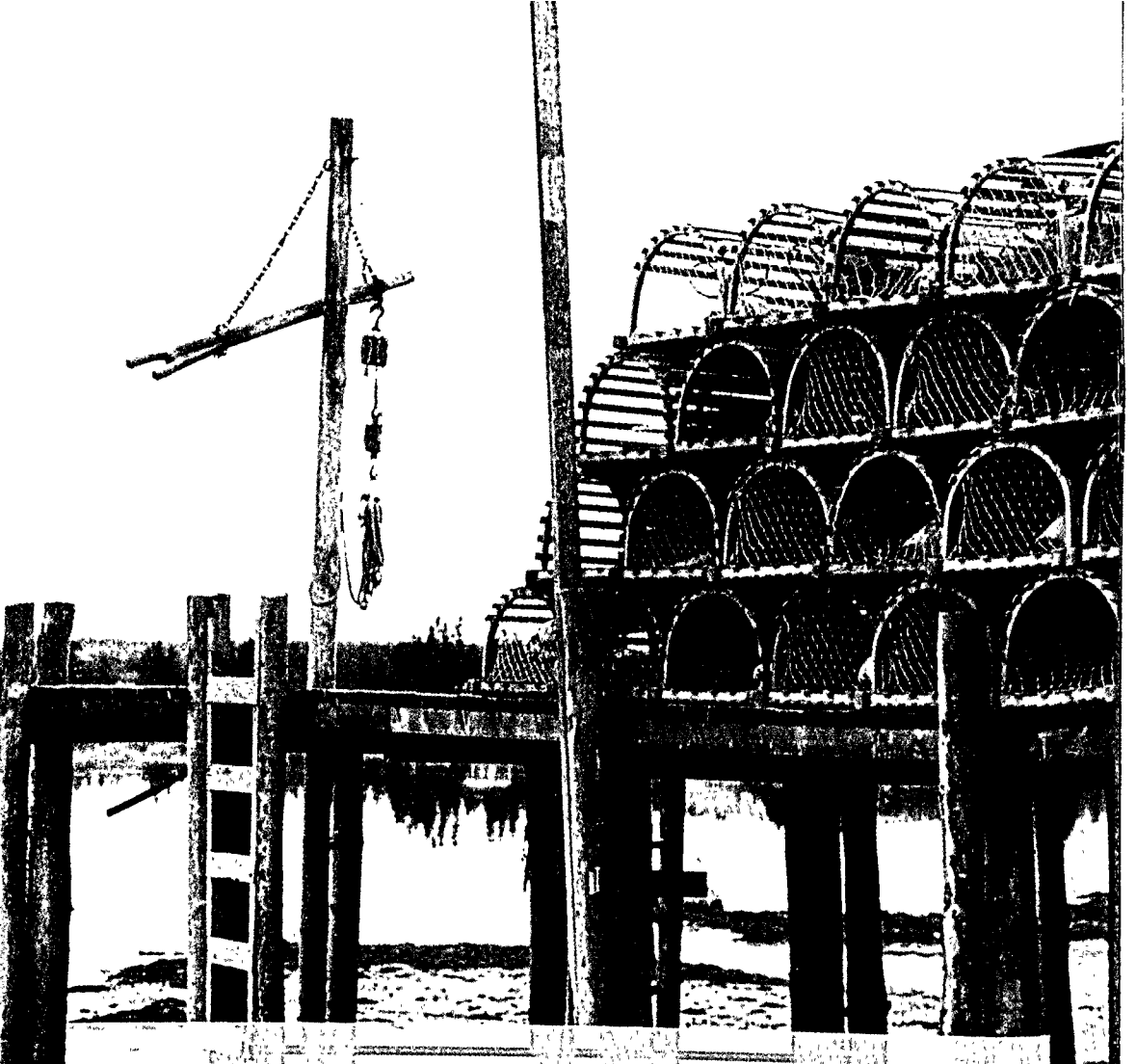
underwater naturalist

Vol. 25, No. 2



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Volume 25, Number 2

Cover Photography
by Robert Villani
Glasswort (*Salicornia virginica*) is an extremely salt-tolerant plant that grows in the salt pans of Long Island's coastal margins. Photo from *Long Island: A Natural History.*

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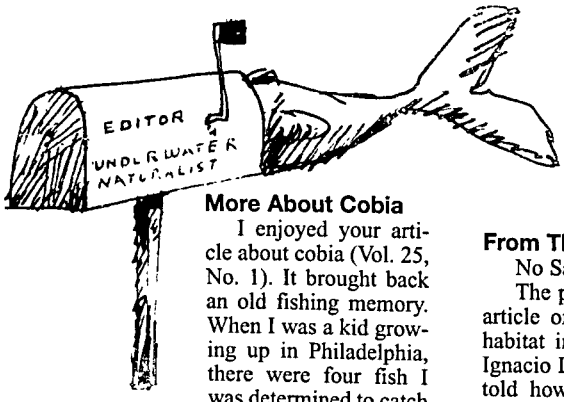


More About Cobia

I enjoyed your article about cobia (Vol. 25, No. 1). It brought back an old fishing memory. When I was a kid growing up in Philadelphia, there were four fish I was determined to catch — black drum, red drum (we called them channel bass), striped bass, and cobia. Over the years, I managed to catch all but the latter. When I was in the Navy stationed in Little Creek, Virginia, in the 50's, I ran into a local cobia fanatic who promised to put me right on the spot where the big ones hung out. We fished the mouth of Chesapeake Bay — this was before the bridge-tunnel was built — drifting shedder crabs around some of the channel markers. We finally nailed a few, including one that must have been close to 40 pounds, long, fat, and beautiful, sort of like a huge remora without suckers on its head. In those days, no one was politically correct. We ate it.

Bill Stellman, Annapolis, MD

Likes COASTWATCH

Thank you for reviving the COASTWATCH section in the magazine. It gave me a glimpse of what is going on in other coastal locales. Here on the Gulf Coast of Florida, our interests may focus on local issues, so it's good to get filled in on the rest of the coastal world. More, more. But I must end this note with a correction. It should have been Peter Clark (not Cook) in the byline under the Tampa BayWatch acticle.

Barbara Borgto, Dunedin, FL

Killing Breeders?

I was fascinated and somewhat taken aback by the reprint of Lionel Walford's essay on fisheries. If I understand it, one of his points is that the practice of protecting spawners has no scientific basis. Does this mean that we don't need to protect egg-bearing lobsters and crabs? Or that it makes sense to catch and kill fish like summer flounder and striped bass before they reach spawning age? It sounds counter-intuitive.

P. Stokes Gaither, Boston, MA

(Ed: Dr. Walford qualified his questioning of the generally held belief that "It is more destructive to catch fish during the spawning season than at any other time of the year" by writing that "If all the adults of a stock collect in one place to spawn, they might be particularly vulnerable..." This is one reason that fisheries managers in Alaska regulate the take of salmon river by river, so each river gets its supply of migrant breeders. Otherwise, he certainly questions what many of us believe.)

From The Editor

No Salt on the Whales' Tails

The previous issue of this journal carried an article on the threat to a sensitive grey whale habitat in the Gulf of California. Titled " San Ignacio Lagoon: World Class Nature Refuge," it told how this Baja California bay was being threatened by a saltworks operation proposed by Mitsubishi International Corporation and asked readers to object in writing to the company and to Mexico's president. Your letters and other efforts have paid off. The saltworks plan has been dropped.

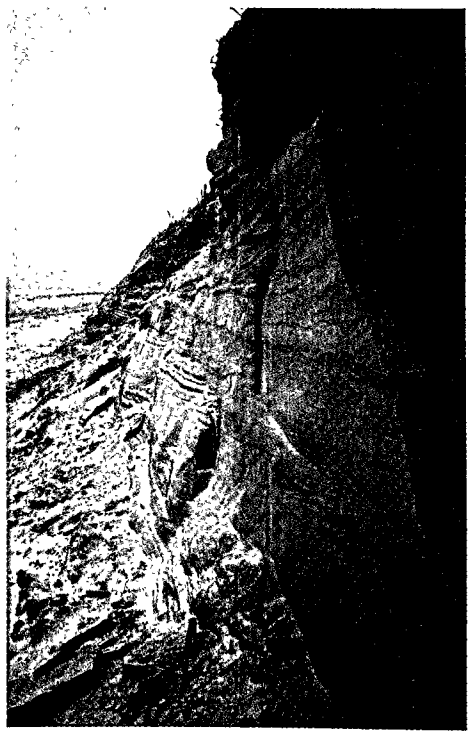
Barrier Islands

by ROBERT VILLANI

Like many large islands, Long Island itself harbors numerous smaller islands of various sizes, shapes, and origins. Barrier islands, in particular, have a significant role in preserving Long Island's varied habitats. A short distance from Long Island's South Shore, delicate ribbons of white sand stretch for miles, cradling the mainland and providing pristine beaches to the delight of countless individuals who sunbathe, swim, and fish on their shores. Few of them are aware of these islands' primary importance in shielding the mainland of Long Island from the fury of the Atlantic. Were these islands to disappear, wave action would quickly begin to eat away the unconsolidated gravels and sands of Long Island's South Shore.

The barrier islands also shelter a number of distinct plant and animal communities, adding to the biological diversity of Long Island. The large shallow lagoons, rich in beauty and varied in life, that have formed between the barrier islands and the mainland are probably the most significant of these habitats, but the islands themselves are home to flora and fauna not found elsewhere.

The barrier islands extend the length of Long Island's South Shore from Rockaway Inlet, Queens, in the west, to the South Fork in the east, and include Rockaway Beach, Long Beach, Jones Beach, Fire Island National Seashore, and the Hampton beaches. They are one of the most recent additions to the Long Island landscape, first making their appearance shortly after the glacial retreat and are probably no more than eight to ten thousand years old. The birth of Long Island's barrier islands began with the formation of a submerged sandbar a short distance offshore caused by the breaking action of waves over the sandy shallows that extend out for miles from the beach. It seems that under the proper conditions, the slightest variation in the height of the ocean floor is sufficient to cause this process to begin, and eventually the constant wave action deposits enough material to elevate the sand bar above the surface,



High bluffs of sand, gravel, and clay are characteristic of the North Shore coastline. Pictured here are the clay-rich bluffs at the David Weld Sanctuary in the village of Nissequogue.

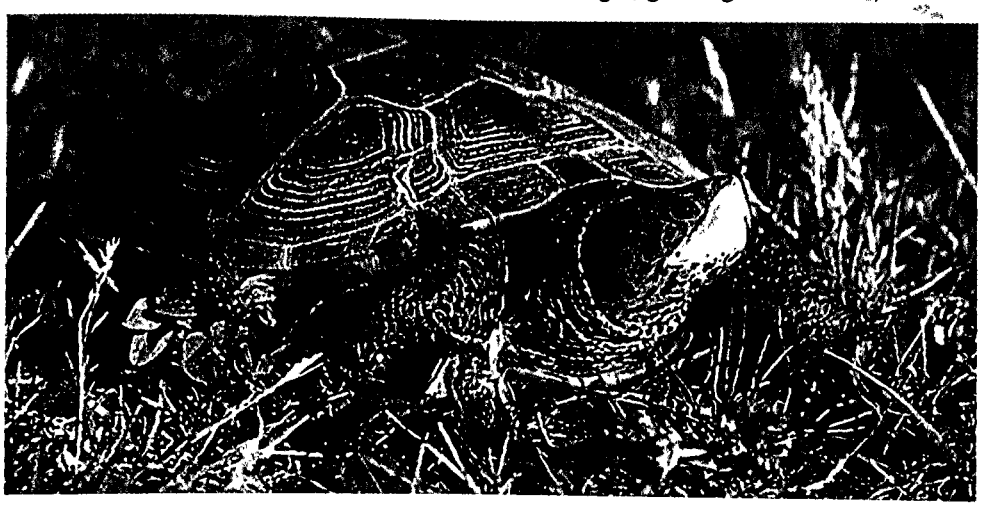
Rob Villani is a naturalist, photographer, illustrator, author, and doctor. He is a long time member of the Society, primarily involved with the Northeast Chapter. Villani has led numerous ALS field trips (Montauk, Chincoteague, Iceland). A native Long Islander, he has spent years documenting the Island's vanishing natural landscape and wildlife. This article is an excerpt from his book: Long Island: A Natural History, *published by Harry N. Abrams Inc. All photos are by the author.*

creating a long island of sand roughly parallel to the mainland. Barrier islands are among nature's most malleable landforms due to their close association with the sea. Waves wash up on Long Island's barrier beaches at a slight angle, known as the angle of incidence, only to flow back to the sea at an equivalent but opposite angle, known as the angle of reflection. Where the incoming waves meet the receding waves a longshore current forms, flowing parallel to the beach, often behind a submerged sandbar. Along the barrier beaches of Long Island's South Shore this current runs in a predominately east to west direction. The ceaseless waves pick up sand from the beach and carry it out to sea, where it then gets caught in the longshore drift until it is returned to the beach at a point farther west. Over the last 250 years, nearly six miles of land have been added to the western end of Fire Island as the longshore current has carried sand there from as far east as Montauk Point.

The fierce winter storms and occasional hurricanes that assault Long Island pose an acute challenge to the stability of the barrier islands. High winds and violent waves open new inlets by breaching the dunes and opening a path for seawater to flow across the land into the lagoons beyond. On occasion, entire sections of the islands have been returned to the sea.

While longshore currents and storms account for the most significant changes to the barrier islands' topography, other factors account for the existence of sand dunes, which are the most obvious feature of the seashore landscape. The relatively gentle wave action of summer creates small berms and runners of sand running parallel to the shore on the lower portions of beaches. These small ridges are washed away with the summer beach each winter, but often on a flat sandy area beyond a berm an irregularity, such as a pile of shells or a piece of driftwood, acts as an obstruction to onshore winds, causing them to drop sand on the leeward side of the obstacle. Quickly the small ridge of sand increases in height and length, growing within the wind shadow of the obstruction. As the dunes become more prominent, they invite the specialized plants that are able to flourish in the protection they offer from direct exposure to the sea.

American beach grass (*Ammophila breviligulata)* thrives in this inhospitable environment and is the first plant to colonize the sterile sand ridges. The tickling of windblown sands on the beach grass's emergent stems stimulates the grass's



Diamondback terrapins (Malaclemys terrapin) *are turtles of the island's bays and tidal creeks. They are fully aquatic, but in June the females come to shore to lay their eggs in warm sandy soil.*

growth so that it is actually more vigorous where sand is being deposited. The plant's extensive rhizomes (underground stems) and deep fibrous roots reach out like grasping hands and act as anchors, not only for the grass but more critically for the sand as well. Eventually the ridges colonized by the beach grass capture enough sand and other material to form a long dune lateral to the ocean.

While the continued growth of beach grass further anchors this dune, another dune between it and the sea may develop in the same manner: the dune system closest to the ocean is called the primary dune and any dunes behind the primary dune are called secondary dune systems. The swale (hollow) between the primary and secondary dunes becomes a specialized environment for a variety of plants and animals. Most of Long Island's barrier beaches display this primary/secondary dune pattern, although at any one time, portions of the beach may have lost their dunes entirely in winter storms.

Occasionally, when the onshore winds are high, the dunes resemble volcanoes as clouds of sand rise from their tops to fill the air and eventually be deposited on the dune's leeward side. A barrier island migrates toward the mainland as windborne sand is carried beyond the secondary dunes, while the ocean's bite reduces the primary dune. The protected hollows that develop behind the dunes often remain stable for long periods of time. It is in this area, in the shadow of the secondary dune, that a sunken forest may develop. The Sunken Forest on Fire Island is the finest example of this special habitat on Long Island.

If you could slice a barrier island in half and examine the face of the cut from the ocean to the bay, an interesting pattern of varied habitats is evident. The sandy beach from the foot of the primary dune to where the continental shelf drops off to deep water is the first such habitat, comprising three interdependent zones of life.

The sublittoral zone begins at the low tide line and extends out into the Atlantic to the edge of the continental shelf. An abundance of swimming organisms occupies this region, including finfish, jellyfish, and occasionally sea mammals, but most characteristic of the sublittoral off Long Island's barrier beaches is the abundance of bottom dwellers. Anyone who has walked the shoreline at Fire Island or Jones Beach has surely seen the large shells of the Atlantic surf clam (*Spisula solidissima*). They are the largest bivalves that live in Long Island's waters and favor sandy bottoms, where they thrive in strong wave action and tidal currents of the barrier beach. They anchor themselves by burrowing into the sand and feed on microscopic plants and animals that they filter out of seawater. During severe storms -- particularly in the winter -- they often will be uprooted and washed ashore, where their shells litter the beach, resembling crude ashtrays, a destiny many of them fulfill when collected and brought home by beachcombers.

The littoral zone -- or intertidal zone -- includes the area from the high tide's wrack line to the low tide mark. This narrow strip,

A snowy owl (Nyctea acandiaca) *roosting at the top of a seaside dune at Jones Beach State Park. Snowy owls are Arctic breeding birds that occasionally winter along Long Island's barrier beaches, which are not unlike the Arctic tundra where the owls breed.*

occupying no more than the ambiguous border between water and land, harbors an abundance of life: it is a dynamic region where plants and animals have evolved to endure the fury of breaking waves and the endless fluctuations of the tides. Although as often dry as it is submerged, few terrestrial species have exploited the intertidal zone, leaving marine flora and fauna full reign of its varied niches.

These plants and animals have evolved to endure the effects of tidal withdrawal, including extreme temperature fluctuations and the desiccating effects of the blazing sun and stiff winds. When the tide is low, the barrier beach reveals an apron of white compressed sand sloping gently toward the sea. Countless small crustaceans make their home in this seemingly lifeless environment. Sand amphipods (*Haustorius arenarius*) are gilled air breathers about half an inch long that are protected by rigid plates along the sides of their flattened bodies. Their three pairs of hind legs are for jumping, while the three front pairs serve as flippers for swimming, the combination making them superbly adapted for intertidal life. They feed on nutrients extracted from water, which they draw in through special feeding appendages, and they are able to perform this task underground using the water trapped between grains of sand.

As a breaking wave rushes back to the sea, close observation will reveal thousands of tiny leathery objects rising from the sand and waving at the receding tide as if in celebration of the arrival of the nourishing water. These are really little mouths, the feeding appendages of the Atlantic mole crab (*Emerita talpoida*), or sand crab, another small crustacean common along the barrier beaches. The largest females are about the size and shape of a human thumb from the tip to the first joint. Their streamlined shape and special appendages for excavating and anchoring make them efficient diggers, able to burrow themselves below the sand in a matter of seconds. At times large numbers of mole crabs rise from the sand at once, and scurry up or down the beach slope to a more favorable feeding location. These and other small invertebrates serve as the base of a large food chain dependent on the intertidal zone.

Gulls and other water birds are common around the intertidal zone. Herring gulls (*Larus argentatus*), ring-billed gulls (*Larus delawarensis*), and greater black-backed gulls (*Larus marinus*) are ever-present and, when not pilfering snacks from swimmers and sunbathers, usually dine on crabs, clams, and other seashore offerings.

During the winter, Long Island's barrier beaches host the sanderling (*Calidris alba*), a small sandpiper as pale as the sand itself that breeds in the high Arctic and winters along the east coast of the United States. Sanderlings patrol the shores for food in merry little flocks. In unison, they rush away from incoming waves then abruptly charge the ebbing surf searching for tiny crustaceans and worms hidden in the wet sand. Other wintering shorebirds on the barrier islands include dunlins (*Calidris alpina*), ruddy turnstones (*Arenaria interpres*), greater yellowlegs (*Tringa melanoleuca*), black-bellied plovers (*Pluvialis squatarola*), and, favoring the rock jetties and groins, purple sandpipers (*Calidris maritima*).

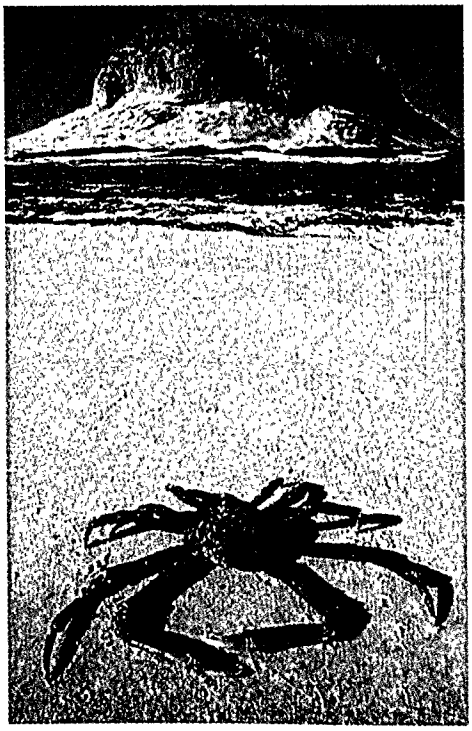
The third zone is the upper beach, or supralittoral, that extends from the intertidal wrack line to the base of the primary dune. This is the most inhospitable and sparsely populated of the three littoral zones. Unlike the primary dune, whose beach grass-anchored sand is relatively stable, the shifting sands of the dry, windy, often wave-washed upper beach can support little vegetative growth. Its predominately quartz sands are blinding white on a bright sunny day and, were it not for the summer heat, might pass for snow. Occasionally, the charming purple hue of garnet grains spreads across the white sands in what look like rippled stains of spilt wine. The sea and wind's propensity for separating the beach's constituents by their specific gravity and mass accounts for these bands.

The wrack line, which marks the border

of the intertidal region, is the most important part of the upper beach. Among the wrack -- consisting of material left behind by the high tide -- is found a collection of seaside organisms, both dead and alive, making it an accurate indicator of littoral and sublittoral inhabitants and their health. The bulk of the wrack is usually made up of seaweed that provides moisture and shelter to a variety of creatures who thrive in this unlikely habitat. Beach fleas (*Talorchestia spp.*), a small amphipod of the upper beach, find the wrack especially inviting, as do flies and midges that lay their eggs in the decaying flesh of marine creatures. Crows, gulls, and shorebirds are frequent visitors scouring the wrack for these hidden treasures.

The rest of the upper beach supports little life, although there are several species of water birds that nest here. Some species are colonial nesters -- colonial birds nest in large groups -- while others are relatively solitary. The American oystercatcher (*Haematopus palliatus*) is, in both appearance and its distinctive piercing cry, a stunning member of this group. A southern species that has recently expanded its range northward, the large, noisy flocks of the once rare oystercatcher are now a common sight on Long Island. The birds prefer to lay their big, speckled, sand-colored eggs in a small hollow on the white sand of the upper beach.

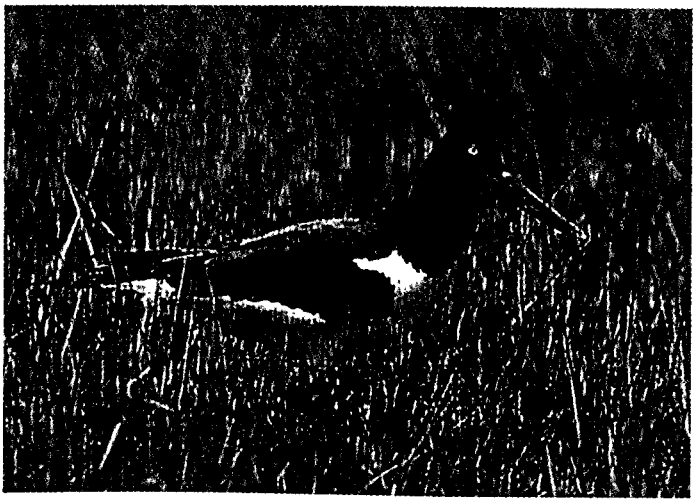
The least tern (*Sterna antillarum*), an endangered species and our smallest tern, possesses nesting requirements that restrict it to the unblemished sand of the upper beach. Like the oystercatcher, it lays its cryptically decorated eggs in nothing more than a slight depression, relying on the eggs' apparent invisibility to protect them from predators. The terns nest in large groups that tend to keep such predators as raccoons and foxes at bay. When one approaches, the birds will swarm the skies above the intruder, uttering piercing cries and sometimes diving and striking the invader with pinpoint accuracy. Common terns (*Sterna hirundo*), which are certainly the most common tern on Long Island, nest



A common spider crab (Libinia emarginata) *washed up on the shore of the Great South Bay on Fire Island National Seashore.*

on the upper beach in large colonies but also use other coastal zones for nesting. Occasionally the endangered roseate tern (*Sterna dougallii*), an especially elegant bird that is maritime in habit, usually coming to shore only to breed, can be found nesting among the common terns. On Long Island the various species of terns feed on a variety of small fish that they catch in the ocean, bays, and estuaries, and their survival is dependent on the health and productivity of these waters.

