

Home Range and Habitat Use of Immature Green Sea Turtles (*Chelonia mydas*)

Maisie MacMillen, Paityn Wedder, Hannah Wakeman, Vanessa Pinney, and Lillian Nystrom

Advisors: Meagan Gary and Brittney Parker



CAPE ELEUTHERA INSTITUTE
RESEARCH EDUCATION OUTREACH

Background Information

Home range is the area an animal normally occupies over a given time period, excluding atypical movements. Home range is influenced by an animal's needs to reduce energetic expenditure while increasing energetic intake when performing all activities. This study focuses on the home ranges of individual green sea turtles which will help to determine how and why turtles occupy these specific areas.



Fig. 1. Map showing turtle movement to The Bahamas from nesting and mating grounds.

Juvenile turtles are being studied during their neritic phase. During this part of their lifespan, turtles migrate to coastal areas for foraging purposes (Fig. 1).

- The Bahamas serve as important foraging grounds.
- Turtles in The Bahamas have a significant effect on populations across the world. If populations die out in The Bahamas, turtles cannot migrate back to their nesting grounds to reproduce.

Studies have shown that food distribution is a key factor when an animal chooses its home range (Seminoff, Resendiz, & Nichols, 2002).

Sea grass is the main food source for green sea turtles, thus the abundance growing in The Bahamas influences turtle populations to migrate.



Fig. 2. Seagrass is the green sea turtle's main food source.



Fig. 3. Tiger sharks are the main predators of sea turtles.

The presence of predators can be very influential when organisms are deciding their home range (Fig. 3).

- Turtles avoid areas where predators are found.
- Individual size of turtles may affect how they react to predation.
- Habitat structure is another influential structure related to predation.

Green sea turtles are an endangered species and are an essential part of ecosystems

- There is a lack of knowledge about juveniles, making it challenging to protect the species effectively.
- Studying juveniles provides us with more information and leads to more effective conservation practices.

Purpose Statement

The purpose of this study is to determine how environmental fluctuations and individual size affect immature green sea turtles' home range and habitat use in a shallow, tidal foraging ground.

Study Site: Starved Creek Foraging Ground

Starved Creek is located in South Eleuthera, in The Bahamas

Starved Creek foraging ground is unique because:

- Extremely shallow waters
- High tidal fluctuations
- Sparse sea grass beds
- Large population of juvenile turtles
- High thermal fluctuations

Starved Creek has 3 different sections (Fig. 5):

