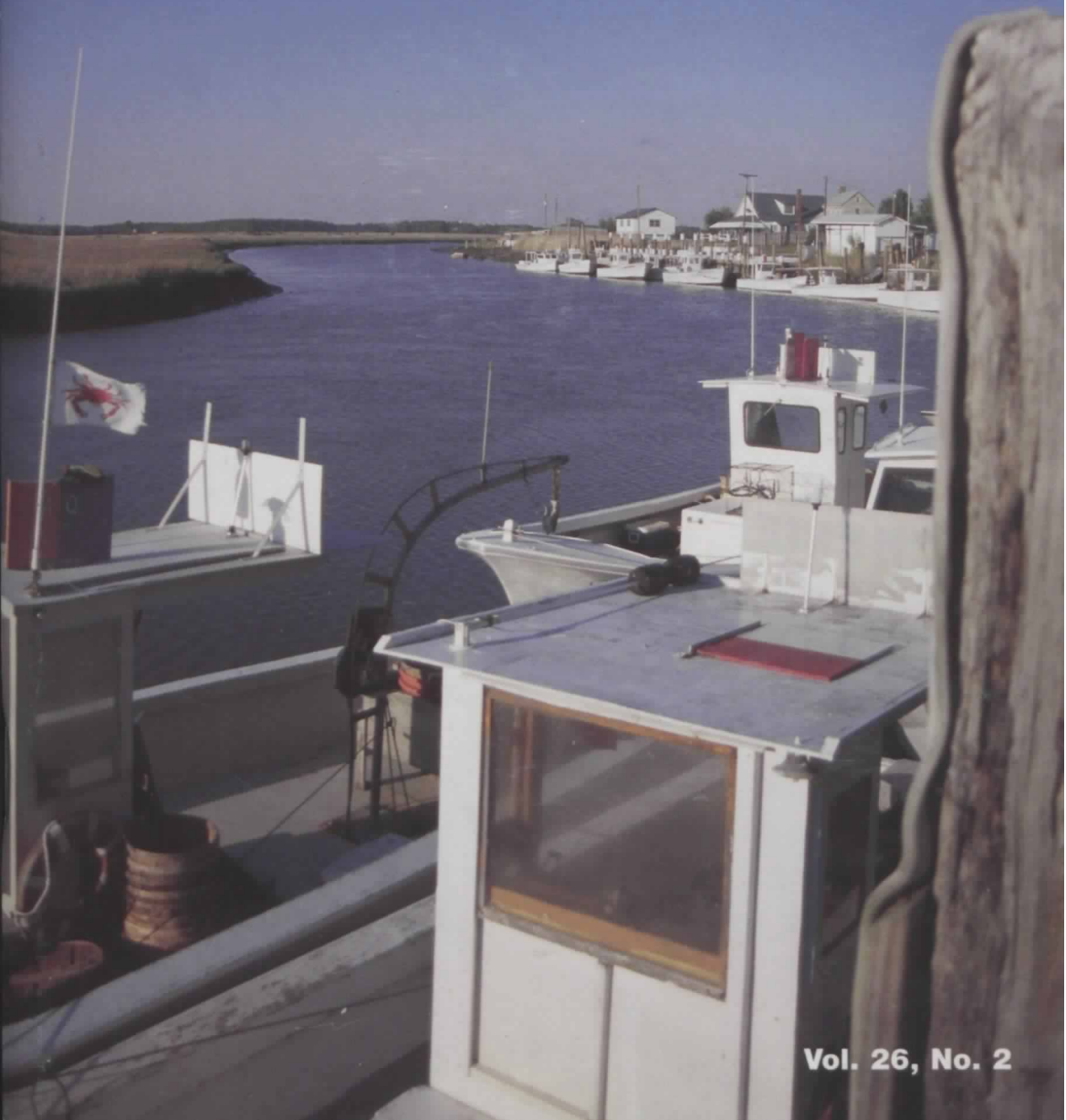


underwater naturalist



Vol. 26, No. 2

FIELD TRIPS 2003

A few of the upcoming field trips for 2003. Check the Field Trip Schedule for more, and for local trips check your newsletters. Call ALSHQ for more details.

May 29-June 1

Maine Coast Weekend

Visit the Maine coast when the birds are migrating, flowers are in bloom, and the ocean is full of life, but the summer crowd has not arrived. We stay at the Caignair Inn on the water south of Rockland. The Inn lies across from Clark Island where we take short hikes for birds and wildflowers, ending up at the water's edge for tidepool exploration. All day Saturday is spent on Monhegan Island to hike its trails and eat a picnic lunch on cliffs above the Atlantic -- eiders, seals, guillemots, lobster traps, and an artists' colony. Other days there is time to hike to the top of Camden Hills overlooking Penobscot Bay. During the weekend: warblers, eagles, osprey, and lots of flowers -- clintonia, lady's slipper, bunchberry, and wild sarsaparilla. The weekend starts Thursday evening with a short introduction at the Inn and then proceeds each day with box lunches as we go, and a lobster dinner Saturday night. The trip ends late Sunday morning with a visit to Owl's Head lighthouse. The weather in Maine is changeable, but we get outdoors anyway and there's plenty to see. Limit: 20. Leaders: Dery Bennett, Dennis & Becky Reynolds.

July 14-19

Machias Seal Island

Our fourth visit to Machias Seal Island. Five days in northern coastal Maine. Day boat trip to Seal Island to see puffins, razorbills, Arctic terns, and pelagic birds. Other trips to see eagles, osprey, river otters, and other northern specialties. Limit: 10. Leader: Bob Quinn.

September 7-10

Cuttyhunk Island & The Upper Cape

After checking into our lodging and touring local sites, we'll explore the Upper Cape's treasures, like the seaside town of Falmouth with its stately sea captains' homes and historic lighthouse. On Monday, we'll cruise across Buzzards Bay to hike and picnic on Cuttyhunk Island (population 26) to search for migrating butterflies and birds sailing among the rolling hills and blooming heather. Enjoy a sailor's view of the magnificent beaches and the colorful cliffs of Martha's Vineyard before heading back to the mainland for a sumptuous seafood supper.

Day two: we'll stroll the village of Woods Hole for a behind-the-scenes look at the Marine Fisheries aquarium, the Oceanographic Institute visitor center, secret garden, pleasant shops and lovely Quissett Harbor.

Day three: set out for a half-day ocean adventure in search of whales, dolphins, and sea birds; and, of course, visit a cranberry bog on the way home. Limit: 10. Leader: Nancy Church

October 13-22

Northern California Coast - Klamath Basin, Oregon

The redwoods, tallest trees in the world, tower above the mist-shrouded shoreline. Huge Pacific waves crash upon massive sea stacks and coastal headlands while countless flocks of sea birds migrate south. This is the dramatic and isolated northern California coastline. De Norte County is more like the true Pacific Northwest than the rest of California and has an abundance of wildlife and scenery, without the crowds. In addition to the magnificent redwoods (words and pictures cannot portray their majesty), we hope to see large mammals such as California sea lions and Roosevelt elk plus one of the largest concentrations of migrant water birds in all of North America. We'll also spend several days in southern Oregon, including a day at the spectacular Crater Lake National Monument (do you know what a lava tube is?), and the Klamath Basin National Wildlife refuge, all in habitats vastly different from the coast. This is a wonderful time of year to explore an exciting and unique, yet little visited, part of our continent. Limit: 20. Leader: Bob Quinn.

This expanded issue of UNDERWATER NATURALIST concentrates on Delaware's coast, present and future. Its lessons are applicable to all coastal states.

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Cover Photo: by Dennis Reynolds
Commercial fishing boats docked
on the Leipsic River.

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Note: Past volumes of Underwater Naturalist and individual articles are available on microfiche from UMI, Ann Arbor, MI 48106.



Correction I

Pam Carlsen sent me a copy of the magazine 26(1) and you can let her know I appreciated it. You might also mention that striped bass are not *Scianendae* but are members of the family *Percichthyidae* along with white and yellow perch, weakfish, and everybody's favorite the keelcheek bass. Thanks again.

Regards
Gary Shepard
Woods Hole, MA

Correction II

In the last issue, in a book review of "fisheries of the United States, 2000," you report that China produced 40 million metric tons of fish in 1999, slightly more than the next eight nations combined." Recent data indicate that China's numbers are wildly exaggerated because fishermen and their companies overstated landings or aquaculture harvest to avoid criticism from the central government. There is little doubt that China is the number one producer; the absolute numbers are suspect.

Tyrone Goodall
Washington D.C.

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Coastal Delaware: an Introduction

by GEORGE KOWALLIS

*Farewell happy fields,
Where joy forever dwells. Hail, horrors, hail,
Infernal world, and thou, profoundest Hell,
Receive thy new possessor: one who brings
A mind not to be changed by place or time.*

John Milton, *Paradise Lost*



The Addy Sea House, Bethany Beach, built at the turn of the 19th century, has weathered 100 years of coastal storms.

In the life of every child there should be a special stream, pond, lake, river -- a body of water that holds magic. For me, it was the ocean and bays at Bethany Beach, Delaware. Once, largely a church retreat, Bethany had grown into a family town. There was no drinking of alcoholic beverages and it was quiet. The Washington diplomatic corps went to Rehoboth, 12 miles to the north.

The surf was good then, maybe the best on the east coast. There was a broad shallow bottom making for a good run.

Kowallis is a longtime Society Board of Trustees member. He practices psychiatry in New York City and has studied a wide variety of marine life -- from seaweed to monkfish brains. Photos by the author.

Hanging on to a canvas raft, you thought you could ride forever. The great northeaster of March, 1962, would reshape the bottom in a way that the great hurricanes of the 1950s had not and the surf now spills much closer to the beach.

The waters were full of fish and from the shore we would watch the menhaden boats work the waters. A trip up to the commercial docks at Lewes showed the catch of the day: giant turtles, old aircraft engines, and every type of fish. Vast schools of dolphins stretching out to the horizon would pass, taking days at a time. Few fish were to be caught then.

The variety of shorebirds were many and nameless to the young. Mole crabs, exposed by each wave, promptly reburied themselves. Ghost crab burrows pocketed

the beach. The crabs were fun to chase at night with flashlights. The inland bays were full of clams, oysters, blue crabs, and flounder. The marshes there had probably started to form before the Egyptian pyramids were built.

Outside of town the beaches soon became deserted. The flotsam and jetsam of the world's oceans washed ashore to be collected or gawked at by the delighted beachcomber. The beach was punctuated by boarded up, concrete anti-submarine towers from a not too distant World War II. We all heard the stories of ships torpedoed and burning at night off Ocean City, Maryland, and of German landing parties setting ashore spies and saboteurs. The National Guard conducted anti-aircraft artillery practice during the summer using live ammunition. The black pock marks and dull thuds following the drone aircraft were reminders of what the war must have been like. Cupping our hand just so, we learned to slap the ocean surface hard producing a shell like thud and sending up a column of water.

When they rebuilt the town's jetties, it was amazing to see the huge blocks of granite trucked in to form the new bulwark and the machines used to accomplish this task. The machines had names like "Beach Monster" and were oversized as their names suggested.

The Indian River Inlet, six miles north up unimproved, two lane Route 1, was another awe inspiring feature of the locale. When the tide changed the waters would race out or in creating huge standing waves. Passing through these in a small charter boat would put your heart in your throat. Thinking what fish might lurk below had no bounds. Especially at night you could picture behemoth sharks and other nameless monsters plying the black waters.

Time brings change. All the fish come to have names and limits to their size and prowess. Things also change because forces beyond our control intervene. Condominium projects go up which are

totally out of scale with the rest of the community but the force of money proves unstoppable. The sprawl problem has begun.

More drastic than this is the change in water quality affecting all of life. For Delaware's three inland bays, Rehoboth, Indian River, and Little Assawoman, the downfall has come from three principal sources: chickens, sewage treatment plants, and unchecked housing development.

The Delaware poultry industry is the nation's largest, producing at least 700 million broiler chickens a year and 1.25 billion pounds of chicken manure in the area around the bays. Chicken manure is light and fluffy, and considered uneconomical to transport more than ten miles from the site of production. Hence, it is usually spread on nearby farm fields where it easily penetrates the sandy soil. The manure's contents, such as nitrogen and phosphorous as well as various growth enhancers including copper and arsenic, readily descend to the water table and from there into the bays. Facing this problem is a political hot potato, so you can imagine the courage it took when on July 26, 1998, Molly Murray and Jeff Montgomery of the *News Journal* of Wilmington, DE, ran a seven page spread entitled "*Poultry industry endangers health of state waterways: Runoff from chicken manure strangles life in rivers and bays, but growers deny responsibility for the pollution.*" The dirty little secret was now out in the open.

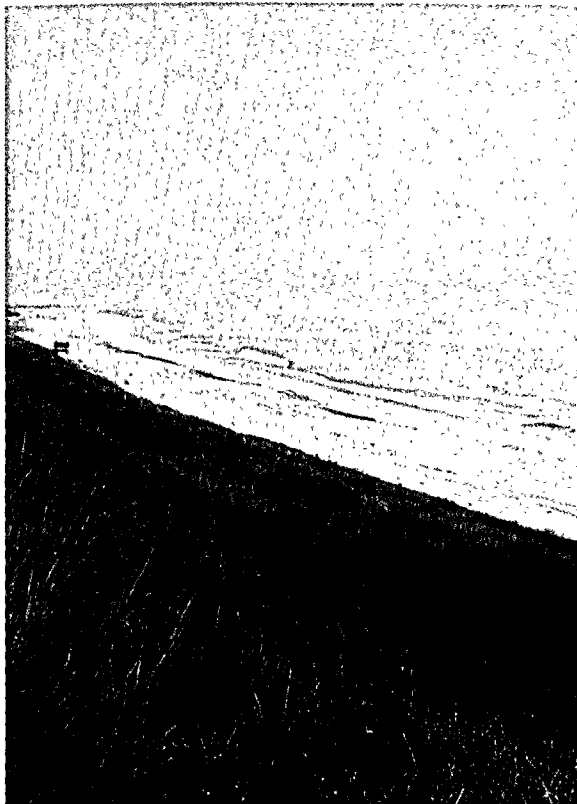
The second water quality problem results from a number of outdated sewage plants but principally those in Rehoboth and Millsboro. The Rehoboth plant has a nitrogen scrubber but that doesn't help with the phosphate side of the equation. To update these facilities would require raising property taxes which local officials are loathe to do and when the state has had surplus funds, these have gone toward sewage plant modernization in the Wilmington area.

The third problem is from uncontrolled housing development, especially on flood plains and areas close to ocean and bay, with septic tanks as the favorite means of dealing with sewage. The pumping action of the tides is quick to move the contents of these tanks into nearby water systems. The State of Delaware has been happy to take Federal funds for beach replenishment but has not fulfilled its obligation to enact legislation that would protect its wetlands from development, or limit its dredging activities for which it issues itself its own permits, an apparent conflict of interest. By its actions over the years, DNREC, the state equivalent of the EPA, would appear to be more interested in real estate development than preservation of the state's unique natural resources. The Center for the Inland Bays, an organiza-

tion ostensibly dedicated to the well being and health of the inland bays, has a board of directors dominated by real estate and agricultural interests. Hence, we cannot expect significant change from either of these two organizations.

Returning to the pollution problem, the nitrogen-phosphorus output into the groundwater and into the bays is ten times the maximum carrying capacity of these waters. It has been estimated that if no additional phosphorus or nitrogen compounds were added, it would take the system 20-30 years to clear itself of the current overload. No surprise then that the eel grass is gone, the species of fish that are able to survive tend toward the hardiest such as the fundulus group, that hypoxic events are common in the bay waters now with many clam and fish deaths, and that the stripers can no longer make the trip up to their spawning waters. In addition, *Pfiesteria piscicida*, the toxic dinoflagellate, made its first documented appearance in 1987 and is here to stay in active form. In addition, *Chattonella verrucolosa*, another toxic dinoflagellate, appeared in the summer of 2000 and produced its first massive fish kill during January, 2001. This is a new and startling event to have a fish kill of this magnitude in well oxygenated waters during the middle of winter.

Another concern is the high estrogen levels in chicken manure. No one knows the impact of this when it reaches the marine environment. Certainly it can feminize male fish. But what does it do to humans? Is there any connection with the high cancer rate in this area? Current third generation insecticides, the so called "super-hormones," appear to compromise immune system functioning. A particularly moving examination of aromatic hydrocarbons (DDT,



A tranquil Atlantic Ocean beach looking north from the Indian River Inlet Bridge.



This tower, and others like it, dot the coast of southern Delaware along Route 1. Built during World War II, they were used to search the Atlantic coast for enemy submarines.

PCB, etc.) and their impact on the environment was the recent Bill Moyers PBS special, *Trade Secrets*, an examination of the vinyl chloride story. Years of having been sprayed with DDT for mosquito control at the beach clearly was not very desirable. Safety studies on the majority of synthetic chemicals we use in our daily lives and in food production, such as poultry, have yet to be done.

What was once paradise at Bethany

Beach is deteriorating rapidly. If present trends continue, little will be left in twenty years. The damage will be irrevocable. The story of the decline of this area of Sussex County in southern Delaware is being replayed all over the American coastline. The story is the same in Florida, the Carolinas, Virginia, Maryland, New Jersey, the Long Island area of New York and the coastal states to the north. Individual citizens realize the dangers of present trends but cannot get their politicians and legislators to change course. The focus is on making as much money today as possible and not planning for the future. And in Bethany Beach, the many tourists from Washington, DC, Baltimore, and Philadelphia who came to the beach to get away from the problems at home, are content to return home blissfully ignorant of the problems they are leaving behind in the place that brought them refreshment and rejuvenation. If we are to save anything for future generations, we must act, unsympathetic administration in Washington or not. Our children and their children have a right to clean water that they can play in and dream about.

It is we who must save it for them.

This issue, devoted to the memory of William S. Green, a fierce legal advocate for environmental protection in the Bethany Beach area, will examine the many problems facing southern Delaware. We hope that increased awareness of these problems will change public opinion and help move us toward much needed solutions in every coastal state in the country.

Delaware Facts and Figures

by BETSEY SELKIRK

With only 2,396 square miles of land, 71 square miles of inland water and 371 square miles of coastal water, Delaware is the second smallest state in land area. Located on the Eastern Seaboard of the United States, bordered by the Atlantic Ocean, Delaware Bay, New Jersey, Maryland, and Pennsylvania, it is 96 miles long and varies from just 9 to 35 miles wide. It makes up the Del in the DelMarVa Peninsula (Maryland and Virginia account for the rest). As of 2000 the state averaged 401 people per square mile with a total population 783,600. New residents moving to Delaware's beaches and newly developed suburbs fueled a boom that gave Delaware a 17.6% increase in population in the 1990s. Most of that growth was split between coastal communities in southern Delaware and suburban communities near the northern city of Wilmington. Between the years 2000 and 2030 the state predicts a 26% increase in population.

Delaware is divided into two physical regions, each of which is a part of a larger region of the eastern United States. The Piedmont Plateau includes a small section of Delaware, extending from Pennsylvania and the larger Appalachian Region. The region of Delaware in the Piedmont Plateau is north of the Christina River and holds fertile river valleys and forested hills. The highest point in Delaware (near Ebright Road in New Castle County) is in this region and is only

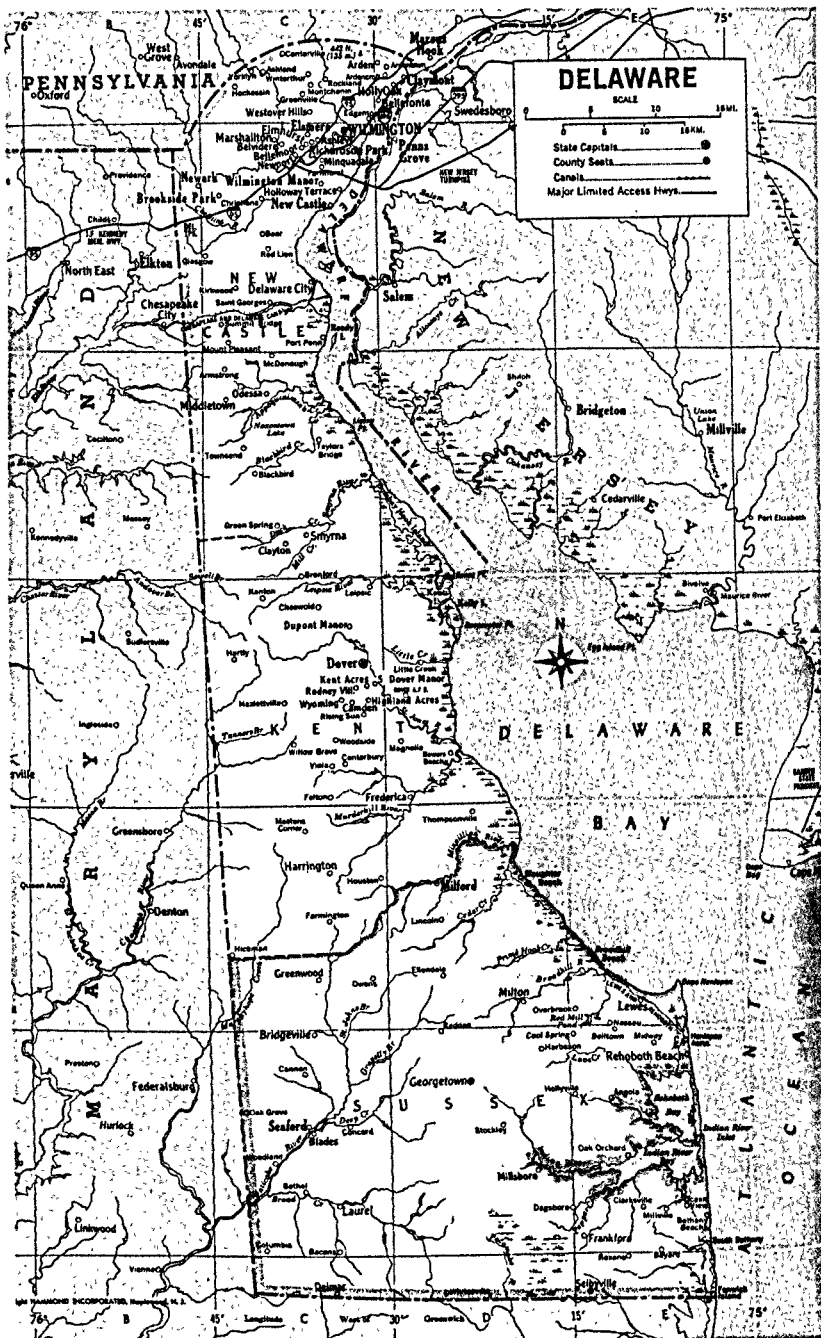
Selkirk is a graduate student at the University of Delaware, studying, obviously, geography.

about 448 feet above sea level. Only in this extreme northern region will you find the ancient marbles, gneisses, and schists belonging to the Piedmont province.

