

# underwater naturalist



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*Harvesting cockles from the mangrove mud -- story starts on page 3.*

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Cover Photo: by Herb Segars

His son Tom diving with French angelfish in  
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## WHOOPING ERROR

The caption of the photograph on page 31, which accompanies the "Protecting Coastal Wetlands" article, contains an error. It would lead one to believe that Whooping Cranes nest in Nebraska. In fact, all the Whooping Cranes that winter at the Aransas National Wildlife Refuge nest in Wood Buffalo National Park located in the Northwest Territories and Alberta Canada.

John J. Collins  
Whitestone, NY

## BY THE SEA, BY THE SEA

While Bennett's Last Page column is supposed to be funny, his cataloguing of the McMansions arising along the coast of the U.S. is true and therefore sad. The North Carolina coast, which I have visited since I was a boy, is now crowded by huge houses. In many places the houses are cheek-by-jowl; there is little room for us weekend and off-season fishermen and beachcombers.

Somehow we are locked into a system that rewards the owners of "show off" houses at the shore. We pump sand onto their beaches, and we subsidize their flood insurance. I guess they like the shore but they don't like us.

Taylor Griswold  
Washington, DC

## WHO IS THAT MAN?

Who is this M Hawkins tagging (and often recapturing) all those black sea bass off the Maryland coast? And, are the data he is producing of any use to marine science?

Dale Murray  
Montauk, NY

*(Ed.: That's Captain Monty Hawkins; he runs the party boat "Morning Star" from Ocean City, Maryland, and, obviously, con-*

*centrates on bottom fishing. He has been a super active sea bass tagger for five years. A biologist from the National Marine Fisheries Service tells us that sea bass tagging is a priority for them now and the more tagged sea bass the better.)*

## CORRECTION

In Volume 26, Number 3, we listed the phone numbers for the office of the Northeast Region and the Jamaica Bay Guardian wrong -- the correct number for both is 718-318-9344, not 9334. For good measure, it should be noted that the same mistake was made in Vol. 26, No. 2.

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# The Fishery for Mangrove Cockles, Mexico to Peru

by JOSH GIBBONS



*A mangrove forest at-the water's edge.*

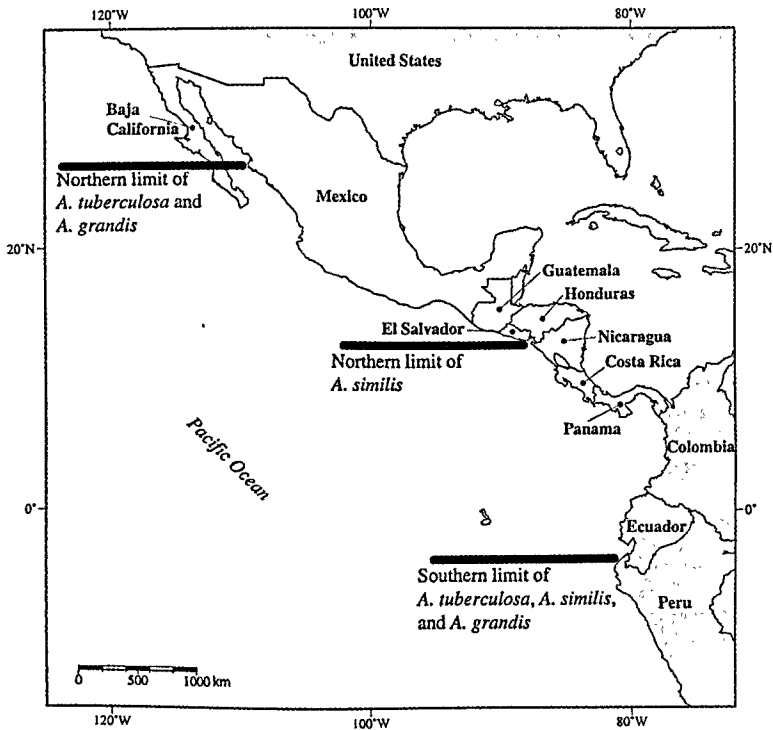
Mangrove cockles, also called ark shells, of the genus *Anadara*, are harvested for food by large numbers of artisanal fishermen in the Pacific Coast lagoons of 10 countries from Mexico through Central America to Peru, a range of about 4000 miles. They are by far the most important commercial mollusks along this coastline. The 10 countries, north to south, are Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Columbia, Ecuador, and Peru.

Over a period of four years (1998-2001), Clyde MacKenzie, a biologist at the Sandy Hook Marine Lab, made 10 trips there to study the fishery and the people who do the harvesting. What follows is a summary of MacKenzie's paper on the subject, an excellent study of the mangrove coasts, the fishermen, and their way of life in a large number of small coastal villages.

If the subject strikes your fancy, I can recommend the full paper. It's titled "The Josh Gibbons is a free lance writer, he lives in San Diego, CA.

Fisheries for Mangrove Cockles, *Anadara* spp., from Mexico to Peru, With Descriptions of Their Habitats and Biology, the Fishermen's Lives, and the Effects of Shrimp Farming." It appeared in the bulletin "Marine Fisheries Review" 63(1), 2001. You can get it from the bulletin's website or by writing MacKenzie for a reprint (Clyde L. MacKenzie Jr., J. J. Howard Marine Laboratory, NOAA/NMFS, Highlands, NJ 07732).

There are three commercially valuable species of cockles along this stretch of the Pacific coast, *A. tuberosa*, *A. similis*, and *A. grandis*, the first found in among mangrove roots, the second along mangrove edges, and the third on tidal flats farther from shore. For purposes of this summary, I will deal primarily with *tuberosa*, by far the most abundant of the three, and refer to it simply as a cockle except where noted. It is the smallest but most common of the three species. Similarly I will discuss in general terms the biology of the cockle, its fishery, its marketing, and the villages where cockle



Ranges of the three cockle species and the countries where they are harvested; the cockles are not harvested in the U.S.

fishermen live. MacKenzie deals in interesting detail with the relationship between the cockle resources and their habitats and the fishermen.

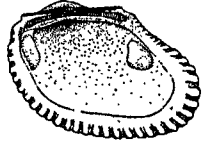
### The Cockle

Cockles are bivalves, their two shells of equal shape with 30 or so radial ribs. Commercial size is about two inches across the widest part. The two shells can lock tightly like a quahog or hard clam. The cockles described in MacKenzie's paper live about 6-12 inches in mud in between, around, or near mangrove roots in bays and estuaries of the Pacific coast. They are sexually mature at about one inch, well before they reach harvest size. They reproduce over a period of months and grow rapidly, ready for market within about six months after reaching maturity. They don't appear to suffer much predation

because of their habitat, between the thickly rooted mangroves or deep in the mud. The predominant mangrove habitat in this region is provided by the red mangrove, *Rhizophora mangle*.

### The Fishery

Cockles are harvested singly by hand. Fishermen (about half are women or children) walk or go by small boat to areas where they plan to fish. They can harvest cockles for about four hours at a stretch, from two hours before low tide until two hours after when water does not cover the flats. They wade across sticky mud to mangrove edges and then dig between the prop roots by bare or cloth-wrapped hand, harvesting by feel, keeping their catch in string bags or plastic buckets. It is onerous but not heavy lifting manual labor. The diggers get muddy, and there are biting



*Exterior and interior views of the valves of A. tuberculosa (from Mora Sanchez, 1990).*

insects around (which the fishermen fight with smoky bunches of coconut branches or the smoke from hand-rolled cigarettes, or cigars), but air temperatures are moderate under the mangrove canopy.

Fishermen usually go out in groups, often a family of mother and children (schools hours are sometimes changed so children can join their parents to fish the tides). If the cockle beds are a way off, fishermen go by boat, either long wooden canoes or small fiberglass boats called "pongos" with small outboard motors. They rent the boats or pay the boat owner, often with about 25 cockles per person. Fishermen go to different locations each day, leaving harvested sites alone for two to three weeks to allow cockle seed to grow.

After harvesting, the fishermen return to their boats, slosh the cockles in the water to wash off the mud, go back to their villages, set aside 12-24 cockles for home use, and take the rest of their catch to dealers in the village. The number of cockles harvested per day varies widely with location and season, from 30 to (in exceptional cases) 500 per fishermen per day. Fishermen get paid from \$.02 to \$.07 per cockle; the larger the cockle the better the price. In general, a cockle fisherman makes about \$1.50 a day. For a family of four fishermen, fishing seven days a week with good prices, that could mean \$30 a week, but days are lost to weather or when tides are wrong, so the rough average income of this family would be more like \$15 a week.

When MacKenzie gets farther south to

Ecuador and Peru, he addresses the impacts of shrimp farming on cockle fishing, primarily the destruction of mangrove swamps to make way for the farms. Shrimp farming developed rapidly in the 1980s and 1990s particularly in Ecuador where it is far more extensive than in any other country in the Americas. About 400,000 acres of coastal areas in Ecuador (30% former mangrove swamps) are now covered with shrimp ponds, which have taken cockle habitat directly out of production and altered water flow into the mangrove zones, reducing the growth and development of the mangroves. An acre of cockle habitat produces almost twice as much meat weight as an acre of shrimp pond; however, shrimp is much more



*A typical canoe used to transport cockle fishermen to their mangrove sites.*

valuable than cockle pound for pound and lends itself to mass production, much of it for export. Recently, shrimp farming has come under scrutiny in a number of these coastal countries as its impacts on wildlife habitat become better understood.

### **The Market**

Cockles can stay alive for 4-8 days without refrigeration if kept in the shade.



*This fisherman is working for cockles as the tide rises. Soon his fishing time will end till the next low tide.*



*In Honduras, bags of cockles ready to be picked up for transport to city markets.*





*Sidewalk cockle market in Mexico City.*

Dealers buy cockles from the fishermen, wait till they have a load, typically around 3000 cockles and then move them to market either in their own trucks or by bus. Their markup appears to be about 10-15%. They sell to distributors or directly to restaurants and retailers in larger inland towns, or in some cases, in large cities -- Tijuana, Mexico City, Tegucigalpa, Guatemala City, Managua, Guayaquil, and San Jose.

Cockles are opened by banging a nick in the outer edge of the shell and getting inside with a knife to cut the two adductor muscles, or by using a hinged, metal device that looks and works like a paper cutter. Cockles can be eaten raw right out of the shell, as seviche (uncooked, with lime juice and spices), baked, in soup, or steamed as is and mixed with rice. The blood of the cockle which is black is reserved when cockles are opened and can be used to flavor rice. Additionally, MacKenzie says that it is mixed with

liquor and spices for drinking as a tonic or libido enhancer.

### **The Fishing Villages**

MacKenzie believes in talking to people who fish for a living. This is evident in a book he wrote a few years ago titled "The Fishermen of Raritan Bay," a complete and colorful story of the Bay fishery for oysters, clams, and fish. For that book, MacKenzie interviewed generations of fishermen, read histories, and collected and published pictures that recall the boom times of the Bay fishery. In addition, he recorded hours of conversations with fishermen which he has collected and distributed on tape and disk.

He does much the same in this paper, recording and photographing as he moved up and down the coast, except that in this case, he is recording current events.

Acknowledging from the start that his mastery of the Spanish language was about nil, he was wise enough to take on a



*A pile of cockle shells indicates the size of the market.*

young history student, as interpreter.

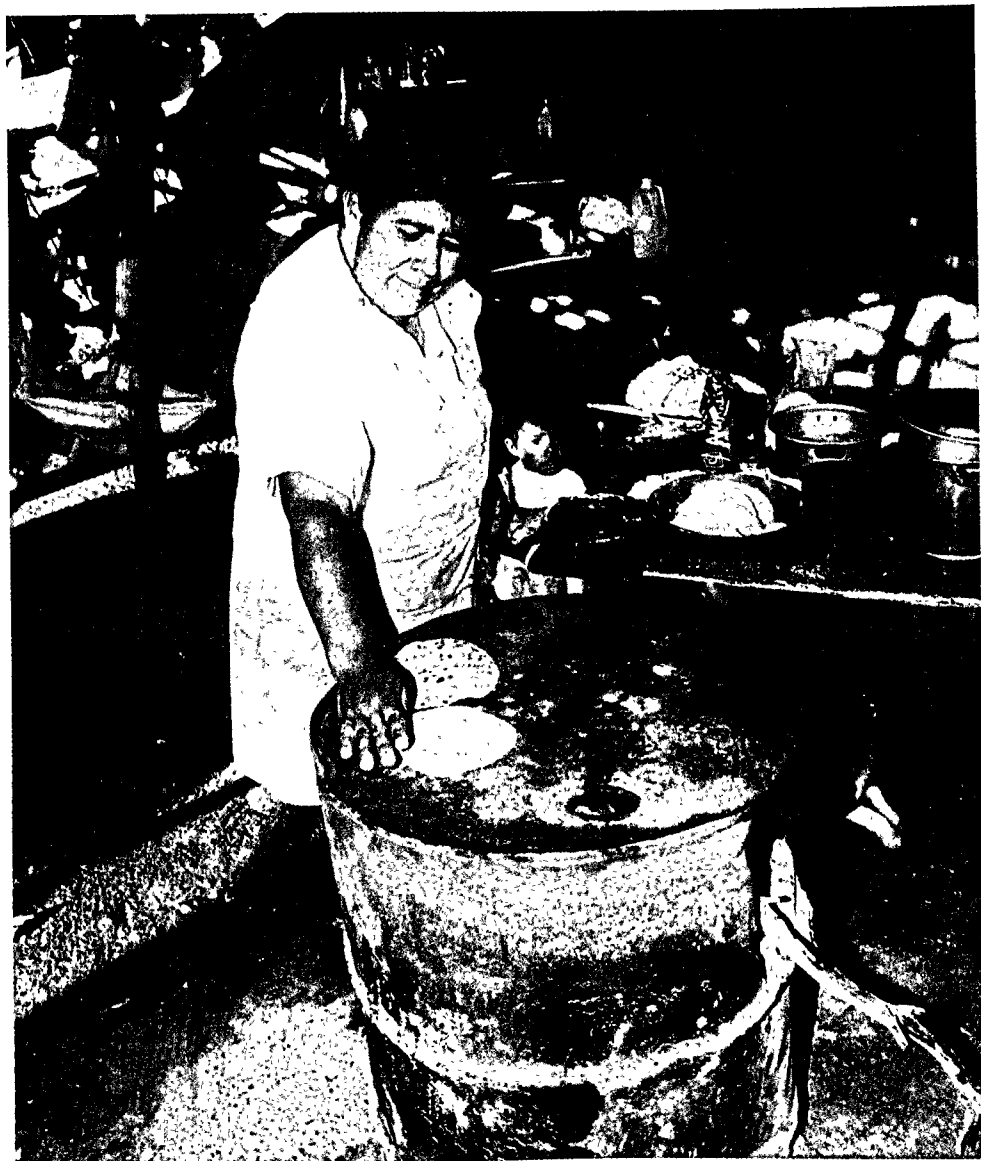
It is not possible to give more than a sketchy summary of the sections of MacKenzie's paper that he calls the "Physical Setting and Human Life in the Cockle Fishing Villages." Here's how he describes his goals: "This section describes the lives of the fishermen who harvest mangrove cockles from Mexico to Peru, but with particular emphasis on villages around the Golfo de Fonseca (El Salvador and Honduras) surveyed in April, June, and September, 2000, and January 2001, after the fisheries in the other countries had been studied...The main aspects covered were settings of the villages, economics, types of dwellings, personal possessions, water sources, marital unions and family size, social life, schooling, medical and social care, and longevity."

Cockle fishing is true subsistence fishing. It is estimated that there are 15,000 fishermen; their average household wage is around \$2 a day. Most of this money is used to buy a meagre ration of food, predominantly rice and beans. This diet is augmented by locally caught fish; additionally, villages raise chickens and pigs.

Most of the cockle villages are close to the sea at elevations of 10 feet or less. The climate is regular -- roughly 80° degrees throughout the year, often humid, with



*Three cockles = 27 cents to the fisherman. From the size, these appear to be *A. grandis*.*



*Cooking tortillas on top of a recycled 55-gallon drum is a basic technique all along the Central American coast.*

some heavy rains during rainy season. The surroundings are verdant and attractive when it rains, but otherwise brown and dusty. Houses are made of concrete or wood (usually sapling trunks), with plastic, thatch, or corrugated steel roofs, dirt or concrete floors, one to three rooms, including a cooking area with a sand floor,

though cooking (with sticks as fuel) is often done outdoors but under cover. Cooking stoves can be made of dried mud on an abandoned 55-gallon drum on its end. If the house is wired, there is one bare light bulb, a small radio, and sometimes television. Electric rates can be as little as a dollar a month. Water is from



*Opening cockles with a paper cutter-like device.*

village wells, five cents a bucket. There are no toilet facilities.

