Assessing the Body Condition of Juvenile Green Sea Turtles (*Chelonia mydas*) in Tidal Creeks across South Eleuthera

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CAPE ELEUTHERA INSTITUTE
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Introduction

Sea turtles are marine reptiles. There are seven species found across the world, but only four can be found in Bahamian waters. These are the Leatherback (*Dermochelys coriacea*), Hawksbill (*Eretmochelys imbricata*), Loggerhead (*Caretta caretta*), and Green (*Chelonia mydas*).

Why Study Green Sea Turtles?

This study focused on the green sea turtle, which is endangered across its range (IUCN 2014). This species has been in decline since Pre-Columbus times and its population is at 3-7% of those half a millennia ago (Hamann *et al.*, 2010). This can be attributed to harvest (Fig. 2), coastal degradation, pollution, and habitat destruction. This species takes 29 years to reach sexual maturity and have lived to be 90 years old. Sea turtles go through a developmental migration, which means they as they develop, they migrate between different habitats (Fig. 1).

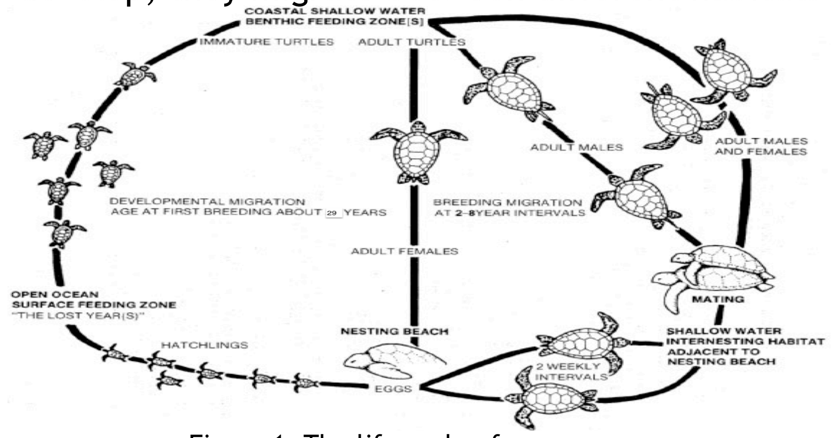

Figure 1: The life cycle of a green sea turtle

Figure 2: One of the affects leading to population declines is harvesting.

Green Sea Turtle Importance

Green sea turtles play an important role in their respective ecosystems. They cycle nutrients by consuming and passing sea grass (Fig. 4), increase the productivity of seagrass (Moran, Bjorndal 2005), and they serve as prey for sharks (Heithaus et al., 2009)

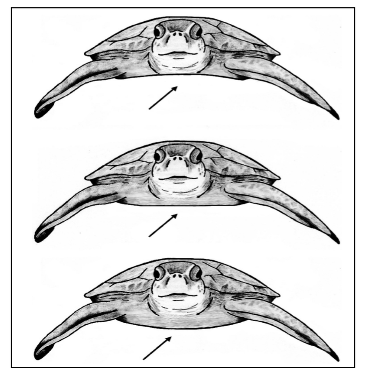

Figure 3: This diagram shows the rapid visual assessment categories for a sea turtle. The categories are concave, flat and convex. Concave represents poor health, flat is fair, and convex is good health.(Thompson et al., 2006)

Figure 4: A green sea turtle feeding on sea grass.

This Study

This study used body condition to indicate health. Weight and straight carapace (shell) length measurements are one way to determine body condition. A previous study by Thomson *et al.* (2006) confirmed a rapid visual assessment technique analyzing the plastron (chest, Fig. 3) to determine body condition.

The purpose of this study was to assess relationships between body condition and foraging grounds. The objectives of our study were to determine relative abundance of turtles across foraging grounds and to assess body condition of turtles across foraging grounds. The hypothesis was that as seagrass abundance increased, relative abundance and body condition would increase. Through this study, we hoped to find trends amongst creeks and establish habitat baselines for green sea turtle juvenile foraging grounds.

Methods

Figure 5 shows the performance of an abundance survey

Figure 6 shows photos being taken to be sent to The University of Massachusetts Amherst

Figure 6 shows turtle chasing (rodeo technique)

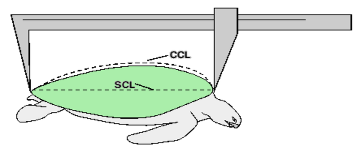

Figure 7 illustrates how straight and curved carapace length are measured

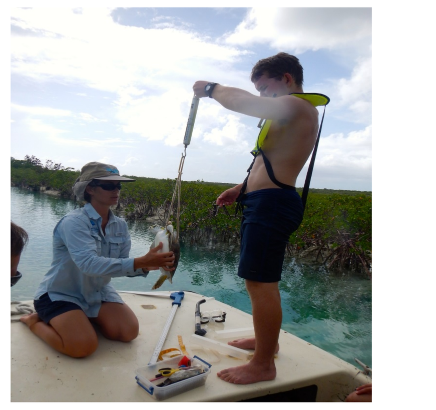

Figure 8 shows a turtle weight being measured with a scale

This study was conducted during Fall 2014 in the mangrove creeks and bays of South Eleuthera. Data was compiled with previous semesters.

