The National Save the Sea Turtle Foundation contributes $5400 toward Marine Turtle Research at Florida Atlantic University

Mike Salmon
Department of Biological Sciences
Florida Atlantic University

The National Save-the-Sea-Turtle Foundation has again demonstrated its commitment to marine turtle research by providing essential financial support for student projects at Florida Atlantic University. This year, their donation to the FAU Foundation for marine turtle research will be used to support several projects, one of which is just beginning while two others will be completed this year. Here is a brief description of those projects.

Project I: Why do hawksbill turtles lay so many eggs?

Megan Reising completed the field work for this study last summer at Jumby Bay, Antigua WI (Figure 1). This location is home to the oldest marine turtle monitoring project in the Caribbean, the Jumby Bay Hawksbill Project, that began in1987. Since then every female nesting in the bay has been marked, and all of her eggs and hatchlings counted. That leaves an invaluable record of each female's “productivity”, as well as the number of new females (“recruits”) attracted to the site. This Information is essential for determining whether the turtles are declining, holding their own, or increasing in number.

Figure 1. Inset: Antigua is located in the northeastern Caribbean sea. Jumby Bay is one of several small offshore islands that are part of Antigua, WI. Over 200 hawksbill nests are laid every summer on the shores of Jumby Bay (red arrow, upper right). Picture, below, shows the bay enlarged. Each red dot indicates the location of a single nest. The females clearly prefer to nest on the West side of the bay, and most of the hatchlings enter the sea on that side of the Bay.

All marine turtles lay lots of eggs in each nest but hawksbills deposit more than any other - up to 200 eggs. Megan wanted to know why. In other animals large clutches of eggs are associated with low probabilities of egg or juvenile survival. Was that the case at Jumby Bay? Megan confirmed that the problem wasn't in the nest as on average, about 80% of the eggs ultimately resulted in hatchlings that left the nest and entered the sea. That meant that hatchling survival might be the issue. To find out, she followed 50 hatchlings at night for as long as 30 minutes as they swam offshore to determine how many of them survived to exit the Bay. She found that almost none survived if they entered the bay on the west side where most females nested (Figure 2) while almost none were taken by predators if they were released into the sea on the east side of the Bay. Apparently, hatchling predators had learned where to obtain an easy meal!

Thanks to this study, we now know why females lay so many eggs. We also know what can be done to better manage hatchling survival at Jumby Bay. The solution is simple: release more hatchlings where females rarely nest!

Project 2: How does the magnetic orientation develop?

Jessica Pate is doing a study to determine when during their embryonic development loggerhead embryos gain the capacity to navigate, using the earth's magnetic field. We know from previous studies that when hatchlings emerge from the nest, they already have this capability. In fact, locked inside their tiny brain is an entire magnetic map of their migratory route across the North Atlantic Ocean, along with “instructions” on how they should use that map to make that journey.

Since hatchlings leave the nest in possession of this ability, Jessica's goal was to find out when during development the embryos acquire this amazing capacity. To find out, she exposed eggs during portions of their 7 weeks of incubation within the nest to magnetic fields distorted by bar magnets (Figure 3). She chose

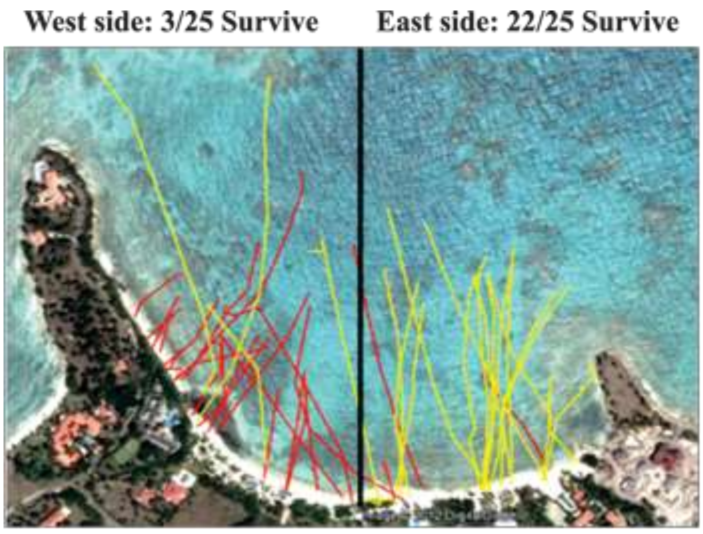

Figure 2. Megan's results. Most of the hatchlings swimming offshore from the west side of the Bay do not survive more than 10 minutes before they are taken by predators (red lines describe their paths). In contrast, most of the hatchlings released on the east side of the Bay survive and reach the relative safety of deep water outside of the Bay (yellow lines describe their paths).

