

Diamondbacks Aren't Forever

These diamondbacks aren't the poisonous rattlers feared by hunters and hikers. They're terrapins, once so desired for stew that their numbers dropped dangerously low.

by Tony Tucker

illustration by John Sill

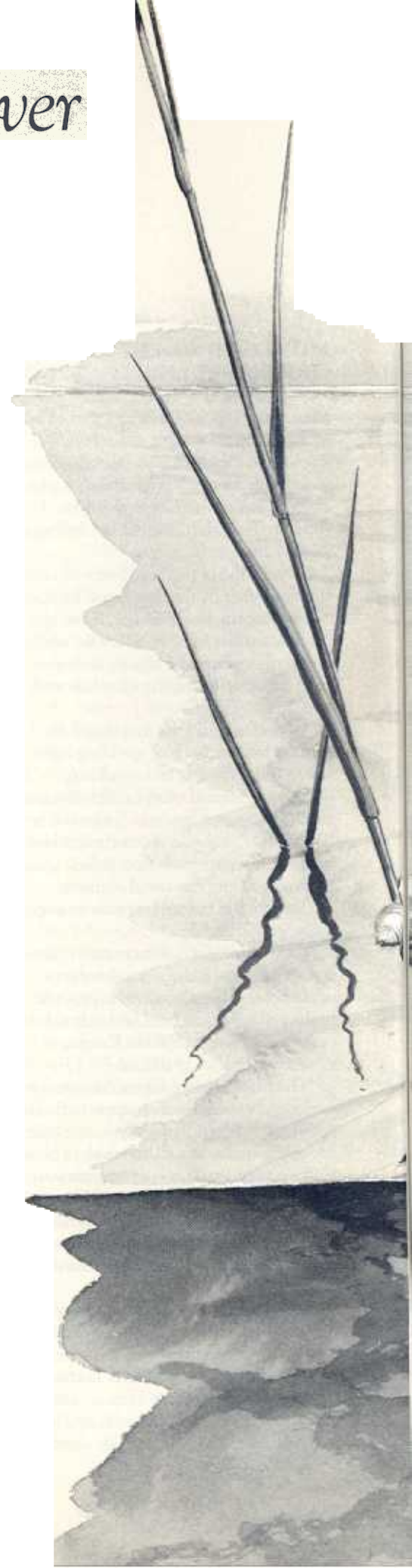
D*ark and triangular*, a thumb-sized head bobs at the sun-glared surface of the saltmarsh creek. Seconds later only concentric circles remain to mark the presence of a diamondback terrapin. Whit Gibbons and his Savannah River Ecology Laboratory research team know it's easy to see the little turtles at water level, but difficult to capture them while struggling to pull a seine through the murky marsh.

Though many would find the muddy and difficult task an unpleasant chore, it's the type of field work that Dr. Gibbons loves. The saltmarsh habitat of these unique and poorly studied turtles changes dramatically with every high and low tide and makes a wonderful outdoor lab for terrapin research.

Gibbons, a professor of ecology with the University of Georgia, has been studying this particular population of terrapins on Kiawah Island since 1982. A decade earlier, he and Julian Harrison, of the College of Charleston, first inventoried the island's reptiles and amphibians. Earthwatch volunteers have assisted the study since 1990, and their input more than doubled the number of turtles captured and tracked. To date, more than 1,600 terrapins have been caught on the annual trips to mark and recapture terrapins.

Historical interest in terrapins predates Gibbons' contemporary study by some two centuries, but this was hardly scientific curiosity. During the colonial period, the small turtles were so plentiful and tasty that they were sold for eating by the barrelful. In the early 1800s, they were common enough to even be used to fatten pigs. But by 1900, the terrapin's popularity in the culinary world began to threaten its very survival.

Lavishly prepared terrapin stew was so desired that wild populations dwindled. Their scarcity drove prices to \$125 a dozen by 1920 (for a creature less than ten inches long!), and attempts were made to farm terrapins commercially to meet the demand. Little wonder that Roger Conant, in his Peterson field guide volume on reptiles and amphibians, termed it the "most celebrated of American turtles." When the popularity of terrapin stew finally waned during World War II, the turtle populations began to recover. Yet nowhere over their range, from New England to the Gulf States, have they rebounded to historic levels of abundance.