- The Sound
- The Flats
- The Creek



Fig. 4. Map of South Eleuthera

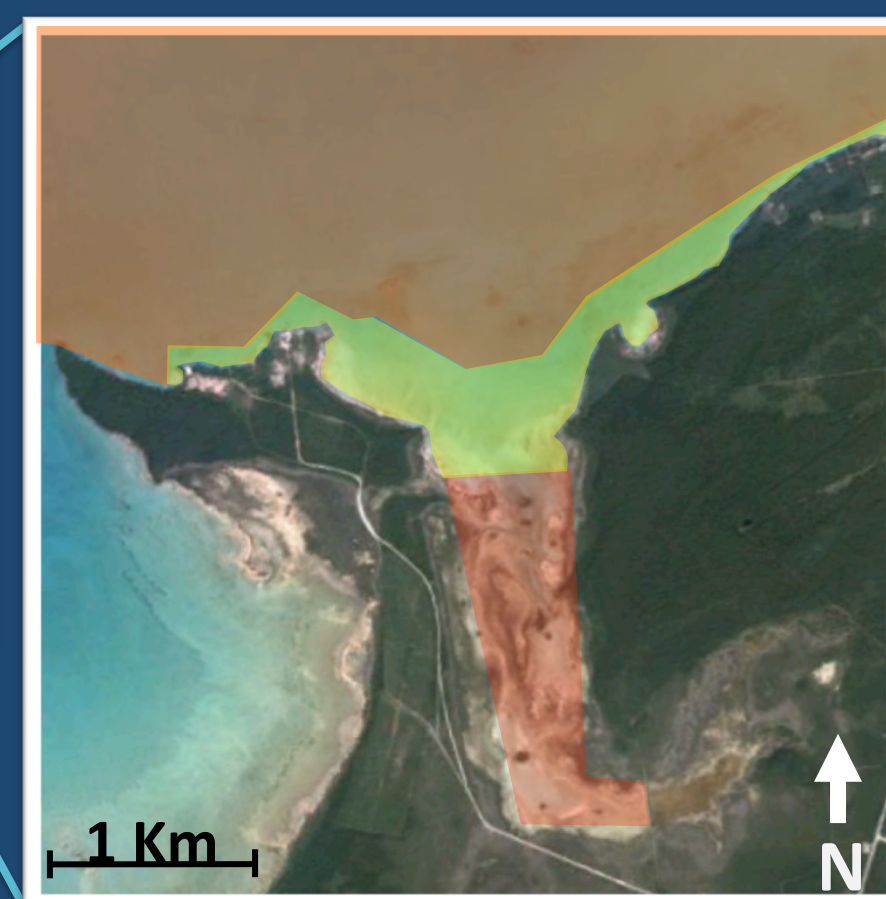


Fig. 5. Map of our study site, Starved Creek

Methods: Acoustic Telemetry



Fig. 6. Turtles are captured using the rodeo method, where turtles are followed by boat. Eventually a snorkeler enters the water to catch the turtle by hand.



Fig. 7. The turtles are measured, tagged with an acoustic transmitter and a time depth recorder, and then released at their point of capture.



Fig. 8. Two types of hydrophones are used (omnidirectional and directional) to detect a unique beep pattern emitted by the acoustic transmitter.

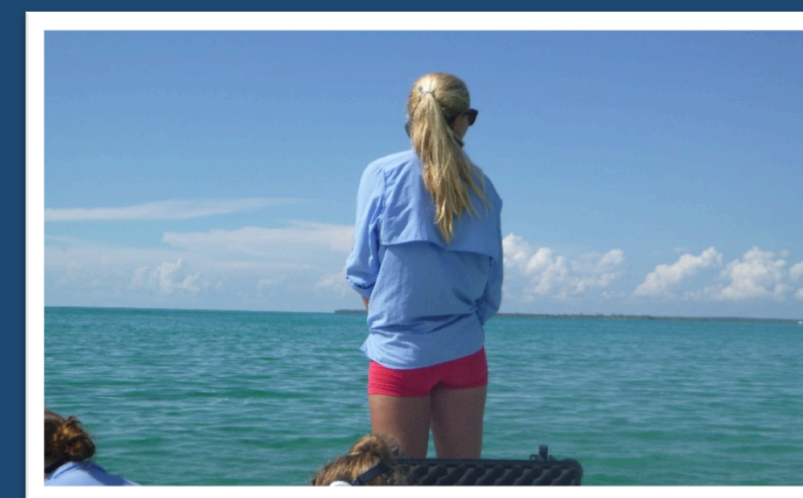


Fig. 9. Once the turtle is visually spotted, a GPS point is taken and the time and depth of the location are recorded.



Fig. 10. The turtles are recaptured at a later point, and the data from their time depth recorders are collected and analyzed.