The Coastal Plain occupies the rest of the state, full of flat, wet plains, and part of the large sandy plain that covers most of the eastern coast of the United States. A low ridge of well-drained land runs the entire length of the Coastal Plain in Delaware. This ridge forms the divide between the rivers flowing east into the Delaware Bay and west into the Chesapeake Bay. Nearly all of the coastal plain in Delaware is less than 60 feet above sea level.

The boundary between the two physical regions of Delaware is called the Fall Line, which is the zone where the older and harder rock of the uplands shifts to the sands, clays, and shales of the Coastal Plain. The state's principal river is, of course, the Delaware River, which is the only river in the state that is navigable by large boats. The Chesapeake and Delaware Canal extends across the northern part of the state to link Delaware Bay to Chesapeake Bay, and is part of the Intracoastal Waterway along the East Coast.

The coastline is only 28 miles long but if you include all of the state's bays and inlets its total shoreline measures 381 miles. Extensive salt marshes are found along the shores of the Delaware River and the Delaware Bay. According to Delaware Natural Resource (DNREC), there are 90,000 acres of tidal wetlands and 132,000 acres of freshwater wetlands in Delaware. Approximately 40,000 acres



Delaware and its major streams. Delaware is divided into three counties - New Castle, Kent and Sussex. Its major cities are Wilmington, Newark and Dover with Dover being the state capital. Most of the state's industry is in the north with agriculture and tourism more prominent in the south. Delaware's 28 miles of ocean beaches and its Inland Bays are all located in Sussex, the southern most county.

of wetlands have been lost in the last 40 years. South of Cape Henlopen you'll find a change in landscape, with mostly sand dunes and long barrier beaches. The Indian River Inlet is the only break in the barrier beaches allowing access to Rehoboth Bay, Indian River Bay and other inland bays and lagoons.

Prior to European settlement, most of Delaware was densely forested. Today 31% of the state remains forested, with principal deciduous trees including the oak, hickory, maple, beech, gum, and ash. In the sandy areas you'll find pitch pine, loblolly pine, red cedar, and bayberry. Loblolly pine, found mostly in southern Delaware, is the principal pine. The bald cypress, which is common in the southern United States, has its northernmost American stand in the Great Cypress Swamp (also known as Great Pocomoke Swamp). The American holly is the official state tree and in Delaware has been known to reach 60 feet in height with a trunk diameter of 20 inches.

Wild flowers are found in great abundance between early spring and fall, including the crocus, violet, azalea, honeysuckle, pink lady's slipper, and aster. Water lilies are common in freshwater throughout the state and hibiscus and swamp magnolia can be found in saltwater regions. The peach tree blossom is the state flower of Delaware.

Birdwatchers love Delaware for the wide variety of birds found, including the robin, Carolina wren, starling, boat-tailed grackle, wood thrush, purple grackle, catbird, cardinal, tufted titmouse, blue jay, and ruby throated hummingbird. There are a number of species of warbler, woodpecker, vireo, and sparrow. Shore and water birds include the great blue heron, snowy egret, black duck, blue-winged

teal, and species of sandpipers, gulls, and terns. With a northern landbridge, the ocean to the east, large bays to the west, north and south, and lots of coastal fresh water and tidal wetlands mixed among upland forest, Delaware is important to coastal migration and an excellent place to see migrating bird species. The domestic blue hen chicken is the state bird, making Delaware one of only two states (Rhode Island being the other) to have a domestic bird as its state bird.

The white tailed deer is the only large game animal found in Delaware today. You will also find fox, raccoon, chipmunk, rabbit, mole, muskrat, mink, otter, and beaver. Snapping turtles are common in the swamps and snakes that can be found include the hognose snake, blackrat snake, garter snake, and the only poisonous snake in the state, the copperhead.

Crabs and clams are gathered in Delaware Bay, with numbers much lower than in years past. Oysters have been practically eliminated due to a combination of diseases. Bass, perch, pike, trout, and other game fish are found in many of the lakes, ponds, and streams throughout the state. Sturgeon, catfish, and drumfish are also common. The weakfish is Delaware's official state fish.

In the 1960s the water quality of Delaware's bays, streams, and wetlands was generally high. It rapidly declined in the 1970s, largely due to poorly treated sewage discharges and excessive sediments from erosion. As of today, Delaware is the only state to operate a statewide solid waste management agency that locates and runs disposal facilities. The creation of this agency in 1978 was too late to save the shellfish industry, which was basically destroyed by pollution by the late 70s.

Southern Delaware's Natural and Unnatural History

by CORNELIA MELVIN

With the exception of a portion of New Castle County on the edge of the Piedmont, Delaware is situated on the coastal plain and shares the Delmarva Peninsula with portions of Maryland and Virginia. The soil is sandy with some pockets of clay and the average rainfall is 44-48 inches. When the European settlers first arrived in Lewes in 1638, they found vast acres of saltmarsh with its spartina meadows, glasswort, marsh elder, and groundsel. The inland forests were a mix of pitch pine, loblolly pine, American holly, red cedar, oak, hickory, red maple, sassafras, and American dogwood. There were high bush blueberries, and bayberry, as well. Food was plentiful. The ocean and bays provided fish and waterfowl. Clams, mussels, oysters, and blue crab flourished. There were white-tail deer, squirrels, and wild turkey, too. The forests provided wood for housing and for heat. When later settlers arrived they gradually fanned out across the state with its fresh water marshes, large forested tracts and great swamp, site of the northernmost stands of bald cypress.

Much of the swamp and interior land was cleared and drained for farming and for home sites. The cypress were cut to supply a thriving ship building industry.

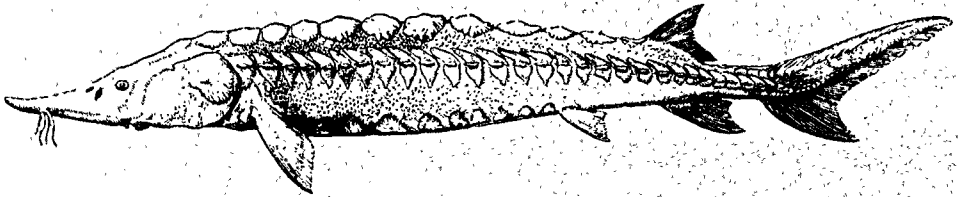
Today, some 400 years later, the forests have dwindled to wooded fragments scattered across the state; although some sizable tracts remain where the land has been purchased by government, conservation organizations, and national lumber companies. Except for a few survivors, the baldcypress have been cut and 82% of the

Cornelia Melvin wrote this from her vantage point in Lewes, Delaware. She has served as chair of the Southern Delaware Group of the Sierra Club.

swamp has been drained. The Delmarva fox squirrel has become endangered and can only be found in Delaware on Primehook Wildlife Refuge and in Maryland at Blackwater Refuge. The Atlantic sturgeon which is believed to use the Delaware Bay for breeding is now seriously depleted. The same is true of the horseshoe crab which was used for fertilizer and now for bait and medical testing, as well as for nourishment of migrating shorebirds who use the horseshoe crab's eggs for obtaining the energy necessary to continue their flight to the arctic and sub-arctic.

The Inland Bays and Indian River in the heart of tourist country are so impaired that this spring the Division of Natural Resources and Environmental Control(DNREC) placed signs along the bayside beaches warning people that to come into contact with the water could be hazardous to their health. This action is a direct result of the discovery of *Chattonella* and *Pfiesteria*, toxic dinoflagellates, which affect fish and mammals.

Residents were expressing concern long before 1969 when then Governor Russell W. Peterson requested an environmental study of the Indian River, Indian River Bay and the Rehoboth Bay. From then until 1989 studies were conducted by various organizations. Then the Inland Bays Estuary Program was designated. In 1995 the final Comprehensive Conservation and Management Plan was presented to then Governor Thomas R. Carper. The bays continue to be studied, the studies sit on shelves, citizen committees prepare plans, the plans sit on shelves and nothing gets implemented. At the root of this action is a lack of political will. Agriculture and development interests are the predominate force in local politics and



The Atlantic sturgeon has nearly disappeared from Delaware Bay. Once they bred here.

at the state level in southern Delaware issues.

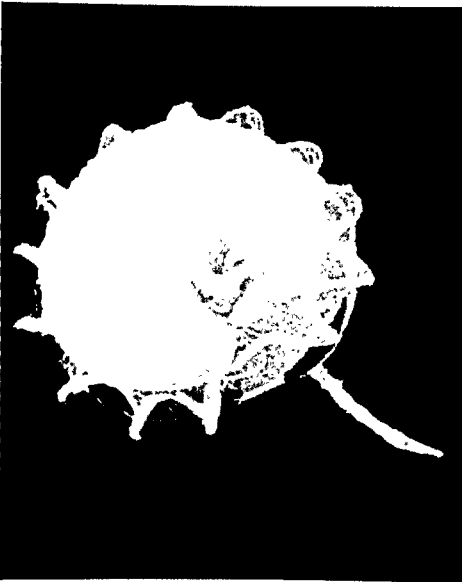
For example, in the summer of 1996, Rehoboth Bay experienced a massive sea lettuce bloom due in part to high nitrogen levels in the water. When the high winds and rough water caused the plants to become loose from their foothold, they were driven to the shores along Dewey Beach where they proceeded to rot. The resulting mess and odor caused complaints and the state cleaned up the beaches. The root causes of this problem were at no time addressed. However, the following year at the personal request of the local state representative and senator acting from pressure applied by the local real estate industry, DNREC was ordered to obtain a harvester. During a survey of the harvest, biologists from the Division of Fish and Wildlife determined that the harvester was trawling the bay bottom and catching juvenile fish and blue crabs and dumping them to rot. Only when a local environmental organization went public with this information obtained from documents using the Freedom of Information Act, was it admitted that this did not address the underlying problems but merely removed evidence of the problem from the visiting public's sight, a harvest-

ing protocol was written and they no longer scrape the bay bottom. Another committee was formed, the representative in question requested more studies and still nothing has been done to eliminate the cause.

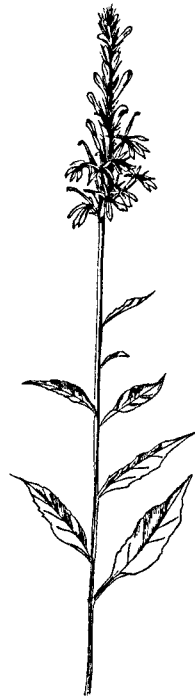
Another example involves the Clean Water Act lawsuit involving the Total Maximum Daily Load (TMDL) section of the act. As a result of suit filed against the federal EPA, Delaware entered an consent agreement whereby they must prepare TMDLs for agreed upon waters. The Inland Bays TMDL and resulting regulation was completed on schedule and hearings were held in August, 1999. To date there has been no attempt to implement it. Two of the municipalities which would be required to reduce their effluent loads have appealed and will probably sue. Non-point source pollutants from agriculture are being dwelt with "Delaware Style." The legislature appointed a Nutrient Management Committee comprised of agricultural interests with two seats for other interests. They have decided that they will rely on Best Management Plan remedies and that compliance will be voluntary.

To grasp the significance of this decision, one needs to understand a little about

the poultry industry, the major player in Delaware's agriculture. Since Frank Perdue, Sr. revolutionized the industry some 20 years ago, the large poultry labels control the operation. He implemented something called integration in which the corporations supply the chicks to the farmer to raise using corporation feed they must purchase. The corporation determines who will raise the chicks and how many will be raised each year. The corporation, however, does not assume any responsibility for the dead chicks or for the manure they produce. Unless the farmer obtains a composter for the dead chicks, they are left on the ground to rot and to pollute the ground beneath them. This makes its way eventually into the ground water, as do the excess nutrients from the manure which is spread liberally on crop fields in an effort to dispose of it. As would be expected, the industry has an effective lobby and continues to fight



Pfiesteria, a toxic dinoflagellate harmful to fish and mammals. Its occurrence in the Inland Bays caused the state to post warning signs on some of Delaware's most popular beaches. For more information on *pfiesteria* see *Underwater Naturalist Vol. 25 No. 1*.



The cardinal flower is bright red and can be found growing along freshwater streams like Doe Branch in Delaware.

imposition of any regulation affecting them. However, to its credit, Perdue, with a sizable cash grant from the state, has started to take manure from some growers to use in a plant built to pelletize the manure for sale out of state. The technology to be used is new and untested as is the existing market for such a product but it will be interesting to watch what develops.

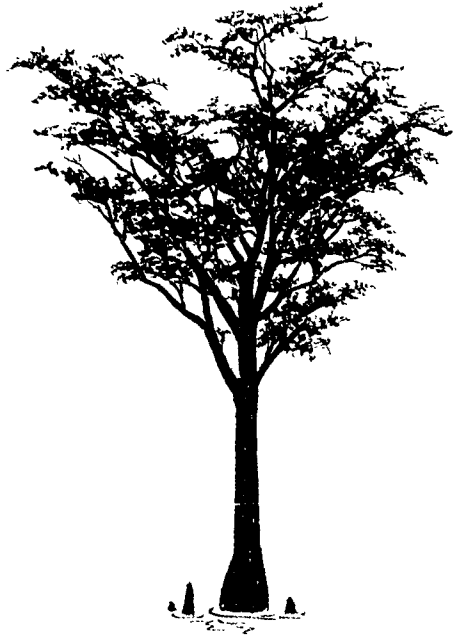
As grim as all this sounds, there is still much of beauty to be enjoyed in southern Delaware. Along the coast, the beaches attract thousands and provide an opportunity for surf fishing, dolphin watching, and ocean kayaking. There are fish to be caught in the bays with rockfish, tautog, summer flounder, croaker, and weakfish popular catches. Clammers can find hard-shell clams in the Inland Bays and of course, there is blue crab. If you put in a

kayak at the launch just before the entrance to the office at Delaware Seashore State Park on SR 1, you can paddle west and around Burtons Island.

If you go halfway around the island to the shallow area inside the sandbars, you can float and immerse yourself in the sight and sounds of the flocks of common tern, willet, semi-palmated plover and several gull species feeding there. When you tire of this, paddle north and look at the small island which is a heron rookery. Here you can find great blue heron, green heron, black-crowned night heron, snowy egret and the larger great egret. Another good kayak trip involves putting in at the state launch at Jefferson Bridge Road by the Assawoman Canal bridge. Here you have the choice of paddling to the right along the canal to White's Creek and Indian River Bay or the left toward Assawoman State Wildlife Area. Along this route look for wading birds, heron, and eventually oystercatchers.

Once at the wildlife area there are several beaches to pull out at for a picnic, swim, and walk. If you walk along the unpaved roads you might spot wildflowers in bloom depending on the season, damsel and dragon flies of several colors and more birds. Be sure to use insect repellent. There are mosquitoes and ticks. If you wish to venture a little west and paddle some inland waters, there are some good trails. Putting in at Millsboro Pond, you can paddle to the right toward Doe Branch. In the late summer the edges along the branch are abloom. Marsh mallow and cardinal flower provide the most color but there are other flowers, as well.

If you are feeling like an even longer ride, head toward Laurel and Trapp Pond State Park. Just beyond the park entrance you will find a launch for the lovely Trussum Pond, Delaware's most photographed pond. You will be able to paddle the pond among some of the remaining bald cypress. Look for basking turtles. Painted turtles are a good bet. If you're especially watchful, you could spot a

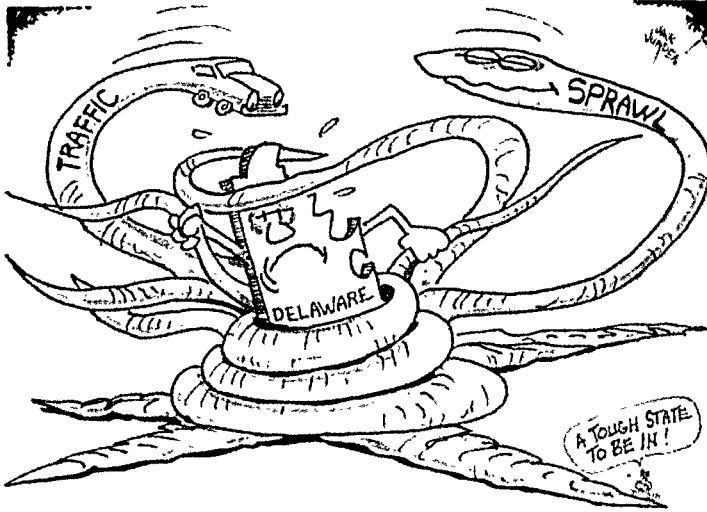


Cut for lumber, and much of its wet habitat drained and filled, the baldcypress has all but disappeared from Delaware, the northern edge of its range.

beaver swimming. In the spring the bushes along the shore provide color and the cypress turn a pretty orange in autumn. On land, hiking at Cape Henlopen State Park in October provides the opportunity to see large groups of migrating monarch butterflies. The park also conducts a hawk watch in the fall and has sighted large flocks of migrating sharp-shinned and Cooper's hawk among the many species seen and many flocks of brown pelican. Throughout the year southern Delaware provides great birding. Winter brings waterfowl of many species and early spring the opportunity to view migrating song birds including many kinds of warbler. The wish to preserve all the remaining wonderful life forms in southern Delaware makes it so necessary to try to prevent any further losses.

Sprawl in Lower, Slower Delaware

by SALLIE CALLANEN



Delaware's poorly planned and uncontrolled development has provided plenty of fodder for political cartoons like this one reprinted from The News Journal of Wilmington, Delaware.

"When we see land as a community to which we belong, we may begin to use it with love and respect."

Aldo Leopold

Sussex County provides an excellent example of sprawl as defined in Webster's New Collegiate Dictionary, "to cause to spread out carelessly or awkwardly with

Sallie Callanen met her husband and fellow author in this issue at Villanova University where she studied nursing, which she practiced until going into the medical supply business. Also a resident of Ocean View, DE, since 1997, she is the chair of the Sierra Club's Southern Delaware Group.

wanton development of every available piece of property bordering the ocean beaches and the Inland Bays.

Squeezed between the metropolitan areas of Washington, D.C., Baltimore and Philadelphia, Delaware's 1,955 square miles are vulnerable to dispersed development. Delaware's beauty, location, climate, relatively inexpensive lands, robust economy, and tax free shopping have spurred an unprecedented building boom over the past 25 years, drastically changing the landscape. Urbanization along the shoreline of our beaches and Inland Bays and their tributaries defines what most of us recognize as urban/suburban sprawl. In addition to creating irresponsible, poorly planned development that destroys green space, increases traffic, crowds schools, and drives up taxes, we are witnessing

explosive growth. Applications for rezoning are submitted to the County Planning & Zoning Commission, which then makes recommendations to the pro-development County Council. Rezoning is standard practice in computing housing densities on agriculturally zoned land. Builders increase density to increase profits. With the exception of the town of Bethany Beach, developers can take advantage of loopholes in the County Code by using golf courses and wetlands to increase housing density.

With little land use planning or public transportation, development has sprawled across Sussex County and overwhelmed the area's roads, water supply and sewer systems. Ten-mile traffic jams, low water pressure and overloaded sewers have been the result. Sussex County is one of the fastest growing markets in the Mid-Atlantic States. Census 2000 indicates a 44% growth in unincorporated areas within the last 10 years. County officials are issuing building permits at a rate of nearly 2,000 annually, and potential development could take up more than 37,200 acres over the next two decades.

Open Space

The importance of open space or "green infrastructure" cannot be minimized. Across the nation, parks and protected open space are increasingly recognized as vital to the quality of life that fuels economic health. Open space has many benefits beyond scenic beauty. It is habitat for our native plants and animals, providing refuge for our threatened and endangered species. It protects waterways from sediments and pollutants. It also provides recreational space, hunting and fishing opportunities, and a place of solitude away from the hustle and bustle of daily life.

