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DOCUMENTATION OF FIBROPAPILLOMATOSIS IN GREEN TURTLES (*CHELONIA MYDAS*) CAPTURED FROM TEXAS INSHORE WATERS

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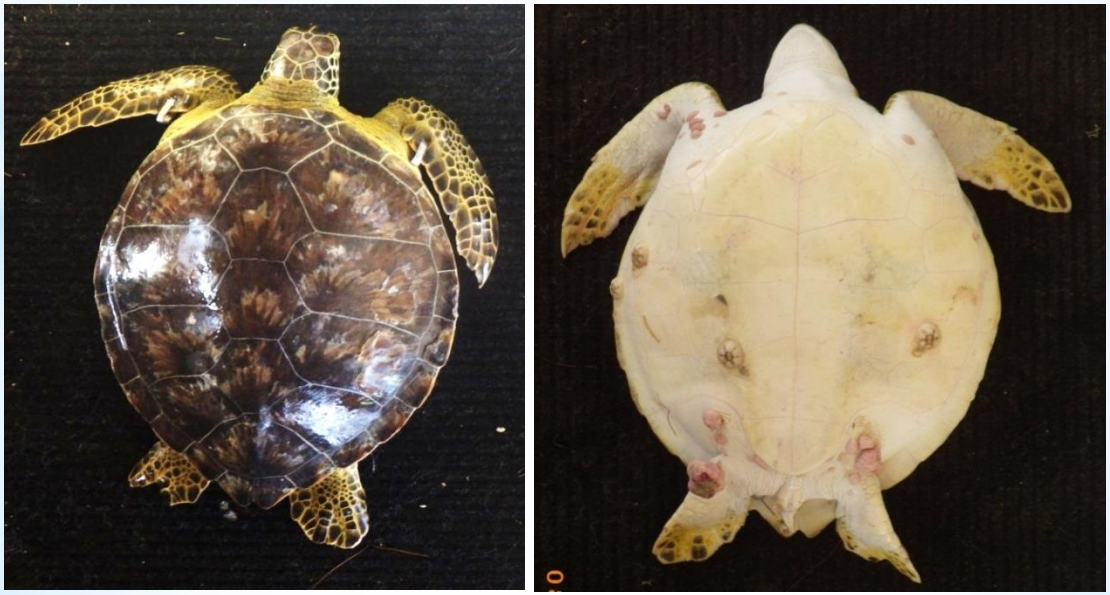
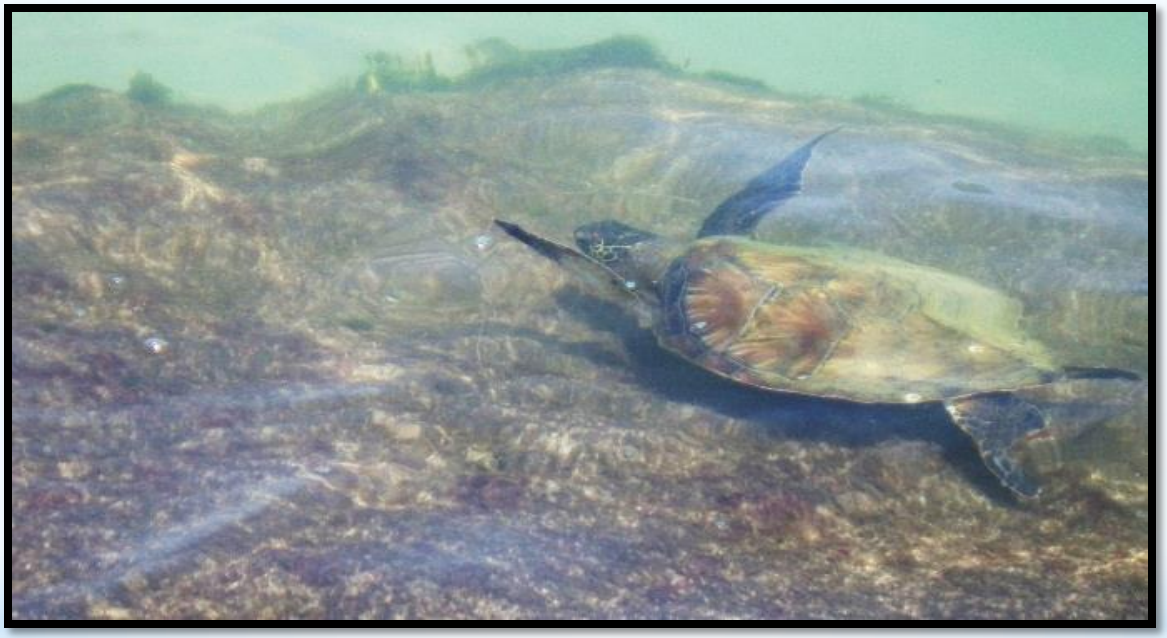


