Evaluating the abundance and distribution of juvenile green sea turtles (Chelonia mydas) in South Eleuthera

By Anya Ham, Avery Vanacore, Catherine Argyrople, Greta Poler, Robin Grathwohl, and Tess Balobrzeski

Advisors: Meagan Gary and Eric Schneider

Introduction

Sea turtles live in temperate and tropical regions world wide. All seven species of sea turtles are listed as endangered under the International Union for Conservation of Nature Red List due to anthropogenic factors (Figure 1), slow growth rates and late maturity (Hamann et al. 2011). Green sea turtles play an important role in their ecosystems through a positive impact on seagrass health and productivity. Seagrass is a main food source and habitat for many different marine species. Green sea turtles eat seagrass causing it to grow faster and more dense. This creates a higher quality seagrass, thus increasing a major food source and habitat for other marine species (Moran & Bjorndal 2002).

This study focuses specifically on the juvenile life stage, which is spent mostly within foraging grounds. By monitoring the juvenile stage researchers are able to make predictions about changes in populations (Bjorndal et al. 2005). Foraging grounds in the Bahamas are tidal mangrove creeks. There is a wide variation in abundance of sea turtles across foraging grounds. There is also variation in species of algae across foraging grounds. Juvenile and adult turtles occupy these creeks. During this part of their life cycle the turtles forage for food and find protection from predators.

Little is known about the distribution of juvenile green sea turtles. Factors such as predators and seagrass may influence juvenile green turtle distribution. Examining predator distribution is important to top down control, which describes how the predators influence turtles population. Predators can lethally and non-lethally influence their prey population. Lethally is when predators physically eat their prey. Non-lethally, and non-lethally affecting the turtle distribution (Heithaus et al. 2007). Bottom up control describe how the seagrass abundance, or food source, influences the turtles abundance.

Methods

Abundance Surveys

Fig. 4. An anthropogenic factor including pollution, human development, c. direct surveys, d. indirect sources. 

Fig. 5. Visually scanned the water. It was determined by the hard color of a green sea turtle was seen. 

Habitat Mapping

Fig. 6. Quadrats were placed throughout the creeks. This determines species of algae and seagrass were examined. 

Predator Surveys

Fig. 7. The baited attractiveness in the area to the BRUVS site and also this recorded for the two BRUVS locations. The conclusion was predators were in each area. 

Results

The purpose of this study is to examine factors such as predator effects and substrate type that influence the abundance and distribution of juvenile green sea turtles within their foraging grounds in Southern Eleuthera.

The study consisted of 311 habitat mapping points, 13 abundance surveys, and 43 BRUVS during the spring of 2014 throughout foraging grounds in Southern Eleuthera. The creeks were categorized by proximity to open ocean, with creeks adjacent to the Bahamas Banks in light blue, the Exuma Sound in dark blue, and the Atlantic Ocean in black.

Habitat Mapping: Figure 8 shows the habitat mapping results and demonstrates that each creek had the same amount of seagrass and algae.

Abundance Surveys: Figure 9 represents the abundance survey results and demonstrates that Half Sound had the highest relative abundance of turtles with a mean of 61 sightings of turtles per survey. Deep Creek and Starved Creek also had a high relative abundance of turtles, while Broad Creek and Kimps Creek had a mean of zero turtles.

Discussion

This study begins to assess the potential influence of seagrass and shark populations on the abundance and distribution of green sea turtles. After putting the results together, the study showed that there were often a high abundance of green sea turtles in areas with a high abundance of sharks. This did not support the initial hypothesis, which stated that the turtles would avoid areas of high predator abundance, an idea demonstrated in previous studies (Heithaus et al. 2007). The results of our data suggest that seagrass may play a larger role in the distribution of green sea turtles more so than the influence of predators. This could be because the turtles risk predation in order to find better quality sea grass. Sharks also may be following green sea turtles into their foraging grounds, this is unlikely because the most abundant shark species were nurse and lemon sharks. Both nurse and lemon sharks not commonly known as predators of green sea turtles use these creeks as nursery habitat. The high abundance and quality of the seagrasses in the creeks allows the area to serve as a nursery habitat for juvenile fish. The characteristics of these creeks seem to be favorable to both the sharks and sea turtles.

Future Directions

Further research needs to be conducted to investigate why the green turtles are foraging in creeks that have a high abundance of predators, instead of staying in creeks with a low population of predators. This would help support the conclusion about the relative abundance of predators, species of algae, and the juvenile green sea turtles. Data will be used to create maps that depict where the predators, turtles, and seagrass/algae species are most abundant. The data from this study goes towards identifying critical habitats and foraging grounds for the juvenile green sea turtles. These maps can help inform the primary areas that need to be marine protected from coastal development and other anthropogenic effects.

Literature Cited


Acknowledgments

We would like to acknowledge Meagan Gary, Eric Schneider, Addie Alldrin, and forehead brake for all their support with this study throughout the semester. We’d also like to thank EarthWatch and ACST/IE for their collaboration and funding.

Appendix

Table 1: Mean number of species, seagrass, sharks, and turtles per BRUVS video survey by creek and location.

<table>
<thead>
<tr>
<th>Creek</th>
<th>Seagrass</th>
<th>Sharks</th>
<th>Turtles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starved Creek</td>
<td>1.5</td>
<td>0.4</td>
<td>61</td>
</tr>
<tr>
<td>Broad Creek</td>
<td>2.5</td>
<td>0.3</td>
<td>10</td>
</tr>
<tr>
<td>Half Sound</td>
<td>2.0</td>
<td>0.2</td>
<td>61</td>
</tr>
<tr>
<td>Exuma Sound</td>
<td>1.5</td>
<td>0.1</td>
<td>10</td>
</tr>
<tr>
<td>Atlantic Ocean</td>
<td>1.0</td>
<td>0.0</td>
<td>61</td>
</tr>
</tbody>
</table>

Figure 9: The map of Southern Eleuthera showing where turtles were present with red dots and where turtles were absent with an ‘x’.

Fig. 10. The mean number of sharks in the creeks throughout Southern Eleuthera, using catch per unit effort to show the sharks seen per hour.

Figure 11 shows the mean number of sharks using CPEU and the types of species in each creek. The most abundant species throughout the creeks were lemon sharks and nurse sharks. Starved Creek had the highest abundance of both species. Tiger sharks, which are the main predator of green sea turtles, were only spotted in Rollins Creek.

Fig. 11. The mean number of shark species in creeks throughout Southern Eleuthera, using catch per unit effort to show the sharks seen per hour.

Fig. 12. Data collected and satellite imagery will be used to create a habitat map of the substrate type within foraging grounds throughout Southern Eleuthera.

Fig. 13. Map of study sites throughout Southern Eleuthera. These sites were separated based on their proximity to the Bahamas Banks in light blue, Exuma Sound in dark blue, and Atlantic Ocean in black. 

Fig. 14. The map of Southern Eleuthera showing where sharks were present with red dots and where sharks were absent with an ‘x’.