

A Summer of

Ecology and molecular genetics connect a group of Wheaton researchers to the future of the northern diamondback terrapin turtle on Cape Cod and across the country.

SURVIVAL

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Kate Hunt '03, professor of biology Barbara Brennessel and Robert Monteiro '03 find plenty of specimens on Lieutenant Island.

On the way from Indian Neck to Lieutenant Island, Professor of Biology Barbara Brennessel steers her SUV to an abrupt halt on King Phillip Road. It's an epic mid-June day in Wellfleet, Mass., and the sunny blue Cape Cod sky is now partially obscured by the sand and dust we've kicked up from the unpaved road. "We've got one!" Brennessel shouts, pointing to the diamondback terrapin turtle that strides methodically toward the far side of the road. All four doors of the truck pop open simultaneously, but Brennessel reaches the turtle first. The young female is a new discovery; we know this because its shell is free of the tell-tale notches that identify each Wellfleet turtle that has been previously logged in.

It's an important find for Brennessel and her team. They are engaged—with local volunteers and scientists from throughout the country—in an ongoing population study of the northern diamondback terrapin, threatened seriously enough by human and environmental factors to place it on Massachusetts' endangered species list. With each new turtle they find, Brennessel and her students are another step closer to learning more about their life, death and long-term survival.

The team—Brennessel, psychobiology major Kate Hunt '03 and biology major Robert Monteiro '03—springs into

action. Monteiro takes measurements while Hunt records the data. They note the turtle's age, weight, height, length, breadth and any unusual markings that might indicate trauma or deformity or might help in future identification. Brennessel pokes her finger under the back end of the shell. "She's gravid," she reports as she hands the turtle to each of us so we can feel the eggs this pregnant terrapin will soon lay; they feel like large marbles beneath the turtle's soft leathery skin.

Hunt takes a DNA sample from the papery skin of the turtle's top shell, then hands the creature to Monteiro, who will file a series of notches into the shell. These notches identify the turtle—#1351—for current and future study. The filing is hard work and Hunt occupies the turtle with her pen in order to keep its head from being injured by the file.

Just a few minutes have elapsed, but the activity in the middle of King Phillip Road is enough to draw out the neighbors. One couple approaches with their granddaughter, who is intrigued by the commotion. A Mrs. White stops by to say she spotted a turtle yesterday and called it in to the local "turtle hotline." She asks if our crew is from Wheaton, and we answer "yes." She then tells us that her granddaughter, Jenna Lookner, is a Wheaton student, and was in her younger days a record holder in spotting the diamondback terrapins in Wellfleet.

We are starting to realize that these endangered little turtles are connected to us in ways we might never fully understand.



The northern diamondback terrapin, *Malaclemys terrapin terrapin*, occupies a unique niche in Wellfleet Harbor, according to Don Lewis, a retired senior executive and a full-time volunteer at the Wellfleet Bay Wildlife Sanctuary, which is the base of operations for this study. Lewis explained that the turtles live year-round in Wellfleet's rich estuarine system of rivers, creeks, coves, bays, and marshes, the species' absolute northern limit.

"Observing an animal at the extreme edge of its range serves as an important bellwether to monitor the health of the ecosystem," Lewis said. "Massachusetts lists the diamondback terrapin as a threatened species and recognizing its signal role within the harbor environment, Massachusetts Audubon's Wellfleet Bay Wildlife Sanctuary has organized research studies of terrapins since 1980, with informal observations stretching back a quarter century."

The terrapin—disarmingly endearing with a natural smile and a nasty bite—has been a force in the region's ecosystem for centuries. Until the early 1900s, it was a popular food source for humans and was nearly hunted to extinction. Today these

reptiles are a bellwether for environmental health because they are so resilient. They recover from lost limbs, boat and auto accidents, and even some of the development of their natural habitat. When the turtles begin to die, scientists must question not only the health of the terrapin population, but also the health of the environment.

Brennessel began working with the terrapin in Wellfleet in 2001, when she joined a group of wildlife biologists working out of the Wellfleet sanctuary. She attended the sanctuary's field school for research, participated in data collection, and recognized the opportunities students might have to work with an organized group of scientists and volunteers both to study and protect an endangered species. The team spent six weeks last summer collecting data for examination in Wheaton labs this winter.

"The research is similar to the work we did on campus with vernal pool salamanders," Brennessel said. "We captured and marked terrapins, looked for nesting females—by daylight and moonlight—and protected nests with predator excluders that my students and I made during the previous winter. We also took skin biopsy samples to prepare DNA fingerprints of the turtles during the academic year."

This DNA fingerprinting is at the heart of Brennessel's study of the diamondback terrapin. This molecular genetic work, the first of its kind in the Wellfleet Bay population,



The researchers must complete a series of measurements before releasing a turtle to the wild. Barbara Brennessel, left, checks under the shell for eggs; Robert Monteiro, center and right, measures a turtle's length, then carefully files an ID number on the shell.

now complements ecological studies.