Wetlands are extremely valuable resources. They serve as nursery grounds for fish, nesting sites for waterfowl, and feeding and stopping off areas for migratory water birds. Wetlands are nature's

number one and most effective pollutant filtration system. Unfortunately, they are disappearing from Delaware's landscape at an alarming rate. Between 1951 and 1992, at least 44,000 acres of wetlands were destroyed. Since 1938, urban development has been the primary cause of tidal wetland loss.

A new threat to the potential future destruction of coastal wetlands involves promotions for the creation of an "environmental bank" for wetlands. This resource mitigation-banking scheme involves the "selling and trading" of environmental wetland assets. "A property's environmental assets are the currency for the environmental markets and the basis for a comprehensive asset management strategy." The proposed concept for the "selling and trading" of wetlands is based on the assumption that wetlands from one geographical area can be swapped by developers for wetlands in another area; – the presumption being that all wetlands are of equal value under the law. This is a false ecological premise. It has taken thousands of years to create the unique soils that are the foundation of coastal Sussex wetlands. It is well documented that man-made "mitigated" wetlands are often a failure and have greatly reduced ecological value.

Open space protection is a clear example of the disagreement between county and state land-use planning because the selection and funding for open space acquisition must come from the state, but land use decisions are local. \$10 million was allocated for 2001. No permanent, ongoing funding mechanism has been established. In contrast, New Jersey enacted legislation for a \$1 billion dollar open space acquisition program. Based on land area alone, Delaware would have to set up a program of over \$260 million to be comparable.

Farmland

Agriculture is Delaware's number one industry, bringing in over \$800 million to

the state's economy. Unfortunately, due to sprawl, Delaware's farmland is disappearing. From 1992 to 1997 Delaware lost over 18,000 acres of farmland or over 3,000 acres a year. Sussex County alone accounted for 6,656 of those lost acres. Population growth will only exacerbate this trend during the next two decades.

The state's method of preserving farmland is a program for purchasing the development rights (PDR) — that is paying the farmer the difference between the fair market value of the farm and the "agriculture only" value of the farm based on agricultural rent values and current rates of return on investments. This is known as the appraised value of the developmental rights. To date the PDR program has preserved 54,000 acres, more than 4% of the state's total land area, at a cost of \$56 million. Currently 204 farms, representing approximately 45,000 additional acres, have applied for the PDR program, but only \$7 million remains in the fund.

When farmers are admitted to the PDR program, they must maintain their land as farmland for ten years before they may voluntarily withdraw from the program.

Maintaining farmland also reduces spending on new infrastructure. "For every dollar we spend on agland preservation, we are going to save \$10 in highway and road costs," according to Michael McGrath, Director of the Delaware Agricultural Lands Preservation Foundation.

Transportation

Roads are the lifeblood of sprawl. Expanding road capacity attracts unplanned growth. Route 1 entering the beach resorts in Sussex County was widened in the 1980s to accommodate growing traffic. It also became a magnet for development. One three-mile segment of this highway has been the site of approximately two million square feet of commercial development. The traffic congestion during the summer has created

ten-mile backups with empty cars parked on the region's major emergency evacuation route while the occupants shopped at adjacent malls. The area's rural nature, with towns located 15-20 miles apart, and the limited public transit system which fully operates only during the tourist season, and even then only provides limited county wide service, increases the need for automobile travel.

On a busy summer Saturday, traffic volume on this section of Rt. 1 has reached 61,258 vehicles. Weekdays during July and August 54,709 vehicles traverse this same road.

Adding to the abundant usage of our roads is the sky rocketing vehicle miles (VMT) we travel. Fragmented suburban development requires an automobile trip for every errand. Studies have shown that residents of sprawling communities drive three to four times as much as those living in planned mix-use communities. Most of this increase comes not from new drivers but from drivers already on the road.

The average U.S. household pours 18 cents of every dollar into transportation expenses according to *Driven to Spend* a November 2000 report prepared by the Surface Transportation Project and the Center for Neighborhood Technology. Almost all the money goes to automobile travel which burns up more of the typical American family's budget than health care, education or food. The report recommends that governments spend less on "sprawl-inducing roadway projects" and more on alternative transportation options.

Schools

Our children experience longer than necessary rides to and from school due to traffic congestion with backups and delays. Money that should be spent on providing children the best education possible goes instead to combat the effects of sprawl. Enrollment in Delaware's public school system increased by almost 8,000 students from 1994-1998. Some schools have filled to capacity and must resort to

trailer classrooms to augment the over flowing enrollments. Teacher salaries suffer when a district must focus on constantly building facilities and paying the added costs associated with bussing children further distances. Planned development can make a difference in providing our children a quality education.

Utilities

Development of land outside existing urban boundaries requires the extension or installation of sewer and water utilities. Much of the residential construction on large lots throughout Delaware uses wells for water supply and septic systems for water and waste disposal. Many of the public and private drinking water wells are relatively shallow.

In southern Delaware, where soils are sandy and aquifers are thin and shallow, the heavy use of septic systems is having detrimental effects on water quality. Although bacteria are filtered out after relatively short travel distances through the ground, recent studies in the coastal plain of Maryland indicate that viruses can travel much further. Nitrogen and phosphates from septic systems, agricultural applica-

tion of animal manure and nitrogen oxides from the atmosphere are three of the major factors contributing to the nutrient load affecting water quality in our Inland Bays. Runoff from fields travels to the bays quickly in surface water, but nutrients and pesticides in groundwater take a long time to work their way out of the system. Even if all contaminate inputs stopped today, it would still take decades for the high levels of nutrients to flush from the groundwater in southern Delaware.

New housing development requires the extension of sewer and water lines. Making these utilities available help protect ground water quality; however, their availability acts as a magnet for greatly increased rates of residential construction.

Drinking water supply is another resource issue affected by sprawl. Municipal water supplies of the city of Newark, the city of Wilmington, and United Water Delaware are obtained from surface intakes such as White Clay Creek, Brandywine Creek, Red Clay Creek, and the Christina River while all remaining municipal water supplies in Delaware are groundwater.



A new string of immodest Delaware summer homes, lagoon development, rough on both land and water resources.

Groundwater supplies in southern Delaware are limited by a thin unconfined aquifer at the surface and a lack of thick, productive confined aquifers at depth. Wells in Sussex County must be drilled deeper to tap into these aquifers. The quality of the water in these aquifers degrades with depth. Dissolved minerals and salts are present in greater abundance in the aquifers at lower depths. To add to the problem, wells tapping into these aquifers further north tend to draw the mineralized water up due to pumping, thus degrading the water quality in the southern part of the state even further. Overpumping the unconfined aquifer can cause saltwater intrusion from the ocean. This is a problem in Ocean City, MD, and Cape May, NJ, and will happen in Delaware if coastal areas are overdeveloped.

A master plan generated for one public utility company in the coastal development area establishes that a significant portion of the area's public water system fails to provide either adequate water quantity and/or pressure. This raises the safety concern for pressure sufficient for fire suppression. Furthermore, the county's engineering department has stated that wastewater treatment facilities, designed to accommodate growth according to existing zoning classifications, will experience premature capacity depletion if rezonings continue.

Emergency and Medical Services

Persistent sprawl is creating negative impacts on Sussex County's police, fire, and emergency medical services. Public safety is jeopardized by several factors. The fact that response time has been increased by as much as an hour for a call to the State Police concerns many residents located in heavily populated areas where traffic congestion hampers driving time. Sussex County must rely on the state police because, unlike New Castle County, it does not have its own police department. Increasing numbers of com-

plaints, up as much as 130% between 1995-1998 creates the need for a larger police force.

Emergency medical response time is affected by sprawl, thereby jeopardizing public safety.

FEMA has announced that an emergency evacuation of 250,000 people from the Fenwick Island, Ocean City, MD area, using the main evacuation route, Rt. 54, will take 18-20 hours. And yet Sussex County Council has approved construction of 1700 more units in the Americana Bayside project located off Rt. 54 to further overburden these services, and contribute to negative cumulative impacts.

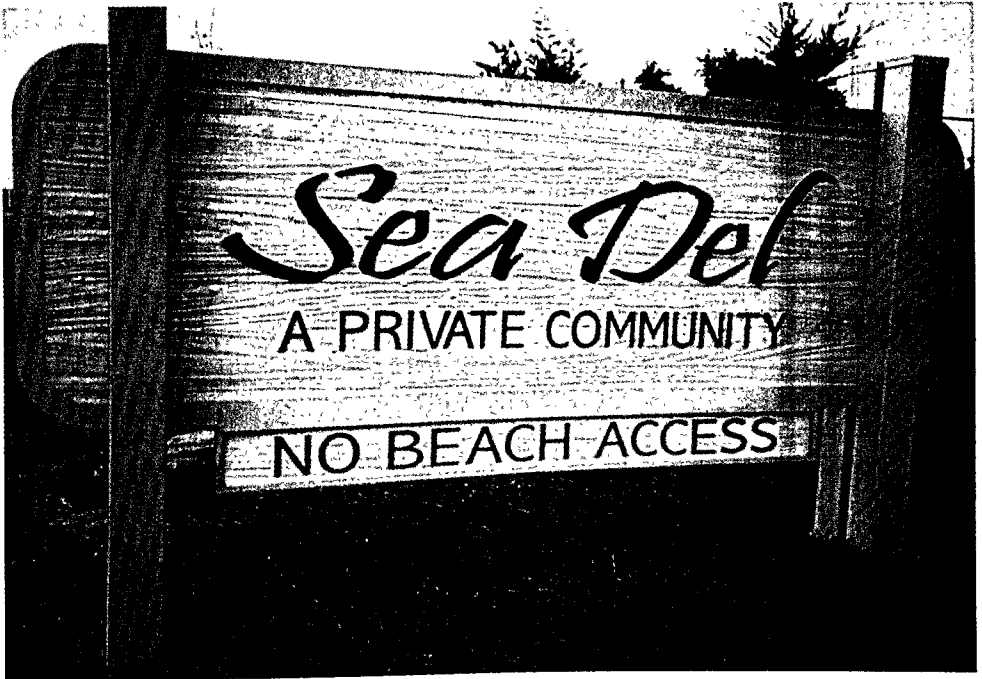
Biodiversity

Biological diversity is the "variety of life and its processes." Sadly, Delaware leads the nation in the loss of native plant and animal species. The loss of biological diversity in aquatic ecosystems has been caused by physical habitat alteration, the introduction of exotic species, chemical pollution, hybridization, and over-harvesting.

According to the Division of Fish and Wildlife, 84% of our fresh water mussel species are either extinct or extremely rare; 50% of our native reptiles and amphibians are extremely rare; 31% of our native fish species are uncommon; and nearly 20% of bird species naturally nesting here are considered rare or extinct.

Water Quality

Indian River and the Inland Bays are one of Delaware's most troubled ecosystems. The problems of the Inland Bays have received considerable attention; excess nitrogen and phosphorus have produced massive blooms of an alga known as sea lettuce. Factors such as agricultural activity, wastewater contamination (treated sewage is discharged into the Bay and offshore), effluent from defective septic systems, and chicken manure contribute to the problem. Agricultural activity damages water quality, particularly



One of a dozen or so semi-private communities south of Cape Henlopen State Park. As private beachfront communities proliferate, public beach access wanes.

because forested strips along stream banks—which act as buffers to filter out nitrogen, phosphorus, bacterial contamination, and pesticide residues have been removed. Population growth has major impacts on water quality. For example, a one-acre parking lot generates 16 times more polluted runoff than a meadow, washing toxic chemicals and hydrocarbon pollutants into our coastal area. Approximately 62% of the state's rivers and streams currently cannot effectively support fish and wildlife, and 79% of the rivers and streams are not suitable for swimming.

While the Environmental Protection Agency (EPA) has classified 41% of our nation's waterways on average as being drinkable, fishable, and swimmable, Delaware is much worse: only 14% of our waters receive a favorable rating.

During the summer of 2000, five million menhaden reportedly perished in Delaware's Inland Bays for reasons not

totally understood, although suffocation from low oxygen levels is a prime suspect. In addition to a fish kill, two harmful organisms, *Chattonella veruculosa* and *Pfiesteria*, toxin-forming one cell dinoflagellates, were both recently discovered in water samples from the Inland Bays and their tributaries. Experts have said Delaware's discovery of the *Chattonella* toxin, which has been linked to fish kills and human health problems around the globe, is significant because it has not been detected this far north.

Public awareness of *Pfiesteria* has resulted in bringing to light numerous health issues that were previously unknown to occur in our coastal communities. *Chattonella* behaves similarly to the *Pfiesteria* micro toxin, causing fish kills, "red tides," and from empirical evidence being accumulated in Pocomoke, Maryland, similar human health effects to *Pfiesteria*. *Chattonella* produces a biotoxin called a breve toxin which affects fish

and mammals.

The Department of Natural Resources Environmental Control (DNREC) is compiling data regarding this discovery in conjunction with the Academy of Natural Sciences, Estuarine Research Center, and Old Dominion University, Department of Biological Sciences, and Delaware Department of Health and Social Services; but many citizens are asking how much more study is necessary before action is taken to correct this situation.

Air Quality

The EPA has ranked Delaware as having the second worst level of air quality in the nation. DNREC states that Delaware meets all National Ambient Air Quality Standards for toxic pollutants set by the Clean Air Act Amendments of 1990 except for ground level ozone. Ground level ozone is the major component of

smog and is produced by motor vehicle emissions. There are also potential threats to continued economic development and future transportation investments. Sussex County currently has marginal non-attainment area status and any lapse in meeting conformance requirements could pose serious consequences to the state. Unless hard decisions are made, funding for major transportation expansion projects may be delayed.

Inadequate options for transit, biking, and pedestrian connections limit Sussex County's ability to comply with the Clean Air Act requirements. A long-term vision of bold new transportation and land use strategies is needed to improve our air quality.

Recent Political Initiatives

Legislation designed to protect the Inland Bays has been vigorously opposed

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, black and white prints are preferred, but clear color slides or color prints with good contrast, drawings, maps and charts will also be considered. For Cover Photos, we need clear, sharp 35mm color slides or color

prints, 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.

by the development and real estate communities. Representative Shirley Price, D., 38th district introduced House Bill 39 into the General Assembly. This bill designated the Inland Bays Watershed as a critical area under the Land Use Planning Act; established an approach to assessing the impact of developments and other land uses within the Inland Bays Watershed; provided for the designation of a project as Development of Regional Significance; required that assessments be prepared by applicants that identify the impacts of the proposed land use action on the environment, general pattern and character of land use, public facilities, and transportation; and provided for a review and finding by the Cabinet Committee on State Planning Issues prior to any local action.

Eight mayors of the coastal towns submitted a request to County Council, on behalf of their constituency, for a rezoning moratorium (or 'pause' as some folks prefer to call it) for requests on rezoning land in the coastal development area only. This innovation to decrease density was deferred until citizens could avidly announce their desire, publicly, to have the mayors' request granted until the county's Comprehensive Plan has been updated.

Livable Delaware Executive Order by Governor Ruth Ann Minner will address sprawl, congestion and other growth issues through legislation and policy changes that hopefully will direct growth to areas where the state, counties and local governments have planned for it to occur. It builds on the significant foundation laid by the 1999 Shaping Delaware's Future report on Strategies for State Policies and Spending. Governor Minner proposes to create a new Advisory Council on Planning Coordination that includes representatives of county and local governments and others with a stake in growth and land-use issues.

Delaware's Inland Bays and coastal areas must be protected. They are an incomparable economic resource for tourism, recreation, and commercial fish-

ing. We risk squandering this resource if we do not act promptly to conserve it from the effects of excessive and unmanaged development. The state needs to assume more responsibility for the protection of its Inland Bays as one of its most important resources.

Conclusion

"Sprawl is driven by myopic public policies, irresponsible private practices, outdated cultural norms, and population growth" (Carl Pope, Sierra Club). The coastal zone, which pays over two-thirds of the taxes for the entire county has only one County Council representative. And unlike the other four council members, this councilman has been denied the privilege of naming a member from his district to the Planning & Zoning Board. One of our illustrious and outspoken activists has suggested that we consider a replay of the Boston Tea Party since we, too, are experiencing Taxation without Representation. Adding another voice to the County Council and the General Assembly from the coastal area is necessary.

Delaware voting districts have been changed, based on Census 2000. The new districts for Sussex County council members now have boundaries that run more in east-west directions rather than north-south directions. It is hoped that this new configuration will result in greater representation for the coastal area.

Concerted effort on the part of various activist environmental groups to change public policies and irresponsible private practices is ongoing. The Sierra Club, Save Our Coastal Communities (SOCC), Citizens Coalition, Sussex Women in Motion, and A.A.R.P. have recently sponsored educational outreach programs, which have garnered interest and galvanized the public's desire for change. The difference between then and now is that citizens are no longer willing to sit back and wait. They are now asking how they can affect change.

Environmental Problems and Land Use Around Delaware's Inland Bays

by STEVE CALLANEN

Statewide Cumulative Pollution

An alarming June 5, 2002, *News Journal* article by Jeff Montgomery identified Delaware as a leading industrial source for some of the country's worst pollutants. According to the article, the May 23, 2002, Environmental Protection Agency's annual Toxic Release Inventory, reported that about 9.8 million pounds of toxic materials were released to the air, land and water around the state; 108 toxic chemicals were released in Delaware in 2000 and Delaware factories led or were among the highest nationwide for total emissions of:

- Vinyl chloride, a cancer-causing chemical used in plastics production.
- Dioxin, a compound believed to have toxic effects even at parts-per-trillion levels.
- Mercury, a toxic metal that can cause neurological and developmental disorders.
- Chlorinated benzenes, a group of chemicals that linger in the environment.

Delaware is reported to have the highest per capita cancer rate in the nation; however, there is no proof that refinery or chemical pollution contributes to this ranking.

Delaware's clean air and water laws have not been aggressively enforced during the administrations of past governors, and toxic discharge penalties have consti-

Steve Callanen was trained as a mechanical engineer, and worked in the Washington, D.C. area on naval vessel research. He is a member of the executive committee of the Southern Delaware Group of the Sierra Club. He has visited the Delaware Shore for 40 years and lived in Ocean View, DE, since 1997.

tuted little more than a "slap on the wrist" for large corporations. *The News Journal* of Wilmington, Delaware recently pointed out that "to date, no Delaware governor has taken a clean-up-or-get-out stance with habitual polluters. Some of that has been lack of political will, and some a lack of willingness to confront powerful lobbyists and their lawmaker friends." Delaware's much heralded environmentalist, Russell W. Peterson, was denied a second term as governor by the pollution lobby.

Inland Bays Pollution

Not all pollution sources were upstate industrial areas. Near Millsboro on the shore of Indian River, the largest tributary flowing into one of Delaware's environmentally sensitive Inland Bays, sits the coal-burning Indian River Power Plant - identified as the state's largest overall polluter, releasing more than 2.6 million pounds of air pollution alone in 2000. Much of the power plant's pollution emerged as hydrochloric acid, mercury compounds and dioxin. The latter two substances reportedly have come under increasing attention in recent years because of their tendency to accumulate in sediments and living tissues.

In addition to serious pollution from the Indian River Power Plant, the Rehoboth Beach Sewage Treatment Plant discharges its "treated" effluent into the Lewes-Rehoboth Canal. To make matters worse, the town of Lewes also dumps treated sewage effluent into the Canal that flows into Rehoboth Bay. According to National Pollutant Discharge Elimination System (NPDES) permits, BOTH plants exceed capacity during seasonal peak

times. Why, in areas recognized as environmentally sensitive, is tertiary treatment not mandatory?

The Rehoboth Beach municipal plant, which serves 2,800 residential and business customers, has been operating under an expired National Pollutant Discharge Elimination System (NPDES) permit since August 31, 1999. In 1999 the town of Rehoboth Beach sued DNREC over its proposal to stop dumping wastewater into the Lewes-Rehoboth Canal. A legally binding Consent Order is currently being negotiated between the town of Rehoboth Beach, DNREC, and a Superior Court judge that will reportedly establish a deadline date for elimination of the Rehoboth wastewater discharge. Rehoboth Beach submitted an application for renewal of its NPDES permit, but the permit can't be issued until the Consent Order is executed.

Another issue is the location of the Sussex County Wastewater Plant, which is located adjacent to the Lewes-Rehoboth Canal. Given the area's highly permeable soil types and the concentration and quantity of the treated effluent (a spray/land application), it is questionable if sufficient time duration and lateral effluent transfer distance exists to adequately remove pollutants from the treated wastewater before it naturally commingles with the shallow Columbia aquifer and/or surface waters.

DNREC's plan to cut Inland Bay pollution by up to 85 percent is three years beyond the state's non-binding deadline established by a federal court order. It is sad that it takes legal action to eliminate major pollution sources in Delaware and distressing that the efficacy of such action is of highly questionable value.

Harmful Algae Blooms and Rotting Seaweed

For the past two years Dr. Edythe Humphries, PhD, DNREC, Division of Water Resources, has been monitoring and charting harmful algae bloom sites in the Inland Bays where potential fish



Another bayfront "McMansion;" note the ten-foot pilings used to raise the first floor above base flood elevation.

killing organisms *Pfiesteria*, *Gyrodinium galatheanum*, *Heterosigma akashiwo*, and *Chattonella* have been found.

