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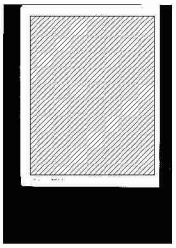
Hatching a Future

BARNEGAT BAY'S LADY WITH A MOUSTACHE **STORY AND PHOTOS BY DAN RISCH**

At the Lighthouse Center for Natural Resource Education along New Jersey's Barnegat Bay, Claire Coleman clips an x-ray onto a portable backlighter and switches the device on. Faint outlines of eggs appear. Lots of eggs. Twelve-year-old Jon Linen studies the image while Coleman explains why she x-rays diamondback terrapins. Jon speaks up, cutting through the chatter of adults gathered around. "There are 18 eggs," he reports.

"Really?" says Hal Avery, a turtle biologist and Coleman's boss. "That's a record, Jon," he enthuses. Eighteen had been the most eggs recorded from a single diamondback that summer.

In 1995, the Environmental Protection Agency (EPA) designated Barnegat Bay a national estuary. The designation helps protect some of the mid-Atlantic coast's dwindling salt marshes. To gauge how human activities are affecting the bay, in 2002 Avery and a team of graduate and doctoral students began studying the diamondback terrapin, North America's only turtle that thrives in brackish marshes. Each summer, Earthwatch Institute volunteers lend a hand trapping and tagging diamondbacks. Jon was one of the youngest expeditioners during the 2007 season.



Black dashes on the upper jaw of this female diamondback terrapin (above) inspired the author to dub her "Lady with a Moustache." This turtle species takes its name from the diamond-patterned growth rings on its top shell. Female terrapins are much larger than males.

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The study's fieldwork begins soon after diamondbacks wriggle from the muck of creeks and coves where they've buried themselves over the winter. As waters warm in April and May, the terrapins form aggregations. Then, exhibiting a behavior called polyandry, each female mates with several males. Afterward, the terrapins disperse, and from early June to late August, Avery's team follows. By trapping and recording the sex, age, size, and general health of terrapins, Avery hopes to tease out over the course of the 20-year study the changes in diamondback behavior and genetic adaptations brought about by the expanding human footprint in the bay.

Avery rises early most mornings and drives to a bait-shop where he buys frozen menhaden. While the volunteers rouse themselves, Avery's students sit on the Lighthouse Center's boat ramp and chop, saw, and slice the bait fish into "bunker." Stuffed into plastic, lidded bottles with holes punched through the sides, the bunker lures diamondbacks into hoop nets anchored at a scattering of study sites.

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We think of turtles as awkward and slow. Not diamondbacks. They pursue snails, crabs, shrimp, even fish, and feed so aggressively they've been described as "ram feeders." Upon sighting prey, the terrapins launch themselves with powerful breaststrokes to snap up their meal. Such vigorous feeding helps Avery's team find the terrapins they study.

Unfortunately, active foraging also leads diamondbacks into submerged crab pots. Along with habitat loss, crab pots threaten diamondbacks throughout their range from Cape Cod to the Texas Gulf Coast. Crab pot openings are sized for blue crabs, but admit juvenile and mature male diamondbacks. Most female diamondbacks are too big to slip through. One biologist has calculated that in New Jersey alone, 177,480 terrapins are expected to drown in crab pots during a single season.

Losses of males have tilted the sex ratio of diamondbacks toward females, an imbalance that threatens the long-term viability of many populations. In the short run, however, females keep the species going with an intriguing strategy: They store sperm. In the absence of males, females can fertilize eggs using sperm cached for up to four years. Within the 18-egg clutch Jon counted, more than one male's genes may have been passed on to new generations.

The diamondback terrapin is a model species for studying human impacts on New Jersey's Barnegat Bay ecosystem and its wildlife. Students (above) prepare frozen bait fish to produce the "bunker" that will lure terrapins into nets so they can record their sex, age, and other parameters.