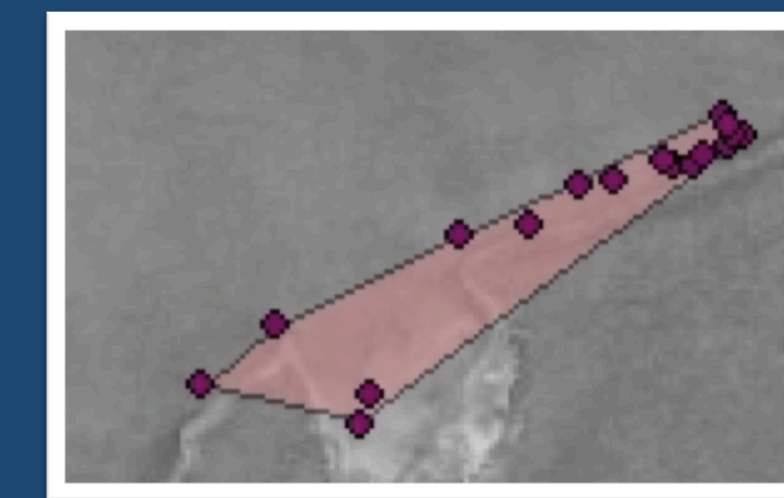


Fig. 11. The data is compiled into a map of each turtle's home range. We use ArcGIS to quantify their home range using the Minimum Convex Polygon (MCP) technique.

Results

In this study acoustic transmitters were attached to 12 different turtles. Of these 12 turtles, 4 experienced tag loss or migrated away from the study site. The turtles ranged from 34.2 cm to 57.6 cm in straight carapace length. Each individual turtle had a unique home range. In this study it was also found that tidal fluctuations influenced both small and large turtles differently.

All turtles monitored:

- Prefer shallow edges compared to the deeper center
- Readily make use of habitats exposed when tide is high
- Small turtles monitored (Fig. 12):
- Reside in shallow, near shore waters, at mouth of creek
- Can be found farther up creek at high tide
- Second smallest turtle (#10) was found farthest up the creek

Large turtles monitored (Fig. 13):

- Prefer slightly deeper waters than small turtles, but still stay near to shore
- Largest turtle (#4) was never found in the creek or flats area