The black skimmer (*Rynchops niger*) is a large ternlike bird with a peculiar call -- it sounds like a barking dog -- and an even more peculiar bill. The lower mandible is longer than the upper, giving the bill a deformed, useless appearance, yet this clumsy appendage is marvelously adapted to its unique style of fishing. The bird flies gracefully just over the water's surface, "skimming" the water with its protruding lower mandible. When a small fish strikes



American oystercatchers (Haematopus palliatus) *can often be found on the mud flats of the Jamaica Bay Wildlife Refuge. Fifteen years ago they were virtually absent from Long Island, but since then they have expanded their range from the south, and today groups of more than eighty individuals have been observed there.*

it, the two mandibles crash together instantly, locking the prey in a viselike grip. It is without doubt one of the most memorable sights you may come across while strolling the barrier beaches.

The bird most often associated with the barrier beach is the piping plover (*Charadrius melodus*). It too is a nationally endangered species, disappearing with the undisturbed white sand beaches it requires to breed. On Long Island we find the piping plovers' highest known breeding concentrations. It is thoroughly a creature of the beaches: so superbly camouflaged that it often goes unnoticed until uttering its plaintive, bell-like piping call. These birds nest on the sand and then feed and shelter their young at various stations along the beach from shore to wrack line to dune and swale.

The primary dune is next in our island cross section. Primary dunes separate the beach from the rest of the barrier island and often resemble long winding walls adorned with a shining mane of beach grass, sturdily shielding the interior from the surf and wind. On the seaward side of the dune few plants besides the beach grass are able to survive in the difficult growing condition of salt wind, high surface temperatures, and sand accumulation. A few plants have adapted to this environment by developing thick, succulent leaves to conserve water. In summer the violet blossoms of beach pea (*Lathyrus japonicus*) lie hidden among the dune grass. Beach pea is an edible species of the legume family that closely resembles cultivated peas and was once a source of food for Native Americans and colonists. In early autumn the brilliant flower heads of seaside goldenrod (*Solidago sempervirens*) splash the silvery waves of beach grass with gold. On the leeward side of the primary dune a less harsh environment increases the diversity of plant life found there. Here woody shrubs thrive, among them poison ivy (*Toxicodendron radicans*), bayberry (*Myrica pensylvanica*), and beach plum (*Prunus maritima*).

Between the primary and secondary dune lies the swale, a low-lying valley somewhat sheltered from saltspray but nevertheless another difficult environment for plants to thrive in. The swale sands often reach very high surface temperatures during the summer, especially in areas between small dunes where the sun's rays are magnified by reflection. Undisturbed areas of the swale are often blanketed with a prostrate evergreen mat of bearberry (*Arctostaphylos uva-ursi*), a small woody shrub with dark green leathery leaves and plump red berries in late summer. Resembling cranberries, the tempting edible berries are in fact quite bad tasting and even wildlife resort to them only as a win-

ter starvation food after other food sources have been exhausted. Bearberry is the dominant plant in the swales of Fire Island, occupying more than 25 percent of the available area.

Blowouts and other disturbed dune and swale areas that are not attractive to beach grass are first colonized by beach heather (*Hudsonia tomentosa*), which often forms sizable mats. Beach heather is another ground-hugging plant with tiny overlapping scalelike leaves clinging close to its numerous stems. In late May and early June, little yellow flowers smother the heather's muted teal green leaves in a showy floral display.

Large numbers of horseshoe crabs (Limulus polyphemus) *crawl to the high water mark to lay their eggs in the sand during a new or full moon high tide in May.*

As we move through the swale toward the secondary dune, a more diverse collection of plants can be found, including some tree species that mark the transition from the dune/swale community to the maritime forest. On the beachward slope of the secondary dune we find pitch pine (*Pinus rigida*), red cedar (*Juniperus virginiana*), black cherry (*Prunus serotina*), and winged sumac (*Rhus copallina*). Because growing conditions are not optimum here, many of these plants take on atypical forms. Pitch pine reaches heights of fifty to sixty feet in Long Island's pine barrens but due to the caustic effects of salt spray, pitch pine in the swales of Fire Island may only reach heights of four to six feet. Trees in the swale have the look of bonsai: they seem stunted and gnarled, with curious crowns of numerous branches abruptly clipped flat at the top by the wind.

Besides the various water birds, the dune/swale community is home to a number of interesting creatures, each superbly adapted for life in this taxing environment. Various highly specialized insects thrive in the sands, such as the seaside grasshopper (*Trimerotropis maritima*) whose pale color renders it almost invisible on the dunes, and the sand-colored dune wolf spider (*Geolycosa pikei*), which rarely leaves its silk-lined burrow, where it waits at the entrance for an unsuspecting "meal" to pass by. Intimately linked with the dunes is the life cycle of the eastern sand wasp (*Bembix americana spinolae*). The female has curved front legs with rigid hairs that make them especially useful as little shovels. She feverishly digs in the sand, stopping at times to hover in the air when she gets overheated. The process continues until the burrow is sufficiently deep beneath the surface so that the temperature remains cool. In the burrow she deposits a fly that she has caught, paralyzed, and laid an egg in, and seals the chamber. When the egg hatches, the larva has an instant food supply in the fly, but the wasp must feed the developing larva several more times. The wasp memorizes the location of the sealed chamber by familiar landmarks, such as plants, shells, patterns of beach grass, and so forth. If the visual clues become altered the wasp will fail to locate its burrow.

Among other creatures that can be found in the dune/swale habitat, the most

Seaweed is often broken from its substrate of shells or rocks by wave action and deposited along the shores with the tide. This ropelike thallus of green fleece (Codium fragile), *found along the shoreline of the Little Peconic Bay, is still attached by its holdfast to a substrate of shells*

spectacular are the monarch butterflies (*Danaus plexippus*). Large and showy, these orange-winged beauties appear in mid-September by the thousands as they congregate along the barrier islands while migrating south to their wintering grounds in the mountains of Mexico. At dusk they gather in large numbers on the leeward side of trees and shrubs, where they huddle together in tight, motionless masses for warmth and protection during the cool autumn evenings. When reanimated by the warming rays of morning's light, they rise to the skies in clouds. If you're lucky enough to hit it right, usually on a September morning after a cold front from the north passes, you may find thousands of monarchs flying about the dunes at Sunken Forest.

Fowler's toads (*Bufo woodhousei fowleri*) are the most conspicuous amphibian of the barrier islands. They hide during the heat of day beneath logs, bushes, or leaf litter and forage at night after the desiccating sun has set. In May and June, the toads mate and deposit their eggs in the bogs and temporary pools of water that often form between dunes. At dusk the male toads' distinctive calls -- imagine the bleat of a sick sheep -- echo through the dunes as they compete for mates. The small tadpoles metamorphose into miniature adults in a matter of weeks, and at times the young depart the ponds in such great numbers that the ground itself appears to be moving. One summer evening at Jones Beach I watched as hundreds of laughing gulls (*Larus atricilla*) took advantage of just such a mass exodus by voraciously feasting on the helpless toads as they emerged from their ponds.

Among the matted dune grasses you may observe narrow runways an inch or two wide. These are the trails of the meadow vole (*Microtus pennsylvanicus*), a small mouse-sized rodent with long brownish fur and a short tail. These vegetarians are active diurnally as well as nocturnally, feeding on grasses, sedges, seeds, and bark. Meadow voles reproduce throughout the year at astonishing rates and serves as a food supply for the barrier islands' predators. The red fox (*Vulpes fulva*) hunting the dunes at night is particularly fond of them, as are the northern harriers (*Circus cyaneus*), hawks that patrol the dunes by day.

Beyond the crest of the secondary dune in its leeward shadow, conditions are sometimes suitable for the existence of a maritime forest. Maritime forests consist of some of the same deciduous and evergreen species found on mainland Long Island, but their growth patterns are quite different from mainland forests. Salt-laden winds passing over the secondary dune act like a hedge trimmer, neatly pruning the tops of trees. The resulting canopy is very dense, allowing little light to penetrate to the ground below. The shade- and salt-tolerant American holly (*Ilex opaca*) seems better able to tolerate these conditions than other species, hence its dominance in the Sunken Forest, the most impressive maritime for-

est on Long Island, sassafras (*Sassafras albidum*), juneberry (*Amelanchier canadensis*), and black tupelo (*Nyssa sylvatica*) are the next most numerous tree species here.

The trees' lower trunks are usually straight, but they become more twisted and gnarled as they approach the forest canopy and its deforming winds. The species that survive in this habitat happen to have very distinctive bark: the ocher colored bark of the sassafras tree is furrowed; the juneberry has smooth, steel gray bark occasionally marked with vertical slashes; and the American holly's smooth bark has a shiny golden color. The textures and colors combined in twisted masses of trunks give this forest its special character.

Maritime forests on Long Island's barrier islands often have freshwater bogs and swamps in depressed areas where the water table reaches the surface. Their water source is a freshwater lens under the surface of the island that floats on top of denser seawater below and can only be replenished with rainwater, so the condition of the bogs and swamps may change drastically from year to year depending upon annual precipitation. Fire Island has a variety of boggy depressions, from areas that are waterlogged for long periods of time to others that are wetter or drier from month to month; some are heavy with a buildup of organic material while others are largely composed of wet sand.

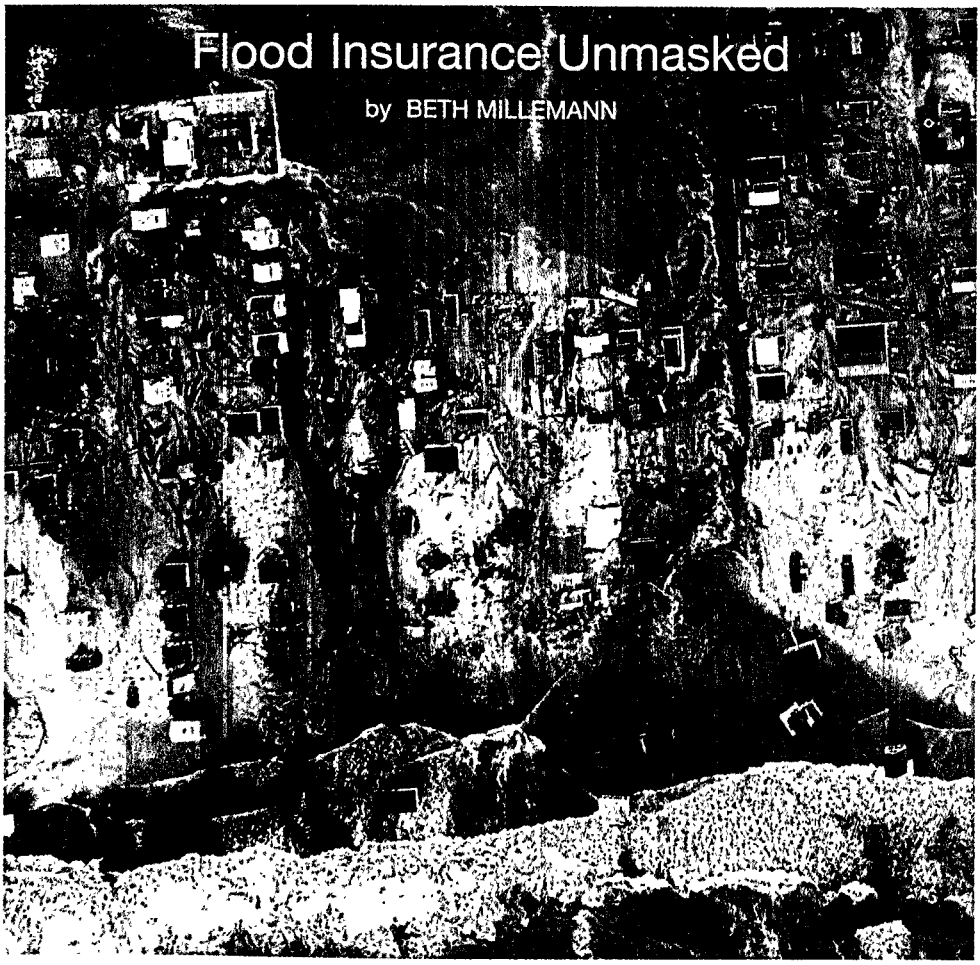
In the Sunken Forest, the sunnier boggy spots have luxuriant colonies of marsh fern (*Thelypteris palustris*) accompanied by the pinkish flowers of marsh Saint John's wort (*Hypericum virginicum*) in late summer. The bog margins also host high bush blueberry (*Vaccinium corymbosum*), whose sweet summer fruit is as popular with the wildlife as it is with pie pickers. The dominant tree in the Sunken Forest's wet areas is the black tupelo, but in several spots red maple (*Acer rubrum*) flourishes as well.

The maritime forests are home to many species of wildlife. The trees are alive with birds. Because of their geographic positions, the barrier islands act as traps for migrating birds on the east coast of North America, making the islands a birder's paradise. (From September through October, the Sunken Forest is an excellent place to look for migrating hawks, and on good flight days, literally thousands of hawks of various species can be observed passing over the dunes.) Most of the larger animals present on the mainland live on the barrier islands as well. On Fire Island the most notable animal denizen must be the white-tailed deer (*Odocoileus virginianus*). When the Sunken Forest was first opened to the public more than twenty years ago by the National Park Service, the deer population of Fire Island is thought to have been as low as fifty individuals; today the number is somewhere around five hundred. As there is no natural predator to check their expanding numbers, deer have greatly altered the environment through their overbrowsing of plants. The deer's association with the northern deer tick (*Ixodes daminii*), the carrier of Lyme disease, which, when left untreated, can have serious consequences for its human victims, has made their presence on the barrier islands an issue of public health. The incidence of Lyme disease on Long Island is very high, with Fire Island having one of the highest occurrence rates.

The sand apron that supports the maritime forest eventually tapers off into the comparatively gentle waters of the lagoons separating them from the mainland. These waters are considerably calmer than the Atlantic, and in their margins an entirely different community of life than the littoral has evolved: the salt marsh. The salt marshes along the barrier islands' northern edge and the marshes among Long Island's many lagoons, bays, harbors, and estuaries are places of great biological complexity and importance. □

Flood Insurance Unmasked

by BETH MILLEMANN



An aerial view of Harvey Cedars, New Jersey. During the Nor'easter of March 1962, Barnegat Bay and the Atlantic Ocean met in the middle of town as nature tried to create a new inlet.

Cape May, New Jersey, got us into this mess with an ad that appeared 200 years ago. In 1802, an "extensive house room" was listed for rent in the Jersey town. With one adman's copy, the age of the beachfront getaway was born.

The description of the lodgings wasn't entirely accurate, which makes it the first example of the resort hyperbole that's common still today. The "extensive" accommodations consisted of a single multi-occupancy room with a curtain down the middle that divided the men from the women. Luxury aside, the lodgings were still very desirable since they were a place for the public to stay at the beach. Perhaps President Thomas Jefferson applauded this step forward for the common beach-going man, but by the time his successor came along, William Jefferson Clinton was making haste for private, gated compounds with full security and multi-million dollar price tags.

In the two centuries between the two presidents, the coast has gone from beaches interrupted by the occasional resort to resorts interrupted by the occasional beach. Fishing shacks have been replaced by cot-

The author is a coastal expert living in Washington, D.C. She has written books and reports on coastal development and the National Flood Insurance Program, and she spearheaded a national campaign to reform the Program.

tages, which have given way to second homes and condominiums that only the wealthy can afford. Some of the blame for what's happened rests on that nineteenth-century adman's shoulders. Most of it, however, rests with the twenty-first century taxpayer whose unwitting beneficence has contributed to the construction and destruction of the American shore.

Like a bridge -- and road -- over troubled waters

The rush to the beach didn't get going in earnest until post-WWII prosperity gave Americans more money and more leisure time to spend it. Major public works projects began, including a road-building and bridge-raising frenzy along the shore. Formerly inaccessible islands and beaches were suddenly within the reach of the automobile. Before the War, less than ten percent of the country's coastal areas were developed, but by 1980, half of the 280 coastal barriers along the Atlantic and Gulf of Mexico were at least partially built up. During the post-WWII to 1980 period, a million new residents moved to the coast every year, causing an unprecedented development boom.

The nature of the development changed over the decades. Building lots sold in Nags Head, North Carolina, used to be narrow and long so homeowners could retreat from the rising seas. One family moved its house three times in 100 years, retreating 200 feet from the waterline. Today, lawsuits challenge the state's requirement that houses be constructed out of the area that's likely to erode before the 30-year mortgage is paid off. The kind of strategic retreat practiced in the early twentieth century, and applauded by Orrin Pilkey and Katharine Dixon in their excellent book *The Corps and the Shore*, is now treated by homeowners and developers as lunacy, not a prudent response to the inexorable forces of wind, tides, and waves.

The reality of the shore, condensed to its bumper-sticker essence, is that storms happen. Erosion happens. Flooding, overwashing, dune-flattening, beach-gobbling acts of nature occur where the sand meets the sea. Sometimes a good slap by Mother Nature will drive the lesson home, as was the case in 1962 when a storm coincided with a high tide and flushed 50 houses and a 10-mile paved road off Assateague Island and into a Maryland bay. Realtors had already sold 5,000 lots on the island, but the loss of the first 50 pioneers ended the great eastward expansion -- that and Congressional action that placed the island permanently off-limits to developers.

In fact, the pattern of coastal development bears the imprimatur of Congress. Rather like the Lord and the blessings He bestows, Congress giveth and Congress taketh away. Mostly it gives and gives. The massive outpouring of transportation grants led millions of people to the shore, for now federal disaster aid helps pay the damages to their homes when storms hit. In the '90s alone, $9 billion in federal disaster aid poured into coastal areas, along with billions more in taxpayer-subsidized loans, flood payments, and other assistance, according to a scathing expose in the March 5, 2000, *Philadelphia Inquirer*. Congress rushes to help pay the bills just as it rushed to help people build in harm's way.

Congress acts not only as the nation's chief paver and post-storm cleaner-upper, but also as the nation's insurance underwriter, a job first offered to the private insurance sector which looked a bad idea in the face and said, "no thanks." The government got into the insurance game when flood damages began mounting in the '60s. Construction had skyrocketed in floodplains, areas that host a great water view and the water itself when storms hit. And hit they did, causing massive federal disaster relief payments followed by rebuilding in the same flood-prone location. It didn't take a rocket scientist to figure out that the giveth to waterfront communities was far outpacing the financial taketh away. But it did take Congress to recognize a palpably bad situation and act decisively to make it worse.

Enter the National Flood Insurance Program

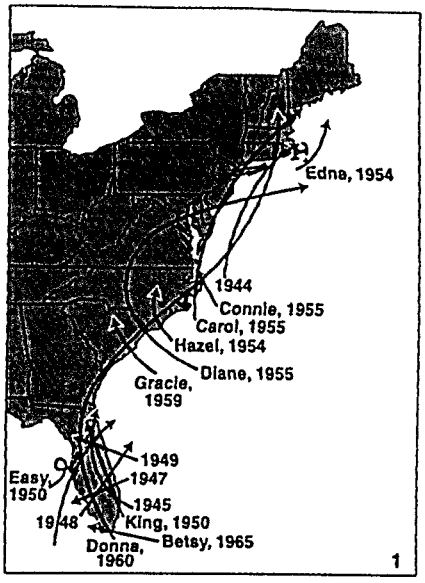
The idea behind the National Flood Insurance Program was simple. Floodprone communities would get flood insurance -- which the private insurance industry refused to provide since it was such a huge risk -- if they guided new development out of the floodplain. Old buildings would sooner or later fall apart or be torn down, and the new buildings would be constructed at a safe distance from the hazardous water's edge. In this way, tax dollars would be saved in the future as the need for disaster relief payments diminished because fewer and fewer buildings would be in harm's way. Fewer people would be in harm's way, too, helping to protect human lives from deadly acts of nature. Additionally, the coastal and riverine floodplains, which support a huge variety of wildlife, would be shielded from ecologically devastating development.

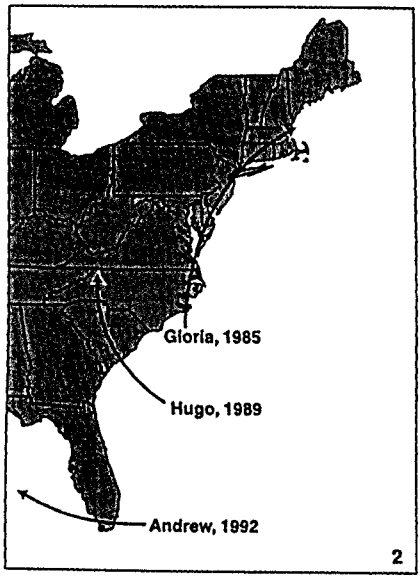
In today's parlance, it was a win-win-win idea.

In today's reality, it's a loser-loser-loser.

The National Flood Insurance Program is hemorrhaging money, more people are in harm's way now than ever before, and the coastal environment is disappearing or degrading at a rate that's threatening wildlife and fisheries around the nation. If the Program were a driver, its license would be revoked.

What makes the Program's failures even more troubling is that three factors are converging that spell disaster: the coastal population is growing by a whopping 3,600 people per day, sea levels are rising, and super-hurricanes are poised on the horizon. The result will be more water for the big winds to blow further inland, colliding with the development built for millions of people. So far, federal agencies have largely responded to the collision of people and nature by trying to engineer solutions, like building seawalls to "stop" erosion and dumping billions of dollars worth of sand on the beach to "keep it in place." Throwing concrete and sand grains at rising seas and monster storms will be financially futile, ecologically disastrous, and a threat to public safety. The real win-win-win solution is to address the massive problems that plague the Flood Insurance Program. The environment, human safety,





Hurricane patterns in the U.S. East Coast may be related to dry or wet weather in West Africa, the nursery of hurricanes. 1944-1960 was wet; 1960-1992 was dry.

THE NATIONAL FLOOD INSURANCE PROGRAM'S FAILURE TO MEET ITS MANDATE: WHAT THE EXPERTS SAY.

"What is indisputable is that the National Flood Insurance Program has not restricted coastal development to any measurable degree." The Federal Emergency Management Agency's Federal Insurance Administration, 1981.

The Federal Flood Insurance Program provides coastal developers with a "financial safety net" and therefore, an incentive to develop in high-risk areas. The U.S. General Accounting Office, 1982.

"Increased affluence and Federal subsidies (including Federal Flood Insurance) are among the primary causes for the extensive development of our beaches in the past four decades." The Department of Interior, 1988.

Generous federal subsidies are a disincentive to safe coastal development, in effect rewarding governments that build on barrier islands and other storm-prone sites. Office of Technology Assessment, 1993.

"The (National Flood Insurance) program, by design, is not actuarially sound . . . Because the program does not collect sufficient premium income to build reserves to meet the long-term future expected flood losses, including catastrophic losses, it is inevitable that losses from claims and the program's expenses will exceed the funds available to the program . . ." U.S. General Accounting Office, 1999.

and the Federal Treasury require nothing less.

The financial failings of the National Flood Insurance Program

The National Flood Insurance Program has metastasized into one of the biggest domestic liabilities, second only to the Social Security program. More than four million policies insure development nationwide, with the vast majority insuring houses along the Atlantic, Pacific, Great Lakes, and Gulf of Mexico. Underwriting the building, and inevitable rebuilding, of homes and businesses has turned what was supposed to be a cost-saving program into a giant rathole for taxpayer dollars. The National Flood Insurance Program required a $1.1 billion bailout in 1981, after it had been in business for little more than a decade. It continued to fall in and out of debt during much of the '80s, and then racked-up another $1.6 billion in losses from 1993 through 1998. As of last summer, the Program owed the U.S. Treasury -- which is the U.S. taxpayer -- a cool half-billion dollars.