To allay public fears about the presence of these organisms Mark S. Crane, Environmental Laboratory Manager, DNREC Division of Water Resources, has stated that "their is no link between any of the organisms identified on the maps that can directly or indirectly be related to the health of the fish in those waters. Additionally, there are many factors that can effect the health of fish and other wildlife in these bays and those factors are still under scientific investigation." The maps nevertheless raise questions about the spread of these organisms and the potential for problems related to them.

Excessive nutrients - nitrogen and phosphorous from failing septic systems, municipal sewage discharges and runoff from farm fields, residential yards and roads - are causing excessive growth of odor producing Inland Bays seaweed. In response to this problem DNREC in June 2002 expended \$153,000 on the purchase of two aquatic combines that respectively cut seven or nine foot wide swaths on the bay bottom. During the process of lifting clumps of algae and seaweed to the surface, where it is hauled away on barges, the harvesters pull up some horseshoe crabs and fish, but reportedly a spotter on board the harvester tries to rescue the larger fish.

Fish Kills

Roy W. Miller of Delaware's Division of Fish & Wildlife estimated that 5,075,000 menhaden died during the summer of 2000 in tributaries of Delaware's Inland Bays, including Bald Eagle Creek/Torquay Canal, Pepper Creek, Arnell Creek, and Love Creek. Although never fully explained, the cause of death was suspected to relate to extremely low dissolved oxygen levels. In the summer of 2001 menhaden deaths in Pepper, Arnell, and Love Creeks had fallen to a total of 107,400.

Health Risks

In his 2001 book, *Desperation Medicine*, Dr. Ritchie C. Shoemaker, M.D., rural family practitioner from near-by Pocomoke City, Maryland, documents chronic debilitating illnesses that can result from pollution-linked neurotoxins. Dr. Shoemaker offers evidence that George Demas, Ph.D., Soil Scientist, U.S. Department of Agriculture, died in December 1999 after repeated exposure to *Pfiesteria* during field study sampling of submerged sediments in Maryland and Rehoboth Bay, Delaware. It has been reported that exposure to *Pfiesteria* toxins can severely affect the memory and immune systems of humans.

In the summer of 2001 DNREC posted signs on state park property that provides public access to Inland Bay waters warning, "The waters of the Inland Bays may contain organisms that could be harmful to your health. Swimming could result in an increased risk of rashes, infections, or gastrointestinal distress, especially during and after rainfall. For your health and safety, please swim at beaches with lifeguards where the water quality is tested weekly."

Combined air and water pollution causes my wife and me to seriously rethink the wisdom of establishing permanent year-round residence on the shore of Indian River Bay. When treated recently for a persistent cough that I had never

experienced, my doctor informed me that a large percentage of his patients, and especially those new to the area, suffered from allergy related symptoms such as mine - a condition he routinely treats symptomatically with nasal spray and time-release anti-histamines. It is sincerely hoped that my cough remains nothing more than an allergy to Sussex County air.

Environmental Problems and Solutions Well Documented

Politicians in Delaware are well aware of existing environmental problems, but they lack the collective will power to oppose wealthy development and real estate interests to implement meaningful corrective measures. The political tendency has been to create an illusion of environmental concern, or action, by studying environmental problems to death and generating a never ending stream of reports containing good ideas that are subsequently ignored.

For example, almost twenty years ago in February 1983 the University of Delaware's College of Marine Studies identified many Inland Bays environmental problems in an excellent report entitled *Decisions for Delaware, Sea Grant Looks at the Inland Bays*.

In 1986, during Governor Castle's administration, then State Representative George H. Bunting, Jr., along with then Senator Ruth Ann Minner and 232 others representing the private sector, environmental organizations, the EPA, and all branches of State and local government, worked for approximately two years developing Delaware's Environmental Legacy Program. The final 1988 program report addressed a broad spectrum of important environmental issues, including land use. It contained 122 recommendations to help ensure that future generations of Delawareans will continue to enjoy a clean healthy environment. This report is chock full of key issues and sensible recommendations that unfortunately now serve as a vivid reminder of how little

progress has been made in many areas due to political intransigence.

Most paragraphs in this report are as valid today, as when they were written in 1988, including the warning that, "The projected steady rate of population growth and increased density suggest that pressures on the state's natural resources will increase and will inevitably impact all aspects of the environment."

The section entitled, "Land Use and The Environment," wisely advises that "Protecting and managing our natural resources, maintaining a desirable "community character" and providing roads, sewers and other infrastructure in a manner that safeguards environmental quality, are principles that should guide land use policy making and regulation in Delaware."

In June of 1995 the *Delaware Inland Bays Comprehensive Conservation and Management Plan*, (commonly referred to as the CCMP) was published. This massive report represents more than a year's worth of work by approx. 260 individuals - many of whom, also worked on Delaware's Environmental Legacy Program. This report notes that "in the past, inattention to environmentally sensitive land use planning has greatly contributed to current losses of valuable habitat in uplands, along shorelines and in shallow waters" and "has also resulted in excessive levels of sediments and nutrients in waterways." It identifies the upstream two-thirds of Indian River Bay as the most degraded of the whole Inland Bays estuary and states that "Much work remains to be done to improve the environment in the Bays' watershed," and that "as the population in the watershed grows

there remains a lack of comprehensive planning for sewage treatment and shoreline preservation."

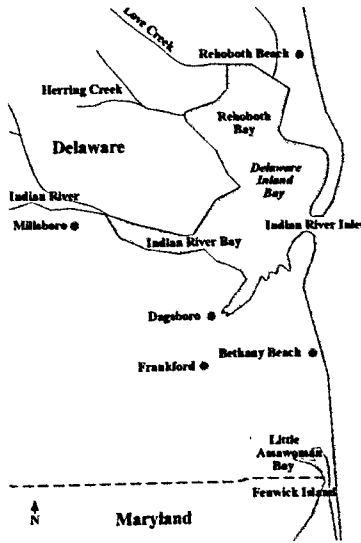
The need for the CCMP to list "action" elements calls attention to deficiencies in the County's Land Use Plan. For years the County Council, through its inaction, has demonstrated a serious disregard for the environmental importance of wetlands and the irreplaceable habitat that they provide.

In September 1996 one of the best scientific eye openers, documenting serious environmental degradation of the Inland Bays, was published in an EPA report entitled, "Assessment of the Ecological Condition of the Delaware and Maryland Coastal Bays." This report states that major portions of Delaware's coastal bays have degraded environmental conditions. More than 75% of the area in the coastal bays failed the Chesapeake Bay Program's Submerged Aquatic Vegetation (SAV) restoration goals, which are a combination of measures that integrate nutrient, chlorophyll, and

water clarity parameters. Most areas failed numerous SAV goal attributes. About 40% of the area failed the nutrient and chlorophyll components of the SAV Restoration Goals.

In May 1997 another "who's who" gathering of 145 Delaware government officials and prominent special interest private sector representatives participated in an exercise called, "Choices for Delaware, The Future of Land Use and Infrastructure."

In December 1999 we had "Shaping Delaware's Future: Managing Growth in 21st Century Delaware, Strategies for State Policies and Spending" recommending that



The Inland Bays of Delaware, all stressed by development, chicken farms, and wetland loss.

Sussex County ordinances and regulations be developed and implemented to promote environmentally sound land use consistent with the Inland Bays CCMP.

Also in 1999 a must read comprehensive report, *Protecting Delaware's Natural Heritage: Tools for Biodiversity Conservation*, authored by the Environmental Law Institute in cooperation with the Delaware Nature Society, The Nature Conservancy, the Delaware Division Fish & Wildlife, and the National Oceanic and Atmospheric Administration (NOAA), was published. This report highlights opportunities to protect and restore the state's biological diversity," and "outlines a clear and persuasive set of recommendations for using or modifying existing policies, programs or laws." The findings were presented to the cabinet Committee on State Planning issues in May 2001 and resulted in the formation of a workshop consisting of key leaders in state and county governments and environmental community leaders.

Environmental Danger Signals

The Inland Bays have been designated as "waters of exceptional recreational or ecological significance" under the state's water quality standards, and as "impaired waters" under the Federal Clean Water Act. These designations reflect the vulnerability of the area to insensitive development.

The Biodiversity Conservation report and others have identified the following environmental danger signals and warnings:

- Approximately 62 percent of Delaware's rivers and streams currently cannot effectively support fish and wildlife.
- 79 percent of Delaware's rivers and streams are not suitable for swimming.
- Delaware has lost a higher percentage of its native plant species than any other state in the nation.
- 41 percent of the state's plant species are rare or uncommon and are in need of protection.
- Delaware's native plants are under severe threat primarily due to the direct loss of the state's wetland and forest habitat.
- Delaware has identified 236 animal species of conservation concern.
- 93 species of Delaware birds are in trouble.
- 41 percent of Delaware's forest-dependent birds are either rare or extirpated.
- Forest fragmentation and selective logging have taken a particularly hefty toll on those migratory and forest interior-breeding birds that require large contiguous blocks of forested habitat.
- 25 species of native birds, reptiles, insects, and mussels have not been identified in the state for over 15 years.
- Rapid urbanization is threatening the state's diverse forest resources. Between 1984 and 1992, nearly 35,000 acres of the state's forests were lost to urbanization.
- Delaware had lost about 54 percent of its original wetland acreage by the mid-1980s. The majority of these wetlands were lost to stream channelization and ditching, as well as direct conversion to agriculture and urban development.
- Most of Delaware's remaining ecosystems - the forests, marshes, and forested swamps - have been highly fragmented. Much of this is due to land use changes resulting from the growth and distribution of human populations.
- Between 1984 and 1992, the state's population grew by about 14 percent, while the percentage of developed land increased by 50 percent. This rate and pattern of growth and habitat fragmentation has placed Delaware's ecosystems at high risk.
- Most non-point source pollution in Delaware stems from sedimentation and erosion due to urbanization and nutrient loading.
- Rapid growth - especially the suburban growth that has occurred in Delaware - has a profound affect on biological diversity. While poorly planned growth

leads to the direct loss of farmland and forestland, it also fragments and degrades remaining forests and wetlands. Many species depend upon large areas, and therefore the cumulative impact of human activities across separately owned tracts of land can cause the failure of conservation efforts.

Published reports conclusively show that our government has known for many years about the environmental problems impacting the state and Sussex County, and also has known much of what needs to be done to remedy these problems. What has been conspicuously lacking is the resolve of enough elected officials, on all levels of government, to fight for implementation of protective measures. The many good ideas contained in these documents are of absolutely no value to wetlands, birds, clams, fish, or our health, unless they are acted upon.

Recommendations for Land Use Plan Upgrades

A few recommendations submitted to Sussex County Council and the state for Land Use Plan improvements include:

- Provide adequate funds and legislation to protect Delaware's critical natural areas and habitats. Ensure closer cooperation between state and local governments, and the environmental community.
- Develop detailed regional planning to better define desired growth patterns, provide for efficient infrastructure phasing, promote better community design, and provide more comprehensive environmental standards to prevent water pollution and to prevent sewer service from triggering other infrastructure and land use problems.
- Develop and implement Sussex County ordinances and regulations consistent with the Inland Bays CCMP that promote environmentally sound land use, i.e., ordinances that provide habitat protection, establish a shoreline building-setback line, establish wetland buffers,

provide tree protection, and establish impervious cover limitations, etc.

- Consider activities carried out within a watershed in a "holistic" manner, where emphasis is placed on the functional relationship between each activity.
- Require all local government land use regulations and infrastructure placement decisions to be consistent with comprehensive development plans.
- Require that state environmental protection policies and standards be incorporated into local plans.
- Require developers to subtract wetlands and golf courses from land available to build upon, and thereby correct an irrational net density loophole.
- Amend the state tidal wetlands law to provide protection for buffer areas adjacent to tidal wetlands. The law should also be amended to require local governments to adopt the appropriate tools to protect critical wetlands and buffers.
- Enact non-tidal wetland laws to provide sufficient protection for habitats and waters of the state not sufficiently protected by the federal 404 program.
- Protect freshwater wetlands through legislation and enforcement.
- Adopt water quality criteria specific to wetlands. Adopt and implement regulations guiding Delaware's 401 program for approving, conditioning, or denying federal 404 wetland permits.
- Require strict implementation of wetland mitigation policies, ensuring that rigorous alternatives analysis be conducted. If mitigation banks are utilized to compensate for permitted losses, banks should support functioning wetlands prior to the withdrawal of credits, success criteria should take biological diversity into account, and long-term management responsibility should be secured. Similar standards should be developed for other compensatory mitigation approaches, including on-site mitigation. Commission a study to review the ecological success of existing compensatory mitigation projects.



New development on Sussex County wetlands, each with 5600 square feet of "cottage" living. Water in the foreground is a man-made lagoon.

- Protect groundwater aquifer recharge areas through land use restrictions and other controls by state and local governments.
- Implement sufficient pollution controls so that waters can restore and sustain populations of anadromous fish and other species that have seriously declined over the years.
- Revise the scoring system of the Agricultural Lands Preservation Act to give increased weight to wetlands, forests, areas in close proximity to open space, windbreaks, bufferstrips, and other natural amenities on agricultural lands.

Zoning Changes Promote Unbridled Development and Environmental Damage

Although much of the land surrounding the Inland Bays is zoned for agricultural and residential development (AR-1) with a density of 2 dwelling units (DUs) per acre, it has become common practice for developers to apply for, and be granted, zoning overlay changes for Residential Planned Communities (RPC), which allow for the otherwise impermissible introduction of commercial uses, under the guise of creating open space. However, rather than creating the positive impacts inherent to open space these RPC applications are being approved in concert with general upzonings to Medium (MR) and High (HR) Density Residential usage

which increases the overall permissible unit density from 2 DUs to 4 - 12 DUs thereby eliminating the creation of any meaningful "open space."

The increase in development pressure and the approved density increases are particularly acute around the shores of Delaware's environmentally fragile Inland Bays. Excluding state parkland, dwellings have been constructed on most parcels of land bordering the bays and their tributaries. This rapid gobbling up of remaining forested areas, wetlands and shoreline buffers drastically increases the environmental value and importance of all remaining wetlands.

Citizens representing environmental groups have repeatedly testified at planning and zoning hearings and County Council meetings in an effort to emphasize the cumulative environmental damage caused by proposed large scale housing and commercial developments around the environmentally sensitive Inland Bays. Trying to curb specific projects by means of such testimony represents an uphill, almost futile, exercise due to the legal precedent established by the county's Land Use Plan and the developer friendly council majority that includes the owner of a building supplies company. Changes in the Land Use Plan and new council members are essential to achieving environmentally friendlier development in the future.

Coastal Development District in Environmentally Sensitive Area

The unprecedented city-size magnitude (1,700-houses, golf course, hotel, and office buildings), of the approved 2001 Carl M. Freeman Communities' "Americana Bayside" development on the shoreline of the Inland Bays served as a wake-up shock call to local residents. The 887-acre development tract includes 132 acres of tidal wetlands and 159 acres of fresh water wetlands.

Developers repeatedly emphasize their legal right to concentrate development in the existing "Coastal Development District" and how this area was intentionally identified for concentrated development. According to numerous individuals with environmental concerns who participated in drafting the 1997 Sussex Comprehensive Land Use Plan, specification of a development zone around the perimeter of the Inland Bays was never viewed as desirable, but grudgingly agreed upon as a necessary prerequisite for obtaining state funding for preconstruction of central sewage treatment systems that were required to eliminate hundreds of failing septic tanks that were continuously polluting the Inland Bays. Unfortunately, as soon as central sewer hookups were available, it immediately became possible for developers to have their coastal properties rezoned for higher density developments. The 1997 county Land Use Plan thus created a "Catch-22" situation for those who were opposed to higher density development around the Bays, but who also wanted septic tanks eliminated. Under this circumstance, the 1997 Land Use Plan was seriously flawed, and it arguably should never have been adopted.

In 2002 Delaware's Office of State Planning Coordination identified the area around the Inland Bays as an "Environmentally Sensitive Developing Area," the "developing" term makes this designation an oxymoron.

The firestorm of vigorous public oppo-

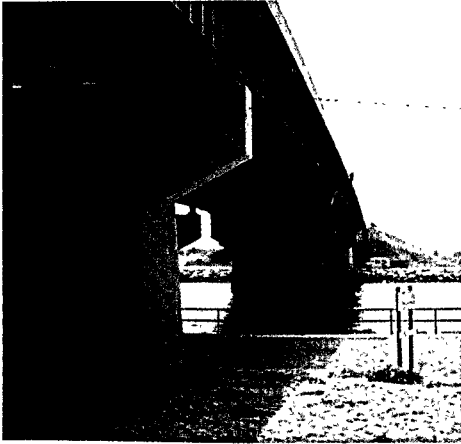
sition ignited by "Americana Bayside" resulted in the introduction of state legislation aimed at setting extra standards for development around the Inland Bays, including environmental impact statements and DNREC approval. These bills (#39 & #446) met with strong opposition from the development community and never made it to the House floor for a vote.

This year DNREC lobbied strongly, with minimal visible support from the Governor's office, for a wetland protection bill that would have given DNREC authority to regulate 30,000 acres of non-tidal wetlands that were under the jurisdiction of federal law until overturned by a 2001 Supreme Court decision. In late June state lawmakers declined to take action on this bill.

State Dredging Fosters Shoreline Development

The type and location of dredging projects within the Inland Bays are major determinants in the pattern of adjacent land uses. The availability of navigable channels, or lack thereof, directly encourages or discourages adjacent upland development. Certain dredging projects have resulted in deep-water access, thereby drastically increasing shoreline property values.

Circa 1968 the state appropriated funding for the dredging of five tributaries of the Inland Bays for the purpose of improving the downstate economy by helping to attract both annual visitors and permanent residents to Sussex County. Land values were expected to increase along the dredged waterways. In the 60s and 70s emphasis was placed on stimulating the economy with little concern for the long-range cumulative environmental impact of dredging approximately 900,000 cubic yards of sediment from these shallow "creeks." Studies predicted that, once the creeks were dredged, that it would only be a matter of time until they would need to be redredged. Exploding over-development along shorelines, and



Keep 'em moving. Four lanes of Route 1 traffic cross the Indian River Inlet on the Indian River Inlet Bridge. For reasons unknown, the inlet is deepening from about 30 feet to 90 feet, undermining the bridge pilings in the process.

Photo by George Kowallis

the proliferation of docks, marinas, and ocean going vessels, help to explain the ever-increasing demand for dredging.

Inland Bays dredging projects are determined by a legislative process whereby private citizens, or DNREC's Division of Soil and Water Conservation, petition elected representatives to submit a resolution before the General Assembly to appropriate state funds for specific dredging projects. Through this process state funds were allocated, prior to DNREC obtaining an Environmental Impact Statement and a permit from the U.S. Army Corps of Engineers, for "maintenance dredging" the historically shallow Assawoman Canal (a narrow 4-mile-long, 40-foot-wide waterway, connecting Indian River and Little Assawoman Bays, that has not been redredged in over 110-years and has naturally evolved into a fish spawning area). Dredging the canal will increase erosion of its fragile tree lined banks and drastically increase motor boat and personal water craft traffic.

The political decision to fund dredging projects, such as the Assawoman Canal, is made under pressure from development interests and in advance of environmental impact studies. After state money has been appropriated, for dredging projects, DNREC considers that it has received a legislative mandate to perform the work. Since DNREC issues permits to itself for dredging work, and then performs the dredging with state owned dredges, an inherent conflict of interest exists, especially in those cases where the environment would be better served by less dredging or no dredging. Delaware reportedly is the only state that owns and operates dredges. DNREC's Division of Soil & Water Conservation must keep its dredges busy to justify its annual \$900,000 dredging appropriation that primarily benefits wealthy property owners around the shoreline. Many believe that DNREC should get out of the dredging business.

DNREC recently completed a new dredging methodology guidance document for the Inland Bays that classifies water bodies "open for dredging" if the percentage of land within 0.25 mile of the shoreline is greater than 50-percent developed. This dredging justification rationale ensures that most of the Inland Bays's privately owned shoreline eventually will be dredged, since development assuredly will continue at current high rates on all property with a water view.

Mayors of Eight Coastal Towns Attempt to Halt Zoning Changes

The never ending and arbitrary increases in allowable housing densities severely tax existing infrastructure, especially capacities for law enforcement, fire protection, roads, potable water, and wastewater treatment. Development has been occurring at such a rapid pace that the mayors of the eight coastal towns, i.e., Lewes, Rehoboth Beach, Henlopen Acres, Dewey Beach, Bethany Beach, South Bethany, Ocean View, and Fenwick Island, supported by civic organizations

and the environmental community, requested the Sussex County Council, at a special public hearing held on June 12, 2001, to suspend further changes in zoning until after the County's new Comprehensive Land Use Plan had been adopted in December 2002.

The mayors felt that such action was reasonable and necessary for the purpose of providing the towns with a short pause in zoning changes on their borders for strategic planning purposes. The proposed action would not have stopped development of previously approved projects or halted the granting of building permits in accordance with existing zoning. Nevertheless, a loud hue and cry went up from development and real estate interests claiming that the proposed action would cause a serious economic depression.

It came as no surprise to most coastal residents that the County Council refused to grant the mayor's request by a 4 to 1 vote.

Out of fear that the new Land Use Plan may be more environmentally restrictive and in the absence of a controlling moratorium on "rezoning," developers have, been rushing to obtain zoning amendments before the new plan takes effect, thus increasing development pressures to an even greater extent.

