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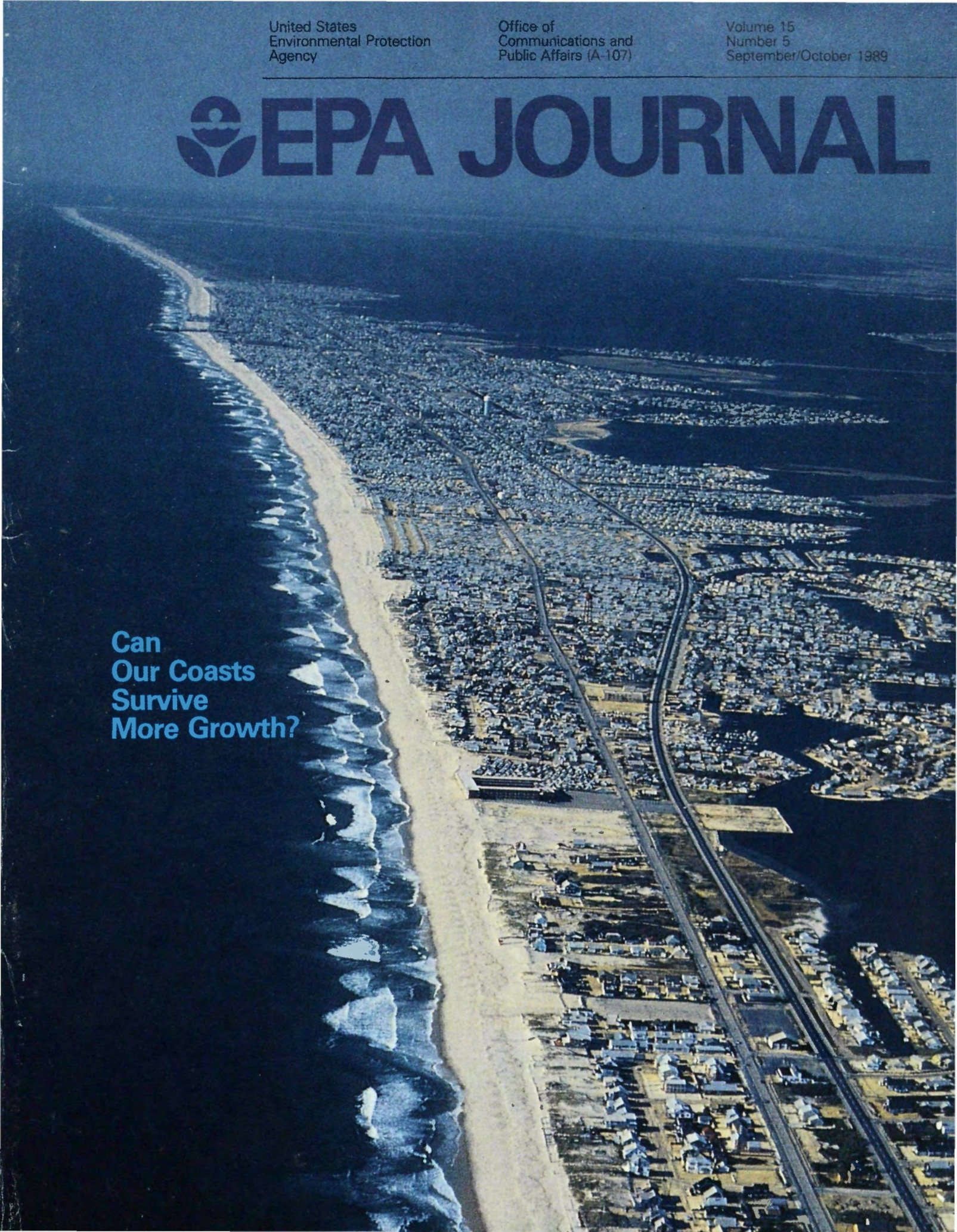

Can Our Coasts Survive More Growth?

Can Our Coasts Survive More Growth?

From closed shellfish beds to vanishing marshes: our coastal environmental problems include more than medical syringes on the beach. *EPA Journal* explores why these ecologically vital areas are in trouble and what can be done about it.

To set this issue of the *Journal* in context, a leadoff article describes the phenomenon of Americans moving, lemming-like, to coastal areas—some to vacation and many to live year-round—and the squeeze this is putting on the natural environment.

EPA Administrator William K. Reilly declares a no-nonsense policy toward the environmental problems that are plaguing our coastal zone. The Agency, he explains, will be very tough on coastal and marine pollution. A side piece spells out EPA's coastal laws and programs.

Next is a forum in which seven observers from different vantage points answer a question that inevitably arises regarding the nation's coastal environmental situation: can these areas tolerate more growth and still maintain their ecosystems?

Articles then discuss three key features of the coastal environment and the ways in which the surge of growth is affecting them. The first piece focuses on estuaries, the mixing zones between fresh and salt water that include many bays and lower-river areas. The second item focuses on coastal wetlands. And the third piece focuses on beaches and recent findings about waste on these sandy strips.

Skip Brown photo Sea Grant College, University of Maryland

An article then raises the question, is the nation focusing on the right targets in its urgent efforts to stop the pollution that has been showing up along the coasts?

Next, writers in a second forum discuss Maryland's nationally unique initiative to protect a coastline—in this case, that of a major estuary, the Chesapeake Bay. The question posed to these observers is: do the land-use controls in Maryland's critical area protection program represent an effective approach to protecting coastal resources?

A view from Congress on the steps that the nation should take to rescue its coastal environment is presented by Congressman Gerry E. Studds (D-Mass.), Chairman of the House Subcommittee on Fisheries and the Environment.

Five articles follow on particular situations that relate to this issue's theme of the crunch between human activities and natural resources in near-coastal environments. The pieces focus on Louisiana's ongoing coastal wetlands loss, largest in the nation; the story of a Virginia barrier island threatened by development; the successful revival of a marsh in the San Franciso Bay area; the clash between erosion and development in many coastal areas; and the attack now under way on pollution in the Gulf of Mexico.

Then, taking a step back from the current situation, an article provides a historical perspective on the heavy growth along U.S. coasts.

Concluding the articles on coastal issues is a feature on the "people power" now at work to help get a handle on the pollution.

Then a nontheme article reports on the Superfund cleanup of a radioactive hot spot in New York City. And the magazine concludes with a regular feature—Appointments. □

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EPA is charged by Congress to protect the nation's land, air, and water systems. Under a mandate of national environmental laws, the agency strives to formulate and implement actions which lead to a compatible balance between human activities and the ability of natural systems to support and nurture life.

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Front Cover: An aerial view of the New Jersey shoreline, looking south. Highly developed barrier islands and back bays stretch into the distance on the right; on the left, the Atlantic surf and beach. Photo by Mike Yamashita for Woodfin Camp.

Design Credits: Ron Farrah; James R. Ingram; Robert Flanagan.

The next EPA Journal will profile environmental success stories.

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A Prologue

Along the eastern coast of North America, from the north where ice packs grate upon the shore to the tropical mangrove swamps tenaciously holding the land together with a tangle of roots, lies a green ribbon of soft, salty wet, low-lying land, the salt marshes . . . .

The undisturbed salt marshes offer the inland visitor a series of unusual perceptions. At low tide, the wind blowing across *Spartina* grass sounds like wind on the prairie. When the tide is in, the gentle music of moving water is added to the prairie rustle. There are sounds of birds living in the marshes. The marsh wren advertises his presence with a reedy call, even at night, when most birds are still. The marsh hen, or clapper rail, calls in a loud, carrying cackle. You can hear the tiny, high-pitched rustling thunder of the herds of crabs moving through the grass as they flee before advancing feet or the more leisurely sound of movement they make on their daily migrations in search of food. At night, when the air is still and other sounds are quieted, an attentive listener can hear the bubbling of air from sandy soil as a high tide floods the marsh.

The wetlands are filled with smells. They smell of the sea and salt water and of the edge of the sea, the sea with a little iodine and trace of dead life. The marshes smell of *Spartina*, a fairly strong odor mixed from the elements of sea and the smells of grasses. These are clean, fresh smells, smells that are pleasing to one who lives by the sea but strange and not altogether pleasant to one who has always lived inland.

Unfortunately, in marshes which have been disturbed, dug up, suffocated with loads of trash and fill, poisoned and eroded with the wastes from large cities, there is another smell. Sick marshes smell of hydrogen sulfide, a rotten egg odor. This odor is very faint in a healthy marsh.

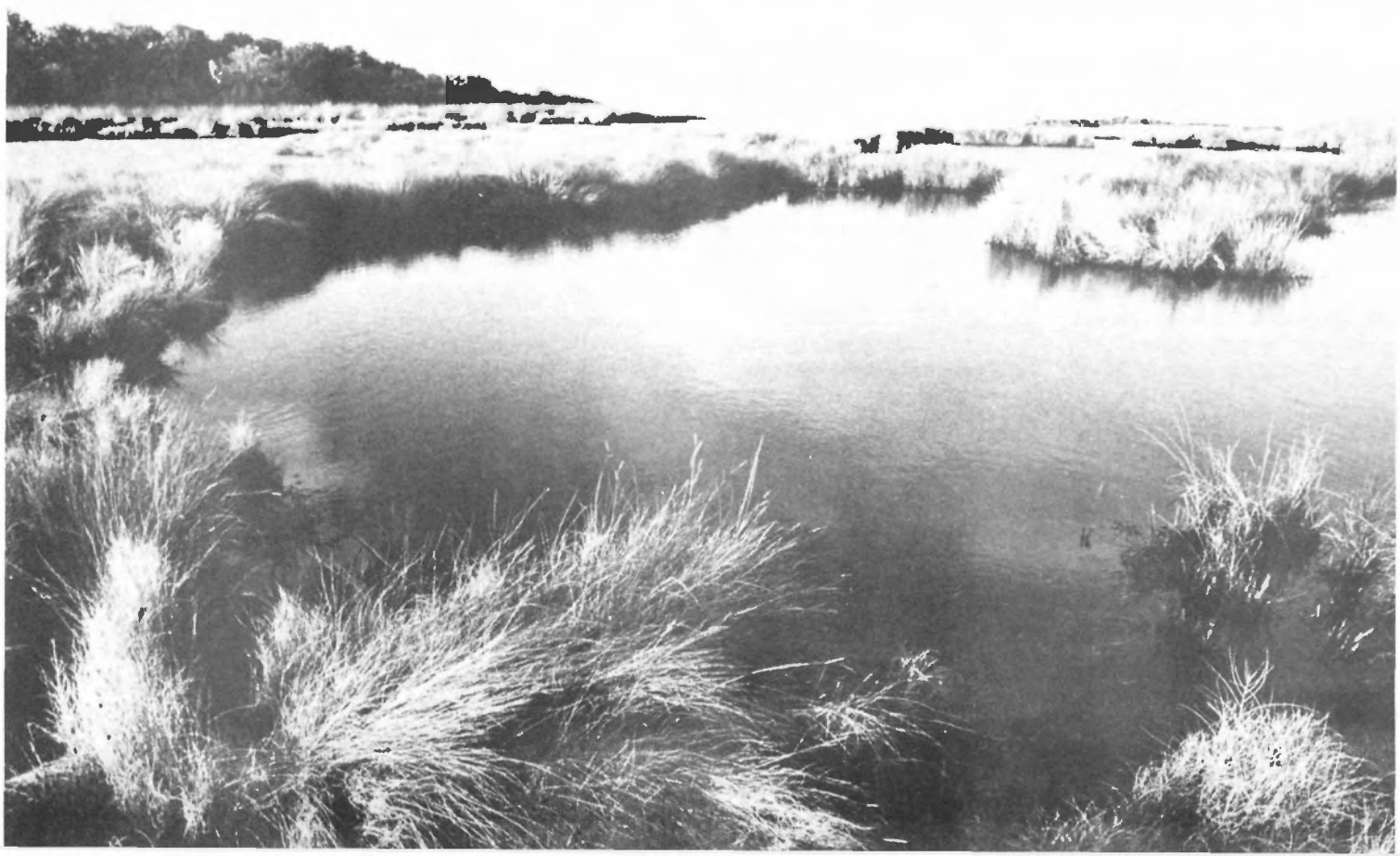
As the sound and smell of the salt marsh are its own, so is its feel. Some of the marshes can be walked on, especially the landward parts. In the north, the *Spartina patens* marsh is covered with dense grass that may be cut for salt hay. Its roots bind the wet mud into a firm surface. But the footing is spongy on an unused hay marsh as the mat of other years' grass, hidden under the green growth, resists the walker's weight and springs back as he moves along.

In the southern marshes, only one grass covers the entire marsh area, *Spartina alterniflora*. On the higher parts of the marsh, near the land, the roots have developed into a mass that provides firm footing although the plants are much more separated than in the northern hay marshes and you squish gently on mud rather than grass. It is like walking on a huge trampoline. The ground is stiff. It is squishy and wet, to be sure, but still solid as you walk about. However, jump and you can feel the ground give under the impact and waves spread out in all directions. The ground is a mat of plant roots and mud on top of a more liquid layer underneath which gives slightly by flowing to all sides when you jump down on it . . . .

Down toward the creek, where the mud is watered at each tide, the soil is as muddy as you can find anywhere. When you try to walk across to the water at low tide, across the exposed mud where the marsh grass does not yet grow, hip boots are not high enough to keep you from getting muddy. The boots are pulled off on the first or second step when they have sunk deep into the clutching zone. There are no roots to give solidarity, nothing but the mud and water fighting a shifting battle . . . . □

—*From John and Mildred Teal's* Life and Death of the Salt Marsh *(1969). Reprinted by permission of the authors.*

Skip Brown photo Sea Grant College, University of Maryland



Trouble in Paradise

by Jack Lewis

Maryland Office of Tourist Development.

The lure of this Ocean City, Maryland, inlet is a chance at catching flounder, sea bass, and sea trout.

Media attention was drawn to the problem of coastal deterioration during the summer of 1987 when garbage and dead fish began to appear on U.S. beaches. But public opinion was not really galvanized until the middle of 1988 when used hypodermic needles, surgical gloves, and other forms of medical waste—wrongly feared to be AIDS-related—started to wash up on Eastern shorelines. The consensus formed last summer has since gained added momentum as a result of the shocking series of coastal oil spills that have dominated the headlines in the first half of 1989.

New human communities, once settled, become daily sources of pollution that continue to degrade already traumatized ecosystems.

Environmental scandals need environmental culprits, and in these cases, like so many Adams trapped in an increasingly trashy Eden, human suspects have not been hard to find . . . *in their ones and in their millions.* The recent history of America's coastlines has been a story of too-big populations and too-rapid development, and the environment is now paying a heavy price.

According to demographers, Americans have since World War II been moving in greater and greater numbers to the nearest major body of water: whether to the shoreline of the Atlantic Ocean, the Gulf coast, or the Pacific Ocean. Already more than half of the U.S. population—52.9 percent as of 1987—live within 50 miles of the coast, where people are densely packed—especially in the East—onto less than 10 percent of the nation's land.

Experts differ over the exact speed of growth and the exact definition of "coastal area." For instance, the figure just cited mixes numbers from the expanding saltwater sea coasts with numbers from the declining freshwater Great Lakes. Nevertheless, all experts agree that the population of U.S. sea coasts is rising in absolute terms and will continue to rise in virtually all regions in the years ahead.

Dr. Steven F. Edwards of the National Oceanic and Atmospheric Administration Northeast Fisheries Center predicts that by the year 2000, U.S. population clustered along the sea coasts will rise, but only to 53.5 percent of the national total. Others, conjuring up the image of a lemming-like surge to the sea, claim that 75 percent of U.S. citizens already live in coastal communities, with another five percent to follow by 2000.

No analysts, whether conservative or apocalyptic, deny that there is already a serious problem of overcrowding in certain highly popular coastal locations, especially in the Northeast, the mid-Atlantic, Florida, and Southern California. Our focus here, and in the rest of this issue of *EPA Journal*, will be strictly on areas such as these: the portions of America's saltwater shorelines that have proved most fatally attractive to transplanted city-dwellers.

Paradise Lost

To such once-pristine coastal environments, new inhabitants—some of them permanent residents, some just weekend or vacation visitors—have brought large-scale, quasi-urban construction and with it, large-scale, quasi-urban pollution. As a result, many overdeveloped areas have—in a genuinely vicious cycle—lost the very charms that once made them lucrative tourist attractions and treasured natural wonders: abundant fishing grounds, exquisite scenery, healthy air, and clean water. The situation is already such that on any given day, one-third of U.S. shellfish beds are closed to fishermen, whether sport or commercial.

What we are witnessing now in the most popular coastal communities is, in a certain sense, a recapitulation of the decades of rapid urbanization and population growth that fell like a bomb

(Lewis is an Assistant Editor of EPA Journal.*)*

Full speed ahead.

©Scott Taylor photo. Duke University Marine Laboratory.

on the ecospheres of America's greatest cities early in the 20th century. Urban patterns of development differ, however, from what most sea coasts are witnessing today.

The near-coastal development boom has erected few cities but many a cluster of houses, stores, offices, and marinas near saltwater coastlines running from Kennebunkport on down the most attractive parts of the East Coast, then continuing around the peninsula of Florida and parts of the Gulf coast, as well as from San Diego up to San Francisco—and perhaps someday soon from San Francisco to Seattle.

With the exception of Miami, Tampa, Orlando, Virginia Beach, San Diego, Long Beach, and Santa Monica, not many cities have emerged from this diffused development pattern; on the other hand, a great many coastal towns have increased in size, and many small communities have sprung up. This pattern has spared the environment the worst intensity and scale of urban pollution, but it has subjected a disproportionately large area of the near-coastal world to disruptive human settlement.

New human communities, once settled, become daily sources of pollution that continue to degrade already traumatized ecosystems. The sources of pollution within the immediate coastal environment are already enormous in scale, and constantly growing. Each day 900 sewage treatment plants discharge 9.5 billion gallons of effluent directly into estuaries and near-coastal waters. Another 3.2 billion gallons are discharged each day by over 1,300 commercial and industrial facilities.

In some areas, nonpoint-source pollution causes even greater problems than pollution from point sources. Point sources, since they are large, can be easily located, and thus regulated. Nonpoint-source pollution, on the other hand, originates in thousands of hard-to-pinpoint places. Most often, it takes the form of toxic run-off from city streets, suburban developments, or agricultural land.

Some of the environmental trauma is externally inflicted. Near-coastal environments, because of their proximity to big cities located slightly inland, become sinks for large quantities of pollution discharged from urban point sources, such as municipal sewage treatment plants, industrial facilities, and hazardous waste disposal sites. Many of these are located miles upriver from the coastal communities in question, but still within polluting range. Many nonpoint problems also start far upstream from sea-coast communities, forming a poisonous legacy bequeathed by America's older urban jungles to her new beachfront "paradises."

Paradise Described

The media have spoken primarily of the threat to U.S. beaches and the scenic waters that pound against them, but it is impossible to generalize about sea-coast environments without mentioning two other kinds of watery environment: wetlands and estuaries. Together with beaches, they form a trinity of interdependent ecological entities that constitute the key components of near-coastal environments. It would do well to examine each in turn:

- Beaches are the sandy stretches of coastal real estate dear to millions of Americans as a recreational haven. They—and the salt water adjacent to them that lies over the inner portion of the continental shelf—are so magnetic to tourists that their most alluring attributes have in many cases been compromised.

When sewage effluent, industrial waste, and other pollutants foul beach areas, it is sometimes necessary to terminate swimming privileges for brief

periods of time. However, the everyday threat to the health of ocean bathers is, in general, less than the media and public opinion have recently chosen to imagine. This is largely because swirling ocean currents keep polluted sediments and bacteria from settling on the skin, and therefore from causing lasting damage.

A more real—and more visible—beach problem is the detritus washed ashore from vessels that have sloppy loading practices or throw used fishing gear and galley garbage into the sea, as well as from combined sewer overflows that pipe a strange variety of waste, including medical items, into the fragile ocean. The scope of the debris problem is indicated by the experience of the 47,500 volunteers who worked in "Coastweeks" clean-up activities in 1988: they found, catalogued, and disposed of nearly two million pounds of debris along 3,500 miles of shoreline (see article on page 23).

- Wetlands—habitats transitional between terrestrial and aquatic systems—are today highly valued as havens for fish and wildlife. Most U.S. wetlands—95 percent—are inland, freshwater wetlands, usually on or adjacent to agricultural property. Coastal wetlands, on the other hand, are saltwater or brackish enclaves subject to fluctuation with ocean tides. As a result of intense regulatory scrutiny, coastal wetlands are today fairly stable, except in the endangered Louisiana Delta, which is the site of 40 percent of the existing tidal wetlands in the United States (see article on page 37). However, future trends such as the Greenhouse Effect could spell the ruin of wetlands that now seem well-protected.

- Estuaries are meeting places between river and sea: the partly salty, partly freshwater area where the wide, lower region of a river finds its currents met and influenced by the tides of the sea. Renowned for their abundance of fish and wildlife, and their enormous economic value to man, estuaries are unusually susceptible to pollution. Not only are they frequently downstream of major cities, and thus on the receiving end of inland, urban pollution, but a peculiarity of their own currents in many cases prevents them from flushing all but a small portion of that pollution out to sea.

In most estuaries, fresh surface waters have an outward, seaward current, and initially they carry a majority of estuarine pollution in the form of freshwater run-off. Those contaminants start to sink in the estuary as they become attached to sediment particles, but then their outward flow is reversed when they are hit by heavier, saltier bottom waters that have a net flow landward. As a result, many pollutants remain trapped in estuaries and never reach coastal waters, with disastrous long-term effects on water quality.

The situation is already such that on any given day, one-third of U.S. shellfish beds are closed to fishermen, whether sport or commercial.

Among America's most famous—and most polluted—estuaries are Long Island Sound in New York, Chesapeake Bay in Maryland, San Francisco Bay in California, and Puget Sound in Washington State. Plagued by problems such as sewage spills, fertilizer run-off, and toxic contamination, these and other estuaries were the target of state and local clean-up efforts in the 1970s and 1980s. In 1985 they also provided the impetus behind the formation of EPA's National Estuary Program (see article by Tudor Davies on page 15).

Paradise Explained

Our improved knowledge of beaches, wetlands, and estuaries is the result of scientific advances that have occurred during the past decade. This new emphasis on the science of near-coastal ecology marks a departure from earlier years when it was fashionable for scientists to focus on deep ocean waters. The shift of attention nearer to shore has enriched various types of applied science that are relevant to the needs of the government regulators who are now trying to save near-coastal environments.

What are a few of the new insights this scientific work has engendered? Experts now realize that estuarine ecosystems differ distinctly from freshwater and open-ocean systems in that they act as sinks, trapping toxins from land, rivers, and streams. The peculiarity of their currents has already been described; what needs to be emphasized here is the type of impact toxics and other pollutants have when they become trapped in these sinks.

Scientists now believe that impact to be cumulative, both in the soil sediments that often first absorb the pollutants, and in the living organisms later exposed to pollutants environmentally and through the food chain. While studying this impact over the past decade, EPA scientists have developed an improved knowledge of the ways that ingestion of contaminants affects living organisms.

First, "bioaccumulating" in the tissues of fish, shellfish, and birds, these toxins sometimes cause smaller birth size and birth defects. Then, if these animals are in turn consumed by other animals, the effects of their bioaccumulated contaminants are "biomagnified"; in other words, their harmful effects are amplified in direct proportion to body weight. Because the contaminant impact often comes simultaneously from different, interacting pollutants, EPA now assesses ecological risks by

Homes on canals at West Palm Beach, Florida. Elbow room along our coasts is diminishing.

conducting whole-effluent toxicity tests rather than working strictly on a chemical-by-chemical basis.

Another area of intense scientific scrutiny in recent years is the phenomenon of "eutrophication," overgrowths of algae blooms caused by organic nutrients purveyed by fertilizer run-off, septic leakage, sewage effluents, and manure run-off from farms and feedlots. This nitrogen and phosphorus "enrichment" stimulates explosive growth of aquatic plants, particularly algae, in near-coastal waters. The decay of these plant masses when they die consumes dissolved oxygen in the water and reduces oxygen availability for other marine life. In addition, major algae blooms can restrict light penetration into the water and with it the vital process of photosynthesis.

"Red tides" are another phenomenon of great concern to scientists specializing in near-coastal ecology. These bizarre occurrences, great waves of algae that have been the cause of numerous beach closures, are caused by sudden population explosions of dinoflagellates (zooplankton). Dinoflagellates, which are toxic to some fish, dolphins, and whales, also cause harmful reactions when ingested by people.