Tommy

During the heyday of the commercial harvest, certain facts of terrapin biology seem to have been overlooked. At four years of age, males and females are the same size, about four inches long, but the males never grow much bigger. The females continue growing, usually to become 1.5 times larger, and sometimes up to nine inches by the time they reach maturity at seven years. In the commercial market, larger terrapins fetched a higher price, thus concentrating the harvest on big animals. As a result, a huge proportion of the reproductive females were killed. Little wonder terrapin populations were slow to recover.

Information about the current status of populations in most Atlantic and Gulf states is sketchy, but all states except South Carolina and Georgia now consider terrapins a threatened species. Gibbons muses, "It's sobering to think that most of what we know today about terrapins in South Carolina is limited to an area of salt marsh we can see from a single dock."

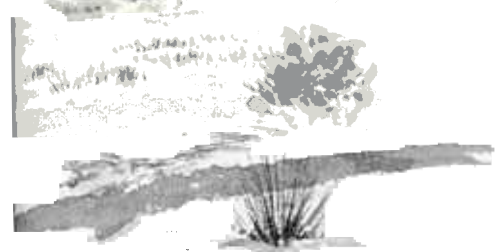
Each year Gibbons and his helpers net many of the same terrapins. Once untangled from the seine, they are sorted by size and sex and placed in pillowcases for the short boat ride back to a field laboratory. The captives are kept temporarily in holding bins until they can be examined. Toweled clean, then carefully measured with large calipers and a metric ruler, each terrapin is assigned a unique identification code by filing notches into the edge of its shell. Every ID is checked by reading the small notches and comparing against a computer printout of previous capture records. Researchers always release the terrapins in the same drainages where they were caught so that movements can be traced.

By day's end, a layer of crushed shells and crab claws covers the bottom of each holding bin, evidence of the foods consumed in the wild. The broken fragments are rinsed, sieved and sorted carefully to help determine the animals' food. For both sexes, periwinkle snails compose the majority of the diet. However, subtle dietary differences exist between the genders. Females develop larger heads and bodies, allowing them to consume bigger periwinkles and a wider diversity of prey (more mud crabs, fiddler crabs, barnacles, small blue crabs and small clams).

Nancy FitzSimmons, another Savannah River Ecology Lab researcher, followed feeding terrapins via radio telemetry in 1992 to obtain more information on their use of habitat. Her Kiawah studies measured shifts in terrapin feeding patterns between spring and neap tides, a finding dubbed the "six foot tide" hypothesis. The idea suggests that spring tides greater than six feet are high enough to inundate the marsh and allow terrapins access to snails that live farther from the creek drainage. Moderate tides less than six feet don't sufficiently bring up the water level to allow terrapins to paddle about and graze on snails. Spring tides provide a bountiful feast for terrapins in comparison to the leaner rations available during the neap tides. This may be particularly important for the females that feed on large snails, which appear to concentrate in scattered patches. The smaller snails preferred by male terrapins are dispersed rather widely.

The tidal marsh provides more than just the food sought by terrapins. High ground near the marsh is needed for the turtles' nesting. Sparsely vegetated sand dunes are favored, while isolated marsh islands and island causeways also allow high ground for nesting.





Diamondback terrapins, the only turtles in North America whose habitat is restricted to the salt marsh and brackish waters, seldom venture into fresh water or open ocean. Other species of turtles rarely occur in the terrapins' habitat. Nesting areas — high ground on marsh islands, coastal dunes or road embankments — may be more than a mile from a female's aquatic home.

Unfortunately, when ancient instincts direct the females to search for appropriate nesting areas, traveling to high ground sometimes means traversing roadways, often resulting in the death of adult females. Turtle crossing signs are now posted each spring on the long causeway to Tybee Island, Georgia, and other well-traveled routes to remind motorists of the vulnerable, slow-moving females.