While attributing the wonderful prosperity in Eastern Sussex County to development, shortsighted individuals fail to understand that future prosperity will surely suffer if wetlands continue to be destroyed and bay waters become so polluted that fish and clams aren't safe to eat, and swimming and other water activities become health risks. At what point does the profit motive translate into blatant greed and avarice?

Inland Bays Sensitive Areas Task Force

In 2001 the House of Representatives passed a resolution (#31) establishing the Inland Bays Sensitive Areas Task Force to review and evaluate current State and County procedures and processes, to eval-

uate land use applications and development impact in the Inland Bays environmentally sensitive area, and to make recommendations to the House of Representatives. Nicholas A. DiPasquale, Delaware's top environmental officer, chaired the Task Force.

Secretary DiPasquale asked the Task Force to develop a listing of information it would like to see as part of a hypothetical environmental impact assessment for proposed development projects. This request was met with a great deal of self-serving concern by members of the Task Force representing the development and real estate industry.

The Task Force asked representatives of the development industry to identify impediments to environmentally sound development that result from the government land use review and permitting processes. An airing of those issues, while minimally constructive, did not result in the Task Force reaching agreement on a course of action.

In light of what appeared to be the County's commitment to include in the update of its Comprehensive Land Use Plan a requirement for developers to submit, as part of a pre-application process, a variety of more detailed information concerning impacts to transportation systems and the environment, the Task Force determined that its work was completed.

In a final report to the House of Representatives on May 7, 2002, Secretary DiPasquale, relinquished leadership responsibility. He recommended that another group be established to assist in coordinating implementation of future changes at both the County and State levels, with many of the same stakeholders, including the Office of State Planning Coordination, Department of Transportation, Department of Education and DNREC.

Secretary DiPasquale announced his resignation on July 23, 2002, (effective Sept. 20) and said, "I'm convinced the only way to deal with our environmental

problems is through better land management and better land use. . . Unfortunately, the housing industry is propping up the economy.” *News Journal* columnist Al Mascitti astutely points out that “Housing (a traditionally generous segment of the electorate) also props up the Delaware political process.” Hence, it isn’t surprising that suburban sprawl continues unabated. DiPasquale is correct in observing “All you have to do is drive the roads in Delaware and you see the vinyl popping up all over the place.”

DiPasquale urged Governor Minner to press ahead with growth management efforts, dubbed “Livable Delaware,” and he cautioned that “it may soon be too late to head off some of the problems posed by sprawl.”

High hopes existed for creation of an environmentally sensitive County Land Use Plan in 2002. Sadly this did not happen. Most of the suggestions submitted by the environmental community and the mayors of the eight coastal towns were ignored. The Governor certified the new County Land Use Plan even though it lacked specifics on how development will be controlled in the “Environmentally Sensitive Developing Area.”

The Delaware Office Of State Planning Coordination has heralded the new Land Use Plan as a “great improvement” and is confident that it can work closely with DNREC and Sussex County to develop an ordinance that will protect the water quality of the Inland Bays. If past is prologue, efforts to implement environmental protection ordinances can be expected to encounter a protracted up-hill battle against powerful development interests and the pro-development county council.

The next opportunity for improving the Land Use Plan will not occur until 2007. It is frightening to imagine the potential additional loss of wetlands, buffers, and forested areas that likely will occur over the next five years if unconstrained development continues at its current breakneck pace.

Voting District Changes

The voting districts for Sussex County council members have been changed, such that the boundaries run more in east-west directions rather than north-south directions. It is hoped that this new configuration will result in greater representation for the coastal area, which until this time essentially has had one representative.

Although the majority of the county’s new development is occurring in the county’s coastal region, these areas have lacked sufficient political influence, not only because of the manner in which the voting district boundaries were drawn, but because most part-time coastal residents lack the standing to vote.

Livable Delaware?

Recognizing the potential adverse impact collateral with uncontrolled growth, the current Administration compiled its “Livable Delaware Program.” Conceptually proactive, the program, to date, has enjoyed limited success. Proposed impact fees to address infrastructure needs have been opposed by the development and real estate communities. Legislation designed to protect the Inland Bays met a similar fate and now the state’s TMDL requirements are facing legal challenges. Considering that 83% of DE’s waters appear on the EPA’s 503(b) list as impaired and air quality has reached a level of non-attainment under the Clean Air Act, it makes one ask, “How ‘livable’ will Delaware be by the end of the decade?”

Delaware’s 1988 Environmental Legacy Report to the Governor and People of Delaware conveyed a critically important message that should be heeded in 2003 and future years. “The protection of lands through wise land use planning, where natural conditions are allowed to prevail, is essential. The loss of such critical and unique areas is irreversible. The preservation of our natural heritage - our biological and ecological diversity - is a crucial legacy for future generations.

Groin Construction and the Fight to Save the Disappearing Beaches of Cape Henlopen

by STEVE CALLANEN

Groins, commonly referred to as jetties, generally consist of long stone or wooden wall-like structures that extend into the water perpendicular to the shoreline for the intended purpose of controlling erosion by trapping sediment.

Cornelia Dean in her 1999 book, *Against The Tide, The Battle for America's Beaches*, points out that:

Over the years, engineers and developers have attempted to trap sand on beaches using everything from stone breakwaters to artificial seaweed. They have hardened the coast with everything from rocks to blocks of petrified sewage sludge. But the interaction between coastal engineering projects and sand on the beach is highly complex and, as the engineers say, "site-dependent." The cost of misjudgment is high. Almost always, these stabilizing and hardening projects have carried high costs and awful consequences.

Though the malign effects of sand-trapping efforts differ, they share the same weakness: they do not add sand to an eroding coast. Instead, they usually work by stealing sand destined for someone else's beach.

Groin construction is the most common -- and possibly the least understood -- method of sand-trapping or stabilization. Groins, especially the ones built ad hoc, without benefit of engineering, can be quick, relatively cheap, and effective solutions, at least for the person who

installs them. They may be built of timber, steel, concrete, rock, or other materials. But seemingly minor changes in their height, length, spacing, and permeability can greatly alter their effects. If they don't trap enough sand, they don't work. If they trap too much sand, they overflow and dump the excess sand into deep water, where it may be lost to the beach.

Usually, groins cause more problems than they cure. They aren't much to look at and they make long walks along an unobstructed beach a thing of the past. On beaches with any kind of surf, they pose a potentially serious hazard to swimmers. And they leave property owners downdrift bereft of sand. Usually, these property owners respond in the only way they can, by constructing their own groins and sending the problem down the coast to the next guy.

This insight is hardly new. Groins -- or groynes -- were recognized as a problem almost a century ago. The best protection a beach can have is its own unfettered self -- is today universally acknowledged. But it is no match for the financial incentives for development on the coast.

In 1980 the U.S. Department of the Interior, Geological Survey, documented the adverse effect of groins in Professional Paper 1177-A, authored by the University of Virginia's Dr. Robert Dolan, et. al., which states: "For more than a century, coastal structures, including jetties and groins, have been built in the inshore zone

See page 22 for author's bio.

in an effort to trap sand and protect beaches. In general, these structures collectively have aggravated problems rather than resulted in solutions. These structures work only when the land down the beach from the groin is considered expendable. Groins trap sand, and the sand gained at one place must be lost to another."

An August 22, 1972, U.S. Geological Survey aerial photograph clearly shows that the southern portion of Delaware's Cape Henlopen State Park (CHSP) shoreline was straight and the beach in this area was wide. The historic World War II lookout towers were behind the dune line.

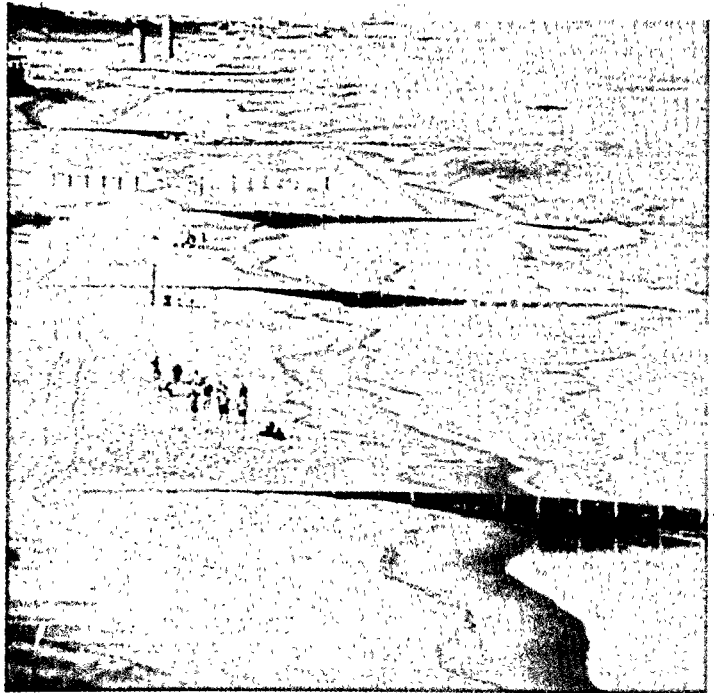
In December 1972 the upscale ocean front community of North Shores (N.S.), located a short distance north of Rehoboth Beach, DE, applied for a state permit to construct a wooden groin structure into the Atlantic Ocean for the purpose of providing protection for expensive ocean front homes. For those living along the Atlantic coast, this scenario likely sounds familiar.

The state was concerned about the potential erosion of CHSP beach that might result from construction of this groin at N.S. Governor Russell W. Peterson personally signed the permit, which stipulated "the permittee agrees and understands that any substantial or detrimental harm or substantially adverse change in the shoreline shall be cause for the removal of this structure." The president of N.S. approved this permit that

included an addendum specifying that "the groin shall be located 100-ft. south of the lands owned by the State of Delaware as measured from the mean high water mark," and that "a bench mark shall be constructed by the permittee at the point between the North Shores property and the land owned by the State of Delaware." The purpose of the benchmark was to determine the erosion effects of the groin.

For some unknown reason the N.S. groin was located with its landward end on the property line between CHSP and the N.S. community, and the benchmark was never installed. Although aerial photographs conclusively show significant erosion of the state park beach after construction of the N.S. groin, the state never requested the community of N.S. to remove its groin.

By December of 1978 Delaware's



Looking north along Cape Henlopen Beach. Each groin robs sand from the beach beyond it, accelerating erosion.

Department of Natural Resources and Environmental Control (DNREC) was well aware of the erosion problem on the downdrift side of the N.S. groin; but rather than requesting N.S. to remove its groin, as per terms of the 1972 groin construction permit, DNREC instead constructed, at taxpayer expense, a groin in CHSP located 1550-ft. north of the N.S. groin. The documented purpose of this "Gordons Pond" or "Whiskey Beach" groin was "to stabilize a rapidly eroding section of publicly-owned recreational shoreline and protect the public parking and beach access facilities located landward of the beach."

In March 1979, prior to construction of the Gordons Pond / Whiskey Beach groin, Thomas E. Pickett, Associate Director, Delaware Geological Survey, sent a letter to DNREC warning that "the long-term geologic effect will be merely to shift the area of erosion to the north on Cape Henlopen. Seven or eight years ago, when the North Shores groin was permitted we also expressed the same opinion and suggested that it be bonded to be removed if it caused erosion to the Park lands. Apparently, our fears were justified, but the groin is not to be removed. Unfortunately this "leap-frog" sequence of events will probably be repeated." Needless to say, the predictions of the Delaware Geological Survey were prophetic.

In 1988 a permit was issued to N.S. by John E. Wilson, III, Secretary of DNREC for replacement of the original N.S. wooden groin with a new and larger stone groin with the stipulation "If the State determines that the effects of this groin are sufficiently adverse to warrant removal of this structure, Grantee shall be required to remove said groin." It should be noted that neither the 1972 nor the 1988 groin removal stipulations contained time limits, and therefore these conditions for groin removal appear to still be in effect.

Considering the substantial erosion caused by the original wooden N.S. groin,

constructed in 1973, it is surprising that in 1988 DNREC granted N.S., not only a permit for increasing the size of its groin, but an easement for extension of its groin "onto lands of the State which is part of Cape Henlopen State Park" in consideration of the sum of one dollar (\$1.00). This action effectively increased protection for N.S.' northernmost lot.

Even a small piece of ocean front real estate has extreme value and should not be given away by DNREC by way of easements. Between 1998 and 2000, N.S. oceanfront properties sold for prices ranging from \$1,600,000 to \$2,475,000. If the community of N.S. can justify building additional groin or bulkhead extensions to protect its expensive homes, it should be required that such structures be built totally on N.S.' property.

On February 4, 2000, the community of the N.S. requested a permit to extend its groin an additional 79-ft. into the ocean, extend the groin landward onto state park property, and rehabilitate the groin with larger stones to make it impermeable, including a height increase of 1.5-ft. with the addition of 2-ft. x 4-ft. x 10-ft. pre-cast concrete members along the groin's top crest.

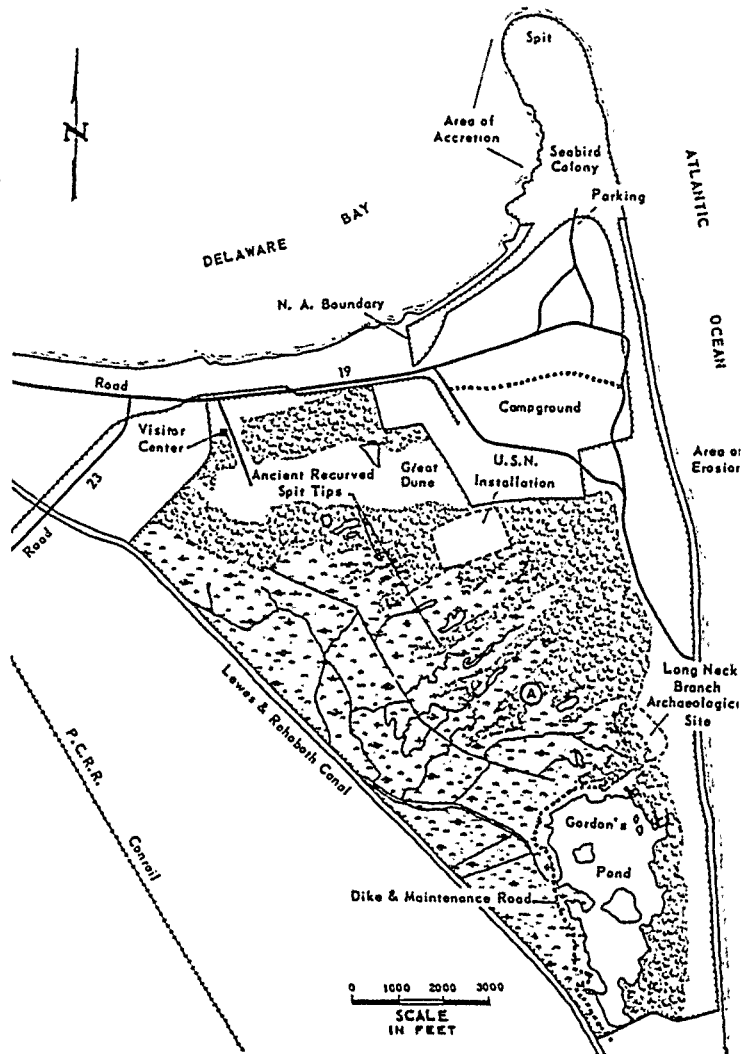
To expedite design and permit approval for its groin rehabilitation plan N.S. hired a licensed professional engineer, who had previous experience working on projects for DNREC and had worked for 17 years as Chief of the Coastal Engineering Section, Baltimore District, U.S. Army Corps of Engineers.

In the February 2000 N.S. groin rehabilitation permit request, the applicant's engineer astutely pointed out that "One of the primary reasons for the accelerated erosion along the North Shores shoreline is the presence of the Henlopen Acres groin to the south which was constructed about 1959. This groin reduces the net longshore sand transport reaching the North Shores shoreline. As a result, accelerated erosion occurs." Ironically, this admission identifies the adverse erosion

effect that the N.S. groin has had, and will continue to have, on the downdrift CHSP shoreline. In 1984 the community of Henlopen Acres sought a permit to rehabilitate its wooden groin with large stones. The N.S. Board of Governors, by "unanimous resolution," sent a letter to DNREC and the ACOE stating it "objects to anything less than a naturally sloped, low-level groin which will permit the overflow of excess sand accumulation from the south to the north side." N.S. obviously is well aware of the downdrift erosion effects associated with groin height. It is hypocritical to petition for keeping the height of the Henlopen Acres groin low and to then request permission to increase the height and impermeability of its own groin.

CHSP erosion concerns raised by citizens at an August 22, 2000, public hearing caused N.S. to withdraw its February 2000 permit request.

On June 18, 2001, N.S. submitted a new permit request for a scaled-back groin rehabilitation plan that included only the 1.5-ft. height increase and the features aimed at making the groin impermeable. Even this modified rehabilitation plan will



Cape Henlopen

worsen existing severe erosion of CHSP.

In the permit request letter to DNREC, the applicant's attorney, disparagingly referred to opposition testimony presented by private citizens at the August 22, 2000, public hearing as a "barrage of rank hearsay in the form of internet science and Chicken Little public outcry."

At that August 22, 2000, public hearing written testimony was submitted from Dr. John C. Kraft, former Chair of the Geology Department at the University of

Delaware, stating that “the massive acceleration of erosion over the past several decades was surely exacerbated and caused by the original construction of the groin at North Shores.”

During a recent visit to the N.S. groin, Orrin H. Pilkey, Professor of Earth Sciences at Duke University, and co-author of the popular 1996 book, *The Corps and the Shore*, called this groin an “atrocious.”

The Cape Henlopen State Park Master Plan discusses in detail the serious shore erosion rates on the coast of CHSP. The plan states that the highest rates of erosion (10.9 to 14.4 feet per year) have occurred along the southern section of CHSP, near the N.S. groin. The recent rapid landward migration of the shoreline is especially noticeable at the two World War II lookout towers. The southern tower was located well behind the dune line in 1976. By 1992, the structure was within the active beach zone, and in 1998, the tower was in the surf zone. Interruption of longshore sediment transport and recent storm erosion has resulted in rapid transgression of the beach.

The Delaware Coast Profile Trends table, prepared by the U.S. Army Corps of Engineers in 1996, lists erosion rates at 30 locations along the Delaware coast. The Long Trend Shoreline Change Rate at Line Reference Point, (LRP #43), located in CHSP, 3220-ft. north of the N.S. groin, equals minus 9.31 feet/year - the highest rate listed over the entire Delaware Atlantic Coast. This represents strong, if not conclusive, evidence that the combined influence of the N.S. and Gordons Pond / Whiskey Beach groins is exacerbating erosion of the CHSP beach.

At the September 6, 2001, public hearing the applicant’s engineer stated that the N.S. groin is “basically ineffective in retaining sand.” Based on the continuing significant erosion of the CHSP beach downdrift of the NS groin, it can be argued that even in its present “damaged” condition that the NS groin is still effec-

tively trapping sand. The NS groin appears to be in better condition than other groins in the area, and most certainly it is not “basically ineffective.”

With full knowledge of Corps of Engineers erosion data for the CHSP shoreline, the applicant’s engineer further stated at the public hearing that “We expect that the impact on the Cape Henlopen Park shoreline as a result of this reconstruction will be very temporary and very minor while the groin regains sand, once it is sand tightened and, once that happens, over a short period of time sand will be transported around the structure to find its way up north to the park area. These impacts, even the temporary impacts, we believe, will be confined to the compartment from the North Shores groin up to the first groin in the park system.”

Since the applicant’s engineer was hired to achieve an objective on behalf of the applicant, it would seem appropriate for the state to demand far more assurance of no resultant erosion damage to CHSP than “we expect” and “we believe” statements. Where is the science and data to support these claims? What amount of increased CHSP erosion does “very temporary and very minor” represent? Where are the calculations and data that prove “the temporary impacts . . . will be confined to the compartment from the North Shores groin up to the first groin in the park system”?

Rather than requesting the applicant to substantiate his claims, the State of Delaware’s beach manager for the past 20 years, incredibly claimed at the same September 6, 2001 hearing that “From 1985 until now that (CHSP) shoreline has been very stable. The location of the high water line relative to those (World War II lookout) towers has not changed in the last 15 to 16 years. It had a quantum leap from the 1970’s to mid 1980. It has been stable since then.” This is a preposterous statement. Aerial photographs conclusively show a continuous CHSP shoreline erosion trend after construction of the N.S.

groin in 1973. The WWII lookout towers are now awash in the surf zone. The “quantum leap from the 1970’s to mid 1980,” corresponds to the period following construction of the original N.S. groin and the Gordons Pond groin. An obvious correlation exists between these events – a correlation that DNREC denies or fails to recognize.