Another problem scientists are studying is habitat loss, a crisis threatening near-coastal fish and wildlife. Acres of housing, stores, and offices now occupy environments where birds, fish, and other wildlife once thrived. Other natural habitats have been irrevocably altered by the dredging of channels, the construction of dams, and the diversion of fresh water for purposes of irrigation and drinking. Scientists are studying the adaptations that affected species are making to this endemic habitat loss.

In addition, two larger threats to the coastal environment now appear to be underway: the Greenhouse Effect and stratospheric ozone depletion. Of course, it is significant that both these phenomena have been blamed primarily on human technology and development. However, in both these cases, the root causes are not to be found simply in the immediate vicinity of the sea coasts but throughout the industrial world. As a result, science has had to throw its net extremely wide to get a handle on what is happening.

Scientists are now predicting that the Greenhouse Effect will melt polar ice-caps and raise coastal sea levels roughly three and one-fourth feet by the year 2100. If these predictions prove valid, the net result will be inundated beaches and wetlands, and destruction of shoreline environments in estuaries. A sea-level rise of this magnitude would destroy 30 to 70 percent of U.S. coastal wetlands and intrude several miles into the already eroding Louisiana Delta. Such a development would bring an end to the relative stability those crucial environments now enjoy in places other than Louisiana.

In addition, two larger threats to the coastal environment now appear to be underway: the Greenhouse Effect and stratospheric ozone depletion.

Beaches would not come off any better than wetlands. A sea-level rise of even one foot would erode beaches 50 to 100 feet from the Northeast to Maryland, 200 feet in the Carolinas, 100 to 1,000 feet along the Florida coast, and 200 to 400 feet in California. This would wreak havoc with beachfront recreation, since today's average commercial beach in the United States is a mere 100 feet wide.

The cycles set in motion could be not only self-sustaining but self-amplifying. It is, for instance, an acknowledged fact that the oceans absorb much of the carbon which, in excess quantities, is linked to the higher temperatures of the Greenhouse Effect. In performing this vital function, the oceans become warmer; some experts now fear that any further warming could alter worldwide weather patterns to an extent even more radical than Greenhouse experts have already predicted.

One more habitat change—this one also global in scale—is expected to make beaches less attractive places to be: namely, stratospheric ozone depletion. Proliferation of chlorofluorocarbons and other chemicals has been eating away at earth's protective layer of stratospheric ozone, the gas that shields us from the most deadly of the sun's rays. Already doctors are reporting higher incidences of serious skin cancers. With each passing day, the American fad for sun-bathing—whatever its cosmetic selling points—is beginning to look increasingly dubious from a health standpoint.

In addition, stratospheric ozone depletion will permit excessive quantities of ultraviolet radiation to penetrate near-coastal waters. This will slow down photosynthesis and deplete production of much-needed forms of vegetation, such as phytoplankton. The long-term effect of this trend, especially near the equator, will be to foster new species of ultraviolet-resistant algae. An evolutionary change of this nature would have an unforeseeable impact on the food chain as a whole, including the health of the human consumers at its pinnacle.

Such a trend would, however, certainly hasten the Greenhouse Effect, because killing off non-resistant

South Florida Water Management District photo, West Palm Beach.

algae would mean a shortage of marine organisms on the surface of the water—the very organisms most needed to absorb the excess carbon thought to cause the Greenhouse Effect.

Paradise Regained?

The challenge between 1989 and the end of the century is to work toward approaches to coastal development that will protect the health both of its human inhabitants and of the environment as a whole, with all its diverse forms of life. A large part of that work will have to be done at the state and local levels of government, which stand in a very real sense at the cutting edge of conflict between development pressures and conservation values.

The State of Maryland, in particular, has been a pioneer in this kind of work, and not just through its participation in the Chesapeake Bay Program. Maryland's "critical area program," which has drawn national attention, provides a specific framework that communities can use to control the adverse effects of land use on wildlife habitats and water quality (see forum on page 29). Other states are now following suit, sometimes alone, sometimes in concert with their neighbors.

EPA's role is to set national policy for coastal waters, wetlands, and estuaries (see box on statutes, page 10) as well as specific regulatory requirements governing the discharge of pollutants. The Agency also intervenes in serious situations that are either multi-state or too large for an individual state to handle, such as the Chesapeake Bay or the Gulf of Mexico (article on page 46). Dealing with these situations requires EPA to cooperate with officials of local and state government as well as often skeptical, even hostile, members of the business community.

In recent years, much has been learned in various localities from the process of working together to combat coastal pollution. As a result, a consensus is now slowly emerging about which strategies for coastal management are successful, and which are not. Now is the time to share that information more broadly at all levels of business and government.

A few of the more widely discussed strategies include pollution prevention (waste reduction, recycling, pretreatment, etc.), adoption of cross-media and cross-boundary "systems" thinking, volunteerism, land-use planning, community consensus-building, tax incentives, user fees, and monitored private-party land acquisitions. Each of these approaches accepts the reality of expanding socio-economic development along the nation's shorelines but tries to protect the ecosphere through artful balancing of self-interest and the public interest. They all operate on the premise that unless the proper balance is achieved, all will be losers; if it is achieved and sustained, all will be winners.

Needless to say, such tactics will have to be used in conjunction with a degree of good old-fashioned coercion if true enforcement is to occur, as EPA Administrator William Reilly has vowed that it will. Enforcement is vital, for without it, airy ideals and ambitious proposals come to nothing. Any slackness in that area would mean that the development pressures now barraging our nation's coastlines will continue to be an onslaught.

The loss will be grievous if developers continue to win too many battles in the war for coastal supremacy, and that loss will be felt not just in economic and ecological terms, but also—and very keenly—in an aesthetic sense. People who have sought refuge from the air-conditioned nightmare of big-city life do not relish the prospect of becoming trapped in a salt-air nightmare: an ugly new world of narrowing, littered beaches . . . algae- and sewage-laden surf discolored to a sickening brownish-red . . . overly salty wetlands devoid of many once-familiar varieties of fish and birds . . . once-thriving estuaries hovering helplessly on the brink of death.

Only by striking—and sustaining—a proper balance between man and nature can the economies and the ecospheres of America's sea coasts continue to be life-sustaining sources of plenty. But an added effort will be needed, a further infusion of creative foresight and planning, if they are to remain bastions of that strangely satisfying serenity that man has always sought—and found—by communing with nature at the ocean's edge. □

Getting Tough on Coastal Pollution

by William K. Reilly

Skip Brown photo Sea Grant College, University of Maryland

To protect our oceans, EPA will be enforcing anti-pollution rules like Captain Bligh, says the EPA Administrator

(Reilly is Administrator of EPA.)

Ocean dumping, closed beaches, coastal development, oil spills, trash washing up on our shorelines—all these have produced a tidal wave of indignation among Americans. For too long there has been an imbalance favoring economic development over ecological protection of our nation's coastal areas. An emerging national consensus says that we must now tip the scales towards ecological protection.

Fortunately, we have already started at EPA. EPA is working with states to reduce the ocean and coastal discharges of industrial and wastewater treatment facilities. We are also working with states to eliminate virtually all ocean dumping of raw sewage or sewage sludge through outfall pipes. Deep-sea dumping of municipal sludge is being phased out, and the ocean has been closed to industrial dumping, waste incineration, and radioactive waste disposal. Despite this progress, it is becoming clear that all of us—citizens, businesses, municipalities, states, EPA, and other federal agencies—must do even more to protect our coastal areas.

EPA's National Coastal and Marine Policy

Responding to the need for more action to protect our coastlines, my predecessor Lee Thomas unveiled EPA's National Coastal and Marine Policy on January 18, 1989. That policy articulated a set of goals critical to the protection of the near-coastal environment. The policy states:

> The Environmental Protection Agency will protect, restore, and maintain the nation's coastal and marine waters to protect human health and sustain living resources. We will take actions to further reduce pollution of these waters and limit the effects of increasing coastal populations. Future uses of these resources that are vital to the nation's growth, economy, and security can and must be conducted in an environmentally sound manner.

To ensure that this policy produces real environmental improvements, EPA has set five goals:

- Recover the recreational use of *all* our shores, beaches, and coastal waters by reducing sources of contamination, plastics, and debris.
- Restore and protect our shellfisheries, saltwater fisheries, and other wildlife habitat by controlling pollution and causes of habitat degradation and loss.
- Stop wastes from entering coastal waters by stepping up enforcement of ocean dumping laws, reducing the amount of waste that our society generates, and improving coastal land use.
- Improve our economic and scientific understanding of coastal ecosystems by expanding research and monitoring.
- Lead other nations in protecting the world's oceans by aggressively promoting international treaties and cooperation.

These broad goals provide a blueprint for action by all levels of government. EPA will follow this blueprint. When actions are the sole responsibility of EPA, this Agency will move aggressively. When actions are the shared responsibility of other federal agencies, we will work with them to assure a coordinated approach. When actions are the responsibility of state and local governments, we will persuade, encourage, and support them in their efforts.

EPA's Responsibilities

EPA's coastal protection efforts are being implemented through the Agency's coastal and marine programs: the Chesapeake Bay and Great Lakes Programs; the National Estuary Program; the Regional/State Coastal Water Strategies; and special initiatives like the Gulf of Mexico Program, the Mid-Atlantic Bight Initiative, and the Ocean Dumping Program. These programs emphasize taking quick action to achieve specific environmental results in places with special problems.

EPA can do much more to improve enforcement of its own regulations. In fact, as far as ocean waters are concerned, we are going to start enforcing like Captain Bligh. I gave my first speech as EPA Administrator to the National Association of Attorneys General. I said that polluters would be prosecuted to the full extent of the law. I mean it.

For too long there has been an imbalance favoring economic development over ecological protection of our nation's coastal areas.

EPA is going to increase the pressure to end all ocean dumping of waste. The dumping of industrial waste has been stopped, and we will not issue any new permits. The dumping of sewage sludge will be illegal after 1991; any dumping thereafter will result in heavy penalties. In short, we will use all the enforcement tools at our disposal to make the ocean a no-dumping zone.

The President fully endorses this emphasis on enforcement. He has made strong, vigorous enforcement of the law one of his major environmental principles. The President is also working to toughen environmental laws to eliminate, at the source, the wastes that often end up in marine environments. The President's proposed Clean Air Act Amendments, for instance, would sharply reduce the tons of airborne toxic emissions that currently contribute to pollution in the Great Lakes.

In addition, because EPA is now committed to stopping pollution before it becomes a problem, our pollution prevention efforts will eventually result in redesigned or reformulated consumer products and packaging. Designing reusable products and biodegradable packaging has the potential to reduce greatly the amount of waste that currently is illegally dumped at sea and washed ashore.

Working with Other Federal Agencies

EPA is not the only federal agency responsible for enforcing ocean-protection laws. The Departments of Agriculture, Commerce, Defense, and Interior all have important responsibilities that directly or indirectly affect the quality of the coastal environment. A number of federal agencies within those departments—the Army's Corps of Engineers and the National Oceanic and Atmospheric Administration, to name just two—have major roles to play in protecting coastal habitats.

It is absolutely essential that EPA build partnerships with these and other agencies to advance the cause of coastal protection. A good example of this kind of partnership is a recent interagency meeting held at the White House. President Bush called together all federal agencies involved in wetlands protection to formulate a coordinated approach for carrying out his pledge to achieve no net loss of wetlands. I have every confidence that this interagency effort will lead to strong, effective action.

EPA intends to work closely with other federal agencies on other coastal issues as well. For example, we are going to ask the Department of Defense if coastal military bases scheduled for shutdown might be set aside as parks or ecological preserves. EPA is already working with the Corps of Engineers to develop new strategies for disposing of dredged materials in ways that will protect water quality. An EPA standing committee has been formed to oversee how well we are working with other agencies to protect the coasts.

Working with State and Local Governments

The federal government, of course, does not work in a vacuum. Therefore, EPA will do everything it can to support the involvement of state and local governments and citizens. We want to encourage efforts like Washington State's Puget Sound program, in which strong state leadership and grassroots support helped to control point- and nonpoint-source pollution, protect

shellfish resources and wetlands, and manage contaminated sediments. We want to encourage efforts like the Narragansett Bay project, where citizens fought to limit development that would degrade the Bay. We want to encourage efforts like Maryland's critical area program, the first state program to confront the effects of land use on water quality and wildlife habitat.

In fact, greater state and local attention to land use along all stretches of the nation's coasts is urgently needed. What happens on the land has a direct and substantial effect on what happens in the water. I think this country can do a better job balancing economic development with environmental protection. The commitment to economic progress is unquestioned. Yet, to quote the President: "Pollution *is not* the inevitable byproduct of progress .... Sound ecology and a strong economy *can coexist.*"

I think we can do a better job balancing economic development with environmental protection. I invite state and local governments, businesses, and grassroots organizations to work with EPA to set the balance right.

All of us *must* work together to protect that fragile ribbon of land and water on which so much of our economy—so much of our well-being—depends. We all gain if we work together; we all lose if we do not. □

COASTAL PROTECTION LAWS

• Under the **Clean Water Act of 1977** as amended by the **Water Quality Act of 1987**, EPA is responsible for:

—Coordinating the **National Estuary Program**, which oversees the development of comprehensive management and action plans by state, local, and federal agencies to restore and protect nationally significant estuaries.

—Regulating industrial discharges and publicly owned sewage treatment facilties under the **National Pollution Discharge Elimination System**, which governs point-source pollution.

—Controlling nonpoint-source pollution, such as agricultural and storm-water run-off.

—Overseeing the **Chesapeake Bay Program**, the purpose of which is to enhance and preserve the Bay and its basin.

—Protecting wetlands and other waters by co-administering, with the U.S. Army Corps of Engineers, a permitting program that regulates the discharge of dredged or fill material into waters of the United States.

• Under the **Marine Protection, Research, and Sanctuaries Act of 1972**, EPA is responsible for:

—Prohibiting the transportation of materials for dumping or the actual dumping of materials into the ocean without a permit.

—Controlling ocean dumping of non dredged materials; working with the U.S. Army Corps of Engineers in controlling dredged material dumping.

• Under the **Marine Plastic Pollution Research and Control Act of 1987**, EPA is responsible for:

—Conducting research to determine the effect of plastic pollution on coastal areas and to evaluate current efforts at reducing plastic in marine environments.

—Prohibiting discharge of all plastics into the sea as well as discharge of food wastes and other floating materials within specified distances from land.

• Under the **Ocean Dumping Ban Act of 1988**, EPA is responsible for:

—Prohibiting all municipal sewage sludge dumping into the sea after December 31, 1991.

—Creating and administering, along with the National Oceanic and Atmospheric Administration, a monitoring program to track municipal sewage sludge dumping until December 31, 1991.

—Prohibiting medical waste ocean dumping.

—Administering the **Shore Protection Act of 1988**, which requires vessels to install handling systems and obtain permits for transportation of non-hazardous commercial waste.

• Additional legislation and programs affecting coastal areas are:

—The **Degradable Plastic Ring Carrier Act of 1988**, which requires all plastic ring carriers to be made of naturally degradable plastic.

—The **Water Resources Development Act of 1986**, which restricts and regulates ocean dumping.

—The **Organotin Antifouling Paint Control Act of 1988**, which phases out existing stocks of organotin paint (used on boat bottoms and marine structures) and continues related research and monitoring programs.

—The **Coastal Zone Management Act of 1972 and Amendments**, which offers grants for states that develop coastal zone management plans.

—The **Deepwater Port Act of 1974**, which regulates deepwater port loading and unloading of materials and evaluates any environmental effects.

Can Our Coasts Stand More Growth?

Can U.S. coastal areas tolerate more growth and still maintain their ecosystems? As coastal development continues at an accelerated pace, this question carries a heightened sense of urgency. EPA Journal asked seven people with different vantage points for their answers. Their responses follow:

Steve Wells

I don't think that it is possible to have more growth in U.S. coastal areas and maintain their ecosystems—at least not in any rigorous sense of ecosystem maintenance. We shouldn't fool ourselves into thinking that continuing growth is free.

Ecosystems have limits, known and unknown, and some of those limits are like steep canyons into which a fall is abrupt and fatal. Others are more like clouds which cause momentary distraction as we pass through. And, because some ecosystems in some ways are resilient, we bounce off them when we bump their edges.

The image I'd like to work with has us walking along near the canyon edges. These precipices are limits beyond which a fall hurts greatly. Each increment of growth—every new family, new clearcut, new road, or new business day is another step towards the canyon.

In the Puget Sound region of the Pacific Northwest we're rapidly learning more about the dangerous edges and how close we are to many of them. These clues show up as the booming costs of land, lengthening commutes, loss of landfill space, tumorous fish, hazy views of Mt. Rainier and other mountains, and ever-deeper wells. We spot fewer owls. Bear Creek is losing its bears. Cougar Mountain Park will not have cougars. And the kids in Crystal Springs can't drink the surface water.

Fortunately, such changes for the worse have captured the public's attention. Ecosystem health, primarily recognized by our regional public as healthy salmon runs in neighborhood streams, is a key issue in this year's local elections. Salmon are politically sexy. Just recently, the King County Council boldly increased the size of the smallest legal lot in three watersheds so that sediments flowing from new subdivisions will not overwhelm the salmon in Soos Creek.

These are clues that growth will be managed. Because Puget Sounders care deeply, we'll avoid many threatening ecological precipices. But let's not fool ourselves. Growth will change our ecosystems. It's not possible to continue growth, sustain more people, use more resources, create more waste, and maintain our ecosystems unchanged.

(Wells is senior Resource Planner, King County, Washington State.)

Lawrence R. Zucchino

We can expect continued development in our coastal areas and increasing pressure on the ability of our coastal areas to sustain their ecological integrity.

If we are to deal with these pressures more effectively, we must begin to restructure our traditional view of the problem. There is no question of the need to maintain viable coastal ecosystems. However, we must take a hard look at the notion that our coastal areas must remain sparsely developed agrarian and resource-extractive areas. The simple inertia of current development will take us well past that point during the next decade.

Our coastal areas and their people deserve a dynamic and diversified economy. We need not squander a viable tax base on the waterfront by restricting development which need not harm the environment but may simply offend some people's notion of a rural aesthetic.

Much of the debate about the ability of our coastal ecosystems to withstand further growth has centered on land-based residential development and its associated impacts. In our East-Coast estuaries, water quality degradation and wetlands loss have been attributed to this growth, and the management focus has been directed primarily at land development.

However, coastal water quality is much more impacted by nutrient overloading from agricultural activity than from development. Considerably more wetland loss results from the timber industry than from development activity. This is not to point the finger elsewhere. It is to say that we need to avoid attacking the most convenient target and instead begin to direct an intelligent effort toward managing the true impacts on our coastal ecosystems.

We can begin by restructuring our thinking about regulatory controls on land development, which often promote the ineffective use of land. For instance, we hear continually about the "problem" of high-density development. It is folly to say that high density in and of itself causes environmental degradation. Poorly conceived and implemented regulation and development cause environmental degradation.

Alternately, increased development densities can provide the economic basis for protecting critical habitats and improving water quality. Well-planned, high-density development would undoubtedly result in less environmental impact than the low-density response which seems so innocuous but in fact spreads

development-associated impacts over a much broader area.

We need to:

- Hold development in the coastal areas to the highest possible standard
- Apply the necessary scientific research to understand where the true problems are
- Let the developers meet that high standard of performance in creative ways.

We cannot solve the problem with the simplistic solution of no growth. Growth in our coastal areas is going to occur. Our coastal areas must maintain their ecological integrity. Success in managing this growth will be measured in the next decade by how creatively we deal with these competing visions.

(Zucchino, President of Paton/Zucchino and Associates, a landscape architecture firm in Raleigh, North Carolina, is a consultant to developers.)

Robert W. Knecht

More growth is possible under certain conditions in portions of U.S. coastal regions. In this regard, three caveats seem important to me:

- Before any additional development is contemplated in coastal areas that are already over-stressed, steps should be taken to restore the vitality of their natural processes and their environmental quality. For example, the flows of pollution into coastal waters should be reduced and, where possible, the ebb and flow of tidal waters should be returned to altered or degraded wetlands and productivity restored.
- Representative and especially valuable but vulnerable areas in coastal regions should be identified and set aside for long-term protection as sanctuaries or preserves for education, research, and aesthetic purposes. Development in such areas should not be allowed.
- Development permitted in coastal areas should be water-dependent (for example, related to recreational or commercial fishing or associated with coastal recreation or traditional maritime uses) and should serve the broadest possible public purposes.

As a general matter, development that is allowed in coastal regions should be undertaken so as to prevent disruption of natural systems which keep areas biologically productive and aesthetically attractive. Further deterioration of coastal water quality should not be permitted. Net loss of coastal wetlands should not be allowed. Modifications or alterations that affect the long-shore sediment drift or the other systems such as bulkheads that maintain physically stable shorelines should not be permitted. Effective, well-enforced (and well-supported) state coastal zone management programs are one way of ensuring this type of sensitive coastal development.

Coastal regions are a precious national asset. As the present-day stewards of this resource, I believe that our generation has a responsibility to leave these regions in at least as good condition as we found them. Certainly, our grandchildren deserve the joy of a summer day on a clean beach as much as we did. Further development of coastal areas must be accompanied by responsibility to repair the damage of the past.

(Knecht is former Director of the Coastal Zone Management Program, National Oceanic and Atmospheric Administration.)

June Lindstedt-Siva

As human populations and their support systems expand, natural ecosystems are disturbed, contaminated, or converted to other uses. There is no area of the country where this pressure on natural systems is felt more than on our coasts, where marshes are converted to marinas and airports, sand dunes lose their native vegetation to off-road vehicles, and nesting sites used by birds and rest areas used by seals and sea lions are occupied by human beachgoers. A marina may be aesthetically pleasing, but it is not a salt marsh.

It may not be possible to have unlimited coastal development of the kind that destroys natural systems and still maintain natural populations. However, development and natural ecosystems can be compatible. All "developed" areas need not be written off as lacking ecological value. In fact, with careful planning and multi-disciplinary project management, it is possible for many kinds of development to preserve the

ecological integrity and functions of the surrounding areas. The result may not be pristine wilderness but can often be a fully functioning ecosystem with few real ecological losses.

One example of development that has actually preserved natural ecosystems and their biological diversity is the Guadalupe Dunes oil field in coastal Santa Barbara County, California. Although the field has oil wells, pipelines, roads, and some storage and treatment facilities, most of the area is maintained as open space and public access is restricted. The field has become one of the few places in the region where native dune vegetation survives, including some endangered species. In fact, the dunes outside the oil field have been damaged by off-road vehicles.

Similarly, in Kern County, California, the oil fields are the only remaining large tracts of land in the San Joaquin Valley that have not been converted to agriculture. Here, too, native plants and animals survive, among them several endangered species.

The Camp Pendleton U.S. Marine Corps Base in San Diego County contains many small wetlands that would have been converted to marinas and condos long ago had they not been on a federal military base. If lost one by one, the wetlands wouldn't have received much attention. However, since so many areas of wetlands habitat have been lost in southern California, the small wetlands at Camp Pendleton have become increasingly important to the total coastal ecosystem. Each year the Marines "enhance" the environment to increase production of the endangered tern gulls which nest there. Since the birds prefer nest sites with some protection from the winds, heavy equipment is run over the beach leaving large tractor marks. The beach is then closed to all activity until after the nesting season.

In these instances, protection of natural systems was an incidental byproduct of the type of development that occurred at the time the projects were begun. Now these natural systems are protected systematically as part of management planning for the facilities. This conservation by design must be encouraged and supported.

There are several kinds of "development" that can be made compatible with natural systems. If we wish to keep our native coastal ecosystems, efforts should be made to encourage and permit those kinds of development that maintain the ecological integrity of the natural system and to deny permits for those that do not. Careful environmental planning and management must be an integral part of project siting, development, and operation.

(Lindstedt-Siva is Manager of Environmental Sciences for Atlantic Richfield Oil Company.)

Vivian D. Newman

We can have more coastal development—and ecosystems, too!

Just one thing, though—first bring back Peter the Great to carry out the environmental controls. He was the Russian tsar under whose reign the penalty for cutting down even a single tree in the tsar's forest (which today might read ecosystems or public trust) was summary execution, with no exceptions made. You might say he was probably the last leader of any nation to have truly grasped the exigencies of environmental law and order.

Of course, such methods have gone out of style in today's age of negotiated conflict resolution and the Executive Order on Takings (which requires federal agencies to assess the economic impacts of federal actions on private landowners). Our modern leaders and lawmakers have embraced risk assessment and growth management, flaccid concepts dreamt up in some office charged with making discomfiting choices. We live in the heyday of legalistic wheeler-dealers hired for princely sums to cajole the professional equivocators into settling for zoning variances, permit modifications, and mitigation projects.