Families are usually extended so that children, parents, and grandparents are close; in most cases, few ever leave the cockle fishing villages to live elsewhere. There are only dirt roads between the villages and the interior -- often the first paved road is 25 miles inland. No villagers own cars; some have bikes; there is lots of walking. If I read him right, MacKenzie's view is that the hundreds of villagers he met are poor but not poverty stricken, living under conditions that are primitive but not deadly, struggling but better off than those who go to or are forced into the downside of urban life where wages may be earned by less independently with less satisfying labor.

MacKenzie ends his paper with suggested research: an analysis of predation on juvenile cockles, ecological interactions between cockles and mangroves, the sizes of spawning cockles in mangrove areas too thickly rooted to be harvested, and the impacts of shrimp farming on cockle habitat.

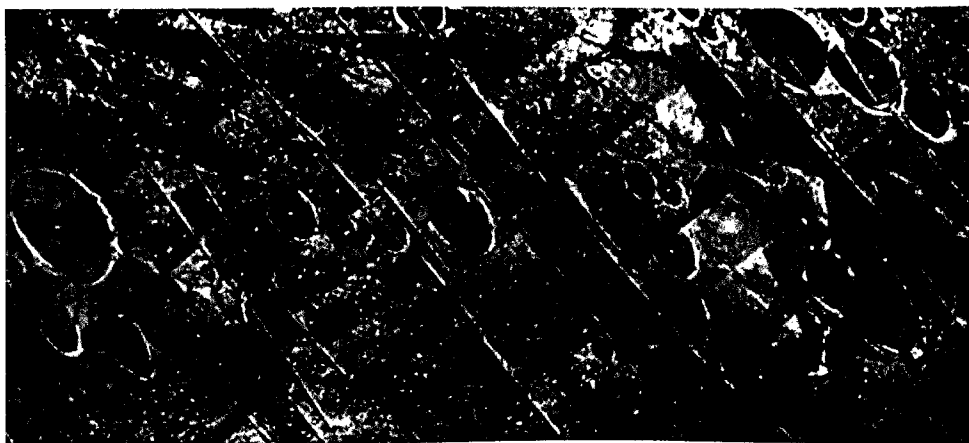
He concludes by writing that "The cockles in all countries, except Mexico,

are under heavy harvesting pressure, in part because cockle harvesting is the only remunerative work available to many villagers. Thus far, the cockle stocks are not being depleted because cockles are harvested at sizes at which they have already spawned, stocks of mature cockles everywhere lie within dense mangrove stands which are difficult or impossible for fishermen to reach, and hand harvesting does not kill juveniles or adversely affect the cockle habitat." He believes that preservation and restoration of mangrove swamps appear to be the best ways to assure the health of cockle stocks.

As I read through MacKenzie's work I couldn't help but compare the cockle fishery on the Pacific coast of the Americas to fisheries almost everywhere. As long as habitat is protected, harvest is limited to species that have had at least one season of spawning, and, maybe most importantly, the fishery is limited to low impact efforts by subsistence fishermen, the species can hold its own. It's when fisheries get big, mechanized, and capital intensive that the fish and shellfish and their habitats begin to show signs of wear and tear.

# Disappearing Wetlands

By Dave Grant



*Cotton Patch Bay (far left), the largest of the Carolina bays in this 1930's South Carolina photo from Fairchild Aerial Surveys, is over a mile long.*

"Should they encounter wetlands, they must urgently proceed through them and quickly depart...defeat is certain."

Li Ching (100 Lessons in the Art of War)

Once, while exploring the back roads of Delaware with some educators, I asked about lakes, and received, what seemed at the time, an odd reply: "No such thing here! We only have whale wallows." I had the same dumb look on my face years later in southern New Jersey when I was introduced to similar ephemeral wetlands, known locally as sponges and pingos. These are peculiar, semi-aquatic depressions that are found in the New Jersey Pine Barrens and are unique to the Atlantic Coastal Plain.

Presumably most once were ponds, but as is the nature of wetlands, they have

*Dave Grant is the chief naturalist for the Society and director of Brookdale Community College's Ocean Institute. He took all the photographs except the aerial on this page.*

gradually filled in with organic material. Now they are typically shrubby wetlands encircled by plants familiar to most of us, like high-bush blueberry and sheep laurel, and sometimes supporting some unfamiliar and globally-rare species of grasses, sedges and even orchids. Pleistocene glaciers and Arctic conditions crept south to the edge of what is now the Pine Barrens, and these vernal pools are thought to have formed from wind blowouts or as the geologist would describe them, periglacial thaw basins.

At least that's the theory. Farther south, similar wetlands are called bays, Carolina bays, or in Delaware, Delmarva bays, to illustrate their distinctiveness in different regions. If you enjoy wetlands, word origins and weirdness, then Carolina bays are right up your alley.

Few wetland terms are uniform in the U.S. or elsewhere and they tend to acquire local labels. For example, in his research, the eminent Dr. Waxman of Rutgers University, uncovered 90 English terms for what he called peatlands. (Which

some authors today would like to simply lump altogether as moors.). Researching the literature on wetlands is almost as entertaining as going out and exploring them.

Spread almost a thousand miles along the coastal plain from New Jersey to the Carolinas, where they were first studied, there may be close to a half-million of these peculiar potholes. The term bay, like many ecological emblems, comes from their distinctive vegetation. In the bays of the Carolinas, you can expect to find these low spots dominated by evergreens like the loblolly pine and the red bay, a laurel. At their northern limits in the Middle Atlantic, they tend to support deciduous facultative wetland trees like sweet gum, tupelo, red maple, and our reluctantly-deciduous magnolia, the sweet bay.

Carolina or Delmarva bays (Or whale wallows, pocosins, coastal plains ponds, or whatever the locals call them) are certainly puzzling. Most are less than an acre in size, elliptical in shape, oriented southeast-to-northwest, and often have a sandy berm on the southeast side. Another feature they share is an alarming concentration of threatened plants and animals that rely on these isolated wetlands for the



*A green frog on his home (wet) turf.*

most critical stage in their life cycle, reproduction.

Unintentionally, I stumbled upon one many years ago on a warm September afternoon while searching for some cypress woods. The place defined the term "frog-pond" for me. I have yet to see another such congress of amphibians - a veritable plague of frogs, shoulder-to-shoulder and plopping into the water like synchronized swimmers in some Esther Williams movie of the 1930's.

Most ephemeral wetlands and ponds like these bays are sensitive areas harboring susceptible species with strict habitat requirements - amphibians and invertebrates that need to raise young away from fishes, and plants with an intolerance of habitat alteration and an inability to compete with many invasive or alien species.

Speaking of aliens, there is no shortage of theories about the origin of bays over 10,000 years ago; and one of many is extraterrestrial -- a massive meteor shower or exploding comet. Other speculation includes: Ice Age wind scouring or frost heaving; depressions formed by artesian springs; "subterranean forces" (whatever that means); basin-to-bay-to-stream drainage cycles (A geomorphic cycle of formation that Lorraine Fleming describes as the geologist's water table-sinkhole-lacustrine-aeolian theory); excavation by schools of spawning fishes or tidal action during periods of raised sea level; stranded icebergs; and of course my favorite, the wallowing of whales.

This year, we finally found an occasion to venture out on my quest for some answers about whale wallows. Maps, local advice and an eye for plants that prefer wet areas, are essential for finding these sites, so I contacted my naturalist friends at the Delaware Nature Society (The same culprits who first befuddled me about whale wallows) and the Delaware Natural Heritage Program, which keeps an eye on these delicate places. All were very helpful and proud of their state's wetland treasures.



*Surviving lake-pond-whale wallow in Delaware.*

First the bad news: Two thirds of the 1,500 sites in Delaware have been altered or destroyed by human activities. Many exist on private property and farmers cut the valuable timber or filled many of these low areas in their fields. Development and changing water quality also take a toll, especially on the invertebrates, salamanders and frogs that rely on these isolated wetlands. The good news is, there are a number of preserved sites on public lands, and they are identified on maps.

Most of these damp depressions on the landscape are in the western part of the state near the New Castle and Kent counties border, but the largest, 10-acre Huckleberry Swamp, is in Sussex County to the south. It is a giant in Delaware, but a dwarf compared to thousand-acre bays in the Carolinas.

If you wish to explore Delaware's freshwater (palustrine) wetland environments, naturalists direct you to Lums Pond State Park along the Chesapeake and Delaware Canal, which is designated for public access. A pond here called the whale wallow has a boardwalk and interpretive signs, and this is a great place to start.

"South of the Canal" -- as they say in Delaware (The rural part of the state -- at least until the next real estate boom.), we

headed for Blackbird State Forest, a managed forest of planted pines and noteworthy stands of oak, beech and hickory. It is also the site of the Tyabout Tract, and one of the better known Carolina bays (which, as you head south, are also known colloquially as round ponds, black bottoms, loblollies and sinkholes).

It's a great place to get lost in the woods and that's exactly what we did searching the trails for these enigmatic wetlands. This was a drought year, but with a little detective work, we followed some botanical clues to wetland soils: princess or ground pine (*Lycopodium*), red maple, pepperbush, sweet bay, cattails, rushes and possum-apple. Because few plants are tolerant of fluctuating water levels, a fringe of rugged buttonbush surrounding an herbaceous central area is a good indicator of the high-water mark of these types of wetlands during the wet periods. Also, it is not unusual to find wind-throws and standing dead trees near wetlands, and fittingly, we could hear the distinctive hoarse broadcasts of a red-bellied woodpecker staking out its claim among them.

Since the campground was empty and we were visiting after the hunting season (Another activity encouraged in this multiple-use area and testimony to the

wildlife value of these spots), we had the whole 6400 acres to ourselves. The quiet forest was alive with the soft yank-yank call of white-breasted nuthatches; surprisingly, the most abundant forest bird this day.

Heading back through the dry upland forest we discovered two more gems. Searching for insects in the deep furrows of the shagbarks that it also relies on for a nest site, we were delighted to spot our first brown creeper of the year. And high overhead, on the topmost branches of a tall oak, a growth of mistletoe -- the perfect finale to our mid-winter hike.

Delaware is not a large state, but winter days are short, and following directions that a colleague provided to another intriguing site, we raced back north searching for one last bay that was reported years ago as "threatened." We sped through the town of Blackbird and the great wintering flocks of crackles, cowbirds, starlings and red-wings demonstrating their graceful afternoon murmurations across the farmlands, with barely enough time to tap the brakes at Bailey's Seafood Store ("Whole muskrat - \$2.95") before crossing over the canal and heading North towards Wilmington.

Working our way down the Old Baltimore Pike near the Maryland border, we followed our primitive map (With warnings regarding "the rapid development of the general area") to what turned out to be (no surprise here) a new housing development. Here we hoped to find a place described as an ancient watering hole, said to be frequented in prehistoric times by Indians and the game they hunted.

Confident that we were becoming world-authorities on bays and all types of wetlands, we entered the development, managing to drive right past our objective and several other ephemeral wetlands without noticing them. Our oversight illustrates the problem of identifying and protecting these small, isolated wetlands.

It's a pleasant community, built along

serpentine streets with names like Preakness Run and Thunder Gulch, that predictably, have nothing to do with the site's history or geography. However it was soon apparent that they weave their way around many isolated wetlands. The immaculate green lawns reminded me of golf fairways mown right up to a curving, wetland "rough."

We were a little disappointed, although not surprised in this region of rapid growth; but we elected to explore it anyway because, after all, it has wetlands. With the helpful advice of some residents (who just happened to have their wetlands delineation survey map handy), we marched into this suburban wilderness; a half acre cul-de-sac of a swamp, right across their street.

All wetlands are interesting and important, and despite being encircled by this All-American suburban street, the inroads of a playground, gazebo and the requisite plush carpet of wood chips (The homeowner's final foray against soggy soil), this remains a neat wet forest. It's dominated by tupelo, sweet gum, oak and red maple and there is also the predictable under-story of blueberry, pepperbush, and holly helping to isolate the open water area and patches of bulrush. We were jealous. If you have to live in Suburbia, what could be better than viewing a wetland from your front porch?

I asked our new friends whether this was the local Carolina bay, and although coincidentally, she had visited one on a geology field trip in college, neither was aware of one locally.

I used the occasion to ask a few more questions to gauge the wellbeing of the place. "The Mosquito Commission takes care of the site." (That's not always good news.) "We like it. The wetlands prevent others from building behind us." (Justice William Douglas once defined an environmentalist as: "The last person to move into town." That's a given.) "The soil stays wet, even in a dry year like this." (That's cer-





*Skunk Cabbage, a distinctive wetlands plant and a sure sign of spring.*

tainly not bad news for amphibians and other wetland-dependent creatures.)

The homes are sewered, but regrettably, I forgot to ask if they had basements; although they appeared to be on slabs. (A wetlands specialist once pointed to a development where a similar palustrine forest was being urbanized in Pennsylvania and told me: "Those homeowners will now have a life-long hobby trying to keep their basements dry.")

Apprehensively, I asked the fateful question... "Do you hear treefrogs calling in the spring?" Blank stares... Quickly our expedition degenerates down to this: We're standing with complete strangers on an unfamiliar street off Dixie Road in Delaware; suffering through quips about the Mason-Dixon Line ("It's what separates y'all from youse!")... imitating frog calls...

"A harsh, duck-like clacking? " (This should be a given since the Wood Frog

ranges farther north than any other North American reptile or amphibian.)

*"Definitely not."*

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*"This woodland gnome starts its lonely, lovely trill as the sun lowers and evening  
"A banjo-like twang?" (The Green frog is ubiquitous in swamps and streams.) "Oh yes!"*

*"High pitched peeps - jingling sleigh bells?" (Spring Peepers seem to be the*

some authors today would like to simply lump altogether as moors.). Researching the literature on wetlands is almost as entertaining as going out and exploring them.

Spread almost a thousand miles along the coastal plain from New Jersey to the Carolinas, where they were first studied, there may be close to a half-million of these peculiar potholes. The term bay, like many ecological emblems, comes from their distinctive vegetation. In the bays of the Carolinas, you can expect to find these low spots dominated by evergreens like the loblolly pine and the red bay, a laurel. At their northern limits in the Middle Atlantic, they tend to support deciduous facultative wetland trees like sweet gum, tupelo, red maple, and our reluctantly-deciduous magnolia, the sweet bay.

Carolina or Delmarva bays (Or whale wallows, pocosins, coastal plains ponds, or whatever the locals call them) are certainly puzzling. Most are less than an acre in size, elliptical in shape, oriented southeast-to-northwest, and often have a sandy berm on the southeast side. Another feature they share is an alarming concentration of threatened plants and animals that rely on these isolated wetlands for the



*A green frog on his home (wet) turf.*

most critical stage in their life cycle, reproduction.

Unintentionally, I stumbled upon one many years ago on a warm September afternoon while searching for some cypress woods. The place defined the term "frog-pond" for me. I have yet to see another such congress of amphibians - a veritable plague of frogs, shoulder-to-shoulder and plopping into the water like synchronized swimmers in some Esther Williams movie of the 1930's.

Most ephemeral wetlands and ponds like these bays are sensitive areas harboring susceptible species with strict habitat requirements - amphibians and invertebrates that need to raise young away from fishes, and plants with an intolerance of habitat alteration and an inability to compete with many invasive or alien species.

Speaking of aliens, there is no shortage of theories about the origin of bays over 10,000 years ago; and one of many is extraterrestrial -- a massive meteor shower or exploding comet. Other speculation includes: Ice Age wind scouring or frost heaving; depressions formed by artesian springs; "subterranean forces" (whatever that means); basin-to-bay-to-stream drainage cycles (A geomorphic cycle of formation that Lorraine Fleming describes as the geologist's water table-sinkhole-lacustrine-aeolian theory); excavation by schools of spawning fishes or tidal action during periods of raised sea level; stranded icebergs; and of course my favorite, the wallowing of whales.

This year, we finally found an occasion to venture out on my quest for some answers about whale wallows. Maps, local advice and an eye for plants that prefer wet areas, are essential for finding these sites, so I contacted my naturalist friends at the Delaware Nature Society (The same culprits who first befuddled me about whale wallows) and the Delaware Natural Heritage Program, which keeps an eye on these delicate places. All were very helpful and proud of their state's wetland treasures.