Tim Zimmerman, a College of Charleston graduate student, spent two summers following terrapin tracks to locate nests and determine nesting success. He walked along the beach to look for the faint tracks left in the sand by claws and tail drag. However, hungry raccoons, also on the lookout for nests, often beat Zimmerman to the prize. More than half the nests he encountered contained only the munched remains of eggs plundered by raccoons.

Females generally emerge at high tide to dig a flask-shaped nest in the sand with their hind feet. The average clutch contains eight pinkish-white, leathery eggs, with maximum production achieved when a female is about twenty-five years old. Eggs take about fifty-five days to incubate, during which time temperature plays an important role in the hatchlings' development. Like most other turtles, terrapins exhibit a phenomenon known as temperature-dependent sexual determination. The temperature of the eggs during the middle third of incubation determines the sex of the hatchlings—warmer temperatures yield more females, and cooler temperatures result in more males. Thermal variation among nesting sites provides a population with both sexes, generally in equal numbers over time.

That's why the unexpected ratio of adult males to adult females (known as the sex ratio) has intrigued scientists studying Kiawah's terrapins. Gibbons and Jeff Lovich, a former graduate student, were surprised by the abundance of male turtles, since they found twice as many males as females. Classic population theories would predict an approximately equal number of adult males to adult females.

After convincing themselves that there was no capture imbalance, Lovich and Gibbons postulated that the most probable explanation is provided by the difference in age at maturity between the sexes. If all other things are equal, including mortality, the gender that reaches sexual maturity earliest should be the one that predominates, in this case, the males. Males mature sexually at about four years, females much later, at about seven years.

The findings concerning terrapin biology are not limited to the theoretical. Numerous conservation questions concerning population trends and habitat use have been posed as well. Diamondback terrapins apparently maintain strong ties to a given tidal creek; individuals are nearly always recaptured near the point of their original capture. Yet a small waterway originally named Terrapin Creek, for the large numbers captured there, has lost most of its inhabitants over the years. Some turned up in neighboring tributaries; others simply vanished. Why and where did they go? Although we have yet to determine a clear cause (or causes) so far, we know the exodus occurred during 1989 to 1990.

This mystery is almost as puzzling as our main poser: Where do young terrapins live?

Little terrapins are very rarely seen in the vast expanses of salt marsh. Two- or three-year-olds are virtually unknown from any population throughout the turtle's

Diamondback terrapin, *Malaclemys terrapin*



Description: Medium-sized turtles reaching a maximum length of about 9 inches. Males considerably smaller than females, seldom attaining lengths of more than 5 inches. Shell is generally grey, brownish, or olive, but may also be black. Lighter-colored individuals often have shells patterned with contrasting dark and light concentric rings in each scute. Head and legs range from light to dark grey with darker spots and flecks that can be highly variable among individuals. Females have distinctively larger heads than males. Generally docile, but some will bite when handled.

Food: Carnivorous, with occasional consumption of saltmarsh grass. Primary food items of South Carolina terrapins include marsh snails, fiddler crabs, blue crabs, marsh clams and barnacles. Other crustaceans and molluscs consumed when encountered. Terrapins will eat dead fish but are seldom able to capture them alive.

Habitat: Species ranges in coastal habitats from Cape Cod in Massachusetts to southern Texas. Although tidal creeks and embayments are the primary habitat of adults, juveniles less than 3 inches long are believed to remain in the heavily vegetated saltmarsh areas. Strictly aquatic with the exception of females that must come ashore to nest in the late spring and summer.

distributional range. Of over 1,600 animals caught at Kiawah, only one was a three-year-old. A sole mention of the whereabouts of young terrapins comes from Delaware where small terrapins were observed beneath the wrack of dead reeds pushed up by the tide.

Such areas might well serve as havens for the young turtles, as they provide shelter from predators or heat and a potential food source of small invertebrates. Small terrapins have such perfect camouflage beneath the wrack that we might overlook them even if they were at our feet. Do they truly wear this cloak of invisibility, or have we just not looked hard enough in the right place at the right time? Many basic facts about their natural history are yet to be discovered.