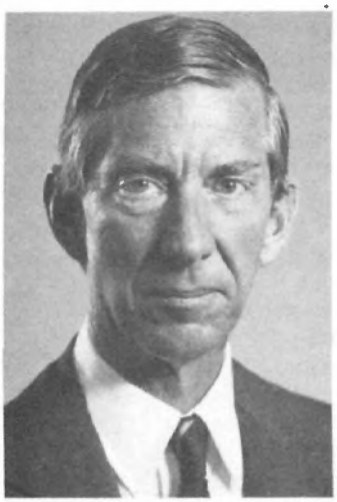
Daily compromises have assured a steady flow of toxic discharges, sediment, nutrients, and floatables into our waters. Obeisance to the false idols of convenience and greed all too often is behind the ridicule of waste reduction at the source and organic no-till farming and energy conservation as laughable, possibly dangerous notions. Befouled beaches and polluted shellfish beds attest to the efficacy of today's tyranny of small-minded decision-makers who have replaced the tyranny of an energetic despot like Peter the Great.

Coasts and wetlands represent only a tiny fraction of our total land mass, but their incomparable riches are not found elsewhere. The life they have supported for centuries—so miraculously diverse and abundant—has been a source of wonder and self-replenishing usefulness to human beings. But "live simply, that others may simply live" is a rarely heard credo today, especially when it comes to the habitat of humbler creatures; overriding "public benefit" has altered if not obliterated most of these ecologically vital areas.

Let's face facts—it's simply too late now even for Peter the Great (harsh, draconian, un-American as he may be remembered) to restore what was. But we must borrow at least some of his governing style if we wish to avert or postpone the collapse of our coastal ecosystems.

(Newman is Chair of the Sierra Club's National Coastal Committee.)

Nathaniel Reed



Florida's coastline is the focal point of tourism in the state. Our failure to manage coastal growth has given rise to a multitude of development-related problems, including inadequate hurricane evacuation, erosion of beach-front properties, limited public access to natural coastal areas, water pollution, and destruction of habitat.

Development has, for the most part, failed to recognize the physical constraints of Florida's coastal zone. Our estuarine systems share all the problems plaguing estuaries in highly urban areas. Unmanaged growth along these water bodies has created conditions which now threaten marine life. Florida's past failure to manage aquatic preserves and regulate marina siting has led to the destruction of critical marine habitat, including seagrass beds. Poor management also threatens a number of endangered species, including the manatee.

Beaches and shores, which play a critical role in the protection and safety of those who live on or visit Florida's coastal barriers, are especially vulnerable to the impacts of development. Seawalls and revetments have replaced many historical beach and dune systems, preempting nature's ability to provide upland protection and to recover from major storms.

Future growth must recognize that Florida's coastal areas should be managed as a whole, acknowledging that any development activity potentially affects the physical processes of the entire coastal ecosystem.

Florida's recent comprehensive planning initiatives, including a special focus on coastal issues, represent our attempt to ensure that future growth is compatible with the needs and physical limitations of the coast. State, regional, and local plans address barrier island development, protection of habitat and marine resources, and enhanced intergovernmental coordination, with the goal of significantly modifying future growth patterns in terms of land use, densities, levels of service, and resource protection.

For Florida, it is not a question whether there will be or should be additional growth in sensitive coastal areas. Instead, collectively we are facing the challenge to manage future growth by abandoning past development practices in order to preserve and enhance our remaining coastal resources.

(Reed, a former Assistant Secretary of Interior, is serving as Chairman of the Governor's Commission on the Future of Florida's Environment.)

Jean Michel Cousteau

I believe it is becoming obvious even to economists, industrialists, and developers that nature's capacity to accommodate human intrusion and expansion is limited.

Civilization cannot continue to intrude on coastal zones without causing a decline in the health of coastal marine systems. Simply, there can be no long-term maintenance of coastal ecosystems, given society's historical approach to growth. I do believe that there can be change and improvement under a slightly different perspective in which growth is defined as replacement rather than endless expansion. Given the limits of resources and space, the expansion type of growth usually exceeds the carrying capacity of the environment to assimilate human impact; ultimately, natural ecosystems are degraded or destroyed.

A more sustainable strategy can be found in nature where ecosystems develop to maturity through successional stages and then remain relatively stable. For example, successional development from a grassland to a forest involves an increasing complexity of structure as the system grows and accumulates biomass and diversity. Similarly, villages grow to become towns and eventually cities as they accumulate greater numbers of people and dwellings.

Yet, in nature, growth levels off as a forest ecosystem reaches maturity. This does not mean that biological vitality ceases. Rather, there is a dynamic process of replacement and innovation and the development of more integrated systems within the community. Species become heavily dependent upon one another in cooperative relationships which create an integrated web of life.

In mature natural communities, cessation of growth is not accompanied by stagnation. Instead, growth is replaced by specialization and a progression toward a more complex and, in human terms, a more sophisticated ecosystem. There can still be growth but of a replacement type. Growth in a mature society can encompass redesigning better systems or products to replace existing, less-efficient ones. Net growth can be shifted to replacement growth with a long-range plan. Then coastal areas can be developed while their ecosystems are preserved.

Increasingly, changes toward improving the quality of life have taken root, but they must be pursued more aggressively. We must opt for quality over quantity and unlimited growth. I am certain that such a shift in value will provide a higher quality life with fewer negative consequences than our present unlimited growth mentality. □

(Cousteau, the son of Jacques Cousteau, is Director of The Cousteau Society.)

Estuaries

by Tudor T. Davies

William C. Franz photo.

Estuaries are often busy "Main Streets" of our waters. Here, an oil tanker plies its way through the Kill van Kull waterway, which separates New York and New Jersey.

Estuaries, by definition, are where rivers meet the sea and fresh water mixes with salt.

Estuaries, by definition, are where rivers meet the sea and fresh water mixes with salt. This mixing makes them among the richest, most productive, and most intensively used habitats on earth, accommodating a uniquely diverse array of uses.

But the down side of this intense use is now apparent as recent events confirm that our coasts are profoundly troubled. Oil spills, inedible shellfish, and unusable beaches raise public concern, but these are only symptoms. The far deeper problems include toxics contamination, eutrophication, pathogen contamination, habitat loss and alteration, and changes in living resources. And underlying even these is the most basic problem of all: too many people and too much development are overwhelming estuaries and coastal environments.

Toxic contamination doesn't occur only in estuaries, of course. But estuaries are particularly vulnerable because they trap pollutants, concentrating them to very high levels. They also receive the accumulated silt, toxic chemicals, pesticides, nutrients, and pathogens discharged from thousands of upstream sources. And while these pollution sources may not seem significant individually, their aggregate impacts are immense.

Toxics such as heavy metals and synthetic organic chemicals have accumulated in such high concentrations in sediments that they now contaminate shellfish and

(Davies is Director of EPA's Office of Marine and Estuarine Protection.)

Going over the top. Here, a heavily trafficked bridge crosses waters near Puget Sound in Washington State.

Puget Sound Water Quality Authority photo

bottom-dwelling finfish, threatening the entire food chain. Toxics have also been linked to increased incidence of fish disease and now threaten the health, reproduction, and very survival of coastal species. Flounder in Boston Harbor have the highest rate of cancers and lesions of any area on the East Coast, and English sole from Puget Sound are frequently riddled with liver tumors.

We are also losing shellfish beds because of pathogen contamination from sewage and agricultural waste. The entire eastern shore of Puget Sound is now banned for commercial shellfish harvesting due to contamination from sewage treatment plant discharges, combined sewer overflows, and urban run-off. Twenty percent of the shellfish acreage east of the Tappan Zee Bridge in New York has been closed, and the Long Island clam and scallop industry has shrunk from $110 million to $40 million. In some places, sewage contamination has also been responsible for outbreaks of hepatitis A, Norwalk illness, and viral gastroenteritis among shellfish consumers and even swimmers.

Eutrophication is another major concern. Nitrogen and phosphorus are vital nutrients, but agricultural run-off and effluent from sewage treatment plants put too much nutrient content in the water. These excess nutrients stimulate explosive algae growth that reduces the oxygen available for other aquatic life. The lower the oxygen levels, the fewer finfish, crustaceans, and submerged aquatic vegetation that can be supported.

Oxygen depletion, or hypoxia, is not simply a change in chemical makeup; it is a symptom of severe ecosystem stress, and its frequency seems to be rising in all our coastal areas. The Gulf of Mexico takes in one-third of the nation's fish landings; yet in 1985 alone, 8,000 square kilometers of the Louisiana shelf went hypoxic. Extensive areas in the Chesapeake Bay, Long Island Sound, the New York Bight, and Massachusetts Bay are so oxygen-deficient that they can no longer support fish and crustaceans.

These declines in fisheries and shellfisheries and other changes in living resources are closely linked to massive development and ensuing habitat destruction in coastal environments. In the last few decades, the scale of uses in estuaries has expanded enormously. More important, so has the number of users.

People don't live in bubbles. To accommodate this growth, we build roads through marshes, dredge, drain, and fill wetlands, and divert essential freshwater flow. We create housing tracts, shopping malls, and sewage treatment plants. In our desire to be close the water, we are destroying the unique habitats and living resources that make it valuable to us.

Clearly, estuaries and coasts bear enormous impacts from high population densities and heavy industry. A recent assessment to identify and target areas that may need special management attention found that more than 2,200 industrial facilities and wastewater treatment plants now discharge directly into estuaries and near-coastal waters; thousands more facilities discharge upstream. Other direct sources include combined sewer overflows, commercial shipping and recreational boating, oil and gas platforms, marinas, and naval and commercial port activities.

Pollutants also enter estuaries from nonpoint sources such as farm and livestock run-off, lumbering, mining, urban and suburban run-off, failing septic systems, contaminated ground water, leachate from hazardous waste storage sites and landfills, and airborne pollution. These diffuse sources originate from a wide range of activities within coastal drainage basins, which can be geographically immense.

The watershed that feeds the Chesapeake Bay, for example, stretches from the Mohawk Valley of New York in the North to the Appalachian Mountains in the West and as far south as North Carolina. Oil washed from the streets of Twin Falls, Idaho, ends up in the Pacific Ocean. Fertilizers washed off the farmlands around Bismarck, North Dakota, end up in the Gulf of Mexico. The result is that despite years of effort and billions of dollars, pollutant loads entering estuaries and coastal waters are still too much.

These conditions are threatening estuaries' unique biological richness and ability to support many beneficial uses. Near-coastal fisheries account for billions of dollars per year and more than 70 percent of total commercial fish landings in the United States; recreational fishing generates $2.4 billion per year. Yet the economic losses in these industries are increasing.

New Bedford Harbor in Massachusetts, for example, has been closed to fishing because of severe PCB contamination. The National Oceanic and Atmospheric Administration has conservatively estimated that the community has lost over $2 million from its lobster-fishing industry, $1.9 million from its recreational-fishing industry, $14.7 million from closed beaches, and $30 million from decreased property values.

The ecological value of estuaries is just as important as their economic value. They provide critical habitat for a wide range of commercially and ecologically valuable species of fish, shellfish, birds, and other aquatic and terrestrial wildlife. Near-coastal waters are particularly important as feeding grounds for juvenile anadromous fish such as striped bass, salmon, shad, and sturgeon, as well as for young and adult fish and shellfish that spend their entire lives within 12 miles of shore. They also support the great bulk of the nation's clam, oyster, lobster, and mussel harvests, and 100 percent of blue crab, abalone, and bay scallops.

In our desire to be close to the water, we are destroying the unique habitats and living resources that make it valuable to us.

Estuaries provide yet other significant values, such as their aesthetic appeal and the unique and irreplaceable species that inhabit them. Many species of wading birds and wildfowl depend on coastal wetlands and other near-coastal habitats for food, breeding space, or migratory rest areas. Seals, sea lions, manatees, sea otters, and others live exclusively in near-coastal areas. These benefits are not necessarily quantifiable, but they are priceless nonetheless.

These conflicts among competing uses and values have forced EPA to take a broader view of coastal protection and raised new questions about habitat protection, resource management, nonpoint-source pollution controls, and land-use planning. Clearly, we must go beyond the Agency's base clean-water programs to a new focus on long-term, comprehensive planning and management.

Under the Water Quality Act of 1987, Congress established the National Estuary Program (NEP) to pioneer this new focus. Congress directed the NEP to identify nationally significant estuaries threatened by pollution, development, or overuse, and to promote innovative management for addressing these threats. Currently, 12 estuaries are in the program. These are Buzzards Bay in Massachusetts; Narragansett Bay in Rhode Island; Long Island Sound in Connecticut and New York; New York-New Jersey Harbor in New York and New Jersey; Delaware Bay in New Jersey, Delaware, and Pennsylvania; Delaware Inland Bays in Delaware; Albemarle/Pamlico Sounds in North Carolina; Sarasota Bay in Florida; Galveston Bay in Texas; San Francisco and Santa Monica Bays in California; and Puget Sound in Washington State.

Three characteristics distinguish the NEP approach to addressing pollution in estuaries. First, we target basin-wide assessment of problems and causes. Second, we integrate the use of all available regulatory tools and clean-up techniques addressing point-source pollution, nonpoint-source pollution, and coastal resource protection; an example of this is EPA's new program to establish requirements for storm-water discharges. We will be working closely on this effort, under which a considerable number of coastal municipalities will need to obtain permits and minimize pollution from their storm-water discharges.

Third, our approach incorporates collaborative problem solving that brings together all relevant government agencies, public interest and user

Pennsylvania has no ocean coast, but agricultural practices in the state definitely affect Atlantic coastal water quality. Pennsylvania farmers along the Susquehanna and other rivers are taking steps to reduce the nutrients, including manure, that drain into the Chesapeake Bay, an estuary of the Atlantic.

Steve Williams photo Penn State University.

groups, and all other parties with an interest in the estuary.

This approach can be tedious and contentious. But it is starting to pay off in terms of new attention and commitments to estuarine concerns from federal, state, and local agencies. The Puget Sound Estuary Program, for example, has had outstanding success in focusing activities of various state agencies to control toxic contamination in the Sound. Its Urban Bay Toxics Control Action Program has resulted in the inspection of more than 380 sites, monetary penalties, notices of violation and orders for corrective action, and the issuance of new and revised discharge permits with more stringent effluent limitations and monitoring requirements.

In our Buzzards Bay project, the involvement of Massachusetts' Office of Coastal Zone Management has served as a model for linking its experience in land-use issues with EPA's experience in water quality. Similar activities are underway in the other projects, including use of natural and artificial wetlands to control storm-water and nonpoint-source pollution; improvement of industrial production lines to reduce toxics discharged in wastewater; improved management of septic systems; and development of land uses that protect water quality.

Results like these are stimulating state interest in joining the NEP. Estuaries are chosen based on their potential to reflect and address issues of significant national concern, as well as their states' demonstrated institutional, financial, and political commitment to supporting a program. EPA may choose additional estuaries for the NEP in response to nominations from state governors or on its own initiative in the case of interstate estuaries. EPA has already received a half dozen full-scale nominations to the program, as well as a number of serious inquiries about the nomination process, and we expect to include four new projects in Fiscal Year 1990.

Estuaries are particularly vulnerable because they trap pollutants, concentrating them to very high levels.

For the 100 other major estuaries along the U.S. coast that can't be in the program, the NEP's role as a demonstration program is especially important. Estuaries share major problems, and they can benefit from the wide dissemination of successful technical and managerial techniques.

The NEP is a young program, but we have already learned an essential lesson for dealing with environmental issues.

We've learned that coastal problems share one critical common denominator—intense coastal development. Explosive population growth is fueling a corresponding boom in commercial, residential, and industrial development, and this pattern has generated increasing loads of sediments, debris, toxic contaminants, pathogens, and other pollutants. Preventing further degradation will call for a stricter, more protective approach across a whole spectrum of activities, and this can only happen with strong, sustained public support.

Learning how to build public support and understanding may well be the NEP's most enduring legacy. The really critical choices for our estuaries and coasts are made by state and local governments. We at the federal level can provide leadership and technical assistance; we can promote changes in behavior, encourage innovations, and focus resources. But the federal government doesn't zone wetlands for condominiums or barrier islands for shopping malls and waterfront hotels. These are local decisions, and it is clear that the political and institutional will to protect coastal resources must also be local.

At a moment when the coastal ecosystem faces irreversible damage, it can be the NEP's contribution to offer ready-made models of effective environmental collaboration and success. □

Wetlands: An Interview with David Davis

Susan C. Waters photo, Virginia Sea Grant College Program

Arrow Arum growing in a coastal freshwater wetland near Williamsburg, Virginia.

(Davis is Director of EPA's Office of Wetlands Protection.)

Q Recently President Bush called for "no net loss" of wetlands as a national goal. What does that mean, both in practical terms and for official policy?

A The no-net-loss goal the President endorsed arose from findings and recommendations made by the National Wetlands Policy Forum, a group representing a wide range of interests, which EPA helped create. In the forum's report, released last November, the paramount recommendation was that the nation set a goal of no overall loss of wetlands in the short run, and a net gain in the long run.

Shortly thereafter, in January, then-EPA Administrator Lee Thomas signed a Wetlands Action Plan in which EPA officially adopted the goal of no net loss. However, EPA has been implicitly following that goal for quite a few years. Using our role under Section 404 of the Clean Water Act (which includes EPA veto power over activities involving a discharge of dredged or fill material into U.S. waters), we have been trying to curtail wetland losses as completely as possible.

And in effect, that is a no-net-loss goal; it's just that previously we didn't use that terminology. Having the terminology sharpens the goal for us and provides a way of accounting for it, much like standard financial accounting with debits and credits.

Q Is the no-net-loss policy specifically a tool for EPA?

A Other organizations have also endorsed the policy. The National Governors' Association, the Association of State and Interstate Water Pollution Control Administrators, the National Association of Counties and the American Forest Council have endorsed it. So it's not just EPA, and it's not just the federal government, that support it.

In fact, I think it's important to note that the Forum's recommendations were made to all Americans, not just the federal government or EPA. The no-net-loss policy is essentially a goal for our *entire* society to adopt.

It requires state, local, and tribal

governments to do their parts. It requires private citizens, in their capacities as corporate people, entrepreneurs, homeowners, and landowners to do their parts as well. It cannot be achieved and should not be achieved solely by the federal government or EPA.

Q Can developers find ways around the no-net-loss goal?

A Well, yes, I guess you would have to say they might try, although I don't think they will necessarily feel compelled to do so. The no-net-loss goal grew out of a consensus process that involved developers. In general, I think developers recognized the new policy as moving away from a system in which each and every permit would be a barrier to them. The process envisioned by the Forum would look at development proposals in the context of the cumulative effects on wetland ecosystems, with plans developed for some gains and some losses that would "net them out" over a larger area and extended time period.

So, in effect, rather than creating an additional restriction on development, the no-net-loss policy gives a better means of proceeding with environmentally acceptable development, then compensating for the unavoidable impacts of that development in ways that protect the overall environmental resource.

Q How do you define a coastal wetland? What makes it different from other wetlands?

A The main distinction between coastal wetlands and other wetlands is that most coastal wetlands have salt or brackish (a mixture of salt and fresh) water, and most are tidal, while inland wetlands are non-tidal and freshwater.

Coastal wetlands are an integral component of estuaries. Since the constant tidal action and high salt content may create poor conditions for the growth of some plants, many coastal wetlands are salt or mud flats. But in other areas halophytic, or "salt-loving," plants thrive in coastal marshlands.

However, it is important to point out that there are freshwater wetlands within a stone's throw from the beach because they are behind the dunes and fed by ground or rain water, which is fresh. Likewise, there are freshwater wetlands just a short distance up major coastal tributaries. There are also forested coastal wetlands, such as Florida's mangrove swamps.

Q What is the range of coastal wetlands? Do they exist along the Pacific Coast or in Alaska?

A Absolutely. They're everywhere you find coastlines. They're going to be different depending on whether you're talking about the shallow, subtropical coast of the Gulf of Mexico, the high-energy coasts of the Pacific Northwest or New England, or the high, cold latitudes of Alaska, particularly the North Slope.

Q Historically, coastal wetlands have sometimes been viewed as expendable or worthless. Now we have a truer understanding of their function. What do you feel is the real importance of a coastal wetland?

A First of all, here at EPA we don't make a strong distinction between coastal wetlands and other wetlands. We're concerned with all wetlands, so much of what I say would be equally applicable to inland wetlands.

The values of wetlands are many, but one primary value is their role as wildlife and fisheries habitat. They certainly provide homes, whether permanent homes, migratory stopover areas, or wintering areas, for a great many types of birds and animals. They provide important areas for spawning and rearing of fish and shellfish.

The role of coastal wetlands as fish-rearing and spawning areas is critical because a great percentage of the commercial fisheries of the Atlantic and, to a lesser degree, the Pacific depends on coastal wetlands for some or all of their life cycle. Figures on this vary, but some experts believe over 50 percent of the commercial catch in the North Atlantic is dependent on wetlands for some portion of its life cycle.

A second important value of the coastal wetland relates to water quality. Wetlands serve as natural filters, much like kidneys function in the human body. They filter out certain kinds of wastes, particularly nutrients, that flow into them from polluted streams or rivers and tidal waters. The plants, for the most part, use these nutrients for their own nutrition and growth, thus cleaning up the water in the process, but microorganisms growing on the plants and in or on the bottom are probably of equal importance.

Coastal wetlands also serve as places where sediments are filtered out and deposited, thereby removing some of the sediment from the waters flowing into or through the wetland. Of course, too much sediment can be deleterious to the wetland, but a certain amount is actually necessary for the wetland's health.

A third important value of the wetland is storm and flood protection. In coastal areas, wetlands often serve as storm barriers. If you have a nice fringe of mangrove forest, for example, along the coast, that will significantly reduce the impact of a hurricane coming ashore. It will dissipate a lot of the storm's energy. And since most people don't build their houses in mangrove swamps, wetlands provide storm buffer zones that have low property values and little or no human life to lose.

There are certainly other values of wetlands as well. In areas where there are a lot of wetlands, they seem to provide certain climatic influences. They can influence rainfall and temperature in ways that are useful to humans, because they tend to moderate the extremes.

Wetlands also produce some harvestable products such as wild rice, shellfish, and finfish. In some cases, wetland plants are used as a hay crop, less so in the coastal areas—although some coastal wetlands are still occasionally used for haying.

Q How many coastal wetlands exist in the United States?

A Looking at U.S. wetlands resources collectively, at least in the 48 contiguous states, we find that only about five percent of our wetlands are coastal. This amounts to less than five million acres of coastal wetlands. So with coastal wetlands we're dealing with a very "minority" resource.

Except in Louisiana, most of the U.S. wetland losses since the 1950s have been non-tidal. However, before 1950, I think wetland losses were probably very high in coastal areas. At some point they were probably the dominant loss because that's where settlement first took place, along the coastline.

Scott Taylor photo. Duke University Marine Laboratory

Coastal wetlands, breeding grounds for fish and shellfish, are invaluable resources.

Q Speaking of losses, what are the major reasons for coastal wetland loss?

A Losses were due primarily to the development that coincides with establishing cities and industry. Early on, large wetland areas were filled simply to build towns. These sites were chosen because they were at the mouths of major rivers which had navigational value. And as nature would have it, those areas tended to be wetland areas.

In more recent times, the loss of coastal wetlands has been due to further expansion and development away from cities as we build industrial facilities, marinas, navigation facilities, housing, recreational facilities, and highways. Every place there were wetlands, we tended to fill them in or drain them to get them out of the way.

Even with the regulations we have today the problem remains that, although individual wetland areas may be intact and even protected in some fashion, they are part of a larger system, so they are very difficult to protect totally. Certain coastal phenomena such as estuary pollution from upstream sources or from off-shore oil spills will certainly affect the wetlands.

There is no way to fully protect the entire coastal wetland area from all types of assaults. You can't build berms to keep the tides from washing pollution into the area or you change the whole system.

Q A recurrent theme in this issue of *EPA Journal* is the mounting pressure on marine coastal ecosystems created by the influx of people and development on our marine coastlines, which you just mentioned. How has recent development affected the coastal wetlands?

A The general answer would be that it affects the coastal wetlands in the same way it affects the coast. Anytime there is a buildup of population pressure, construction, pollution, and all the activities that coincide with such development, wetland areas will be affected. And because the wetland areas are more fragile than other parts of the coast and often have already been more affected than other areas, they are impacted more severely because they've already suffered losses.

The only thing working for the coastal wetlands is the fact that they often are subject to more regulatory protection than are the non-wetland areas such as the beaches, sand dunes, or coastal forests.