*Surviving lake-pond-whale wallow in Delaware.*

First the bad news: Two thirds of the 1,500 sites in Delaware have been altered or destroyed by human activities. Many exist on private property and farmers cut the valuable timber or filled many of these low areas in their fields. Development and changing water quality also take a toll, especially on the invertebrates, salamanders and frogs that rely on these isolated wetlands. The good news is, there are a number of preserved sites on public lands, and they are identified on maps.

Most of these damp depressions on the landscape are in the western part of the state near the New Castle and Kent counties border, but the largest, 10-acre Huckleberry Swamp, is in Sussex County to the south. It is a giant in Delaware, but a dwarf compared to thousand-acre bays in the Carolinas.

If you wish to explore Delaware's freshwater (palustrine) wetland environments, naturalists direct you to Lums Pond State Park along the Chesapeake and Delaware Canal, which is designated for public access. A pond here called the whale wallow has a boardwalk and interpretive signs, and this is a great place to start.

"South of the Canal" -- as they say in Delaware (The rural part of the state -- at least until the next real estate boom.), we

headed for Blackbird State Forest, a managed forest of planted pines and noteworthy stands of oak, beech and hickory. It is also the site of the Tyabout Tract, and one of the better known Carolina bays (which, as you head south, are also known colloquially as round ponds, black bottoms, loblollies and sinkholes).

It's a great place to get lost in the woods and that's exactly what we did searching the trails for these enigmatic wetlands. This was a drought year, but with a little detective work, we followed some botanical clues to wetland soils: princess or ground pine (*Lycopodium*), red maple, pepperbush, sweet bay, cattails, rushes and possum-apple. Because few plants are tolerant of fluctuating water levels, a fringe of rugged buttonbush surrounding an herbaceous central area is a good indicator of the high-water mark of these types of wetlands during the wet periods. Also, it is not unusual to find wind-throws and standing dead trees near wetlands, and fittingly, we could hear the distinctive hoarse broadcasts of a red-bellied woodpecker staking out its claim among them.

Since the campground was empty and we were visiting after the hunting season (Another activity encouraged in this multiple-use area and testimony to the

wildlife value of these spots), we had the whole 6400 acres to ourselves. The quiet forest was alive with the soft yank-yank call of white-breasted nuthatches; surprisingly, the most abundant forest bird this day.

Heading back through the dry upland forest we discovered two more gems. Searching for insects in the deep furrows of the shagbarks that it also relies on for a nest site, we were delighted to spot our first brown creeper of the year. And high overhead, on the topmost branches of a tall oak, a growth of mistletoe -- the perfect finale to our mid-winter hike.

Delaware is not a large state, but winter days are short, and following directions that a colleague provided to another intriguing site, we raced back north searching for one last bay that was reported years ago as "threatened." We sped through the town of Blackbird and the great wintering flocks of crackles, cowbirds, starlings and red-wings demonstrating their graceful afternoon murmurations across the farmlands, with barely enough time to tap the brakes at Bailey's Seafood Store ("Whole muskrat - \$2.95") before crossing over the canal and heading North towards Wilmington.

Working our way down the Old Baltimore Pike near the Maryland border, we followed our primitive map (With warnings regarding "the rapid development of the general area") to what turned out to be (no surprise here) a new housing development. Here we hoped to find a place described as an ancient watering hole, said to be frequented in prehistoric times by Indians and the game they hunted.

Confident that we were becoming world-authorities on bays and all types of wetlands, we entered the development, managing to drive right past our objective and several other ephemeral wetlands without noticing them. Our oversight illustrates the problem of identifying and protecting these small, isolated wetlands.

It's a pleasant community, built along

serpentine streets with names like Preakness Run and Thunder Gulch, that predictably, have nothing to do with the site's history or geography. However it was soon apparent that they weave their way around many isolated wetlands. The immaculate green lawns reminded me of golf fairways mown right up to a curving, wetland "rough."

We were a little disappointed, although not surprised in this region of rapid growth; but we elected to explore it anyway because, after all, it has wetlands. With the helpful advice of some residents (who just happened to have their wetlands delineation survey map handy), we marched into this suburban wilderness; a half acre cul-de-sac of a swamp, right across their street.

All wetlands are interesting and important, and despite being encircled by this All-American suburban street, the inroads of a playground, gazebo and the requisite plush carpet of wood chips (The homeowner's final foray against soggy soil), this remains a neat wet forest. It's dominated by tupelo, sweet gum, oak and red maple and there is also the predictable under-story of blueberry, pepperbush, and holly helping to isolate the open water area and patches of bulrush. We were jealous. If you have to live in Suburbia, what could be better than viewing a wetland from your front porch?

I asked our new friends whether this was the local Carolina bay, and although coincidentally, she had visited one on a geology field trip in college, neither was aware of one locally.

I used the occasion to ask a few more questions to gauge the wellbeing of the place. "The Mosquito Commission takes care of the site." (That's not always good news.) "We like it. The wetlands prevent others from building behind us." (Justice William Douglas once defined an environmentalist as: "The last person to move into town." That's a given.) "The soil stays wet, even in a dry year like this." (That's cer-



*Skunk Cabbage, a distinctive wetlands plant and a sure sign of spring.*

tainly not bad news for amphibians and other wetland-dependent creatures.)

The homes are sewerred, but regrettably, I forgot to ask if they had basements; although they appeared to be on slabs. (A wetlands specialist once pointed to a development where a similar palustrine forest was being urbanized in Pennsylvania and told me: "Those homeowners will now have a life-long hobby trying to keep their basements dry.")

Apprehensively, I asked the fateful question... "Do you hear treefrogs calling in the spring?" Blank stares... Quickly our expedition degenerates down to this: We're standing with complete strangers on an unfamiliar street off Dixie Road in Delaware; suffering through quips about the Mason-Dixon Line ("It's what separates y'all from youse!")... imitating frog calls...

"A harsh, duck-like clacking? " (This should be a given since the Wood Frog

ranges farther north than any other North American reptile or amphibian.)  
"Definitely not."

"A short snore; like a finger running across a comb?" (The Pickerel frog is uncommon on the coastal plain south of Staten Island, but it was worth a try.)

"No."

"A long rattle or squeak; like rubbing a balloon with your finger?" (The Leopard or "Meadow" frog, with the broadest range across America, should be here.)

"No."

"A melodious, bird-like trill?" (Gray treefrog)

"Maybe..." (Things were looking up.)  
"This woodland gnome starts its lonely, lovely trill as the sun lowers and evening  
"A banjo-like twang?" (The Green frog is ubiquitous in swamps and streams.) "Oh yes!"

"High pitched peeps - jingling sleigh bells?" (Spring Peepers seem to be the

most enduring of the tree frogs.)

"You mean the ones that crawl up our patio door in the spring?" This was definitely good news. Of these little marsh sprites the poet wrote: "The pipes of Pan in elfin chorus ringing....Bring sweet dreams of youth and love and spring." (H.H. Collins)

But the day was almost done and we still hadn't found our main objective. It was time to seek out a real authority on the area, and with the exception of fishermen, no one is more knowledgeable about water bodies than kids on bicycles. They didn't know or care about vernal pools or anything called a Carolina bay, so I pulled my last rabbit out of the hat... "I've heard there's a bottomless sinkhole around here..."

We were immediately directed to the local mystery spot, a sinkhole if there ever was one. It is a small but deep, perfectly circular, crater-like pool of dark water, surrounded by trees that should have tipped us off earlier; red maples and that ever-so appropriately named swamp tree, the Pin oak - *Quercus palustris*.

This was our most anticlimactic moment so far. I wasn't expecting the La Brea Tar Pits, but there are no signs or fences, and the lawns are mown right up to the tree line. Ruthless exotics, Asiatic multiflora rose and bittersweet vines, are invading the edges.

It took a good deal of imagination to picture the prairies of post-glacial Delaware, the complement of mammoths, musk oxen and camels that may have visited here, and the Paleo-Indian hunters that pursued them. At least it wasn't filled with trash and tires, so hopefully it is still useful to wildlife. I'd like to revisit it on some April evening during a torrential rainstorm to see what creeps and leaps into it to croak, croon and couple.

Uphill from the sinkhole we noticed patches of cranberry, which led us to our last wetland; a small depression in the forest -- a classic woodland vernal pool.

Except during a rainy Spring, most of us would never dream this could be a wetland. There is a fringe of ground pine, and tupelo trees -- each with a customary skirt of moss on the trunk; all growing in a dry, powdery rusty-colored dirt. The vegetation, oxidized soil and accumulation of leaf litter, are clues that this spot is flooded only temporarily during the year.

We turned over a few rotted logs looking for red-backed salamanders, the most common vertebrate of the Eastern deciduous forest, but to no avail. They are just one of many species that must wait a year or even half a decade for these disappearing wetlands to recharge with water and be suitable breeding sites.

Driving home we passed many new housing developments; each with its own detention basin for rainwater that once filled vernal pools, swamps, bays and other inconspicuous or intermittent wetlands. None of them are clear, dark or mysterious like the natural waters we'd just explored, and many are green from the filamentous algae thriving on fertilizer running off the surrounding acres of lawn.

After our various encounters, I realize now that most people "like" wetlands and "understand" their importance, but it has to be on human terms: neat, manageable, engineered if necessary, and not interfering with our lifestyles. Unfortunately for us and the creatures that rely on these delicate and enigmatic ecosystems, this is something wetlands can never be.

#### Further reading:

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2. Outdoor Delaware. Spring, 1993.
3. H.S. Savage, Jr., The Mysterious Carolina Bays. University of South Carolina Press.
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# The Asian Shore Crab *Hemigrapsus sanguineus* in the Atlantic Ocean

An update on the status of this non-indigenous species fifteen years after its discovery in southern New Jersey

by JOHN J. McDERMOTT

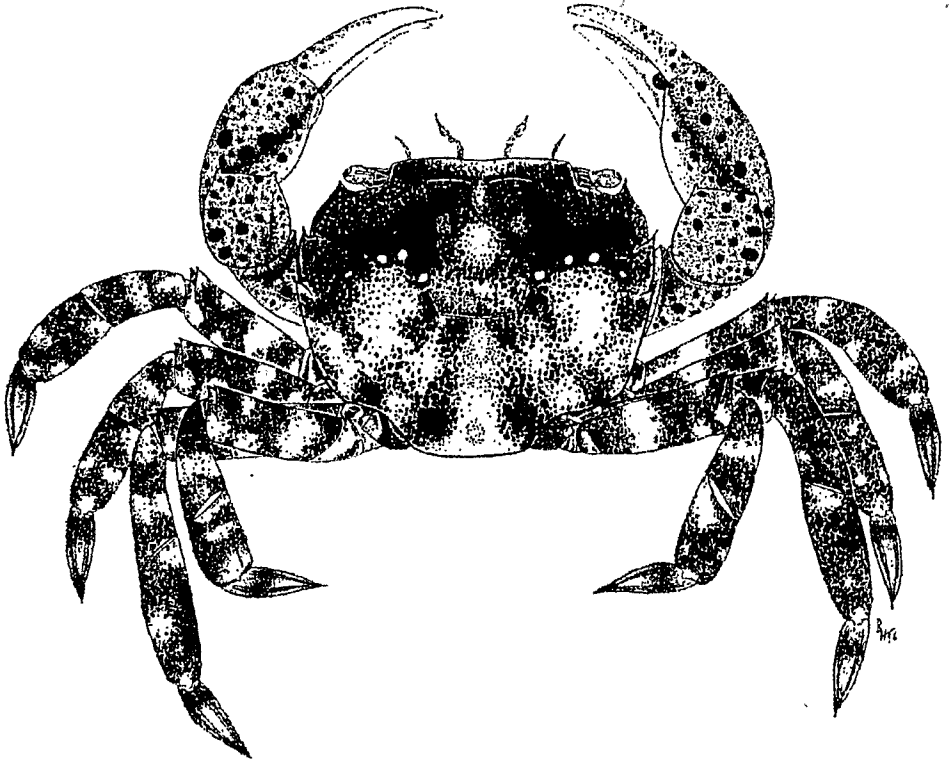


*This rocky area on the south side of the toll bridge which spans Townsends Inlet in Cape May county is where the Asian shore crab, Hemigrapsus sanguineus, was discovered in 1988.*

Fifteen years ago (September, 1988) I was on a field trip at the south Jersey shore with my class in Invertebrate Biology. One of my students (R. Andrew Nusbickel) called me over to show me a female crab with eggs that he had just obtained from under a rock at the base of Townsends Inlet bridge. I said to him, "It doesn't belong here." This was a grapsid crab belonging to the large family *Grapsidae* (generally square-bodied species that inhabit intertidal or shallow water areas), and the only other member of this family known this far north is the purple marsh crab *Sesarma reticulatum*, rarely seen because it lives in deep burrows along tidal creeks. After searching the literature on crabs from the eastern

and western Atlantic Ocean and the eastern Pacific, I was not able to come up with an identification. Thus, I sent the preserved crab along with the hatched first larval stages (zoeae) to my friend and world authority on crabs, the late Austin B. Williams, at the Smithsonian Institution in Washington, D. C., with the hope that he might be able to pin-point its identity. Indeed, he did. To our surprise it was one of a variety of shore crabs, *Hemigrapsus sanguineus*, known from the western Pacific that ranged from Sakhalin Island, Russia to Hong Kong and all around the Japanese archipelago (See Williams & McDermott 1990. Proceedings of the Biological Society of Washington 103: 108-109). To say the least, this was an interesting find. Thanks to the inquisitive nature of Andrew, this exotic crab became the basis for a long series of scientific studies along the western Atlantic seaboard.

*John J. McDermott is emeritus professor of biology at Franklin and Marshall College.*



*Drawing of the male Asian shore crab. Note the spots on the claws and the banded walking legs. (Courtesy of N.J. O'Connor, drawing by Bart Harrison, University of Massachusetts at Dartmouth).*

One of the most interesting things about the discovery of *H. sanguineus* was that it was not found first in the eastern Pacific along the west coast of the United States. However, the fact that two different species of *Hemigrapsus* (*H. nudus* and *H. oregonensis*) already exist in the rocky intertidal may have something to do with its absence -- and it has yet to be found there. On the other hand, there was an open niche for this species in the upper intertidal along the mid-Atlantic coast.

We soon realized that this 36 mm (carapace width = CW) female was only one of many at Townsends Inlet, and it was subsequently found along the whole coast of New Jersey. Thus, the species was established and reproducing. Our best guess as to its origin was that it may have been transported here from the Orient primarily

as larval stages in the ballast water of cargo ships. It should be emphasized that there is no evidence that New Jersey was the focal point of this invasion, but evidence suggests the crab was introduced somewhere between Delaware Bay and the New York harbor region

Subsequent studies along the coast in the early 1990's revealed that *H. sanguineus* extended from just south of Boston to Oregon Inlet, North Carolina. Finally, after two trips to the waters of New Hampshire and southern Maine I located the species on the northern coast of New Hampshire in 1998, but not over the border in Maine. Since that time, however, colleagues in New Hampshire also began finding this species in 1999 in more abundance, and finally it was recovered in Maine in 2001. The species has become



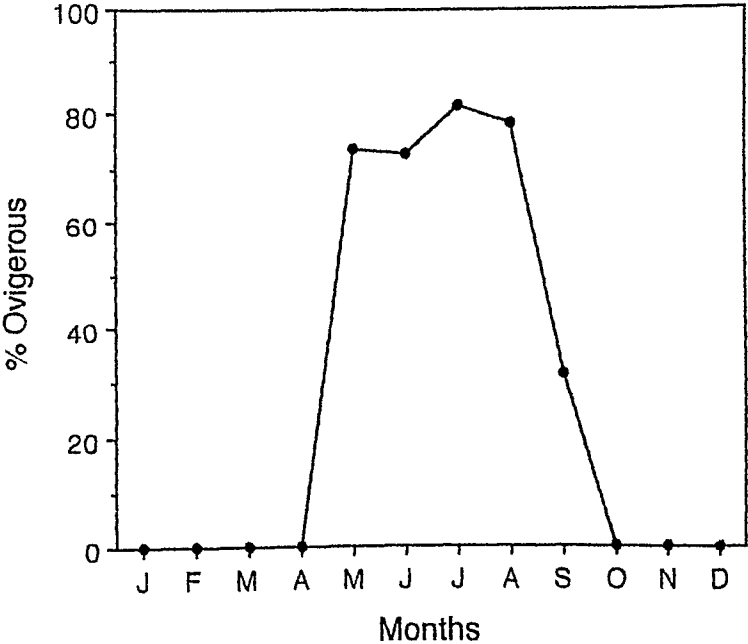
the dominant intertidal crab along much of the coast from Delaware Bay to Massachusetts, and in many intertidal areas it is displacing the green crab, *Carcinus maenas*, itself a species introduced from Europe a couple of centuries ago. It is now easily collected by anglers and used as bait for catching fishes such as the tautog or black fish *Tautoga onitis*, cunner *Tautoglabrus onitis* and black sea bass *Centropristis striata*. People fishing for tautog from rocks around bridges now find it convenient to obtain their bait by merely turning over rocks where they stand rather than digging for fiddler crabs in nearby marshes.