Thanks to this study, we now know why females lay so many eggs. We also know what can be done to better manage hatchling survival at Jumby Bay. The solution is simple: release more hatchlings where females rarely nest!

Project 2: How does the magnetic orientation develop?

Jessica Pate is doing a study to determine when during their embryonic development loggerhead embryos gain the capacity to navigate, using the earth's magnetic field. We know from previous studies that when hatchlings emerge from the nest, they already have this capability. In fact, locked inside their tiny brain is an entire magnetic map of their migratory route across the North Atlantic Ocean, along with “instructions” on how they should use that map to make that journey.

Since hatchlings leave the nest in possession of this ability, Jessica's goal was to find out when during development the embryos acquire this amazing capacity. To find out, she exposed eggs during portions of their 7 weeks of incubation within the nest to magnetic fields distorted by bar magnets (Figure 3). She chose

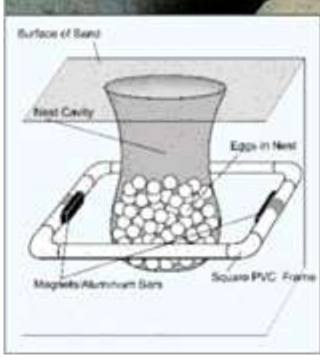

Figure 3. Above, Jessica inspects a nest. Below, eggs are exposed to either magnets (that distort the earth's field) or aluminum bars (which do not and act as a control).

the first, second and last third of the incubation period for that exposure so she could pinpoint when a "magnetic sense" developed. Control nests were exposed to aluminum bars, identical in shape and mass to the magnets placed near the eggs. However, aluminum is non-magnetic and so these eggs served as controls for all of the manipulations around the eggs.

Jessica is in the process of gathering the data now. The results so far suggest that any exposure to a distorted magnetic field, regardless of when it occurs, results in turtles that are unable to use magnetic cues during migration. Whether this effect is temporary or permanent remains to be determined.

These results have important management implications. On many beaches worldwide, nests are "protected" from predators by placing galvanized steel screening or cages over the eggs. These devices may protect the eggs from predators that dig into the sand but they also distort the magnetic field where the eggs are developing. Can these distortions also interfere with the ability of hatchlings to migrate using magnetic cues in the ocean?

At many nesting beaches in Florida, workers have now switched to using plastic instead of metal screening to protect the eggs.

Project 3: Do marine turtles use airborne odors to locate food and nesting sites?

A new project is being started by graduate student Stephanie Kedzug to determine whether juvenile leatherbacks respond to an airborne odor known as DMS (dimethyl sulfide). DMS is produced in oceanic areas where food is especially abundant. DMS is volatile, escapes into the air, and is transported long distances by wind. Recent studies have shown that many oceanic predators, from seabirds (penguins, petrels, prions, albatrosses) to seals, respond to DMS by flying or swimming upwind. Such an ability allows these animals to locate feeding areas more efficiently.

Other studies, done with green turtles nesting on remote islands, suggest that females can home toward these islands from distances of 50 – 100 km, as long as they are in a downwind direction from the island. That ability may also depend upon the detection of DMS, though that hypothesis remains a matter of speculation at the moment. What has recently become evident, however, is that juvenile loggerheads detect DMS in the air and when they do, they swim faster and spend more time with their head exposed at the surface. Are they "sniffing"?!

Kedzug plans to take advantage of our ability to raise juvenile leatherback turtles at the FAU marine lab, currently the only place in the world where these delicate animals can be reared in good health. She will use the turtles not only to determine if they can detect DMS, but also to see if they will swim upwind into an air current that contains either DMS or the odor of one of their favorite prey, the Lion's Mane jellyfish. If she succeeds, she will demonstrate yet another way marine turtles stay on course and navigate toward nesting beaches, nursery habitats, or feeding grounds (Figure 4). Stay tuned for future reports!

M. James, photo

Figure 4. Leatherback at the surface taking a breath. Is it sniffing DMS?