Also, I think in the past decade or so we've turned the corner on encroaching development. We haven't necessarily brought the losses down to truly acceptable levels, and we certainly haven't stopped all coastal wetland losses, but I think we have turned the corner. Many coastal states now have fairly strong laws protecting coastal wetlands.

As a result, coastal wetland losses, in many states are in the tens or hundreds of acres per year, as opposed to the overall national loss rate of total wetlands, which is still in the hundreds of thousands of acres per year.

Q Your answer—that we have "turned the corner" in coastal wetland protection—is somewhat surprising. Would you say, then, that marine coastal wetlands are not presently at risk in a way that compares with estuaries and other near-coastal waters?

A When I say we have turned the corner in terms of protecting coastal wetlands, I mean this in relation to non-tidal, or inland wetlands. The point here is that the state, local, and federal governments became concerned about coastal wetlands long before they thought about inland wetlands.

Some laws to protect coastal areas were enacted in the early 1970s, such as the Coastal Zone Management Act, the Marine Protection, Research and Sanctuaries Act. But we didn't get serious about inland wetlands for the most part until this decade.

Q Is there, for purposes of development and regulation, sometimes a quarrel about what a coastal wetland is?

A Surely. And the quarrel hinges on a couple of different things. One is a biological question, about where does the wetland end and the dry land begin—which is something that even professional biologists can disagree over.

And then there are the legal or policy questions. These have more to do with whether the jurisdiction of a particular statute or regulation extends to a certain area. So, biologists might agree that a place is a wetland, but the regulators, for reasons concerning a particular program's statutory limitations, say it is not.

There's no absolute out there in the world between the dry land and the wetland. And that is the way Mother Nature intended it, because the whole concept of wetland or non-wetland is a human construct. It's an abstraction we have come up with. It's not something that is always distinct in the natural world, because we're dealing with a continuum from very deep ocean trenches to very dry mountaintops or deserts, and we've got all gradations in

between in terms of wetness, soil type, temperature, climate, etc. Wetlands occupy a place on that spectrum, but, ecologically speaking, they don't have firm, absolute boundaries.

Q Referring back to the no-net-loss policy, does the policy imply that coastal wetlands can be restored once they are altered? Would it be physically possible to create a coastal wetland to make up for one that is being destroyed?

A It's certainly physically possible, and it's already been done. I think the distinction that's important to grasp here is that it's not easy to do, it's not cheap, and the state of our scientific understanding and technological capability is still such that we can't guarantee that the wetlands we create will have the same functions and value as the ones we have lost.

We can approximate a wetland; we can often satisfy ourselves in the relative near-term, over the first two or three years, that we have manufactured a system that is at least similar to the one that has been lost. But we don't have enough experience to know whether 20, 50, or 100 years down the road the artificial system is still going to be functioning. We don't know if it will provide the same ecological value as the wetland we lost. Creating wetlands is as much art as science. It's not something that anyone and everyone can go out there and do. It is also very costly.

Fortunately, we are somewhat better at working with tidal marshes than with inland wetlands because we have had more experience and can learn from past mistakes. Also coastal marshes are influenced by predictable water fluctuations caused by the tides whereas restoring the water source to create inland wetlands is generally more difficult.

Q What if a marine coastal wetland is located on someone's private property and that someone wants to fill in the wetland and build a guest cottage on the site? Do private property rights prevail?

A Private property rights prevail in the sense that we don't take people's land away, and they're still entitled to use their land to the best of their ability. However, private property rights do not provide protection from regulatory requirements. So all the federal, state, and local regulations that apply to public land also apply to private land.

Private property rights are not a shield behind which a property owner can therefore do whatever he or she wants. The owner must still comply with all environmental regulatory controls and other requirements, but the fact that an area is regulated under public regulation does not take away ownership and does not in any way convey certain public benefits, such as beach access.

If, using the example of the guest cottage, a regulatory agency with decision authority determines that the cottage should not be built because of impacts to the coastal wetland, the individual would not be able to build it in the wetland. But, by the same token, we could not use that regulation to create access for the general public to that site for purposes of using the beach or fishing or anything else. The rights to keep private property private are not extinguished by federal regulation.

Q Individual citizens may feel helpless about the loss of coastal wetlands. Is there anything they can do to help turn the situation around?

A There is a lot the individual can do. If you're lucky enough to be the owner of coastal wetlands, you can do your part by managing and protecting your land in ways that ensure continued health and vitality to the area. And there are many information sources on how to do that: state environmental agencies, local environmental groups, or your town hall are good places to start. Also, there are incentive programs, like tax relief or easements, to help make the proper management more attractive.

Assuming most people are not coastal landowners, they can do their part by supporting local government programs and initiatives through the ballot, public comment, and public participation in the development and implementation of wetland or estuary programs. And there are also citizen activist groups that research and collect data, disseminate information, and lobby to protect coastal wetlands within their communities. So, as with any other environmental issue, there is a role for individuals if they feel strongly enough to take some action.

The coastal wetlands protection issue does lend itself to public concern. Coastal wetlands are a little more tangible in some respects than air pollution or hazardous waste. They are places people want to go and experience firsthand. They can see what they are working to protect and preserve. This makes people more concerned and caring about the issue. □

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Beaches

by Kathryn O'Hara

Sea Grant College Program at Galveston photo. Texas A&M University at Galveston.

Hundreds of 30- and 55-gallon drums wash ashore on the Texas coastline annually. About 20 percent contain hazardous substances or their residue.

The volunteers found a total of 1,973,995 debris items including nearly everything imaginable . . . .

Other articles in this issue of *EPA Journal* focus on the problems created by the influx of people and development along our nation's coastal areas. This article describes another kind of influx—thousands of citizens flocking to the beaches to participate in a National Beach Cleanup during the fall of 1988.

Some 47,500 volunteers participated in the cleanup. Here's what they accomplished:

- More than 3,500 miles of shoreline in 25 states and U.S. territories were at least temporarily rid of nearly two million pounds of beach debris.
- Detailed information on the types and quantities of debris items found was gathered on "Beach Clean-up Data Cards," then compiled and analyzed to assist in development of permanent solutions to our nation's marine debris problem.
- The National Beach Cleanup showed how citizens, businesses, industry, and government agencies—often in conflict on coastal issues—can work together to protect coastal areas.

National Beach Cleanup volunteers found a total of 1,973,995 debris items, including nearly everything imaginable—from bedsprings and boats to mattresses, munitions, and several kitchen sinks. They even found 11 bottles with notes inside, including one found in Connecticut with a note from an author in France.

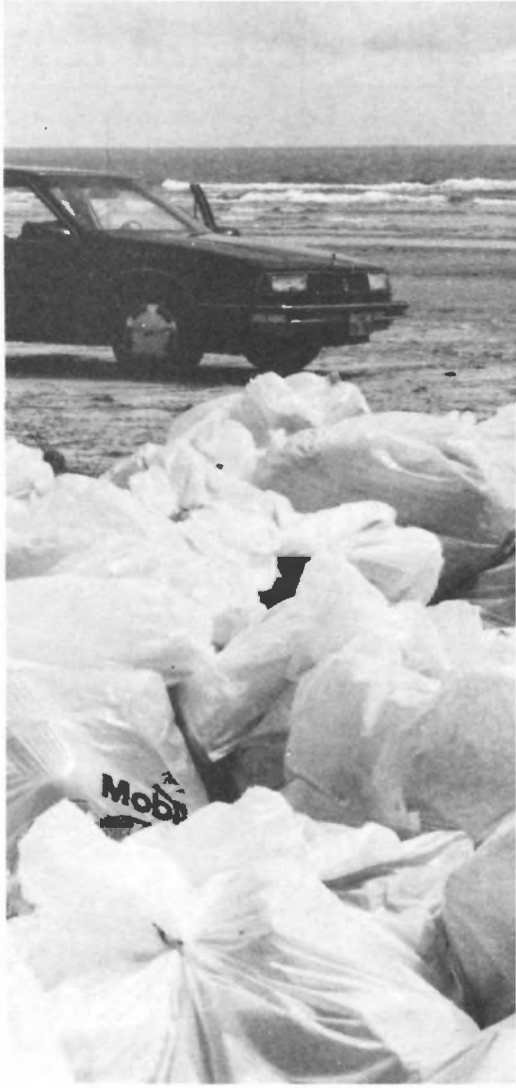
Plastics were by far the single most abundant type of litter; approximately 62 percent of the debris collected was plastic, far surpassing the items made of glass, metal, paper, wood, rubber, and cloth. The predominance of plastic is not surprising, not only because of its increasing use but also because it is so lightweight and buoyant that it is easily carried ashore by the currents. Equally important, plastic is made to be durable; so it has the potential to last much longer than other materials in the marine environment.

Over two-thirds of the 12 most commonly found types of debris recorded by the beach clean-up volunteers were plastic. The 12 most common items—the "Dirty Dozen of 1988"—included:

- 134,685 plastic fragments of larger objects
- 125,725 small foamed plastic (styrofoam-like) pieces
- 112,465 plastic eating utensils—cups, spoons, forks and straws
- 99,847 metal beverage cans
- 95,807 foamed plastic (styrofoam-like) cups
- 95,028 glass beverage bottles
- 90,998 plastic caps and lids
- 85,864 pieces of large paper items
- 78,025 plastic trash bags
- 74,672 miscellaneous types of plastic bags
- 65,819 glass pieces
- 58,116 plastic soda bottles.

If just these items were eliminated,

(O'Hara is Director of the Center for Marine Conservation's Marine Debris and Entanglement Program.)



Trash collected by just a few of the 47,500 volunteers in a fall 1988 national beach cleanup.

Center for Marine Conservation photo.

beaches would be at least 50 percent cleaner.

Who is responsible for this trashing of America's beaches? At least 16 percent of reported items could be traced to dumping by commercial ships, petroleum industry operations, fisheries, and recreational boats. This finding is based on the number of "indicator items" which were traceable to specific debris sources. Such items include plastic fishing nets and cyalume light sticks, for example, which are indicators of debris generated by fisheries. Hardhats and "write-enable protection rings" are signatures for debris that comes from offshore oil and gas operations.

As more and more people move to coastal areas, and the careless ones leave behind their trash wherever they go, how can the marine debris problem be alleviated?

In addition, more than 1,000 items were reported to have labels from foreign countries—48 countries in all—from as close as neighboring Mexico to distant places such as Bulgaria and Japan. Much of this foreign debris can be attributed to dumping by the international fleet of commercial ships. Ironically, the majority of these particular items were empty bottles of cleaning agents. Some volunteers also found items such as plastic shampoo bottles stamped with company names that were traceable to passenger cruise ships.

Fortunately, steps are being taken to protect our coastal areas from trash dumped at sea. On December 31, 1988, an international treaty became effective that halts dumping of plastic garbage from ships at sea. Known as Annex V of the International Convention for the Prevention of Pollution from Ships (or the MARPOL Treaty), the treaty prohibits at-sea dumping of plastic materials and regulates the distance from shore that all other solid waste materials may be dumped. It applies to all ships of the 39 signatory nations.

The Marine Plastic Pollution Research and Control Act of 1987 is the U.S. implementing legislation for Annex V. In U.S. waters no vessel of any size (ranging from super-tankers to rubber rafts) from any country may discharge plastics within 200 miles of our coastline. This should dramatically reduce the amount of debris dumped at sea that subsequently washes onto our beaches.

What does beach clean-up data tell us about land-based sources of debris, and what does this mean with regard to coastal development? One of the more obvious sources of land-based marine pollution is inadequate sewage systems. Often cited as sources of bacteria and toxins, sewage systems can also be major sources of plastic and other solid wastes.

Many of New York City's sewage treatment systems, for instance, are combined with storm water systems. These "combined systems" mix raw sewage with rainwater. Under normal operating conditions these combined sewage systems trap tens of thousands of pieces of solid waste materials each year, but during heavy rainfall their capacities—often already overburdened by increasing population pressures—are exceeded. The overflow—untreated sewage and accompanying solid waste materials—is diverted directly into local waterways.

The presence of plastic tampon applicators on beaches is often cited as an indicator of the less visible pollutants generated by sewer systems. During the 1988 National Beach Cleanup, 7,584 sewer items were reported nationwide.

Although this is less than one percent of all debris items reported, their comparative abundance in some states may reflect a coastal development problem related to population increase without a concurrent upgrading of sewer systems. If coastal populations increase without upgrading sewage systems, such items as tampon applicators, condoms, and other types of sewage-associated solid wastes may soon become a problem for nearby shorelines.

Medical wastes have recently become a visible type of debris in coastal areas of the United States. In the National Beach Survey, plastic syringes were used as medical waste indicators. They were found in all but two of the state beaches cleaned up. While the 1,718 syringes reported amounted to less than

0.1 percent of the total debris collected nationwide, cleanups conducted in New York and New Jersey reported approximately three times more syringes than the national average.

New research suggests that most syringes found during the summer 1988 were actually insulin-type disposable units used by diabetics and often discarded in toilets or trash. Since sewage-associated wastes were also prevalent in New York and New Jersey, there may be a direct correlation between sewage systems and medical debris.

Less obvious than syringes, however, are the untold quantities of man-made debris that enter the ocean via rivers, drainage systems, and estuaries. As more and more people move to coastal areas, and the careless ones leave behind their trash wherever they go, how can the marine debris problem be alleviated in the face of growing coastal development?

Some view degradable plastic technology as a panacea. For example, if 62 percent of the trash on the beaches is plastic, maybe that much of the total problem will go away by itself! But based on what we now know about beach debris, this is not a solution. From the "Dirty Dozen" list, we can see that much of the debris on our beaches is already in the form of fragmented pieces. Degradable plastics will not help to eliminate such items because degradable plastics do not disappear—they merely break down into smaller and smaller plastic pieces.

Moreover, while the advent of items such as biodegradable plastic six-pack rings may help reduce the problem of marine animals becoming entangled in plastic devices, this does nothing to mitigate the problem of ingestion of plastic pieces by marine wildlife. In fact, increased use of degradable plastics may compound the latter problem.

Others consider recycling to be the answer to the marine debris and larger solid waste problem. A large portion of the debris found on our nation's coastline consists of beverage bottles and other goods associated with beverage packaging—plastic, glass, metal beverage cans and bottles, plastic six-pack rings, and metal bottle caps and pull tabs.

Nationally, bottles and associated items constituted approximately 17 percent of all debris reported. On the state level, however, Oregon and Connecticut had the lowest amounts of such wastes. Both these states have enacted "bottle bills" in which a deposit of a few cents is added to the price of the beverage. Since the deposit is refunded when the container is returned by the consumer, it is less likely that the bottles will be thrown away.

Yet even bottle bills are not a clear-cut solution if there is not widespread public cooperation. Delaware and New York have similar laws, but the number of bottles found on their beaches was higher than the national figure.

Ultimately, the solution to the problem of coastal debris requires a change in people's behavior and attitudes. Perhaps the very growth of coastal areas, which further strains coastal environments, may actually help produce that change. As more people move to our coasts, more and more of them are realizing that the trash they casually toss or leave behind does come back to us, sometimes in very disturbing ways.

Citizen beach cleanups are very effective tools for increasing such awareness and changing behavior. It's hard to look at one's own trash in quite the same way after spending several hours cataloging someone else's! Beach cleanups also foster a sense of community stewardship for our coastal areas, as growing numbers of citizens, coastal businesses, and government officials work together on such projects.

In short, citizen beach cleanups demonstrate the power of the individual to make a difference in attaining cleaner beaches. □

Are We Picking the Right Targets?

by Harvey W. Schultz

Coastal populations cause coastal pollution. To get cleaner coasts, given current population pressures, shoreline communities must invest substantial resources in water-pollution control. But as the events of the summer of 1988 show, coastal populations do not easily acknowledge the problems caused by their very presence. Without comprehensive planning and concrete priorities, clean-up efforts are misdirected, resources squandered, and real solutions delayed.

After state and federal funds for water pollution control became available in the 1970s, many communities in the New York metropolitan area virtually stopped routinely discharging raw sewage into local waterways. But much work remains. During storms, shoreline communities in three states—with hundreds of sewer outfalls ringing the New York Harbor, the New York Bight, and Long Island Sound—still discharge untreated sewage and rainwater into the marine environment. Various coastal activities add floatable trash, and major tributaries also carry pollutants from inland areas.

The summer of 1988 offered an excellent opportunity to build public support for a regional plan to address onshore sources of coastal pollution. Public attention was riveted on the beaches daily throughout the season. Many days were marred by discoveries of medical waste, rubbish, and dead rats. Temporary increases in bacteria levels were highly publicized, obscuring general gains in water quality. Tourists fled, consumers avoided seafood, and local economies suffered. Fear of the AIDS virus and the Greenhouse Effect increased the sense of disaster. By August's ominous heat wave, the public was frightened and angry, desperate for solutions, and eager to punish whomever was responsible for a miserable summer.

Throughout, "sludge" was the focus of concern. The word "sludge" was universally employed in reference to any trash, grease, medical debris, or other pollutant on the beaches. "Sludge" was a label casually but firmly attached to many different types of waste. Elected officials and environmentalists assured the public that a ban on "sludge dumping" would cleanse the beaches.

The general public's confusion over words only begins to explain why slang, rather than substance, guided national policy.

Logically enough, at summer's end a federal law was passed banning the ocean disposal of "sludge" by 1992.

After the seasons changed and tempers cooled, the distinctions among different kinds of sludge began to be acknowledged. The new law did nothing to stop garbage and other so-called "sludge" from polluting beaches. It addressed an entirely different type of waste—municipal sewage sludge.

Municipal sewage sludge is the meticulously refined byproduct of the sewage treatment process. It contains no trash or any other material that could pollute a beach, and the federally designated dump site 106 miles east of Cape May, New Jersey, for sludge disposal is in deep waters far from coasts. New York City and other communities in New York State and New Jersey have disposed of sludge in the ocean for 50 years with no effect on the region's beaches, and the issue of harm to deep ocean aquatic life has never been substantiated by research. Federal agencies testified before Congress that the "106-mile site" was safe in the short term, and a research and monitoring commitment was made to ensure its safe long-term use.

The new law requires municipal sewage sludge to be moved from one disposal medium to another, from water to land. This resource-consuming transition will cost hundreds of millions of dollars, without doing anything for the beaches. It has already, however, caused considerable consternation in inland communities that may be asked to host new land-based disposal operations. With pressing issues like ground-water pollution, air pollution, landfill space, and sludge transportation unresolved, the environment gains no overall benefit from the shift.

Despite a near-hysterical concern over coastal pollution, nothing substantial was accomplished after the summer of 1988, but significant resources were diverted elsewhere. The confusion between generic "sludge" and municipal sewage sludge caused so complete a separation of cause from effect, and problem from solution, that no meaningful action on the beaches was possible.

One source of the intense confusion was the simultaneous appearance of different types of pollution throughout the metropolitan region and beyond. In May a lobsterman alleged that municipal sewage sludge was harming lobsters in New England, far from area beaches. His story was widely circulated, though he offered no evidence, and no informed experts backed him up.

By summer's end the beaches were bombarded by other types of waste, which were also called "sludge." The word "sludge" lost its specific meaning. It became slang for all beach pollutants. To the general public—unused to making distinctions between garbage and sewage, and between raw sewage and its treated byproduct—it seemed that New York was dumping garbage at the 106-mile site and that a ban on "sludge dumping" was the solution.

However, the general public's confusion over words only begins to explain why slang, rather than substance, guided national policy. The

(Schultz is Commissioner of the New York City Department of Environmental Protection.)

Rebecca Zilenziger photo, ©Greenpeace

Greenpeace activists hung from New York's Triborough Bridge in September 1988 during a week-long protest against ocean dumping.

failure to recognize obvious differences between various pollutants and correctly identify the appropriate clean-up methods was not confined to the general public. Reporters, spokespersons for environmental groups, and elected officials, who have ready access to experts and facts, persistently entwined the 106-mile site with beach pollution.

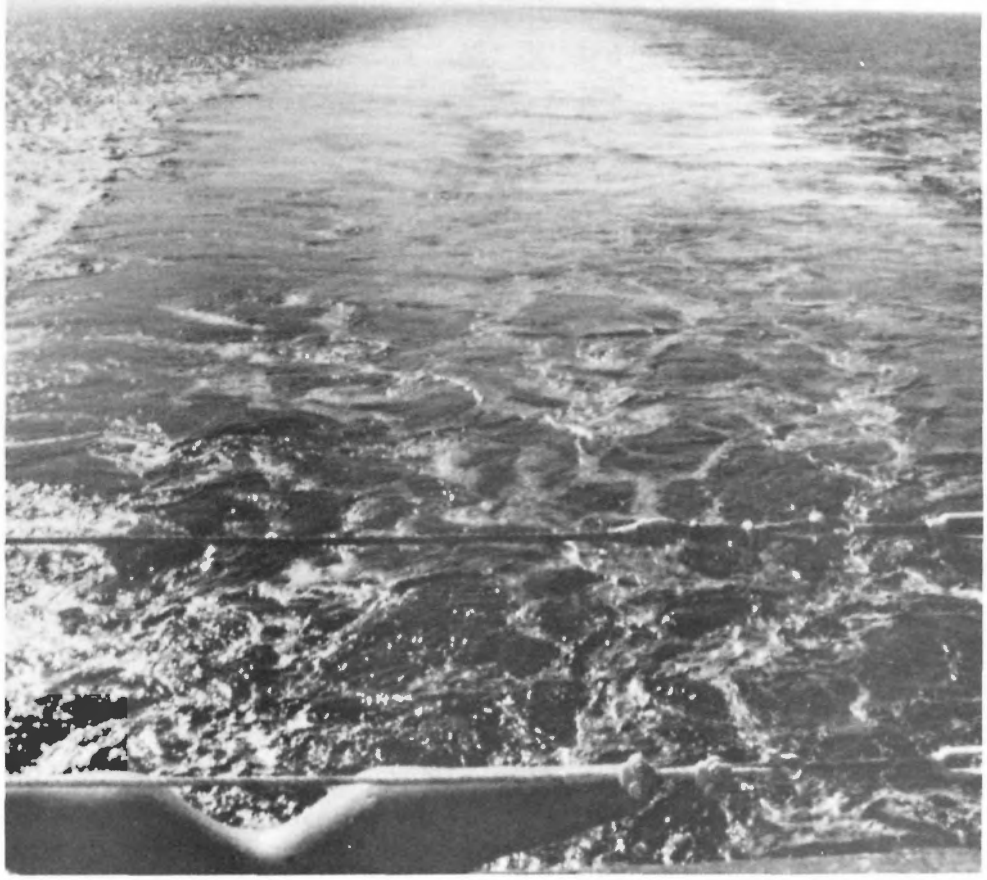
With the media, the confusion was a natural result of the generally accepted style of covering environmental issues. Few reporters on the "sludge dumping" beat sought the experts. Most paid little attention to examining basic premises, and too much to portraying the colorful personalities who sought the media.

The focus on emotion over science was exacerbated by New York City's involvement. The city makes an attractive villain when pitted against newsworthy subjects like a crusty lobsterman or daredevil protesters, who obtained far more attention and sympathy than researchers and scientists who could have helped clarify the issue.

The outreach efforts of environmental groups also contributed to the misdirection. National and international attention focused on New York, creating the opportunity to reach wide audiences through publicity stunts. Some groups were primarily concerned with the 106-mile site and not with the beaches, while others had the opposite emphasis. Though well-intentioned, their tactics emphasized drama over accuracy and further inhibited the public from grasping the issues.

Most importantly, elected officials pushing for the new law refused to acknowledge the true role their own communities played. Behind the confusion over words was a strong resistance to admitting that coastal populations still pollute their own environs.

The stubborn existence of pollution from onshore sources creates a dilemma for communities vying for tourist



Greenpeace photo

Dumping sewage sludge at the 106-mile site off the New Jersey coast. A newly passed federal law will prohibit such sludge disposal in the ocean by 1992.

dollars, where the waters are portrayed as clean and safe, and waterfronts are heavily promoted for residential and recreational use. Tourists avoid areas where shortcomings in water-pollution control facilities are openly discussed.

Prospective residents and businesses hesitate to invest in communities that need substantial capital infusions and years of hard work to guarantee a healthy environment and a strong waterfront economy. But when coastal communities fail to educate the public on the true causes of their problems, and fail to invest in their resolution, then the pollution continues, and the coastal environment eventually declines.

To pursue environmental priorities rationally, two things are necessary. First, the public must be able to obtain the facts needed to support long-range regional planning. Government agencies, environmental organizations, and elected officials can work harder to help clarify the issues, particularly in the midst of a seeming crisis when fundamental matters of fact become confused. The media play an invaluable role because the public relies primarily on the media for information about current environmental issues.