“The molecular methods have the power to assess the genetic makeup of plant and animal species within and between populations to examine genetic diversity and answer questions about population substructure, gene flow, kinship, taxonomy and phylogenetic relationships,” Brennessel explained. “Analysis of the DNA fingerprints can identify genetic differences within the population” of terrapins and perhaps help scientists better understand and protect the turtles’ survival.

This genetic fingerprinting is especially important in monitoring the terrapin population. In 1999-2000, an alarming die-off occurred in the nearby Fox Island Wildlife Management Area. Lewis organized a cleanup of the area waters, but researchers continue to search for other factors that led to the deaths of nearly 100 turtles that winter.

Both Monteiro and Hunt are studying the DNA with Brennessel in Wheaton labs this year, but just as vital to their experience was the level of fieldwork they were able to conduct.

“Some days there is nothing out there, other days there is so much happening that you forget to eat,” Hunt said of the fieldwork. “Learning how to ‘do science’ is a hands-on experience, requiring you to be creative. Research and preserving wildlife can start with just one person—the power of one!”

“I really loved kayaking out to the cove,” Monteiro added. “The first time I went, the water was really warm, so I could see hundreds of turtle heads. I had been taught how to catch and handle a turtle, but not how to contain it. When I finally caught my first terrapin, I excitedly put it in my open-top Styrofoam box. I thought it would go to sleep or just lay there, but all of a sudden a claw came over the top. The box was right between my legs, so I was pretty nervous. I pushed it down into the hull of the boat, but the turtle never gave up.”



Duke University scientist Kirsten Hunt takes a blood sample before releasing this gravid female terrapin.

astonishing when you see the size of the turtle and the size of the eggs. The females—green and golden with the diamond-faceted carapace that gives them their name—measure about 8 to 9 inches long and weigh up to 3.5 pounds. Each egg is about the size of a very large grape.

While Brennessel, Lewis and other volunteers and scientists continue to process the turtles, Hunt, Monteiro and I follow Chris Burns, a Wellfleet summer resident and veteran turtle volunteer at age 18, to a nest site just to the side of a residential dirt road. At the head of the road is a handmade sign, created by area Girl Scouts, warning drivers to watch for turtles in the road. The site of the terrapin nest looks like a crop circle in the compacted sand, and a couple inches of gentle excavation by Burns confirms the nest. He scoops off the top layer of sand and Hunt takes over, gently probing and removing sand until she unearths several eggs. It’s a delicate process; we’re all a bit afraid that we’ll damage the eggs, but they are far more sturdy than we give them credit for. These eggs must withstand a world of dangers just to survive until hatching. Monteiro takes over the excavation while I snap photos. He unearths several more, and then surprises me when he announces that it’s my turn. I gladly take my place and remove the last of the eggs. There are 16 eggs in all; they weigh 123 grams. Hunt explains that the cooler eggs, the ones on the bottom that I removed, were destined to be males; the warmer eggs at the top of the nest would have been female had we left the nest untouched. Because we removed them so soon after nesting, the sex—determined by temperature—wasn’t yet set.

We relocate the nest to a marshside dune beyond the residential areas, aptly named “Turtle Point.” Burns digs a hole of approximately the same size as the original nest in the sandy, sparsely-vegetated incline and buries the eggs. The new nest is topped with a wire enclosure to keep out predators. (The eggs hatched in the late summer and early fall.)

Back at the makeshift turtle processing area, Brennessel, Lewis and Kirsten Hunt, a Duke University researcher, con-

tinue to log in newly-found animals. Lewis’ phone—the turtle hotline—never stops ringing; people all over Wellfleet are calling in sightings and nests. And Lewis himself seems never to stop. “I’ll sleep in January,” he says.

There are two more stops before lunch. We stop at Lewis’ house to pick up a hatchling ready for release at Indian Neck, the marsh that Brennessel and her students patrol. The young turtle is the size of a quarter, and each of us takes turns letting it run the length of our outstretched hands. The turtles are fast, certainly not the slow pokes of children’s fairy tales. When they want to move, they move. We then head for the Wellfleet Audubon Sanctuary, where #693 awaits processing by Wheaton students. The 102.5-gram gravid female was found in the

sanctuary and that’s where it was later released.

The Friday afternoon sun brought a strong onshore breeze and far fewer turtles than in our morning of rescues, relocations and recording. Hunt, Monteiro and I make the Indian Neck loop again, this time searching for the right place to release our tiny hatchling. In the distance we watch shore birds dive-bomb the marsh, a sure sign that they’re finding food, maybe even tiny turtles. Monteiro chooses a grassy area not too far from the water. The tall grass will camouflage the tiny traveler from predators, and the warm inlet waters will provide food and, we hope, survival.

To read more about the work of Don Lewis and Wheaton students in Wellfleet, please visit www.terrapindiary.org.



Clockwise, from top left: Barbara Brennessel checks for evidence of a nest; a newly relocated nest at Turtle Point; Kate Hunt completes a checklist of statistical measures; Hunt buries eggs relocated from a residential road to a protected dune.