Tides
• = low • = incoming • = high
• = outgoing • = unaffected

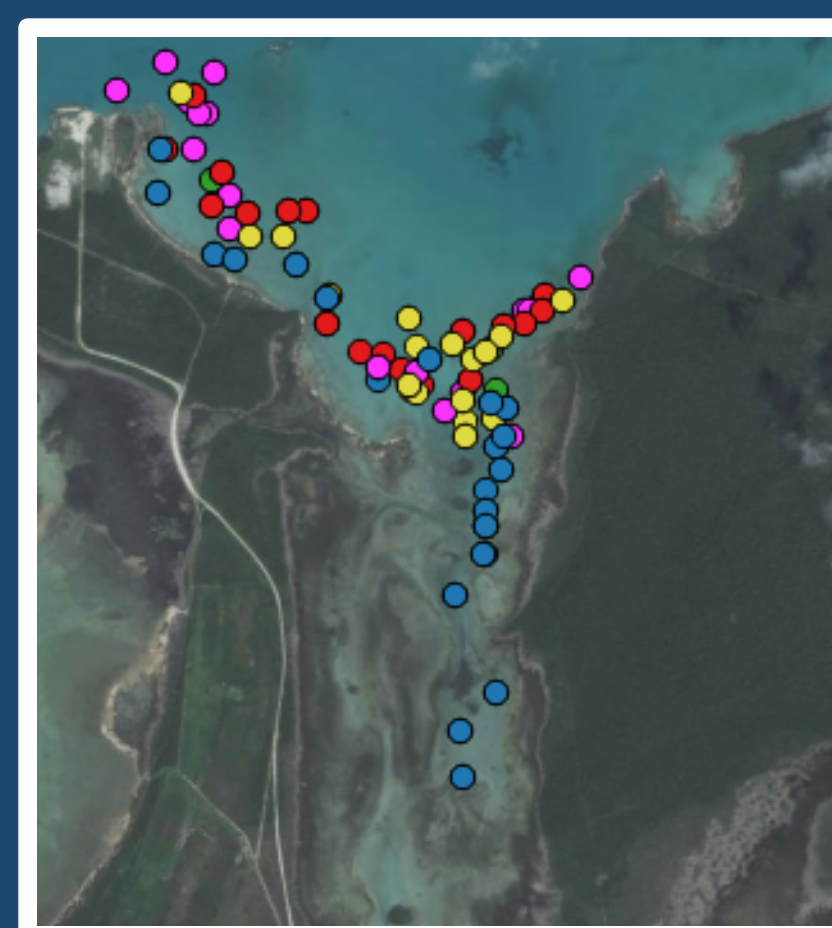


Fig. 12: Marked locations of all small juvenile turtles at different tides

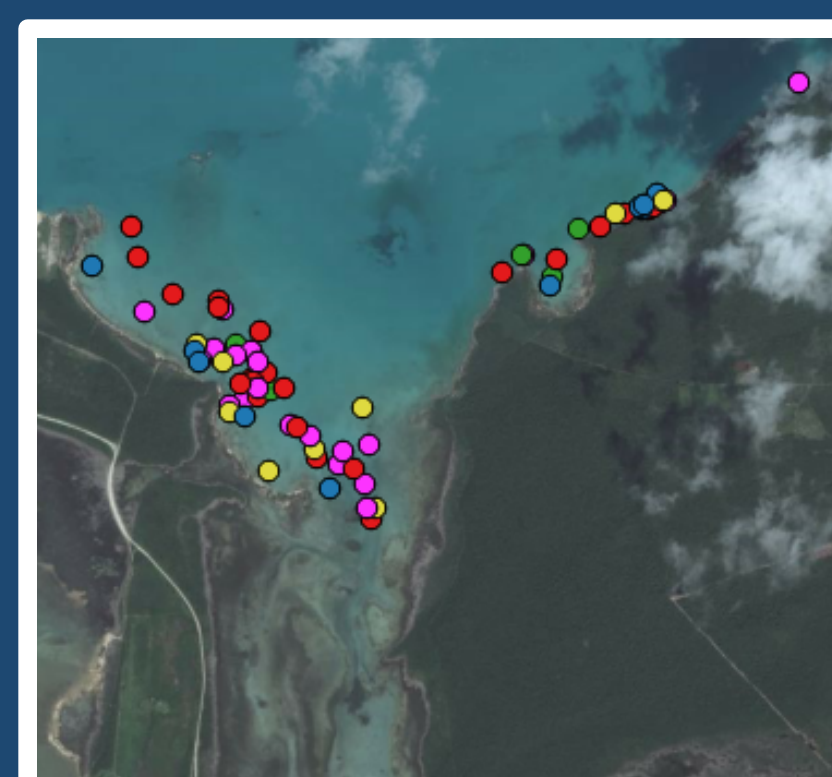


Fig. 13: Marked locations of all large juvenile turtles at different tides

Table 1: Size Class, Home Range, and Straight Carapace Length (mm) of all turtles in the study

Turtle Number	Size	SCL (mm)	HR Area (m ²)
3	Small	342	178689.9
4	Large	576	52036.39
5	Small	423	108568.8
8	Small	415	391512.9
9	Large	484	389239.7
10	Small	351	207717.1
11	Large	470	215867.4
12	Large	480	54838.82

Discussion & Conclusion

Our findings indicate that home range is influenced by:

- Individual size
- Tide and temperature fluctuations
- Habitat characteristics



Fig. 14. Green sea turtle swimming in a mangrove.

Individual size influenced where in Starved creek each turtle chose to reside.

- Smaller turtles may be more vulnerable to predation than larger turtles (Bresette *et al.* 2010)
- Smaller turtles choose to inhabit shallower waters where predators are unable to maneuver easily (Fig. 14)
- Larger turtles reside in deeper waters where they have more maneuverability and room to swim (Bresette *et al.* 2010)

Turtle 4 (57.6 cm SCL) and turtle 10 (35.1 cm SCL) are clear examples of how size may influence home range (Figure 15).

- Turtle 10's home range is found the farthest up the creek. This may be because this area consists of shallower waters, and mangroves, allowing the turtle more protection from predators (Fig. 14).
- Turtle 4's home range is found in a deeper area with a coastline composed of cliffs and overhangs. This area allows the turtle to maneuver to avoid predators and use the cliffs as protection and shelter (Fig. 15).