In New York City's recent drought emergency, for example, many reporters actively urged conservation and kept the public up-to-date on reservoir conditions, and their involvement was a key factor in keeping consumption down. Public education programs are only effective when reporters dig behind the emotions, personalities, and publicity stunts, seek out the experts, and lay out the basic facts.

Second, if the general public can develop a concern for the global environment, then elected officials can discard the piecemeal approach and commit to long-term goals. With vast amounts of sewage sludge being moved around the country, national policy is needed on all disposal methods and their relative environmental impacts, and that policy must evolve from study and research on a national level. The problems we face are too massive, and the solutions too costly, to dedicate resources to short-sighted policies that look good in news reports without providing tangible benefits.

National policies are now being formed on one of the truly significant causes of coastal pollution: the discharge of untreated sewage mixed with rainwater during storms. These combined sewer overflows are common to all older cities. But no research has been done on a national level, and there are no quick solutions. As with the "ocean dumping" issue, ill-informed and hasty action on combined sewer overflows can easily result in much activity without any real accomplishment.

Years of study and planning are needed before combined sewer overflow priorities can be identified accurately and the needed facilities constructed. Not all communities in the metropolitan area, for example, even know where their sewer outfalls are located. On the other hand, New York City has spent many years intensively studying its own sewer system and has allocated $1.5 billion to reduce its combined sewer overflows. Six projects in key tributaries are already underway, and a seventh project will commence later this year. Along with this priority work, the city is preparing for area-wide projects. Last summer, the city also began a study of every major potential source of floatable trash in its waterways and beyond, the first study of its kind in the nation.

New York's efforts will not cleanse the entire metropolitan region. To accomplish that, surrounding communities must reinvest in their sewer systems and treatment plants. In the future, the region must examine issues related to stormwater run-off, which carries bacteria, trash, pesticides, and other pollutants derived from nonpoint sources.

Other sources of floatable debris, ranging from recreational activities to decaying piers, must be studied and addressed on a regional basis, not by New York alone. The cleanup of major tributaries, and the possible need for more stringent sewage treatment standards, will also require years of planning and large capital commitments throughout the area.

In the summer of 1988 the battle cry was: "Stop ocean dumping NOW!," with little thought as to how the task was to be accomplished or why it was necessary in the first place. In reality, the permanent solutions to coastal pollution can arise only from careful research and planning. Another few years of thoughtless misdirection on the coastal environment, and we will find our population again turning inland, away from the dirty waters. □

The Maryland Initiative: Lesson for the Nation?

In the early 1980s, several reports were released documenting severe problems in the Chesapeake Bay and its tidal areas, among them nutrient enrichment, oxygen depletion, loss of submerged grasses and fisheries, and encroaching development. Maryland legislators responded by passing the Critical Area Law in 1984. The program mandated by this legislation is considered to be one of the most extensive and innovative coastal area protection plans in the country.

The stated purpose of the 1984 law is to "restore the quality and productivity of the waters of the Chesapeake Bay and its tributaries," which have suffered from "the cumulative effects of human activity." The law's provisions focus on: regulating further development of the Bay area through land-use policies aimed at minimizing the detrimental effects of growth; conserving wildlife habitats; and controlling the water quality problems caused by pollutant discharge and run-off from developed areas.

Specifically, the Chesapeake Bay Critical Area Law designated a 1,000-foot collar of land surrounding the Bay and its tidal waters as the "critical area"—an area in which development pressures and frequent land-use changes directly impact the Bay's environment. (Technically, the land beneath these waters is also part of the critical area.) Secondly, the law created a 25-member commission to set guidelines, or "criteria," for implementing the law at county and municipal government levels. These commission members, appointed by the governor, represent developers, landowners, state agencies, and several county and municipal governments with land in the critical area. By 1986, a set of criteria crafted by the Chesapeake Bay Critical Area Commission had been approved by the state legislature.

Maryland passed a controversial Critical Area Law in 1984 to "restore the quality and productivity of the Chesapeake Bay and its tributaries." Shown here is a portion of undeveloped Bay shoreline.

Bob Macomber photo.

Applying these criteria, all counties and municipalities within the critical area were required to develop local protection programs subject to approval by the commission. These programs must include local zoning and development plans for minimizing the adverse effects of growth, but the counties and municipalities retain some autonomy in the process. The intent of the law is to let land-use regulation remain a local decision while the state coordinates overall protection of the Bay waters.

Each local protection program must have certain features. For example, the county or municipality must identify and map, within the critical area, agricultural land, wildlife habitats, soil types, endangered species habitats, tidal and non-tidal wetlands, forest areas, streams, and fish-spawning areas. In addition, the county or municipality must classify land within the critical area according to its level of development using formal categories established by the commission:

- The first category is Intensely Developed Areas. These areas are already intensely developed residentially, commercially, or industrially, and they have minimal natural

habitat. Further development must take into account current and future pollution and run-off problems and minimize them. Any new development should, when possible, be clustered in previously developed areas. Also, man-made, impervious surface area must be kept to 15 percent or less of the development site.

- The second category is Limited Development Areas. These areas are light-to-moderately developed, but still contain areas of natural habitat. New development must take measures to protect the natural habitat areas, forest, woodlands, and streams and to maintain slopes with over 15-percent slope. In addition, as with the Intensely Developed Areas, the man-made, impervious surface area must be 15 percent or less of the development area.

- The third category consists of Resource Conservation Areas. These areas are dominated by wetlands, forests, fishery activities, aquaculture, and agricultural activities. Only residential development is allowed, and it must be consistent with all measures for Limited Development Areas and limited to one dwelling per 20 acres. No new or expansive commercial or industrial development is allowed.

The criteria developed by the commission also designated three goals for managing and restoring the water quality of the Chesapeake Bay. First, counties and municipalities should reinforce and bolster existing state sediment and stormwater control programs. Second, forest areas in the critical area must be preserved and enhanced because they play an important role in filtering run-off. Third, all agricultural areas must implement soil conservation and water quality plans.

In addition, to help protect water quality by filtering run-off, the commission designated a minimum, 100-foot wide "buffer zone" consisting of trees and dense grasses on land immediately adjacent to the Bay. The buffer must be preserved if it exists; if there is no buffer, one must be created and maintained.

Despite heated debate among the four constituents of the program—the legislature, the commission, counties and municipalities, and landowners—of the 16 counties and 44 municipalities affected by the law, all but two counties have local protection programs in place. The commission is currently working with these counties to develop a plan for them.

For this forum, EPA Journal asked six people concerned with the law to answer the following question: do the land-use controls in Maryland's critical area protection program represent an effective approach to protecting coastal resources? Their responses follow:

William D. Schaefer

The Maryland General Assembly made a bold decision in 1984 when, under the leadership of former Governor Harry Hughes, it enacted our state's Critical Area Law. This law reinforces Maryland's commitment to protecting its natural resources by requiring controls and specific land-use techniques in sensitive areas.

Maryland's critical area program is unique, both in its goals and its organization. It is unique because of its emphasis on local leadership and participation. Each county adopts its own growth management plans for areas within 1,000 feet of the Bay and its tributaries. Counties also enforce their decisions through local ordinances. The state's role is to set the guidelines and ensure compliance, not to dictate local policies. This approach has not only fostered cooperation between state and local officials, but has produced excellent plans in each county.

To my mind, the program makes sense environmentally and economically. The program is fundamental to the state's Chesapeake Bay restoration effort. For instance, the 100-foot buffer zone ensures essential habitat for wildlife and acts as a filter, absorbing sediment and soaking up pollutants that can harm the Bay.

The critical area legislation has also set a precedent for teamwork. Many caring people and groups have dedicated their talents and energies to ensuring a balanced and equitable approach to the program. Farmers, foresters, builders, developers, realtors, and homeowners, as well as local officials, are working together to plan for Maryland's future.

We have already learned a great deal from our experience with the critical area program. The Non-tidal Wetlands Protection Act, passed by the 1989 General Assembly, is a national model for environmental concern. This new law builds on the precedent set in the Critical Area Law and establishes a net gain in wetland acreage in Maryland. As we face the challenges that lie ahead, we will continue to draw from the critical area program as a model for effective land-use control and planning.

Protecting Maryland's environment and the Chesapeake Bay is an immense challenge. It will take teamwork, ingenuity, and hard work by all of us. But we can do it. The Critical Area Law is a very good first step in managing and directing environmentally feasible growth and protecting one of Maryland's most valuable resources, the Chesapeake Bay.

(Schaefer is the Governor of Maryland.)

George Sheehan

Even in the development industry, most people agree with the state of Maryland's laudable intent in the Critical Area Law. The criticism of the law within that industry, however, is a result of the law's inequitable targeting of and impact on the development industry. There are basic issues in the law that deserve reconsideration.

First of all, housing is no less a vital necessity to life than is farming or employment. Yet, of all the recognized contributors to the problems of the Chesapeake, the housing industry is by far the most severely restricted activity. Ninety percent of the land area within the critical area is, for all intents and purposes, removed from inventory as available land for housing by its being designated as a Resource Conservation Area—i.e., one unit per 20 acres.

Agriculture, on the other hand, is specifically described in the legislation as a preferred land use, despite its significant pollutant-loading of the Bay. Farming, while subject to minor restrictions, is permitted, and even encouraged, for the totality of the land within the designated critical area. To the extent that housing is permitted in the small percentage of the critical area, its development is further restricted by the regulations adopted under the law, including the requirement of buffers from 100 to 300 feet wide, as opposed to a "25-foot vegetated filter strip" for agricultural purposes.

Second, the housing density of one unit per 20 acres in the Resource Conservation Area is an inappropriate and unnecessarily restrictive requirement. The single rationale used by the commission in adopting the 20-acre rule was based on data provided by the Maryland Department of Assessment and Taxation, purportedly showing that agriculture required a minimum of 20 acres. Preservation of farmland is not, ostensibly, the primary goal of the law; protection of the Bay from degradation is.

If you were to take 100 acres and build five houses, each separated by 20 acres, it doesn't take much imagination to understand the amount of roadway necessary to serve those five houses. On the other hand, if you have that same 100 acres, and you clustered, for example, 40 units on 10 of those acres, it is easy to imagine the reduction of road surface, the increase in absolutely undisturbed area, and the significantly favorable economic impact on housing costs.

David W. Harp photo.

Canada Geese are frequently seen foraging on farmers' fields in the Chesapeake Bay area.

Finally, in many cases, the implementation of the Critical Area Law is confiscatory in nature, with no provision for compensation of property value taken. In an actual case example, a developer (who had owned the subject land for 30 years), applied for and obtained, in 1976, local governmental approval for a large residential and industrial park community—a portion of which was located on the shores of a Bay tributary. The developer then began the project, investing millions of dollars in the roads, utilities, and other services necessary for such an undertaking.

This investment was, of course, based upon the developer's reasonable assumption that the land would yield the number of homes and acres of industrial park previously approved. Eight years later, with the arrival of the Bay legislation, the developer suddenly found the ongoing and successful project in financial jeopardy. Almost 20 percent of its previously available, but yet to be developed, land had been designated as Resource Conservation Area. Revenues lost will probably exceed $8 million.

Legislation passed in the heat of debate, more often than not, requires reexamination and amendment after time provides experience and teaches us lessons. Maryland's Critical Area Law appears to fit this pattern.

(Sheehan is former Chairman of the Critical Area Committee of the Maryland Homebuilders' Association and currently Vice President of American Landmark Homes.)

Sarah J. Taylor

Has Maryland's Critical Area Law been effective? Looking back over five years of recent experience, I would have to answer, "Yes, but only if . . . ." You have not lived until you try to develop a set of guidelines, or controls, to direct and manage land use for the protection of a resource or critical coastal area. The effort becomes a highly visible and unpopular one, and no one is fully content or happy when the effort is finally completed.

In order for land-use controls to be successful in protecting a resource, five essential ingredients are needed. First, there must be an overall strategy that addresses every land use that affects and impacts every interest. Farmers, foresters, realtors, developers, conservationists, environmentalists, industry, the legislature, and everyday citizens must be involved in the development of the guidelines or controls.

Every interest must perceive other interests as having to "give up something" dear to their hearts to protect that resource. How often have we heard, "It's the farmers' fault!" or "It's the city's fault with its sewage and industrial dumping that degraded the critical coastal area!" We must stop fingerpointing and take responsibility for our own actions.

Second, there must be a tandem effort to restore declining resources and to handle specific problems. These efforts could include programs to replant disappearing underwater grasses or to upgrade failing sewage treatment plants. Land-use controls are not the panacea for resource protection; they are a part of the overall picture. Reducing

sediment run-off does not necessarily guarantee that underwater grasses will grow and flourish. However, planting of grasses coupled with a reduction in sediment may attain that result.

Third, there must be federal, state, and local coordination to see that these controls or guidelines are carried out. This is important because federal laws and programs influence state and local land use, such as federal funding for sewers and flood insurance. In too many cases, federal policies dictate land uses sometimes to the detriment of state policy. State governments must establish their own programs, setting up a framework upon which local, state, and federal decisions must be based. All levels are essential: the federal for funding and broad-based policies; the state for the overall framework; and the local because that is where decisions are made as to what use goes where and how it is to be designed or managed. In fact, any land-use control program should require that local codes, ordinances, and regulations be changed to reflect the state's standards.

Fourth, land-use controls will only be effective with a continual effort to educate the various interests and publics. It is essential that people know why they must plant trees, reduce impervious surfaces, or maintain a protective buffer between an activity and a resource.

Finally, land controls are only as good as they were envisioned to be. Situations change, and implementing some controls may not result in the protection of a critical coastal area exactly as envisioned. Reassessing and evaluating becomes essential to the overall effectiveness of these controls, and all interests and levels of government must actively play a role in making sure that specific approaches are still applicable.

(Taylor is the Executive Director of the Chesapeake Bay Critical Area Commission.)

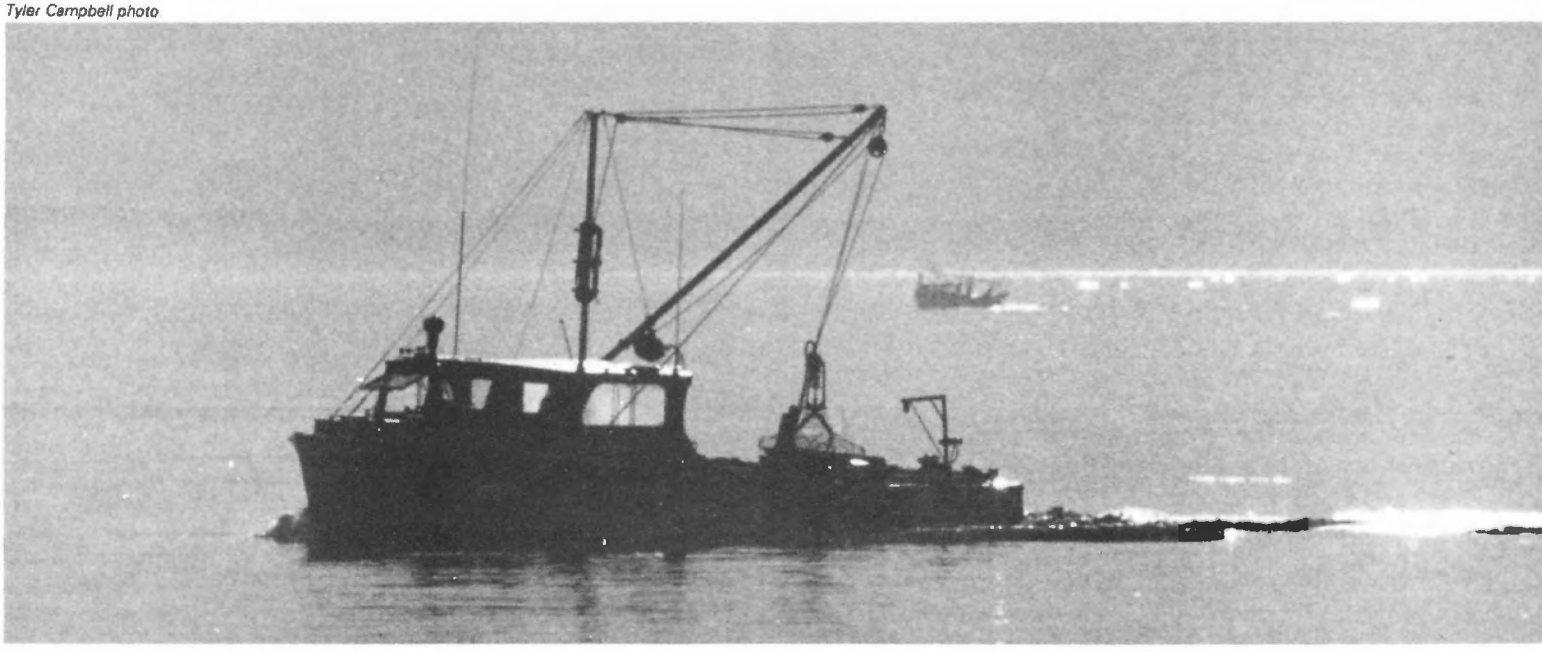
The critical area program has had several positive effects. For instance, the program has forced many local governments and planning departments to make a serious evaluation of the adequacy of existing standards for protecting the environment and managing growth. Until the implementation of local critical area programs, many rural jurisdictions around the Bay had only minimal planning programs and land-use regulations. Many local ordinances had remained almost unchanged since the late 1950s and early 1960s. The program has provided both technical and financial assistance to local governments to help them become more effective in protecting the environment and managing growth for the entire county, not just in the critical area.

The critical area program does, however, have serious flaws which impact the effectiveness of many of the Chesapeake Bay clean-up programs.

The first of the program's flaws is the assumption that managing development activities within 1,000 feet of tidal waters will have anything but minimal impact on water quality. The nonpoint sources of pollution reaching the Bay can only be reduced through management on a watershed basis. The EPA studies conducted on the Bay during the 1970s clearly identified farming as a major source of nonpoint pollution within the watershed. Ironically, farming is noted as a "protective" land use for the waters of the Bay by the Critical Area Law. Until management standards are implemented for agricultural uses and land development on a watershed-wide basis, there will be minimal improvement on nonpoint-source pollution.

The criteria developed as a result of the Critical Area

Tyler Campbell photo



Law attempt to address both growth management and environmental concerns, but they cannot adequately address growth management issues on the present 1,000-foot basis. A density limitation of one housing unit per 20 acres, as imposed by the criteria, has very little relationship to water-quality improvement and might be considered a growth management tool.

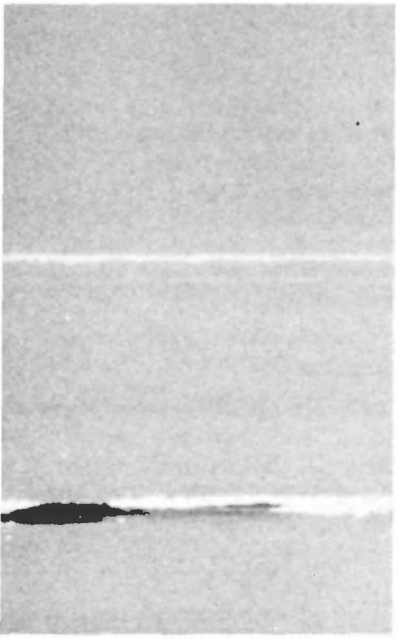
The criteria should be more focused on technical means for improving water quality and protecting wildlife habitat. Regional growth management should not be addressed in an environmental protection program.

For all practical purposes, the program acts as a zoning ordinance for that land area within the 1,000-foot boundary. The program regulates zoning, land use, density, and bulk of all development. The critical area criteria are not equipped, however, to effectively regulate such issues. The criteria lack adequate definitions and procedural requirements to implement effective overlay zoning requirements. The program should be more concerned with the *impact* of land uses rather than actual use.

The program has established several performance standards protecting important wildlife habitat and limiting disturbance. But by strictly limiting development potential along the Bay, it has generated considerable controversy. Although a great deal of attention has been focused on these issues, proportionately the benefit to the Bay will be minimal. Unfortunately, the critical area program has directed the focus away from more immediate and costly problems such as sewage treatment plant upgrading and land-use management on a watershed basis.

Although the program has been in place since 1986, it has not been changed. It is time to constructively criticize and revise the program in order to make it more effective.

(Stevens is the director of the Queen Anne's County Department of Planning and Zoning.)



Due to disease and over-harvest, Chesapeake Bay oyster beds are severely depleted.

The Maryland critical area program, considered at this early date in its implementation, must be tentatively judged a success. Nearly all local jurisdictions now have local protection programs in place, approved by the state's Critical Area Commission, and that alone is an accomplishment. The most strictly controlled subset of land within the critical area, the Resource Conservation Area, comprises a total of 515,269 acres—another impressive measure of achievement.

But there are reasons to be cautious in judging whether the program will be fully adequate in the long run. First of all, the criteria established by the commission for implementing the Critical Area Law at county and municipal levels have a number of loopholes, the full significance of which is not yet clear. Many of these loopholes represent deliberate compromises built into the criteria through the give-and-take of the political process. However, many other loopholes are accidental, and these are now emerging as the program is being implemented in Maryland's various counties and municipalities.

For example, there are intentional loopholes concerning development in the Resource Conservation Area. Within this formally designated area, thousands of subdivided land parcels of less than 20 acres were "grandfathered-in," but we do not know exactly how many. Many of these individual land parcels were hurriedly created by landowners who rushed to subdivide before the criteria set by the Critical Area Commission took effect. In general, development within the Resource Conservation Area must be limited to one dwelling per 20 acres; however, this will not preclude the construction of houses on these "pre-existing" land parcels of less than 20 acres.

In addition, the critical area program criteria contain "growth allocation" provisions whereby, according to a given formula, each county may convert five percent of its Resource Conservation Area either to Limited Development Area or Intensely Developed Area. As a result, islands of development can be expected to pop up in the midst of land that most people now consider to be protected for agriculture or other open-space use.

It is not unusual for accidental loopholes to show up in the first few years of a new regulatory program, when unforeseen questions tend to arise. This is happening now with the Maryland critical area program, and new questions keep coming up every day. For example, is a golf course permissible in the Resource Conservation Area? Can septic systems be built in the Resource Conservation Area that service houses outside the critical area? In the long run, the case-by-case resolution of these and innumerable other questions will significantly affect the overall success of the program.

Moreover, it will not be possible to pass final judgment on the long-term success of the program until local governments and the commission have established a clear track record regarding the strict enforcement of the local protection programs now in place. If special exceptions and program amendments are routinely granted, we will be back to

Gerald W. Winegrad

"business as usual," and the program will fail.

But perhaps the most important point is that Maryland's critical area program is winning political acceptance for the concept that the state has a leadership role to play in land-use planning. The various myths about land-use regulation that clouded the birth of the program are now being dispelled; much of the political opposition to the program has been quieted. This opposition was largely based on misperceptions about the effects of the program on development and property values. Many people feared that all development would be squelched and property values in the critical area would plummet. On the contrary, considerable development is allowed, and recent studies have shown that the value of land in the critical area has appreciated at a higher rate than property outside the area.

Clearly, the use of land anywhere in the vast watershed of the Chesapeake Bay—not just within the first 1,000 feet inland from the shoreline—has the potential to degrade water quality in the Bay and to destroy important habitat. This is one reason why, in the long run, comprehensive regional land-use planning will be needed to provide a viable growth-managment strategy for Maryland. The critical area program does not purport to be this kind of comprehensive program. However, in addition to accomplishing some important immediate objectives, it may serve as a valuable stepping stone to a more broad-scale land-management strategy in the future.

(Hillyer is Director of the Lands Program at the Chesapeake Bay Foundation.)

One of the world's most productive estuaries is experiencing a significant decline in many of its living resources. The great Chesapeake Bay, called a "protein factory" by H.L. Mencken, has experienced a drastic drop in key fisheries, moratoria have been imposed for taking and possession of striped bass and shad, and the oyster fishery is at its lowest ebb.

A 1983 interstate agreement brought EPA, Maryland, Virginia, and Pennsylvania together in a coordinated effort to clean up the Bay, and over $400 million has been spent on initiatives to deal with pollution sources. But continued population growth and sprawl may undo the Bay clean-up strategy. The reluctance or inability of county and municipal governments to effectively manage growth and limit or prevent development of sensitive areas led to Maryland's Critical Area Law.

Critics have charged that the law and the criteria that Maryland's Chesapeake Bay Critical Area Commission established for development are unfair and prevent growth. The criteria governing the critical area do *not* prevent development; they do, however, *limit* development, and what development occurs must be accomplished in an environmentally sensitive fashion. Even a strict interpretation of the criteria allows for the construction of over 65,000 new housing units, *without considering* the exemption for lots subdivided before the law was enacted. This hardly prevents growth.

