DESCRIPTION OF WORK COMPLETED

In-water assessments characterizing the extent of FP were conducted at historical netting sites within lower, middle and upper Texas bay systems. Entanglement nets were deployed at four study areas over two separate sampling trips: Matagorda Bay near Port O' Connor and Aransas/Corpus Christi Bays near Port Aransas were sampled during 28 May to 5 June 2014, while the lower Laguna Madre near Port Mansfield and Port Isabel were sampled during 27 July to 4 August 2014.

Sea turtle capture involved setting 2-4 entanglement nets (91.4 m long; 17.8 cm bar mesh; 2.5- to 4.0-m deep) within a randomly-chosen sampling site during daylight periods for 6-8 hours per day. Monitoring crews on two separate vessels systematically checked nets for turtles every 20 minutes, or more frequently as visual or audible cues dictated, and collected hydrographic data thrice daily. Seagrass samples were collected from grass beds adjacent to netting locations to assess forage material/quality. In addition to entanglement netting surveys, green turtles were captured by cast-net at jetty sites in Port Aransas and Port Mansfield, TX.

Each turtle captured was photographed and examined for number, location and size of tumors. Biopsies of tumors and unaffected skin and leeches were also collected, when applicable. All turtles were measured for straight and curved carapace lengths and widths and equipped with an inconel tag on the trailing edge of each front flipper and a PIT tag inserted subcutaneously into dorsal musculature of one front flipper if no tags were present. Turtles were released alive at their capture location on the same day of capture following the completion of data collection procedures.

EVALUATION OF ACHIEVEMENTS VS. ORIGINAL PROPOSAL GOALS

The work and achievements accomplished by this study very closely follow the proposed goals originally stated as:

> "The impact of FP infection on the health and continued growth of Texas' green turtle population will be assessed via directed capture operations designed to: 1) determine the geographic extent as well as within-assemblage rate of FP infection in Texas' green turtle population; 2) assess size composition of FP-affected population constituents; 3) characterize environmental conditions of habitats within which FP-infected green turtles are found; and 4) potentially identify the herpesvirus variants associated with FP in Texas' green sea turtle assemblages in an effort to document the possible geographic source(s) of this outbreak."

All of these objectives were met or are continuing to be evaluated as follows: 1) in this study, FP tumors were only observed on green turtles in the LLM; 2) size composition of greens with and without tumors are stated in the executive summary above; 3) hydrographic data and seagrass samples were collected to address environmental conditions of habitats (analyses ongoing); and 4) preliminary genetics results indicate that Texas greens have been infected with the herpesvirus variant B that had previously been documented in Florida's Indian River Lagoon green turtle populations.

RECOMMENDATIONS

The results of this study are a promising start to understanding the origin and extent of FP in Texas' green turtles. Additional comprehensive studies are needed to better explain the physical impact of tumors on overall health, survivorship and continued recovery of this population in Texas waters. This need is particularly acute given the fact that Texas' green turtle assemblages are primarily composed of juveniles between 35 and 55 cm straight carapace length, a life stage well within that (40-90 cm SCL) documented as having the highest incidence of FP and most extensive lesions. Future research would build on the results of this study by potentially increasing the number of tumor samples for genetic analyses, continued evaluation of extent and geographic distribution of this disease, and analysis of tumor growth or regression via recapture of tagged individuals. The fact that FP appears to be in an early development stage in Texas' green turtle population provides an excellent opportunity for the State of Texas to play a major role in describing the pattern of spread of this disease to new localities, such as other parts of Texas or areas of the western Gulf, and the development of management strategies that arrest transmission to new locations, thus reducing the effect of FP on turtle populations.

FINANCIAL STATEMENT

Wildlife Care, Conservation, and Research Funds were be used to support field research activities and laboratory analyses to document the incidence of FP in Texas' green sea turtle population. The original budget was partitioned into three major categories, including: 1) salary and fringe for research personnel - $10,500; 2) travel costs for 2 extended sampling trips - $7500; and 3) materials and supplies - $2000. Travel costs include those associated field research and include costs for food, lodging and truck/boat fuel. Materials and supply costs include those associated with the purchase of boat equipment, biopsy supplies, tagging equipment, and laboratory analyses. The $20,000 grant from the Wildlife Care, Conservation, and Research Fund was spent in the following categories as follows:

Salaries and Fringe	$10,140
Travel	$7,355
Equipment, supplies and fuel	$2,457
Total Expenditures to Date	**$19,952**

PLANS FOR PUBLICATION

The results of this study will be presented as at the Southeast Regional Sea Turtle Meeting being held on Jekyll Island, GA 4-7 February 2015. An oral presentation will discuss the FP results while a poster will present the capture results from this summer in comparison to historical records. Additional publications, including genetics results, will be prepared in collaboration with other experts and authors, such as Joel Anderson at TPWD and Dr. Lawrence Herbst, Professor and Director of the Institute of Animal Studies at Albert Einstein College of Medicine. Potential journals for manuscript submission include the Journal of Herpetology, Copeia, Chelonian Conservation and Biology, Journal of Wildlife Diseases and Virology.

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