We found that the reproductive season for *H. sanguineus* in New Jersey was from late April through September, and that after the planktonic larval period of approximately a month, recruitment to the population begins slowly in June and then increases in the fall and winter months. Females begin brooding embryos when

only approximately 12 mm CW; the largest females may brood more than 40,000 embryos and produce at least two broods per season. Studies in Japan indicate that older crabs may produce up to five broods annually.

Our field and laboratory studies of crabs from New Jersey showed that *H. sanguineus* consumes a variety of invertebrates and algae, e.g., blue mussels *Mytilus edulis*, barnacles *Semibalanus balanoides*, amphipods, other small crustaceans, and the algae *Enteromorpha* and *Ulva*. Later studies, particularly in New England verified these food habits and also showed that periwinkles *Littorina spp.* and a variety of other algae may be consumed. The claws of male crabs are much larger than the claws of similar sized females; thus the former are capable of consuming larger prey.

The spread of the Asian crab along the coast from Maine to North Carolina is due primarily to its month-long period as

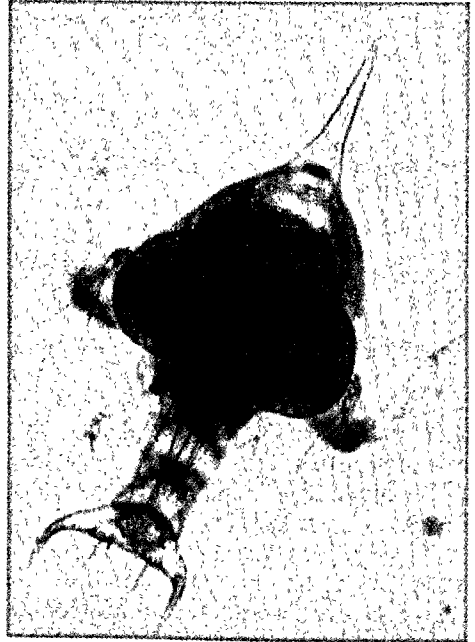


Period during the year in New Jersey when the Asian shore crab broods its embryos; like the common blue crab, the embryos are attached to the underside on the abdominal appendages.

pelagic larvae and its tolerance to a wide range of water temperatures and salinities. Usually living along the coast where the prevailing salinity is about 30 ppt, this species is quite capable of penetrating estuaries as it can withstand salinities down to approximately 10 ppt. Recent laboratory studies in Korea and Delaware have shown that *H. sanguineus* is easily raised from eggs to first crabs, so that pelagic larvae can now be identified from plankton samples. An interesting development of these studies is that the last larval stage (megalopa) needs salinities greater than 25 ppt in order to metamorphose to the first crab stage. This fact may tend to limit somewhat its estuarine penetration.

Numerous studies on the biology of *H. sanguineus* have been completed or are underway by scientists at many institutions, especially in New England where natural rocky shores are abundant. Special emphasis has been placed on the effects of this crab on native species within rocky intertidal communities. In many rocky regions of New England the Asiatic species has displaced the juvenile green crabs which occupy the same habitat. At present, however, in New Hampshire and Maine green crabs still dominate. *Hemigrapsus* has greater resistance to desiccation than the green crab, allowing it to live higher on the intertidal rocks.

Most people who enjoy probing around rocky intertidal locations have no doubt seen or unknowingly collected the Asian invader. It is easy to recognize and distinguish from other crab species. The carapace of *H. sanguineus* is squarish - the CW is about 1.2 times the length (CL). Adult crabs range in CW from 12 mm to more than 35 mm. The largest crab ever recorded was a very old male that I collected at Sandy Hook, New Jersey -- it was 43.9 mm CW with only one normal claw, and had probably reached its terminal molt; it was probably at least five years old. Males weigh more than females because of their conspicuously larger claws. The claws of each sex are equal in



The first larval stage (called a zoea) of *Hemigrapsus sanguineus* in head-on and side views. After hatching from the brood, this swimming stage is carried by ocean currents along the coast, during which time it grows and sheds its outer skeleton six times before reaching the first crab stage (slightly more than 1/16th inch wide or 2.4 millimeters). First crabs then seek the shelter provided by rocks, algae or clumps of blue mussels.

size and shape, unlike, e.g., those of blue crabs *Callinectes* or mud crabs *Panopeus*, and others. Asian crabs are variable in color, the carapace being mottled with dark and lighter shades of brown and green; the undersides are tan. The walking legs are banded with dark pigment, and the upper surfaces of the claws have dark red spots (hence the species name "sanguinius", from the Latin "sanguis" meaning "blood").

In 1999, *H. sanguineus* was reported for the first time along the coasts of France and The Netherlands. Its invasion of Europe was preceded in 1994 by the discovery of another western Pacific grapsid, *Hemigrapsus penicillatus*, along the coasts of France and Spain. This species is sympatric with *H. sanguineus* in the western Pacific with the same geographical distribution.

What will the future bring? Will *H. sanguineus* eventually extend beyond North Carolina? Will this species become a pest as predators of commercial shellfish? These and many other questions remain to be answered. As predicted earlier, the northern spread of the species is more

likely than to the south. As one travels southward, natural rocky intertidal habitats become scarce as compared to such habitats in New England to the north. Furthermore, there are more intertidal grapsid species to the south that could be competitors for space, i.e., a similar situation to that mentioned for the shores of the eastern Pacific. Keep your eyes peeled, however, for *Hemigrapsus penicillatus*, the other recent European invader. In most respects it is similar in size, shape and color to *H. sanguineus*, but if the males have conspicuous tufts of hairs on the immovable fingers of the claws, you have discovered a new introduced species.

For more detailed information see the following selected references: Breton et al. 2002. *Journal of Crustacean Biology* 22: 184-189; Lohrer 2001. *Aquatic Invaders* 12: 1-11; McDermott: 1991. *Biological Bulletin* 181: 195-198; 1998. *ICES Journal of Marine Science* 55: 289-298; 1998. *Journal of Crustacean Biology* 18: 308-316; 2000. *Crustaceans and the Biodiversity Crisis*, Brill, Leiden, The Netherlands, pp. 425-444.

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# GULLS IN ACTION

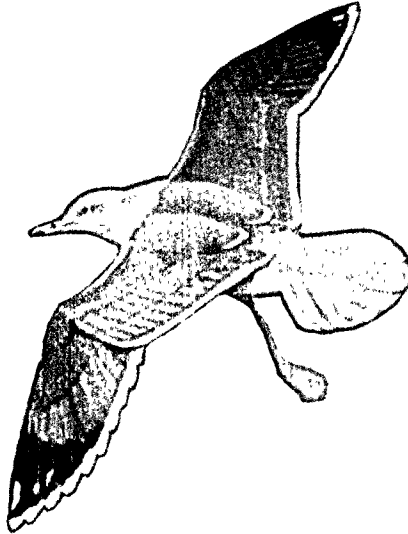
by JOSEPH DUTTON

As divers, fishermen, and birders know, there are two approaches to their craft -- chase, or sit and wait. One can dive on a reef, hunker in, and wait for fish come and hang around, or the diver can chase fish, which the fish don't like. The angler can walk the beach to catch fish or choose spot and stick with it. And birders can walk and look, or sit and watch. Recently, I have taken to sitting and watching gulls. It's been worth it.

Probably my first gull study was on a beach years ago when two of us were surf fishing for northern kingfish in early summer. It was close to low tide and herring gulls were walking the shallow water for edibles. All the gulls except one were strolling slowly upwind (most birds, including gulls, are averse to taking wind from the rear). This one gull was standing head down on the sand just above the waterline in a non-gull-like posture. We put our rods down and walked over to the gull and saw that its bill was held in the tight grip of a large surf clam; the gull could just about walk and couldn't take off.

To the rescue: we tossed a shirt over the gull's head to keep it calm, and while I cradled it in my arms, my friend cut the clam's adductor muscles and freed the gull. *Joseph Dutton is a retired high school science teacher now living on Cape Cod.*

gull's bill. What happened next took only a second or two: the gull turned and pecked a considerable hole in the back of my friend's hand, he yelled and dropped the bird, and the bird flew off. We saved the gull's life and it thanked us with a wound. Now that's a bird worth watching, I thought. Since then, gulls have been a favorite of mine. Here are some things I have seen them do:



*Herring Gull*

from the ocean to the bay. In 30 years of watching I have not seen one gull fly under the telephone wires. They might come across the beach 15 feet in the air; they unfailingly climb in the air before they get to the wires, fly over them with a good 10 feet to spare, and then most often dip quickly to their cruising altitude, and fly out over the bay. This is true for black-back, herring, ringbill, and laughing gulls in all plumages. (Since this was first written, I have seen one or two gulls fly under the wires, but the over and under ratio is still at least 500 to 1.)

Gulls and Telephone Wires --For almost 30 years, I drove to work along a sand spit, some places only 50 yards wide. Between the beach and the road there is a typical line of telephone poles strung with typical wires. The wires are about 30 feet off the ground, the poles 150 feet apart. Gulls routinely fly across the spit

Gulls in Parking Lots -- It is well known that gulls open shellfish by dropping them on parking lots; they will use hard sand beaches for openers but seem to prefer blacktop. They will use highways too, which leads us shoreline motorists to develop driving skills to avoid falling clams, broken windshields, and sitting birds. Lazy gulls hang around parking lots and try to steal the fruits their cousins' labors. Where I watch this performance, most of the gulls' prey is surf clams or moonsnails. Here's one observation in detail: I am parked in a white pickup truck in a large almost vacant parking lot 50 yards back from the surf. It is a cold winter day. No gulls are evident, but then an adult black-back flies in from the beach, gains a little altitude, drops a 4-inch surf clam and flutters down to eat it. Almost immediately, two first-year black-backs or herring gulls land about 10 feet from the adult, which is busy pulling pieces of clam from the shells. When I figure the blackback has about finished its meal, I start the

engine and drive rapidly toward the black-back while tooting the horn; this forces the gull to abandon its meal and fly off. The immatures don't fly off, but walk away a few feet and wait. When I leave the broken clam, they move in to finish it off what's left, small bits of adductor muscle. The adult has flown out over the beach.

I have repeated this tactic half a dozen times, with the same result and conclude that adult gulls are king of the kill and

more skittish than juveniles when challenged by loud, accelerating vehicles in parking lots.

Gulls Announce Their Finds -- Gulls, mostly herring and blackback, do a lot of raucous calling and posturing when they come across a promising load of chow -- freshly broke shellfish or raunchy searobin carcass. Before my recent enlightened studies, I thought this was a bragging strategy -- "Look what I found." Now, it appears more than likely to be a threat of war if interlopers show up -- "Stand back, it's all mine." I have reached three conclusions -- big gulls are aggressive, loud, and maybe profane.

Same Parking Lot, Different Behavior -

- It's late fall but still warm. There are more gulls present this time, a few immature herring and 20-30 ringbill, in a gang, preening or napping. I stop the truck about 25 yards away. Most of the gulls look at the truck and two ringbills walk over closer, stopping about 10 feet from the driver's side. I bid them hello and toss them a french fry (I



*Black-Backed Gull*

know this is bad behavior, but I'm doing research). Immediately, every gull on the lot is alert; they jump into the air, surround the truck, and yap, while one of the nearby walking ringbills gobbles up the fry. I get out of the truck; the gulls back off a bit. Then I walk away from the truck waving a fry high over my head; flying low, the gulls follow (I feel like the Pied Piper of McDonalds). I throw the fry, it hits the lot, and a ringbill nails it. Then I toss a bright penny, and about half the gulls fol-

low it, land near it; a few sample its taste and texture, but don't move it. I retrieve the penny and try again. This time only a few gulls express interest, and a third toss of the penny elicits almost no response. I walk back to the truck and get in. Two ringbills walk over closer, stopping about 10 feet from the driver's side. I'd repeat the experiment but I'm out of french fries.

Same Parking Lot, Experiment Number 3: exactly 51 ringbills are roosting on the blacktop roughly in a circle 75 feet across. The purpose of this experiment is to see if a patch of roosting ringbills can be split in half, and, if so, how long does it take for the gulls to reform the circle. I drive the truck very slowly through the circle, and the gulls part, left or right. They have formed two semi-circles, 27 in one, 24 in the other. Not bad gull herding for a first try. I then pull away and watch; 20 minutes later the gulls are still in their two semi-circles. Conclusions: ringbills choose to roost in circles, but semi-circles will do.

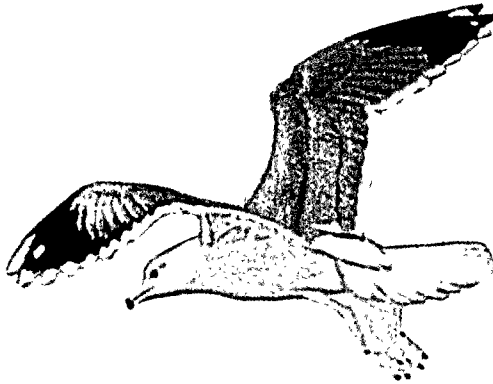
Gulls On Helicopter Pads -- Taking off and landing helicopters creates violent turbulence, tossing objects, including shattered clam shells, into the air. Shells are sharp hazards, so in some places profiles of flying gulls are painted on the pads; the theory is that a gull coming over the pad to drop a clam sees a gull below it which may steal the goodies, so it flies off to find another hard place. To test this hypothesis, I find a little used coastal blacktopped lot in a state park, sweep a section free of shell frag-

ments, paint three life-sized flying gull profiles on the blacktop there, and pull back 50 yards to watch from my car. When a park ranger pulls alongside to ask me what I am doing, I tell him I am looking for ospreys and drive away. Mystery unsolved.

Gulls and Bread in the Suburbs -- I live in a small suburb about five miles back from the ocean. Ring billed gulls often hang around the supermarket three blocks from where I live to pick consumables from dumpsters or off the parking lot. About once a year during a winter cold snap, a neighbor feels sorry for local songbirds and tosses stale bread on the road. Without fail, raucous ringbills are there within minutes. They seem to be able to detect signs of flying bread.

The Walking Gull on St. Petersburg Beach -- On an early fall morning walk along the St. Pete's Beach, Florida, I see about 50 adult and immature laughing gulls standing or sitting, faces into a gentle breeze. They look almost too comfortable so I decide to interfere. I walk

into the middle of the flock, which parts as if to let me through. Then I pick out one immature gull and slowly walk directly at it, step, stop, step, stop. Each time I get within about 12 feet, the gull walks away to put 20 feet between the two of us. I close to eight feet and the gull moves again. Four repeats produce the same results. Conclusion: an immature laughing gull's zone of comfort on an autumn Florida Gulf beach is 20 feet. (Some scientists would challenge the conclusion of



*Ring-Billed Gull*

this observation because I sampled only one gull. I say, my conclusion stands until one of those scientists repeats the experiment.)

Gulls on Fish -- Most surfcasters know that to find fish, look for birds, most often terns or laughing gulls which feed on bait-fish --in my region it's anchovies, mullet, bunker, or silversides -- that have been driven to the surface by fish, usually striped bass or bluefish. Sometimes, gulls over fish are so thick it's difficult to cast a lure without snagging a gull. Usually the caster's line has tangled with the gull's wing; the gull drops to the water and must be hauled in by the angler. A snagged, wildly flapping, yapping gull often draws many of its cousins which follow the gull in toward the beach with great excitement. Some people think the free gulls are expressing concern over the snagged gull's predicament; I tend to believe they hope the gull dies so they can eat it.

Eye contact with a herring gull -- Many animals dislike eye contact. Here's my herring gull experiment: Walk along a beach at the tideline until you come across a gull standing up on the dry beach, say 25 yards away. Stop but don't look directly at the gull; instead, watch out of the corner of your eye. The gull will snap to a more alert posture and maybe take a few quick steps away from you. Now, turn and face the gull head-on and stare at it. Result: instant panic and flight. (This is a good technique for crows too., but I stray from my thesis.)