The Critical Area Law is the most controversial piece of the state's massive Bay clean-up plan. Land-use decisions have long been regarded as the exclusive prerogative of local government and private landholders. But former Governor Harry Hughes and a Maryland legislature formerly committed to protecting local land-use policies, recognized the need to take action to prevent land abuses of the past from being repeated in the critical area. The legislation was overwhelmingly passed over the protests of organized groups representing the counties, realtors, homebuilders, and the Chamber of Commerce.

Despite resistance from many local governments, the law is working. Development has been restricted, and any development that occurs is carefully scrutinized to assure that the stringent criteria developed to enhance water quality are met. Maryland found it absolutely necessary to enact land-use controls on some of our most desirable and expensive real estate because of the realization that population growth and related development could overcome our major efforts to restore the Bay.

But still, critics argue that residential development is necessary to increase revenues for local government. This myth can be put to rest; analytical studies conducted throughout the United States indicate that residential development is a net revenue loser. Maryland counties are already imposing impact fees in recognition of this. A study of Loudoun County, Virginia, indicates that for every $1 in new residential tax revenue, $1.28 in services are required. All taxpayers must pay the cost of new schools and roads to service development.

Population growth, sprawl, and development must be limited and restricted if we are to reverse the decline in the Chesapeake Bay and all of our U.S. coastal resources. With the influx of people and development to coastal areas that is a recurrent theme in this issue of *EPA Journal*, it is no mere coincidence that our coastal areas, including the land adjoining the great Chesapeake Bay, have the greatest population concentrations *and* the greatest water quality problems.

Further development must be placed under stringent environmental controls to prevent the loss of forest cover and wetlands and to prevent the significant increase of point and non point-source pollutants. The Critical Area Law provides for growth limitations and environmentally sensitive development in a 1,000-foot zone around Maryland's portion of the Chesapeake Bay. The law works, but the designated critical area needs to be extended beyond 1,000 feet to further protect Maryland's rivers and the Chesapeake Bay. We face no greater environmental threat than that of overdevelopment and sprawl. □

(Winegrad is a Maryland State Senator from Anne Arundel County and chairs the Senate Subcommittee on the Environment.)

A View from Congress

by Gerry E. Studds

Two years ago, the House of Representatives Subcommittee on Fisheries and the Environment, which I chair, began a series of hearings on pollution of our nation's coastal waters. We wanted to find out why, 16 years and billions of dollars after passage of the Clean Water Act, coastal water quality seemed not better, but worse.

From Puget Sound to Boston Harbor, the story was the same—trashed beaches, poisoned waters, contaminated fish. How could this be? Who is responsible? What can be done?

We were not out to finger villains, but to define problems and explore possible solutions. In fact, rather than villains we found only good intentions that had run into brick walls of demographic, budgetary, and political reality.

We found that the nation's capacity to regulate coastal pollution is being outstripped by its capacity to create coastal pollution.

We found that the nation's capacity to regulate coastal pollution is being outstripped by its capacity to create coastal pollution. Americans are moving to the coasts, bringing with them their automobiles, their garbage, their sewage, a certain amount of carelessness, and their needs for ever-increasing commercial, residential, and recreational space. By the year 2000, two million more people will move into areas along the Chesapeake Bay, enough to populate two new cities the size of Baltimore.

This fact alone confirms what the Red Queen said to Alice in Wonderland: it will take all the running we can do just to stay in place!

We also confirmed the obvious: stopping pollution costs money, and nobody, especially the federal government, has enough. It will take tens of billions of new construction dollars over the next decade to give our sewage the treatment it deserves. In addition, state and local governments will need many more millions for the enforcement, monitoring, and research required for effective regulation of existing and future industrial waste discharge.

The hearings also disclosed how little we really know about coastal pollution,

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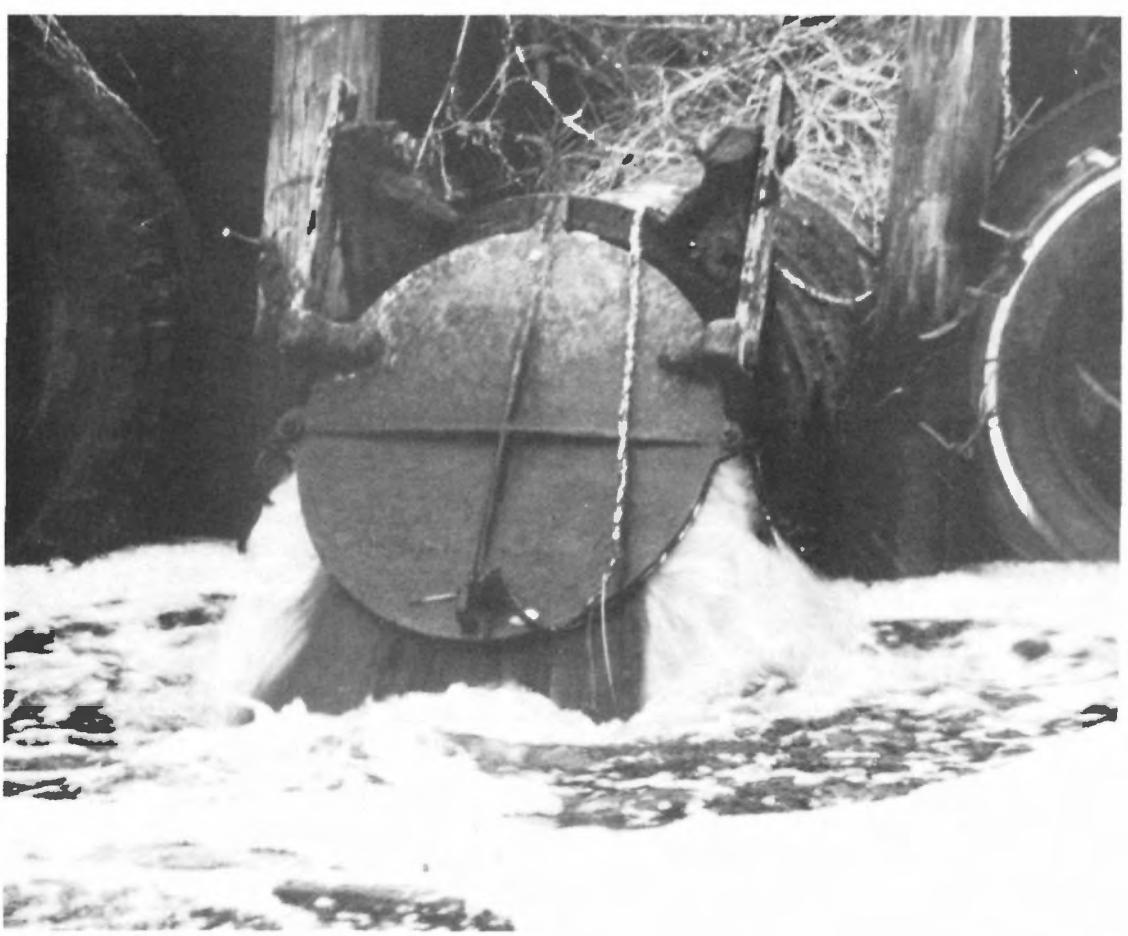
(Studds (D-Mass.) chairs the House Subcommittee on Fisheries and the Environment.)



Estuaries and near-coastal waters are plagued with pollution from industrial and wastewater outfalls, as well as combined storm and sanitary sewage overflow systems.

years of federally funded research notwithstanding. The fact is we know very little about the source or extent of the pollutants that are degrading our coastal waters. Without such knowledge, it is impossible to formulate meaningful water quality standards and implement effective pollution control efforts.

We were told, also, that our laws are not working the way they should. For too long, the focus has been on cleaning up rivers, while estuaries, harbors, bays, and sounds have been ignored. EPA has been slow to perform needed technical work and timid about pressing states to set water quality standards. As a result, most states have failed to establish standards for most pollutants, and the state standards that do exist are often vague and meaningless. Some midwestern states, for example, bar toxics "in toxic amounts" from the waters of the Great Lakes. EPA has accepted that vague standard as adequate to ensure "fishable" waters. Nevertheless, government health experts are telling us not to eat some Great Lakes fish.

Finally, we learned that a major source of coastal pollution—perhaps the single greatest source—isn't regulated at all. Unimaginatively and inaccurately described as "nonpoint-source" pollution, it comes not from sewer pipes but from urban streets, construction sites, farmland, and even from the sky. It may be responsible for 50 percent of the toxics that end up in our coastal waters.

Following the hearings, the Subcommittee published an oversight report entitled *Coastal Waters in Jeopardy*, which documents what we learned about the problems and how some of them might be alleviated or solved. One focus of the report is on the need to encourage states to analyze proposed development in or near coastal areas in terms of its impact on water quality, fish and wildlife habitat, and wetlands. As a related matter, it is also imperative to stop government subsidies for development in the most environmentally fragile coastal areas. (After all, if Mother Nature had wanted casinos and high-rise hotels on our coastal barrier islands, she would have put them there.)

For too long, the focus has been on cleaning up rivers, while estuaries, harbors, bays, and sounds have been ignored.

Our findings also suggest that funding needed for construction of new and better sewage treatment facilities really can't be conjured up by the U.S. Treasury, but might better come from fees assessed against all those, except municipalities, who discharge potential pollutants into coastal waters. Such fees would create a financial incentive not to pollute (or to pollute as little as possible) and could also provide state and local governments up to $100 million a year to improve their water quality and coastal management programs.

In addition, there is a need to establish a national coastal monitoring program targeted at areas of special importance. Such a program could be designed not just to ensure compliance with pollution-discharge requirements, but also to assess the overall health of the ecosystems involved. The program's goal would be to trace pollutants back to their source and to develop data that will tell us more precisely what pollutants are doing to our coastal waters, and why.

Based on the findings of the Subcommittee, it seems clear that certain steps should be taken to improve the overall effectiveness of water quality control programs. For example, EPA should issue minimum federal standards for a broad range of pollutants. In addition, those seeking to discharge into pristine waters should be required to meet special standards of need to do so. Also, as an enforcement measure, federal aid and contracts should be suspended for coastal areas and dischargers that continually violate federal standards.

There is no question that the nation will enter the 1990s with a far different attitude than we had as the 1980s began. After years of complacency, the syringes and vials of blood, closed beaches, and mutant fish have left their mark on the national psyche.

For two centuries, Americans have been drawn to the sea, where we have battled the tides, enjoyed the beaches, and harvested the bounty of our coasts. The oceans are nature's greatest gift to us. The time has come to reclaim that gift for ourselves, for our children, and—if we do the job right—for those whose footprints will mark the clean, white, wet sands of beaches from Maine to California long after ours have washed away. □

Louisiana's Wetlands Calamity

by Peggy Rooney

Office of Sea Grant, Center for Wetland Resources, Louisiana State University photo

Islands of wetlands: aerial view showing the remnants of what was once solid Louisiana marsh.

The present rate of wetlands loss in Louisiana represents about 80 percent of coastal wetland losses annually in the continental United States.

Within the next century, according to scientists' predictions, the four coastal Louisiana parishes of Lafourche, St. Bernard, Terrebonne, and Plaquemines may be mostly under water. Wetlands in Plaquemines Parish could be eroded away in only half that time.

Louisiana has approximately 300 miles of wetlands-rich Gulf coastline, stretching from the Pearl River westward to the Sabine River. However, Louisiana's coastal lands are being lost (transformed into open water) at a rate that presently approaches 60 square miles each year. In recent years, the rate of loss has increased dramatically—from approximately 16 square miles annually in 1970 to roughly 50 square miles annually in 1980—and it continues to accelerate. The present rate of wetlands loss in Louisiana represents about 80 percent of coastal wetland losses annually in the continental United States.

There have always been wetland losses along the Louisiana coast. Historically—over thousands of years—these losses have been largely offset by buildup from sediment deposition elsewhere along the coast. Today, however, wetland losses in Louisiana vastly outstrip any

(Rooney is Public Information Coordinator for the Coastal Management Division, Louisiana Department of Natural Resources.)

compensatory buildup of new land. This situation has interacting natural and human causes.

Natural causes of wetland loss include subsidence (sediment compaction and sinking of the earth's surface), rising sea level, normal wave action, storm-driven surges and tides, and the intrusion of salt water into freshwater areas. Human-induced causes of wetland destruction in Louisiana include the leveeing of the Mississippi River, dredging and spoil disposal, mineral extraction, wave action from vessel traffic, and deliberate draining of wetlands for development purposes.

Consider the natural process of wetland loss. Over thousands of years, sediment from the Mississippi River has fanned out to form several deltas in Louisiana. Always seeking a shorter, steeper route to the Gulf of Mexico, the river has repeatedly shifted its course and begun depositing sediment in another area to form a new delta. The river has shifted course in this way several times over the past 5,000 to 7,000 years. Often, a new delta was built on top of an older, abandoned delta, or old and new deltas overlapped. With time, the sheer weight of these sediments caused them to "dewater" and compact. When this compaction was combined with the redistribution of sediments by wave and current action, the abandoned delta subsided (gradually sank), creating bays and other areas of open water.

Subsidence in combination with a rising sea level results in an increase in "relative sea level"—in other words, a lowering of the earth's surface relative to water level. Subsidence currently plays a much greater role than sea-level rise in Louisiana's wetland losses. Recent studies indicate that subsidence may account for 80 to 90 percent of the relative sea-level rise in southeastern Louisiana. While subsidence is a natural tectonic process, it is exacerbated by human activities such as the pumping of oil and ground water.

Also contributing to wetland losses, normal wave action and storm surges cause erosion of shorelines by breaking up sediment held together by the root systems of wetland vegetation.

The levees have had the effect of reducing or eliminating many freshwater areas and interfering with the deposition of sediment in coastal marshlands.

Hurricanes can be devastating to wetlands—not only because they may erode a coastline very quickly, but also because hurricane winds force highly saline water into freshwater areas, damaging existing vegetation.

This influx of salt water into freshwater areas also occurs to some extent under less severe weather conditions. As coastal wetland areas are lost and barrier islands eroded, allowing increased inflow of salt water, the remaining fresh marsh and swamp areas must support a different and more saline-tolerant vegetation. If this new vegetation does not establish itself rapidly, the freshwater wetlands may become open water as erosive forces carry away the sediment. With no vegetative root system to hold it together, the organic root mat is loosened and the substrate is easily washed away by tides and storms.

In Louisiana, due to human interference with the Mississippi River's flow regime—through the construction of levees along the main channel of the river and its distributaries—new areas of open water are being formed at increasing rates. The levees have had the effect of reducing or eliminating many freshwater areas and interfering with the deposition of sediment in coastal marshlands.

This means new wetlands are not being created to replace those lost due to natural processes. Sediments that in the natural course of things would be deposited in coastal wetlands, as rivers and streams overtop their banks, are now being washed down channels into the Gulf. Jetties, built at the mouth of the Mississippi River for the purpose of keeping sediment from building up, serve to funnel the sediment carried by the river off the edge of the Continental Shelf.

As sediments are washed out into the Gulf, Louisiana's beaches and barrier islands are also subject to increased erosion, again because there is little sediment deposition to counterbalance natural erosive forces. For the same reason, more and more tidal inlets (short, narrow passages connecting two larger bodies of water) are being formed and expanded. All of this has undercut the role of our barrier islands and beaches as the "first line of defense" against hurricanes and other storms. Thus, through a degenerative cycle, our wetlands have become increasingly vulnerable to the destructive effects of such storms.

Wetland loss means loss of fish and wildlife habitat, and for this reason, the ongoing loss of wetlands in Louisiana has tremendous implications for the biological productivity of its coastal areas. South Louisiana's marshes and estuaries provide major nursery grounds for fish and shellfish. Generally speaking, about 75 percent of all commercial marine species, such as menhaden and shrimp, rely on coastal marshes and estuaries to sustain part of their life cycle. Louisiana's economy relies heavily on commercial fisheries, with its seafood catch having an annual value of approximately $170 million.

Clearly, with the loss of its coastal wetlands, Louisiana stands to lose not

What says Mississippi River more than an old-time paddle boat? Engineering efforts to tame the mighty river, interacting with natural forces in unforeseen ways, are causing major wetland losses along the Louisiana coast.

Delta Queen Steamboat Company photo.

just land area, but resources that are vitally important to the state's commerce and industry. Nationally, the state ranks very high in harvests from commercial fisheries, accounting for approximately a quarter of the total U.S. catch. And thanks to its wetlands, Louisiana leads the nation in fur and alligator harvests.

The Louisiana coastal area is a product of thousands of years of delta growth. Unless we act swiftly and effectively to prevent its further deterioration, our wetlands and the vast resources they support will be gone in a very short time. Moreover, continued wetland loss will affect not only the state of Louisiana. These impacts would be felt by the entire nation.

Federal and state agencies including the U.S. Army Corps of Engineers, EPA, and the Louisiana Department of Natural Resources are currently working together on a comprehensive plan to address the problem of wetland loss.

Earlier this year, a report entitled *Louisiana Comprehensive Wetland Study* was completed by the Corps of Engineers. The study concluded that in addition to the continued cooperation of the federal and state agencies involved, a state/federal cost-sharing agreement is needed for success in slowing the present rate of wetland loss.

As part of the comprehensive plan that is being developed, several structural and non-structural measures have been proposed, including freshwater diversion and the creation and restoration of wetlands. Revisions to existing wetlands statutes and regulations and changes in present administrative procedures have also been proposed.

It is impossible to overstate the importance of these initiatives within the context of an overall plan. For without a coordinated state/federal effort, the Louisiana wetlands will not stand much chance for survival. □

The Atchafalaya River Delta

In contrast to the rest of Louisiana, where coastal lands are being lost at a staggering rate, one coastal area is experiencing a gain in land area. This is the Atchafalaya Bay region in Louisiana's central coastal area, in southernmost St. Mary Parish. As an exception to the general pattern, the Atchafalaya River delta is particularly important in that it represents the first progradation of a major shallow-water delta in Louisiana in 300 years. The delta first emerged above water level in 1973, following one of the largest floods on record.

To help protect this new resource, Louisiana has designated an Atchafalaya Delta Wildlife Management Area, which presently includes 15,000 acres of exposed land and 120,370 acres of open water. One of the unique characteristics of the Atchafalaya Delta is that saltwater and freshwater organisms seem to be able to coexist there. Larval and juvenile shrimp, speckled trout, menhaden, mullet, croaker, and crabs may be found along with freshwater catfish, sunfish, and other species.

Scientists project that over the next 30 to 50 years, about 120,000 acres of land may be created in Atchafalaya Bay. These projections are based on the Atchafalaya system's not being significantly affected by human actions, and on the future occurrence of annual flood events with the same frequency as in the past.

The Challenge to Protect a Virginia Island

by Karen L. Mayne

The saying goes that time and tide wait for no man. Perhaps nowhere is this more evident than on the almost 400 islands, spits, and peninsulas that form a protective fringe along 2,700 miles of the Atlantic and Gulf coasts. These coastal barriers—ribbons of sand, as they are called—are the first line of defense against winter storms and hurricanes for 18 states from Maine to Texas.

These coastal barriers are also one of our most important habitats for fish and wildlife. Their extensive beaches, dunes, and wetland complexes harbor a greater variety of bird species than any other ecosystem in the continental United States.

But the effects of hurricanes, northeasters, erosion, and sea-level rise notwithstanding, they are the target of developers seeking to capitalize on America's love affair with the coasts. Some of our largest coastal cities such as Galveston, Miami Beach, Virginia Beach, and Ocean City, Maryland, have been built on what were originally ephemeral coastal barriers. Concern about the continued development of the remaining undeveloped barriers, and the resultant costs to the federal government for flood damage resulting from severe storms, led Congress in 1982 to pass the Coastal Barriers Resources Act. The Act placed essentially undeveloped barrier islands within a "Coastal Barriers Resources System" and prohibited use of federal funds for flood insurance construction or projects such as water supply systems, bridges, bulkheads, or jetties.

Cedar Island, Virginia, is an Atlantic barrier island that reflects in miniature what is happening along much of our nation's coasts. The island is a narrow, six-mile long coastal barrier on Virginia's "Eastern Shore," a portion of the Delmarva Peninsula that forms the eastern boundary of the Chesapeake Bay. There are approximately 35 to 40 summer houses on the island, some built in the 1950s and others more recently. Access is by boat and there are no roads. With the exception of a few houses at the north end of the island that have service from a small electric cooperative that served a former Coast Guard station, residents must generate their own electricity.

The island supports nesting colonies of several species of terns and other shorebirds, as well as the piping plover, a federally listed threatened species, and the Virginia state-listed endangered Wilson's plover. The island was recently designated a national wildlife refuge. Although named for the extensive red cedar forests that once flourished there, Cedar Island now has little forest because of erosion that washes away an average of 15 feet of land per year.

Cedar Island, Virginia, is an Atlantic barrier island that reflects in miniature what is happening along much of our nation's coasts.

Virginia's 80-mile string of barrier islands and their associated barrier bays and wetlands comprise the largest remaining barrier ecosystem on the Atlantic coast that is relatively undeveloped.

Cedar Island is one of the 13 barrier islands that run like a string of pearls along the coast. Seven of them are primarily owned and protected by The Nature Conservancy and have been recognized by the United Nations as an International Biosphere Reserve. Four of the islands are in federal or state ownership. Only Cedar Island and Assowoman Island are still privately owned. Both were placed in the Coastal Barrier Resources System in 1982.

While several of the islands were targeted for development in the 1950s and 1960s, only the plans for Cedar Island made it past the drawing board. In 1950, a large property owner subdivided most of the island and sold hundreds of small lots with the hope of creating an "Ocean City, Virginia" to rival its namesake in Maryland. But plans for a bridge from the mainland fell through and the development was largely abandoned. Through the 1960s and 1970s, only a few small beach cottages had been built, and the erosion of the island resulted in many property owners losing their lots to the ocean.

In 1984-85 the daughter and son-in-law of the original developer bought back most of the island and re-subdivided it into larger lots that extended from the ocean to the wetlands behind the island. Public sentiment, reflected by a number of environmental and conservation groups, was decidedly against further development of Cedar Island, which became a test of whether all levels of government could adequately regulate the private development of an island within the Coastal Barrier Resources System and maintain natural resource values.

Some regulatory actions were quickly taken. The Virginia Marine Resources Commission, which regulates the development of primary dunes, promulgated a special policy and guidelines regarding the development of barrier islands that would, among other things, preclude permanent cuts or roads through dunes and the beachfront or the hardening of the beach by such measures as bulkheads or groins. Accomack County, of which Cedar

(Mayne is with the Division of Ecological Services, U.S. Fish and Wildlife Service in Gloucester, Virginia.)

Stephen Leatherman photo

As the recent history of Cedar Island illustrates, it is not always easy to protect fragile barrier islands from development.

Island is a part, amended its zoning ordinances to establish a barrier island district that included regulations on vehicle use, lot and house size, removal of sand and vegetation from primary dunes, and solid waste disposal.

EPA and the Corps of Engineers conducted an "Advanced Identification of Wetlands and other Special Aquatic Sites" on Cedar Island. This Advanced Identification, authorized under Section 404 of the Clean Water Act, notified the public that the wetlands and other special aquatic sites on Cedar Island would be considered generally unsuitable for the disposal of dredged or fill material.

The U.S. Fish and Wildlife Service initiated the study that determined Cedar Island should be protected as a national Wildlife Refuge and sent out information packages on the endangered piping plover to the approximately 250 property owners listed as having purchased lots from the developer.

Despite these regulatory actions, Cedar Island proved to be a regulatory quagmire for governmental agencies. Other actions notwithstanding, county and state agencies have issued permits for septic systems, houses, and piers. Accomack County does not have the staff to enforce its own zoning ordinance prohibition of activities such as use of all-terrain vehicles and the placement of snow fences.

While there is a general recognition that the development of such an erodible and narrow barrier island is questionable at best, the development is occurring because the activities are in "technical compliance" with the various agencies' policies and regulations. And, as development is permitted, houses, vehicles, and people are replacing the nesting shorebirds and natural habitat.

Concern is now focused on a plan by the current developers to construct a community pier on the island. The pier cannot be constructed without a permit from the Corps of Engineers. Due to the presence of the federally listed piping plover on Cedar Island, the Endangered Species Act requires that the Corps of Engineers consult with the U.S. Fish and Wildlife Service about how the proposed pier would affect this shorebird.

While construction of the community pier would provide the island with easy access by boat, the question is whether the growth-inducing effects of a community pier—which could be detrimental to the piping plover and other shorebirds—can be offset by restricting vehicles and other human uses of the island during the piping plovers' nesting season.

