National Save the Sea Turtle Scholarships for 2013: Four More Graduate Students Benefit from Foundation Support

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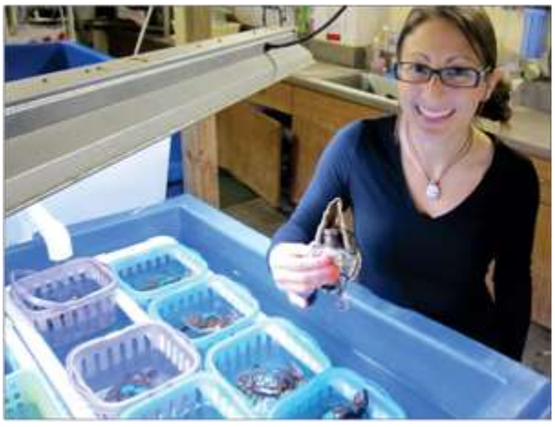
For a second consecutive year, the National Save the Sea Turtle Foundation has generously contributed four $500 scholarships to the Florida Atlantic University Foundation. These scholarships fund projects designed to advance our knowledge of marine turtle biology, conservation and management and in so doing, improve our ability to assist in the recovery of marine turtle populations. That recovery is currently in full swing and this year, green turtle nesting in the State of Florida broke new records. At the same time, both loggerhead and leatherback nesting activity has been increasing as well, though the change has been somewhat less spectacular than the numbers shown by green turtles.

What's important, however, is that nesting in Florida for all three species is definitely on the rise, and so it becomes all the more essential that we maintain those trends by learning more about sea turtle biology. That will only happen if we continue to support the training of the next generation of bright young scientists. The National Save the Sea Turtle Foundation contributes to that cause, which is all the more important because with each passing year it becomes more difficult to find support for graduate student training in biology.

This year's recipients were carefully chosen by our department's Scholarship Committee. They represent our best young scholars. After reading about their projects, I think you'll agree that they are doing interesting and important work. The four 2013 recipients are Courtney Cocilova, Jake Lasala, Karen Pankaew, and Boris Tesak. Here's what they are doing.



Courtney Cocilova's study focuses on the impact of red tides on sea turtles and other marine animals. Red tides occur when populations of single-celled organisms known as dinoflagellates, explode in numbers as a consequence of exposure to large concentrations of nutrients. The cells, which in some species are red in color, become so numerous and concentrated that they discolor the water making it “red”. Abnormal numbers of dinoflagellates also release large quantities of a neurotoxic substance (brevetoxin, or PbTx) into their surroundings. High concentrations of this toxin are deadly to fish, turtles, dolphins, manatees, sea birds and many marine invertebrates. A sublethal exposure to PbTx impairs their physiology and behavior through nervous system malfunction; it also suppresses their immune system, making the animals more susceptible to disease. Marine animals exposed to red tides for prolonged periods die.

The endangered status of sea turtles makes experimental exploration of new and better treatment options difficult. For this reason, we lack firm knowledge of the best ways to manage and treat patients suffering from the specific effects of this toxin. Sick marine turtles are immediately treated to help them recuperate, but turtle rehabilitation centers are only able to treat obvious symptoms; it would be better

to not only treat symptoms, but also to reduce or eliminate the pathological effects of the toxin on the animals' nervous system.

Since it's impossible to do treatment experiments on endangered marine turtles, Courtney uses common and abundant freshwater (red-ear slider) turtles as "models" or substitutes for marine turtles, very much like laboratory mice are substituted for humans to determine the efficacy of new treatments for human diseases. She analyzes the distribution of PbTx in slider organs and tissues to better understand how brevetoxin exerts its effects. Her project is of particular interest because nerve cells in most turtles show higher levels of resistance to PbTx toxicity, especially compared to mammals. Examining impacted organ systems, immune function, and the physiology of fresh water turtles is providing insight into how long it takes PbTx exposure to take affect and how quickly recovery occurs. Her experiments will also allow for the development of more effective treatment protocols that can be used to speed up the rehabilitation and recovery not only of sick turtles, but also of other marine life affected by red tides.

Jake Lasala is interested in the mating systems of marine turtles, defined as how the sexes find and acquire mates. A few years ago, virtually nothing was known about this subject and for good reason. Marine turtles court and mate well out of sight of human observers, often in deep water some distance away from land. That being the case, few humans ever saw how the sexes interacted or had any way of learning how mates were chosen. All of that changed, however, with the invention of sophisticated underwater, battery powered video systems that could be attached to individual turtles (such as "crittercams" placed on male turtles as they pursue females). Another important discovery centered on advances in genetics that allow scientists to analyze the genetic constitution (DNA) of hatchlings, half of which is determined by their mother's and half by their father's genes. That latter approach is central to Jake's study.

How do genetic measurements provide us with insights into mating systems? The answer centers around the differences that show up between the genes contributed to the hatchlings by their fathers. If females mate with a single (and one presumes, very attractive and/or very lucky) male, then all of the eggs produce hatchlings that have a limited, and repetitive, subset of a single male's DNA. However, if each female mates with two or more males, then the hatchlings from a single nest will show a varied constitution of DNA that can only come from two (or more) fathers. That situation defines a promiscuous mating system, or one in which each sex mates with several members of the opposite sex.