Laughing gulls at the Cape May Ferry -- These gulls follow the ferries, usually out a mile or so and then go back to shore to await the next ferry. Prominent signs ask passengers not to feed the gulls, but I cheat in the interests of science. I try two baits: white bread and cheese doodles. The bread is popular; they ignore doodles.

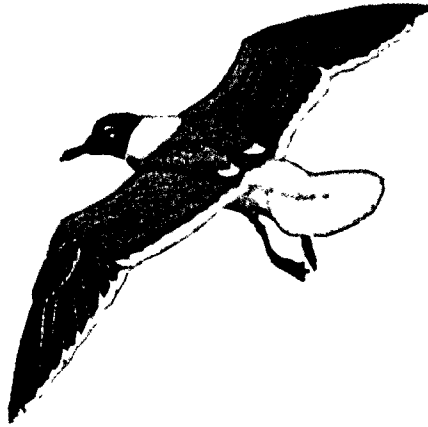
Gulls hawking flying ants -- In late summer, we have afternoons when flying ants hatch and dot the sky with their temporary airborne selves. Laughing gulls

feast on the ants, flying wildly through the swarm and then putting on the brakes to snatch a single ant. It can go on for hours. It seems like a lot of energy spent for such a small caloric intake, but it happens every year.

Finally, a quote from "The Art of Surf Fishing," one chapter of a book the Society pub-

lished years ago called "Fish Stories." Here is the author, Owen Hatteras, on gulls: "I enjoy disturbing gulls. The basic beach gull likes to stand just back of the beach berm. It is facing into the wind, and watching me...If I turn to look, it shifts its feet and cocks its head. If I walk toward the gull, it waddles away. If I run at it half-heartedly it flies a few feet and sets down again. If I run seriously, it takes off and makes a wide, gentle circle downwind before settling onto the beach again. The best way to launch a large group of beach gulls is to run at them with arms spread, shouting 'I want to be your friend!'"

To confirm Hatteras's hypothesis, I plan to replicate his experiment next year.



*Laughing Gull*

# The Natural History of Rottnest Island

by JAMES DUGGAN



*Rottnest Island out the plane window.*

Australia boasts claim to many interesting islands off its coastline. One of particular historical and natural interest lies about 18 kilometres off the coast of Western Australia. Rottnest Island, or Wadjemup, as it is known by the local Aboriginals, was once joined to the Australian mainland about 7,000 years ago. The area of the island measures 11 kilometres by 4.5 kilometres at its widest point and enjoys a semi-arid Mediterranean style climate. It was named Rottnest in 1696 by the Dutch explorer William de Vlamingh, who thought the local marsupials or Quokkas were actually large rats.

Geologically, over the past 6500-7000 years, sea levels had risen twice to the extent that Rottnest Island became separated from the mainland. The first separation took place about 5500 years ago and the second about 2500 years ago. It was during these latter periods that the island was further submerged, creating an addi-

*The author grew up on the East Coast and was a biologist at the Sandy Hook Marine Lab before moving to Australia. He took the photos.*

tional eleven, smaller islands.

Over 30,000 years ago, Rottnest had a very powerful and spiritual connection to the Noongar Aboriginal community. These aboriginals never lived on the island but always had it in view from the mainland settlements. The Europeans settled Rottnest about 1822, when Phillip Parker King, a British captain, made landfall on the island. Seven years later, British Captain James Stirling, laid claim to the western part of Western Australia, which included Rottnest Island.

In the late 1830's, the island became a penal colony for Aboriginals, as an alternate site to mainland prisons. During the period from 1855-1903, the superintendent of the island and penal colony began to beautify the island by restoring old buildings and planting trees. By 1931, the last prisoner had left and the salt works (a major industry in Western Australia) had closed. The island now was being used for recreation, except during World War 11, when it housed 2500 military personnel and in World War 1, housing about 1300 people of German and Croatian descent.

As a result of human activities from the



1800's, and the climatic changes over the centuries, the flora and fauna have had to adapt to these various stresses. The impacts included sea level variability as well as increased wind and salt exposure to the exposed plants. Consequently, a number of plant species have become endangered. Today, only 140 native plant species remain. During the British, French and Dutch occupation of the island from the late 1600's, the land was cleared of forest and vegetation. Trees were cut

### The Flora

After these major climatic and human impacts on this small 1900-hectare island, several species of plant became dominant. The primary dominant plants after these fires were *Callitris preissii* and *Melaleuca lanceolata*, as they require fire for seed germination. Another bush, *Acacia rostellifera*, can regrow from its base after fires and thus between 1830 and 1930, the forests were co-dominated by *Acacia* thickets as well as *Melaleuca*. These



*View of the rugged coast of Rottneest Island.*

for firewood and were used for fuel during the 1830's at the islands saltworks. In addition, as a result of the burning of the forests by the Aboriginal farmers and hunters looking for the Quokka, major fires swept across the island in 1816, 1910 and 1955. This modified the diversity of the local vegetation and landscape forever. Today, there exist six major habitats: coastal, salt lakes, brackish swamps, woodlands, heath and settled areas. Of these, the salt lakes are the most interesting (six are permanent and about five are ephemeral, drying out during the summer).

thickets were overgrazed by the Quokka, a native marsupial mammal that has been protected on the island since the 1920's. The combined effect of fires and Quokka grazing reduced the island's forests from 1000 hectares in 1919 to 130 hectares in 1974, leaving 7% of the island now wooded (1990's).

The island has three major habitats-. The coastal area, the salt lakes and the grassy plains.

### The Coast

Along the coast, you can observe the

following plants: *Cackle maritum* or sea rocket, found on beaches all around the world. *Olearia axillaris*, with its silvery aromatic foliage and *Westringia dampierii* with dark green leaves and small whitish flowers in spring are an attractive sight as you travel around. *Scaevola crassifolia* and *Senecio lautus* grow along the coastal roads making it an attractive bicycle ride during the spring and summer. A very recognizable succulent plant found here is the local Pig Face or *Carprobotus vivescens*.

### The Salt Lakes

The salt lakes are an interesting feature and play host to tolerant plants as well as some interesting fauna.

As an introduction, the lakes cover about 208 hectares or 1/10 of the island. There are trails and roads around these lakes so they are accessible to visitors. There are seven permanent lakes (Government House Lake, Herschel Lake, Serpentine Lake, Baghdad Lake, Garden Lake, Vincent Lake and Timperly Lake). There are five intermittent lakes that dry up in summer (Pink Lake, Negri Lake, Sirius Lake and the two Pearse Lakes). Three lakes are relatively deep

(Government House, Herschel and Serpentine), with Government Lake at about 8.5 metres deep.

In summer, freshwater seeps drain into the lakes from the islands underground reserves. The salinity varies enormously but averages about four times that of surrounding seawater. As a result of these high salt levels, only salt tolerant plants survive in these harsh locations.

The easily identifiable samphires (glassworts) can be seen with their red and green "bead"-like segments growing in waterlogged soils *Salicornia sp.* or at higher ground *Halosarcia sp.* Cockies Tongues *Templetonia retusa* flourish around the lake headlands, with great masses of red flowers in winter.

### Grassy Plains

Lastly, in the grassy plains, the dominant plant species is Tussock Grass *Stipa flavescens*. To add color, *Guichenotia ledifolia* and *Conostylus andicans* add mauve and yellow flashes of color respectively during spring.

### The Fauna

On the island, there is one native mammal, the Quokka, that is protected and



View of the island's interior salt ponds.



*A Quokka, Rottnast's only native mammal.*

endangered or extinct elsewhere in Australia. As one would expect, there is also a reasonable variety of birds on the island. These can be divided into several habitats: Coast, salt lakes, Open Seas, Woodlands and around the island settlements.

Along the coast, the Pied *Phalacrocorax varius* and Little Pied *Phalacrocorax melanoleucos* Cormorant are common, breeding on Phillip Rock and Dyer Island in the autumn. (These islands are close to Rottnest). The only heron on the island is the Reef Egret *Egretta sacra* and usually can be seen around the reefs, feeding on small fish and invertebrates. As in the U.S., the Osprey occurs here all year long, with 3-5 breeding pairs around the island.

Pied Oystercatchers *Haematopus longirostris* are common on the beaches around the coast, while the Whimbrel *numenius phaeopus* is usually found in small numbers near reefs. The Whimbrel, Bar-Tailed Godwit *Limosa lapponica* and Sanderling *Calidris alba* are all non-breeding migrants. They breed in the

Arctic in the northern summer and spend their "non-breeding" time in the Southern Hemisphere, one area being Rottnest. There are also several birds that frequent the Salt lakes, namely the Grey Plover *Pluvialis squatarola*, Ruddy Turnstone *Arenaria interpres*, Grey-tailed Tattler *Tringa brevipes*, Red-necked Stint *Calidris ruficollis* and Curlew Sandpiper *Calidris ferruginea*.

The Silver Gull is by far the most common of all birds on the island. The Bridled Tern *Sterna anaethetus* is a breeding migrant and breeds in the spring and departs in autumn. On the other hand, the Crested Tern *Sterna bergii* is a resident year round, seen breeding near the salt lakes.

Lastly, an attractive bird one would not expect to see in such a harsh environment is the Rock Parrot *Neophema petrophila*. It breeds on several offshore islets and can be seen flying between the islets and main island. The bird was much more common but human disturbance placed it on the brink of extinction. It's now starting to make a comeback.

These salt lakes host their own group of birds, insects and crustaceans which live, breed and feed in and around the lake. In such a harsh environment, one wouldn't expect much animal life around these hypersaline lakes. However, aside from a number of birds that live and breed, there are six species of insects or crustaceans that thrive. The Red Brine Shrimp *Artemia sp.* population is comprised solely of females. Three species of fly have been identified, including a nonbiting midge, brine flies and a biting midge *Culicoides waringi* and also Caddisflies *Symphitoneuria sp.* and an isopod *Haloniscus searlei*. The latter two organisms live in the shallow, saline lakes under rocks.

A distinct pink tinge to some of the lakes is caused by a common pink alga called *Dunaliella salina*. It accumulates beta-carotene and is fed on by Brine Shrimp, giving them their distinctive

pinkish-red color. The bottoms of these lakes are layered by cyano-bacteria (blue-green algae). This helps trap and bind sediment, creating thick sheets or columns called stromatolites. These are most evident along the northwestern coast of Western Australia. These structures are among the earliest forms of life, with fossil stromatolites having been found to be over 3.5 billion years old.

Among the birds favoring these lakes is the richly colored Mountain Duck *Tadorna tadornoides* or Chestnut Breasted Shelduck. They can be seen around all the salt lakes and swamps, particularly where freshwater seeps into the lakes. It's in these areas that they rear their young. They breed in limestone caves around the coast and then lead their ducklings to the brooding territory around the lakes after hatching.

As stated earlier, a number of the wading birds breed in the Arctic and spend summer time in the Southern Hemisphere. The Red-capped Dotterel *Charadrius ruficapillus* and Red-necked Avocet *Recurvirostra novaehollandiae* are two resident wading birds. The Banded Stilt *Cladorhynchus leucocephalus* spends the breeding season around salt lakes of semi-arid and arid regions of Central Australia, while it returns to Rottnest Island during the non-breeding season. This bird breeds only when there has been sufficient rain in the arid regions of Australia, filling the intermittent lakes and thus providing an abundance of food.

The only oceanic species of bird that lands on Rottnest Island is the Wedge-tailed Shearwater *Aquila audox*. This bird

is found year round and breeds in burrows at several sites from November to early May. Other oceanic birds can be seen off the coast with binoculars.

Of all the habitats on the island, the areas that have been dramatically reduced in the 20th century are the woodlands.

As indicated earlier, Melaleuca and Acacia plants comprise the bulk of the forested areas now on the island (7%). The birds frequenting these areas are the Laughing and Spotted Turtle Dove

*Streptopelia sengalensis* and *Streptopelia chinensis*. They are both exotics, being introduced from Perth in the 1930's.

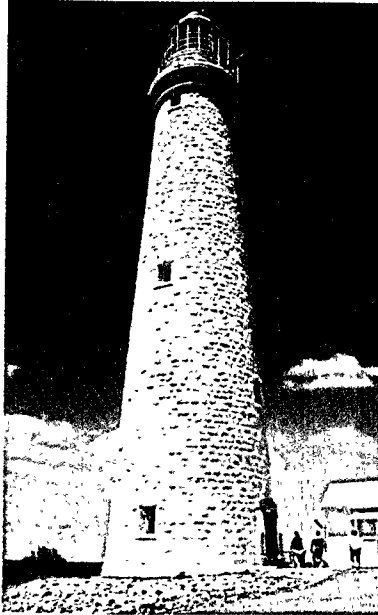
In summer, a common sight is the abundance of Welcome Swallows *Hirundo neoxema* darting across the skies after insects. They nest in many areas around the island. At the same time, the Tree Martin *Cecropis nigricans* is also abundant. However, the Tree Martin tends to return to the mainland to breed while the Welcome Swallow breeds on the island.

This brief overview of some of the natural history of Rottnest Island

should engender the continued protection and conservation of the island. Make it a "point-of-interest," when next you should travel to Australia, particularly Perth.

It's a short ferry ride or flight from Perth. Bicycles and walking are the main means of transport on the island. There is accommodation on the island for those who wish to make their stay longer than one day.

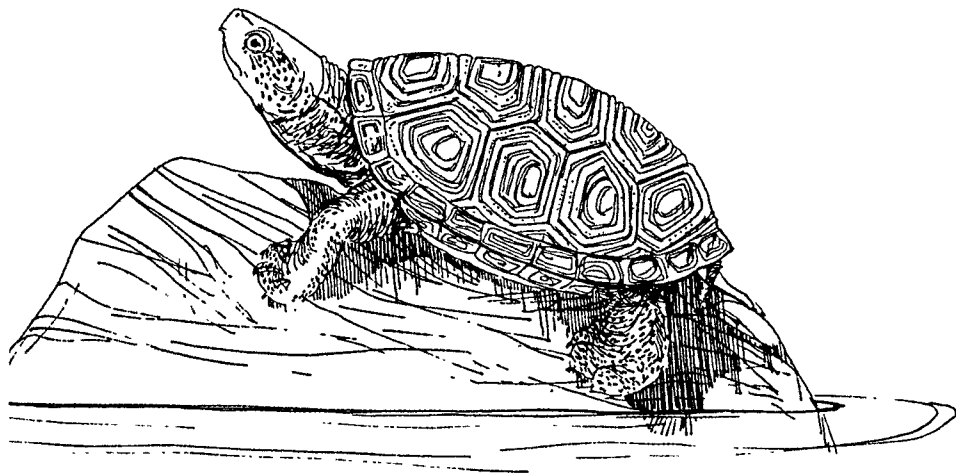
For further information, contact:  
The Western Australian Tourist Center  
Forrest Place (near Wellington Street)  
Perth, 6000 WA, Australia.



*The Island's lighthouse.*

# Diamondback Turtle Rescue

by JIM MERRITT



Roger Wood, a mild-mannered zoology professor who hardly fits a criminal profile, is used to explaining himself to police officers at two o'clock in the morning. "The story I tell them sounds so crazy they figure it's got to be true," he says. "No one's ever given me a sobriety test."

Wood's suspicious behavior occurs on June nights on causeways leading to Stone Harbor and other seaside resorts in Cape May County, New Jersey, where he can be found hunched over the carcasses of diamondback turtles, looking for signs of life. Diamondbacks live in the salt marsh, and June and early July is when the females crawl onto high ground to lay their eggs. Many wind up on roadways and are crushed by cars.

In 1989, Wood launched a project to rescue diamondbacks during their six-

*Jim Merritt edits the journal of the Lewis & Clark Trail Heritage Foundation. Before that he edited the Princeton Alumni Bulletin. And when he has time he fishes the surf.*

week nesting season. Now the causeways have "Turtle X-ing" signs and are patrolled by volunteers. Sometimes they find a turtle upended, with just minor injuries -- grazed by a car's tire and flipped, or "tiddlywinked," as Wood puts it. Even if the shell is broken, a turtle may survive with a little help from her friends, who may literally wire her back together until the wound heals. If the wound is fatal the eggs can often be extracted and incubated.