At the public hearing DNREC’s beach manager talked in glowing terms about what he believed to be the effectiveness of groins located in Rehoboth Beach - “look at the number of groins you will walk over that have no offset. You will walk over groins completely buried and it’s in full bypass mode.” This statement makes the assumption that the Rehoboth Beach groins are effectively preventing erosion of the beach and implies that the groin at NS operates in the same fashion. It should be pointed out that:

1) Groins that are “completely buried” serve no sand trapping function whatsoever;

2) Rehoboth Beach has been replenished numerous times over the years. Those actions arguably are far more responsible for the existing amount of sand on this stretch of beach than the presence of groins. If the groins at Rehoboth were truly effective in preventing erosion it wouldn’t be necessary to continuously replenish this beach;

3) If a groin is constructed in an area where it is not needed and then covered with sand, it isn’t accurate to attribute the subsequent condition of the beach to the presence of the groin;

4) The shape of the shoreline at Rehoboth Beach differs considerably from the shape of the shoreline in the N.S./CHSP area, and therefore it is incorrect and misleading to make any implications that groins constructed in the two areas would behave in a similar fashion;

5) The several groins at Rehoboth Beach are spaced close together, a geometric condition that does not exist adjacent to the N.S. groin;

6) If the Rehoboth Beach groins repre-

sent a good model for an effective groin design that creates “no offset” in the beach and allows “full bypass” of sand, why isn’t the design of these low profile wooden groins being replicated at N.S., rather than attempting to construct an impermeable 1.5-ft. higher structure out of massive new “five to nine ton” armor stones and 2-ft. x 4-ft. x 10-ft. pre-cast concrete members? If the previously installed “four to six ton” armor stones were too small to be effective, it suggests that perhaps the basic concept for the design and location of the N.S. groin is seriously flawed, especially in light of the growing offset in the beach at the groin and continuing erosion of the CHSP beach.

According to the U.S. Army Corps of Engineers, “the purpose of a groin field is to retain sand on the berm, and does not contribute to storm damage reduction.” Although waves are a significant consideration, the Corps recognizes that “coastal erosion and inundation are primarily a function of water level,” and recommends that “potential sea level rise should be considered in every coastal study.” “Water level is the first-order forcing parameter controlling storm-induced beach profile change.”

In August 1998 about 161,000 cubic yards of sand was placed along the 2300 linear feet of N.S. shoreline. The presence of the N.S. groin structure did not prevent a rapid loss of this beach fill material.

At the September 6, 2001 hearing, DNREC’s Hearing Officer asked DNREC’s beach manager if he agreed with the general proposition that the 1972 (groin construction) permit and the structure that resulted from it at N.S. accelerated erosion northward and then required a subsequent groin to correct it at a later date? He responded, “In all honesty, I started working for the State in December of 1980 after that whole construction occurred. I have never seen data for that area. I am sure, without looking at the data, I am hesitant to answer. It would be speculation on my part at this juncture to

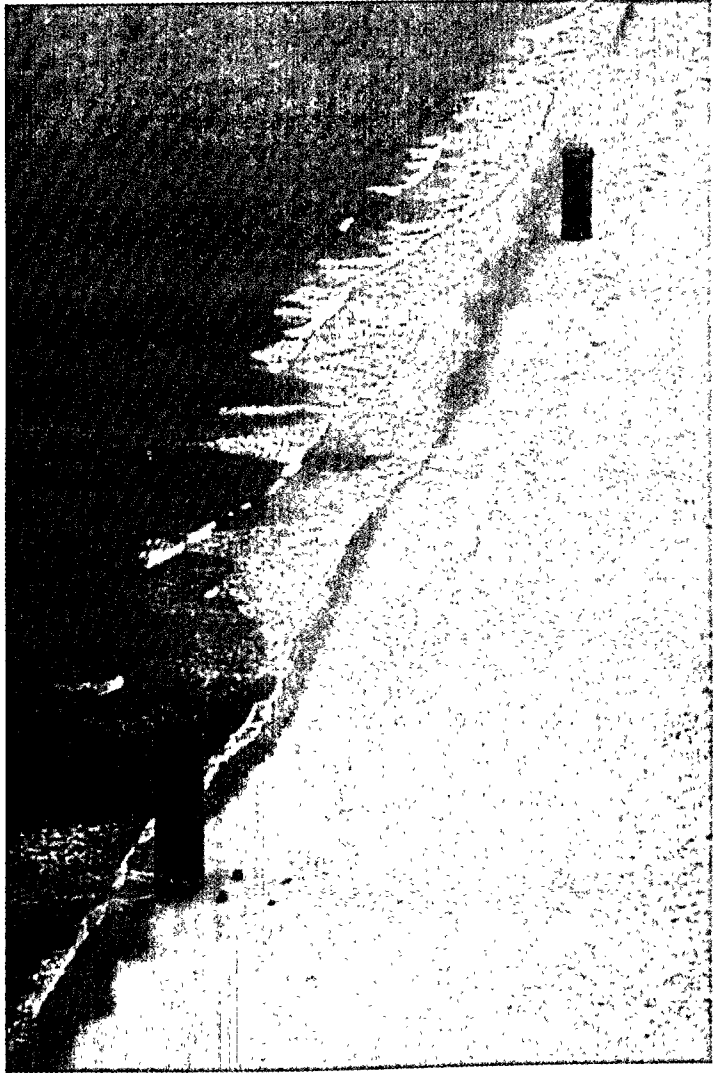
say how much erosion occurred and why they built the groin. I honestly don't know."

The fact that DNREC's beach manager did not come to work for the state until 1980 seems like a weak excuse for failing to understand and analyze shoreline erosion phenomena along the CHSP beach. A thorough knowledge of the historical erosion effects of groins in Delaware is an essential and necessary prerequisite for making appropriate groin modification decisions in the future.

The beach manager claimed that he has "never seen data for that area." The obvious follow-up question is, why not? If this data exists at DNREC, it can be argued that ignorance of its existence, or failure to review it, prior to issuing a permit for rehabilitation of the NS groin represents gross negligence. If data exists, shouldn't its availability have been made known to the public prior to the hearings?

It is difficult to believe that the expert shoreline manager for DNREC would admit to not knowing why N.S. "built the groin" in 1973.

Ideally, the N.S. groin should allow sand to bypass it to nourish the downdrift



Once protected by dunes and beach, these anti-submarine towers now stand at the water's edge.

CHSP beach and minimize downdrift erosion. To this end, a low-profile groin that allows waves to carry sand over it should be considered. Dr. Stewart Farrell, director of the Coastal Research Center at Stockton College of N.J., recommends that the elevation of the offshore portion of the groin not be more than 2-ft. higher than the existing seabed to prevent sand from being "jetted" offshore by storm currents.

After constructing groins for a hundred years, the U.S. Army Corps of Engineers has admitted the harm that they cause to seashore beaches by undertaking an extensive groin-notching project along the Sea Bright to Manasquan Beach in New Jersey. Twenty-one groins have been notched near the shoreline as part of a \$210 million beach-rebuilding project.

According to Nicholas C. Kraus, PhD, Research Physical Scientist, with the U.S. Army Corps of Engineers Research and Development Center, the purpose of groin notching "is to provide an economical and efficient means of bypassing fill and littoral material (typically sand) placed on the beach and to reduce the fillet-and-cut response of the shoreline that is characteristic of standard groins. In other words, the notched groins are to 'straighten the shoreline' while allowing some amount of sediment to pass them and move along-shore. The goal is to control the amount of sediment moving past the notched groins together with readjustment of the shoreline to approach a continuous or smoother line." Sand bypassing alternatives exist that would benefit CHSP, and each of them should have been thoroughly investigated before a permit was granted for rehabilitation of the N.S. groin.

Although DNREC's Hearing Officer, may have advised granting a groin rehabilitation permit to N.S., with no erosion monitoring plan and no mitigation measures to avoid adverse impacts on the CHSP shoreline, it is noteworthy that one DNREC employee had the courage to speak up in an effort to protect the state park. The Manager of Planning, Preservation and Development, in DNREC's Division of Parks and Recreation, submitted written testimony on September 5, 2000, advising that:

"Over 10 years ago, the "Beaches 2000" Report (to the Governor, June 21, 1988) recommended a strategy to renourish municipal and private beaches along the shoreline, and allow beaches within State parklands to follow a course of strategic

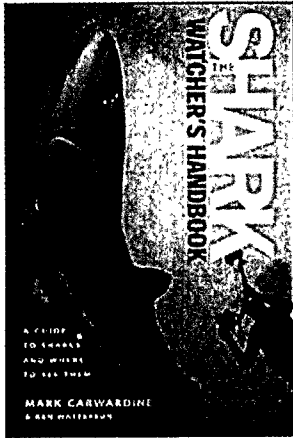
retreat. In the case of the southern section of beach within Cape Henlopen State Park, continued fortification and expansion of groins south, and within, the Park over the last several decades has left important natural, cultural and recreation resources in jeopardy. We believe it is time to reevaluate the policy of "benign neglect" with regards to shoreline management within Cape Henlopen State Park. Specifically, we ask that management of the shoreline between Henlopen Acres and the point at Cape Henlopen be managed within a framework that ensures the public resources along the park's shoreline are considered on equal footing with private shoreline investments. We believe this approach will require evaluation of all public and private groins within the area in question, and should look at how existing structures should be modified to ensure critical nesting habitat, historic structures and recreational uses of beach area within the park are preserved for future generations."

He correctly advocated that groin projects should be required to demonstrate a "positive or neutral impact" on CHSP. Otherwise, they shouldn't be permitted.

The adverse impact of the N.S. and Gordons Pond groins on erosion of the CHSP shoreline is magnified because there is no Federal interest in cost-sharing shore protection for undeveloped areas and park lands. Any protection for such areas must be 100 percent non-federally funded. Delaware has no funds committed for future replenishment of its undeveloped park land beaches.

Beginning in February 2002, the Delaware Chapter of the Sierra Club, represented by the Mid-Atlantic Environmental Law Center in Wilmington, DE, began a series of appeals of the groin rehabilitation permit issued by the Secretary of Delaware's Department of Natural Resources and Environmental Control to the community of North Shores. At this writing there has been no final decision.

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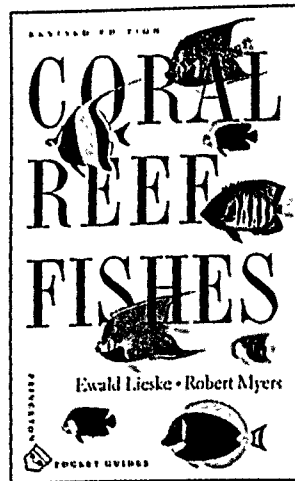
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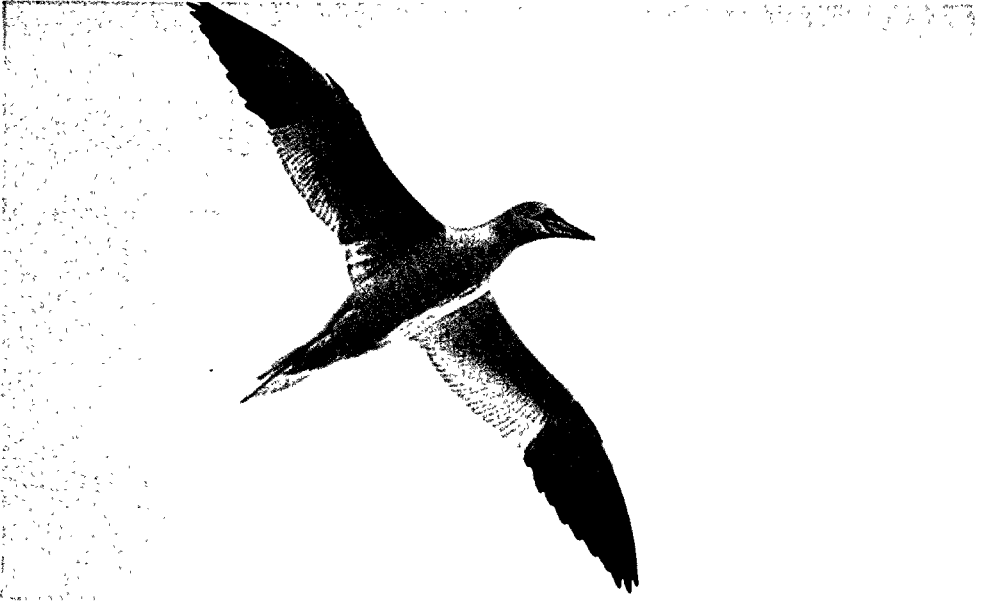


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Crossing Delaware Bay

by DAVE GRANT



A mature northern gannet, white with black wing tips and buff face. One of the great soaring pelagic birds, it spends almost all of its life at sea. Photographed here from the Cape May-Lewes ferry. Photo by Bruce Christensen

Nothing is rich but the inexhaustible wealth of nature. She shows us only surfaces, but she is a million fathoms deep.

Ralph Waldo Emerson

Most of what I have learned about Delaware Bay I associate with crossing it on the Cape May-Lewes Ferry to visit Cape Henlopen and the University of Delaware's marine lab. The 17-mile journey lasts just long enough to clear your mind of most of your worries, and fill it with wonder for this great body of water.

Dave Grant is the director of the Ocean Institute, the Society's Chief Naturalist and Contributing Editor to this journal. For more, visit Dave's Page at www.brookdale.cc.nj.us/staff/sandyhook/dgrant.

Fall: Falcons and Fair Weather

If I have a favorite season to cross Delaware Bay, it's the fall. As we depart from the Cape May Canal, I always position myself at the stern for two important diversions. First, it's crucial to keep one eye out for the natural history sightings off the port side of the vessel. Second, it's entertaining to watch well-wishers off the starboard side.

Heavier birds migrating south to Cape May find their route blocked by the bay, so most make a seventy-mile detour north and west around it (Ornithologists call it a reverse migration.), taking advantage of thermals for soaring (if you are a hawk) and trees for resting (if you are a blue jay). It takes more than three times the energy for a bird to fly, as opposed to soaring on updrafts, so if you do the math, the energy formula works out in the bird's favor,

especially factoring in afternoon Southeast headwinds off the ocean, hungry gulls, and the risk of drowning. Of course if you don't like the math, the birds' behavior validates this too. Regardless, when the sea breeze kicks up at Cape May, the airspace above the ferry dock fills with vultures, sharp-shins and red-tailed hawks, and it often becomes the "hawk-watch capital" of the East.

At the same time, it is also important to observe the action on the starboard side of the ferry. If I were mischievous, I would simply wave back to the sightseers on the canal jetty, rather than point to the ferry wake bearing down on them. Fishermen who habituate the spot know instinctively to move up higher on the rocks when the ferry departs, because when the conditions are right, the wake sets up like a bore and the unmindful get a hands-on lesson in physical oceanography -- a drenching from the thick and powerful sweep of water, moments after the boat passes.

Entering the bay means it's time to get serious about birding and this requires constant scanning of the horizon. Most of the action is usually on the second half of the cruise, but there is plenty to look for as we head south; the Cape May lighthouse, the old WWI cement ship placed as shore protection off Sunset Beach, and occasionally, hanging around it, the last migrating tern of the season. Typically it's a royal, or more likely, a Forster's tern in its distinctive bandit-faced winter plumage.

Wind is your enemy on the bay after storm fronts pass and because of the long fetch to the Northwest, the strong dry gales from that direction kick up a significant chop. An October excursion I look forward to is Coast Day in Lewes; a grand celebration of Delaware's waters. Several times, on the heel of a passing cold front, I've taken a busload of New Jersey festival-goers across on the morning sailing; many of them groaning about the long bus ride, and the driver, and whatever else isn't just perfect when we depart at the

crack-of-dawn. Fortunately for landlubbers, once we sail, it is a following sea for much of the south-bound voyage or, in spite of the size of the ferry, many more passengers would get that grim "Must buy the boat from the captain to turn around" stare.

In October it is also not unusual to have a good ground swell from some distant hurricane adding a long period beat to the mix, and this seems most evident in the ship channel where the water is 150-foot deep. Every so often in the middle of the bay, when the five-second chop complements the 10-15 second swell, we get a shutter that has everyone hoping they followed the captain's instructions to set their car's emergency brake and turn off the alarm.

From the lowest deck the view off the stern is awesome as a hundred gulls jockey for position to catch a free ride on the wave of air that the boat pushes ahead, and to dive into the clashing wake and chop to snatch whatever the propellers kick up. As my bus passengers, many of whom have found themselves suddenly much more appreciative of highway travel, come up to me with suggestions that the three-hour drive around the bay to get home isn't such a bad idea after all, I find myself smiling, enjoying the wildness of it even more, and humming to myself Richard Rodger's tango *Beneath the Southern Cross* -- that theme from the Navy's Victory At Sea classics.

In fall, the bay is still rich with summer life and in the midst of a mass invasion by northern sea ducks, cormorants and other waterbirds. Most likely, you will see long lines of dark scoters undulating over the swells, low-flying flocks of brant and high flights of cormorants, but it is also possible to see a pelican lingering on its trip south, fishing along with another arrival, its northern cousin the gannet, diving on a school of fishes.

Paradoxically, it's the smallest birds that seem to take the biggest risk and sally forth, migrating out across the bay.

Halfway across, songbirds become tired or distracted by the ferry and start to get drawn in behind it. Now, low on the deck with us, they can't see land, have trouble taking off against the pulse of air enveloping the ferry, and are in a real fix.

Their variety reflects what is migrating through at the time -- or at least what I can identify from colors, silhouettes or obvious features; warblers: yellow-rumps, red-starts and the like.

If you are alert you will see falcons over the bay. The high-flyers are likely to be kestrels and these smallest of the falcons seem to be simply making the best of the short-cut and hurrying across, although once I observed one of these agile hunters take a big blue darner dragonfly (one of many migrating insects that also cross the bay). Peregrines are harder to spot, racing low over the water at the altitude of their preferred prey, migrating shorebirds. Anyplace is their hunting ground, and I've seen them spilling white feathers, plucking their catch as they race along (talk about fast food.) Merlins are more likely to be buzzing those hapless warblers near the boat and taking them as we approach the shoreline, since they are large enough to carry their kill to a resting-place. Along with kestrels, they are a regular fall feature around the Lewes dock and are a sensational sight, dive-bombing exhausted arrivals.

Winter: Wandering and Wondering

Winter is not always the rough crossing one might anticipate. It is sometimes windless and flat-calm -- as the boaters say. There are always gannets and gulls to

amuse you (I spotted my first lesser black-backed gull from the *MV Cape Henlopen*), and the slow bird-watching and low sun reflecting its warmth off the water give you more time for reflection about the bay. Also, the ferry is one of only two places I know of locally where you can watch the sun set over water and get a glimpse of the green flash, so I try to schedule my return trip late in the day.

The tide table in the tourist booklet indicates that the tide crests in Cape May before Lewes, and this gets me thinking and scratching in my notebook. The textbook model of estuaries says that because of Coriolis Effect, the tide sloshes to the right around the basin in a counter-clockwise direction in the Northern Hemisphere. Does the rotation of the

earth explain this tidal differential? I know that Delaware Bay is deep in the ship channel, but the average is closer to 30 feet, so the tide is forced to travel like a shallow-water wave progressing up-river past Wilmington and Philadelphia, to the fall-line at Trenton. I recall the formula for the speed of a shallow-water wave (The square root of gravity times depth). I know the length of the bay's shoreline is 128 miles (only 55 of which is in Delaware which I like to point out to my colleagues while I'm over there).

I begin to calculate the speed of that amphidromic wave as it works its way around the bay to see if that will account for the time lag, and after more than a few minutes of scratching my head, conclude that I should have been more alert in physical oceanography class (and to the jaeger that just passed the ferry).



The Delaware Breakwater Light as seen from Cape Henlopen State Park. Photo by Dave Grant

To geographers (and those who know their Spanish) Delaware Bay is a Ria-type estuary -- a flooded river valley. For comparison, the smaller Hudson River/Raritan Bay system is far enough north that the Palisades region is glacially scoured, and it is sometimes called a fjord-like estuary. South of us is the granddaddy of Ria systems -- the Chesapeake, which is five times larger than Delaware Bay.

Oceanographers describe estuaries according to what's happening in the water, and Delaware Bay is a partially-mixed system. In the winter and spring when the land runoff is greatest, I look down and imagine freshwater and the nutrients washed from the land flowing over the denser saltwater, producing a stratified or layered system. In summer and fall, the bay becomes more of a mixed estuary like the lower end of Raritan Bay; and in any location, the salinity is similar from the surface to the bottom.

Check out the charts posted on the ferry, and study the geography of the bay. The freshwater-saltwater interface of the Delaware system is most pronounced near the Smyrna River-Salem transect. Areas like this tend to be the most productive nurseries in estuaries -- not the sort of place an ecologist would dream of placing factories, refineries and power plants that use or abuse large amounts of water -- which of course is just where they all begin to crowd the shoreline. On cold days, if you scan the horizon to the Northwest, you can see the massive plume of water vapor from river water that has been drawn into the cooling tower at the Salem Nuclear plant. The process is said to kill billions of fishes each year. Fortunately the dynamics of the estuarine system and the stamina of the creatures that live here keep the river flourishing.

The estuarine drainage area of the bay is smaller than the Chesapeake or Hudson river systems, but there is enough freshwater inflow from the watershed to produce a flushing time of 2-3 months. This and the remaining wetlands (Since

Colonial times, Delaware, Pennsylvania and New Jersey have lost, respectively, 73, 56 and 39 percent of their original acreage.) maintain the bay's water quality and help it recover from the poor conditions near upstream cities and industry.

Spring: Ice Breakers and Ospreys

Spring is the cruelest season for the naturalist crossing the bay. The ocean has not warmed, so when there is a sea-breeze it is surprisingly cold and clammy out on the water. The bay is discolored from plankton and runoff, especially on the Delaware side (That Coriolis Effect again?), and the multitude of large creatures in the water is not yet apparent. However, as always, the seabirds alert us to the presence of fishes. Arguably the most dramatic bird watching experience along our coast is the great assemblage of gannets that follows plankton-eating herring into the bay. Battling each other and black-backed gulls, gannets plunge like javelins into the ferry wake and quickly resurface, holding in their bill prey that looks impossibly large to swallow.