Jake's research focuses on how many male green turtles, loggerheads and leatherbacks contribute their genes to the offspring of each female nesting on our beaches. He can also determine if the males are related and, in addition, determine for a single nesting beach just how many males are out there servicing those females! That is also a major advance since male marine turtles, unlike females that come ashore to nest, can't be easily counted. Yet, knowing their number is essential if we are to learn how marine turtle populations are changing over time. That's especially important now as the earth is warming. In marine turtles, that means more females than males may be produced (see description of

Boris Tezak's research project, below). We need to know if enough males are around to service all of those females.

Karen Pankaew is interested in marine turtle energetics, especially in the hatchlings that emerge from nests with a limited reserve of yolk energy needed for migration away from the nesting beach out to the open ocean. Between the months of July and October, Florida green turtle hatchlings emerge at night from their nests on oceanic beaches. The hatchlings crawl rapidly across the beach from their subterranean nests to the shoreline, and then swim many miles offshore to algal mats where they find food and shelter. They locate the sea from the nest by crawling away from the darker, taller dune vegetation and toward the brighter, lower oceanic horizon. However, increased beach development by humans brings with it artificial lighting, and this illumination interferes with the “seafinding” process that has gone on for millions of years. Hatchlings can be misdirected landward toward strong, localized artificial sources of light (misorientation). Another response, shown to diffuse skyglow generated by many sources of lighting from urban development, can cause hatchlings to wander for hours on the beach without direction (disorientation). Both misorientation and disorientation increase the distances hatchlings crawl, expose the turtles to predators that they would otherwise avoid, and waste valuable stores of energy. Exhausted animals may suffer from reduced survival probabilities even if they do, finally, locate the ocean.

Karen is investigating the energy cost to hatchlings incurred by prolongued crawling, and how that activity affects the hatchling's swimming performance. To find out, she collects green sea turtle hatchlings as they emerge from their nests and, in a laboratory setting, places each turtle either in an aquarium or on a treadmill to measure swim and crawl behavior. Karen observes hatchling behavior during these trials noting how often each turtle rests and breathes, and how vigorously it swims or crawls. Simultaneously, she monitors oxygen consumption and collects other energy expenditure measurements. Her results will indicate whether misorientation and disorientation events consume a considerable amount of energy such that rescued turtles released immediately (the current protocol) will have insufficient reserves left to swim offshore. An alternative is to hold them in captivity for a few days and later release them by algal mats offshore. This information will help managers to decide which strategy is best for promoting hatchling survival.

Boris Tezak is interested in developing new methods for accurately determining the sex of marine turtle hatchlings. Present methods require sacrificing the animal and that's obviously not the best way to obtain this information from an endangered species! In marine turtles, sex is determined by nest temperature during a critical period in embryonic development, a phenomenon known as temperature dependent sex determination (TSD). The rule is “hot babes” and “cool guys”, which means that when the eggs incubate at warm temperatures they produce mostly females, at cool temperatures mostly

males, and at intermediate temperatures a mixture of males and females. In light of the rapid increase of global temperatures, a number of studies highlight the need for clear assessment of the effects of climate change on sea turtle sex ratios. However, because the mechanisms that trigger male versus female development are incompletely understood, predicting hatchling sex ratios on the basis of nest temperature result in approximations that are often inaccurate.

There are more certain ways to determine sex, such as the use of laparoscopy. Laparoscopy involves the insertion of a small camera into the body cavity of the turtle to peer at the juvenile ovary of females or juvenile testes of males. Characteristics such as their size, shape, and color can be used to determine sex in somewhat older (juvenile) turtles. However, this technique has some disadvantages. First, the turtles have to be raised for several certainly obvious. The presence or, worse, absence of these birds indicates the overall health of the ecosystem. Therefore by protecting the spoonbill's habitat, we are also protecting the community as a whole.

Though we many never completely remove the impact we have had on the environment, we can diminish our footprints. It may seem easy to blame agriculture and development, yet there are a myriad of small dangers the spoonbills face. But thanks to dedicated researchers and devoted bird lovers, there is still a chance for the spoonbill to survive. Currently the Environmental Protection Agency is outlining a plan for filtering phosphorous out of the water flow, and institutions like the Central Everglades Planning Project are collaborating with multiple agencies to make this happen. Educating the public on the importance of water quality, habitat restoration, and biodiversity will help people make wise choices concerning environmental protection.

While large conservation groups and corporations are doing their best to preserve the spoonbills, Floridians can help this species in their everyday lives. Supporting conservation and research efforts is as important as changing our daily habits. Water is utilized not just for large industries but also for individuals. Reducing water use in the home by taking shorter showers or washing full loads of laundry decreases consumption as well as water bills. Altering outdoor usage also lessens human impact. Xeriscaping requires little water, and watering lawns at night prevents waste from evaporation. Water-savvy garden products are becoming more available. Sustainably grown eucalyptus mulch is a better option than cypress mulch, which is harvested from slow-growing cypress trees in natural wetland areas. Fertilizer and pesticides from farms and gardens are also pollutants. Reducing the use of these products further protects the life-giving water needed by spoonbills and other wetland species. These minor changes may seem insignificant on an individual basis, but collectively they can make a huge difference. When it comes to protecting a species, the small steps can lead to great strides in preservation.

For more information on what you can do to help the roseate spoonbill, contact the Audubon society or visit their page at http://birds.audubon.org/species/rosspo.