Abundance Survey: A 30 minute observation around mouth and inside of creek to count turtles seen (Fig. 5).

Capture: Turtles are chased by boat until they are exhausted. Then, a swimmer enters the water to catch the turtle with their hands. This is known as the rodeo technique (Fig. 6).

Morphometrics collected were curved and straight carapace length (Fig. 7), body depth, width, and weight (Fig. 8), and head width. Rapid visual assessment was used to assess body condition, and photos were sent to The University of Massachusetts Amherst, where they calculated surface area and used it as an indicator of body condition.

Results

Table 1 shows the number of turtles caught in each creek, number of recaptures in each creek, as well as the average length and weight of each turtle caught. Starved creek has the highest average weight and length, and Half Sound had the highest amount of captures.

Creek	# Turtles	# Recaptures	Mean SCL min (mm)	Mean Weight (kg)
Half Sound	104	9	331	7.39
Starved Creek	52	34	423	10.85
Winding Bay	24	8	339	6.44
Rollins/ Deep Creek	13	1	342	6.57
Jack's Bay	11	0	412	9.82
Wemyss Bight	11	1	311	6.18
Plum Creek	3	0	383	9.4

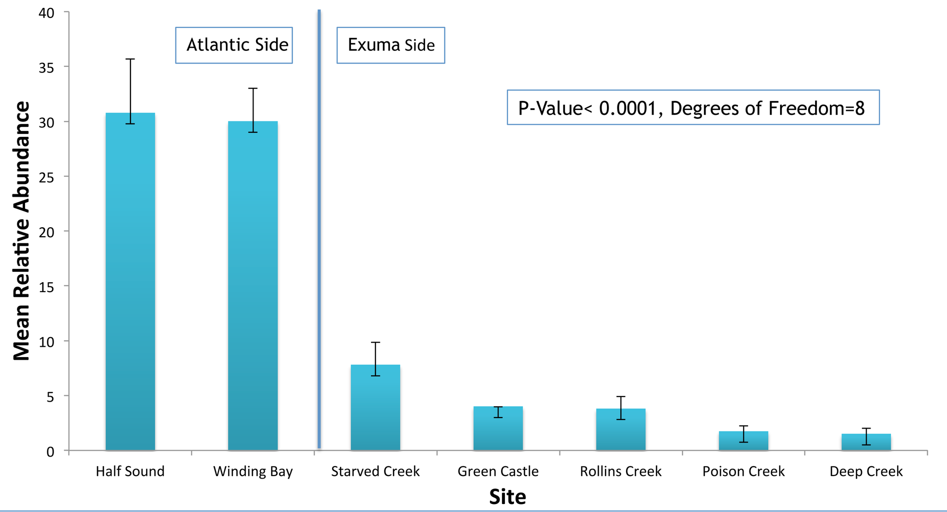

Figure 9 shows the relative abundance of sea turtles in Half Sound, Winding Bay, Starved Creek, Green Castle, Rollins Creek, Poison Creek, Deep Creek, Broad Creek, Paige Creek, and Kemps Creek. Mean Relative abundance It was found that creeks on the Atlantic side had a higher average relative abundance than creeks on the Exuma Sound.