In Maine, people compare a person with a big appetite to the gannet, and it's astonishing to watch these splendid birds in action off the stern, gulping down foot-long fishes while being mobbed by other birds. According to Witmer Stone, that great observer of Cape May's avifauna, your best bet for seeing large numbers of them is in March and April, and I certainly agree with that. The brilliant white and black pattern and the unmistakable "perfect cross silhouette" of a gannet before it plummets from 50 feet or more catches your eye from a great distance and probably signals other birds too. There never seems to be only one bird diving for food and a whole flock gathers in an instant as soon as the first fish is caught.

Arthur C. Bent wrote of them: "Over the unlucky school of fish is a bewildering maze of soaring, circling birds, pouring down out of the sky in rapid succession, plunging into the water like so many pro-

jectiles and sending columns of water and spray many feet into the air like the spouting of a school of whales.” Bent stated that he never heard gannets utter any sound except on their remote breeding cliffs in the Gulf of St. Lawrence, but if you are in a quiet quarter on the ferry (and if it’s cold, you and a crew member out for a smoke are often the only ones on deck) you can hear some of them protest to each other with a guttural *kuur-oak* when two birds dive past the railing like “living arrows” heading for the same target. Even though gannets have been trapped at 50-feet in New England fishing nets, and one was even reported from Salem, NJ, in a shad net; there is little need to dive deep here since their prey is a surface swimming fish, many of which are probably stunned by the swash of the propellers. From the ferry, I’ve never counted higher than seven-Mississippi’s while waiting for a gannet to pop-up at the surface like a great white cork while struggling with its catch and its greedy neighbors. When the fishes disperse, the birds spread out too, or resume gliding behind us by criss-crossing our wake, utilizing the variable wind speeds above and aft of the boat to effortlessly coast to the next feeding ground.

A crew member once gave me an impromptu sermon about the bay when he observed me photographing gannets. In that pleasant, tight-jawed “Delmarva drawl” that identifies the real locals around the bay, he announced, “In summer, you don’t see them no more.” (To my surprise, he didn’t know they were gannets, but seemed somewhat impressed that they are a cousin of the pelican and spend summers in the Maritimes.) He upped the ante: “See those breakwaters and the icebreakers?... (He paused; waiting for me to acknowledge the question)... “It’s a workin’ bay. They shelter the ships from river ice. In 1977 the bay was locked up for a month and a half from it. It comes downriver on the Delaware side.” (I was tempted to bring up Coriolis Effect, but caught myself and simply nodded pur-

posefully.) For good measure, he added, “We’re a small state with big breakwaters!” (They are massive and a great spot to scan with binoculars for purple sandpipers, ruddy turnstones and other wintering and migrating birds.) I made one last ditch effort to disarm him, countering with, “I see the sports fishermen were out today. Are the flounder biting?” He raised the stakes again with, “Last week the draggers were up from Virginia. The Coast Guard chased ‘em out!” “Crabs? Horseshoe crabs?” I asked lamely; but it was too late. He was finished with the conversation, and since we were nearing Lewes, break-time was over. I’d lost out again to a local with the home-court advantage.

A springtime crossing reveals an endless list of surprises for birders and as the ferry weaves between the anchored ships and breakwaters, I watch for windrows of last summer’s dead marsh grasses collecting inside the arm of Cape Henlopen. These boundaries are usually loaded with birds feeding on whatever else is concentrated between the different water masses. I saw my first phalarope from the *MV Twin Capes* in Lewes Harbor and remember thinking, “Why is that sandpiper swimming?”

Lingering loons, buffleheads and Bonaparte’s gulls will soon depart for their northern nesting grounds, and the dark skeins of scoters, cormorants and brant are gradually replaced by loose flocks of gray summer gulls and bright white egrets zigzagging their way north across the wide expanse of water. In spite of the cold, ospreys proclaim the start of the nest-building season by staking out all of the day-marks and lights around the waterfront, and a dock-side greeting by the season’s first tree swallows confirms that it has been warm enough for the first hatch of flying insects.

Cape Henlopen sometimes gets a bad rap among birders because of unfair comparisons to Cape May and the vast numbers of birds that funnel through there in



*A view of Cape Henlopen dunes, pines, beach, and bay from the 90-foot tall Great Dune.
Photo by Dave Grant*

the fall, but fewer birds move north in the spring migration, simply because these represent the winter survivors. Also, the shape of Henlopen is not as prominent as Cape May and it is not as effective as a migration "trap." Still, it is not unusual to see over 100 hawks, and many other migrants fly over the dunes on a typical spring day.

There are many reasons to be here in the spring. Often you will see your first laughing gull of the year from the ferry as early as mid-March, and you are likely to see the first tern of the year too (usually a rugged little Forster's returning in its breeding plumage). The blooming times of plants are earlier on the south side of the bay too and even from the ferry, you can detect flowering plants in Henlopen's dunes and stunted forests: the white of the shadbush, red of the maple and green of the sassafras. These are sure signs of spring.

Summer: Bunkers and Bicycles

This brings us to summer, and what I call my "bunker to bunker bike" tour. A strategy for my friends from Wilmington, hoping to avoid the endless line of traffic to-and-from the Delaware beaches in the summer, is to detour around the bay via the ferry. I do the same by bicycle, and the

flat terrain, absence of a waiting line for bikes, and bargain fare make this the preferred way to cross in the summer.

The bay's richness is evident in the summer and nothing makes that more obvious than the planktivores -- giant lion's mane jellyfish and schools of silver-sided menhaden ("Bunker") flashing below the surface. I have never seen larger specimens of either creature than those that can be spotted from the ferry in August. The other obvious clue to productivity is the great number of fishing boats, especially in the lee of Cape May and the breakwaters; plying the waters for the queen of the bay, the weakfish (if you are from Fortescue on the New Jersey side) or trout (if you are from Lewes). The alert naturalist may also catch a glimpse of a family of dolphins, sting rays, a sea turtle basking at the surface, or even the dorsal fin of a shark, although some of these and other questionable sightings are more likely the numerous shells of dead horse-shoe crabs bobbing at the surface.

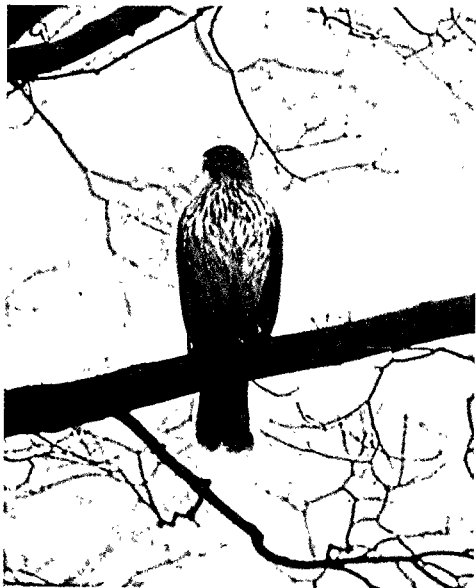
If you drag a seine net along the shore, even in the worst of spawning years, you will catch fingerling weakfish and small blue crabs. If you are barefoot, you may scrape your feet on the abundant oyster and hard clam shells, two other important resources of the bay. And if you are col-

lecting fish for the aquarium, you will be amazed and delighted at the great numbers of juvenile tropicals that drift north in the summer: jacks, pompano, and even butterfly fishes.

Birdwatchers enjoy the great variety of sightings on the bay in the summer and are always on the lookout for southern strays and interesting bird behaviors. In the "good old days" before the new ferry boats were put in service (and you weren't disobeying the signs by throwing snacks off the stern to attract gulls), barn swallows used to find nesting sites on the flat-topped lights over the doorways. I noticed that even though they did not seem to follow the boat across the bay, a parent always seemed to be hovering to feed the youngsters upon docking, regardless of whether we landed at Cape May or Lewes. Looking back, I wish I had found the time to study that question. Did one parent wait at each side of the bay? Did unrelated parents inadvertently feed any youngsters that arrived on any ferry, regardless of its home port? An interesting case of Capistrano coming back to the swallows, every three hours. Today, the new boats are quite a bit more upscale, the light fixtures are unsuitable for the swallow nests, and signs warn of dire consequences if you feed the birds. But I still enjoy watching what the birds are up to, reminiscing about how things were, and occasionally spilling a bag of chips in the wind.

The low, featureless coastal plain shoreline of the bay must have driven early navigators like Henry Hudson to distraction. Fortunately, even today there are no large cities at the mouth of the bay to clutter up the horizon, and the only reference points during mid-voyage are lighthouses and some mysterious obelisks, one of which should be your first destination upon reaching the Delaware shore.

These are concrete columns, called Fire Control towers, placed on both sides of the bay. Hurriedly built during WWII, they were expected to last only a decade, but are so sturdy, with foot-thick walls and



A Cooper's hawk perches near the shore. Probably contemplating the advisability of a Bay crossing. Photo by Dave Grant

17-foot diameters, that they still look formidable. Remarkably, each was poured in only a week as the Army reinforced defenses at the mouth of the bay. They range in height from 40 to 90 feet and were perfect for triangulating targets and directing the fire of shore batteries at Fort Miles (the other Bunkers) guarding the coast.

They also are perfect for studying the dynamic geological forces that shape the coast, and at Cape Henlopen State Park it is possible to climb one refurbished tower to get an aerial view of not just the cape, but the whole "littoral cell" that dominates this part of the shore from its proximal end -- the sand source to the south toward Rehoboth Beach to the distal end of the spit to the north; and across the length of the famous "Great Dune" that dominates the park.

At 90-feet above sea-level, the Great Dune is the highest spot on the beach between Cape Cod and Cape Hatteras. It is atypical because it lies perpendicular to the ocean shoreline, but this is a clue to its

origins. In 1683, none other than William Penn deeded "the land of the Cape" and its timber to "forever lie in common" for the inhabitants of Lewes; one of the earliest such encumbrances on land for public use, and a good example of the "tragedy of the commons" that can be the result. The clearing of trees in the 1800s exposed sand from the bayside at Lewes and the dune has been marching inland ever since, pushed by those strong Northwest gales. Although pine trees were planted to help stabilize it, in a century and a half, the famous "Walking" Dune moved south a rate of 10 feet per year.

Maps of the area dating to the 1600s, along with modern geological surveys, indicate that for the last 11,000 years, the coast has been experiencing what the geologists call a marine transgression phase. Although Cape Henlopen appears to simply be growing to the northward by the accretion of sand washed from the south, the whole system of beaches and dunes is actually being pushed landward and upward in response to rising sea level. With more glacial melting and global warming, today's shoreline will, in thousands of years, retreat halfway across the state. In perhaps another 10,000 years, Wilmington will be "oceanfront" property, and the inundated coastal plain will be transformed back into continental shelf and bay bottom.

Originally the Cape Henlopen area was a barrier beach-lagoon system similar to what can be found farther south along the coast; and old maps show Dutch names for water bodies like Bloemaerts Kill and Hoern Kill that help reveal it. Recorded in the dunes and marsh fringe is evidence of a later recurved spit (as Sandy Hook, NJ, is today) with forested fingers of sand, dominated by pines, cherry, holly, and oak, reaching into the marsh. These are the tips of ancient spits and would have been the destination of Littoral Society New Year's Day beachwalkers 500-2000 years ago. Between them are low, narrow wetlands that are probably old cat's eye

ponds, which form as accreting spits reach out and encompass areas of a bay.

Maps from 1631 and 1801 show the area as a rounded cusped spit, but since then, partly in response to siltation encouraged by those immense breakwaters built in 1829 and 1890, Cape Henlopen has been described as a "simple" spit. Although lately, affirming that the history that most often repeats itself is geological, I have noticed that a new curved finger of sand is reaching into the bay.

Today, Cape Henlopen is a great destination to do all those simple things that make an undeveloped beach so attractive: hiking, shelling, fishing, and observing terns and piping plovers at their nesting refuges. It's also one of the last refuges for the ORV-crowd that gathers at the tip of Henlopen to try their luck at catching some of Delaware Bay's legendary stripers, drum, and especially weakfish.

I hate the noise and tire tracks but shrug it off, because I know the fishermen love the shore as much as I do...and that time is on the side of the birds and the beach; since the ocean will one day reclaim the coast, and the waves and currents will always wash away any marks we leave.

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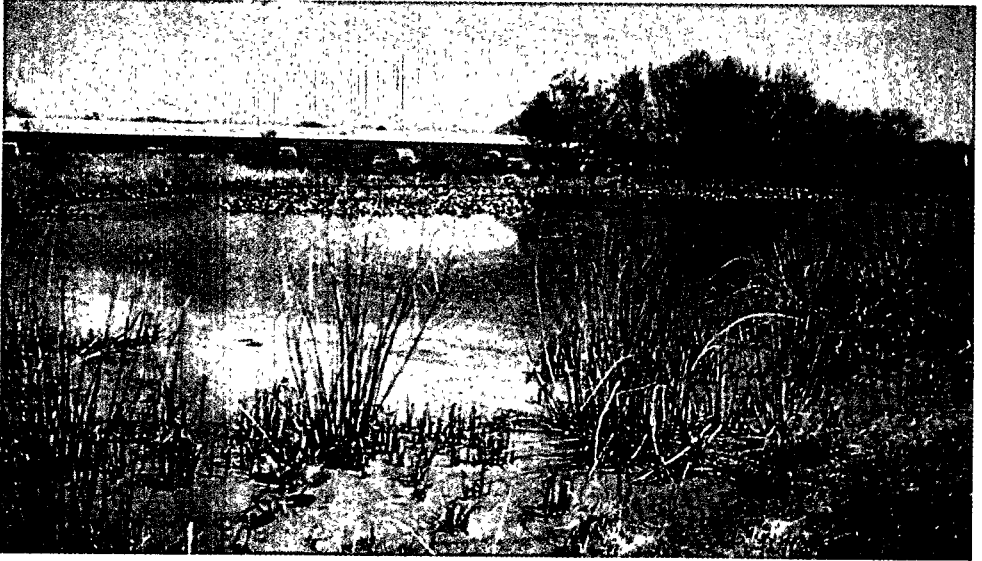
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A Journey Down Route 9

by DENNIS REYNOLDS



A couple of acres of 1000 Acre Marsh, 1300 acres of mostly freshwater wetlands just south of the Reedy Point Bridge and the Delaware and Chesapeake Canal.

Several times a year I travel from my home in central New Jersey to the lower portion of the Delmarva Peninsula. On one such trip about ten years ago, to avoid a NASCAR event traffic jam near Dover, Delaware, I made for home, not as usual on Route 13, but to the east along Route 9 and found myself cruising through some of the nicest marshes and farm country I've ever seen. Since then, whenever I can manage it, I take this new route.

At about 25 miles you can cruise through the main portion of this trip in an hour and a half, spend a day or more exploring more thoroughly, or revisit it often with a different side trip each time. To start, get off of Route 13 above Delaware City, turn left on Tybouts Corner Road and follow the sign for Route

Reynolds is a longtime ALS member, now on the staff of both the Society and its Baykeeper project. All photos were taken by the author.

9. Here you'll pass over Red Lion Creek, through a series of petro-chemical refineries, and the last of northern 9's industrial section. Once past the refineries, Route 9 turns left and heads for Delaware City.

Just before you get to Delaware City you'll cross over Dragon Creek, a slow moving creek with the feel of a southern stream. It's worth a stop to check out the lush vegetation and water lilies in bloom. When you've passed the creek you enter the town of Delaware City.

Delaware City was built on speculation, a small town with dreams of grandeur. In the early 1800s when plans were being made for the Chesapeake and Delaware (C&D) Canal, Newbold Landing, site of a fishing pier and some fishing shacks, was chosen as the location for its eastern terminus. Investors, mostly wealthy Philadelphians, had visions of a great commercial center at the eastern end of an important waterway. But the canal didn't translate into fortune for Delaware City.

Railroads soon offered an alternative to canal transport and, as if to add insult to injury, the entrance to the canal was eventually moved south to Reedy Point where the local terrain made the use of locks unnecessary.

It's worth a stop in town to view some of its historic buildings and waterfront park. If you want, you can catch a ferry to Pea Patch Island in the Delaware River, home to Fort Delaware, used during the Civil War to hold Confederate prisoners of war. Pea Patch is also the location for one of the largest heron rookeries on the East Coast. Visit Delaware City in the fall to take the Halloween Ghost Walk and go back in the summer to catch the Catfish Tournament. Just before you leave town you might want to stop for crabs at Wiso's, a small, family-owned and run crab house. The crabs here come straight from the family boat, no middleman.


About six inches from the border of Delaware City is the foot of Reedy Point

Bridge, one of five bridges that cross the Chesapeake and Delaware (C&D) Canal. From the top of the bridge a wonderful view spreads out before you. To your left (east), saltwater wetlands and the northern edge of the Augustine Wildlife Management Area (WMA). To your right (west), 1000 Acre Marsh, which is actually about 1300 acres of tidal and freshwater wetlands. It's a good place to see waders, as many of the nesters from the Pea Patch Island rookery come here to feed. I've also seen eagles here.

At the southern foot of the bridge turn right onto Reedy Point Road and head back toward the canal. The dredge spoils located near the base of the bridge are a well known spot to look for fossils dating back 65 to 85 millions years. For more info about these fossils check out the web sites of Delaware Mineralogical Society (www.8realms.com/dms) or the Delaware Geological Survey (www.udel.edu/dgs). Turn left along the canal and the road

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turns inland. Here it becomes Dutch Neck Road and cuts through the freshwater wetlands, giving you a close-up view. You can follow this road to Port Penn Road, through farms, back out to Route 9. I prefer to turn around and head back the way I came in.

Route 9 here is low and passes through wetlands on both sides as you approach Port Penn. Signs along the roadway warn of the potential for water on the road. At many spots along this trip the roads are so low in the marshes that storms or high tides sometimes cause flooding.

Port Penn has the feel of a small, watermen's village but in fact was once an important port with its own customs house. When you get to Port Penn stop at the interpretive center. There is a small watermen's museum and self-guided tours of the town. Across the road from the interpretive center is a trail and boardwalk through a large tidal marsh. Route 9 zigzags through Port Penn; before you make the zag right and out of town, turn

left onto Congress Road and into the Augustine Wildlife Management Area. Park your car at the end of the road and walk the trail out to the fishing area at Canadas Beach. You're now just a little north of where the Delaware River turns into the Delaware Bay.

About half a mile south Route 9 makes its closest pass to the Delaware River/Bay at Augustine Beach. An early day resort, steamships once brought people here from upriver to spend the day at the beach. Now there's a boat ramp and small park at the site.

The view here is dominated by two structures. To the east looms New Jersey's Salem Nuclear Power Plant. The power plant is part of almost every eastern vista along this drive but at Augustine Beach you almost feel as if you can reach out and touch it. Look to the west and there stands the Augustine Inn. Built in the early 1800s it was once known as the Walter Diehl Inn. The impressive old inn has seen better days and had many lives,

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Off the beaten path, the house and tower at Cedar Swamp Wildlife Management Area.

some more legit the others. It's been a ferry landing, hotel, restaurant, inn, and more (as the saying goes "if the walls could talk"). These days the Inn can be described as biker friendly. On a warm fall Saturday I've seen the lot packed with motorcycles (mostly Harleys) in the hundreds. If you stop here for a beer, two signs set the tone; outside "No beer off the porch" and inside "We reserve the right to ignore you."

Just south you'll cross over Augustine Creek. During the course of this trip you'll cross over a dozen or so creeks, wetlands, and rivers. At any of the small to large bridges you're likely to see people fishing or crabbing. The bridge at Silver Run is popular, I don't think I've ever crossed it when someone didn't have a line hanging over the side. A small public boat ramp can be found at Silver Run.

At about this point Route 9 turns inland. After you cross over Drawyer Creek and the Appoquinimink River you're in farm country. Once past the Christmas tree farm you start to see the signs of development that threatens much of Delaware's farmlands and open space.

When you've passed over Hangman's Run look for Staves Point Road on your left. The road runs about two miles back toward the bay, first through farms then into the Appoquinimink Wildlife Management Area. When the road enters

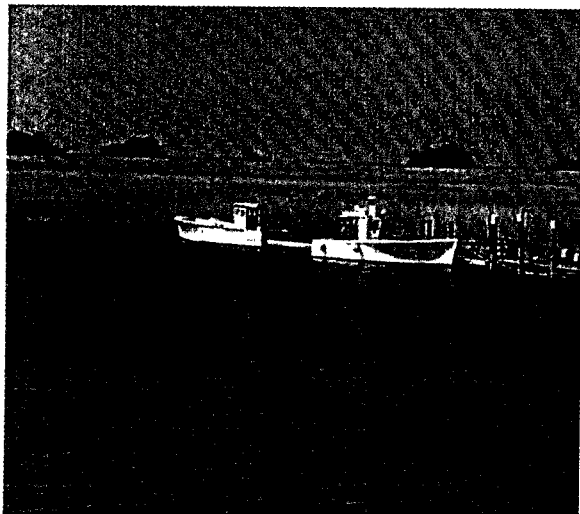
the management area it passes over several tidal creeks. Check them out, I've spotted clapper rails here. The road cuts through an area called "The Rocks" (for me, reason enough to make the trip) and ends at Fennimore Landing, a bend in the Appoquinimink River with a public boat launch. A good place to look for shorebirds and harriers.