TEXAS A&M UNIVERSITY GALVESTON CAMPUS

TEXAS STATE AQUARIUM

GREEN TURTLES IN TEXAS

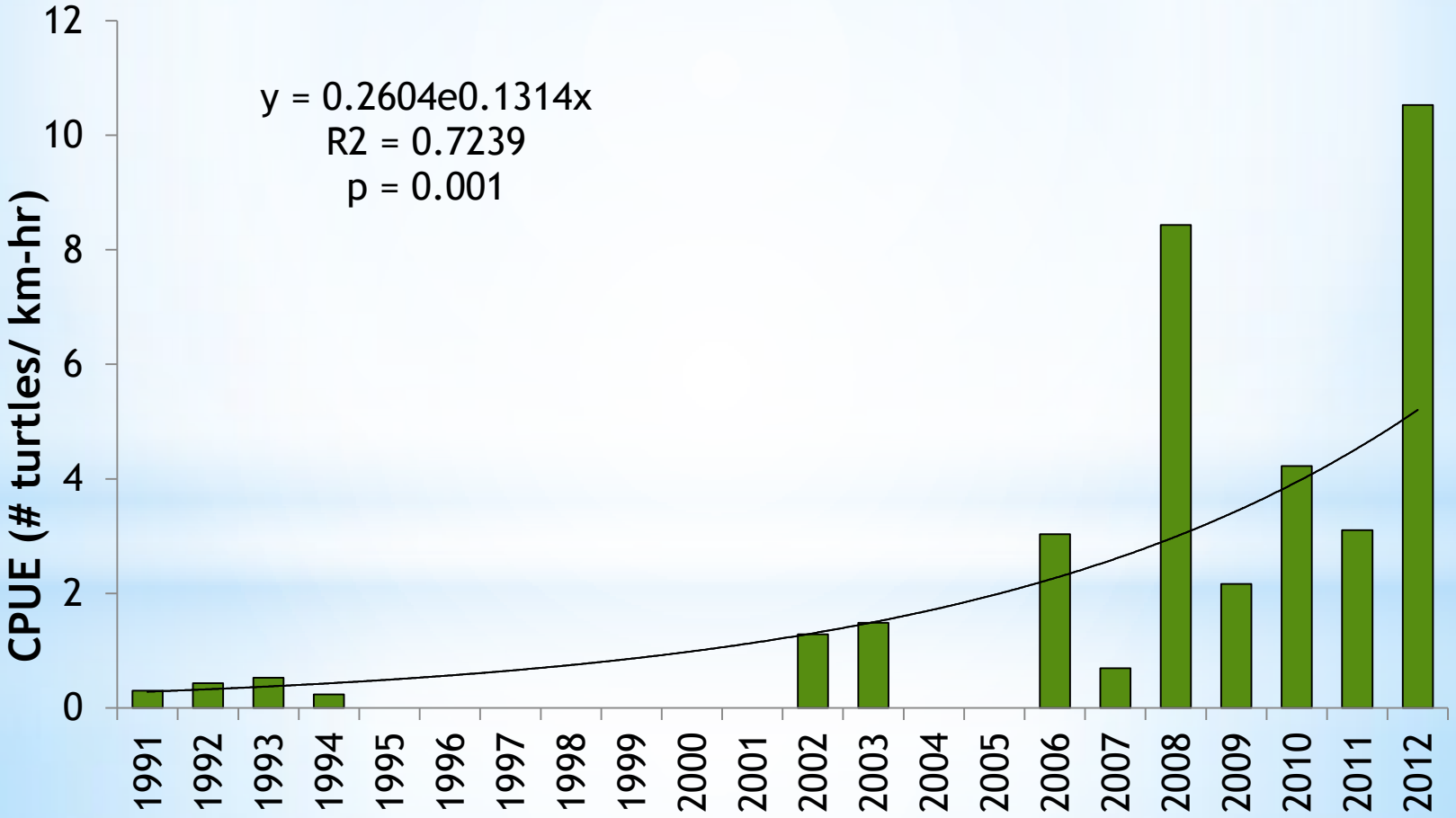
- Green turtles utilize Texas waters primarily as juvenile foraging habitat