The Cedar Island story raises questions with no simple answers. For example, do private individuals have a right to develop barrier islands if they are willing to accept the risks of flood and storm damage with no guarantee of government financial assistance?

What would happen if homeowners became stranded on the island during a storm and the local county couldn't implement evacuation plans to get them off without unduly risking the lives of emergency personnel? How can well-intentioned policies and regulations be enforced when agencies do not have adequate staff, and regulatory boards are willing to permit questionable undertakings because they comply with the technical requirements, if not the spirit, of those policies?

Cedar Island reveals that no matter how well-intentioned are our current laws and regulations, private development of barrier islands will continue, and agencies at all levels of government will continue to spend large amounts of staff time and financial resources evaluating the appropriateness of the development, responding to the concerns of people who believe the nation's remaining natural barriers should remain that way, and monitoring the development once it occurs.

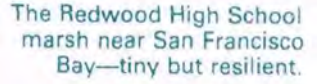
Although no one has tallied up the governmental costs for the review and monitoring of Cedar Island development, these could easily run into thousands of hours of staff time and hundreds of thousands of dollars in cost to the taxpayer.

Meanwhile, time and tide are waiting for no one, especially on Cedar Island. In the last three years, three houses have been lost to storms. The north end of the island eroded approximately 300 feet in one year, forcing four houses to be relocated to a less erosive part of the island. The local electric cooperative abandoned plans to run an electric cable down the island when erosion resulted in its right-of-way ending up near the beach face. As the beach erodes and becomes narrower, the dead and dying cedar trees that once gave the island its name are being cut down and burned so that vehicles can traverse the island.

Will the Atlantic Ocean do what governments seem incapable of doing and stop the development of Cedar Island? Only time will tell. □

The Saga of an Urban Marsh

by Peter Grenell



The Redwood High School marsh near San Francisco Bay—tiny but resilient.

I used to look at marshes and think "swamps"—flat, muddy, uninteresting places of no use to humans, except possibly as sites for duck hunting. But after several years of working to protect our dwindling natural resources, including marshes, I've come to appreciate the immense biological, physical, economic, recreational, educational, aesthetic, and spiritual values that marshes have.

The importance of marshes and other wetlands has only recently been recognized. In fact, most of this country's coastal wetlands have been lost—filled or dredged out for farms, towns, and ports. Around San Francisco Bay, for example, only remnants remain of the once-great marsh system that European settlers found when they arrived a little over 200 years ago. Here, briefly, is the story of how one of these marsh remnants is being brought back to life.

The 11-acre Redwood High School Marsh is located in the suburban city of Larkspur, a few miles north of San Francisco in environmentally conscious Marin County. Levees and streets border the marsh on two sides, and a filled area was recently developed as a community athletic field. Drainage culverts enter the marsh from the west side, bringing in fresh water, especially during the winter rainy season. Because of the large freshwater inflow on this side, plant species that grow in mixed salt and fresh (brackish) water can be seen.

Salt marsh species are found closest to the Bay and its much saltier water near a tide gate. Birdwatchers like to frequent sheltered marshes because they are important refuge, feeding, and resting places for migratory ducks and shorebirds, during the twice daily periods of high tide.

(Grenell is Executive Officer of the California State Coastal Conservancy.)

Over the years, the value of the Redwood High School Marsh (also known as Tamalpais Marsh) as a breeding and feeding ground and general living place for a variety of birds, fish, insects, and microorganisms has been drastically reduced—"degraded" to use the technical term. Degradation was caused by fill and construction activities, dikes that constrict tidal water flows, and storm and wastewater run-off. And because of the marsh's use as a flood control basin by the city of Larkspur, further damage to its sensitive habitat and wildlife has occurred. In short, the marsh was headed for gradual but sure destruction.

This small marsh was considered by resource agencies to be too insignificant and isolated to be worth restoring and managing.

Like many other wetland remnants around San Francisco Bay, this small marsh was considered by resource agencies to be too insignificant and isolated to be worth restoring and managing. Nevertheless, a 1985 study of Bay Area marshes, funded by the California State Coastal Conservancy and done with the help of organizations like the nonprofit Marin Audubon Society and Marin County Open Space District, suggested that these small marsh "islands" in the urban settlement "sea" are still vitally important to the Bay's wildlife and should be saved. Of direct interest to the local people, too, was the opportunity provided by the Redwood High School Marsh for a real educational experience for their children, right in their own backyard.

There were technical problems: how to restore the marsh to health and how to resolve the potential conflict between the needs of marsh habitat and those of the city for flood control; how to provide public access without damaging the fragile marsh plants and wildlife areas; what kind of educational program should be established; and, of course, how money could be raised to make all this happen.

The Marin Audubon group decided to "adopt" the Redwood High School Marsh to demonstrate to other local groups throughout the Bay Area that marshes should and could be preserved, revived, and maintained. The Coastal Conservancy, a unique state government agency with funds and powers to work with local governments and nonprofit groups, agreed to provide money and technical assistance for the preparation and implementation of a marsh plan. Other money for the project came from private foundations through local fund-raising efforts, the Marin Audubon Society, and most recently from EPA through its San Francisco Estuary Project, which has provided funds for similar projects.

So the work began. For the next three years—from the start of 1986 until early 1989—the plan slowly took shape, the product of many cooperative efforts by city employees, the Marin Audubon Society, teachers and administrators, Coastal Conservancy staff, technical consultants, and local citizens.

Why did it take over three years? Biologists and hydrologists needed to be hired to study the year-round cycle of tides, drainage, and wildlife habits; they also had to determine how much to increase tidal flow from the Bay to the marsh to combat the ill effects of stagnant water without upsetting the delicate balances required to maintain wildlife habitat. All of this takes time, as did other efforts. For example, enlarged and improved feeding areas for shore and wading birds had to be designed by increasing the spread of tidal water. And plant cover

State Coastal Conservancy photo, Oakland, California.

had to be provided for wildlife along the drainage channel banks and flat areas.

And work was needed on designing improved drainage channels and tidal flow mechanisms to determine how to preserve the marsh's value as an aid to local flood control. At the same time, the planners had to consider how this could be done without destroying wildlife feeding and nesting areas. In addition, a system of pathways had to be designed providing useful public access to the marsh—especially for high school students who regularly used the area in their studies—without intruding on sensitive habitat areas. And, finally, the high school biology curriculum had to be modified to include the special opportunities for *real* field studies in wetland biology.

The plan was completed, in the spring of 1989, with total costs estimated about $217,000. After extensive public review by the city of Larkspur, its citizens and the Coastal Conservancy, the plan was approved and implementation funding from the Conservancy authorized in April.

Work is now underway to turn the paper document into reality. The dredging, planting, trail-building, fencing, and other construction work will take months to complete. After that, a program of continuous monitoring will be carried out. Through this monitoring, local project participants will follow the progress of the marsh's rejuvenation. The students will be able to study the whole process of biological restoration as it proceeds, and the general public will be able to enjoy the blessings of some of the last open space available to them on the Bay shore.

Sometime soon I will be able to go out to Redwood High School Marsh and enjoy the fresh air and the once-again abundant varieties of wildlife. I will be able to see young people learning about a vital part of their natural environment which, in this increasingly concrete-bound world, is rapidly becoming less possible. Most importantly, perhaps, I will be aware that this has come about because a diverse group of people knew enough and cared enough to see a complex and time-consuming challenge through to a successful conclusion. That's how these things get done after all—isn't it? □

Sometime soon I will be able to go out to Redwood High School Marsh and enjoy the fresh air and the once-again abundant varieties of wildlife.

Where Erosion and Development Meet

by David W. Owens

Close to the edge. Bay Ocean, near Tillamook, Oregon, is mute testimony to the consequences of shifting sands. The entire development was wiped out by the Pacific. This house was last occupied in 1950.

As America's love affair with the coast continues unabated, previously untouched coastal areas are being developed for the first time, and already developed areas are being redeveloped at ever-higher density levels. There are more hotels, condominiums, and cottages for beach visitors than ever before, and many of our shorefront communities now have sizeable and growing year-round populations.

But the coastal beaches that are the economic and social foundation of so many beachfront cities are shifting. From Long Island to Nags Head, many beach cottages along the Atlantic teeter near collapse into the sea. Hurricanes and heavy coastal storms have brought waves lapping against the foundations of high-rise buildings from Ocean City, Maryland, to Miami Beach and Padre Island. Houses have been undermined in Malibu and along Lake Michigan. Coastal structures are increasingly in danger of being lost to coastal storms and erosion.

The cost of coastal erosion is high, not only to individual shorefront landowners, but to taxpayers as well. The property involved is some of the most expensive land in the country. Costs incurred by erosion include expenses of disaster relief, erosion control projects, flood insurance claims, and repair of streets and water lines—to mention just a few. And there is the social cost to the general public as treasured recreational beaches are gradually lost to the sea.

What exactly is happening and what is being done about it?

Although a few beach areas are expanding, approximately 90 percent of sandy beaches nationwide are experiencing some erosion. The national scope of the problem is emphasized by a recent survey in which 22 of 23 state coastal management programs reported coastal erosion to be a "serious concern" in their states.

The 300 barrier islands of the Atlantic and Gulf coasts have the most dramatic erosion problems. Over the past 150 years, erosion of these islands and beachfronts has averaged two to three feet per year, with localized problem areas losing 20 feet of beach area annually. All too often, homes and other structures wash away with the beach areas.

The Pacific coast fares better overall than the Atlantic and Gulf coasts. However, studies indicate that 86 percent of California's 1,100-mile coastline is facing some erosion. Even the Great Lakes are not immune. Periodic high lake levels, as occurred in mid-1970s and again in the mid-1980s, have caused serious beach erosion and bluff collapse, with many homes damaged in the process. Two-thirds of Pennsylvania's Lake Erie shoreline is rated as "highly erodible."

Coastal erosion is a complex phenomenon, and its causes vary. Winter storms and hurricanes can dramatically change the location of a shoreline overnight. But longer-term forces are also at work. A rising sea level may well cause barrier islands to become narrower and their sands to "migrate" toward the mainland, filling in the bays or channels they once protected. Studies not only confirm the reality of sea-level rise but indicate that the *rate* of sea-level rise is increasing—promising even higher erosion rates in the future. By causing a Greenhouse Effect that accelerates sea-level rise, the same human activities that lead to air pollution and deforestation can also increase coastal erosion. To further complicate matters, the land itself is subsiding in some places, particularly along the central Gulf coast.

Human activities can also cause erosion at local sites. When inlets in Florida are dredged to maintain their navigability and the sand is dumped miles off shore, erosion on nearby beaches increases. When dams halt sediment flow down rivers to the Pacific, beaches become narrower on the California coast. Sand mining, the trapping of sand by groins and jetties, subsidence caused by oil and gas extraction: all these can, and do, significantly increase local erosion rates.

Until recently, if anything at all was done to address coastal erosion problems, the usual "solution" was to try holding back the sea with massive structures. After 6,000 lives were lost in a hurricane that struck Galveston in 1900, the nation's most deadly weather disaster to date, residents erected a 16-foot high sea wall to prevent further losses. Huge walls have also been built along parts of the Jersey shore.

But seawalls do not stop erosion. They only protect the upland development landward of the seawall. And if the erosion that created the need for the seawall continues, the inevitable result will be no beach left in front of the seawall.

Stephen Leatherman photo

The historic lighthouse at Cape Hatteras, North Carolina, may be moved because of encroaching erosion. The National Academy of Sciences recently prepared a proposal concerning the Hatteras lighthouse for the National Park Service.

(Owens is Assistant Director at the Institute of Government, University of North Carolina, Chapel Hill.)

Tillamook County Pioneer Museum photo.

More recently, the trend has been away from "hardening" the shoreline with seawalls and other structures. Maine and North Carolina have banned seawalls, bulkheads, groins, and similar "hard" erosion-control structures from their ocean beaches. Where erosion control is being attempted today, the national trend is to pump in sand to replace erosion losses rather than trying to wall out the sea.

The most widely known example of "beach nourishment" is Miami Beach. There, in the late 1970s, sand was pumped from off-shore to create a new 300-foot wide beach over a 10-mile stretch—at a cost of over $65 million.

The high cost of beach nourishment makes it financially impractical for all but the most densely developed beaches, especially since this is a temporary measure that typically lasts only two to 10 years. Environmental concerns are also a limiting factor in many places. Finding an environmentally acceptable source of suitable sand and transporting it to the beach site is a difficult, time-consuming, and costly task.

Furthermore, only very limited federal funds are available for new projects—a fact unlikely to change soon given the budget deficit. In addition, the Congressional study and approval process for beach nourishment projects generally takes at least eight years and more typically 15 to 20 years.

For these reasons, more and more states and localities are taking a different tack. Rather than trying to control the location of the shoreline, they recognize its dynamic nature and try to manage adjacent development in order to minimize the loss of life and property that would otherwise occur when the shoreline moves. The point is that by recognizing the erosion that is taking place, and taking it into account in development decisions, the need for costly beach nourishment programs or erosion-control activities that are environmentally harmful can be minimized or even avoided altogether.

Although a few beach areas are expanding, approximately 90 percent of sandy beaches nationwide are experiencing some erosion.

Since the late 1970s, over one-third of the coastal states have established minimum oceanfront "setbacks" for new construction. Rhode Island, New York, New Jersey, North Carolina, South Carolina, Florida, Pennsylvania, Michigan, and Ohio all require new construction to be at least 30 to 100 times the annual erosion rate back from the shoreline. (For example, if two feet of the beach or shoreline are being lost each year, the required setback would be 60 to 200 feet.) Maine, Delaware, Alabama, and Hawaii use a fixed minimum setback. All of these laws are intended to assure that buildings have a modest "safety zone" to buffer them from storm damage and to allow them to enjoy a reasonable life span before being threatened by erosion.

But what happens when erosion does catch up to the structures, as is happening now to older developments—and as will almost certainly happen to many new shorefront developments 10 or 20 years from now?

One possible answer that is getting increasingly serious attention is relocation of threatened structures. Relocation is not a new idea. Some of the older beach cottages at Nags Head, North Carolina, have been moved back two or three times over the years as the ocean advanced. A National Academy of Sciences committee recently recommended that the historic Cape Hatteras lighthouse be moved to a safer location away from the beach.

What *is* new is the scope of the problem. For example, North Carolina officials estimate that some 5,000 existing structures in that state alone may be lost to ocean erosion over the next 60 years. Michigan officials estimate that nearly 1,000 structures on the Lake Michigan shoreline of their lower peninsula were at risk during the high lake levels of 1987.

As a result, new programs are being developed to encourage and assist relocation efforts. For example, Michigan provided low-interest loans to relocate structures threatened by high lake levels in 1985. And on the national level, there is also a significant new loss-prevention initiative. Congress amended the federal flood insurance program in 1987 to provide coverage for the costs of relocating imminently endangered structures, rather than waiting for them to fall in the ocean, triggering far more expensive total-loss claims. Extension of this relocation program for two more years is pending before Congress. The Federal Emergency Management Agency, which implements the program, is considering establishing minimum standards for local land-use management programs in erosion-prone areas.

Much has been learned about coastal erosion over the past 10 years as most coastal states conducted detailed studies to determine erosion rates. Scientists have pinpointed many of the causes of erosion and the likely impacts of various alternatives for addressing the problem.

For those of us who enjoy vacationing at the beach and want our children to be able to share the same experiences, the most hopeful sign is growing public understanding of coastal erosion issues. With this better understanding, there is a steady increase in the adoption of forward-looking programs to better manage beach development and redevelopment in ways that respect natural processes along the shore and emphasize *preventing* problems rather than trying to *correct* them after the fact. We would be wise to consider this approach for other coastal and environmental issues. □

Around the U.S.

Changing the Fate of the Gulf

by Jack Lewis

The Gulf of Mexico is a key battlefield in the war against coastal pollution. One of America's most important saltwater resources, this partly enclosed sea provides 40 percent of U.S. commercial fish yield, 75 percent of critical habitat for migratory waterfowl, and drainage for 66 percent of all U.S. freshwater rivers.

Featuring all three types of near-coastal environment—beaches, wetlands, and estuaries—the Gulf has long been a vital component of the economies of Texas, Louisiana, Mississippi, Alabama, and Florida. These five states, which contain 17 percent of all U.S. population, accounted for a disproportionate 35 percent of U.S. population growth from 1980 to 1985. This rapid population growth is especially prevalent in Texas and Florida, and it takes its most coastal form in the latter, where 99 percent of the population now lives within 50 miles of the coast.

As a result of population pressures and excessively rapid development, the Gulf has in recent years suffered extensive loss of wildlife habitats, nutrient over-enrichment and resulting oxygen depletion in bodies of water, contamination by pesticides and toxics, closure of shellfish beds, and other forms of environmental degradation.

Since August 1988, EPA's Gulf of Mexico Program Office—headquartered near Bay St. Louis, Mississippi, at NASA's newly created Stennis Space Center—has been working to develop and implement a strategy that will better balance the needs of human development in the Gulf with those of the threatened ecosphere. EPA Regions 4 and 6 have primary responsibility for this huge "macro" environment that is home to 1,631 miles of beaches, 13.7 million acres of wetlands, and 30 important estuaries. In conjunction with state and local government, businesses, and citizens' groups, these EPA officials have been working to evaluate the environmental problems of the Gulf and to propose regulatory and management options for dealing with them.

One Gulf Coast beach—the Padre Island National Seashore—had so many rusty oil drums that it is now on EPA's Superfund National Priority List.

During its first year, the Gulf Program drafted a five-year plan and set up a network of committees that draw together relevant constituencies. There is a Citizens' Advisory Committee, with prominent and knowledgeable citizens representing each of the Gulf's five states; citizen selection is conducted so there will be expertise in five key subjects: fisheries, agriculture, tourism and development, industry, and the environment. A Technical Steering Committee also exists, with eight specialized subcommittees on problems such as marine debris, coastal erosion, public health, habitat degradation, toxics, nutrient enrichment, public outreach, and data information and transfer. In addition, the program relies for direction on a Policy Review Board consisting of highly placed officials from federal and state agencies, academia, and the citizenry.

Not forgotten is the United States' Gulf neighbor, Mexico. The Gulf Program Office is working with EPA's Office of International Activities to implement the United Nations' Caribbean Action Plan, a subject that Agency Administrator William K. Reilly discussed on his trip to Mexico in August 1989.

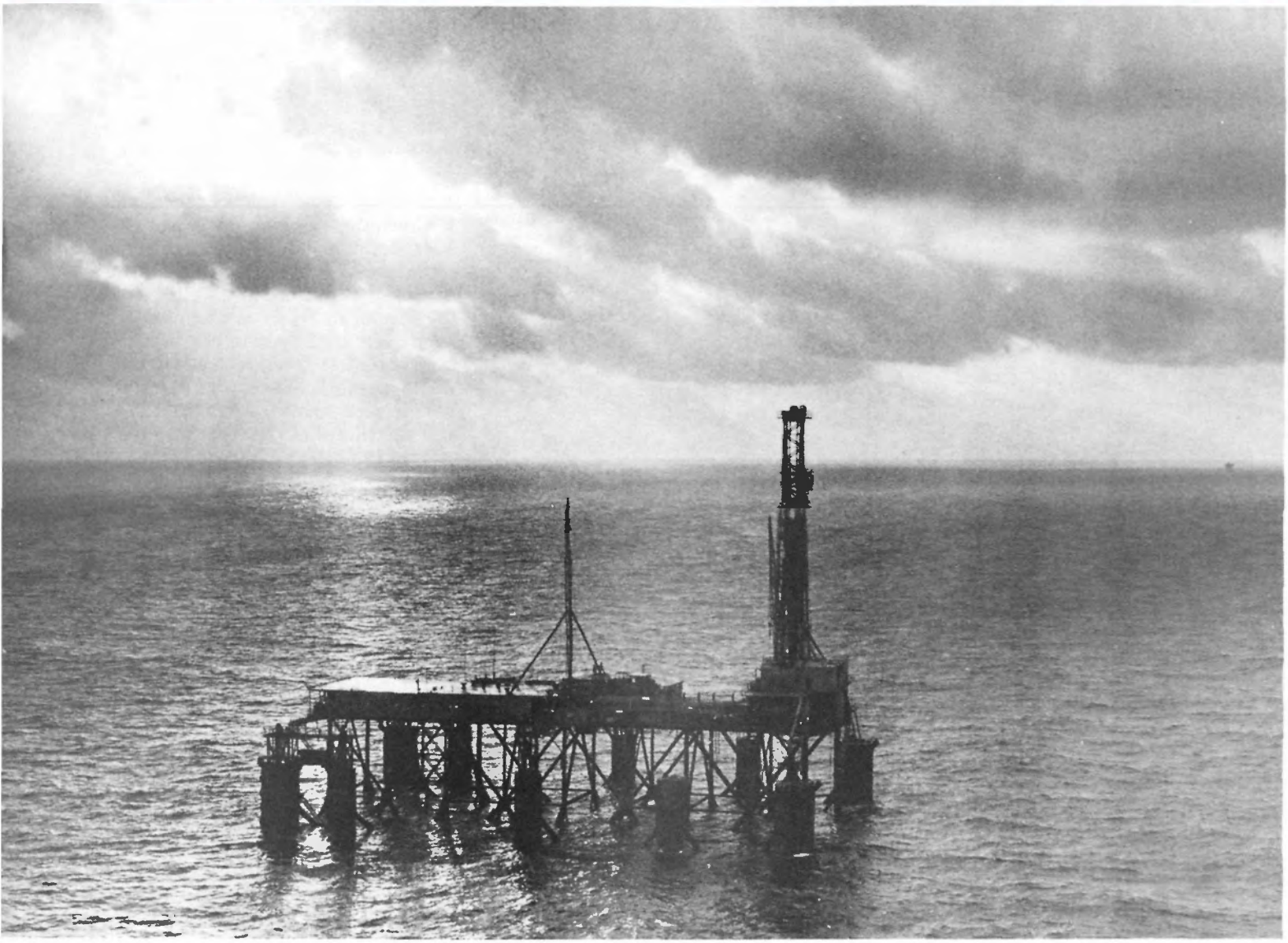
By 1992, these committees and constituencies will forge a comprehensive strategy for dealing with the enormous problems of the Gulf's beaches, wetlands, and estuaries, where some admirable efforts are already underway:

Beaches: Because of the Gulf's looping, criss-crossing currents, waste discarded by boats or oil rigs tends to become trapped, later to wind up on the area's beaches. More than any other in the nation, the beaches of the Gulf regions' five states are disfigured by styrofoam cups, plastic bags, oil drums, and other forms of marine debris. In September 1987 and again in September 1988, 15,000 volunteers removed approximately 500 tons of waste from beaches in the five Gulf states. However, one Gulf coast beach—the Padre Island National Seashore—had so many rusty oil drums that it is now on EPA's Superfund National Priority List.

Wetlands: The extraordinary plight of Louisiana's wetlands is described elsewhere in this issue of *EPA Journal* (see article on page 37). The wild card for the future is the Greenhouse Effect, which could bring almost total obliteration to the wetlands not just of Louisiana but the entire Gulf.

For the time being, however, the threats to Gulf wetlands outside Louisiana appear manageable. Though development pressures are being felt in most parts of the Gulf, particularly in Texas and Florida, federal and state regulation—along with a change in

(Lewis is an Assistant Editor of EPA Journal.*)*



Office of Sea Grant, Center for Wetland Resources, Louisiana State University photo.

An offshore oil rig, a familiar sight in parts of the Gulf of Mexico. EPA's Gulf Program Office is developing strategies to protect the Gulf environment from pollution.