Turtle Central is the Wetlands Institute, a research station in Stone Harbor. Wood is its director of research, and during the summer he oversees college interns studying coastal ecology (the rest of the year he teaches at Richard Stockton College, in Pomona, New Jersey, near Atlantic City). Interns help with the Turtle Rescue Project, and during the height of nesting season the place is part emergency room, nursery, and rehab center for local diamondbacks.

In one room, thumbnail-sized turtle eggs, arrayed in neat rows in a plastic con-



*Roger Wood with one of his charges.*

tainer, bask under an incubation light. "We took these from a road kill," said Wood. "They start out a translucent pink, and if they turn chalky white like most of these it's a good sign -- it means they're fertile." The incubating temperature is kept at 86 degrees Fahrenheit, which for reasons not well understood produces females; lower the temperature by six degrees and you get mostly males. The eggs will hatch in six to eight weeks. The young will then pass the winter being fed and cared for at the "Turtle Farm" at Stockton College, until reaching what Wood calls a relatively predator-proof length of two to three inches. Come spring, kids recruited from local elementary and grade schools will help return them to the wild.

At another container, Wood checks on a half dozen inch-long hatchlings. They seem equally curious about him. "This is our Head Start Program. They're looking at me like that because to them I'm the refrigerators and they think I'm going to

feed them. This year's group is kind of a runty because we can't import the turtle feed we normally use. It's by far the best food for captive turtles, but it contains ground-up cow bones and has been banned because of concern about mad-cow disease. Notice the variation in shell patterns and colors, from yellowish green to gray and almost black -- that's very unusual for turtles but typical of diamondbacks. They're a very attractive species, and there's a certain aesthetic pleasure I get in working with them."

On the floor, an adult female with a cracked and bloodied carapace claws listlessly at the sides of the cardboard box in which she's been placed. Wood lifts her up and inserts a finger in the soft flesh near her tail. He doubts she will survive, but his digital inspection reveals she's gravid. "This one's a candidate for what we call an eggectomy.

### **Digging Fossil Turtles**

Wood's professional fascination with turtles goes back almost 40 years. As an undergraduate at Princeton University then, he majored in geology and wrote a senior thesis on fossil mammals, but as a graduate student at Harvard he switched to fossil turtles. On a dig in Venezuela in the 1970s he unearthed the biggest turtle known to science, a freshwater behemoth from the Age of Dinosaurs with a shell more than eight feet long. Its skeleton is on display at Harvard's Agassiz Museum, and replicas of it can be found at New York's American Museum of Natural History and several other venues around the country. Wood inherited an interest in natural history from his father, Albert Wood, an emeritus professor of biology at Amherst College.

Roger Wood has been studying diamondbacks and writing about them for scientific journals since the early 1970s, not long after he arrived at Stockton, and much of what we know about the species comes from his research. In the early days he collaborated with an octogenarian

waterman named Earl Yearicks, who caught diamondbacks and sold them to a seafood wholesaler, who in turn sold them live to venerable restaurants like Bookbinder's, in Philadelphia, for rendering into terrapin soup. Before the turtles were shipped off, Wood would collect baseline data on sex, size, and distinctive

which grow to a length of six to nine inches (males top out at five inches), typically lay a clutch of eight to 12 eggs in a chamber five to six inches deep scooped out by their hind legs. The diamondback's jaws are made for feeding on a variety of small mussels, clams, and snails. They will also eat small fish and are especially fond of fiddler crabs. In the winter they hibernate, either burying themselves in mud or lying in a dormant state on the bottom of marsh creeks.



*Wood and summer intern examine injured terrapin at the Wetlands Institute, Stone Harbor, NJ.*

markings. "Mr. Yearicks never got past sixth grade," recalls Wood, "and I was pleased that he let me list him as coauthor of the first paper I wrote on diamondbacks."

The diamondback turtle or terrapin, *Malaclemys terrapin*, lives in brackish coastal waters from Massachusetts to Texas. Of the world's approximately 270 turtle species, it is the only one adapted to a salt-marsh environment. Females,

### **Epicurean Delight**

In Colonial times, diamondbacks were abundant and a routine part of the diet of tidewater settlers. Wood cites an account of slaves going on a hunger strike until promised something else to eat (in similar stories about stipulations in the contracts of indentured servants, the offending fare is lobster, salmon, or shad).

After terrapin soup became a staple of gourmet restaurants in the late 19th century, unregulated commercial hunting drove the species to the brink of extinction. As Wood wrote in a scientific paper, epicures "considered diamondbacks to be the ultimate treat for cultured palates." Pound for pound, diamondbacks were unquestionably the most expensive meat in the world -- on the market, a dozen prime females could fetch \$125. He believes the species

was saved in part by the coming of Prohibition, which made sherry, the other key ingredient in terrapin soup, unavailable, and by a further reduction in demand brought on by the Great Depression.

"My dad was born and raised here in Cape May County," said Wood. "As a boy he spent a lot of time sailing in the bays, and he can't recall ever seeing a terrapin. When I was a kid spending summers here in the '40s and '50s I didn't see them, either. We didn't really start noticing them until the 1960s. I think they had been coming back for a while, but during the early decades of their recovery they stayed out of sight because there were still plenty of natural nesting areas on the back dunes of barrier islands. By the '60s and '70s turtle numbers were up, but by then the shore towns were pretty well developed, and the bulldozing and bulkheading of nesting sites forced them onto the causeways.

And into the paths of motorists hell-bent for the beach. On average, some 500 diamondbacks are crunched by cars in Cape May County each year, and throughout the turtle's range fatalities number in the many thousands. Even more may drown in commercial crab traps -- Wood lobbies for laws requiring traps fitted with turtle excluders; New Jersey and Maryland (where the diamondback is the state reptile) now require them, and he hopes other states will follow suit. Habitat destruction also remains a threat as the diamondback's natural breeding areas continue to succumb to development.

Wood's team rescues 600 to 800 eggs a year, of which 250 to 300 hatch. He estimates that, after six years, two out of three released hatchlings reach breeding age. Replacements don't add up to the numbers squashed, and the diamondback may be headed for another population crash. Still, Wood continues to hope -- partially offsetting the loss of natural habitat, new breeding areas have been created by the pumping of dredge sands onto march

islands -- and to do what he can to make people aware of the diamondback's plight. His advice to shore-bound drivers: "When you see a turtle crossing the road, slow down, stop, pick her up, cross her in the direction she was traveling, and wish her good luck."



*Terrapin-crossing sign on Stone Harbor Boulevard, the causeway from the mainland to Seven Mile Beach, Cape May County, NJ.*

#### **THE TERRAPIN PROJECT**

The Society has set in motion plans to work with Roger Wood on a number of projects aimed at cutting diamondback terrapin hit-and-run accidents on coastal causeways. One such action would be to erect low fences along particularly lethal roadways to either prevent crossings or guide the turtles to safer places. The first-year goal is to set up a few pilot projects to test the effectiveness of the fences. In time, we may need to locate volunteers to erect fences and monitor them during the busiest six weeks of egg laying (May and June). If any readers know of similar work going on up and down the coast, please pass the word along to us so we don't reinvent the wheel.



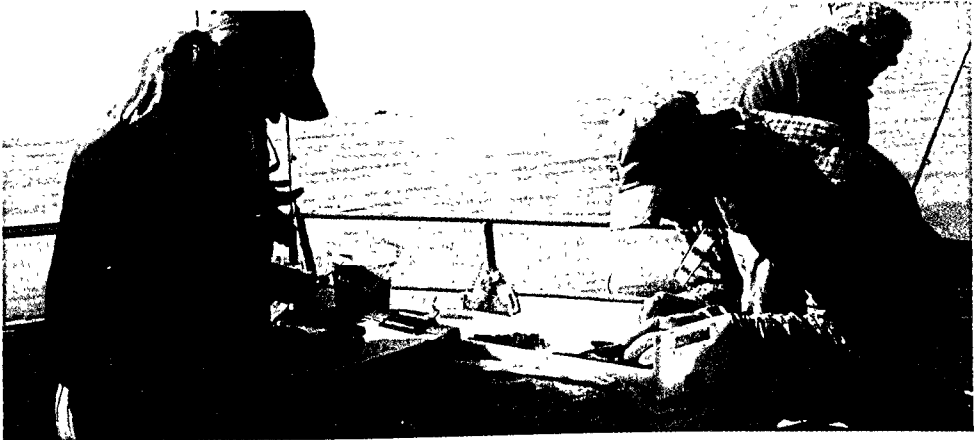
# Sea Bass Tagging

By PAM CARLSEN

The invitation came from Gary Shepherd of the Northeast Fisheries Science Center, Woods Hole, MA. The purpose of his call was to invite us to go fishing. This trip would be part of his black sea bass tagging project in ocean waters off six east coast states. The biologists would use the tagging information to improve their understanding of the abundance and distribution of black sea bass. The tags to be used were red or orange internal anchor tags and would be inserted in the fish by Josh Moser of NMFS. We only needed to catch the fish. Recapturing fishermen, who reported these fish, would receive \$100 for information on the red tags and an embroidered baseball cap for the orange tags.

May 20, 2003, was the day and between 6:30 - 6:45 a.m. 13 volunteer anglers, representing American Littoral Society, Clean Ocean Action, Baykeeper, Sandy Hook Marine Lab, and the New Jersey Division of Fish, Game, and Wildlife showed up at the Belmar Marine Basin to *Pam Carlsen runs the Littoral Society's fish tagging program. She took the photo.*

board the "Rosie R." Josh Moser, Capt. Jim Hull, and mate Chris were set to go. The day was perfect, sunny with a light breeze. The "Rosie R" left the dock timed with the 7 a.m. bridge openings on Shark River and headed out the inlet to a long slow swell on the ocean. While we traveled, the mate cut squid into strips and prepared clams for the small bait buckets set about on the deck. Most chose to use boat poles provided, but I brought along my "good old fishing pole." Chris rigged all the poles (including mine) with 5 oz. sinkers and two-hook rigs. Meanwhile, Josh set up his tagging station, consisting of two large black tubs filled with sea water to hold the anticipated sea bass, a clipboard to record tag data; a bucket containing 600 tags, each in its own numbered envelope, a scalpel to make the incision in the belly cavity where the tag is placed, and heavy rubber gloves to shield his hands from countless fin pricks. The "Rosie R" continued to travel until we were approximately three miles offshore, when the engine was cut and the fishing began. Choice of bait was up to the angler



*Biologists tag one of the 400 black sea bass landed on the trip. Fisherman in background has either hooked a big one or doesn't feel well.*

and we soon found that either worked, as fish came over the rail almost immediately and were placed in the tubs. All legal sea bass, 12 inches or more were tagged, data recorded, and released. The fishing was steady and hectic and double-headers were common. The largest fish was 48 cm or 19". Many had aqua blue colorings and some had the square "humpback" forehead.

Sea bass are fun to catch, hitting the bait quickly, swiping it, if the angler is asleep

at the switch. Our group was a good bunch of anglers and at days end over 400 fish were caught in six hours. Moser tagged 360 of these and a small bycatch of porgies were kept for consumption. To complete the species list, we also caught skate, smooth dogfish, tautog, cunner (bergall), and fluke. The "Rosie R" sailed back in through the Shark River Inlet in time to catch the 3 p.m. bridge openings. A great day of fishing and tagging -- scientific recreation.



## Eastern Prickly Pear Cactus in the Littoral Zone

By ANDREW JOYCE

Hiking that Dune Trail south of Gunnison to Spermaceti Cove on Sandy Hook? Look down! Yes, your eyes do not deceive you -- that is a cactus you see clinging to the dune landscape. In fact it is the Eastern Prickly Pear Cactus, scientific name *Opuntia Homifusa*, the only indigenous cactus species east of the Mississippi. In portions of its range from eastern Texas to southern Ontario, it is considered endangered. On Sandy Hook however, amateur botanist have ample opportunity to observe this fascinating species in many areas due west of the primary dunes at the Sandy Hook beaches. In among the holly, beach plum, milkweed and yes poison ivy, this cactus thrives below most people's radar.

This low succulent species grows in sandy areas in the early stages of succession. Succulents are plant species with thickened, juicy or fleshy apparatus to store water. This Eastern Prickly Pear Cactus succulent thrives in the secondary sand dunes near the shore that provide this succession habitat in abundance. Colonies

*Andrew Joyce is a Society member who grew up a beachcomber and is still at it. He lives in West Orange, NJ.*

usually spread outward from a core area. These formations are many years old considering this cactus's slow growth rate and the shorter growing season experienced in this northern climate. It bears yellow flowers in June and an edible fruit emerges following the pollination of these flowers. Various insect species including honey bees are the prime pollinators. The fruit forms later in the summer. They are reddish to purple forming on buds off the areole. The areole are also the apparatus on the top of the pads where the spikes are.

The crushed flowers are touted by some vitamin providers as beneficial to urinary tract function and even a cure for prostate ills. Considering the fragility of the dunes at Sandy Hook where this species grows, gathering is discouraged. When Carole Silano of the Sandy Hook staff was asked about the policies of gathering the fruit, she replied that as long as no damage is done to species a quantity of one gallon per person per day is permitted to be gathered though this is discouraged due to dune fragility. At Island State Beach Park where the cacti also grow, gathering is permitted too in limited quantities though following the parks policies is essential.



*Sandy Hook prickly pear cactus. Note fruits on top of pad at left.*

Avoid handling the fruit without leather gloves as barbed spikes will pierce your skin and be difficult to remove. Now you know why they call it the Prickly Pear Cactus.

Seeds from the fruit are thought to be dispersed through ingestion and then excrement by field mice, certain bird species, skunks and probably foxes too. As we have shown, dispersion of seeds can start new colonies of Eastern Prickly

Pear. However, often the upper cactus pads aid the spread of the cacti colony. When they upper pads fall off, they are capable of taking root and spreading the colony outward. With the onset of winter, the pads of the plant will often change colors to yellow or even red.

Next time you hike the dune trail on a fair day in June look out for the flowering Prickly Pear cactus plants; you'll be glad you made the trip.

### GUIDELINES FOR SUBMISSION

*UNDERWATER NATURALIST* is the Society's journal. We encourage members to submit articles, pictures, observations, comments, compliments or criticisms. Please follow these guidelines.

**SUBJECT MATTER:** Feature articles run 1,500-3,500 words (4-10 double-spaced, typed pages); please refer to back issues for guidance. For *Field Notes and Coast Issues*, submit no more than three pages of direct observations of interesting natural history found while walking, diving, or fishing in a coastal area. Topics can be of current interest, such as red tide in the Carolinas, whale deaths in New England, or mangrove preservation in the south; you can also submit a number of short observations or notes regarding a particular area. Letters to the Editor expressing thoughts on the magazine and its contents or general food for thought are especially appreciated.

**ART WORK:** For illustrations we accept black and white prints, clear color slides, color prints with good contrast, and high resolution digital photos. Drawings, maps, and charts are welcome. For cover photos, we need clear, sharp 35mm color slides or prints, or high

resolution digital photos, either horizontal or vertical, of littoral subjects above or below the water. Horizontals can wrap around from front to back. Action is not necessary. (Note: Unless otherwise requested, we keep all accepted art work until it is published.)

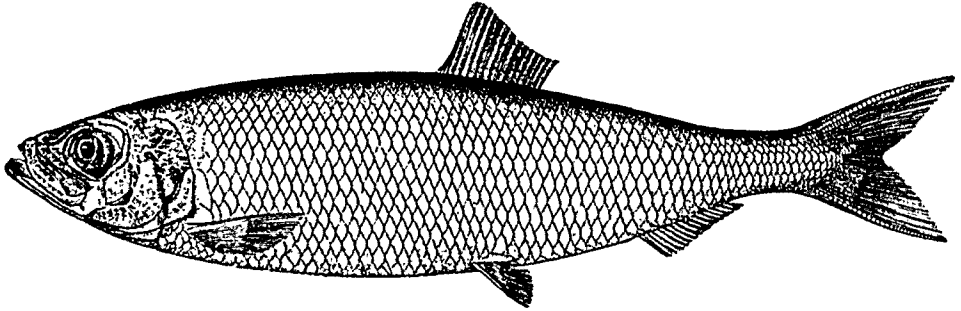
**HOW TO SUBMIT:** Typed, double-spaced manuscripts, please. If possible, please send a disk with your manuscript. Use common, not Latin, species names. We do not carry footnotes; incorporate sources in your article. We edit for clarity using Strunk and White's *Elements of Style* as our guide and favor clear wording over specialized terminology. Send your work with a stamped, self-addressed envelope; we will acknowledge its receipt.

We do not pay for articles or illustrations, but we do send five authors' copies when published. Thank you for your interest. We look forward to receiving your submission.