What happened to make the program stray so far from its mandate? The failure of two key players to keep their ends of the bargain has contributed enormously to the program's financial weakness. The Federal Emergency Management Agency (FEMA), which runs the program, has refused to make the communities that participate in it do what they are supposed to: guide new development out of the floodplain. FEMA has confused building up with building out. Instead of getting communities to site new development away from the water's edge, FEMA has encouraged communities to plan new development above the water's edge.

Consequently, houses are still on the shore, but they're now up on stilts. That may allow mild flooding to pass under the structure instead of through it, but it ignores the fact that erosion is often a

Frequent destructive storms in the 1870s and 80s, and the flooding and beach erosion they brought with them, inspired illustrations like this one from Harper's Weekly *in 1885.*

Siamese twin to floods. Hurricane winds up to 100-hundred-miles-an-hour, and storm surges of eight or more feet, do not miraculously leave a sandy beach untouched. Yet FEMA refuses to calculate the risk from erosion into what it charges for a flood insurance policy, which is equivalent to a car insurance company ignoring the make of a car in deciding the risk a driver poses. The result is that houses on stilts that were built too close to the water's edge on a sunny day, become houses on stilts in the surf zone on a post-storm day.

Further complicating the situation is FEMA's unwillingness to do what every other insurance company does, which is increase premium rates when a client makes repeated claims on his policy. Unlike auto insurance, which is guaranteed to go up after a crash or two, flood insurance policy holders can make unlimited claims and their policies never go up in price. Not surprisingly, these "multiple-loss properties" cost the program a bundle: about $200 million annually, according to a study conducted in 1999 by the U.S. General Accounting Office. In one small community in North Carolina alone, owners of 217 properties that have been flooded two or more times have collected nearly $11 million from FEMA in National Flood Insurance Program payments.

The future looks increasingly bleak for the taxpayer if Congress doesn't act to fix the Flood Insurance Program soon. Superhurricanes and sea level rise are on the horizon. The taxpayer could be facing losses in the new millennium that eclipse everything that's gone before.

A new hurricane cycle: bigger & badder

In the waning days of 1999, Dr. William Gray, described by *The Washington Post* as "one of the country's prominent hurricane forecasters," made a Cassandra-like prophecy in a *Post* article:

"A new era of intense hurricane activity is about to unfold. Likely to be hit more than ever will be the Caribbean Islands, the East Coast of the United States, and the Florida peninsula. The last intense era of hurricane activity ended in the 1960s, when Florida and the East Coast were not so extensively developed. As evidence that the new era could be underway, (Gray noted that) from 1990-94, there were only five major storms in the Atlantic, Caribbean and the Gulf of Mexico with wind speeds that exceeded 110 mph. During the past five seasons since then, there have been 20 such storms, a fourfold increase."

The area most vulnerable to hurricanes is the nation's most heavily populated. Although the coasts occupy a mere 17 per-

cent of the contiguous U.S. land area, more than half of the nation's population lives there. Most of the people living along the shore have never experienced a major hurricane, and the explosion of development has occurred, by and large, during a time of relative hurricane quiet. Now, nearly $2 trillion worth of property sits directly in harm's way.

The expanse of expensive storm-bait has not gone unnoticed. In the 1980s, the insurance industry started counting the number of houses along the volatile edge of the continent and realized that enormously costly storms were a growing possibility. The industry calculated that $7 billion storms were possible, given the density of coastal development. In 1992, Hurricane Andrew quadrupled the single-storm cost calculus, leaving $30 billion in damage behind. Andrew was the most costly natural disaster in U.S. history.

None of the hurricanes in the past 30 years have been Category 5, the supernovas of the storm world. Dr. William Gray and others warn that the nation is overdue for a Category 5 storm, which could cause $100 billion in damages, soaking the U.S. taxpayer as much as the landscape.

Rising sea levels could intensify the impacts from big storms. Scientists note that higher temperatures will cause the seas to swell from melting icecaps and through sheer heat-induced molecular expansion. Sea level along the Jersey shore and the Atlantic Ocean could rise by 20 inches by the end of this century, which would greatly increase the area that could be inundated or affected by flood surges.

Throwing sand at the problem while the environment suffers

The response to colossal acts of nature should not be colossal acts of futility, but FEMA's insistence on issuing federally-backed insurance for waterside development is just that, but FEMA is not the only federal agency with a penchant for costly and ultimately futile responses to the ocean. More than 50 federal agencies provide funding for coastal development and re-development. Coastal resorts and U.S.

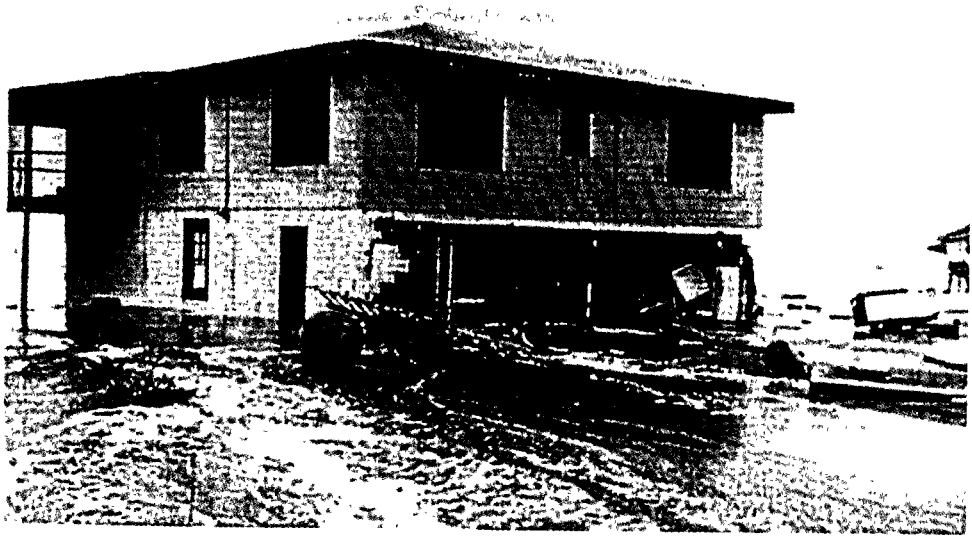
A YEAR TO REMEMBER: 1999 HURRICANES

Name	Dates	Category
Bret	Aug. 18-23	4
Cindy	Aug. 19-31	4
Dennis	Aug. 24-Sep 5	2
Floyd*	Sep 7-17	4
Gert	Sep 11-21	4
Irene	Oct 13-19	2
Jose	Oct 17-25	2
Lenny	Nov 13-25	4

* Floyd clocked in at 155 mph, exceeding the 150 mph winds of the 1992 Hurricane Andrew. Hurricane Floyd caused $2 billion in damages in North Carolina alone. It also spawned the largest peace-time mass evacuation in U.S. history as it raked its way up the East Coast.

Hurricanes are ranked 1 to 5:
Category 1: winds of 74-95 mph, storm surge 4-5 feet
Category 2: winds from 96-110, storm surge 6-8 feet
Category 3: winds from 11-130 mph, storm surge 9-12 feet
Category 4: winds from 131-155 mph, storm surge 13-18
Category 5: winds greater than 155 mph, storm surge higher than 18 feet

Sources: The Washington Post, September 28, 1998, and November 28, 1999.



Storm surge has destroyed the lowest floor of this house in Buxton, NC.

territories siphoned two of every five disaster dollars in the 1990s alone. These communities have also become adept at securing Army Corps of Engineers' projects that spend billions of taxpayer dollars to pump sand onto the shore.

Since the 1960s, the Corps has spent $3.5 billion on more than 1300 beach replenishment projects, vainly seeking to help those who ignore the Bible's exhortation to not "build their houses upon sand." As coastal geologists note, erosion of a sandy beach is not a "problem" until a house is threatened by it. Unfortunately, erosion is a fact of life at the shore, since 80 to 90 percent of the U.S. coastline is eroding at rates varying from one to two feet a year, to upward of 14 feet a year. An equally unfortunate fact is that sand doesn't stay put, no matter if placed on the beach by nature or by the Army Corps of Engineers.

The cost of coastal development is immense, not only to the taxpayer but to the coastal ecosystem, as well. According to the Congressional Quarterly, coastal development annually discharges about 2.3 trillion gallons of partially treated sewage into nearby waters. Nutrients and pathogens in the effluent foul ecosystems, closing down shellfish beds and swimming areas. Polluted runoff pours into coastal waters from streets, parking lots, and sprawl. Construction also paves over habitat, transforming once productive wetland, estuary, beach and dune, and nearshore habitats into biological wastelands. The victims are finny, feathered, and furry - and voiceless. Yet the toll that is taken begs to be heard.

A first step forward: the "Two Floods and You are Out of the Taxpayers' Pocket Act"

In 1991, the U.S. House of Representatives passed legislation that would have made sweeping reforms to the National Flood Insurance Program, only to have the bill die an ugly death in the Senate at the hands of key senators and lobbyists for the National Association of Homebuilders and National Association of Realtors. Consequently, the Program's essential problems remain unaddressed. It still provides insurance for development right on the hurricane-prone, flood-prone, and eroding water's edge. Its policies grossly underestimate the risk from erosion and colossal acts of nature. The program still lets policyholders make limitless claims without the cost of the policy increasing in response.

That, however, could change. An Oregon Democrat, Rep. Earl Blumenauer, has teamed up with a Nebraska Republican, Rep. Doug Bereuter, to introduce the "Two Floods and You are Out of the Taxpayer's Pocket Act," H.R. 2728. The bill's sponsors note that approximately $140 billion in federal revenue has been spent preparing for, and recovering from, natural disasters during the past 25 years, with floods accounting for the majority of those expenditures. Repetitive claims under the Flood Insurance Program --claims filed again and again by the same property owners without their rates increasing -- are a major drain on the program.

Under the legislation, if more than one claim was paid, and the owner of the property refused to make his structure less vulnerable to flooding, including by relocating it, the policy would be charged to reflect actuarial rates: that is, the true risk of the policy would be reflected in its cost. The goal is to increase the amount of money coming into the Flood Insurance Program by charging sounder rates, and by encouraging vulnerable properties to become less so by retrofitting or relocating out of harm's way.

While the legislation, which has yet to be passed by either the House or Senate, is a step in the right direction, it's a small step. As long as FEMA provides waterside insurance, buildings will be perched as close as possible to the sea. The primarily wealthy investors and second-home owners will continue to profit from all taxpaying Americans, including the vast majority of taxpayers who can no longer afford a house by the sea since property values have been jacked-up artificially high by federal, taxpayer-backed programs.

As long as development clusters on the shore, millions of people will form a human bull's eye for the new 25-year cycle of super-hurricanes that experts warn the nation has entered. And as long as houses spread over beaches, dunes, and wetlands, and along back bays and estuaries, fish, shellfish, and other wildlife will face disappearing habitat and polluted waters.

It's time for the federal taxpayer to get out of the business of destroying the coast. Otherwise, there will be no ads for the coast appearing in the newspapers of the next century, just an obituary for the ecosystem, human lives, and taxpayer dollars that were lost. □

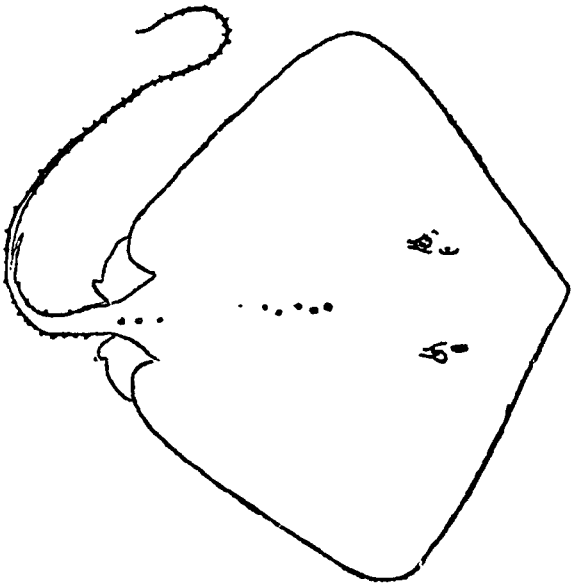
SAND DOLLARS - A SAMPLE OF BEACH RENOURISHMENT PROJECTS

- ***Ocean City, MD*** – Sand has been pumped onto the beach every few years since 1988, totaling 9.5 million cubic yards on eight miles of beachfront. Cost to state and federal taxpayers: $80 million. The federal government plans to keep pumping sand onto Ocean City's 10 miles of shoreline over the next 50 years at an estimated cost of $500 million - or $1 million a mile per year.
- ***Rehoboth, DE*** – 245,000 cubic yards of sand were put on the beach in 1998 at the cost of $1.2 million in state funds alone, to cover a one-mile stretch of beach.
- ***Folly Beach, SC*** – A $12 million replenishment project was done in 1993, most of which disappeared within two years, even in the absence of a significant storm.
- ***New Jersey*** – The Corps' largest beach replenishment project is along the Jersey shore. It's designed to maintain a 100-foot wide beach for 50 years on a 33-mile stretch between Sandy Hook and Barnegat Inlet. The Corps estimates that the total cost of the first 21 miles will be $1.1 billion.

Sources: The Washington Post, September 9, 1999; The CQ Researcher, "Coastal Development: Does It Put Precious Lands At Risk?" August 21, 1998, Congressional Quarterly, Inc, Washington, D.C.

Behavior of Stingrays

by ARTHUR M. HEYMAN



The southern stingray is the largest stingray found along the southeastern Atlantic coast. They're found from New Jersey to the Gulf of Mexico and feed mainly on mollusk, crabs and annelids.

Fourteen stingrays raise and lower their fins simultaneously, swimming in perfect unison in the clear waters off Marathon Key. Fourteen rays swim by as I watch, mesmerized. That was 52 years ago and the memory is as clear as the water. Six years ago I swam with the rays at Stingray City in Grand Cayman; they gobbled conch out of my hand, swam up my back, twisted into my hair, rubbed their smooth skin against mine. They liked playing as much as I did. Two years ago in Shark and Ray Alley in Belize I met another group of friendly rays. It was apparent the rays were telling me something.

I decided to study them. Other than locomotion and reproduction, ray behavior had not been investigated much, so I began observing Southern stingrays and six other species at the National Aquarium in Baltimore. My study was intended to characterize diel (day/night) patterns, locomotion and other behaviors, and to determine if the rays had individual characters.

Observations from 1996 to 1999 totaling about 60 hours were made from the window of the Ray Tank facing the deep well in the tank. Observations lasted a half-hour to an hour and were taken every two to three hours for several 24-hour periods. The population of Southerns consisted of five females which I studied individually (Alpha, Blacky, Blanco, Number Three and Spot) and four males. Spot was a hybrid, having both Southern and Bluntnose blood. Both she and Blacky died during the course of the study. At night it was sometimes difficult to identify a Southern female with assurance. Such a siting was designated "unidentified Southern female" and excluded from the results below.

Arthur M. Heyman is an ALS member who lives in Garret Park, Maryland and says he has had a love affair with stingrays all his life.

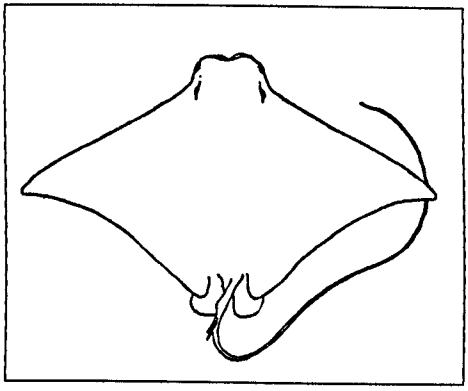
Light in the Ray Tank simulates a real-world day, so the study of diel patterns is feasible. The Southerns were most active between 9:00 p.m. and midnight, and they rested most between midnight and 7:00 a.m. Resting (lying motionless on the bottom) varies by species and individual. Bullnoses, Butterflys and Guitarfish swim close to the bottom and rest a lot. Cownoses and Spotted eagle rays stay in the water column and swim actively. Roughtails fall in between. Some Southerns are "active"; others are "easy going."

There is little indication of territoriality. The Spotted eagle rays spend most of their time swimming on the eastern side of the tank, rarely venturing west of the well. The Bullnose rays dawdle mostly on the western rim of the well. The other species do not have territorial preferences. No individual was aggressive in the defense of a locality in the tank.

Locomotion of Southerns and Roughtails contrasts with that of Cownose rays. The Cownoses move their fins simultaneously up and down in a flapping motion. Roughtails undulate their fins, forming a ripple down the fin from head to tail, alternating the stroke from one fin to the other. Southerns usually undulate. Southern males alternate fins like Roughtails (and occasionally flap like Cownoses), but females undulate both fins simultaneously. Southerns can swim backwards, change direction abruptly, quickly climb or drop in the water column without apparent movement of the fins, turn by keeping one fin still, spin in tight circles, hover, and undulate up the fin instead of down. Southerns swim vigorously in the water column or slowly close to the bottom. Cownoses, Spotted eagle rays and Bullnoses flap. Southerns, Roughtails, and Butterflies undulate. Guitarfish, showing their close relationship with sharks, propel themselves with a side-to-side undulation of their bodies and dorsal fins.

Since flapping is more efficient than undulating, I assumed that flapping rays would be more active than their counterparts. I was surprised to find that flapping Cownose rays and Spotted eagle rays are active, but Bullnose rays are quiescent. Southerns, which undulate, can be among the most active rays.

Mating involves a male gripping the trailing edge of a female's fin with his teeth while inserting one of his two claspers. At the Aquarium, according to Alan Henningsen, Senior Aquarist, gestation lasts four to seven months. A Southern female gives birth to two to six live young that are miniature versions of an adult. The mother abandons them (divers have to scoop them out of the tank before they are eaten by a shark or an adult stingray) and goes into estrous almost immediately. Mating takes place promptly thereafter. Unfortunately, neither birthing nor mating took place during my observations; but I was able to observe foreplay 20 times, usually between 9:00 p.m. and midnight. This involves a male chasing a female and holding the edge of her fin with his teeth. The chase can be vigorous and sustained, or lassitudinous. On some occasions up to four males chased a female. It is easy to tell when a female is, or recently was, in estrous: the trailing edge of her fin is tattered by the males' attentions.



The cownose stingray ranges from southern New England to the Gulf of Mexico and South America. The cownose is known to jump from the water in what some speculate might be a territorial display.

Divers feed the rays at 10:30 a.m. and 2:30 p.m.. The rays anticipate the divers and begin swimming more vigorously when they are due. (Some divers say the rays may be able to tell the divers are coming when they see activity on the dive platform.) When the divers enter the tank, the rays -- mostly Cownoses, Spotted eagle rays and Southern females -- maul them and each other trying to get their share of the bounty. The Southern males and Bullnoses are smaller. In spite of the aggressive sexual behavior of Southern males, they are timid feeders. The divers have to single them out to ensure each gets enough nourishment. After the initial frenzy, many rays lose interest in the divers and prowl the bottom seeking leftover tidbits. Some rays continue to visit the divers after their food baskets are empty.

Under normal circumstances the rays rarely touch one another (except, of course, during feeding). That makes "bonking" such intriguing behavior. Bonking involves a ray in the water column deliberately swimming into a resting ray. I say "deliberately" because: 1) there were 41 occurrences -- the rays swim far too well to be bumbling into each other accidentally; and 2) there were no occurrences of a ray colliding with a swimming ray. Two-thirds of the bonkings took place between 9:00 p.m. and midnight. Female Southerns, the most prolific bonkers, bonk both males and females, and male Southerns bonk both females and males. The bonkee usually moves -- as little as a few feet or she may swim away altogether. The bonker may settle in her place. If the bonker is male, he may settle next to the bonkee and rest touching her.

In "near-bonking" the aggressor dives at a resting ray but just misses her -- a threat to bonk. Strangely, three-quarters of near-bonking incidents occur in off-peak hours (midnight to 9 a.m.). The target ray almost always appears to be aware that she was nearly bonked. Reaction is similar to that of being bonked: the bonkee moves, spins and/or displays annoyance. There is considerable interspecies activity. Southerns were seen to bonk or near-bonk Cownoses, Roughtails, Butterflies and Guitarfish, but not Spotted eagle rays or Bullnoses.

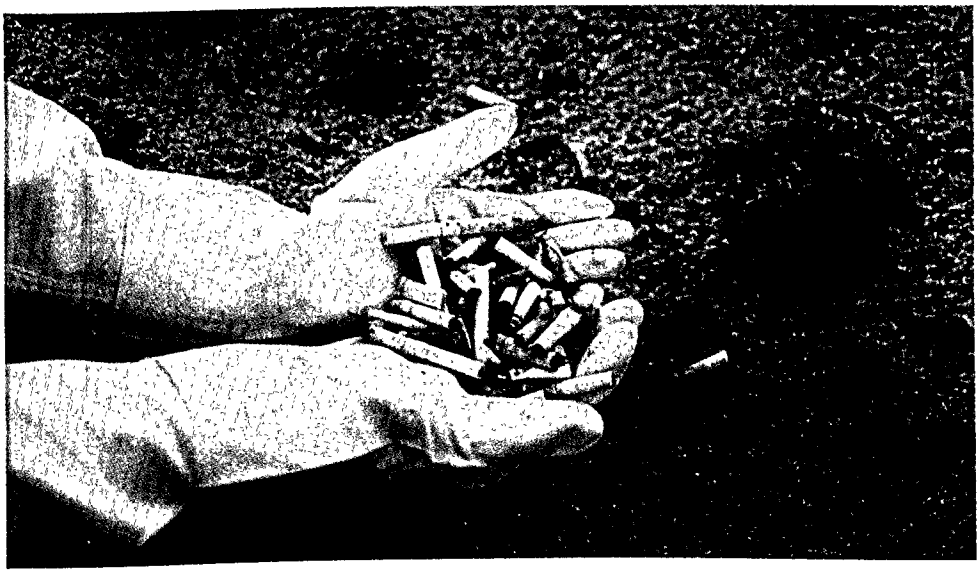
Several hypotheses were explored to interpret bonking. Could it be a sexual activity, a mechanism to establish social hierarchy, a territorial claim, an indication of aggression or affection, a form of play, a release of boredom, an accident? The bonking was most probably not due to carelessness or territoriality. Aggression also seemed unlikely. Establishing a position in a social hierarchy seemed to explain most occurrences and "flirting" several others, but a number did not fit these explanations. I could not help feeling that, at least in part, the behavior has a component of play or affection or hazing or boredom. (Are these variations of the same thing?) The name I chose for the behavior attempts to capture these ideas.

Do the rays have individual characters? Well, Alpha swam vigorously in clockwise circles 20 hours a day, while Blacky swam slowly, rested a lot and was the champion backwards swimmer. Spot, the chief bonker, was never bonked, while Blanco and Blacky were perpetual victims. Number Three was noteworthy in that she was not outstanding in any way. Yes, the Southern stingrays in the Baltimore Aquarium are clearly individuals to the extent that I could identify them by their behaviors, then confirm the identification by their physical features.

I plan to watch Southerns in Belize next summer to see how behavior in the wild compares with these observations. □

Cigarette Butts as Litter - Toxic as Well as Ugly?

By KATHLEEN REGISTER



Cigarette butts are the most common form of plastic litter on the beaches of the U.S. and worldwide. Toxic chemicals can leach out of the butts. Photo by Chris Register.

Every beach-goer has seen them -- cigarette butts littering the shore. Beyond being unsightly, does cigarette litter present a threat to organisms? This article summarizes research conducted to determine if the compounds in discarded cigarette butts (the filters and remnant tobacco) are biohazards to the water flea (*Daphnia magna*). Short-term bioassays (48 hours) using the water flea as the test organism were conducted. The results indicate that the chemicals released into freshwater environments from cigarette butts are lethal to *Daphnia* at concentrations of 0.125 cigarette butts per liter (one butt per two gallons of water).

