

# USE OF MOLECULAR TECHNIQUES TO UNDERSTAND THE SPATIAL AND TEMPORAL FEATURES OF THE OCEANIC STAGE IN HAWKSBILL SEA TURTLES, *ERETMOCHELYS IMBRICATA*; A THESIS PROPOSAL

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## INTRODUCTION

The hatchlings and post-hatchlings of some sea turtle species forage in oceanic habitats for several years before returning to neritic developmental habitats. Many sea turtles will spend years in different foraging habitats before reaching sexual maturity, and such foraging grounds typically represent a mixed stock of turtles coming from a variety of nesting beaches.

Hawksbill sea turtles (*Eretmochelys imbricata*) recruit from oceanic habitats to neritic developmental habitats when they reach approximately 22 cm in SCL and become sexually mature at ~ 80 cm in SCL 16-20 y later<sup>1,2,4</sup>. The duration of the post-hatchling oceanic stage is unknown. Stable isotope analysis, in combination with growth rate estimates, enables making these estimates<sup>1,2,8</sup>.



Figure 1 (left). Hatchling hawksbill post-emergence. Photo credit: Megan Reising. Figure 2 (right). Adult and juvenile hawksbill for size comparison. Photo credit: Robert van Dam.

Genetic identification (mtDNA) of subpopulations has been used to understand the dispersal and potential contribution of hawksbill matrilineages to developmental foraging habitats<sup>3,5,7</sup>. Ocean current data has also been incorporated to infer potential migratory pathways and stock contributions<sup>3</sup>.

Our objectives of this study are to determine:

- 1) the duration of the post-hatchling oceanic stage of development,
- 2) whether the contributions of the identified matrilineages are proportional to the densities of breeding females at nearby rookery sites, and to assess
- 3) whether those contributions are related to the proximity of favorable ocean currents.



Figure 3. Hawksbill turtle in West Palm Beach, FL. Photo Credit: Jim Abernethy.

## METHODS

We will collect and sample between 30 and 50 newly recruited juvenile hawksbill turtles (~20 - 36 cm in SCL) at the Jaragua National Park (JNP) in the Dominican Republic (Figure 4), selected in part because it is downcurrent of several hawksbill rookeries in the eastern Caribbean sea.

### Stable isotope analysis

To determine the relative trophic level of the hawksbills while in their oceanic post-hatchling stage, we will analyze the bulk  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  of scute tissue and identify a timeline for an ontogenetic habitat shift between epipelagic and neritic habitats. Samples will be cut into 50 $\mu\text{m}$  deep segments, the minimum quantity required for analysis. Samples will be analyzed at the Stable Isotope Laboratory at the University of Florida<sup>8</sup>. By measuring when an ontogenetic habitat shift, and subsequent shift in isotopic signature, occurs, we will estimate the duration of the oceanic stage<sup>1,8</sup>.

### Mitochondrial DNA (mtDNA) analysis

We will collect epidermis samples and store them in NaCl for mtDNA analysis at the ICBR Genetic Analysis Core at the University of Florida. Haplotypes will be identified using a 740 base pair segment of mtDNA. Nesting beach origin will be determined by comparing the haplotypes to those previously published for Caribbean hawksbill nesting beaches<sup>5,7</sup>.

### Relationship between rookery site and oceanic surface currents

We will use published descriptions of ocean surface currents, from University of Miami's Rosenstiel School of Marine and Atmospheric Science (RSMAS), to test a model that predicts a mixed stock outcome at Jaragua National Park that reflects both rookery densities (Figure 4) and current flow direction (Figure 5) to infer potential migratory pathways<sup>3</sup>.

Figure 4. Map depicting hawksbill nesting beach densities in the Caribbean Sea and southern Atlantic Ocean as of 2006. JNP is depicted with a red star. (Source: SWOT Report, Volume III: Where the hawksbills are)

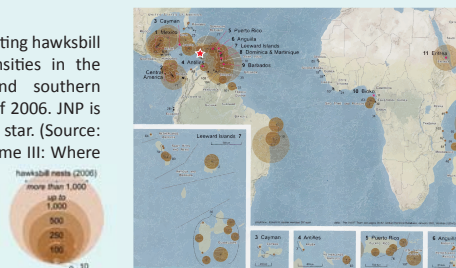


Figure 5. Map of surface currents in the Caribbean Sea. JNP is depicted with a red star. (Adapted from: Sverdrup et al. 1942)



## ANTICIPATED RESULTS

We anticipate that the stock origins at Jaragua National Park will be primarily composed of turtles that hatched on beaches in the Barbados, Puerto Rico, US Virgin Islands (USVI), and Antigua<sup>6</sup>. Puerto Rico and the USVI are some of the densest hawksbill nesting areas in the Caribbean so we predict that they will contribute a large proportion of turtles to the foraging grounds in Jaragua National Park. In addition, the surface currents tend to lead westward and slightly north from Puerto Rico, the USVI, and Barbados toward the Dominican Republic.

## SIGNIFICANCE

1) Reich et al. 2007 estimated that hawksbills ( $n = 4$ ) and green turtles have similar  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  signatures and probably exhibit similar trophic strategies. Our results are needed to confirm this result.

2) Hawksbills shift habitats from the oceanic to neritic locations at a smaller size (21-23 cm in SCL) than loggerheads, their closest relative<sup>1,2</sup>. By calculating the duration of the oceanic stage, we can determine whether growth during this phase of development also differs from the loggerhead, and gain important insights into early hawksbill life history characteristics.

3) In the literature, there is considerable speculation about how much "control" hatchlings and post-hatchlings have over their migratory locations. This study will enable us to determine whether the selection of developmental habitats by young hawksbills that have recently shifted habitats is governed primarily by stochastic processes, on the one hand, or is shaped an array of constraints, on the other hand. These include where females nest, prevailing currents at those sites, the duration of the oceanic phase, or some combination of these factors.

## ACKNOWLEDGEMENTS

We would like to thank the National Save the Sea Turtle Foundation for funding assistance. We would also like to acknowledge the following individuals for their assistance: Drs. Jeanette Wyneken, Kimberly Reich, and Yolanda León.

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