Back on Route 9 and coming up on Taylors Bridge, at the corner where Route 9 takes a sharp right turn, seemingly springing up out of a farm field, is the Reedy Island Rear Range Light. You may think a farm field is a strange place to put a lighthouse but at one time this was not such an unusual sight. Range lights came in pairs; one lower light close to the mouth of a waterway and another taller light a few miles inland. Approaching the inlet the navigator knew he was in the channel when the two lights lined up. The front light of this pair is at the mouth of the C&D Canal near Reedy Island.

A mile or so south turn left onto Thoroughfare Neck Road. You're now in the forested upland portion of the Cedar Swamp WMA. The road comes to a T-intersection. Across the road is the gated entrance to one of the hunting areas. Through the gate a long sandy driveway lined with trees (autumn olive?) leads to an impressive old cedar sided homestead. Next to the house, attached by covered walkway, is a tapered tower, taller but with the same siding. Observation deck,



A group of fiddler crabs make a living in the mud below the wetlands boardwalk at the Aquatic Resource Education Center.



Commercial fishing boats docked at Flemings Landing on the Smyrna River.

lighthouse, windmill? This is a good area to look for songbirds and flycatchers.

A word of warning. Wildlife management areas are primarily managed for hunters, so be careful when in them. If you leave your car stay on the paved road. If you want to explore off the paved roads know the hunting seasons -- better yet make your trip on Sunday when Delaware bans hunting statewide.

Back at the gate turn right onto Collins Beach Road. Once a popular summer resort, the hurricane of 1878 was its downfall. At the end of the road stop and look west up the tidal inlet and enjoy the view of the dozen or so oyster and crabbing boats that now moor there.

Just south of Thoroughfare Neck Road you'll come to Flemings Landing where the road rises up and passes over what once was known as Duck Creek and now is called the Smyrna River. A small fleet of oyster boats dock just east of the bridge. The beautiful little river passes through farmland and out to the bay. Passing over Smyrna River you've gone from New Castle to Kent County.

A couple of miles below the Smyrna River you come to the northern edge of

the Woodland Beach WMA and the facilities of the Aquatic Resource Education Center, an educational operation of the Delaware Division of Fish and Wildlife. Pull into their lot and take a walk out onto the marsh trail and boardwalk. It's a good spot to find shorebirds hunting the edges of the creeks or swallows skimming insects just above the water's surface. On the boardwalk stand still for a few minutes then look down into the marsh. Hundreds of fiddler crabs can be seen working the flats and the creek beds.

Just south of the Aquatic Center, to the right, is a large wetland called Taylor's Gut Pond. The water level here is controlled by a tide gate and when the level is low it's a great spot to look for shorebirds and a popular place to crab or catch bait fish. Just past there on the left side of the road is a small observation tower offering a good view of the tidal wetlands with wading birds and snow geese in season.

At Route 6 turn left (east) and head for the town of Woodland Beach, another



Willetts on the "beach" at Port Mahon.

beach resort done in by the hurricane of 1878. Route 6 was built through a large marsh area and water runs along both sides most of its length. Shorebirds can be spotted along the way and ospreys nest right overhead on several of the telephone poles that line the road. At the end of the road is a small community. Stop here and look around, with just a little bit of imagination, you can still see the old resort. At the end of the road is a small pond surrounded by a park and over on the bay's edge, a fishing pier.

Back on Route 9 you're coming up on Bombay Hook National Wildlife Refuge. But pass it by, we'll come back later.

Now you pass over the Leipsic River. If you feel a little hungry turn left onto Front Street and stop at Sambo's Tavern where they serve the second best crab cakes I've ever had. Outside, 30 or so commercial fishing boats line the town's scenic waterfront.

About six miles south, in the town of Little Creek, turn left onto Port Mahon Road. The history of human endeavor on the Delaware Bayshore is the history of erosion and nowhere is it more apparent than on Port Mahon Road. Once bustling with shucking houses, fishing shacks, docks, homes, and a lighthouse, they're all gone now. The road is a mixture of black top, sand, and rubble and should probably be avoided in bad weather. Port Mahon is worth the trip just to see what nature can do to our works, but it's also a great birding spot.

A short way down Port Mahon Road is a trail that leads out to the north impoundments of Little Creek WMA. Just past there is an observation tower and photo blind that look out over the impoundments. But venture down the road further. On your left is the Little Creek WMA and to the right the Delaware Bay. To your left look for seaside sparrows and marsh wrens, to your right look for all kinds of shore birds. This is a good spot to find a surprise or two; on my last trip here I looked out on the bay and there were two



Some introduced exotics at Cowgill Corner.

Iceland gulls, a first for me.

Heading back up Route 9 to Bombay Hook, when you reach Cowgill Corner, look to the left to see if the llamas are out. A little farther north stop at the Lane Farm Stand for some fresh produce and homemade jams and honey.

Now you come back to Bombay Hook Wildlife Refuge, a 16,000-acre gem with saltmarsh, fresh water ponds, upland forest, and farm fields. Bombay Hook is a good place to see stilts and avocets or to spot an eagle or two. If you do this trip in late October or November time your arrival for about an hour before sunset and get ready for a treat.

As the sun begins to set, snow geese start coming in to roost from the surrounding farm fields. And they come and come and come some more. Sometimes tens of thousands of geese make their way to Bombay Hook. The sky above you fills with the large white birds and conversation becomes impossible above the sound of their incessant vocalizing. It's an event well worth experiencing and a great way to end the day.

But we have one more stop. Head back north and turn left onto Route 6. Turn right onto Lighthouse Road, there in the middle of a farm field you'll see single level cinderblock building. You've found Boondocks, one of my favorite crab houses anywhere. Stop in and have a dozen.



Tagging Report

by PAM CARLSEN



Greater amberjack caught, tagged, and released August, 2001, off Cape Henry, VA, by ALS tagging member C.T. Cowling, recaptured in March, 2002, off Islamorada, FL.

Greater Amberjack (*Seriola dumerili*) is an important gamefish from Massachusetts to Brazil. This fish is sought by sportfishermen trolling near the surface or by using cut bait or lures. The fish grow to huge sizes, with 177 lbs. the known record.

In August of 2001, two taggers from Virginia Beach, VA, tagged greater amberjack and received exciting returns in early 2002. Capt. C.T. Cowling, Jr. tagged a 44" fish at the Triangle wreck (32 miles E of Cape Henry, VA) on 8/28/01. This fish was recaptured on 3/28/02, twenty two miles S of Islamorada, FL. Dr. Jim Wright tagged two amberjack on 8/30/01 at the south tower (50 miles SE of Rudee Inlet, VA). One fish was 50", the other 48". The larger fish was commercially caught by the fishing vessel *Capricorn* at Fort Jefferson in the Dry Tortugas, between 2/15 and 2/21/02. The Dry Tortugas lie west of Key West in the Gulf of Mexico. The second fish of Dr. Jim's was caught on 3/21/02, off Islamorada, FL

in the Keys. Greater amberjack is not a fish commonly tagged by ALS taggers, so these three returns were very exciting.

Dr. Jim has a fishing show in Virginia and has produced many videos. One of which shows him fishing for greater amberjack at the south tower. This video, as well as others about fishing, safe release of fish, and tagging, are available from the office on loan. For a complete list, contact Pam or Vicki.

Florida also brought a letter from Jack O'Keeffe, dated Jan. 18, 2002. "A series of cold fronts over the new year pushed the bluefish south into the river systems here in Stuart. Top water plugging in three feet of water over the grass is quite a blast. Tagged the ones in best shape and released them when the dolphins were not lurking around for a free meal."

The winter of 2001-2002 was very warm and dry in the northeast. It led to some "odd" fishing conditions. Jim Balicki tagged a 27" bluefish at

Mantoloking, NJ. He wrote, "First time ever that I caught a bluefish in December from the beach in New Jersey." Then in March, he tagged an 18" striped bass at Cliffwood Beach on Raritan Bay, and wrote, "March eighth is the earliest that I have caught a striped bass in New Jersey." Bob Pearson of Croton, NY, wrote, "I'm almost embarrassed to pass along these few tag cards. The 2002 Spring striper action in the Hudson was the worst in my memory. I blame the lack of rain with NO Croton dam overflow to bring the fish up toward the Upper Croton River."

April of 2002, brought letters of the largest flatfish caught by two long standing taggers. George Horvath wrote, "Enclosed is a copy of a photo of the largest fluke that I have ever caught, tagged, and released. The 26", 6 lb. 8 oz fish was caught 9/09/01, drifting off Island Beach State Park, NJ. Three big fluke made vicious strikes and nearly cut my finger. Lost one and kept a 28", 8 lb. 12 oz. fluke with which I won my eighth NJ Skillful Angler Award." Stuart Fries wrote of the largest winter flounder he had ever seen. "The flounder was caught on the boat fishing next to mine, 4/27/02, and was kept alive and brought back to the Brooklyn Yacht Club, where it was weighed, measured, tagged, and released. It was 18", 3 lb. 9 oz. A beauty! We caught six other flounders that day and while I was filleting them and discarding the carcasses, I looked down into the water. Every so often a large striped bass would appear...You can guess what happened next. A couple of poles come out and we caught, tagged, and released a 31", 11 lb. and a 27" 8 lb. bass. It may be that a new fishery has been located very close to home."

Capt. Al Anderson of Snug Harbor, RI, has been doing a lot of striper tagging during the winter in the Thames River of Connecticut. On 11/16/01 and on 12/6/01, he tagged a 16" striped bass. On 4/10/02, the November striper was recaptured in the Hudson River at Newburgh,



A 26-inch, 6.8-pound fluke tagged and released off Island Beach State Park, NJ, by longtime tagging member George Horvath, who here demonstrates how to hold a fish out close to the camera lens.

NY. On 4/22/02 the December striper was recaptured at Montville, CT, in the Thames River. These recaptures raise some questions. Did both fish winter over in the Thames? Why did one small fish move to the Hudson? Was the one that moved a male, which matures at two or three years and is ready to spawn, and the other a female, which matures a few years later and therefore stayed behind? We learn many things from the tagging and recapturing of fish, but some things remain a mystery.

For a complete list of current tagging data watch for the next issue of the Underwater Naturalist, Vol 26 No. 3.



Book Reviews

BLUE FRONTIER: SAVING AMERICA'S SEAS

by David Helvarg

Holt, New York
249 p. \$15 (paper)

This is a wide ranging overview of the ocean and its troubles. The author is so immersed in his subject that he wanders some, but this only adds to the book's charm and its heartfelt message. It's as if Helvarg is so full of information that he can't get it on paper fast enough, so it spills out.

But there is a design -- some quick history, enough science to understand how the ocean works, and strings of anecdotes, asides, and seaside visits to give much detail and lift to a subject obviously dear to his heart. His field work is prodigious -- time on the aircraft carrier *Stennis* working visits with commercial fishermen and with divers in an undersea habitat in the Florida Keys, a field trip to the Palmer Station in Antarctica among leopard seals, penguins, skuas, and krill, to the beaches of Miami and New Jersey, to Coney Island and the exclusive Ocean Reef development on Key Largo.

He's kind of part Carl Hiasson, part John McPhee, sometimes serious but often overcome by the sheer silly madness of many of man's oceanic follies.

He retells the story of Howard Hughes's *Glomar Discoverer*: 600 feet of drilling ship supposedly after deepsea manganese nodules but, in fact, a CIA operation to try to hoist a dead Soviet sub from three miles down on the Pacific Ocean bottom. No sub, no manganese nodules, but good history and later a valuable reiteration of Secretary of Interior

James Watt's blatant attempt to auction off millions of square miles of ocean floor to the highest bidder.

The title means that the ocean is the only part of earth still hiding its secrets. To the author, it also means that we should handle this frontier with more care than we have treated others.

The book is chock full of facts (with references) and ocean details that will entertain and educate; it's also a call to action -- the ocean needs help. Recommended.

LOBSTERS GREAT & SMALL: HOW SCIENTISTS AND FISHERMEN ARE CHANGING OUR UNDERSTANDING OF A MAINE ICON

by Philip Conkling and Anne Hayden

Island Institute, Rockland, ME
119p. \$24.95 (paper)

Homarus americanus, the American lobster, is at the heart of the most valuable fishery on the Atlantic Coast of the United States, averaging upwards \$250 million dockside annually and over 80 million pounds. Although it can be found from Virginia to Labrador almost 60 million of that 80 million pounds is harvested from the waters of coastal Maine. Of that, the largest portion comes from Penobscot Bay.

From the late 1800s to about 1950 the lobster fishery averaged around 20 million pounds a year; it's been on the rise ever since. Once lobsters were a seasonal and regional delicacy. Now, with advent of better lobster pounds (holding pens where live lobsters are kept for later sale) and air shipping, the American lobster, and more specifically the Maine lobster, is served year round and around the world.

But can a fishery grow or even sustain itself at this kind of pace? How long can an area and ecosystem continue to pro-

duce that many lobsters? Can the men and women of this industry, known for their individualism, continue to successfully work together and manage one of the world's most important fisheries?

In 1996, 150 fishermen, a dozen scientists from five research foundations, three non-profits, three state agencies, and one big federal organization joined together to study the fishery. That you could get this group together on anything is a big enough story itself. Fishermen question the management abilities of the government, scientists and researchers seem to be wrapped up in their own narrow focus projects, state and federal agencies find themselves having to make policies that please no one, and non-profits are forever finding themselves

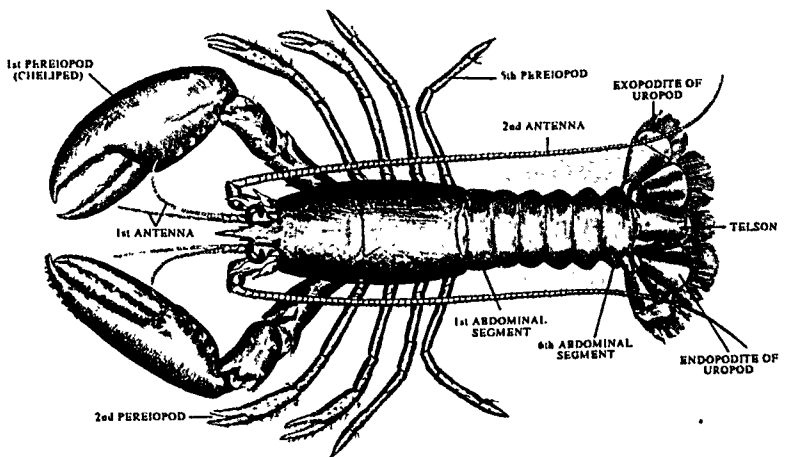
asked to take on projects no one else wants to do and still fewer want to pay for. But this disparate group took a chance and for five years worked together across specialties and disciplines to study this fishery and the resource it depends on. The project eventually came to be known as the Penobscot Bay Collaborative.

Lobsters Great & Small is the story of the Penobscot Bay Collaborative. Authors Phillip Conkling and Anne Hayden have written a clean and concise book that makes the science and issues understandable but doesn't talk down to

the reader. There are 20 or so sidebars that profile individual members of the Collaborative, give them a chance to express themselves or highlight different aspects of the project. In addition, there are just enough charts, graphs, maps, and historic drawings to help you understand the study and photographs of Maine that will make you start thinking about your next vacation.

Scientists got out on boats (almost

JUVENILE (STAGE XIV) *Homarus americanus*



always a good thing), fisherman got to meet some of the previously faceless people who make decisions that so greatly affect their lives, friendships were made. A ton of data was collected, observations were recorded, measurements were taken, proposals were made, models were produced, questions were answered and still more were asked. Will it all help to keep Maine's lobster fishery alive and thriving? Will it help to deal with or fend off future crises? Only time will tell, but it was surely a worthwhile project and this is an enjoyable book.

IF MARY HAD HER BLUE JEANS ON, WHAT DID DELLA WEAR?

Because this issue of UNDERWATER NATURALIST is mostly about the State of Delaware, it is only fitting that this page also concentrate its energies on this small Mid-Atlantic state resting somewhere between New York and Washington. First a lesson in pronunciation:

Lewes, Delaware, is a small, historic town on the coast where the Delaware Bay meets the ocean. It's where the ferry from Cape May lands. It does not rhyme with "snooze"; it's not pronounced "lose" or "looz." It has two syllables and is pronounced like the "Lewis" in "Lewis and Clark" or in John L. Lewis or Joe Louis of boxing fame. It sounds like the second part of the name of a city in Missouri on the bank of the Mississippi River whose baseball team is nicknamed the Cardinals, but it's not Louie or Lou. It's just plain Lewes. They even wrote a song about it: "Meet Me in Lewes."

Other Delaware towns with exciting names are Blades, Blackbird, Kitts Hummock, Pepper, Hardscrabble, Dagsboro, and Sharptown (never play poker with a guy from Sharptown). There's Bethany Beach, Rehoboth Beach, Broadkill Beach, Fowler Beach, Slaughter Beach, Cedar Beach, Big Stone Beach, Bower Beach, Woodland Beach, and Bay View Beach.

And there is Wilmington, where Pierre "Boom Boom" Dupont built a gunpowder factory, and later offspring invented nylon and monofilament fishing line. Despite what people think (especially people who live in Wilmington), it is not the state capitol. That's in Dover, farther south toward Newark (pronounced "New Ark," accent heavy on the second syllable).

Some say that Delaware is one half Wilmington and the other half corn and soybeans, but that's not exactly true. They grow great muskmelons. Lots of chickens too. And snow geese. Go to Bombay Hook National Wildlife Refuge in the fall and late winter. There will be thousands of snow geese and, if you are lucky, eagles nearby...and sometimes avocets. Or go to Indian River Inlet in the fall to fish for stripers and bluefish and to see waterfowl migrating south.

Delaware may well have a higher percentage of its ocean shoreline in public hands than any state on the east coast (except Virginia): about half of its 28 miles of oceanfront is state park, from Cape Henlopen south to the first of a series of basically gated communities with welcoming signs at the entrances of its private drives that say such warm things as "Private Beach" or "No Public Access Here." It makes you proud to be an American.

Delaware put in place the first coastal zone land use management laws in the U.S. while at the same time failing to get a grip on coastal sprawl -- the state is cursed with a tax structure that favors retirement communities and the construction of vacation houses. Couple that with the population pressures from Baltimore-Washington and Philadelphia and an almost non-existent wetlands protection policy and "progress" has come to the Delaware coast with a vengeance and shows little sign of abating.

But there are still places worth visiting. Some are spelled out in this issue -- particularly the hidden byways off Route 9. Or you can go to Lum's Pond and fish for crappie and then drive to Dewey Beach for excellent barbecue with nearby amusement parks. It's just a few miles south of Lewes, and now you know where that is and how to say it.

D.W. Bennett

AMERICAN LITTORAL SOCIETY REGIONAL OFFICES

The Society maintains regional offices where members may keep up with local issues and events. Call the chapters for newsletters and local field trip information.

New Jersey
Highlands, NJ 07732
732-291-0055

South Jersey
P.O. Box 1306
Tuckerton, NJ 08087
609-294-3111

**Institute of Coastal
Education**
3419 Pacific Ave.
Wildwood, NJ 08260
609-729-9262

NY/NJ Harbor Baykeeper
Highlands, NJ 07732
732-291-0176

Northeast Region
28 West 9th Road
Broad Channel, NY 11693
718-318-9334

Southeast Region
4154 Keats Drive
Sarasota, FL 34241
941-377-5459

Delaware Riverkeeper
P.O. Box 326
Washington Crossing, PA
18977
215-369-1188

Project ReefKeeper
2809 Bird Ave., Suite 16
Miami, FL 33133
305-358-4600

Cape Florida Project
An Ecological Restoration
1200 South Crandon Blvd.
Key Biscayne, FL 33149
305-361-0611

Jamaica Bay Guardian
28 West 9th Rd.
Broad Channel, NY 11693
718-318-9334

www.littoralsociety.org

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

The Art of Shelling by Chuck and Debbie Robinson. A complete guide to shells and beach collectibles. \$14.

Blue Frontier: Saving America's Living Seas by David Helvarg. A detailed, lively discussion of the ocean's future, with the American Littoral Society a prominent player. \$12.

Crisis on the Coast by Gilbert Gaul and Anthony Wood. A tale of silly home location, greed and selfishness as defined by a second home at the shore. \$9

AMERICAN LITTORAL SOCIETY BOOKS

Anglers Guide to Sharks by Jack Casey A classic field guide to the sharks that inhabit the waters from Maine to the Chesapeake Bay. \$3.

New Jersey Coastwalks by D. W. Bennett. Pack a lunch, put on your walking shoes, get in your car, and drive to Kearny, NJ. At this point take out your copy of NJCW and follow the author's route from Kearny to Cape May and on to the Delaware Bay. Always changing, the coastline of New Jersey offers many surprises. This book will take you on a watery tour that will fascinate and teach you at the same time. \$5.

OTHER ITEMS

***NEW* Lighthouse T Shirt** - Front features lighthouses familiar to ALS members: Montauk, Cape May, Sandy Hook and Assateague. Dictionary definition of "littoral" on the back. 100% cotton, white with black, red, and brown in illustration. M, L, XL, 2X. \$15.

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Crab T for Kids - Just the right size for young beachcombers. Similar to the adult Crab T but in stonewashed blue. 100% cotton. Youth Sizes: S, M, L. \$10.

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