Kathleen Register is the founder and executive director of Clean Virginia Waterways, and coordinates the International Coastal Cleanup in Virginia. She is adjunct faculty in the Department of Natural Sciences at Longwood College in Farmville, VA. She and her husband love to tag and release bluefish.

Smokers discard billions of cigarette butts yearly, tossing many directly into the environment. Cigarette butts accumulate outside of buildings, on parking lots and streets where they can be transported through storm drains to streams, rivers, and beaches.

Some background on cigarettes

Cigarette filters are 95% cellulose acetate, a plastic slow to degrade. Cellulose acetate fibers are thinner than sewing thread, white, and packed tightly together to create a filter; they can look like cotton. Cigarette filters are specifically designed to absorb vapors and to accumulate particulate smoke components.

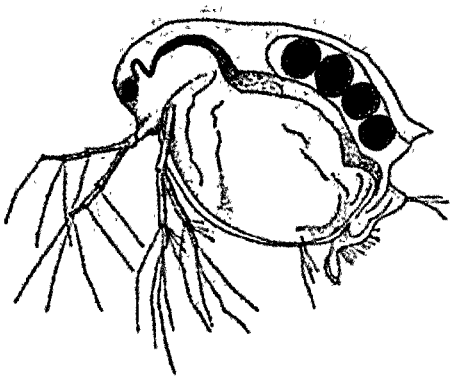
Cultivated tobacco, *Nicotiana tabacum*, is a member of the nightshade family of plants. It is a broadleaf native of tropical America cultivated as an annual.

Depending on the type of tobacco and its growing location, the leaves of the tobacco plant can have different tastes, burning properties, aromas, color, and nicotine content. Tobacco leaves contain several alkaloids, including the highly toxic alkaloid nicotine. Nicotine is a powerful insecticide and among the deadliest of all plant products in its pure form. According to the U.S. Department of Health and Human Services, it raises blood pressure, affects the central nervous system, and constricts blood vessels in humans. Nicotine is a colorless liquid highly soluble in water, and readily absorbed through the skin in its pure form.

Potentially hundreds of additives are mixed with tobacco during the manufacturing process. Additives to smoking tobacco include flavorings and humectants used to keep tobacco moist. According to a publication written for the tobacco industry, additives can constitute ten percent of the weight of the "tobacco" portion of a cigarette, and four percent of the entire cigarette. A widely used cigarette additive is menthol, which provides flavor and serves as an anesthetic. When burned, many additives form new compounds, possessing unique properties. The "tar" often referred to in connection with cigarettes is not a black petroleum tar product, but instead refers to the hundreds of substances and additives found in tobacco. Tar, when cool, is a sticky yellow-brown substance and the U.S. Department of Health and Human Services states that it is composed of organic and inorganic chemicals, including some carcinogens. The complete list of 1,400 potential tobacco additives, which include sweeteners and flavors such as cocoa, rum, licorice, sugar, and fruit juices is considered a trade secret. Since tobacco is not classified as a food or drug, there are no legal maximums on agricultural chemicals or chemical additives cigarettes may contain.

Emergence of the issue

Cigarette butts accumulate in the environment due to the popularity of plastic cigarette filters and the habit some smokers have to "toss their butt" rather than use ashtrays. Prior to 1954, most cigarettes were nonfiltered. In the mid-1950s, sales of filtered cigarettes increased dramatically as the cause-effect relationship between smoking and cancer was reported extensively in the press. Before these reports, in 1950, sales of filtered cigarettes in the U.S. were 1.5% of all cigarette sales. Now, more than 97% of cigarettes sold in the U.S. have filters.



The transparent crustacean Daphnia *(often called a water flea) are planktonic animals which occupy a critical position in aquatic ecosystems, as they transfer energy and organic matter from algae to higher consumers. Tests using* Daphnia *have been widely used for decades to estimate acute toxicity. Illustration by Chris Register.*

The recent bans on indoor smoking have also appeared to cause a shift in cigarette butt deposition. Circumstantial evidence indicates that more cigarette butts are accumulating outside of buildings due to the popularity of indoor smoking bans. In Australia, cigarette butts account for 50% of all litter, a trend that the executive director of Keep Australia Clean blames partly on indoor no-smoking policies.

How many discarded cigarette butts are there? Trillions. Global tobacco consumption has more than doubled in the last 30 years, and world cigarette production reached a record high in 1997 according to the U.S. Department of Agriculture (USDA).

The USDA estimated that in 1998, 470 billion cigarettes were consumed in the U.S.; world cigarette production was 5.608 trillion. The World Health Organization estimates that 1.1 trillion people in the world smoke -- that is one third of all people on earth over the age of 15.

The 470 billion cigarettes smoked in the United States in 1998 translates to a total of 176,250,000 pounds of discarded butts in one year in the United States alone. The filters from 5.608 trillion cigarettes (approximate world production) would weigh more than 2.1 billion pounds (Table 1). This figure does not include the weight of the tobacco still attached to the filter, or the packaging, matches, disposable lighters, and other "collateral" waste that is generated by smoking.

The filters on one pack of 20 cigarettes weigh 0.12 ounces (with no tobacco attached) and displaces a volume of 10 ml. With annual world-wide production of cigarettes at 5.608 trillion, the potential weight and volume of cigarette butts becomes enormous (Table 1).

Similarly, cigarette butts take up a large volume of space. If one person smokes a pack and a half a day, he will consume more than 10,000 cigarettes in a year. This number of cigarette butts (filters only -- not including remnant tobacco) will fill a volume of five liters. Worldwide annual consumption of cigarettes creates enough cigarette butt waste to fill more than 2,800,000,000 liters (2,800,000 m^3).

There is one measure as to how many cigarette butts are finding their way into streams, rivers, and coastal environments. The International Coastal Cleanup Day, organized annually by the Center for Marine Conservation, involves more than 500,000 volunteers picking up debris from beaches, rivers, and streams around the world. Volunteers complete Marine Debris Data Cards indicating the quantity and type of litter they pick up. Cigarette butts

Table 1 -- Weight and Volume of Discarded Cigarette Filters*

number of filters	ounces/pounds	milliliters/liters
20 (one pack)	.12 oz	10 ml
10,000 (one year's consumption for one smoker)	3.75 lbs	5 liters
1,000,000	375 lbs	500 liters
100,000,000	37,500 lbs	50,000 liters
10,000,000,000	3,750,000 lbs	5,000,000 liters
100,000,000,000	37,500,000 lbs	50,000,000 liters
470,000,000,000 (Number of cigarettes smoked in the U.S. in 1998)	176,250,000 lbs	235,000,000 liters
1,000,000,000,000	375,000,000 lbs	500,000,000 liters
5,608,000,000,000 (1998 world cigarette production)	2,103,000,000 lbs lbs.	2,804,000,000 liters

*The percentage of cigarettes with filters varies, depending on the country.

were the most common debris item collected during the international cleanup, numbering 1,616,841 in 1998. Cigarette butts have topped the list in all CMC International Coastal Cleanups since they were added to the Data Cards as a separate item in 1990.

Because of the vast inflow of cigarette butts into the environment, experiments were conducted to determine if cigarette butts as litter present an environmental problem beyond aesthetics and have a measurable toxic effect when they enter the aquatic environment.

A series of bioassays (tests which use the response of a living organism to determine the effective level of a chemical in the environment) were conducted. One of the organisms most studied in aquatic bioassays is the planktonic animal *Daphnia magna*, often called a water flea. Static acute toxicity tests using *D. magna* have been widely used for decades to estimate the acute toxicity of chemicals to aquatic invertebrates. In aquatic ecosystems, water fleas occupy a critical position as they transfer energy and organic matter from primary producers (algae) to higher consumers such as fishes. Water fleas are small transparent crustaceans, have one central black compound eye, and swim in jerky motions. They feed by rhythmically beating their legs, collecting algae or bacteria on the filter-like bristles on their thoracic legs, and passing the food toward their mouths.

The Experiments

The large number of chemicals in used cigarette filters precluded toxicity testing of each chemical. Thus, a test that can estimate aquatic toxicity from the composite of chemicals and compounds found in cigarette butts was used.

Using the U.S. Environmental Protection Agency's 1996 "Aquatic invertebrate acute toxicity test for freshwater daphnids" standardized toxicology protocols and procedures, water fleas were introduced to petri dishes filled with dilution water and the test solution. For these experiments, the test solution was made by soaking the components of cigarette butts (remnant tobacco or the cellulose-acetate filters) in distilled, deionized water, and allowing the chemicals in the butts to leach into the water. Water fleas in the petri dishes were observed at 24 and 48 hours. In addition to death, any abnormal behavior or appearance was also recorded.

Data collected during the experiments were used to develop dose-response curves. Data were also used to determine the experimentally derived toxicant concentration producing death to 50% of the test population during continuous exposure over a specified period of time. This is referred to as the "Lethal Concentrations 50" values (LC50). LC0 means no animals died, and LC100 means they all died. Lethal Concentrations provide a quantifiable measure and precise expression of toxicity.

Each test included controls consisting of the same conditions, procedures, and daphnids from the same population. The only difference being that none of the test chemical was added.

Prior to conducting the definitive experiments, three range-finding tests (preliminary hazard assessments) were conducted to establish parameters for the acute toxicity tests. The range-finding tests established test solution concentrations and leaching periods. The definitive tests had four components:

Experiment A - Used filters. To establish if the chemicals in used cigarette filters produce death in *Daphnia* after exposure to a specific concentration for a specified period of time. Remnant tobacco was removed from cigarette butts for this test. Filters from two cigarette butts were soaked in 500 ml of distilled, deionized water for one hour at room temperature. Twenty daphnids were exposed to each concentration level: 4, 2, 1, 0.5, 0.25, 0.125 butts per liter.

Experiment B - Remnant tobacco. To

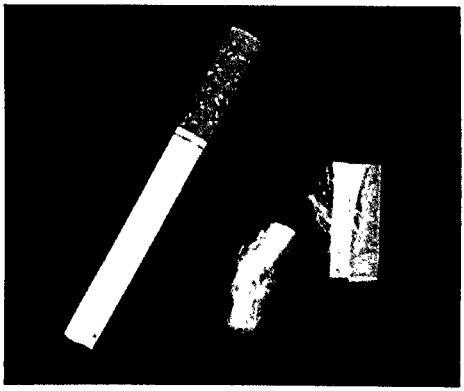
establish if the chemicals in the tobacco found in smoked, discarded cigarette butts produce death in *Daphnia* after exposure to a specific concentration for a specified period of time. Remnant tobacco (totaling 28 mm) from two cigarette butts was soaked in 500 ml of water for one hour at room temperature. Twenty daphnids were exposed to each concentration level: 4, 2, 1, 0.5, 0.25, 0.125 butts per liter.

Experiment C - New, unused filters. To establish if the chemicals in new, unused cigarette filters produce death in *Daphnia* after exposure to a specific concentration for a specified period of time. No tobacco was used in Experiment C. *Daphnia* were exposed to the chemicals that were leached out of new, unused filters to determine if any of the compounds in new filters were toxic to *Daphnia*. New filters were soaked in distilled, deionized water for one hour at room temperature. Twenty daphnids were exposed to each concentration level: 16, 8, 4, 2, 1, and 0.5 filters per liter.

Experiment D - Cigarette butts' effects on the pH of freshwater. To determine if the presence of cigarette butts in freshwater changes the pH of the water. pH is an important factor to aquatic animals, and can affect the toxicity of pollutants. For this experiment, one cigarette butt (the filter plus 28 mm of remnant tobacco) was soaked for one hour in 100 ml of spring water at room temperature. The pH of the water was measured before and after the one-hour soak using a Hach brand pH tester that had been calibrated just prior to the test.

Results

Experiment A (filter only). In this "filter only" experiment, 100% of the animals died after 48 hours in the concentrations that were equivalent to the chemicals found in two or more used cigarette filters per liter. In the 25% dilution, equivalent to one cigarette filter per liter of water, 20 % of the *Daphnia* died within 48 hours. The LC50 was, therefore, between one and two



Cigarette filters may look like cotton, but are made of cellulose acetate, a plastic that is slow to degrade in the environment. Cigarette filters are specifically designed to accumulate particulate smoke components including toxic chemicals. Photo by Chris Register.

used cigarette filters per liter. In concentrations of one used filter per liter and greater, deposits of material were noted on the swimming hairs of some Daphnia.

Experiment B (remnant tobacco only). In this "tobacco only" experiment, 100% of the animals died after 48 hours in the concentrations that were equivalent to the remnant tobacco from 0.5 or more cigarette butts per liter. In the solution that represented the remnant tobacco from 0.25 cigarette butts per liter, 80% of the animals were dead after 48 hours. In the most dilute solution, representing 0.125 remnant tobacco cigarette butts per liter, 15% of the *Daphnia* died in the testing period. The LC50 was, therefore, between 0.25 and 0.125 remnant tobacco cigarette butts per liter.

Comparing Experiments A & B. In both experiments, the swimming patterns of affected *Daphnia* resulted in a departure from the normal hop-sink swimming pattern. Before dying, some affected individuals whirled in one place, while others lay on the bottom, ineffectually beating their swimming hairs, but unable to produce net movement.

In the high- and mid-range concentrations (0.25 to 4 cigarette butts per liter) of

the tobacco-only group, *Daphnia* developed dark deposits or accumulations on their swimming hairs (setae) at 24 hours. Some *Daphnia* with this dark substance on their swimming hairs floated without attempting to swim, and several frequently became stuck together in groups. Deposits also formed on the animals in the filter-only group. These deposits were lighter colored and occurred only in the test solutions that were two or more filters per liter.

As seen in Figure 1, significant differences in acute toxicity among treatments were evident after 48 hours of exposure. The survival rates of the water flea were poorest in the tobacco-only test solutions. Acute toxicity at 48 hours was higher in the higher concentrations for both remnant tobacco and the cigarette filters. This indicates that the tobacco has a greater toxicity than the filters. For both tobacco and filters, the toxicity increased dramatically over a small interval. Such a steep slope of the dose-mortality curve indicates that individuals within a species will behave very similarly to each other in their response to the chemical (whereas a shallow slope of the curve indicates considerable variation in susceptibility to that particular chemical within a species).

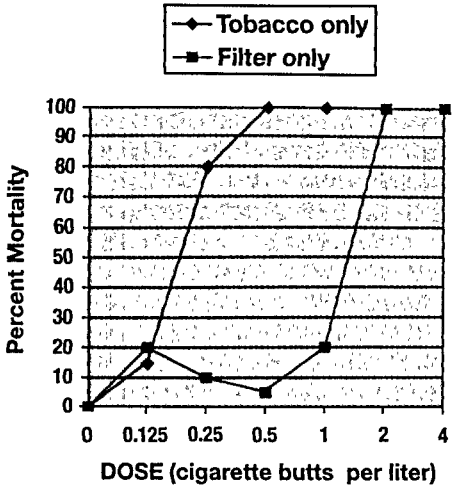


Figure 1 Dose-mortality curve at 48 hours for the filter only and tobacco only doses.

Experiment C (new filters). The survival rates of the water fleas after 48 hours of emersion were poorest in the solutions with the higher concentrations of filters. But even at the highest concentrations of 16 new cigarette filters per liter of water, death rates were less than 50 percent.

Findings in control animals. At the conclusion of Experiments A, B and C, all water fleas in the control groups were alive, maintained a vigorous swimming pattern, and did not whirl or accumulate a dark substance on their swimming hairs.

Experiment D (effects of cigarette butts on pH). The pH of the tested water was 6.6 before cigarette butts were added, and remained 6.6 after cigarette butts soaked in the water for one hour. The presence of cigarette butts did not change the pH of the water.

Given that exact real-world exposure of water fleas to cigarette butts is unknown, the tests done in this study cannot attempt to imitate the actual exposure. It is possible that the concentrations used in this study exaggerate the duration and dosage of exposure. It is recognized that exaggerating exposure can result in distortion, but it is felt by the author that the results of the experiments reveal relevant patterns.

Experiments A and B show that the chemicals in cigarette butts are acutely toxic to water fleas at concentrations higher than 0.125 cigarette butts per liter of water. This translates to one cigarette butt per 8 liters, or approximately one butt per two gallons of water. In addition, the evidence was strong that the remnant tobacco in cigarette butts is a principal factor determining the mortality, although the compounds in used cigarette filters also have a lethal effect on the water flea. The presence of the remnant tobacco from just one-half a cigarette butt per liter was enough to kill 100% of the animals, while it took the filters from two cigarette butts per liter to have the same 100% fatal outcome. The dark deposits that formed on the swimming hairs and affected the swimming patterns of the water flea suggest that this should be studied to deter-

mine if these deposits constitute a physical, rather than toxic, effect from this source of pollution.

The results of Experiment C indicate that the components of new cigarette filters are toxic only at concentrations very much higher than used filters. Even at a concentration of 16 new filters per liter (the equivalent of 64 new filters per gallon), the chemicals that leached from the filters killed less than 50% of the water flea. While the components of new cigarette filters may contribute to the total toxicity of cigarette butts, the chemicals and compounds that are absorbed by the filters during the act of smoking are responsible for most of the deaths associated with cigarette butts' filters.

The results of Experiment D show that the presence of cigarette butts in freshwater does not affect the pH of the water. This indicates that the chemicals leached from cigarette butts do not kill water fleas simply due to a change in the pH of the water.

Cigarette butts are the most common type of litter on earth. Collected, they weigh in the millions of pounds. The toxic chemicals, absorbed by cigarettes' cellulose acetate filters and found in butts' remnant tobacco, are quickly leached from the butts by water.

The evidence indicates that the toxic chemicals leached from discarded cigarette butts present a biohazard to the water flea at concentrations of more than 0.125 butts per liter, or about one butt per two gallons of water. The leachate from the remnant tobacco portion of a cigarette butt is deadlier at smaller concentrations than are the chemicals that leach out of the filter portion of a butt.

Implications of research

The experiments summarized in this article are just the preliminary steps to fully understanding the impact cigarette litter has on our aquatic environment.

With cigarette butts identified as a biohazard, governmental agencies, environmental organizations, and anti-litter groups could educate smokers that littering cigarette butts causes harm to the environment.

Cigarette butts in the environment is a litter issue -- not a smoking issue. Just as the manufacturers of sodas have no control over the consumer's disposal of empty cans or bottles, cigarette manufacturers cannot control a smoker's behavior when it comes to the disposal of cigarette butts. Just as beverage manufacturers contribute to anti-litter campaigns, and have invested in public education on litter issues, so too should the tobacco industry. Thus far, cigarette manufacturers have made small efforts at anti-litter education. They need to take an active and responsible role in educating smokers about this issue and devote resources to the cleanup of cigarette litter. Strategies can include anti-litter messages on all packaging and advertisements, distribution of small, free portable ashtrays, and placement and maintenance of outdoor ashtrays in areas where smokers gather. Maybe cigarette packages can be redesigned to accommodate discarded butts.

In some states, consumers pay a small "anti-litter tax" every time they purchase a canned or bottled beverage. These funds support anti-litter efforts. A similar tax on cigarette purchases would go a long way toward funding campaigns aimed at eliminating the littering of butts. Picking up littered cigarette butts costs schools, businesses, and park agencies money. By taxing smokers for anti-litter educational efforts, some of the costs of cleaning up cigarette butts will shift onto smokers.

Smokers who now treat outdoor spaces as public ashtrays may reconsider their behavior when they learn that cigarette butts are made of plastic, not of cotton and paper; and worse, that cigarette butts contain chemicals that can kill some of the animals that occupy critical positions in aquatic communities. It is important that smokers' littering behavior be modified to decrease this source of pollution. □

Beach Party: Volunteers Gather in the Littoral Zone

by BARBARA TOBORG

Photo by Don Riepe

Along the Atlantic shores of the Hamptons and the Rockaways, along Long Island Sound, the Hudson River and the myriad waterways throughout the state, New Yorkers will be swarming the beaches the weekend of September 16-17, 2000. Instead of the usual beach gear of towels, chairs, and sunblock, they will be toting trash bags, work gloves, and clipboards. The event is the International Coastal Cleanup, a volunteer, grassroots effort to remove and document debris from the shores of oceans, streams, lakes, rivers, ponds, and canals. The effort in New York State has been coordinated by the Northeast Chapter of the American Littoral Society since the 1980s.

In 1999, over 9,000 New Yorkers pitched in to help at 318 sites to remove 258,000 pounds of debris. The underwater contingent of 145 divers at 7 sites removed 3,900 pounds. The volunteers represent schools, environmental groups, scouts, civic associations, dive clubs, corporations, and the general public.

By recording the amount and type of debris collected, the volunteers get a clearer picture of what is impacting our waterways; the first step for devising solutions to stem the tide. The haul can be quite revealing. Nearly 60 percent of all the waterfront debris in New York is plastic, continuing a trend evident over several years. Leading New York's "dirty dozen" of the most com-

Barbara Toborg is the Conservation Coordinator for the Northeast Chapter of the American Littoral Society.

mon items found during the cleanups are cigarette butts, a finding consistent with national data.

Another lesson the volunteers learn is that most beach trash comes from land-based sources. The cigarette butt thrown out of the car driving down Broadway has a good chance of washing ashore on Coney Island, thanks to storm drains. The "Clean Streets/Clean Beaches" theme of the US Environmental Protection Agency is right on target. You name it and it can be found on the beach: car seat, barrel, bicycle, shopping cart, tire, propane tank, pirate flag, voodoo doll, weed whacker, toilet seat, BBQ grill, etc.

Animals found impacted by debris included a sea turtle and a horseshoe crab entangled in fishing line and a fish wrapped up in balloons. Less dramatic but also important is the effect debris has on the productivity of wetlands. The most unique find occurred during a beach cleanup several years ago at Robert Moses State Park in Suffolk County: the side of a house that had been swept away when a hurricane crashed over Fire Island.

The data collected from the cleanups are sent to the Center for Marine Conservation for inclusion in a national report that helps to inform legislators, the media, and the general public. The information also helps fine tune educational materials aimed at curbing pollution. Those who clean the beaches are prompted to work toward solutions to the problem of marine debris. They strive to have sewage treatment plant filters improved to catch "beach whistles" and to have the local bait shop switch from styrofoam cups to paper. The annual beach cleanups serve not only as a coastal consciousness raising effort, but also as a means of gaining members for ALS and for networking with people who are environmentally aware and politically active. The Beach Captain in charge at a particular site is often a member of a local grassroots organization, and the cleanup enables him or her to find volunteers to testify at hearings and lobby for local environmental initiatives.

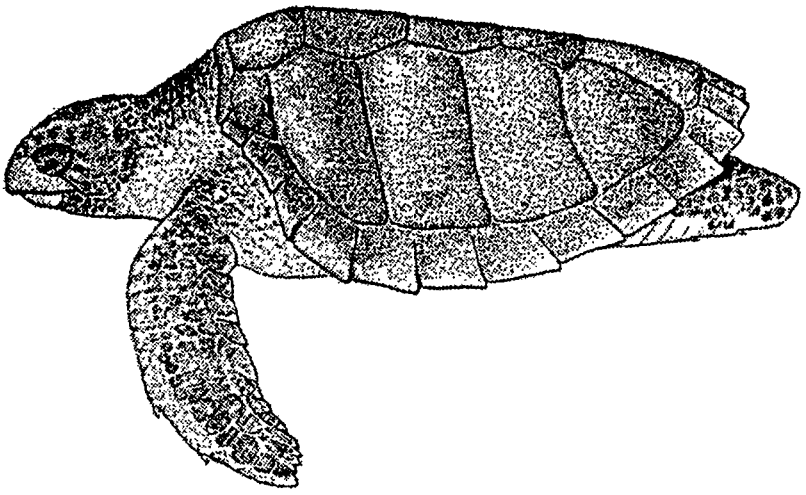
To become a part of the annual beach cleanup in New York, the largest volunteer effort in the marine environment, call Barbara Cohen of the American Littoral Society. As Beach Cleanup Coordinator for New York, she can direct you to a beach near you where a cleanup will occur, talk you into becoming a beach captain and adding a new site to the list, or direct you to the beach cleanup coordinator in your state if you happen to live outside the Empire State; e-mail alsbeach@aol.com or visit the chapter website at www.alsnyc.org. For more information call 1-800-449-0790.