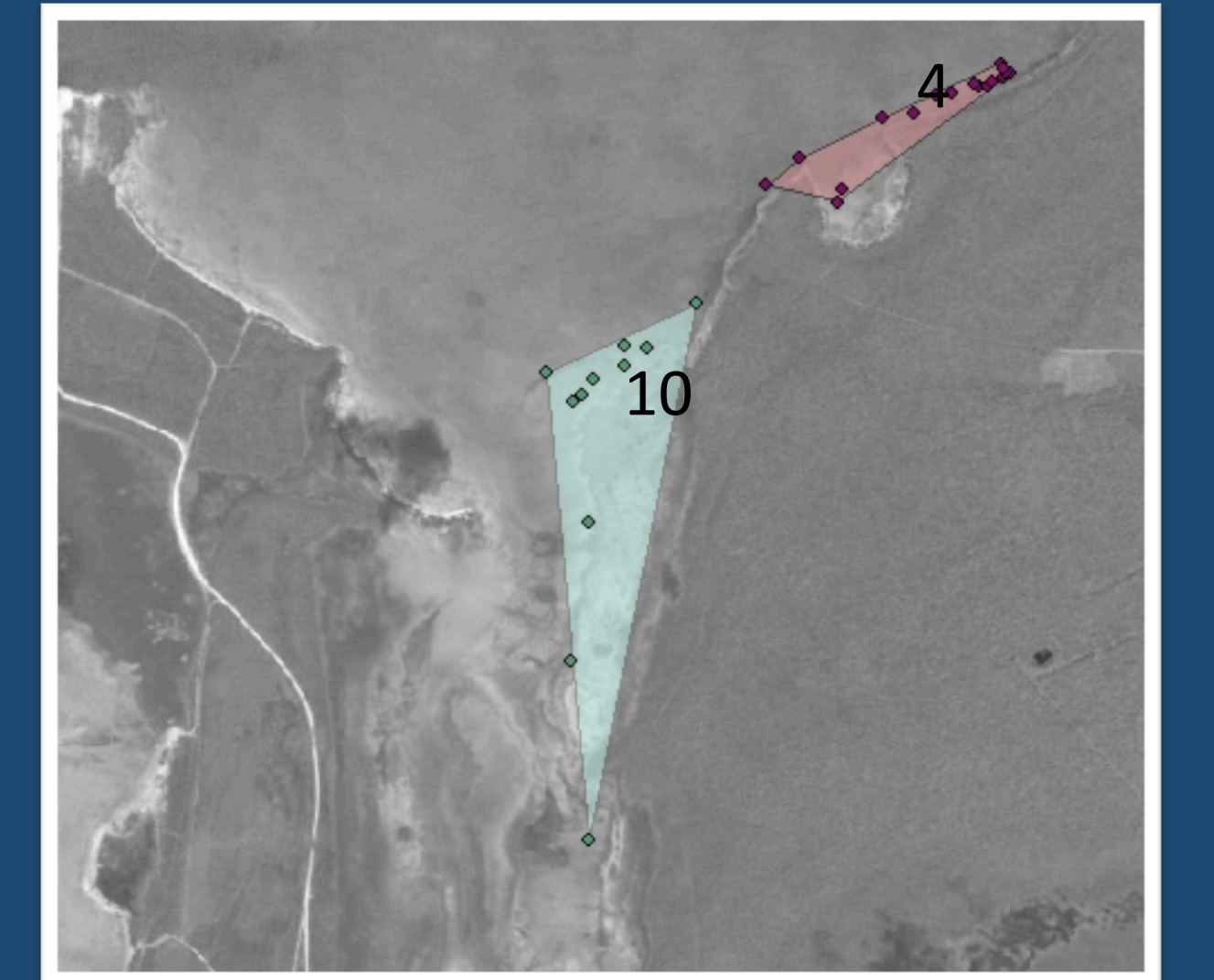


Fig. 15. Map showing home ranges of turtle 4 and turtle 10.