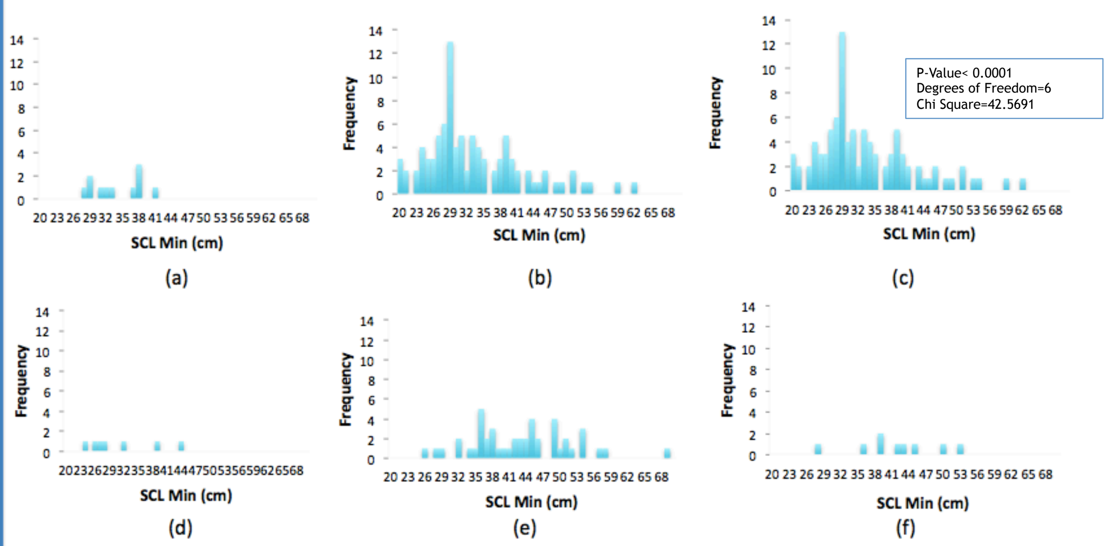

Figure 10 shows the straight carapace length minimum distribution (cm) of turtles in (a)Rollins/Deep Creek, (b)Half Sound, (c)Winding Bay, (d) Wemyss Bight (e)Starved Creek, and (f)Jacks Bay. There was a significant difference in length frequency amongst all creeks.

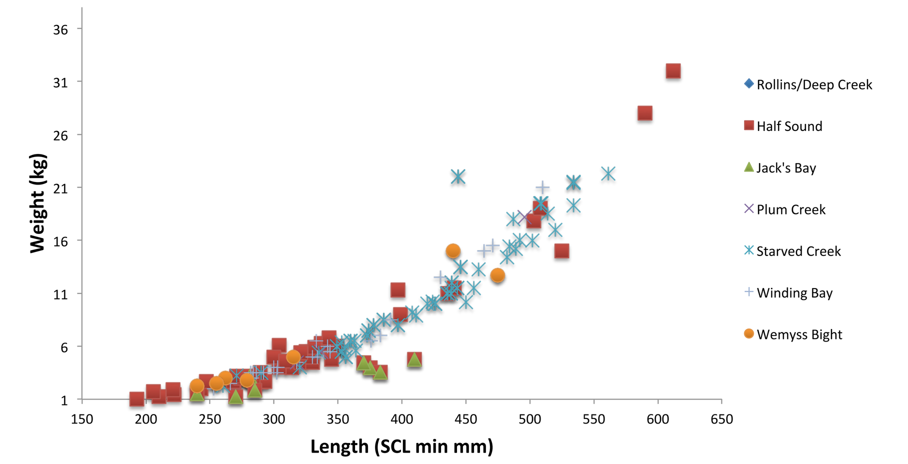

Figure 11 is constructed of data points representing the length (SCL min mm) and weight (kg) of every unique capture in out study sites (Winding Bay, Wemyss Bight, Starved Creek, Plum Creek, Jack's Bay, Half Sound, Rollins Creek, Deep Creek). This shows an overall sample size of 252 turtles across all study sites in South Eleuthera. Length and weight show a positive correlation during growth and this is best seen in larger creeks.

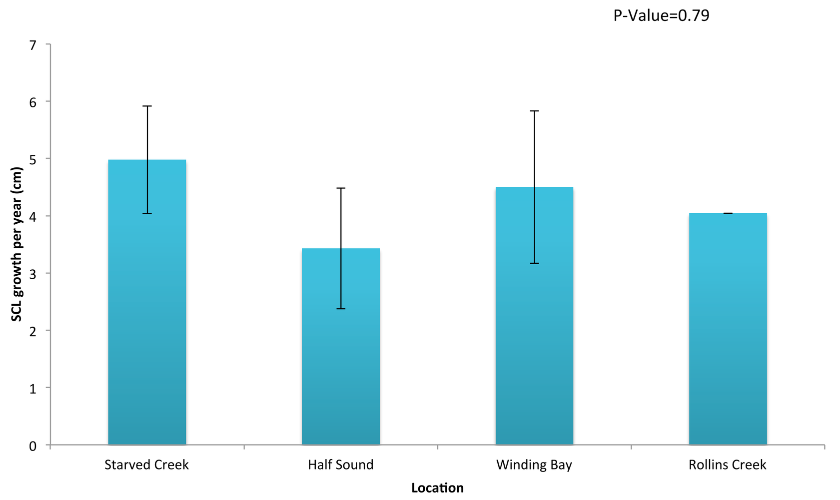

Figure 12 shows the average SCL growth per year in Starved Creek, Half Sound, Winding Bay, and Rollins Creek. Recapture average is found by subtracting first capture by second. P-value shows a non-significant difference between creeks. There was no significant difference between creeks.