Sea Turtle Strandings:
Cumberland Island, Georgia

by C. RUCKDESCHEL AND C.R. SHOOP

A 1994 article in the *Underwater Naturalist* (22(3):34-35) described the sea turtle stranding survey conducted on Cumberland Island, Georgia. This is an update of that report. The survey has been conducted on the 17 miles of ocean beach since 1979, and over 1550 dead sea turtles of five species have been necropsied; parts of most have been prepared as museum specimens. Notification of strandings by National Park Service personnel and weekly surveys throughout the year have assured that few, if any, strandings have been missed. Strandings represent the minimal number of animals killed since the likelihood of a carcass washing ashore is dependent upon many variables, such as

C. Ruckdeschel is a naturalist living in the wilderness section of Cumberland Island. C.R. Shoop is Professor Emeritus of Biological Sciences at University of Rhode Island. Both authors have been studying marine turtles for many years.



Atlantic loggerhead turtle: juvenile loggerheads make up the majority of animals killed. Next to leatherbacks, they are the largest sea turtle.

wind direction, the number of scavengers, in the area, and water temperature, which effects decay rates. All sea turtles are on the federal list of endangered species.

Use of devices installed in commercial shrimp trawl nets to reduce the incidental "take" of sea turtles (determined by the National Research Council as the primary cause of mortality of juvenile sea turtles) was required by law during the summers of 1990 and 1991, and full-time thereafter. Despite this attempt at conservation, the stranding rate on Cumberland Island has not declined; in fact, it has increased (Table 1).

Juvenile loggerheads comprise the majority of the animals killed, and the percentages of adults and other species have remained similar with one exception. In 1998 we recorded the first hawksbill stranding in the state. It was an adult female that had suffered head trauma in the past and was recuperating. Another hawksbill, a juvenile, stranded later in 1998 on Jekyll Island, Georgia, the island north of Cumberland.

So why are dead sea turtles still washing ashore on Cumberland Island? Most of the animals did not appear to have been ill or suffering from previous trauma. A few had knife wounds or showed signs of human interaction such as having rope or fishing gear attached.

The Georgia Department of Natural Resources (DNR) initiates U.S. Coast Guard vessel checks and conducts surveys of its own on trawling vessels to insure that Turtle Excluder Devices (TEDs) are being properly used, and the DNR reports full compliance. Could the TEDs be faulty? Research suggests that when sea turtles are forcibly submerged they go into anoxia and frequently into irreversible shock, and while they might revive and appear normal, they also may collapse and die several hours later. We have found signs consistent with irreversible shock in fresh carcasses.

Another local commercial fishery could be contributing to the turtle problem. Gill nets intended for sharks are set outside state waters (three miles from shore) but obviously cannot specifically target only one or two species. There are no data that significant numbers of sea turtles are caught and killed by these nets, but we do know that several species of large fishes, including tarpon, wash ashore dead along with sea turtles when the nets are in operation.

Two other potential causes of turtle mortality occur in the area. An active commercial port was established at Fernandina, Florida, within the last two decades and giant cargo ships now enter Cumberland Sound via the St. Mary's River entrance channel. That channel and part of the Intercoastal Waterway leading from it to Kings Bay Naval Submarine Base are regularly dredged to a depth of 52 feet, a depth necessary for navigation of the submarines. Dredging itself presents a threat, but it is conducted primarily in the fall and winter when sea turtles are less active in this area, and such mortality could be identified by condition of the carcasses and time of year. Large, highly maneuverable tug boats (sea tractors) usually accompany the submarines and other large vessels associated with the Naval Base, which stepped-up operations within the last two decades. Is it possible that the greatly increased large vessel traffic in the St. Mary's River entrance channel and environs is somehow contributing to sea turtle mortality? It is true that a portion of the carcasses we examine are inexplicably smashed, but a greater number strand intact with no outward sign of physical damage.

One explanation for the increasing (at least not declining) stranding rate is that there is an increasing number of sea turtles out there to be caught. If indeed our rising rate is due solely to an increased number of sea turtles in this area, presumably a result of conservation practices, then certainly the use of TEDs is not the entire resolution of the problem. That would mean that the number of strandings will continue to increase if other conservation actions are successful and will reflect what the government agency responsible for protection of sea turtles must consider an acceptable amount of mortality.

That sea turtle strandings have been documented along the U.S. coast for two decades and that turtles continue to die in vast numbers suggests that the U.S. Government considers that amount of "take" an acceptable tradeoff for the lucrative shrimping industry despite the Endangered Species Act. While the specific causes of all the mortalities are not known and may be of multiple origins, it is known that turtles die in trawl nets. Halting trawling for one year in an area of high turtle mortality would either exonerate or condemn trawlers and shed much light on the frustrating problem, but that will probably not happen. Instead, commercial fisheries will continue to slaughter these endangered animals until their numbers fall precariously low or until the public becomes concerned enough to demand serious action by the government, such as shifting the charge of protection of sea turtles to another agency. The National Marine Fisheries Service (Department of Commerce) is the agency presently responsible for protection of sea turtles, yet their primary directive is to promote and protect commercial fisheries. We should not be surprised at the devastating outcome of these conflicting roles. The Fish and Wildlife Service (Department of the Interior) is in charge of terrestrial and avian endangered species, and the only way sea turtles will receive adequate protection from commercial fisheries is for them to be placed in the custody of an agency without a conflicting agenda. Investigations need to be made to determine the source of the continued mortality in the waters adjacent to Cumberland Island, but until the present amount of mortality is of concern to a governing agency, nothing will be done.

Year	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Sea Turtles Stranded	87	219	60	60	47	30	51	59	74	55	45	69	55	71	42	80	67	87	83	100	68

Table 1. Number of sea turtles stranded on Cumberland Island, Georgia from 1979 through August 1999.

TAGGING REPORT

compiled by PAM CARLSEN

Tagging fish is important for many reasons. The data collected are used in many ways, primarily to study fish migration and growth, but also for habitat protection and education.

This winter brought many opportunities for our tagging program to "speak for the fish." The coast of New Jersey is under seige, once more, with proposed dumping of toxic dredge spoils at the historical three-mile dump site and the proposed sale of ocean floor for private sand mining. At both public hearings, one in February and the other in March, I used our fish tagging data to show that both summer and winter flounder, which migrate onshore, offshore, striped bass, traveling up and down the coast from North Carolina to Canada and bluefish, which do it all, would pass through these areas of dumping and mining. This would subject the fish to the possibility of added toxins in their systems or disruption of their feeding patterns, in the case of sand mining. These issues, which appear to be of local interest, should concern all fishermen, because almost all fishing is coastal fishing.

Education is one way to raise awareness of these issues and to teach others the importance of fish tagging. This spring, I participated in both the Student Summit, here on Sandy Hook, sponsored by Clean Ocean Action and in a Science Day at a local school. Since young people will decide the future, the more they know about fish and the habitat it needs to survive, the better off we all will be.

Educating the public can also take the form of exhibits or demonstrations. On Feb. 1, 2000, we tagged a 25" striped bass, which was released in Jenkinson's Aquarium on the boardwalk at Point Pleasant Beach, NJ. This fish is part of a larger effort on behalf of the aquarium to educate visitors about fish tagging. Along with "Buddy", the tagged striper, we are now included in aquarium's larger display featuring the National Marine Fisheries Service's shark tagging program. P.S. "Buddy" is doing fine and has adapted quickly, residing with bluefish, blue runners, weakfish, sea bass, tautog, fluke, and other stripers. And, thanks, to long time tagger, Paul Grippo, of NY and FL, there is an ALS fish tagging display at the world reknown, I.G.F.A. World Fishing Center in Dania Beach, FL. So, whether you are in New Jersey or Florida, you can visit these places and feel good that you are part of this program. You make it all happen. Thank you and keep on tagging.

TWO NEW RECORDS SET FOR TIME OUT WITH TAGS:

–a fluke (summer flounder), tagged by Robert Anderson Jr. on the south shore of Long Island at 11 1/2", on 6/25/91, was recaptured at Fire Island reef in 60 feet of water on 6/26/99, 26" - 6.59 lbs. (one day over eight years).

–a striped bass tagged 5/24/88 by Francis Urban at the Verrazano Bridge, NY, 23"- 4 lbs., was recaptured in August of 1999, at E. Rockaway Inlet, NY (11 years 3 months). Unfortunately, the recapturer took no measurements on this fish. It is very important to "get the word out," on what to do when you catch a fish with a tag, so we or any tagging organization gets the complete information. We now have a recapture flyer, which we include in all returns. If you would like one, contact the office.

Check out our tagging website and a few others we are linked to:

www.americanlittoralsoc.org/tag.htm
www.soundfishing.com
www.njstriper.com
www.reel-time.com