Already the Avery study has turned up some surprises. For example, it was believed that diamondbacks stay within well-defined ranges for their daily needs. But in 2007, graduate student Jacqueline Walters used radio-telemetry for the first time to track Barnegat's diamondbacks. She discovered that lady terrapins make moves that contradict conventional wisdom.

When Walters tracked her first radio-tagged diamondback, the gravid female (one with eggs) "took off across the bay and swam four miles for three and a half hours." Although Walters tried all summer to find her again, the lady never reappeared. By summer's end, all the tagged females had traveled far beyond their home ranges, and gravid females ventured the farthest. In contrast, Walters noticed the males acting like

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Terrapin eggs (left) are buried in fenced-in areas to protect them from raccoons, skunks, and other predators. Forty-five to 105 days later, when the inch-long hatchlings emerge, the research team will release them close to the water's edge. Around Barnegat Bay, the diamondback terrapin sustains more than 90 percent nest and hatchling loss each year.

"grass potatoes," always remaining close to where they were first trapped. "I had one male," says an amused Walters, "that stayed around the same ditch all summer!"

Walters thinks the differing movement patterns reflect the sexual dimorphism of the species. The size difference between female and male diamondbacks is the greatest of all North American turtle species. The females may be foraging far and wide to meet greater energy needs. But Walters also wonders, "What's their strategy for nesting that makes them look so far away?"

Claire Coleman has taken on the role of midwife to Barnegat's diamondbacks, and she offers some insight into the fussiness of nesting females. "When the females come up, what you first see them do is swipe the ground with their front limbs so the dust and dirt flies in their face. We don't know why. Are they testing the soil to see how soft it is, or are they smelling something?"

Deciphering these puzzles could mean the difference between a continuing presence or the extirpation of diamondbacks from the bay. In 2006, the Avery study uncovered a 95 percent terrapin nest mortality rate, a statistic Coleman is working long hours to reverse.

A red cabin at the center serves as a terrapin maternity ward. When field teams return with captured females, Coleman gently probes the inguinal area of their hind limbs to check for eggs. If she's unsure whether the eggs are shelled, she'll use the x-ray. When satisfied the eggs are ready to drop, she injects the mamas with oxytocin, a drug that mimics the animal's own hormones.

Underfoot between lab tables sit several buckets. Each holds a terrapin treading water and now and again dropping a small pinkish egg. Coleman, who at this point in the "nesting" process sleeps only in short snatches, plucks out the eggs to prevent them from being mashed. Gathering each female's 12 to 18 egg clutch, the doctoral student buries the eggs on the center's grounds. Around each nest she erects a wire cage, which she reinforces with a second, more tightly woven wire mesh when the quarter-sized hatchlings begin to emerge. The first cage protects the nest from being dug up by rats or raccoons. The second layer allows Coleman to collect the hatchlings before they can scuttle down to the bay's murky waters.

Taking tissue samples from hatchlings and adults, Coleman extracts their DNA to create a genetic database of Barnegat's diamondbacks. Over time, her database will help researchers look for correlations between genetic changes appearing in the terrapins and environmental conditions in the bay.

Coleman and her colleagues see diamondbacks as more than objects of study. Walters was frustrated when she talked of the tagged terrapins she finds dead, possible victims of crab pots. And on the morning after Jon's surprising egg count, graduate student Karen Sullam smiled brightly through her mosquito netting as she brought to shore that day's first terrapin, a female.

Sunlight glinted from the diamond-shaped plates of the lady's carapace (top shell). She stretched her neck, showing off paisley swirls and, along her upper jaw, black dashes—like a natty moustache. Then the lady looked around with an attitude of pure "turtleness," suggesting "If I just soldier on, all will be well." With Avery's team and volunteers helping, perhaps she's right.

Throughout the 1980s and '90s, Dan Risch wrote environmental and natural resource laws for Kentucky. Upon his retirement, he was named a wildlife steward for the state.