# Anchovies on the Menu for Sea Herring

By STEPHEN C. SAUTNER



*Atlantic Herring, Clupea harengus* Linnaeus 1758

Schools of sea herring (*Clupea harengus*) move within range of surfcasters in New Jersey beginning in the late fall and lasting through mid January, until cold water eventually pushes them offshore. This brief migration goes largely ignored by anglers, most of whom have hung up their tackle for the year. However, a few hardy souls scramble down to their favorite beachfronts and jetties and lob multi-hooked Sabiki rigs, sometimes hooking two, three and even four fish at a time. The herring average 12-14 inches, and give a peppery, albeit short-lived fight on light spinning tackle. Their bone-riddled fillets are excellent when pickled, and a half dozen or so can fill a few jars with delicious mid-winter treats.

While cleaning a particularly plump specimen caught on Dec. 20, 2003 at Shark River Inlet in New Jersey, I discovered it was filled with two dozen young-

*The author is in the communications department of the Bronx Zoo and is a frequent contributor to the outdoor column of the Sunday New York Times; the drawing is from Bigelow & Schroeder's "Fishes of the Gulf of Maine."*

of-the-year bay anchovies (*Anchoa mitchilli*). Still undigested, the tiny fish ranged from one-half to three-quarters of an inch long, and appeared almost clear except for the black of their pupils. According to Bigelow and Schroeder's classic *Fishes of the Gulf of Maine*, as well as other references, sea herring feed mostly on zooplankton and copepods, and only occasionally eat fish. The ones I caught were obviously taking advantage of locally abundant anchovy schools, which pour out of estuaries when water temperatures drop. During the peak of fall migration, dense shoals of bay anchovies - some numbering in the hundreds of thousands and the size of school busses - appear like reddish stains in the ocean. Everything from jumbo bluefish to common loons follow them, causing the schools to undulate this way and that as they flee from hungry mouths and gaping beaks. Though no anchovy schools were visible that cold December day, small flocks of Bonaparte's gulls began dipping along the riplines, possibly cashing in on what the herring had already discovered below the inlet's surface.



# Symphony of The Sand Plants

by CYNTHIA LANE

I grew up in a small Wisconsin town that had no symphony, at least not in the classic sense. Instead it had a symphony of natural wonders: ponds hosting the fugue of the frogs and bubbling streams composing original water music. It was not until I moved to Miami that I heard my



*Contrast of natural and developed South Florida coast*

first classical symphony. The tone and volume were different from the Afro-Cuban and West African music I know so well, but the synergism was the same. At times, I heard a single instrument, then heard others join in, lyrically creating the whole.

I remembered this experience last September as Sam Wright and I walked to our research sites within the edge of Hurricane Michelle churning just offshore. The sky and ocean loomed, a contrast of dark and frothy white. Halophytic (salt tolerant) dune – plants struggled to hold the sand, but the high tide and breaking waves exposed their roots. Spray hit my face and the wind whipped my hair. My lips tasted of salt. Yet when I bent

*Dr. Lane is a conservation ecologist at Fairchild Tropical Garden, some of her co-hosts addressing aspects of coastal conservation are: Dr. Jack Fisher, Sam Wright, Hannah Thornton, Elena Pinto-Torres, Meghan Fellows, Jennifer Possley, and Dr. Javier Francisco-Ortega.*

down to examine a plant, I could feel calm air near the ground. This is the phenomenon that forms dunes – calm air in the shelter of the dune plants allows the sands to fall. Only a foot above, the wind whipped the sea oats (*Uniola paniculata*) into a wild dance as sea grapes (*Coccoloba uvifera*) did a slower funk. Plants moved individually, yet in unison, forming a whole greater than the parts, a symphony of sand plants.

We were searching for the federally endangered beach clustervine



*Sea oats surround skeletons of Australian pine*

(*Jacquemontia reclinata*). A wiry, tough vine, it hunkers down out of the wind, toughing out the heat and sun. By growing inland from the halophytic zone, *Jacquemontia* avoids being buried by sand or washed away by wild seas and high



*Coccoloba uvifera* (sea grape)

tides. Surprisingly delicate white flowers lace the ground. It was once abundant on the east coast of South Florida, but despite extensive efforts by Fairchild Tropical Garden conservation staff, local land managers and naturalists, only nine small natural populations have been found.

Intense coastal development and recreational use have drastically reduced the extent of the once contiguous dune ecosystem. A 1993 survey of intact coastal areas indicated that only a small percentage of original coastal vegetation had escaped destruction. The remaining coastal vegetation is heavily impacted. Raking the beach to pamper sunbathers destroys the waving grasses quicker and more often than the occasional storm. Beach stars (*Cyperus pedunculatus*) are the first to be uprooted as trampling widens the beach area. Non-native invasive species often out-compete native beach species. Luckily, some, such as Australian pine (*Casuarina spp.*), are not as adapted to hurricanes as the natives. The high mortality of these species following Hurricane Andrew gave our locals another chance.

I wonder if the thousands of beachgoers know the musicians of these dunes. At most public parks, balancing natural

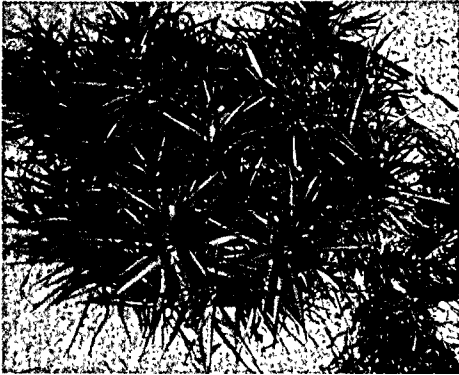
resource preservation with recreation is a constant challenge. Last year there was pressure to put a ballpark in a coastal park. Cute and cuddly animals tend to be more successful in capturing public interest than small plants. While everyone jumps with excitement as dolphins swim by, far rarer plant species bloom unnoticed just a few feet behind – gems unlike any, anywhere, anytime.

On that day last fall, Sam and I were thankful for the wind. The back side of a dune on a hot day in Florida is as bright and intense, and in many ways as unpleasant, as the 40° below zero days back home. But even on the hot days we love the unique sonatas of the dune. And as Sam says, “It sure beats being in a cubicle.”

We share our fascination with these dune ecosystems with the land managers who oversee them. Steve Bass, a land manager in Palm Beach County, has worked for years to protect coastal areas and educate people about them. Fairchild’s conservation staff is working with him and a group of teens to restore a section of the dune which will include plantings of *Jacquemontia*. We’ve started working with Ernie Lynk (Miami-Dade County) to evaluate the effects of trails and foot traffic on rare plants. He suspects that while unauthorized trekking through sensitive areas crushes dune plants, the effect of human activities is not always



*Okenia hypogaea* (beach peanut)



*Cyperus pedunculatus (beach star)-a cymbal splash on the beach*

negative. Activities that result in the reduction of competitive woody species may be beneficial to low growing plants like *Jacquemontia*. Some plants, like *Okenia hypogaea* (the beach peanut), seem to flourish with a little rough treatment. *Okenia* is thickest in an area where Britney Spears recently shot a video. It appears that soil disturbance or the crushing of competing species were conducive to *Okenia* growth. Then again, maybe it was the music.

Sea oats, abundant and waving in unison; the slow and steady undulations of

the hardy sea grape; *Jacquemontia* and beach peanut vines recklessly soloing as they reach for space; the cymbal crash of beach star; shifting sands; the wind as maestro: This is a symphony I have seen many times. Different musicians, different songs – silver maples and nettles, oaks and prairie grasses, along with the maestros of flood and fire.

But these composers and musicians are disappearing rapidly. Conservation biologists and ecologists warn that we face one of the greatest extinction events this planet has ever experienced. Ignored, the symphony of the sand plants will likely be reduced to a few common species. Is this the legacy we leave for future generations? Do we condemn them to one violin and cello? I for one urge: let's save the symphony.



*Blossoms of the federally endangered beach clustervine Jacquemontia reclinatolook like stars.*

## GENERAL STORE

Here is a sampling of books and items for sale. More selections are available in our BEACHLOVERS Catalog. Call or write for a copy.

### BOOK SHELF

**Anglers Guide to Sharks** by Jack Casey. A compact 32-page guide to Atlantic sharks. Learn one from another and about size, color, range, and behavior. \$3.

**Blue Frontier: Saving America's Living Seas** by David Helvarg. What is the future of the ocean? Detailed, lively discussion with American Littoral Society a prominent player. \$14.

**Life in the Chesapeake Bay** by Alice and Robert Lippson. Some books are classics. This is one of the best. A 2nd edition, the Lippsons have added close to 120 species which include birds, insects, reptiles, and mammals. Easily read by professional biologists to the summer vacationer. \$14.

**New Jersey Coast Walks** by Dery Bennett. Follow the author's route from the Hackensack Meadows to Cape May and on to the Delaware Bay. Seashore tour will fascinate and teach you at the same time. \$5.

**Profiles in Salt Water Angling** by George Reiger. Published in 1973 this is a history of the sport - its people and places, tackle and technique, and stories about Lerner, Van Campen Heilner, Farrington, Hemingway, and Zane Grey. Hardcover, signed by the author. \$35.

**Seaside Reader** edited by Dery Bennett. To quote some reviews "One of the best collections I have ever seen," "Bennett's witty selection is just the right thing to take you away from the din of a beach in July," "...an anthology featuring writers as diverse as Cousteau and Mailer..." \$14.



**NEW**  
**ALS Hat** - Khaki with adjustable leather strap. ALS logo in navy. \$12.



**I Care About the Coast T** - Stonewash green. M, L, XL, 2X. 50/50. \$15.

### OTHER FAVORITES

**Lighthouse T** - Featuring the four lighthouses most frequently visited by ALS members. White w/Littoral description on the back. 100% cotton. M, L, XL, 2X. \$15.

**1/2 Zip Sweatshirt** - Hunter green w/"We Care About the Coast" on the front. M, L, XL, 2X. \$25.

#### FOR THE KIDS

**Crab T** - Blue w/Littoral description on the back. 100% cotton. Youth Sizes: S, M, & L. \$10.

**I Care About the Coast T** - Leaf green. 100% cotton. Youth Sizes: S, M, L & XL. \$10.

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\$ 0.00 to \$ 5.00 - \$ 0.00	\$15.01 to \$30.00 - \$6.00
\$ 5.01 to \$10.00 - \$ 2.50	\$30.00 to \$45.00 - \$6.50
\$10.01 to \$15.00 - \$ 3.95	\$45.01 to \$60.00 - \$8.00

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# Tagging Report

By PAM CARLSEN

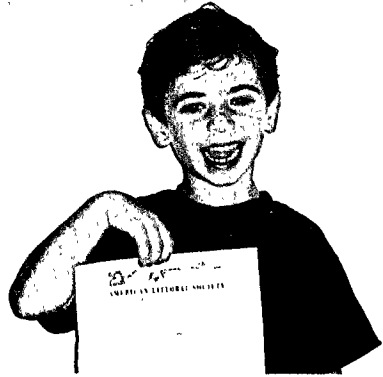
Taggers have said that there is nothing like receiving a "lumpy" envelope from A.L.S. with the striper on the front. This signals a return of a fish they tagged. Stuart Fries has tagged since the 1980's and now is teaching his grandchildren to fish. On July 3, 2003, Brandon Fries caught a 14" fluke at Rockaway inlet. His grandfather tagged the fish and together they released it. On 8/7/03, Stuart's neighbor, Henry Lipper, fished Rockaway Inlet, and recaptured Brandon's fish. Even after a short time, the recapture letters are appreciated.

Stuart Fries is also our contact with the Brooklyn Yacht Club and in November 2003, he relayed this amazing blackfish story. BYC member, Richie Shapiro, fishing in his "favorite spot", off Sandy Hook, NJ, caught the biggest blackfish, he had ever seen. The fish was kept alive in a livewell on his boat and brought back to the yacht club. It was then placed in a large cage and lowered into the water to be kept alive, until it could be taken for an official weigh-in. The next day, the fish was placed in a cooler filled with water and taken to Stella Maris Fishing Station in Sheepshead Bay, where it weighed in at 18 lbs. 11 oz., 28" in length, with a girth of 20". Then the fish was placed back in the cooler and was returned to the Brooklyn Yacht Club, tagged by Fries, and returned to the cage. The cage was lowered back down into the water. The next day, the fish was returned to the livewell and brought back by Shapiro to a place near Sandy Hook and released. The IGFA (2001) all tackle gamefish record for blackfish was a fish caught in January of 1998, at Ocean City, NJ, weighing 24 lbs.

*As noted earlier, the author directs the Society's tagging program.*

According to Bigelow and Schroeder, "Fishes of the Gulf of Maine," tautog's (blackfish) maximum length is three feet and fish of more than 14 pounds are very rare. This is a great fish carrying an A.L.S. tag.

In 2003, three striped bass were returned after 10 years "out with our tag."



*Brandon Fries displays citation letter for his first tagged fish return, a fluke.*

This is a record number of fish in one year. Dick Mann's 29" bass tagged 8/22/93, at Sow and Pigs, Buzzards Bay, MA, was recaptured 8/5/03, 46", at Montauk, NY, by another ALS tagger, Ron Onorato. Arthur Fette's 28" fish tagged 6/26/93, at S. Kingstown, RI, was recaptured 8/11/03, at Race Rock Lt. in Long Island Sound. Unfortunately, no measurements were taken. Lastly, Bill Sharpe's 24" striped tagged 4/24/93, in the Navesink River, NJ, was recaptured in Delaware Bay on 11/16/03. It was 39", 32 lbs. Another striped bass "out" eight years, 10 months, has a chance to make the 10 year mark. George Terpenning's 17" fish, tagged at Old Lyme, CT, was recaptured 5/15/03, farther up the Connecticut River at Windsor Locks, by Tom Savoy. Tom released the fish with the tag in place.



Time after time, striped bass return to the same spots. Bill Shillingford tagged a 14" striper at I.C.W. buoy #304 behind Ocean City, NJ, on 6/30/98. On 9/14/03, he recaptured that same fish at I.C.W. buoy #297, behind Ocean City, NJ, 27", just a few markers from the original tagging. Four bass tagged by Frank Casey in Boston Harbor, in August and September of 2002, were recaptured in June and July of 2003. Three fish were in Massachusetts: Hull, Boston, and in the Merrimack River, the fourth fish was in Portland, Maine.

Greg O'Driscoll's stripers tagged in April, 2003, at Penns Grove, in the Delaware River, were recaptured far apart in early June of the same year. One was at Cape May Inlet, NJ, and the other was in Boston, MA. Both were 35" fish.

It was also the year of big fluke. Blanche Goodman, Merrick, NY, wrote, "This was one of those fluking days that fishermen dream of. We could do nothing wrong...and even released a 25-incher that was at least five pounds. We did keep a 9 lb. 14 oz. fish. It was a great day!" Howard Leeman, Bogota, NJ, tagged 10 fluke ranging in size from 21.5", 3 lb. 15 oz., to 30", 12 lb. 7 oz., in late July and August. With his tag cards, he sent pictures and this note, "I have also enclosed a picture of a 14 lb., 32.75" fluke caught 7/3/03, which I did not tag. This fish was also released, however." Many of Howard's fish were caught in Ambrose Channel, as was a 28", 7.5 lb. fluke tagged and released by Tank Matraxia on, once again, 7/3/03.

Some fluke aren't so lucky as to be tagged and released. Robert Conklin, Riverhead, NY, wrote, "This tag was turned in to me by a commercial fisherman, who recovered it on 6/20/03. He was fishing outside of Shinnecock Inlet for monkfish. This tag came from the stomach of a 10 lb. monkfish. I guess you can find out what he ate." This tag was on an 11" fluke, tagged 8/8/02, by John Weber, inside Jones Beach Inlet, NY.



*Howard Leeman with one of the large fluke he tagged last summer in the Ambrose Channel entrance to New York Harbor.*

Sea robins are not a species of fish that we encourage tagging; however from time to time, one is tagged. On 6/4/03, an 11.5" sea robin, was tagged in Sandy Hook Bay, by Joseph Dishman on a Hudson County School of Technology, Explore 2000, trip. This fish was recaptured, 1/2 mi. east of Mantoloking, NJ, on 8/6/03 at 12.5". The Explore 2000 program is run by teacher, John Ponticorvo. Glenn Blank of the NJ Hudson River Fishermen's Association, assists with the tagging. Students learn about fish, habitat, and the importance of protecting this resource for the future.