TAGGING RETURNS

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
Atlantic Spadefish							
12	JC Wright	Linkhorn Bay, VA	06/18/98	A Sturgeon	Tiger Wreck, Offshr, VA Beach	15	08/30/98
Black Sea Bass							
12	W Filce	Mantoloking, NJ	09/17/97	E Piersanti	Mantoloking, NJ	13	08/21/98
Bluefish							
21	F Como	Hart Is., NY	09/16/97	NMFS, NE Fish. Ctr	Nags Head, NC	21	12/14/97
24	A Anderson	Block Is , RI	07/29/97	L Anastasia	Cape Cod Canal, MA		06/27/98
26	A Anderson	Montauk Pt., NY	10/19/97	R Middleton	Osterville, MA		07/01/98
18	B Finke	Montauk, NY	10/31/97	A McNamara	Eatons Neck, NY		07/09/98
18	C Wilcox III	Moriches Inlet, NY	06/22/98	R Nielsen	Moriches Inlet, NY	18	07/14/98
30	R Kyker	Norwalk, CT	10/13/97	P Coscia	Norwalk, CT	34	07/14/98
32	R Kyker	Norwalk, CT	06/24/98	C Ripley	Norwalk, CT	32	07/19/98
22	A Anderson	Montauk Pt., NY	10/14/97	K Brehaut	Cuttyhunk, MA		08/07/98
23	A Anderson	Block Is , RI	06/27/96	J Petrella	The Race, L.I. Sound	30	08/25/98
22	A Anderson	Block Is , RI	05/16/98	H Laub	Trumans Beach, NY		08/25/98
19	B Finke	Norwalk, CT	07/23/98	R Kyker	Stamford, CT	19	09/04/98
Fluke							
14	R Dykas	Asbury Park, NJ	09/27/97	J Lynch	Fire Island Inlet, NY	19	06/26/98
16	J Gibbons	Atlantic Beach, NY	05/16/98	G Lowy	Long Beach, NY	16	06/27/98
17	R Walters	Sandy Hook, NJ	05/26/98	R McCloskey	Atlantic Highlands, NJ	17	06/28/98
14	R Dykas	Great Bay, NJ	05/02/98	E Connor	Inside, Brigantine, NJ	15	06/28/98
13	P Hahn	Flynn Knoll, NJ	07/27/97	N Leodin	Mattituck, NY	16	06/28/98
15	A Schweithelm	Montauk Pt , NY	06/05/98	A Barry	Montauk, NY		06/28/98
14	S Klaumenzer	Offshr., Holgate, NJ	08/09/97	J Rynkiewicz	Brigantine, NJ	16	06/29/98
12	B Shillingford	Ludlam Bay, NJ	07/08/97	T Kirchner	Stone Harbor, NJ	16	06/29/98
14	C Kennedy	I.C W #457, NJ	07/19/97	T Kirchner	Stone Harbor, NJ	16	06/29/98
15	S Carlsen	Deal, NJ	10/13/97	T Carpluk	Pt Lookout, NY	17	06/30/98
14	J Dotsey	Reynold's Chan., NY	05/26/98	W Bryan	Long Beach, NY	15	07/01/98
14	J White	Babylon, NY	06/13/98	D Makofske	Captree St Pk , NY	14	07/01/98
13	M Willey	Roosevelt Inlet, DE	06/19/98	R Johnson	Roosevelt Inlet, DE		07/02/98
22	G Bachert	Flynn's Knoll, NJ	06/10/98	S Graboski	Leonardo, NJ		07/02/98
13	J Gibbons	E Rockaway Inlet, NY	06/06/98	E Singh	Magnolia Pier, NY		07/02/98
12	B Shillingford	Ocean City, NJ	07/03/96	R Borjeson	3 mi S Bass R , MA	18	07/02/98
14	S Knapik	Pt. Lookout, NY	08/10/97	D Block	Jamaica Bay, NY	15	07/03/98
22	C Kennedy	I.C W marker 468, NJ	06/17/98	F Cwikla	I.C W marker 469, NJ	22	07/03/98
15	J Gibbons	Ambrose Channel, NY	09/19/97	J Kaminsky	Roanoke Pt , L.I , NY	15	07/03/98
16	J Gibbons	Island Pk , NY	05/24/98	J Uzenski	Reynold's Chan , NY	17	07/04/98
15	W Filce	Mantoloking, NJ	08/31/97	J Pellegrino	Brooklyn, NY	17	07/04/98
12	J Gibbons	Rockaway Bch, NY	06/29/97	J Ralston	Coney Is Flats, NY	14	07/05/98
11	J Gibbons	Atlantic Beach, NY	06/21/98	V D'Addona	E Rockaway Inlet, NY	11	07/05/98
14	S Carlsen	Deal, NJ	06/24/98	G Bazilus	Deal, NJ	15	07/07/98
12	W Leahey	Coney Island, NY	05/27/98	R Nowicki	Norton's Pt., NY		07/10/98
14	D Haines	Egg Is , DE Bay	07/04/97	S Rosenzweig	Jones Beach, NY	16	07/11/98
14	J Hickey Jr.	Bay Head, NJ	06/27/98	K Gilligan	Manasquan R , NJ	14	07/11/98
11	S Wisnewski	Oregon Inlet, NC	06/25/98	T Brown	Oregon Inlet, NC	12	07/11/98
16	W Anderson	Provincetown, MA	06/14/98	G Cameron	Provincetown, MA	16	07/11/98
9	S Wisnewski	Oregon Inlet, NC	06/25/98	L Cook	Oregon Inlet, NC	10	07/11/98
17	C Kennedy	I C W marker 469, NJ	06/15/98	T Sabo	Two Mile Run, NJ	17	07/11/98
14	F Grande	Moriches Bay, NY	07/11/97	D Manley	Pt. Judith, RI	15	07/12/98
14	J Gibbons	Atlantic Beach, NY	06/14/97	R Munroe	Cape Cod Canal, MA	17	07/13/98
16	T Carlsen	Deal, NJ	06/24/98	J Blandano	Allenhurst, NJ	16	07/14/98
12	S Fries	Jamaica Bay, NY	07/01/98	J Kurdziel	Jamaica Bay, NY	12	07/14/98
12	M Willey	Roosevelt Inlet, DE	06/19/98	B Gerritse	Roosevelt Inlet, DE	12	07/14/98
13	E Swain Jr.	Robert Moses Brdg., NY	06/18/98	P oT	Captree, NY	14	07/14/98
14	J White	Fire Is Inlet, NY	05/18/98	J Covello	Massapequa, NY	15	07/14/98
14	A Gano	Fire Is , NY	05/28/98	A Smith	Robert Moses Brdg., NY		07/15/98
13	J Gibbons	Atlantic Beach, NY	05/23/98	R Calleo	Island Pk., NY	13	07/15/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
13	J Gibbons	Long Beach, NY	06/08/97	J Covello	Fire Is. Inlet, NY	17	07/15/98
13	W Filce	Ortley Beach, NJ	05/24/97	S Cataleno	Shinnecock Bay, NY	15	07/15/98
13	W Filce	Manasquan R., NJ	06/21/98	B Duerr	Manasquan R., NJ		07/16/98
14	B Carlsen	Shark R. Inlet, NJ	07/03/98	A Coakley	Shark R., NJ	14	07/18/98
13	G Nigro	Sandy Hook, NJ	06/06/98	D Wood	Leonardo, NJ	14	07/18/98
12	J White	Fire Is. Inlet, Ny	08/30/96	B Luty	Sandy Hook, NJ	17	07/18/98
12	S Fries	Brooklyn, NY	05/25/98	M Schrader	Jamaica Bay, NY	13	07/18/98
11	S Giaccone	Jones Inlet, NY	06/30/98	G Gwinner	Baldwin, NY		07/19/98
13	A Gano	Fire Is. Inlet, NY	09/07/97	G Moynihan	Bayshore, NY	15	07/19/98
11	J Gibbons	Atlantic Beach, NY	07/11/98	D Cannella	Reynold's Chan., NY	13	07/19/98
14	W Quick	Barnegat Lt., NJ	07/21/98	T Giresi	Barnegat Inlet, NJ	14	07/20/98
11	R Haug	Moriches Bay, NY	08/07/97	L Schellinger	Three Mile Hbr., NY		07/20/98
13	J Hickey Jr	Bay Head, NJ	06/27/98	M Gassaway	Manasquan R., NJ	13	07/21/98
15	J Gibbons	Long Beach, NY	09/27/97	L Passione	Brooklyn, NY	17	07/21/98
13	C Fiorillo	Avon, NJ	06/25/98	R Wescoe	Sandy Hook, NJ	15	07/21/98
14	G O'Connor	Coney Is., NY	06/28/98	A DeMario	Old Orchard Lt., NY		07/21/98
14	A D'Amato	Cape May, NJ	09/14/97	E Gleason	Great Bay, NJ	16	07/22/98
13	S Fries	Rockaway Inlet, NY	06/06/98	E Burke	Jamaica Bay, NY	14	07/22/98
14	A Gano	Fire Island Inlet, NY	06/28/98	R Baldwin	Fire Island Inlet, NY	16	07/23/98
14	J Hickey Jr	Manasquan R , NJ	07/13/97	D Dzielak	Leonardo, NJ	15	07/23/98
14	J White	Robert Moses Brdg., NY	05/27/98	M Rada	Robert Moses Brdg., NY	16	07/23/98
12	W Quick	Barnegat, NJ	07/08/98	D Lehman	Barnegat, NJ		07/24/98
13	C Kennedy	Offshr., Cape May, NJ	07/21/97	G Bachert	Leonardo, NJ	14	07/25/98
13	B Shillingford	Strathmere, NJ	07/01/98	J Fragassi	Strathmere, NJ	14	07/25/98
12	C Kennedy	Lower DE Bay, NJ	06/24/96	B Quartararo	Ambrose Chan., Bklyn, NY	17	07/25/98
15	J White	Robert Moses Brdg., NY	06/06/98	G Bartalini	Babylon, NY	17	07/25/98
14	W Filce	Bay Head, NJ	06/06/98	P Donnelly	Seaside Park, NJ	15	07/26/98
13	V Galgano	Bay Head, NJ	05/28/98	J Ferrante Jr.	Deal, NJ	14	07/26/98
13	A D'Amato	Cape May, NJ	07/13/98	M Mack	Cape May, NJ	14	07/26/98
14	S Fries	Sea Bright, NJ	07/18/98	E Lee	Sandy Hook, NJ	14	07/27/98
11	J Gibbons	Long Beach, NY	05/23/98	G Vonnoh	Reynold's Chan., NY	13	07/27/98
15	J Gibbons	Atlantic Beach, NY	05/16/98	B Mann	Reynolds Chan , NY	16	07/28/98
14	A Schweithelm	Montauk Pt., NY	06/05/98	M Hegarty	Montauk, NY	14	07/28/98
16	A D'Amato	Lower DE Bay, NJ	07/16/98	J Bannon	60'slough, DE Bay	16	07/28/98
17	C Kennedy	I C W #453, NJ	05/28/98	P Corcoran	N Wildwood, NJ		07/28/98
13	P Carlsen	Shrewsbury R., NJ	07/07/98	T Reed	Leonardo, NJ	13	07/29/98
14	B Goodman	Jones Inlet, NY	05/23/98	S Ramieri	Moriches Inlet, NY	14	07/29/98
14	R Anderson Jr	Fire Is Inlet, NY	07/26/97	M Moore	Moriches Bay, NY	15	07/29/98
14	T Stanik	Sea Bright, NJ	07/12/98	G Nemetz	Sandy Hook, NJ	13	07/29/98
14	C Kennedy	I.C W marker #465, NJ	07/18/98	L Medernach	Wildwood Crest, NJ		07/30/98
14	J Dotsey	Long Beach, NY	05/28/98	L Taglianetti	Reynold's Chan , NY	14	07/30/98
13	R Anderson Jr.	Fire Is Inlet, NY	06/06/98	R Potts	Great South Bay, NY	13	07/30/98
12	J White	State Boat Chan , NY	06/13/98	D Lippman	Captree St. Pk , NY	12	07/31/98
14	J Hickey Jr	Offshr , Klondike, NJ	07/13/97	P Rothe	Sandy Hook Chan., NJ	16	07/31/98
14	K Carson	Ambrose Chan., NY	07/03/98	D Egloff	Coney Is., NY		08/01/98
14	W Filce	Mantoloking, NJ	07/03/98	S Raab	Mantoloking, NJ	14	08/02/98
13	C Kennedy	I.C.W., Marker 457, NJ	06/14/97	K Lau	Absecon Bay, NJ	15	08/03/98
13	A Schweithelm	Eatons Neck, NY	05/31/97	M Nast	City Is., NY	14	08/03/98
12	J Calamia	Democrat Pt., NY	08/12/96	W Stiefel	Montauk, NY	15	08/04/98
11	P Migliaccio	Long Branch, NJ	06/20/98	J Morrell	Sandy Hook, NJ	11	08/05/98
14	E Swain Jr	Robert Moses Brdg , NY	08/17/97	J Makofskiel	Fire Is Lt., NY	16	08/06/98
13	A Schweithelm	Montauk Pt., NY	06/05/98	G Yanakos	Montauk, NY	13	08/06/98
14	S Carlsen	Deal, NJ	06/24/98	R Wright	Belmar, NJ	14	08/07/98
14	W Heilemann	Barnegat Lt , NJ	09/16/97	B Dow	Manasquan Inlet, NJ	16	08/07/98
12	B Shillingford	Corson's Inlet, NJ	05/25/97	N Burke	Little Egg Harbor, NJ	15	08/07/98
12	S Knapik	Pt Lookout, NY	07/25/98	M Viscounti	Reynold's Chan., NY	12	08/07/98
13	J Schwartz	Coney Is , NY	07/06/97	G Bachert	Leonardo, NJ	14	08/08/98
14	W Filce	Bay Head, NJ	07/13/97	T Buban	Raritan Bay, NJ	15	08/09/98
14	S Fries	Montauk, NY	07/29/97	L DeWeerdt	E of Montauk Pt., NY	16	08/10/98
13	R Dickerson	Pt Pleasant, NJ	07/07/98	R Casale	Mantoloking, NJ	14	08/10/98
12	D Hepner	Deal, NJ	07/12/98	W Filce	Manasquan, NJ	12	08/11/98
9	S Wisnewski	Oregon Inlet, NC	07/08/98	W Bull	Oregon Inlet, NC		08/12/98
14	M Murphy	Montauk, NY	06/14/97	L McDonald	Montauk, NY	17	08/13/98
16	G Ottavio	Cape May Pt., NJ	05/29/98	D Davis	Cape May Pt , NJ	16	08/13/98
11	J White	State Boat Chan , NY	06/13/98	P Chaldaris	State Boat Chan , NY	11	08/15/98
13	P Chowansky	Sea Girt, NJ	09/01/97	E Trione	Chadwick Beach, NJ	16	08/15/98
15	A D'Amato	Delaware Bay, NJ	06/18/98	B Laxton	3 mi E Cape May, NJ	15	08/15/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
14	J Hickey Jr.	Belmar, NJ	07/26/98	F Barreca	Shark R , NJ		08/15/98
12	J Hickey Jr.	Seaside Pier, NJ	09/07/97	T Kurinsky	Shinnecock Inlet, NY	19	08/15/98
14	M Witham	Keansburg, NJ	05/17/98	P Kamienski	Sandy Hook, NJ	15	08/16/98
15	R Notine	Ambrose Chan , NY	08/08/98	F Hirsch	Ambrose Chan., NY	16	08/16/98
13	A Schweithelm	Montauk, NY	07/09/98	M Fraser	Montauk, NY	14	08/16/98
13	M Willey	Roosevelt Inlet, DE	07/05/98	R Genthert	Roosevelt Inlet, DE		08/16/98
13	D Crann	Beach Haven, NJ	08/08/98	C Minissale	Little Egg Hbr Inlet, NJ	13	08/16/98
14	T Stanik	Sandy Hook, NJ	08/16/98	D Keegan	Sandy Hook, NJ		08/17/98
15	J White	Fire Is. Lt , NY	07/13/98	J Garone	6 mi. E Fire Is Inlet, NY	16	08/17/98
14	L Ruch Jr.	Asbury Park, NJ	08/01/98	C Pisano	Long Branch, NJ	14	08/17/98
12	M Willey	Roosevelt Inlet, DE	07/26/98	T Brawal	Roosevelt Inlet, DE	13	08/19/98
13	C Fiorello	Long Branch, NJ	07/13/98	S Kozlowski	Deal, NJ	13	08/19/98
11	J Hickey Jr.	Belmar, NJ	07/26/98	F Darlea	Shark R., NJ		08/20/98
13	A Berman	Atlantic Beach Brdg , NY	06/26/98	G Benenati	Reynold's Chan., NY	13	08/20/98
14	J White	State Boat Chan., NY	06/15/98	J Ryan	Babylon, NY	14	08/20/98
12	J Calamia	Democrat Pt., NY	07/27/97	J Denmeade	Fire Is Inlet, NY	14	08/20/98
11	A Berman	Atlantic Beach Brdg , NY	06/26/98	G Benenati	Reynold's Chan., NY	13	08/20/98
14	A Gano	Fire Is. Inlet, NY	06/28/98	L Lugo	Great South Bay, NY	16	08/20/98
14	J Gibbons	Atlantic Beach, NY	05/24/98	C Ueckerman	Long Beach, NY	16	08/21/98
15	E Zinke	Sea Girt, NJ	06/22/98	U Fisherman	Sandy Hook Chan., NJ	15	08/21/98
13	D Hepner	Deal, NJ	07/12/98	T Savko	Atlantic Highlands, NJ	14	08/21/98
13	W Filce	Ortley Beach, NJ	07/11/98	T Andersen	Seaside Hts , NJ	14	08/22/98
15	G DuBois	Moriches Bay, NY	06/30/97	J Kalinowski	Moriches Inlet, NY	17	08/22/98
13	D Hepner	Bay Head, NJ	07/03/98	J Howard	Mantoloking, NJ		08/22/98
13	C Kennedy	McCrie's Shoal, NJ	07/02/98	P Fagan	McCrie's Shoal, NJ	13	08/23/98
15	A D'Amato	Cape May, NJ	08/20/98	C Carlin	Offshr., Cape May, NJ		08/23/98
13	W Filce	Bay Head, NJ	07/12/98	J Martin	Manasquan, NJ	14	08/23/98
13	J Hickey Jr	Pt. Pleasant, NJ	06/27/98	L Frank	Manasquan R., NJ	15	08/23/98
12	F Spall	Sandy Hook, NJ	07/28/98	G Maxson	Sandy Hook Bay, NJ		08/26/98
10	P Carlsen	Shark River Inlet, NY	07/03/98	C Travers	Shark River Inlet, NJ		08/27/98
12	C Kennedy	Offshr , Cape May, NJ	07/21/97	C Vanek	Robert Moses Brdg , NY		08/29/98
10	S Knapik	Pt. Lookout, NY	07/14/98	J Lagudi Jr	Lido Beach, NY	10	08/29/98
14	R Dykas	Asbury Park, NJ	09/27/97	G Pope	Pt Judith, RI	15	08/30/98
15	A D'Amato	Cape May, NJ	09/14/97	J Goodwin	Hampton Bays, NY	18	08/30/98
13	T Stanik	Sandy Hook, NJ	08/16/98	H Kittel	Raritan Bay, NJ		08/31/98
14	W Filce	Mantoloking, NJ	07/19/97	E Kazikaitis	Barnegat Inlet, NJ	16	09/04/98
12	J White	Robert Moses Brdg , NY	08/11/97	B Wiemann	Fire Is Inlet, NY	16	09/04/98
13	J Dotsey	Long Beach, NY	06/20/98	B Helldorfer	Reynold's Chan , NY		09/05/98
13	A Gano	Fire Is. Inlet, NY	09/18/97	D Mambrino	Shinnecock Bay, NY	16	09/08/98
Greater Amberjack							
49	JC Wright	Offshr., VA Beach, VA	07/23/98	K Anderson	Offshr , VA Beach, VA		07/28/98
Grouper							
17	F Waltzinger III	Offshr , Bahia Honda Key, FL	02/23/97	S Golden	Ohio Key, FL	23	06/28/98
Red Drum							
20	J Wright	Venice, FL	09/30/97	D Turgeon	Nokomis, FL	25	07/12/98
Spotted Seatrout							
12	D George	Pass Christian, MS	06/27/98	T Kilpatrick	Pass Christian, MS		07/07/98
Striped Bass							
30	F Coronato	West Bank Lt., NY	06/08/96	B Hall	Flynn's Knoll, NJ		07/08/96
17	J Krauss	Shrewsbury R , NJ	05/23/92	B Brown	Piscataqua R., NH	29	07/01/97
19	H Sweet	Barrington, RI	10/23/96	E Skokowski	Brigantine, NJ	21	06/26/98
29	A Anderson	Block Is., RI	11/13/97	D Farber	Nantucket Sound, MA	32	06/26/98
20	J Della Porta	Swampscott, MA	08/11/97	D Marshall	Marblehead, MA	21	06/26/98
30	M LeBlanc	Quick's Hole, MA	06/29/96	R Burr	Quick's Hole, MA	34	06/26/98
17	C Wilcox III	Moriches Inlet, NY	06/23/97	J Cruz	Coney Is., NY	20	06/26/98
22	L Tikuisis	Bay Head, NJ	05/07/98	R Fink	Staten Is., NY	22	06/27/98
22	J Ragusa	Fire Is. Lt , NY	06/08/98	M Bernard	Fire Is. Inlet, NY	24	06/27/98
32	R Greene	Quick's Hole, MA	06/16/97	D Girard	Quick's Hole, MA	38	06/27/98
8	G Horvath	Trenton, NJ	06/20/98	G Horvath	Trenton, NJ		06/27/98
22	A Anderson	Block Is., RI	06/12/98	E Lopez	Block Is., RI	22	06/27/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
18	R Pearson Jr	Breezy Pt , NY	11/10/97	G Gregory	Great Egg Hbr R., NJ	19	06/27/98
21	P Johnson Sr.	Charlestown, RI	10/05/97	T Hoxsie	Charlestown, RI	21	06/27/98
8	G Horvath	Trenton, NJ	06/17/98	G Horvath	Trenton, NJ	08	06/28/98
23	M Bolton	Middletown, RI	07/15/96	C Silva	Middletown, RI	25	06/28/98
31	A Anderson	Montauk Pt., NY	10/02/96	D Walker IV	Watch Hill, RI	33	06/28/98
19	A Anderson	Pt. Judith, RI	10/22/97	S Hallinan	Marblehead, MA	19	06/28/98
32	W Sharpe	Sandy Hook, NJ	04/23/96	G Church-Smith	Quick's Hole, MA	36	06/28/98
27	R Canfield	Westport, CT	06/20/97	R Kyker	Norwalk, CT	28	06/28/98
27	L Gonnello	Sandy Hook, NJ	05/26/98	R Luik	Sandy Hook, NJ	28	06/29/98
22	A Anderson	Block Is., RI	06/11/98	J Shepard	Block Is., RI	23	06/29/98
8	G Horvath	Trenton, NJ	06/11/98	G Horvath	Trenton, NJ	08	06/29/98
17	A Anderson	Pt. Judith, RI	06/23/98	E Petronio Jr	Pt. Judith, RI	17	06/29/98
18	R Pearson Jr	Breezy Pt., NY	10/01/97	J Brinson	Jamaica Bay, NY	18	06/29/98
24	J Rand	Eaton's Neck, NY	07/05/97	J Burke	Eatons Neck, NY		06/29/98
23	W Stuvens	Huntington, NY	08/03/97	J Burke	Eatons Neck, NY	23	06/29/98
28	J Posh	Stratford, CT	09/15/96	A Garayua	New Haven, CT	32	06/30/98
23	C Kollett	Prudence Is , RI	06/26/98	J Cordeiro	Prudence Is., RI	30	06/30/98
19	A LoCascio	Manhasset Bay, NY	11/05/95	C Denning	Manhasset Bay, NY	23	06/30/98
25	R Conklin	Moriches Inlet, NY	11/22/97	M Burridge	Rockport, MA	30	06/30/98
25	F Stunkel	Stamford, CT	11/13/97	P Mowgeon	Cape Cod Canal, MA	27	06/30/98
28	A Anderson	Block Is , RI	05/20/98	A Anderson	Block Is , RI	28	06/30/98
19	R Chmiel	Watch Hill, RI	05/23/98	K Carrigan	Rockport, MA	21	07/01/98
25	G Nigro	Sandy Hook, NJ	11/25/97	G Bass Jr.	Watch Hill, RI	27	07/01/98
14	F Ryan	Norwalk, CT	10/30/94	W Perlman	Atlantic Beach, NY	23	07/01/98
23	R Wolfskeil	Ipswitch, MA	09/21/97	T Guertner	Ipswich, MA		07/01/98
23	R Nystrom	Stratford, CT	06/23/98	R Visokay	Fairfield, CT	24	07/01/98
24	R Spiro	Plum Is., MA	09/07/96	A Littell	Kennebunk, ME	26	07/01/98
18	K Leopold	Great South Bay, NY	07/01/97	K Jackson	1.5 mi. off Fire Is., NY	25	07/01/98
23	T Shaheen	Rumson, NJ	10/06/97	F Decker	Shrewsbury R , NJ	24	07/02/98
27	C DeFoe	Shrewsbury Rocks, NJ	11/23/96	G Mirowski	Boston, MA	30	07/02/98
23	G Nigro	Sandy Hook, NJ	06/06/98	L Gonnello	Sandy Hook, NJ	24	07/02/98
14	H Sweet	Warren, RI	08/15/97	R Prindle	Warren, RI	14	07/02/98
22	G Ciriello	Sandy Hook, NJ	11/11/95	L Gonnello	Sandy Hook, NJ	26	07/02/98
8	G Horvath	Trenton, NJ	06/11/98	G Horvath	Trenton, NJ	08	07/03/98
19	R Kyker	Norwalk, CT	06/14/98	G Wetmore	Norwalk, CT		07/03/98
29	T Burden	NY Harbor	06/27/98	E Seola	NY Harbor	29	07/03/98
22	P Lowcher	Sea Bright, NJ	04/13/98	G Hodapp	Highlands, NJ	24	07/03/98
29	B White	Flynn's Knoll, NJ	10/07/96	P Fotino	Ipswich, MA	33	07/03/98
33	W Perlman	Atlantic Beach, NY	06/15/98	W Marker	East Rockaway Inlet, NY	33	07/03/98
33	C Husta	Little Egg Inlet, NJ	05/28/97	H Walker	Shrewsbury Rocks, NJ		07/03/98
30	R Kyker	Norwalk, CT	07/20/97	R Kyker	Norwalk, CT	31	07/03/98
23	R Nystrom	Bridgeport, CT	06/15/97	M Jewett	Fairfield, CT	26	07/03/98
33	J Karolides	Beverly, MA	06/10/98	R Lagerquist	Hull, MA		07/03/98
35	F Coronato	West Bank Lt , NY	05/24/97	G Caputi	Shrewsbury Rocks, NJ	37	07/03/98
31	P Kozak	Kingston, NY	05/22/98	W Marker	E Rockaway Inlet, NY	33	07/03/98
22	G Blank	Governors Is., NY	10/04/97	M Supko	Spring Lake, NJ	26	07/04/98
11	R Ferraro	Narragansett, RI	05/26/97	S Lomas	Pt Judith, RI	19	07/04/98
19	A Schweithelm	Northport, NY	11/29/97	J Rogers	Newburyport, MA	21	07/04/98
27	A Anderson	Pt. Judith, RI	10/30/97	C Tarabelli	Newburyport, MA	30	07/05/98
31	M Favale	Boston Harbor, MA	07/06/97	J Geyster III	Salisbury, MA	35	07/05/98
16	J Murray	Atlantic Beach, NY	10/12/96	R Taylor	Bayonne, NJ		07/05/98
26	J Foti	Staten Is , NY	07/05/97	R DiPaolo	Verrazano Brdg , NY	27	07/05/98
17	A Perednia	East R , NY	10/13/96	R Diaz	Far Rockaway, NY	20	07/05/98
25	L Gonnello	Flynn's Knoll, NJ	06/17/98	R Vogel	Ambrose Chan , NY	25	07/06/98
20	J Silva	Riverside, RI	06/20/98	J Cordeiro	Prudence Is , RI		07/06/98
27	J Silva	Riverside, RI	06/18/98	J Cordeiro	Prudence Is , RI	27	07/06/98
29	A Anderson	Block Is , RI	09/22/96	S McQuaid	Provincetown, MA	34	07/06/98
32	S Boulmetis	Flynn's Knoll, NJ	06/02/98	L Gonnello	Ambrose Chan , NY	32	07/06/98
21	A Anderson	Block Is , RI	06/08/98	C Hiza	Block Is , RI	22	07/06/98
32	D Kelly	Sag Harbor, NY	06/08/97	T McKeon	Boston, MA	33	07/06/98
20	R Leja	Bridgeport, CT	04/18/98	A Fredette	Newburyport, MA	24	07/06/98
8	G Horvath	Trenton, NJ	05/28/98	G Horvath	Trenton, NJ	09	07/07/98
30	F Tellefsen	South Beach, S.I., NY	11/21/96	K Winslow	Jones Beach, NY	35	07/07/98
16	N Kittredge	Norwich, CT	02/22/98	D Tamulevich	Freeport, ME		07/07/98
40	H Sweet	Block Is., RI	06/23/98	E McBlain	Martha's Vineyard, MA	40	07/07/98
16	T Tavares	Revere, MA	06/24/98	S Hamalainen	Lynn, MA		07/07/98
24	A LoCascio	Manhasset Bay, NY	06/24/98	C Chicosky	Kings Pt., NY		07/07/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
20	R Kyker	Stamford, CT	11/11/97	R Zakas	Marblehead, MA	20	07/07/98
27	H Schauer	Martha's Vineyard, MA	05/12/98	C Babb	Kittery, ME	30	07/07/98
19	G Kerkhan	Deal, NJ	11/11/96	J Kominis	Madison, CT	23	07/07/98
28	R Garlepy	Newburyport, MA	07/23/96	M Krenzer	Newburyport, MA	31	07/08/98
21	T Marburger	Shinnecock Inlet, NY	07/05/98	W Olsen	Shinnecock Bay, NY		07/08/98
14	M Wahlgren	Plum Island, MA	05/21/98	J Desmarais	Merrimack R., MA	14	07/08/98
27	F Coronato	West Bank Lt., NY	05/19/98	L Clay	Westerly, RI	31	07/08/98
22	A D'Amato	Cape May Inlet, NJ	11/25/97	R Botoff	Gloucester, MA		07/08/98
18	C Wilcox III	Moriches Inlet, NY	11/13/97	M Mucha	Cos Cob, CT	18	07/08/98
21	E Petronio Jr	Pt. Judith, RI	07/22/96	R Katz	Montauk, NY	26	07/08/98
8	G Horvath	Trenton, NJ	06/24/98	G Horvath	Trenton, NJ	09	07/08/98
27	A Anderson	Montauk Pt., NY	05/26/98	T Maloney	Waterford, CT	28	07/09/98
36	A LoCascio	Execution Lt., NY	06/05/97	J Boone	Westbrook, CT	39	07/09/98
21	R Wolfskeil	Ipswich, MA	09/20/97	R Zakas	Marblehead, MA		7/09/98
22	D Zurheide	Bay Ridge, NY	06/23/98	D Zurheide	Bay Ridge, NY	22	07/09/98
32	A LoCascio	Execution Lt., NY	05/29/98	J Cigarra	Fairfield, CT	33	07/09/98
28	D Stratton	The Race, L.I. Sound	08/26/97	A Murphy	The Race, L.I. Sound	31	07/09/98
21	R Conklin	Moriches Inlet, NY	10/27/97	S Hale	Salem, MA	25	07/09/98
22	F Stunkel	Stamford, CT	09/12/94	J White	Cape Cod Canal, MA	38	07/10/98
21	B Radice	Long Branch, NJ	07/31/97	R Soyka	Long Branch, NJ	23	07/10/98
27	A Anderson	Block Is., RI	05/15/98	M Lynch	Newburyport, MA		07/10/98
25	C Wilcox III	Moriches Inlet, NY	10/31/97	P Cesario	Scituate, MA	26	07/10/98
22	C Carroll Jr.	Monmouth Beach, NJ	04/18/98	R Chmiel	Watch Hill, RI	23	07/10/98
23	G Kerkhan	Provincetown, MA	06/17/98	F Briscoe Jr	Eastham, MA	25	07/10/98
22	M Berger	Jones Beach, NY	10/12/97	W Perlman	Atlantic Beach, NY	24	07/10/98
21	J Karolides	Beverly, MA	06/09/98	B Campbell	Danvers, MA		07/10/98
35	A Anderson	Block Is., RI	11/24/96	F Xiong	Pt Judith, RI	38	07/10/98
24	W Kobel Jr	Eatons Neck, NY	07/14/97	M Lomangino	Eatons Neck, NY	27	07/10/98
20	F Stunkel	Stamford, CT	10/15/97	R Stasinos	Stamford, CT	22	07/11/98
18	A Pisczatowski	Glen Cove, NY	08/06/97	S Goodman	Salisbury, MA		07/11/98
25	J Karolides	Marblehead, MA	08/15/94	L Castagneto	Boston, MA	35	07/11/98
8	G Horvath	Trenton, NJ	06/16/98	L Higginson	Cornwell Hts., PA	08	07/11/98
21	J Ragusa	Fire Is Lt., NY	04/21/98	V DeAmicis	Boston, MA	22	07/11/98
25	K Bilodeau	Sugar Reef, CT	10/02/97	C Huskes	Watch Hill, RI		07/11/98
43	D Brodeur	Plum Is., NY	06/14/97	T Lewoc Jr	Fishers Is , NY	45	07/12/98
29	H Sweet	Block Is., RI	06/23/98	J Treat	Block Is., RI		07/12/98
8	G Horvath	Trenton, NJ	06/17/98	G Horvath	Trenton, NJ	08	07/12/98
23	D Kelly	Orient Pt , NY	10/26/95	F Atkinson	Newport, RI	24	07/12/98
21	R Chmiel	Watch Hill, RI	07/02/97	J Olsaver	Watch Hill, RI	21	07/12/98
20	T Shaheen	Raritan Bay, NJ	08/11/97	A Schweithelm	Asharoken, NY	22	07/12/98
24	D Zurheide	Bay Ridge, NY	06/25/98	M Norman	S of Red Hook, NY		07/12/98
13	G Kerkhan	Keyport, NJ	03/25/98	C Chase	Newburyport, MA	16	07/12/98
19	N Kittredge	Annisquam R., MA	09/23/97	K Weatherbee	Merrimack R., MA	19	07/12/98
22	J Shastay	40th St., East R., NY	10/17/96	C Stamm	East R., NYC	30	07/12/98
18	B Shillingford	Strathmere, NJ	07/12/96	R Galuska	Sea Isle City, NJ	23	07/12/98
27	F Stunkel	Stamford, CT	11/05/96	J Armienti	Nahant, MA	29	07/13/98
18	P Lowcher	Rumson, NJ	06/13/97	C DeCrescenzo	Rockaway, NY		07/13/98
24	T Scotto	Lower NY Bay, NY	08/16/97	A Pazzini	Rockaway, NY	28	07/13/98
8	G Horvath	Trenton, NJ	07/03/98	G Horvath	Trenton, NJ	08	07/13/98
25	M Heffernan	2 mi off Jones Inlet, NY	10/31/97	C Womack	Waterford, CT	27	07/13/98
17	D Hoxsie	Pt. Judith, RI	08/19/97	C Webster	Pt Judith, RI		07/13/98
20	W Woodroffe	Rins Park, NY	10/26/97	J Faulkner	Kennebunk, ME	20	07/13/98
30	C Bassano	Nantucket, MA	07/13/97	S Pietruska II	Martha's Vineyard, MA	30	07/13/98
29	C Wilcox III	Moriches Inlet, NY	10/22/97	T Silva	Cape Cod Bay, MA	30	07/14/98
24	D Donnelly	Shrewsbury R., NJ	05/20/98	J Bova	Leonardo, NJ		07/14/98
27	A Anderson	Block Is , RI	06/17/98	R Green	Montauk, NY	30	07/14/98
20	R Spiro	Merrimack R., MA	07/27/97	F Wilson	Merrimack R., MA	20	07/14/98
14	J Yamakaitis	Sandy Hook, NJ	10/27/97	D Andujar	Harlem, NY	13	07/14/98
33	D Kelly	Orient Pt , NY	10/27/96	A Elson	Block Is , RI	36	07/15/98
27	A Noronha	Mt Hope Brdg., RI	05/23/98	R Brooks	Woods Hole, MA	27	07/15/98
26	A LoCascio	Manhasset Bay, NY	05/16/98	A Jamet	Eastchester Bay, NY	26	07/15/98
27	R Vogel	Sandy Hook, NJ	07/21/98	R Alvarez	Flynn's Knoll, NJ		07/15/98
14	J Karolides	Danvers, MA	09/11/95	V Griffin	North R , MA		07/15/98
18	D Adams	Aberdeen, MD	04/18/98	R DePaiva	Solomons Is., MD		07/15/98
30	R Stroz	Shrewsbury R , NJ	11/11/96	B Elmas	Cape Cod Canal, MA	34	07/15/98
18	N Kittredge	Old Lyme, CT	05/21/97	A Bogart	Old Saybrook, CT	21	07/15/98
18	J Ragusa	Fire Island Lt , NY	05/13/97	L Lucas	Brighton Beach, NY		07/15/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
8	G Horvath	Trenton, NJ	07/12/98	G Horvath	Trenton, NJ	08	07/15/98
38	A Anderson	Montauk Pt., NY	10/14/97	R Colagiovanni	Martha's Vineyard, MA		07/15/98
33	F Stunkel	Stamford, CT	06/15/98	J LoBianco	Stamford, CT	36	07/15/98
9	G Horvath	Trenton, NJ	06/11/98	G Horvath	Trenton, NJ	98	07/16/98
34	A Anderson	Montauk Pt., NY	06/19/96	R Wells	Watch Hill, RI		07/16/98
16	B Shillingford	Ocean City, NJ	07/05/96	C Pascale	Gr. Egg Harbor R., NJ	16	07/16/98
36	F Stunkel	Stamford, CT	06/15/98	J LoBianco	Stamford, CT	38	07/16/98
32	A LoCascio	Hewlitt Pt., NY	05/19/98	L Alder	The Race, L I Sound	35	07/16/98
21	R Leja	Bridgeport, CT	10/09/97	L Gomes	Bridgeport, CT		07/16/98
24	F Stunkel	Stamford, CT	07/15/98	C Nakashian	Stamford, CT	24	07/16/98
38	D Kelly	Orient Pt., NY	07/17/97	J Roslak	Plum Gut, NY	38	07/16/98
8	G Horvath	Trenton, NJ	06/29/98	G Horvath	Trenton, NJ	08	07/16/98
34	K Bilodeau	Race Pt , NY	08/14/97	P Massores	Fishers Is , NY	36	07/17/98
24	R Kalenka	Shinnecock Bay, NY	06/20/98	J Capuano	Shinnecock Inlet, NY	24	07/17/98
15	H Sweet	Warren, RI	07/06/98	F Kue	Barrington, RI	16	07/17/98
25	H Schauer	Martha's Vineyard, MA	05/19/96	N Kolterman	Chatham, MA	36	07/17/98
17	D Partusch	Shrewsbury River, NJ	05/15/92	E Baldrian	Montauk Pt , NY		07/17/98
20	A Schweithelm	Asharoken, NY	05/27/96	J Porinchak	Huntington, NY	29	07/17/98
27	A LoCascio	Hart Island, NY	07/02/98	T Velerio	W. L.I. Sound		07/18/98
25	A Anderson	Block Is., RI	06/21/98	D Clay	Quick's Hole, MA		07/18/98
26	G Nigro	Flynn's Knoll, NJ	05/21/98	J Beaver	Sandy Hook, NJ	28	07/18/98
26	G Nigro	Sandy Hook, NJ	11/26/97	M Weiss	Huntington, NY	27	07/18/98
27	A Anderson	Block Is., RI	07/10/95	M Benoit	Block Is , RI	30	07/18/98
26	L Gonnello	3A, Ambrose Chan., NJ	06/23/98	J Beaver	3A, Ambrose Chan.	26	07/18/98
33	S Jakubowski	Brooklyn, NY	05/29/98	D Peterson	Flynn's Knoll, NJ	35	07/18/98
27	A Anderson	Block Is., RI	05/24/98	G Houston	Fishers Is., NY		07/18/98
9	G Horvath	Trenton, NJ	06/11/98	A Brooks	Bristol, PA		07/18/98
9	M LeBlanc	E Providence, RI	08/07/97	D Clay	Quick's Hole, MA	31	07/18/98
19	R Conklin	Moriches Inlet, NY	10/27/97	D Grimes	Biddeford, ME	21	07/18/98
16	P Fallon III	Kennebec R., ME	06/09/96	T Hyde	1/2 mi. NW Ventnor, NJ	21	07/18/98
23	W Perlman	Rockaway Beach, NY	11/12/97	F Forbes Sr.	Yarmouth, ME	25	07/18/98
32	A Anderson	Block Is., RI	10/30/96	F McNally	Fishers Is , NY	33	07/19/98
21	P Grippo	3rd Wantagh Brdg., NY	06/18/97	D Grindstaff	Wantagh, NY	24	07/19/98
21	P Grippo	Long Beach, NY	11/29/97	B Fristensky	Northport, NY	22	07/19/98
26	A Anderson	Block Is , RI	07/05/98	R Bellavance	Block Is., RI	28	07/19/98
38	R Bergeron	Kingston, MA	08/02/97	K O'Farrell	Plymouth, MA	39	07/19/98
36	D Dibblee	Esopus, NY	05/12/97	J Barker	Boston, MA	36	07/19/98
27	A LoCascio	Throgs Neck Brdg., NY	07/30/97	R Jo	Throgs Neck Brdg., NY	29	07/19/98
19	F Stunkel	Stamford, CT	09/16/97	A Glowka	Stamford, CT	24	07/19/98
27	M Witham	Old Orchard Lt., NY	07/22/97	L Gonnello	Sandy Hook, NJ	28	07/19/98
32	A Anderson	Block Is., RI	06/11/98	J Perry	Green Hill, RI		07/19/98
31	A Anderson	Montauk Pt , NY	05/26/98	S Rankin	Offshr., Montauk Lt , NY		07/19/98
8	G Horvath	Trenton, NJ	06/24/98	G Smith	Trenton, NJ		07/20/98
19	GR Gray	Charlestown, RI	06/08/98	K Marcoux	Quonochontaug, RI		07/20/98
26	A Anderson	Montauk Pt., NY	06/26/97	V McDiarmio	Montauk, NY	28	07/20/98
24	P Lowcher	Sea Bright, NJ	05/17/98	G Bagnuolo	Navesink R., NJ	25	07/20/98
26	W Stuven	Target Rock, L.I. Sound	07/07/98	C DeMarco	Smithtown, NY	29	07/20/98
38	J Posh	Milford, CT	08/26/97	P Massores	Fishers Is., NY	40	07/20/98
24	A Anderson	Block Is., RI	06/30/98	C Renkun Sr	Block Is., RI	25	07/21/98
21	P Lowcher	Sea Bright, NJ	04/18/98	F Decker	Shrewsbury R , NJ	22	07/21/98
20	P Cappuccio	Beach Haven, NJ	04/30/98	M Clement	Jones Inlet, NY	22	07/21/98
20	J Ragusa	Fire Is Lt , NY	05/07/98	P Samson	Little Compton, RI		07/21/98
15	J Karolides	Danvers, MA	09/11/95	D Schmidt	Moriches Bay, NY	23	07/21/98
17	P Grippo	Wantagh Brdg., NY	06/18/97	N Kalish	Zacks Bay, NY	21	07/21/98
24	S North	Sandy Hook, NJ	11/18/95	W Fisler	Flynn's Knoll, NJ	27	07/21/98
22	B White	South Beach, S.I , NY	10/04/97	S Messeri	Sandy Hook, NJ	23	07/22/98
18	K Bilodeau	Watch Hill, RI	05/29/96	P Gerber	Center Moriches Bay, NY	20	07/22/98
19	J Della Porta	Swampscott, MA	05/30/98	J Voci	Gloucester, MA	21	07/22/98
27	G White	Piscataqua R., NH	08/26/97	E Philbrick	Kittery, ME		07/22/98
21	M Simmons	Barnegat Lt., NJ	10/01/97	A Dalessio	Staten Is , NY	24	07/22/98
19	G White	Piscataqua R., NH	08/26/97	R Wright	Hampton, NH	20	07/22/98
	P Lowcher	Sea Bright, NJ	06/01/98	M Dalessio	Verrazano Brdg., NY	26	07/23/98
20	G Horvath	Barnegat Inlet, NJ	06/05/98	M Simmons	Barnegat Inlet, NJ	20	07/23/98
26	R Vogel	Sandy Hook, NJ	06/16/98	W Perlman	Breezy Pt., NY	27	07/23/98
21	J Daly	Pt. Pleasant, NJ	11/16/97	T Kowitski	Oyster Cr. Chan., NJ		07/23/98
29	J Foti	The Narrows, NY	07/05/96	D Bershaj	Verrazano Brdg , NY	31	07/24/98
28	A Anderson	Block Is , RI	09/22/96	G Chandler	Sandy Hook, NJ	30	07/24/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
23	R Chmiel	Fishers Is., NY	07/10/98	D Pogany	Fishers Is., NY	24	07/24/98
21	R Kyker	Stamford, CT	09/01/96	C Denni	Rockaway, NY	25	07/24/98
34	D Kelly	Montauk Pt., NY	11/23/96	R Bury	Island Beach St. Pk , NJ		07/24/98
34	A LoCascio	Execution Lt , NY	05/27/98	B Millar	Big Gull Is., NY	36	07/25/98
23	F Como	New Rochelle, NY	08/04/97	F Como	David's Is , NY	26	07/25/98
17	D Zurheide	Ellis Is., NY	07/27/94	D Smith	Liberty St. Pk., NJ	25	07/25/98
19	D Sowerby	York Beach, ME	08/23/95	A Davidson	Cape Neddick, ME	23	07/25/98
20	T Marburger	Shinnecock Inlet, NY	07/11/95	D Peterson	Flynn's Knoll, NJ	28	07/25/98
36	F Casey	Boston, MA	06/15/98	T Morrissey	Georges Is., MA		07/25/98
32	D Kelly	Orient Pt., NY	06/29/96	H Mason	Orient Pt., NY		07/25/98
30	P Kozak	Rondout Cr., NY	06/01/97	M Nuzzo	Clinton, CT	34	07/26/98
27	A Anderson	Block Is., RI	06/25/97	M Salvo	Montauk, NY	33	07/26/98
26	W Perlman	Breezy Pt., NY	07/23/98	S Butrico	Jamaica Bay, NY	26	07/26/98
32	R Pearson Jr.	Croton Bay, NY	03/28/98	J Correia	Rockport, MA	34	07/26/98
18	T Marburger	Northport, NY	03/25/96	S Kellner	Mattituck, NY	28	07/26/98
19	T Lynch	Stamford, CT	08/10/94	P Farinella	Stamford Reef, CT	25	07/26/98
15	A Anderson	Thames R., CT	04/25/97	D DuFresne	E. Providence, RI		07/27/98
22	C Kollett	Prudence Is., RI	06/24/98	A Rochefort	Prudence Is , RI	24	07/27/98
17	J Karolides	Danvers, MA	06/17/94	K Kimmett	Duxbury, MA	27	07/28/98
25	J McAfee	Quick's Hole, MA	07/17/98	J McDonald	Quick's Hole, MA	26	07/29/98
15	M LeBlanc	Riverside, RI	06/18/98	D DuFresne	E. Providence, RI		07/29/98
20	F Stunkel	Stamford, CT	11/15/97	K Grace	S. Dartmouth, MA	25	07/29/98
21	T Marburger	Northport, NY	05/07/96	L Martinez	Whitestone Brdg , NY		07/29/98
30	G Buono	Sandy Hook, NJ	10/18/94	A Dudas	Sandy Hook, NJ	32	07/29/98
21	A LoCascio	Throgs Neck Brdg., NY	10/29/94	H Lombardi	Throgs Neck Brdg., NY	24	07/30/98
36	A Elson	Block Is., RI	07/15/98	T Miller	Montauk, NY		07/30/98
31	A LoCascio	Manhasset Bay, NY	06/18/98	W Case	Watch Hill, RI		07/30/98
26	A LoCascio	Throgs Neck Brdg , NY	10/05/97	H Lombardi	Throgs Neck Brdg., NY	27	07/30/98
15	A Anderson	Thames R., CT	12/06/97	J King	Scarborough, ME		07/30/98
20	G Horvath	Barnegat Inlet, NJ	09/17/97	F Fay	Barnstable, MA	25	07/31/98
9	G Horvath	Trenton, NJ	07/08/98	G Horvath	Trenton, NJ	09	07/31/98
24	R Nystrom	Bridgeport, CT	07/26/98	S Vilay	Housatonic R., CT	24	07/31/98
22	W Anderson	Provincetown, MA	06/17/98	R Ciecko Jr.	Truro, MA		07/31/98
46	K Bilodeau	Fishers Is., NY	10/17/96	K Nye	Barnstable, MA	48	08/01/98
20	R Crawford Jr.	Shinnecock, NY	07/05/97	R Marshall	Hampton Bays Inlet, NY	0	08/01/98
34	W Kobel Jr	Montauk, NY	09/22/97	B Young	Montauk, NY	35	08/01/98
18	J Calamia	East R., NY	01/07/98	J Scandone Jr.	Avalon, NJ	19	08/01/98
18	T Marburger	Northport, NY	02/11/97	W Pintauro	Darien, CT	19	08/01/98
23	W Perlman	Atlantic Beach, NY	07/01/98	W Marker	E Rockaway Inlet, NY	25	08/01/98
33	R Leja	Bridgeport, CT	09/01/97	Unk Fisherman	Bridgeport, CT	33	08/01/98
19	J Silva	Riverside, RI	06/20/98	A Rochefort	Prudence Is., RI	24	08/01/98
19	N Rouleau	Charlestown, RI	06/09/97	C Sewell	Roosevelt Inlet, DE	22	08/01/98
22	F Stunkel	Stamford, CT	06/19/97	N Lotstein	Stamford, CT	25	08/01/98
31	F Coronato	Old Orchard Lt., NY	04/25/98	A Healey	Provincetown, MA	33	08/01/98
26	M Favale	Boston, MA	05/30/98	B Felins	Boston, MA	26	08/01/98
27	F Stunkel	Eatons Pt , NY	08/15/97	B Zlokovitz	Eatons Neck, NY	28	08/02/98
19	M Simmons	Barnegat Light, NJ	11/25/97	G Yeaton	Gardiner, ME		08/02/98
29	G White	Piscataqua R., NH	08/26/97	S Lula	New Castle, NH	31	08/02/98
22	A Anderson	Block Is., RI	05/24/98	K Reback	Plymouth, MA		08/03/98
33	S Fries	Montauk, NY	10/13/97	B Hoffman	Salem, MA	34	08/03/98
18	C Wilcox III	Moriches Inlet, NY	07/14/97	J Gismondi	Center Moriches, NY	26	08/03/98
20	T Marburger	Northport, NY	05/19/98	D Thibault	Nauset Marsh, MA		8/03/98
19	G White	Piscataqua R., NH	07/05/98	P Cuneo	Kittery, ME	19	08/03/98
14	M Strober	Jersey City, NJ	06/06/98	J Wojcik	Harrison, NJ		08/03/98
16	R Pearson Jr.	Croton Bay, NY	05/19/98	B Haibi	Ward's Is., NYC	17	08/03/98
25	M Bolton	Middletown, RI	07/15/97	C Silva	Middletown, RI	27	08/03/98
19	M Bolton	Middletown, RI	07/15/96	C Silva	Middletown, RI	27	08/03/98
20	M Bolton	Middletown, RI	07/14/98	C Silva	Middletown, RI	22	08/03/98
27	B White	South Beach, S I , NY	10/04/97	M Ward	L.I. Sound, CT side	29	08/04/98
34	D Brodeur	Niantic, CT	06/13/98	K Brodeur	L.I. Sound	35	08/04/98
22	N Kittredge	Annisquam, MA	07/07/97	M Geggatt	Salem Sound, MA		08/04/98
23	R Kalenka	Shinnecock Bay, NY	06/03/98	B Brown	Shinnecock Inlet, NY	25	08/04/98
19	A Blair	Strathmere, NJ	05/06/98	G Errickson	Strathmere, NJ	20	08/04/98
30	R Nystrom	Devon, CT	05/17/98	L Comeau	SE Nantucket, MA		08/04/98
38	A Anderson	Block Is., RI	05/23/98	J Landry	Block Is., RI		08/04/98
24	A LoCascio	Throgs Neck Brdg., NY	10/04/97	J D'Alessandro	Throgs Neck Brdg., NY	28	08/04/98
26	F Stunkel	Stamford, CT	08/03/96	S Shay	Stamford, CT	28	08/05/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
32	F Casey	Boston, MA	06/01/98	F Casey	Boston, MA	32	08/05/98
22	B Richmond	Seaside Park, NJ	11/23/96	P Mitchell	Newburyport, MA	24	08/05/98
27	L Gonnello	Flynn's Knoll, NJ	07/06/97	B Troncone	Flynn's Knoll, NJ	29	08/05/98
31	F Coronato	West Bank Lt., NY	06/10/98	R Colagiovanni	Martha's Vineyard, MA	34	08/05/98
22	A Olivieri	Quincy Bay, MA	05/27/95	A Lehmann	Boston, MA	28	08/06/98
21	W Perlman	Atlantic Beach, NY	07/10/98	P Eng	Atlantic Beach Brdg., NY	21	08/06/98
33	F Coronato	Old Orchard Lt , NY	05/02/98	K Brodeur	L I Sound	37	08/06/98
31	S Kellner	Mattituck, NY	05/25/98	S Witthuhn	Montauk, NY		08/07/98
18	T Shaheen	Raritan Bay, NJ	05/26/96	J Cohen	5 mi. E Breezy Pt., NY	27	08/07/98
36	A Blair	Millville, NJ	04/24/98	B Shaner	Boston, MA		08/07/98
27	A Anderson	Block Island, RI	06/20/97	D Eichin	Montauk Pt., NY	27	08/07/98
22	G Horvath	Barnegat Inlet, NJ	09/26/97	J Hunt	Montauk Pt , NY	25	08/07/98
33	R Nystrom	Fairfield, CT	07/04/98	R Foster Jr.	Fairfield, CT	35	08/07/98
20	J Evans	Raritan Bay, NJ	05/05/98	A Curcio	Tin Can Grounds, NY	23	08/07/98
25	G White	Piscataqua R , NH	06/21/98	R Woodbury	Portsmouth, NH	26	08/07/98
20	GR Gray	Charlestown, RI	10/24/97	K Lamb Jr	Lynn, MA	22	08/07/98
28	A Anderson	Montauk Pt., NY	05/22/98	P Muolo	Pt Judith, RI	30	08/07/98
24	B Garfield	Portland, ME	07/22/98	E Christensen	Scarborough, ME	25	08/07/98
27	A Anderson	Block Is , RI	06/16/98	A Schenck	Pt Judith, RI		08/08/98
17	J Karolides	Beverly, MA	07/18/97	B Reynolds	Wareham, MA	18	08/08/98
28	A Anderson	Montauk Pt., NY	05/30/97	M Plain	Montauk Pt , NY	30	08/08/98
26	J Beaver	Sandy Hook, NJ	05/26/98	L Hoffman	Rockaway Inlet, NY	27	08/08/98
26	M Favale	Boston, MA	06/21/98	K Smith	Cape Cod Bay, MA	27	08/08/98
15	J Karolides	Danvers, MA	05/29/94	B Stern	Manchester, MA	31	08/09/98
39	G Karr	Popham Beach, ME	07/01/98	R Perez	Chatham, MA		08/09/98
9	G Horvath	Trenton, NJ	08/02/98	G Horvath	Trenton, NJ	09	08/09/98
23	R Conklin	Moriches Inlet, NY	11/23/96	R Brenseke	Eatons Neck, NY	30	08/10/98
15	T Marburger	Northport, NY	02/19/96	S Murdock	Cape Cod Bay, MA	28	08/10/98
20	R Conklin	Moriches Inlet, NY	07/08/98	E Monnia	Moriches Bay, NY	22	08/10/98
33	A Schweithelm	Montauk, NY	11/26/95	K Perachio	Long Point, MA	38	08/10/98
28	S Fries	Montauk, NY	08/04/98	E Baldrian	Montauk Pt., NY		08/11/98
24	F Casey	Boston, MA	07/09/98	C Maxon	Boston, MA	25	08/11/98
21	P Johnson Sr.	Pt. Judith, RI	07/29/98	T Varatta	Snug Harbor, RI		08/11/98
21	K Hollins	Island Beach St Pk , NJ	05/31/98	J Becker	Sandy Hook Chan., NJ	24	08/11/98
19	R Conklin	Moriches Inlet, NY	11/13/97	A Frechette	Guilford, CT	20	08/12/98
18	J Della Porta	Swampscott, MA	08/30/97	J Grillo	Gloucester, MA	21	08/12/98
17	R Allen	Cape Charles, VA	04/13/97	J Helmick	Baltimore, MD	19	08/12/98
27	B Shillingford	Cape May Rips, NJ	11/02/97	S Feyl	Waterford, CT	31	08/12/98
19	A Schweithelm	Northport, NY	12/13/97	J Rinaldi	Boston, MA		08/12/98
32	J Caputo	Great Neck, NY	05/31/98	E Balusek Jr.	Middle Ground Lt., NY	32	08/13/98
20	C Wilcox III	Moriches Inlet, NY	11/13/97	D Gilbert	Hampton Beach, NH	21	08/13/98
21	D Sowerby	York Harbor, ME	09/12/97	J Almeida	Manchester by the Sea, MA	23	08/13/98
15	T Marburger	Northport, NY	03/16/97	T Gomez	Stratford, CT	20	08/13/98
17	D Sowerby	York Harbor, ME	06/23/98	J Kaye-Schiess	York R., ME	17	08/14/98
25	J Della Porta	Swampscott, MA	07/26/98	M Holey	Swampscott, MA		08/14/98
16	T Tavares	Revere, M	07/10/98	J Thomas	Lynn, MA	19	08/14/98
21	N Fiorillo Jr	Deal, NJ	11/05/97	A Curcio	Tin Can Grounds, NY	22	08/14/98
23	R Pearson Jr.	Upper Croton R., NY	05/16/98	A Weinstock	Montauk, NY		08/14/98
27	A Anderson	Montauk Pt., NY	05/25/98	M McCormick	Plum Gut, NY	29	08/14/98
23	B Gray	Charlestown, RI	11/03/96	R Guay	Saco Bay, ME	25	08/15/98
30	J Posh	Watch Hill, RI	07/01/98	D O'Reilly	Montauk Pt., NY	32	08/15/98
21	R Kyker	Norwalk, CT	11/16/96	T Bennett	W. Bath, ME	26	08/15/98
35	A LoCascio	Manhasset Bay, NY	04/30/98	R Mei	Salisbury, MA		08/15/98
27	W Perlman	Breezy Pt , NY	07/23/98	M Schachner	Tin Can Grounds, NY		08/15/98
24	J Della Porta	Swampscott, MA	08/20/97	P Kay	Boston, MA	26	08/15/98
29	J Brittin	Cape May, NJ	11/11/94	R Clarke	Provincetown, MA	46	08/15/98
11	E Canton	Gravesend Bay, NY	05/07/96	A Sherman	Moodna Cr., Hudson R., NY	14	08/15/98
34	J Howard	Elizabeth Is , MA	06/07/98	J Cabral	Quick's Hole, MA		08/15/98
27	R Conklin	Moriches Inlet, NY	10/27/97	R Dufresne	Martha's Vineyard, MA	30	08/15/98
23	P Lowcher	Rumson, NJ	06/10/97	E Andresen	Nantucket, MA		08/15/98
32	A Elson	Block Is , RI	07/15/98	D Cagno	Montauk Pt , NY	35	08/15/98
31	R Allen	Cape Charles, VA	11/29/97	L Murphy	Mouth of Choptank R., MD		08/15/98
18	G Horvath	Manasquan Inlet, NJ	12/05/96	L Murphy	Mouth of Choptank R., MD	0	8/15/98
20	W Woodroffe Sr.	Rus Pk., NY	08/10/98	B Haag	Reynold's Chan., NY		08/15/98
27	S Fries	Montauk, NY	08/04/98	A Innamorato	Montauk Pt., NY		08/15/98
21	R Nystrom	Devon, CT	04/17/98	P Hartwell	Newburyport, MA		08/15/98
15	J Karolides	Danvers, MA	09/12/96	L Lucas	Brighton Beach, NY		08/16/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
23	A Anderson	Montauk Pt., NY	07/02/97	J vonBargen	Montauk Pt., NY	24	08/16/98
29	F Casey	Boston, MA	05/22/98	F Woodman	Nauset Inlet, MA	32	08/17/98
22	J White	Providence, RI	10/18/97	D Pickering	E. Providence, RI	23	08/17/98
19	C Silva	Tiverton, RI	07/01/98	K Bouchard	Fall River, MA		08/18/98
27	W Perlman	Tobay Beach, NY	10/18/97	J Oertel	Westbrook, CT	29	08/18/98
27	J Dotsey	Montauk Lt., NY	07/30/98	D Marmeno	Montauk, NY	30	08/18/98
25	W Perlman	Tin Can Grounds, NY	11/18/97	P Bucking	Montauk Pt., NY	28	08/18/98
22	G Nigro	Sandy Hook, NJ	10/30/97	H Kessler	Moriches Inlet, NY	22	08/18/98
19	W Perlman	Atlantic Beach, NY	06/28/97	R Mazanec	Sayreville, NJ	22	08/19/98
19	T Rinaldi	Mulford Pt., NY	08/29/92	V Vecchio	Cutchogue, NY	31	08/19/98
22	R Conklin	Robins Is , NY	06/17/98	T Amato	Peconic R., NY	23	08/19/98
23	J Krauss	Sandy Hook, NJ	11/25/96	R Dury Jr.	The Race, L.I Sound	27	08/19/98
31	A LoCascio	Manhasset Bay, NY	06/23/98	P Sugarman	Martha's Vineyard, MA		08/20/98
18	G Blank	Beacon, NY	04/20/96	R Mazanec	Sayreville, NJ	23	08/20/98
25	S Fries	Montauk, NY	07/31/96	S Witthuhn	Montauk, NY		08/20/98
28	R Canfield	Westport, CT	06/21/98	P Shepard	S. Norwalk, CT	29	08/20/98
26	A LoCascio	Manhasset Bay, NY	04/24/98	V Wright Jr.	Groton, CT	28	08/20/98
33	D Goldberg	Montauk Pt , NY	08/05/98	D Mann	Montauk Pt , NY	34	08/20/98
23	F Stunkel	Stamford, CT	06/01/98	H Klein	Stamford, CT	26	08/20/98
23	N Kittredge	Old Lyme, CT	04/18/98	S Woidyla	Salisbury, MA	23	08/20/98
27	A LoCascio	Throgs Neck Brdg., NY	07/17/97	J D'Alessandro	Throgs Neck Brdg., NY	28	08/20/98
27	L Gonnello	Flynns Knoll, NJ	07/03/97	S Whitting	Montauk, NY	29	08/20/98
24	W Perlman	Atlantic Beach, NY	06/22/98	L Richards	Atlantic Beach, NY	24	08/20/98
24	R Conklin	Moriches Inlet, NY	11/15/96	S Wilkinson	Salisbury, MA	28	08/21/98
21	G Nigro	Romer Shoal, NJ	04/26/98	R Pickering	Harwich, MA	22	08/21/98
22	D Sowerby	York River, ME	06/29/98	S Royal	Plum Is , MA		08/21/98
26	D Waldo	Eastham, MA	05/27/98	F Olander	Provincetown, MA	29	08/21/98
29	F Coronato	Old Orchard Lt., NY	05/14/98	A Nicodemus	Cape Cod Bay, MA	30	08/21/98
27	S Fries	Montauk, NY	08/04/98	B Carman	Montauk Pt., NY		08/22/98
33	F Dyer	Race Lt., NY	08/30/97	R Jobin	Fishers Is., NY	36	08/22/98
31	S Fries	Montauk, NY	08/04/98	B Carman	Montauk Pt , NY		08/22/98
29	A Anderson	Block Is., RI	05/15/98	M Levasseur	Chatham, MA	30	08/22/98