- Green turtle fishery and turtle canneries present in Texas during the late 1800s, but fishery had collapsed by the turn of the 20th century (Hildebrand 1982)

GREEN TURTLES IN TEXAS

- Exponential increase in green turtle CPUE (turtles/ km-hr) from entanglement netting surveys since 1990 (Metz and Landry, 2013)



GREEN TURTLES IN TEXAS

- Greatest genetic contribution from Florida and Mexico rookeries based on mixed stock analyses, although confidence intervals for these estimates was large (Anderson and Shaver 2013)

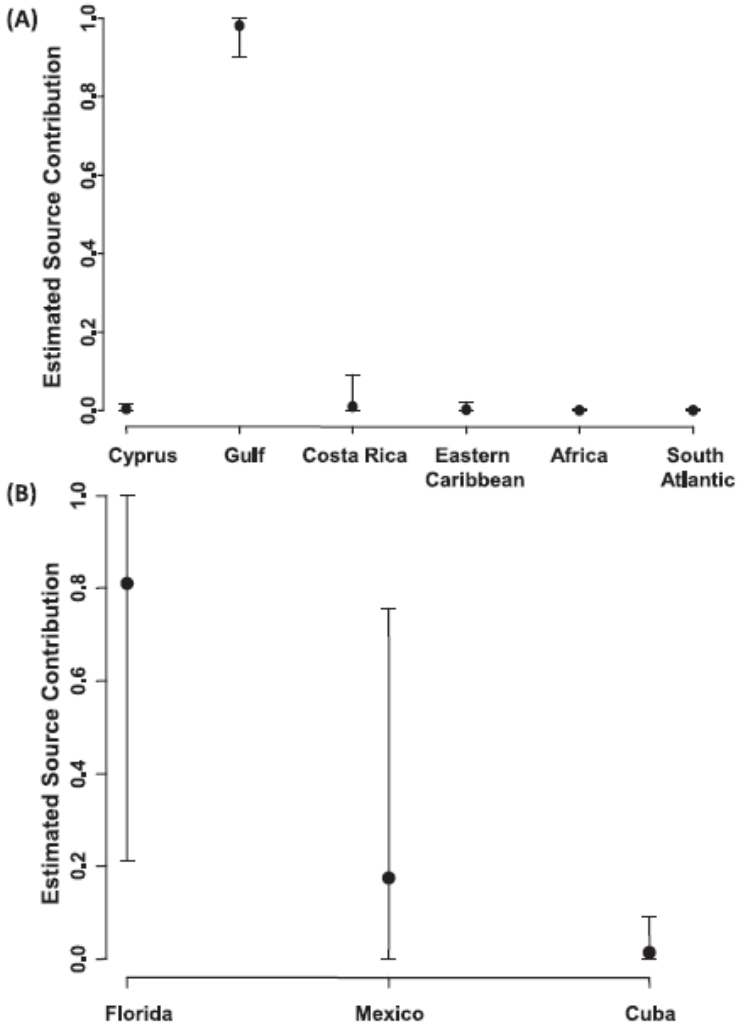


FIG. 3. Estimated stock contribution of six regional nesting stocks to the western Gulf of Mexico Green Turtle foraging group, broken down by (A) Atlantic regional rookery groups, and (B) single Gulf of Mexico rookeries. The bars above and below point estimates represent the two-tailed 95% confidence interval around stock estimates.