By contrast, the implications of obvious findings are sometimes slow to be recognized—and even slower to be acted on. For instance, research conducted as far back as the 1940s revealed that terrapins frequently drown in crab pots set out in tidal creeks and shallow waters. But not until the late 1970s did anyone acknowledge commercial crabbing's impact on terrapin populations.

According to a 1983 study by James Bishop of the S.C. Wildlife and Marine Resources Department's Marine Division, an estimated 176 terrapins per day drowned in crab pots placed in good turtle habitat in Charleston Harbor. Although fisheries statistics quoted by Bishop are now dated, and follow-up studies have not been performed, his findings provide a rough estimate of the potential toll in South Carolina waters. Multiply this by the number of crab pots fished in the entire United States and the cumulative impact is certainly significant.

Today, scientists hold a renewed concern that undocumented mortality in crab pots may be severely underestimated and a cause of sustained decline in terrapin populations. Biologists who monitor terrapin numbers in Florida, Louisiana and Texas all express anxieties about the perceived decline in local terrapin populations.

Roger Wood, of the Center for Wetlands Research in New Jersey, has developed a potential solution for excluding terrapins from crab pots that is similar in principle to the turtle excluder devices used in shrimp trawls. A simple insert, consisting of a 2½ by 5-inch rectangle bent from coat hanger wire, is fitted to each side tunnel on the pot. It obstructs entry by terrapins but allows even the bigger blue crabs to crawl inside.

Although the device has been tested only a single season, early results suggest that the modification effectively reduces the risk of terrapins entering the trap without decreasing the size or number of crabs caught. If Dr. Wood's terrapin excluder continues to yield promising results, it may one day be adopted as a standard design for commercial crab pots so that the hungry little bait-stealers do not find themselves imprisoned.

Conspicuous and abundant diamondback terrapin populations provide evidence of a healthy salt marsh, and their continued survival is a concern in which we all have a stake. Terrapin populations remain viable as long as they can continue to do what they do best: live long and prosper. To help them achieve the former, we should ensure that they do not drown accidentally in crab pots. To accomplish the latter, we can make provisions for nesting females while they are vulnerable on land. Turtle crossing signs and trap doors on crab traps may sound slightly ludicrous on first consideration, but they provide simple and effective methods to make sure that this celebrated turtle survives. 🐢

Tony Tucker is a former research technician at Savannah River Ecology Laboratory and is now in graduate study at the University of Queensland, Australia.

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CONTENTS

- 2 Biosphere 3 Books 4 Events
- 6 Natural History: Diamondback Terrapin 11 Readers' Forum
- 12 **Breaking Clay** by Rick Leonardi
Catching on fast and challenging even the experts, this shooting sport offers more variety and action than trap and skeet.
- 16 **Forestry's New Frontier** by Mike Livingston
How do you grow timber, nurture a galaxy of life forms, and nourish the human spirit—all on the same piece of ground?
- 24 **Backyard Biodegradation** by Joel M. Vance
This back yard looked like a jungle long before natural landscaping became the fashionable way to plant.
- 26 **All Visitors To A Stately Home** by Linda Renshaw
Now a state park, 250-year-old Hampton Plantation offers guests a sense of what the Lowcountry was like in its infancy.
- 38 **A Christmas Hunt** by Archibald Rutledge
South Carolina's most beloved outdoor writer reflects on holidays long past, when the deer drive surpassed in popularity the pudding and the mistletoe.
- 42 **Where The Ducks Are** by Bob Campbell
Southbound waterfowl favor "wintering complexes" of rich habitat, places not simply there by chance.
- 48 **Stories Around The Firepot** by Joe Hamilton
Leaping flames or dying embers bring out the philosopher and yarn-spinner in each of us.
- 50 **Field Trip: Peachtree Rock Preserve** 54 Roundtable 61 Index

The Cover by Robert Clark

Lauded in the writings of Archibald Rutledge, the Santee River delta still provides a winter haven for tens of thousands of migratory ducks. (See page 42.)

12



26



42



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