Species Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
30	M Willey	Indian R., DE	08/08/98	W Ciociola	Indian R , DE		08/22/98
31	S Fries	Montauk, NY	08/04/98	Unk. Fisherman	Montauk Pt., NY		08/22/98
21	F Stunkel	Stamford, CT	10/06/93	R Anderson	The Race, L.I. Sound	28	08/22/98
29	G White	Piscataqua R , NH	08/02/98	P Whelan	York, ME	29	08/22/98
24	J McAfee Jr	Quick's Hole, MA	07/17/98	R Pimental	Cuttyhunk, MA	26	08/22/98
26	H Schauer	Martha's Vineyard, MA	10/16/97	D Dahlstrom	Nauset Beach, MA	29	08/22/98
26	A Schweithelm	Montauk, NY	06/06/97	S Szoke	Montauk, NY	29	08/22/98
22	JC Wright	Ches Bay Brdg. Tun., VA	04/21/98	A Land	Smith Pt , VA		08/22/98
21	J Karolides	Beverly, MA	09/20/97	J Karolides	Danvers, MA	24	08/23/98
29	W Kobel Jr	Eatons Neck, NY	06/15/98	B Gugliotta	Eatons Neck, NY	30	08/23/98
31	S Fries	Montauk, NY	08/04/98	E Reidman	Montauk Pt , NY		08/23/98
36	S Fries	Montauk, NY	10/14/97	W Murphy	Montauk, NY	36	08/23/98
31	F Coronato	Old Orchard Lt., NY	04/28/98	A Bombardieri III	Cuttyhunk Is , MA		08/23/98
27	F Laskowski	New Haven, CT	07/12/97	M Criscudlo Jr	E Haven, CT	32	08/23/98
28	A Anderson	Block Is., RI	06/06/98	T Harms	Montauk Pt., NY	29	08/23/98
29	D Kelly	Sag Harbor, NY	06/11/97	P D'Andrea	Montauk Pt., NY	33	08/23/98
24	W Perlman	Atlantic Beach, NY	07/10/98	W Marker	E. Rockaway, NY	24	08/23/98
14	R Wolfskeil	Ipswich, MA	09/20/97	E Gorini	Ipswich R., MA	15	08/24/98
25	R Wolfskeil	Sandy Hook, NJ	10/29/97	M Barton	Newport, RI	30	08/25/98
28	F Dyer	Watch Hill, RI	07/03/97	T Shawyer	Watch Hill, RI	31	08/25/98
26	G Cirnello	Pt. of Sandy Hook, NJ	05/22/96	M Gramse	Montauk Pt., NY	28	08/25/98
37	A LoCascio	Manhasset Bay, NY	05/30/98	G Magnuson	Montauk, NY		08/25/98
26	R Conklin	Moriches Inlet, NY	05/11/98	M Murphy	Hereford's Inlet, NJ	32	08/26/98
32	W Kobel Jr.	Montauk, NY	08/04/98	J Grob	SE Montauk Inlet, NY	33	08/26/98
25	L Gonnello	Sandy Hook, NJ	06/29/98	B Keane	Romer Shoal Lt., NJ	26	08/26/98
26	L Gonnello	Sandy Hook, NJ	07/20/98	B Keane	Romer Shoal Lt., NJ	26	08/26/98
30	G White	Piscataqua R., NH	08/14/98	M Crawford	Kittery, ME	32	08/27/98
22	F Casey	Boston, MA	07/27/98	E Westland	Hull, MA	24	08/27/98
22	T Marburger	Shinnecock Inlet, NY	06/09/96	D Coronesi	Shinnecock Inlet, NY	29	08/27/98
30	T Marburger	Shinnecock Inlet, NY	06/11/96	D Purcell	Montauk Lt., NY	35	08/27/98