FIBROPAPILLOMATOSIS

- Etiology of the disease not completely understood, but a virus in the Herpes family (with geographic variants) has been isolated from tumors
- Additional contributing factors have been identified with the occurrence of FP:
  - Environmental habitat degradation related to elevated nutrient levels and ingestion of species that have tumor promoting compounds (i.e. cyanobacteria *Lyngbya majuscula* in Australia and Hawaii)
  - Environmental stressors, including cold stunning events and pollution
  - Occurrence of a parasite vector (i.e. marine leeches in the genus *Ozobranchus*)
- **First documented in Texas in 2010**
  - 2 stranded turtles and 11 of 33 turtles captured by entanglement netting displayed tumors (Tristan et al. 2010)

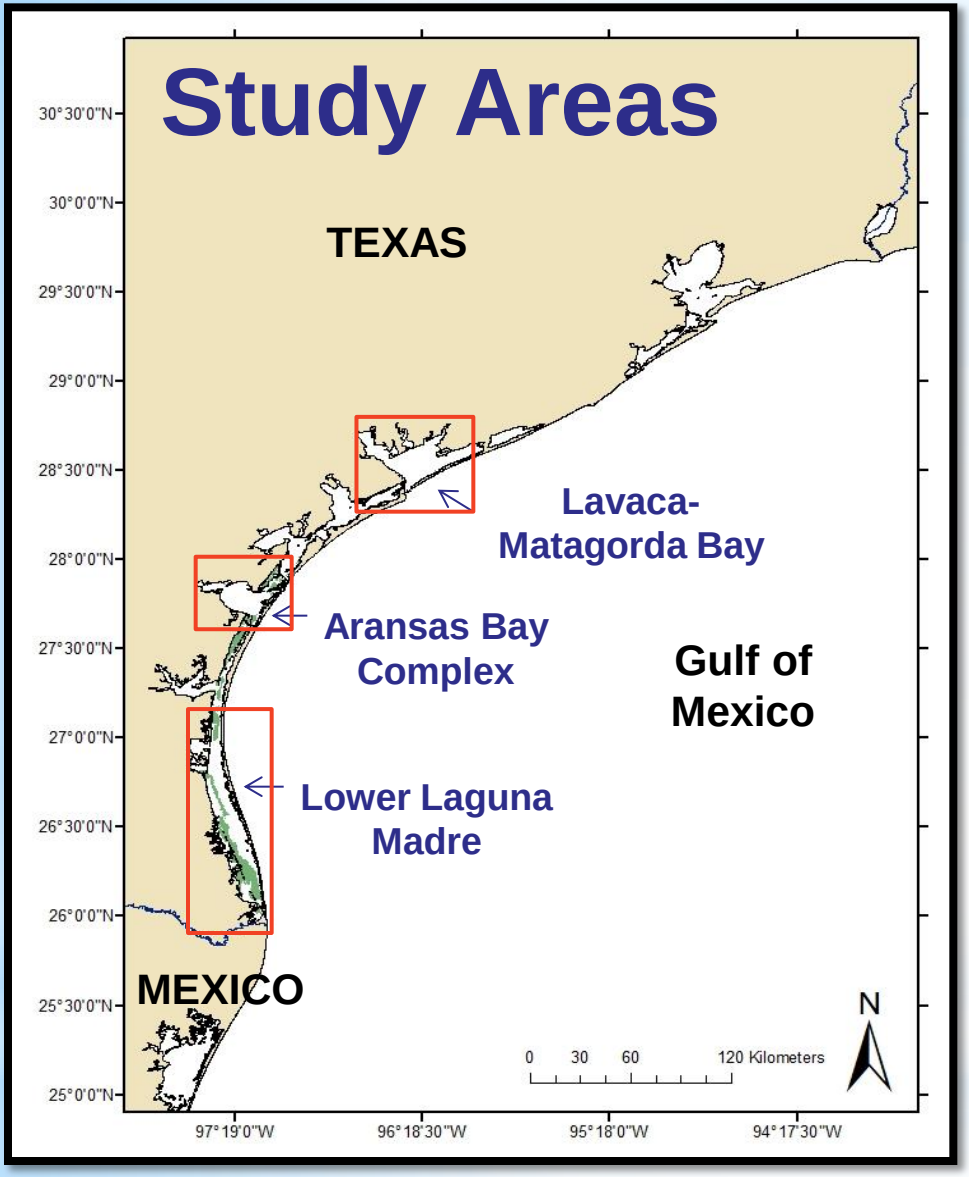
STUDY OBJECTIVES

- The impact of FP infection on the health and continued growth of Texas' green turtle population was 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