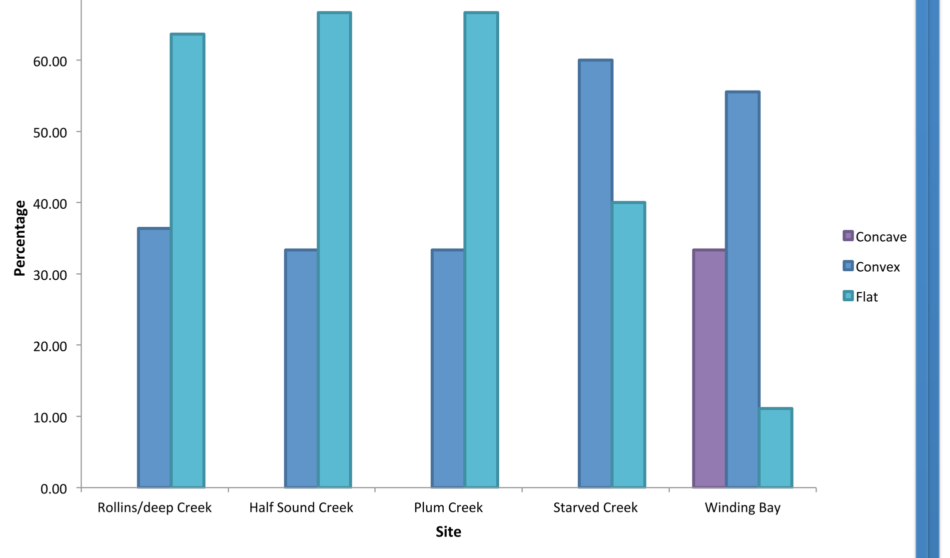

Figure 13 shows the percentage of turtles with concave, convex or flat plastrons in Rollins/Deep Creek, Half Sound, Plum Creek, Starved Creek, and Winding Bay. The majority of creeks had dominantly flat plastrons.

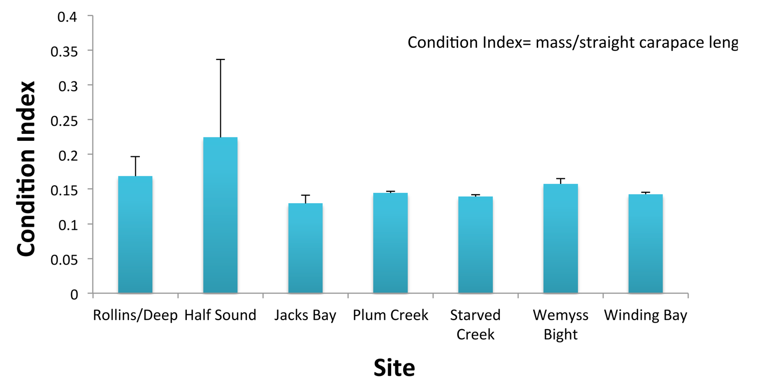

Figure 14 shows the average body conditions of turtles Rollins/Deep Creek, Half Sound, Jacks Bay, Plum Creek, Starved Creek, Wemyss Bight, and Winding Bay. There was no significant difference in mean body condition index across all creeks.

Discussion

Mean relative abundance was found to be significantly different across all creeks. There was a connection between mean relative abundance and side of Eleuthera (Exuma or Atlantic). This could be due to the fact that habitats on opposite sides of the island have very different ecosystems. This could have been influenced by foraging ground quality.

There was a significant difference in length frequency across all creeks. Length and weight show a positive correlation during growth and this can be seen amongst all of the study sites; however this is most heavily seen in some more than others. This could be due to foraging ground variation in size, sea grass abundance, predation and seasonal changes.

In a similar study conducted in the southern Bahamas by Bjorndal et al. (2000), with a sample size of 528, an average growth rate of 4.2 cm/yr was found. Our study had a sample size of 28 and an average growth rate of 4.23 cm/yr. Starved Creek had the highest SCL growth rate, and this could be because of a multitude of reasons such as higher abundance of sea grass, lower risk of predation, and higher quality of sea grass.

The majority (3 of 5) of the creek's turtles with plastron data were flat. Starved Creek had the only creek with a majority convex, which signifies the healthiest turtles. Winding Bay was the only creek with concave plastrons which could be due to a number of non-anthropogenic factors such as lack of seagrass and/or predation risk.

Mean body condition index had no significant difference across all creeks. This means that in general turtles are about the same health between all creeks. This could be connected to the fact that in general, the habitats around South Eleuthera don't vary that significantly in terms of abundance of food.

Sea turtles have seen a drastic decrease in their population in the past several centuries. South Eleuthera has some relatively undisturbed ecosystems, and the data that this study collects can be used as a baseline to aid in determining habitat conservational efforts in other areas.

This was the first year that rabid visual assessment was used, and the sample size was quite small. Because of this most of the data collected was not significant enough to make claims. Future studies could focus on collecting more data to find if there is a strong relationship between body condition and foraging grounds.

Acknowledgements

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