Species / Length	Tagger	Place Tagged	Date	Recapturer	Location	Length	Date
26	S Fries	Montauk, NY	08/04/98	L Mule	Montauk Pt , NY	28	08/29/98
25	L Gonnello	Sandy Hook, NJ	07/19/98	T D'Anna	Romer Shoal Lt., NJ	26	08/30/98
26	T Shaheen	Sandy Hook, NJ	06/21/97	T D'Anna	Romer Shoal Lt., NJ	27	08/30/98
16	E Murray	Gloucester Hbr , MA	08/20/98	E Lopez	Gloucester, MA		08/30/98
28	D Kelly	Sag Harbor, NY	05/20/97	P Jansak	Niantic, CT	32	08/30/98
29	C Wilcox III	Moriches Inlet, NY	10/22/97	E Carreiro	Wood End Lt., MA	29	08/30/98
17	A Schweithelm	Asharoken, NY	06/12/97	R Stasinos	Stamford, CT	20	08/30/98
24	W Horner	Island Beach St. Pk., NJ	08/08/97	P Bouchard	Island Beach St. Pk , NJ	29	08/30/98
13	G Morris	Marshfield, MA	06/18/96	D Akerblom	Marshfield, MA	28	08/31/98
29	D Kelly	Sag Harbor, NY	08/05/96	S Witthuhn	Montauk, NY	32	08/31/98
25	A Anderson	Block Is., RI	07/16/97	K Bilodeau	Napatree Pt., RI	28	08/31/98
29	A Anderson	Montauk Pt , NY	10/24/97	S Pike	Saco, ME	31	09/01/98
29	F Casey	Boston, MA	06/15/98	A Mellyn	Quincy Bay, MA		09/01/98
22	J Crawson	Fire Is , NY	11/07/96	J Kane	Bath, ME	24	09/01/98
28	M Fernano	Moriches Inlet, NY	08/05/97	D Lukert	Moriches Inlet, NY	32	09/02/98
36	H Sweet	Block Is., RI	06/23/98	B Wallace	Block Is., RI	36	09/02/98
22	A D'Angelo	Block Is., RI	07/13/97	J DeRosa	Montauk Pt., NY		09/02/98
19	T Shaheen	Raritan Bay, NJ	06/28/96	S Leadbeater	Romer Shoal, NJ	27	09/02/98
24	C Kennedy	Cape May Pt., NJ	11/13/96	J Velez	Sandy Hook, NJ	28	09/02/98
17	H Sweet	Barrington, RI	06/18/98	G Makuck	Barrington, RI		09/03/98
34	H Sweet	Quick's Hole, MA	05/27/98	B O'Connell	Naushon Is., MA	37	09/04/98
30	A Anderson	Block Is., RI	06/20/98	A Weiss	Orient Pt , NY		09/05/98
21	T Marburger	Northport, NY	04/21/98	R Martin	Jamestown, RI		09/05/98
22	A Anderson	Block Is., RI	06/20/98	M Foley	Bourne, MA		09/05/98
29	B Perlman	Atlantic Beach, NY	11/10/96	M Mistina	Montauk Pt , NY		09/05/98
17	R Conklin	Stamford, CT	06/01/97	S Lewin	Sprite Is., CT	21	09/05/98
22	B Perlman	Atlantic Beach, NY	05/13/98	W Perlman	Atlantic Beach, NY	23	09/05/98
18	JC Wright	Ches Bay Brdg. Tun., VA	04/21/98	B Herrick	Ipswich, MA		09/05/98
16	W Anderson	Provincetown, MA	05/08/98	C Johansen	Cape Cod Canal, MA		09/06/98
19	R Grobarz	Monmouth Beach, NJ	04/15/98	G Belanger	Old Orchard Beach, ME	25	09/06/98
27	A Anderson	Montauk Pt , NY	08/09/97	G Bertie	Montauk, NY	27	09/06/98
21	R Locke	Provincetown, MA	07/11/98	B Wotherspoon	Wellfleet, MA	21	09/06/98
20	R Nystrom	Devon, CT	12/02/97	B Welsh	Portsmouth, NH	21	09/07/98
33	D Sowerby	York River, ME	07/30/98	R Hussey	Wellfleet, MA	34	09/07/98
25	C Maxon	Boston, MA	08/11/98	U Fisherman	Boston, MA	29	09/07/98
17	T Marburger	Northport, NY	12/21/97	J Cassidy	Salisbury, MA	18	09/07/98
26	A D'Amato	Cape May, NJ	04/22/98	M Betty	Narragansett, RI		09/07/98
29	S Fries	Montauk, NY	08/04/98	B Carman	Montauk Pt , NY		09/08/98
27	A Anderson	Montauk Pt., NY	06/01/97	C Ruger	Montauk, NY		09/08/98
22	F Stunkel	Stamford, CT	11/18/97	G Devenger	Boothbay Harbor, ME	25	09/08/98
22	A Anderson	Block Is., RI	07/05/98	C Duckworth	Charlestown, RI	22	09/08/98
	D Chase	Napatree Pt , RI	06/20/98	R Langworthy	Watch Hill, RI	18	09/08/98
26	S Fries	Rockaway Inlet, NY	11/29/97	P Crook	Horseneck Beach, MA	28	09/08/98
27	J Della Porta	Swampscott, MA	08/07/97	J Voci	Gloucester, MA	32	09/08/98
17	A Schweithelm	Northport, NY	10/27/96	M Paras	Oyster Cr Power Plant, NJ	25	09/08/98
19	R Allen	Ches Bay Brdg Tun , VA	01/07/98	A Villatoro	Chesapeake Bay, MD	23	09/08/98
25	R Templeton	Block Is., RI	08/30/98	J Stockman	Block Is , RI		09/09/98
17	E Murray	Gloucester, MA	08/22/98	J Matheson	Gloucester, MA	18	09/09/98
19	G Dulka	Ches Bay Brdg. Tun , VA	11/24/96	D Kendall	Worton, MD	21	09/09/98
16	B Gray	Charlestown, RI	06/02/95	W Seaton	East River, NYC	25	09/09/98
26	T Marburger	Shinnecock Inlet, NY	06/09/96	P Jayne	Southampton, NY		09/09/98
20	D Wright	Linkhorn Bay, VA	11/29/96	C Bryan	Ches. Bay Brdg., MD	23	09/09/98
29	W Kobel Jr	Eatons Neck, NY	06/18/98	S Whitting	Montauk Lt., NY	30	09/09/98
20	R Conklin	Moriches Inlet, NY	08/09/98	D Sommerfeld Jr.	Moriches Bay, NY		09/09/98
26	G Ministeri	Cape Cod Bay, MA	07/09/98	A Metcalf	Boston, MA	26	09/09/98
Tautog							
13	JC Wright	Offshr , VA Beach, VA	04/07/98	M Urbanek	Offshr , VA Beach, VA	13	07/03/98
Triggerfish							
15	JC Wright	VA Beach, VA	07/24/98	JC Wright	VA Beach, VA	15	08/13/98
12	JC Wright	VA Beach, VA	07/24/98	JC Wright	VA Beach, VA	12	08/13/98
Weakfish							
15	D Taft	Fire Is., NY	07/15/98	J Montruny	Kismet, NY	15	07/30/98

Book Reviews

HEARTBEATS IN THE MUCK
by John Waldman

The Lyons Press
166 pp. $24.95 (cloth)

New York Harbor is a writer's challenge. Its history is long and replete with Dutchmen, Tories, polluters, shellfishermen, bureaucracies, do-gooders, and users. It's an estuary, a bunch of tributaries, and a drowned river valley. It has sewage and striped bass, muck and mullet, bacteria and bluefish, crud and crabs. It is a shell of its former self and a body of water recovering.

What to do? Record the indignities or the signs of improvement? Waldman does both, and while he calls himself an optimist, he is at his best when he describes the Harbor's environmental stresses. He calls Newark Bay the armpit of the Harbor. Here he is on Newtown Creek, a tributary in Queens: "In September 1891, members of the Fifteenth Ward Smelling Committee embarked on a voyage up the creek to determine the sources of foul odors that permeated their streets. The air became riper as they passed cargo ships, manure scows, a dog pound, and sausage factories where they saw heaps of flesh rotting in open doorways. When they reached the refineries 'the stenches began asserting themselves with all the vigor of fully developed stenches.'" He lists offensive trade establishments located on Newtown Creek: "Barnett Starch Works, Acme Fertilizer Company, Nichols Chemical Works, U.S. & Canada Degreasing Syndicate, manure barges, and, not surprisingly off by itself, a suffocating combination — the night-soil and dead animal wharf."

Waldman describes the metropolitan area before it got trashed — brook trout in Manhattan streams, oysters covering the bottom, fringing wetlands, and swimmable water. And he also lists the signs of a recovery that started around 1965 — better sewers mean higher dissolved oxygen levels and less bacteria contamination and more marine life as the harbor's cul-de-sacs and cleaned up or flushed. Like others who have tackled regions under stress, his is a mixture of anger over what has happened and hopefulness about the future.

The book is extremely well written (Waldman has a nice turn of phrase) and the many illustrations are fine — a cartoon of women in proper bathing skirts holding their noses as they flee floating trash at Coney Island 100 years ago and a photo of NYC cops firing at a shark that blundered into the Gowanus Canal in 1950. This book is a real find.

EVALUATION OF EROSION HAZARDS

The Heinz Center
203 pp. (paper).

To get a copy call Mark Crowell, Project Officer at FEMA 202-646-3432

The subject is coastal erosion, which Heinz tackled under a contract with the Federal Emergency Management Agency (FEMA). The study was published in April 2000. Among the report's conclusions: close to the ocean's edge, property owners face as large a risk from erosion as they do from flooding; about 1500 homes a year (out of the 350,000 built within 500 feet of the edge) will fall in the ocean every year; half of all

structures within 500 feet of the edge are on the Atlantic coast; flood insurance rates should be doubled to be actuarilly sound.

The report makes two general recommendations it says "are cost effective, and are acceptable across most of the political spectrum." (1) Congress should instruct FEMA to develop erosion hazard maps that display the location and extent of coastal areas subject to erosion. The erosion maps should be made widely available in both print and electronic forms, and (2) Congress should require FEMA to include the cost of expected erosion losses when setting flood insurance rates along the coast.

The report is chock full of good data, and conclusions from that data are often persuasive. But the approach may be too timid for some. The federal flood insurance program has been a disaster, and it and the attempts to cure coastal erosion and flooding with beach sand pumping have seldom been in the public interest. Sea level rise is treated but its effects are not clearly put into the equation. Disclosure of erosion hazard maps is fine, but how about flood markers on highway shoulders and truth in shore real estate advertising: "For sale, oceanfront four-bedroom, four-bath colonial (first floor last under water in 1997). "And why should taxpayers continue to subsidize coastal dwellers with federal sand and federally guaranteed insurance? There's a part of the political spectrum — inland landowners — who will continue to wonder how we got into a situation where we reward silly land use with federal subsidies.

THE SECRET LIFE OF FISHES: FROM ANGELS TO ZEBRAS ON THE CORAL REEF

by Helen Buttfield

Harry N. Abrams
72 pp. $19.95 (cloth)

This an amazingly fine book in writing, illustration, and design. The secret to such a success is probably finding a good writer-water colorist who really knows and cares about coral reef fishes (a tough enough job by itself) and then hooking up with a quality publisher, in this case Abrams.

The result is a handsome book for all ages, describing with superb watercolors more than 250 fishes found in and near coral reefs. The illustrations are striking and accurate. But even better, Helen Buttfield has done a wonderful job of describing the intricate behaviors of reef fishes: "The Green Razorfish can escape by changing its color, bending its body to blend into the grass, or dive into the sand, where it keeps on swimming" and "Most gobies, who have no buoyant swim bladders, rest easily on the bottom, their ventral fins often fused into a cupped disc to help hold them fast." And, "The courting dance (of Anthias) begins at dusk, with the supermale performing acrobatic displays for the entire colony. He swims upward in great circles, and drops down in long loops to climb even higher, stimulating the whole population to follow."

This is a worthy read for veteran reef divers as well as those us who will never see a reef but want to learn about its fishlife. Highly recommended.

AGAINST THE TIDE: FATE OF THE NEW ENGLAND FISHERMAN

by R.A. Carey

Houghton Mifflin
381 pp. $23.00 (cloth)

Carey lives with and looks at the intertwined lives of four Cape Cod commercial fishermen and how they are faring in these days of depleted stocks and government restrictions. The men carry on in the face of reduced catches, low prices, bad weather, and the threat of still harsher fishing rules. Whether lobstering, dragging, clamming, or long-lining, nothing seems to be going quite right these days.

Interwoven with the human side are segments on the plight of the groundfish business over the last 30 years and the errors of the Northeast Fishery Management Council and the National Marine Fisheries Service.

As for lobster, that old chestnut about how plentiful they were in colonial days pops up once again..."so common that the General Court of Massachusetts was petitioned ...that indentured servants not be served lobster more than twice a week..." In Connecticut, the story claims it was salmon...whatever.

DKB

ROARING INTO THE ZERO ZEROES

To paraphrase somebody or other, "To err is human, to be partly correct is sublime." The piece below appeared in UNDERWATER NATURALIST, Vol. 18, No. 3, January 1990. It was titled "Roaring into the Nineties." Some of it is frighteningly accurate; the rest is still food for thought (one reference to Kennebunkport, Maine, I have left out because it was dated and parochial). Otherwise, read it and weep. If any readers feel like trying out the next 10 years, send us your best shot.

The beginning of a decade is always a good time to look ahead, think good thoughts, and maybe even gaze into the crystal ball. These may be some of the environmental happenings of the next 10 years:

Something strange and disgusting will wash up on a beach somewhere in the US. It will probably be made out of plastic.

A permanent driftnet will be stretched from the Aleutian Islands to Fiji.

The fish oil that was supposed to be good for humans will be declared unfit for human consumption.

The Giant Jack Company of Cleveland will get permits to elevate east coast barrier islands as sea level rises.

Government officials will downgrade the importance of acid rain even as a new species of fish — the vinegar sole — establishes a niche in Chesapeake Bay.

Interstate Realty will build a marsh on top of Mt. St. Helens to replace filled wetlands in South Carolina.

The following striped bass regulation will be adopted: recreational anglers will be allowed one striper in each month ending in the letter "r" if the fish is a male between 29.5 and 30.25 inches long. Commercial fishermen will be allowed to paint black stripes on any herring species and sell them as striph-errs.

Midst great hue and cry, an oil tanker will run aground and spill. Meantime, 80 million happy motorists will pour used motor oil down storm drains without a whimper.

When axed, the last old growth tree in the Pacific northwest will fall across and dam the last stream supporting a natural salmon run.

The Pentagon and the Corps of engineers will get together to sponsor the completion of the Cross Florida Barge Canal for "national security and flood control."

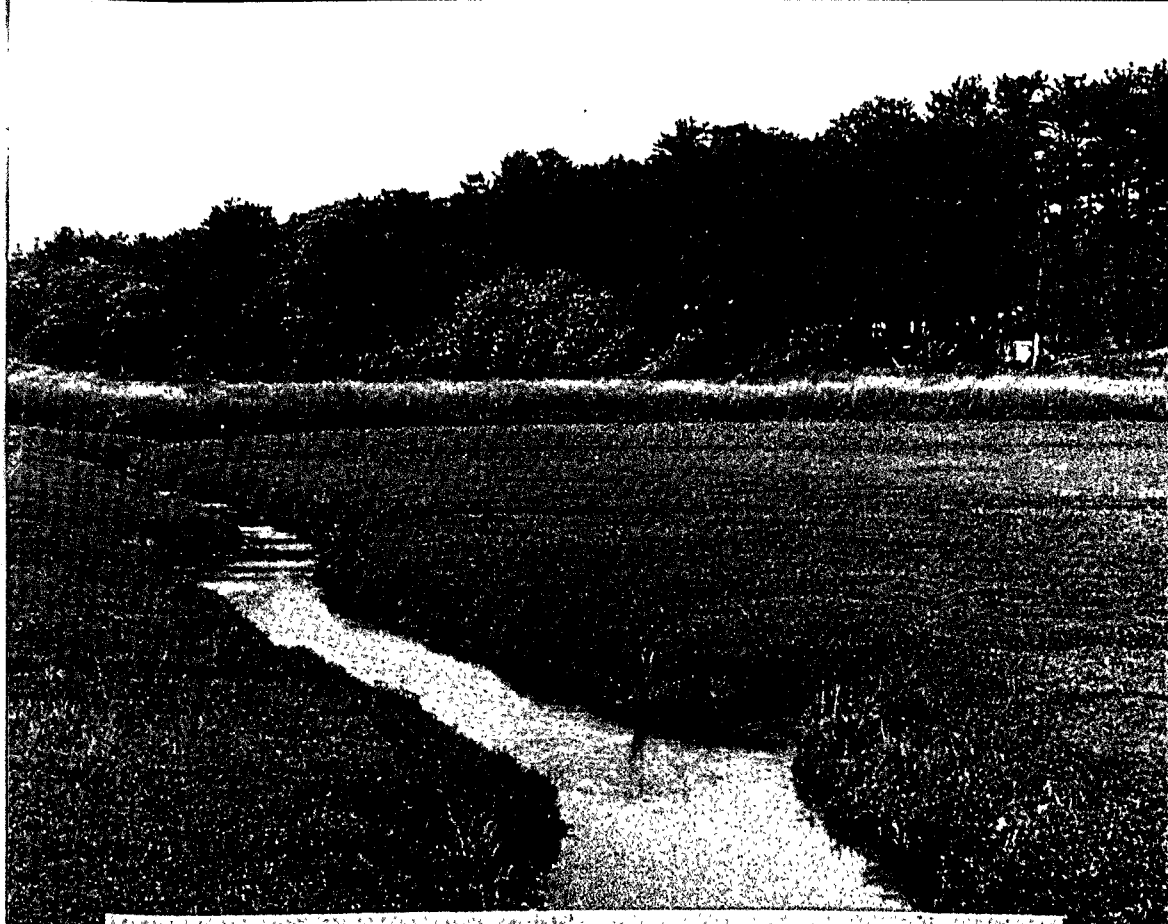
A hurricane will strike the Atlantic coast. Damage will total several billion dollars. Surprise will be expressed.

A West German pair trawler will net the world's last haddock, Latitude 41 50 north, Longitude 66 20 west, just east of Georges Bank.

An inventor will announce a new, foolproof method for preventing beach erosion, a system made up of cinder blocks, chicken wire, old sewer pipe, discarded Big Mac wrappers, and $2 million, the latter to be provided by a state agency.

By the end of the decade 140 percent of the US population will live within 16 feet of the coast's high tide line.

D.W. BENNETT



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.

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