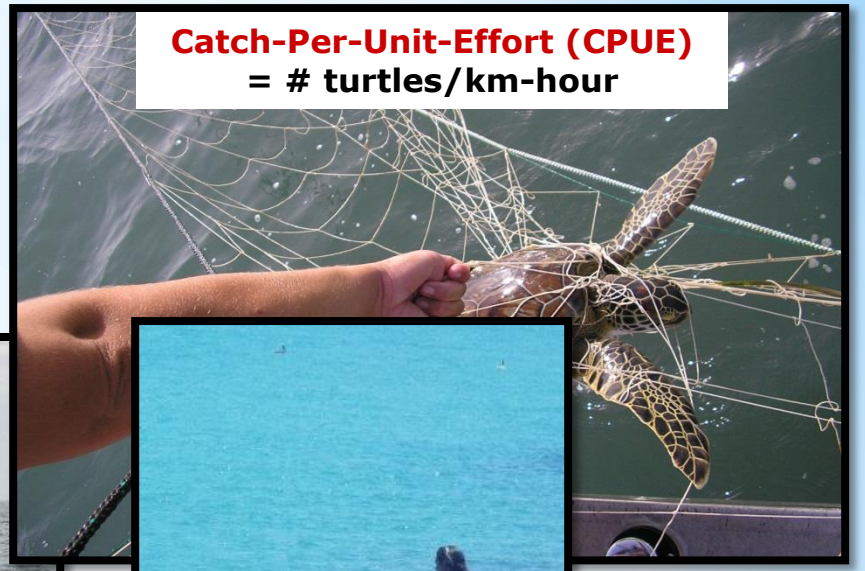
2) assess size composition of FP-affected population constituents

3) 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


Study Areas
TEXAS
Lavaca-
Matagorda Bay
Aransas Bay
Complex
Gulf of
Mexico
Lower Laguna
Madre
MEXICO
N
0 30 60 120 Kilometers
30°30'0"N
30°0'0"N
29°30'0"N
29°0'0"N
28°30'0"N
28°0'0"N
27°30'0"N
27°0'0"N
26°30'0"N
26°0'0"N
25°30'0"N
25°0'0"N
97°19'0"W
96°18'30"W
95°18'0"W
94°17'30"W


Port
Mansfield
Gulf of
Mexico
N
Port Isabel
Mexiquita Flats/ Brazos-
Santiago Pass
0 5 10 20 Kilometers
Corpus Christi Channel
Port
Aransas
Corpus Christi Bay
Kilometers

Catch-Per-Unit-Effort (CPUE)
= # turtles/km-hour



Entanglement Nets:
91.4 m long; 2.9-3.6 m deep
17.8 cm bar mesh
2-4 nets deployed

Net check every 20 minutes

Tumor and skin biopsies were collected using a 3-5 mm punch

	Tumor score			
	0	1	2	3
Tumor size				
(A) <1 cm	0	1–5	>5	>5
(B) 1–4 cm	0	1–5	>5	>5
(C) >4–10 cm	0	0	1–3	>4
(D) >10 cm	0	0	0	>1

[a] Based on the actual count of tumors on 108 turtles from Pala'au Molokai subjectively scored in this study.