Tom Lake, also teaches young people, and wrote about a small striped bass he tagged in October. "I do not usually tag 9.3" fish. In this instance, however, the water was cold, the air was cool, the sun was behind a cloud, the fish was a chunky little guy, and I had 30 middle school kids from Elisabeth Morrow School, watching intently. This one tagged bass became an extremely good object lesson for the students on how we keep tabs on the life history of Hudson River fishes, as they venture out into the North Atlantic. The fish swam away with much vigor." Teaching young people to fish and to care about fish is a gift to all concerned.

## From The Director's Desk

### Next Ocean Commission - New Directions or Missed Opportunities?

*The driving force and urgency of our new concern for the sea stems from the changing character of the world itself - from mounting economic needs, from congested populations, from our own deteriorating shores. -- Final Report of the Commission on Marine Science, Engineering and Resources (The Stratton Commission Report, 1969).*

For the first time in over 30 years, not one but two "blue ribbon" panels have been examining the condition and issues facing the coast and nearshore oceans of the United States.

The United States Commission on Ocean Policy was created by Congress through the Oceans Act of 2000 to establish findings and make recommendations to the President and Congress for a comprehensive national ocean policy to address a broad range of issues from the stewardship of marine resources and pollution prevention to enhancing and supporting marine science, commerce, and transportation. The Commission's final recommendations are expected this spring. The Pew Oceans Commission, created by the Pew Charitable Trusts was a bi-partisan, independent organization that conducted a three-year study bringing together a diverse group of American leaders from the worlds of science, fishing, conservation, government, education, business, and philanthropy for an inquiry into the state of U.S. oceans, the problems they face, and what might be done to address these problems.

The fact that each commission reviewed a strikingly similar issue set is an indication that the ocean and coastal agenda is readily apparent to even fairly conscious observers: pollution, coastal development, fisheries, commerce, governance and stewardship. Ironically, it is much the same agenda as was examined by the Commission on Marine Science, Engineering and Resources - the famed Stratton Commission - over 30 years ago. The Stratton Commission was responsible for recommending the creation of the National Oceanic and Atmospheric Administration, the enactment of the Coastal Zone Management Act and many other fixtures of our current approaches to coastal resource management; an interesting footnote was the Commission's recommendation that Congress "authorize the Army Corps of Engineers to deny a construction permit in order to protect the environment." The Commission was also among the early proponents for managing international fisheries on the basis of ecological units rather than species. Ocean advocates hold great hope that the current commissions will have similar impact as they pursue, in many instances, the unfinished agenda of the Stratton Commission.

Whether the recommendations of the Pew and US Oceans Commissions will find the traction that those of the Stratton Commission did -- with significant innovation and changes in the way the ocean and its resources are managed --remains to be seen. It is clear that the state of the ocean, the coast and their resources demand immediate and serious change in the status quo. Despite the seriousness of the environmental issues documented by both Pew and the USOC, no tremendous political consideration or priority - no buzz - has surrounded the release of the reports. The Stratton Commission report was delivered at a time when, unlike Pew and USOC, leading political figures had given significant priority to ocean policy questions in political campaigns or their own independent policy development initiatives. In the words of one chronicler, national government was primed to listen, and as it proved, was also poised to act.

Today's Ocean Commissions face similarly challenging (and many of the same) questions as the Stratton Commission did. Coastal areas face new pressures from continuing population growth and development, with their accompanying impacts to water quality and habitat -- keys to their ability to support life and vibrant marine communities. Damage to coastal habitats and waters is very much an "in my backyard issue." More than 50 percent of Americans live within 50 miles of our 95,000 miles of shoreline. The dismal condition of many key fisheries is beyond denial, and significant questions are posed by all sides as to the effectiveness of the current management structure. In the words of the Pew Oceans Commission:

*We have reached a crossroads ..what we once considered inexhaustible and resilient is, in fact, finite and fragile.*

We are facing our generational moment -- the opportunity to advance our stewardship and caring for the coast. It will take a significant effort to act on the renewed concern for the ocean embodied in this generation of Ocean Commission reports, but it is an opportunity we can ill afford to miss.

Tim Dillingham

# Book Reviews

## **COASTAL HAZARD MANAGEMENT**

By Norbert P. Psuty and Douglas D. Ofiara

Rutgers University Press, New Brunswick, NJ  
401 p. \$68.00(cloth).

New Jersey published its first comprehensive study of state shore protection problems and solutions in 1981, a three-volume document with lots of good detail and commonsense, but a little light on alternatives to then current practices. By the mid-1990, it was obvious that the report needed updating to reflect better science and consideration of alternatives to the common practice of trying to hold the beach in place. And so a reassessment of the 1981 plan was conducted by Norbert Psuty of the Rutgers Institute of Marine and Coastal Studies at the request of the NJ Department of Environmental Protection. The medicine in Psuty's report was much too strong for the Whitman administration and its supporters who promptly disowned it and consigned it to oblivion ("If the messenger brings bad news, shoot the messenger"). This book is that report between hard covers. It's good to see it see the light of day, big, serious, and important, a cautionary tale about the

geologic, social, and economic reasoning that goes into current approaches to the problem of too much investment built too close to the ocean's edge. The investments are mostly residential structures, and the ocean that borders them is often unruly.

We have a problem.

The book's subtitle is "Lessons and Future Directions From New Jersey," an indication that the authors want readers to understand that New Jersey is not necessarily the state with the most problems with coastal development, but rather an early leader in the rush-to-the-shore, now-what-do-we-do syndrome. They want other states to benefit from (but not necessarily follow) the New Jersey example.

Psuty does the science; he addresses the subject as a coastal geomorphologist who has studied beaches all over the world, measured everything from sand grain sizes to 5500 years of sea level rise, charted coastal storms and overwashes, befriended dune grasses, and explained to large and small groups his firm, balanced ideas about what to do now.

Get the book and follow his arguments. You will learn that there are as many approaches to beach science as there are beaches. Some he says should be left alone, others replenished, dunes should be protected, some houses should retreat, others should get jacked up.

Ofiara tackles the economic issue in a complex chapter that examines various studies that have tried to measure the



cost/benefit ratio of shore protection projects, i.e., does an investment of, say, \$100 million for beach replenishment result in more or less than \$100 million in benefits. And, are those public or private benefits? His thesis is that true costs and benefits are hard to measure but in studies so far have tended to err on the side of benefit.

So, Psuty wants us to try to prevent coastal storm damage through a variety of devices and practices, and Ofiara wants us to measure the costs carefully. Good advice.

## **THE DANCE OF THE FLYING GURNARDS**

by John Waldman

The Lyons Press, Guilford, CT  
206 p. \$24.95 (cloth).

Waldman's office is at the Hudson River Foundation in downtown Manhattan. There he sits and works through his days thinking and writing about fish. Then he goes fishing. The office (and probably his home and his auto) house collections of tackle, lures, scientific papers, and other assorted seashore treasures.

He has an eye for the curious and writes well; that's quite a combination. In this book, he sets down about 120 vignettes of what he calls "coastal curiosities and beachside wonders," and it is a splendid collection of interesting subjects from ambergris, a greasy ball of fat laced with squid beaks that a sperm whale periodically dumps at sea, to worm hatches, when marine worms hatch and dance in coastal shallows, much to the delight of striped bass. In between, he covers such things as coastal fog, fiddler crabs, jellyfish, ocean sunfish, horseshoe crab spawning, puffins, icebergs, hurricanes, and herring runs. For each subject he describes behavior, feeding, migration, or something else distinctive.

About flying gurnards, an unlikely sea robin-like fish that grows to a foot, lives on the ocean floor but jumps. It's got wings but it can't fly, an attribute which

didn't prevent ancient scholars from classifying gurnards with dragons. This the kind of interesting stuff that Waldman has either dug up or directly experienced about coastal curiosities.

A quibble: in one of his selections, Waldman calls ospreys or fish hawks "superb fishers." We object: a fisher is a mammal, a predator of northern forests; it makes its living running down squirrels in the tree tops. Fisherman, fisherperson, fisherthing, angler, fisher? It's tough to be correct these days. Maybe ospreys should be called plumed piscatorial plunderers. But Waldman ends up okay on ospreys as he describes them diving 50 feet toward the water at up to 40 miles an hour to nail their prey. What's not to like about ospreys, or about this book?

## **CRAB WARS**

By William Sargent

University Press of New England,  
Lebanon, NH  
122 p. \$24.95 (cloth).

Horseshoe crabs have been around for at least 300 million years. They look like giant trilobites or pill bugs, shaped in the form of a horseshoe with a long sharp tail, which they use to turn themselves over if stranded on the beach upside down, contrary to the belief that they crawl around looking for people to impale. They are prolific, easy to catch and over time have been used for chicken food, fertilizer, bait, and most recently as a source of *Limulus* amoebocyte lysate (LAL), invaluable in the biomedical industry to test for bacterial contamination.

They are harvested from Massachusetts to the Carolinas and shipped over tortuous routes by boat and truck to reach labs and bait houses while escaping the best efforts of environmentalists and fisheries biologists to bring the decimation under control.

Sargent covers the horseshoe crab story with charm and in detail in a short book of fact after fact, leavened by eye witness, hands on, personal accounts of the fisher-

men, the fishery, and the biomedical business. While accurate counts are often in dispute, it is undeniable that the numbers of horseshoe crabs are in a downward spiral. The LAL industry wants about 600,000 a year, which they bleed and then either return to the water or sell as bait. The bait industry will take all it can get, at least half a million a year. In addition to this unrelenting pressure on the crabs, there is another complicating factor -- a species of shorebird (the red knot) has evolved over time to rely on horseshoe crab eggs to fuel its exhausting migrations from Terra del Fuego at the tip of South America where they winter to the Arctic where they breed. They make this trip by hopscotching up the coast to Brazil and then flying non-stop to get to the beaches of Delaware Bay, where they fatten up on crab eggs for the next long flight to their breeding grounds. This is a death-defying life style: they arrive on the Bay beaches having used up all of their fat and some of their body tissue as fuel. They need to add weight in a hurry, and horseshoe crab eggs appear to be their sole, or at least most important, source of energy. So there are



two species at risk, the crabs and the birds.

Efforts to control the crab harvest have had limited success; harvest quotas have been cut almost in half, but the LAL industry continues unabated.

Sargent covers all these issues

in short, well written diary entries as he winds his way from Woods Hole, MA, to Delaware Bay, Virginia, and South Carolina. He is on the side of the crabs. Those of you who visited Delaware Bay 10 years ago to witness this red knot migration were treated to one of nature's

grand spectacles. This spring the migration was late and the numbers sparse, about half last year's count.

Sargent quotes Brian Harrington, a longtime red knot researcher on May 29, 1985: "The beach was olive green with billions upon billions of tiny green horseshoe crab eggs. The beach was more eggs than sand. But the birds were not eating or flying...the knots seemed more alert and vigilant than usual. Their posture was somehow different." Brian knew something was about to happen. Then suddenly it did. "At 5:15 sharp a thousand birds took off at once...heading north-northwest. Two minutes later a thousand more birds followed...in a few hours it was mostly over. We had witnessed the exodus of over fifty thousand birds...we took a compass bearing of the birds as they flew...fourteen hours later we received a call from Chris Rimmer on Hudson Bay. He has just seen red knots flying overhead on exactly the same course. Those were our birds. I knew it in my bones." Surely, Sargent is telling us, such birds deserve to maintain their horseshoe crab connection.

## SOLOMON STARBUCKS STRIPER

by Roy Rowan

Book Nook Press, Box 598, Block Island, RI 02807

booknook@ricconnect.com

86 p. \$22.95 (cloth).

If you want to raise your kid to learn about striped bass, this a great start. It's about Solomon's life, his journeys, loves, mishaps, and his search for better things. He lives to a ripe old age and has adventures that will teach and charm youngsters; adults will like it too.

Solomon is different right from the start -- for one thing, his stripes are coffee colored, not black. Hence the middle name. And while his life is fiction, he experiences are realistic and piscatorially accurate. Give it to eight-year olds to read; when they are finished, read it yourself. Or, vice versa. It's a delight.

### TOUGH QUESTIONS, EASY ANSWERS

The mailbag is overflowing with questions from loyal readers. Some of the letters show inquiring minds; others are, quite frankly, mundane and even shockingly infantile. But they deserve answers, so here we go:

Q: I found a dead bird on the beach (picture enclosed). Can you tell me what kind of bird it was and why it died?

A: If I can accurately interpret the out-of-focus picture you sent in, I believe what we have here is a weathered plastic 6-pack ring. While these rings can kill birds, I believe this one just washed up with the tide; 6-pack rings don't die.

Q: Do all fish live in water?

A: This is a tricky one, so I called on T. Forbes Lodge Ph.D. at the Museum of Comparative Zoology at Harvard University. He interrupted a rousing game of backgammon to telegraph this reply: "By definition fish swim, and thus anything that swims is a fish, except, of course, a swimming person, polar bear, muskrat, labrador retriever, or some such mammal. Fish can't swim on land or in the air, though walking catfish can walk and flying fish can flit above waves for some distance. For that matter, mudskippers can skip across mud; that goes without saying. And eels can squirm over wet grass. But all fish do live in water, except the lungfish which can survive for a long period in dried mud. I could go on about this, but I have a squash game with Lowell Sedgewick in 20 minutes, so I must depart. Tootaloo."

Q: Last week, I was kayaking around in a tidal bay in North Carolina when my kayak came to a dead stop. What caused this?

A: Chances are you ran aground. Up north we learned about this phenomenon many years ago. The solution is to stay in water deep enough to keep your kayak afloat. We believe knowledge of grounding avoidance will reach people who live in the southern states before the end of this decade.

Q: I made up a riddle (I'm 11 years old): Why didn't anyone pay attention to the tidal wave in the Bay of Fundy?

A: Because it was a tidal bore. Even for an 11-year-old, this is a stupid riddle. Might I suggest you spend less time listening to Britney Spears CDs and more time on your school work. And, please show this to your parents.

Q: What's the hardest fish to catch?

A: I'm tempted to say the one that got away. Instead, I posed your question to Suds Gronickle, with whom I often pursue the finny prey (go fishing). "I've been trying to catch tarpon in Alaska for 10 years," he said. "Not a bite. That's one tricky fish!"

Q: Is sushi good?

A: Compared to what? This kind of question drives me nuts. I wouldn't use sushi for earplugs, and it's not a good substitute for duct tape. I think your question should be: Is sushi good for you? And the answer is: of course. What could be better for you than raw fish, sticky rice, salty soy sauce, pickled ginger root, and mustard that blows the top of your head off? Go for it.

Q: Last year, I saw a hawk dive in the water and come up with a fish. Is this fair?

A: I trust you don't need a lecture on ecology, food chains, the web of life, and survival of the fittest. What you witnessed was an osprey catching a fish, fair for the osprey but tough on the fish. Let me answer your question with a question: Last week, I saw a man dive into a Big Mac and come up with mouthful of beef. Is this fair, or, for that matter, nutritionally wise?

Coming Next Issue: Is the parrotfish a wise wrasse?

D.W. Bennett

## AMERICAN LITTORIAL SOCIETY 2004 FIELD TRIP SCHEDULE

A brief listing of trips through the rest of the year.

**May 8-17**

**BELIZE REEFS, RUINS, AND RAIN FOREST**

Hikes through forests, snorkeling -- monkeys, birds, fish.

**May 20-23**

**ASSATEAGUE SPRING WEEKEND**

Three days at the national seashore during spring migration, birds, butterflies, beaches, some ponies, and a seafood buffet.

**June 4-6**

**MONTAUK SUMMER WEEKEND**

At the eastern tip of Long Island -- nature away from the madding crowd.

**July 10-20**

**OLYMPIC PENINSULA/PACIFIC NORTHWEST**

Puget Sound, then west to the ocean -- killer whales, puffins, mountains, rain forests, alpine meadows.

**September 9-14**

**GRAND MANAN AND CAMPOBELLO ISLANDS**

Hiking these rustic islands with four ferry trips, two boat trips (whales, birds).

**October 20-26**

**NORTH CAROLINA OUTERBANKS**

Ninety miles of beach -- swimming, birds, villages, Hatteras Light, and a look at last year's hurricane damage.

**November 4-7**

**ASSATEAGUE FALL WEEKEND**

Back to the national seashore and its beaches, wetlands, and trails, and yes, the Chincoteague ponies.

*Consult your field trip brochure or our web site ([www.littoralsociety.org](http://www.littoralsociety.org)) for details, or phone Pat at 732-291-0055.*

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