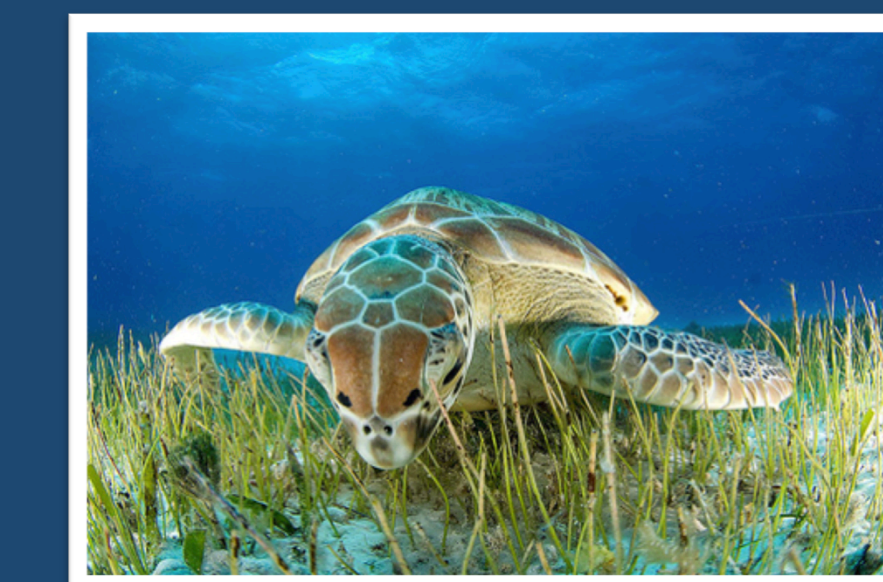


Fig. 16. Juvenile green sea turtle in a foraging ground.

Another factor influencing habitat selection is foraging opportunities.

- Seagrass is not highly abundant at Starved Creek, but can be found around the creek mouth and shore line
- Sea turtles will try to stay where sea grass is more abundant, but will balance that decision with avoiding predation (Heithaus *et al.* 2007)

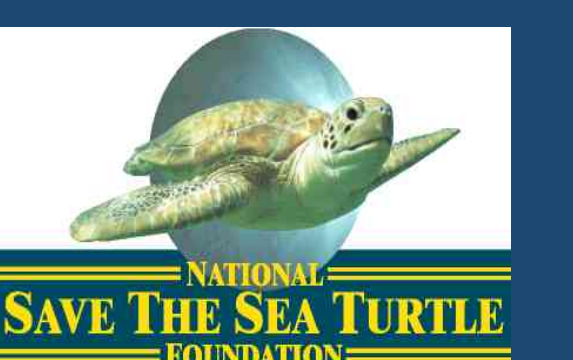
In conclusion:

- A turtle's home range is influenced by individual size in regards to predation, foraging opportunities, and habitat structure
- This information can help us understand the affects risk such as coastal developments, have on juvenile sea turtle populations and can lead to more effective conservation practices

Acknowledgements

Thank you to the following people for assistance and support throughout our study:

- Annabelle Brooks, CEI sea turtles manager
- Dr. Michael Salmon, Florida Atlantic University
- Abby Gordon, Photographer
- Cape Eleuthera Institute
- CEI Sea Turtle Interns
- The Island School
- National Save the Sea Turtle Foundation



Citations

- Bresette, M.J. *et al.* 2010. Size-class partitioning and herding in a foraging group of green turtles *Chelonia mydas*. *Endangered Species Research* 9; 105-116
- Heithaus, M.R. *et al.* 2007. State-dependent risk-taking by green sea turtles mediates top down effects of tiger shark intimidation in a marine ecosystem. *Journal of Animal Ecology* 76; 837-844
- Mendonça, M.T. 1983. Movements and Feeding Ecology of Immature Green Turtles (*Chelonia mydas*) in a Florida Lagoon. *Copeia* 4; 1013-1023
- Seminoff, J.A. *et al.* 2002. Home range of green turtles *Chelonia mydas* at a coastal foraging area in the Gulf of California, Mexico. *Marine Ecology Progress series* 242; 253-256