(Work and Balazs 1999; Hirama and Ehrhart 2007)

CAPTURE RESULTS

Lavaca-Matagorda Bay — **0 Greens**

Aransas Bay Complex — **14 Greens**
- 8 entangled
- 6 cast-netted at jetty

Lower Laguna Madre — **27 Greens**
- 25 entangled
- 2 cast-netted at jetty

41 Total

33 entangled

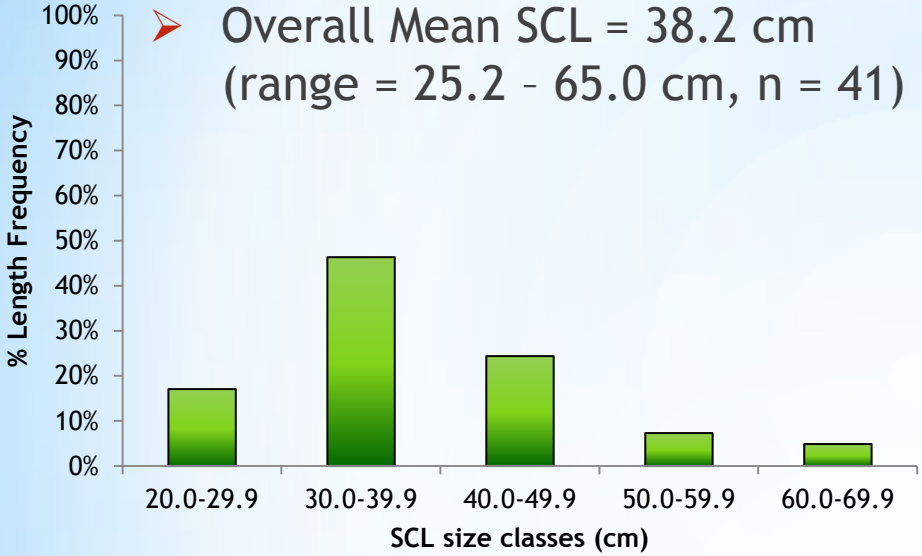
8 cast-netted at jetty

0 15 30 60 90 120 Kilometers

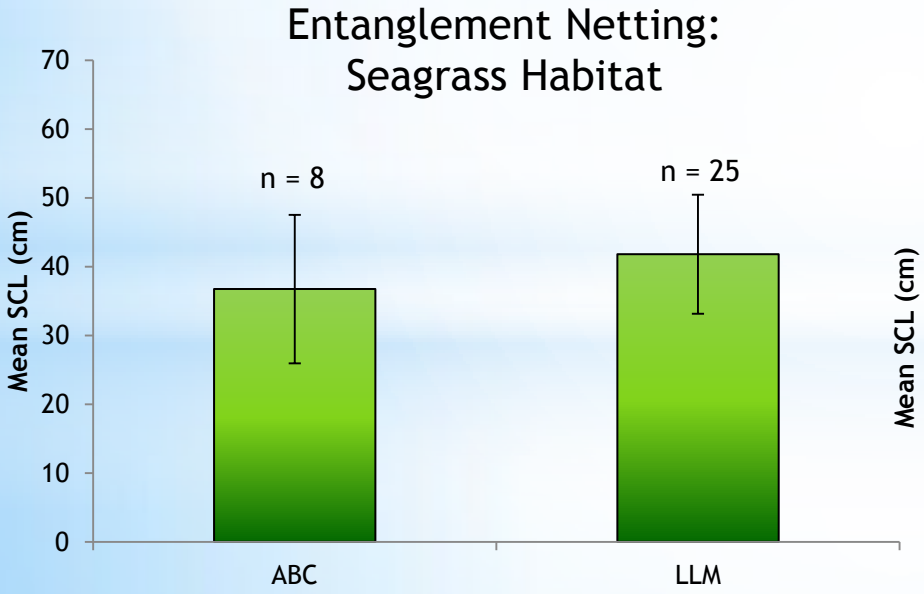
N W E S

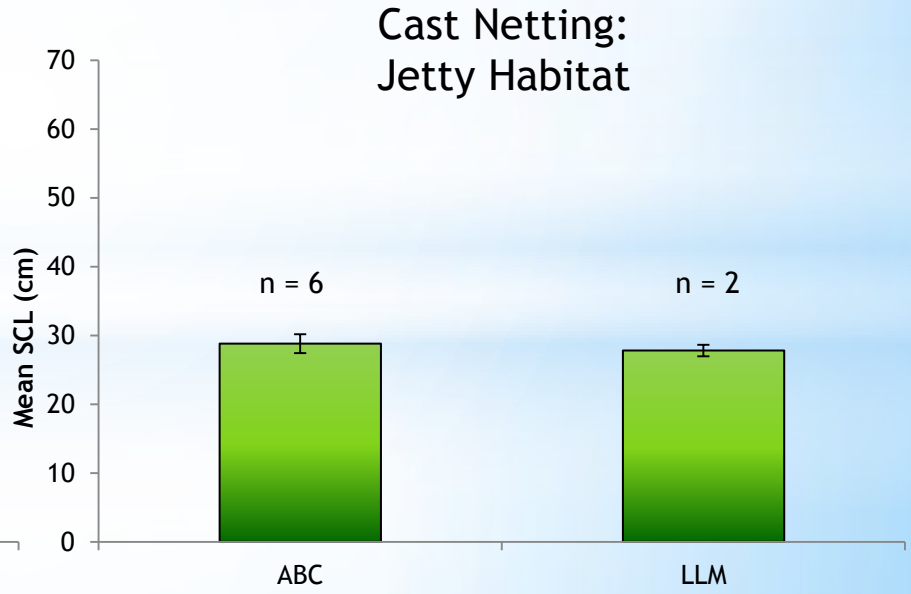
GREEN TURTLE SIZE

- Overall Mean SCL = 38.2 cm (range = 25.2 – 65.0 cm, n = 41)



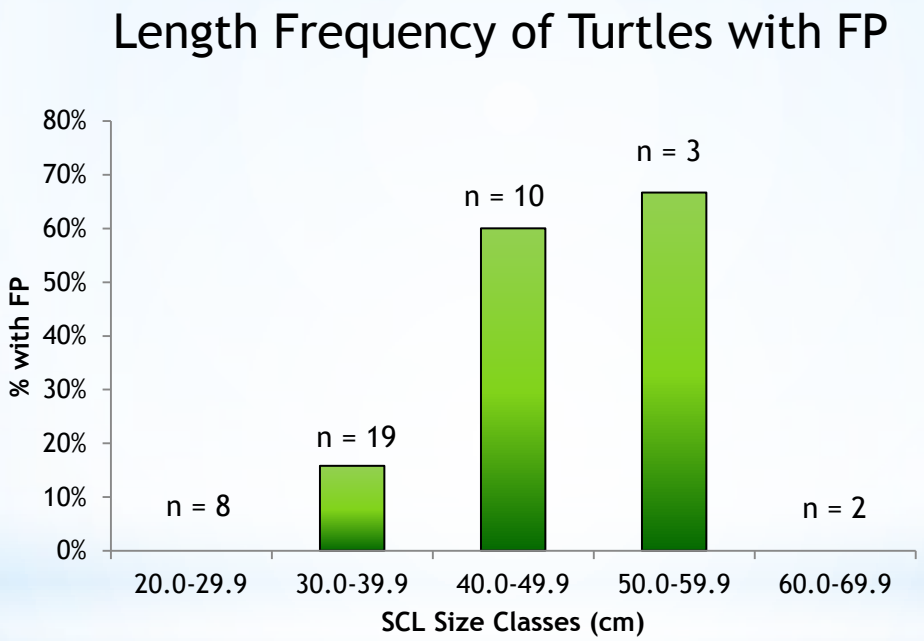
- No significant difference in mean SCL between study areas for turtles captured at either seagrass habitat or jetties
- Green turtles captured at jetties were significantly smaller than those captured at seagrass habitats (t_{36} = 7.14, $p < 0.001$)





GREEN TURTLES WITH FP

- **11 of 41 turtles had FP tumors (26.8%)**; all from the LLM
  - 11 of 33 green turtles had tumors (33.3%) in 2010 (Tristan et al. 2010)



- Size of turtles with FP was consistent with those afflicted in other Atlantic locations (Foley et al. 2005; Hirama and Ehrhart 2007)

TUMOR SCORES

	# of Tumors in each size class				
Turtle ID	A (<1 cm)	B (>1-4 cm)	C (>4 - 10 cm)	D (>10 cm)	Tumor Score
PI14-7-2w	19	7	0	0	**2**
PI14-7-3r	5	2	0	0	**1**
PI14-7-9w	1	1	0	0	**1**
PI14-7-10w	5	0	0	0	**1**
PI14-7-11w	1	1	0	0	**1**
PI14-7-12r	58	74	0	0	**3**
PM14-8-1w	17	19	1	0	**3**
PM14-8-2w	7	4	0	0	**2**
PM14-8-5w	3	5	0	0	**1**
PM14-8-7w	18	35	3	0	**3**
PM14-8-12w	6	14	0	0	**2**

TUMOR SCORES FOR TEXAS GREEN TURTLES (2014)

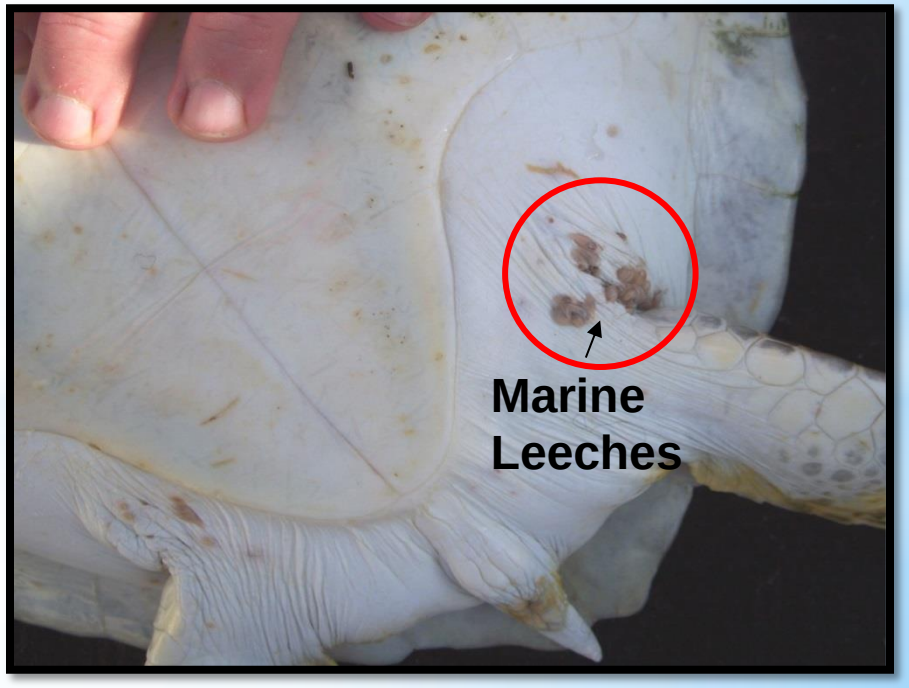
	TS 0	TS 1	TS 2	TS 3
% of turtles	73.2	12.2	7.3	7.3

- Majority of turtles observed with FP only mildly afflicted

GREEN TURTLES WITH FP

- FP herpesvirus "variant B", (Ene et al. 2005) was found in all tumor samples and unaffected skin samples from the 11 turtles with tumors
  - "Variant B" is prevalent in the east-central FL and Indian River Lagoon green turtle foraging population

- 14 of 41 green turtles had **marine leeches** (*Ozobranchus spp*);
  - 6 of these had both leeches and tumors
  - Typically located on the flippers and axillary/inguinal regions of the turtle
  - Some leeches were found attached to tumors



SUMMARY AND CONCLUSIONS

- Size of green turtles with FP in Texas was consistent with those afflicted in other locations with juveniles (40-60 cm SCL) most affected
- Based on the results of this study, Texas green turtles have an FP occurrence of ~ 30% and are mostly mildly afflicted
- Presence of FP herpesvirus "variant B" in Texas green turtles suggest a connection with east-central FL and Indian River Lagoon green turtles or a dispersion of this variant to more distant regions
  - Genetic link between Texas greens and east-central FL nesting populations (Anderson and Shaver 2013)
  - Raises new questions about the spread of this virus and the overall epidemiology of this disease
  - Need additional samples and analyses

SUMMARY AND CONCLUSIONS

- On-going research is assessing other contributing factors, including:
  - The role of marine leeches as a vector of virus transfer
  - Presence of tumor promoting algal species in the environment
  - Nutrient levels and environmental stressors, such as cold stunning events

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  - Sherah Loe
  - Jim DelBene
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