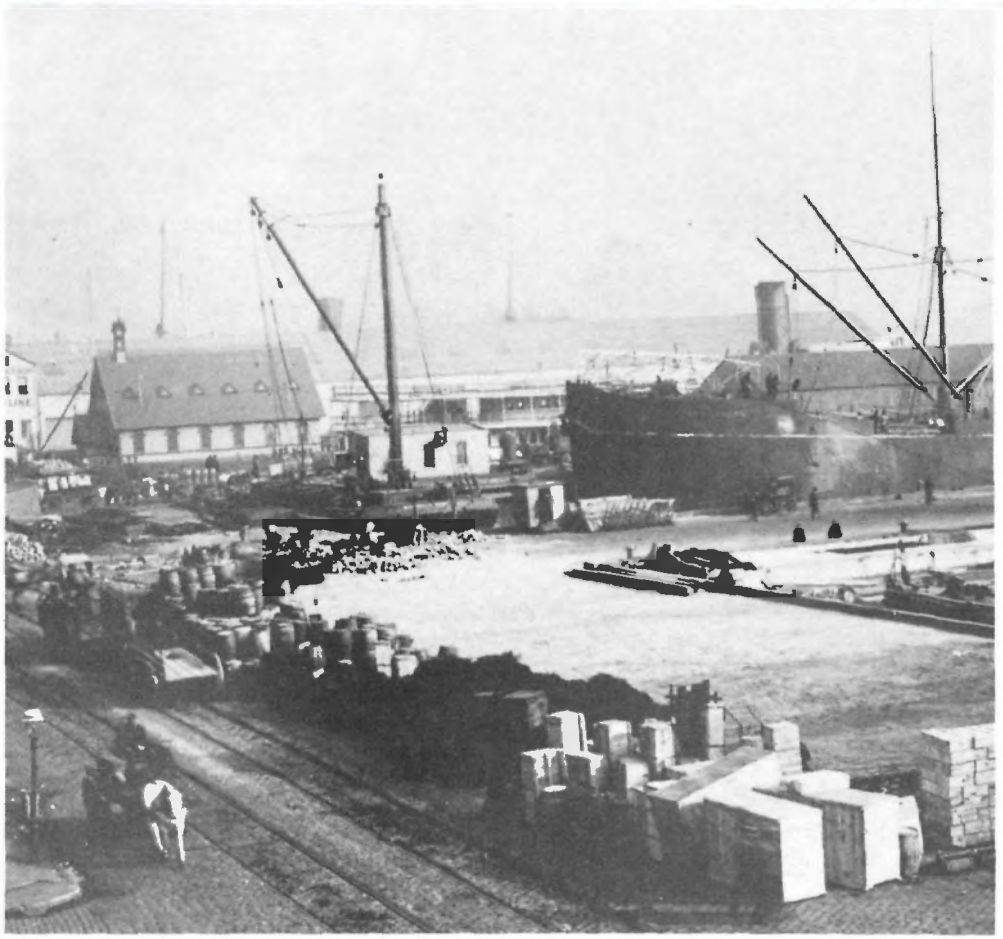
public attitude—is subduing them to a greater extent than before.

Estuaries: The Gulf of Mexico is also home to 30 important estuaries, two of which—Galveston Bay, Texas, and Sarasota Bay, Florida—are the target of special restorative efforts today. Both were recently named part of EPA's National Estuary Program, and as a result, they are now in the organizational stage of establishing management committees and drafting the five-year work plans required by EPA.

Galveston Bay—Texas' largest estuary—is a particularly interesting example of the conflict between man and nature: a project has been proposed to widen the Houston Ship Channel to make it better able to deal with foreign trade. Unfortunately, if approved, this would almost certainly lead to a great increase in the quantities of salt water in Galveston Bay, with disastrous impacts on fisheries and tourism. The Galveston Bay management committee has put at least temporary roadblocks in the path of the developers. □

How the Coastal Migration Began

by Richard Delaney
and Jack Wiggin



New York Harbor in olden days. Like Boston and Philadelphia, New York housed a busy port by the 1790s.

Development along the world's coastlines today reflects patterns of settlement begun during the earliest days of civilization. Since ancient times, the oceans and resources of coastal areas have been used by man for transportation, food, recreation, and waste disposal. The earliest sites of human settlement were the river valleys and shorelines of the seas, which offered important natural advantages.

In the United States, the earliest urban settlements began as mercantile outposts of Europe along the banks of navigable waters such as the Connecticut, Delaware, and Hudson Rivers and the Chesapeake Bay and in sheltered estuaries and small bays along the Atlantic coast. By 1790, America's major cities—New York, Philadelphia, and Boston—were the most successful of these ports, and together with Baltimore and Charleston, these cities made up one-half of the nation's population. By the mid-19th century, New Orleans (which by 1840 had become the fourth largest city in the United States) and San Francisco grew as commercial coastal gateways of the Mississippi basin and the central valley of California.

Up until industrial revolution, the impact of human activity on the coast consisted of modifying the shoreline to accommodate marine-based industries or creating buildable land for expanding cities. However, the impact of these activities, although significant, was generally limited to the local environment. The industrial revolution led to rapid urbanization and economic expansion—greatly increasing the number and magnitude of problems. This was the beginning of a major environmental crisis which, because of historic patterns of settlement, was felt first and most profoundly in coastal areas.

Between 1870 and 1920, industrialization transformed many of the older commercial centers of the United States such as Boston, Baltimore, and New York. The semi-enclosed waters of the harbors and bays that were ideal for the shipping trade on which

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(Delaney is the Director and Wiggin a staff member of the Urban Harbors Institute at the University of Massachusetts at Boston.)

these cities were founded and prospered became depositories for the wastes of rapidly expanding populations and industries. During this period, when world population increased by 55 percent, the population of the United States rose by 357 percent, with 80 percent settling in the Northeast.

The new manufacturing facilities were deliberately sited on rivers and estuaries to take advantage of water in the manufacturing process and to facilitate the discharge of industrial waste. Sanitary sewer systems slowly replaced individual privies as the means for collecting and disposing of human waste. The earliest municipal sewers were adapted from storm drainage systems that, in some cases, had been in existence since the 17th century and discharged directly into the nearest waterway.

Sewer systems that diluted wastes and carried them away by water were a significant advance for the sanitary conditions of cities. But these systems introduced large quantities of fouled water into the rivers and estuaries. Initially, receiving waters had the capacity to assimilate wastewater. However, this method of purification by assimilation was, invariably, relied on long after it ceased to be successful.

Solid waste was also deposited in the waters along city shorelines. In Boston and San Francisco, for example, refuse and material from excavations were disposed of in the low-lying marshlands which were considered to be of little value. At New York's waterfront, garbage was loaded onto scows and shipped out to sea. A less costly alternative was to let the refuse spill into the water at the berths, eventually creating new waterfront real estate.

Following World War I, petroleum and its products were used to meet the growing demands of production and consumption. This led to what has been called the Sea Pollution Era. Oil transported by ship reached the ocean waters through leakage, accidents, flushing of tankers, and mishandling during loading and unloading. The spiraling demand for oil in the United States was satisfied in part by shipping from distant sources and increasing off-shore exploration of the continental shelf, both of which heightened the potential for accidental spills.

During the middle of this century, large-scale metropolitan growth continued, and as the impacts of 20th-century technology were felt on the quality of inland waterways and ground water, the ocean received renewed attention as a disposal site with an apparently infinite capacity. Bulk material such as sewage sludge from treatment plants was dumped offshore,

Following World War I, petroleum and its products were used to meet the growing demands of production and consumption. This led to what has been called the Sea Pollution Era.

along with its burden of phosphates and other contaminants. Although the dumping of garbage in the waters off New York City was discontinued in the 1930s, the practice continued off the Pacific coast. Dredging of harbors and rivers to maintain navigability contributed the greatest volume of waste material dumped in the ocean.

The most serious threat to the ocean resources came from less visible sources. Toxic chemicals and heavy metals from industry were discharged directly to coastal waters. Chlorinated hydrocarbons such as DDT, which was widely used to control insects, and PCBs found their way into marine sediment and into the food chain, where they become concentrated through biomagnification. The potential effects of mercury and PCB on humans who consume seafood contaminated by these substances is well documented. And greater amounts of petroleum increasingly reached the ocean by atmospheric transport of the vaporized product.

In recent decades, pressures on coastal resources have intensified. With advances in technology, rising incomes, and increasing leisure time, more people have moved from urban to coastal areas, particularly in the states along the south Atlantic, Gulf of Mexico, and the Pacific Southwest. Census figures reveal that in 1980, 118.4 million people lived in the cities and counties within 50 miles of the coastline, compared with 60.5 million in 1940. This is an increase of over 95 percent; Gulf coast counties alone grew by 200 percent.

The rapid development of coastal areas has strained the natural resources that provide protection from flooding and have been a primary source of food and purified water. From the mid-1950s to the mid-1980s alone, approximately 480,000 acres of tidal wetlands were lost to urban development, agriculture, port and marina expansions and other causes. Development of coastal barriers increased from 5.5 percent of the total acreage in 1945 to 14 percent in 1975.

What do these trends forecast for the next chapter of coastal history? Demographers' predictions vary, but by 2000, up to 75 or 80 percent of the U.S. population may reside in coastal areas. The dumping of industrial waste has decreased substantially. Thousands of industrial and municipal facilities currently discharge to coastal waters along with a significant contributions from nonpoint sources.

Will we adopt more comprehensive planning and management strategies to promote sustainable growth? Will we reverse the propensity to direct wastes to the ocean? Will sea level rise and again dramatically alter the physical shoreline? Whatever the course, it will require more knowledge, extensive cooperation, and respect for the limits of the natural environment. □

People Power

by Tom Armitage

In 1972, Congress enacted the landmark Clean Water Act to clean up our nation's polluted waterways. Now, nearly 18 years later, the state and federal agencies responsible for administering water programs are unable to determine with certainty how effective those programs have been. Even with increases in federal spending, water quality may be getting worse in some areas of the country.

Nowhere is water quality more problematic than along our coastlines, a point that is underscored by other articles in this issue of *EPA Journal*. Thus state and federal coastal water program managers are faced with difficult questions. Where should limited resources be directed to obtain the most benefit? What programs have worked? What is the status of our coastal waters?

Scientists and agency managers agree that additional data are required to answer these questions. Moreover, the success of our programs will depend not only on good databases, but also the support of an aware and informed citizenry.

In some coastal areas of the country, the public has begun to help state and federal agencies collect the data needed to assess how well clean water programs are working and to help governments make effective decisions concerning coastal water clean-up efforts.

An army of trained volunteers has taken to the waters of Rhode Island's coastal lagoons, the tributaries of the Chesapeake Bay, North Carolina's Albermarle and Pamlico Sounds, the beaches along the Gulf of Mexico, the beaches of the Pacific Northwest, and other coastal areas to provide scientists with answers to some important questions. These volunteers have diverse and varied backgrounds. Some are retired college professors, research scientists, and engineers. Others are high-school and college students, teachers, community activists, and other people who may have little technical training but share concerns about coastal pollution. Pooling their resources, they have become allies in a campaign to prevent further degradation of the coast.

Federal and state environmental program managers were initially skeptical of the value of data collected by volunteers, but are gradually accepting and using the new information to support their activities. Yet the use of volunteers to collect environmental data is not really a new idea. For example, the National Weather Service has been using volunteers for the past 100 years to collect temperature and rainfall data from many remote sites across the country.

Pooling their resources, they have become allies in a campaign to prevent further degradation of the coast.

Today, the Weather Service has 11,500 volunteers nationwide collecting weather information on a daily basis. The data they collect have been extremely useful in determining trends for climatological analysis. Likewise the U.S. Geological Survey uses volunteers to monitor earthquake precursors. Another highly successful volunteer monitoring effort is the National Audubon society's "breeding bird survey," which has become one of the most widely used measures of bird population status in the United States.

Ross Toney, a retired manufacturing engineer, and George Vinal, a self-employed Rhode Island locksmith, who are gathering water-quality information to describe the status of Rhode Island's coastal lagoons or "salt ponds," typify the thousands of volunteers who have joined the growing number of active monitoring groups across the country. In summer, the recreational opportunities afforded by the Rhode Island salt ponds and their beaches attract more than 165,000 people a day. Intensified residential and commercial development in this area has resulted in serious water quality problems.

The resulting decline in the quality of fishing disturbed Toney and Vinal, avid fishermen who found that they were coming home with fewer fish and clams. They decided to do something about it and joined the Rhode Island Salt Pond Watchers, a group of volunteers collecting data on environmental parameters such as water clarity, water temperature, nutrients, chlorophyll, and bacteria levels.

As Toney, Vinal, and others like them see it, coastal waters do not belong to a state, a nation, or a town, but represent a resource that is part of their own "backyard." This kind of feeling has created a widespread sense of urgency for environmental action and is generating a groundswell of public support for stewardship groups around the country. Many citizens have recognized that, as individuals, they have a hard time being heard, but by joining volunteer environmental monitoring organizations, they have collective clout and access to the people empowered to take action.

The data collected by the Rhode Island Salt Pond Watchers are in fact being used by state decision-makers. Bacteria-monitoring data have been used by the Rhode Island Department of Environmental Management in making decisions regarding closures of areas to shellfishing or swimming. The

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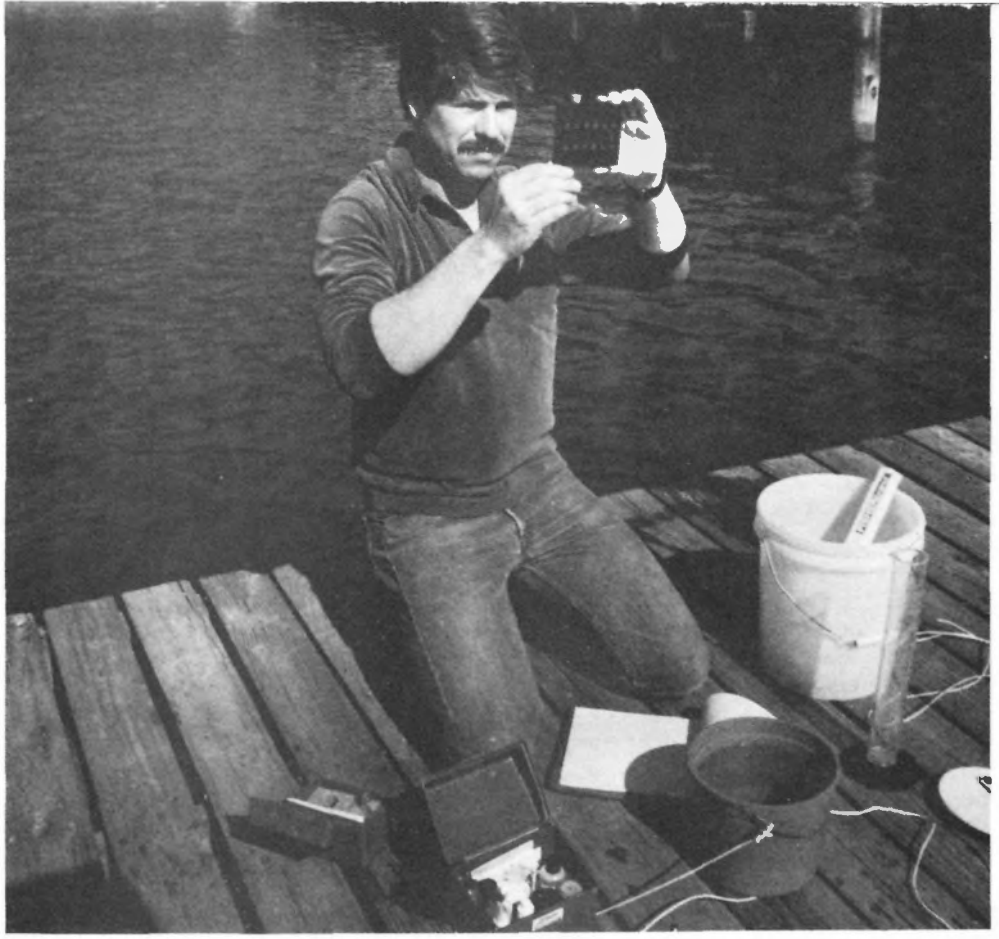
(Dr. Armitage is a marine biologist in EPA's Office of Marine and Estuarine Protection.)



Citizen monitoring and data collection efforts are making a difference. In Anne Arundel County, Maryland, volunteers are supplied with water-testing kits and practical training.

Citizen Water Quality Monitoring Program photo.

"time-series" information provided by the volunteers will also be applied to state agency permitting and planning decisions.

In Maryland and Virginia, volunteers are collecting time-series data on water quality in tributaries of the Chesapeake Bay. The Alliance for the Chesapeake Bay began a pilot water-quality testing project for volunteers in July 1985 as one of the activities funded through EPA's Chesapeake Bay Program.

Two objectives of the pilot effort were to determine whether volunteers could in fact collect water-quality data that met rigorous quality-control standards, and to evaluate the feasibility of establishing a permanent Bay-wide citizen monitoring network. Volunteers collected weekly data from piers, docks, and the shoreline to determine water temperature, pH, water visibility limits, dissolved oxygen content, and salinity. Simple data-collection methods were chosen, and sampling kits were distributed to the volunteers.

As Toney, Vinal, and others like them see it, coastal waters do not belong to a state, a nation, or a town, but represent a resource that is part of their own "backyard."

The results clearly indicated that, with adequate training and properly selected sampling methods, environmental data collected by volunteers can be just as reliable as data collected by government agencies. The Chesapeake Bay Citizen Monitoring Program is now well established. It has enlisted a growing number of volunteers and received funding from the state of Maryland.

Information collected by the volunteers is expected to provide scientists with a better picture of what is happening to the Bay because the volunteers can gather samples at remote sites and frequent time intervals. They may also be able to respond quickly to events such as storms, providing valuable information about the impact of stormwater run-off on water quality. All of this information will be used in assessing the health of the Bay and evaluating the effectiveness of state and federal programs.

Recent coastal clean-up campaigns have been organized for the dual purpose of creating public awareness of the problems caused by marine debris and collecting data on the types and quantities of the debris. (See article on page 23.) These campaigns have been highly successful. For example, during one recent effort, 28,000 volunteers in a single day filled 7,900 trash bags with 124 tons of debris taken from 122 miles of Texas beach. As the debris is collected, the type and amount of material are recorded.

These data have been used to develop recommendations for government and industry to find long-term solutions to the floatable debris problem. The beach clean-up campaigns have also opened the eyes of hundreds of volunteers to the problem of plastic debris in coastal waters.

Some volunteers have indicated that the experience has changed their lives. Many express a new appreciation of the need for changes in lifestyle; and for waste minimization, pollution prevention, and recycling initiatives in order to solve coastal pollution problems. And many are committed to continued participation in environmental monitoring and clean-up activities. In fact, Congress has recognized the important role of volunteers in beach cleanups. Recent legislation called upon the Department of Commerce and EPA to establish citizen pollution patrols to clean up the beaches.

In the Pacific Northwest, volunteer monitoring programs are providing a valuable link between state and federal programs to protect the coast and local communities. The "Adopt-a-Beach" program established to promote environmental education and beach enhancement has proved an effective public education program. Through this program, volunteers participate in the restoration of degraded beaches to their original condition. These projects have instilled in the volunteers a sense of stewardship for their adopted beaches, thus promoting a conservation ethic that can work to make the environment cleaner and safer.

In Massachusetts, volunteers recently began twice weekly measurements of

Mike Siegel photo, Seattle Times.

"Adopt-a-Stream" groups are painting storm drains, such as these in Bothell, Washington, with this explicit warning. The goal is to restore polluted water bodies such as Puget Sound.

dissolved oxygen, water temperature, salinity, and transparency in Boston Harbor. This program, coordinated by the Massachusetts Audubon Society, is a cooperative effort of citizens and nonprofit organizations working to find solutions to the Harbor's well-publicized pollution problems. Measuring the amount of dissolved oxygen present is important because marine life depends on oxygen to survive.

Sewage contains large amounts of organic matter and can reduce the amount of oxygen dissolved in the water. The data will become part of a long-term water-quality database needed to improve scientific understanding of the harbor and to assist decision-makers in tracking the progress of harbor clean-up activities.

EPA is greatly encouraged by the success of these new coastal volunteer monitoring programs. Coastal area environmental problems confronting the Agency will be difficult to solve. Finding solutions to many of the problems associated with population growth and development along our coasts will require public education, consensus building, and augmented data-collection efforts. It is clear that concerned citizens, responding in ever-increasing numbers, can help gather information to meet many of our data needs.

For some people, collecting scientific data may be a daunting task, but there are still other ways in which the public can provide support to state and federal agencies.

In addition to the priority pollutants listed in the 1977 amendments to the Clean Water Act, EPA has identified more than 600 hazardous or toxic chemicals that may require regulation. Volunteers can help out by locating bird and fish kills, collecting specimens for tissue analysis, and locating pipes that discharge toxic substances into estuaries.

EPA will also need additional information to identify and characterize nonpoint sources of pollutants. Such sources contribute heavily to the degradation of estuaries and near-coastal waters, which are threatened by nutrient and pesticide run-off from agricultural fields, faulty septic systems, urban runoff, and seepage from hazardous waste sites. Volunteers collecting samples at remote sites throughout the year can provide scientists with a better understanding of the origins and impact of nonpoint-source pollution.

At monitoring sites in Rhode Island, for example, seawater samples collected during the winter disclosed unusually high nitrate and nitrite levels. This nutrient enrichment has been linked to ground-water contamination from intensifying development and on-site sewage disposal. The data provided by the volunteers will be used by planners to assess the impact of future growth on estuarine water quality.

EPA will also need additional data to demonstrate the environmental results of pollution-control investments in the coastal zone. Sustained volunteer monitoring programs can provide the extended time-series data required at numerous sites and frequent intervals to support such analysis.

Recognizing the valuable role volunteers can play in supporting the Agency's mission of protecting and improving water quality in estuaries and near coastal waters, EPA's Office of Marine and Estuarine Protection is currently working, through its National Estuary Program, to encourage the establishment of a network of volunteer monitoring organizations to collect data that will assist in developing comprehensive conservation and management plans for estuaries. Citizen volunteers can aid decision-makers charged with managing estuarine resources in a number of ways: by collecting data needed to characterize resources and proceed with planning and policy development, by functioning as "watchdogs" for enforcement, by helping to educate the public about environmental problems, and by collecting information for special research projects.

Volunteers can support National Estuary Program projects by reporting fish kills, precipitation levels, and the number of fish caught by recreational fishermen and by acting as "expert witnesses" concerning trends, past practices, and conditions in a given area. They may also form constituencies for legislative or political initiatives and thus influence local actions or ordinances.

In their capacity as "watchdogs" for enforcement, volunteers can help the regulatory community by red-flagging illegal pipes or discharges and dumping sites, collecting observations of excessive erosion and failed sediment control structures, and compiling data collected for compliance with discharge permits.

Along all of our coasts, citizen groups are beginning to take effective action to help solve pollution problems. They are gathering invaluable scientific data and educating people about the dimensions of pollution problems that affect their lives. They are serving as facilitators for open discussion about coastal pollution and helping to build the local and area-wide political will needed to support effective action. □

Cleaning Up a New York Hot Spot

by Miles Kahn

When people talk about New York's hot spots, usually they are referring to places like South Street Seaport or Greenwich Village, not a Woodside, Queens, building next to the Brooklyn Queens Expressway—that is, not until recently. Last year, the abandoned building, which belongs to the Radium Chemical Company, was found to contain what may be the world's largest concentration of radium. It is also the site of one of the few Superfund removal actions directed at radioactive contamination.

The one-story brick building, on 27th Avenue, is located in a light industrial area that includes several small factories and businesses and a popular athletic club. Nearby are two densely populated residential areas that begin, respectively, about 500 and 1,000 feet away.

Beginning in 1955, the Queens facility was used to mix luminous paints and to package and distribute radioactive source materials, usually in the form of needle-like containers or other small diameter cylinders for use in treating cancer. In the late 1970s, however, the medical community began to use other radiation sources. Consequently, Radium Chemical found itself with a large supply of radium that it was unable to lease or sell.

In 1983, after years of inspections revealed continual violations including lost radium shipments and excessive radiation levels in the plant, the state suspended the company's operating license. Despite repeated efforts thereafter to bring the plant into compliance with state regulations, the situation did not improve, and community sentiment began to mount for corrective action. Radium Chemical was apparently insolvent, and after the company failed to comply with a court-ordered cleanup, the State Attorney General obtained a second court order declaring the building "abandoned." This set the stage for the state to request direct assistance under Superfund.

In August 1988, EPA Region 2 initiated a Superfund action. The first step was to secure the area by installing a barbed-wire-topped fence around the site and posting a 24-hour guard, augmented by constant video surveillance. The next step was getting into the building and determining the extent of the radiation problem. That job fell to two Region 2 staff members who entered the building outfitted in protective clothing and armed with radiation-monitoring equipment.

They found a radiation hazard far greater than expected.

They found a radiation hazard far greater than expected. The working area of the building contained between 120 and 125 curies of radium, or about one-fourth pound of the extremely dangerous substance. To put the hazard in perspective, a person could exceed the yearly occupational exposure limit after only one hour in the worst parts of the building. Even the administrative offices were contaminated, although not to the same level.

The radium sources were held in lead containers, called "pigs," and stored in a concrete vault. But many of the sources leaked, and even with the lead shielding, radiation levels were dangerously high. Contaminated equipment was everywhere; highly contaminated debris had been swept up and put in boxes that were left out in the open. To make matters worse, EPA staff also discovered a significant amount of hazardous chemicals, including potentially explosive ethyl-ether.

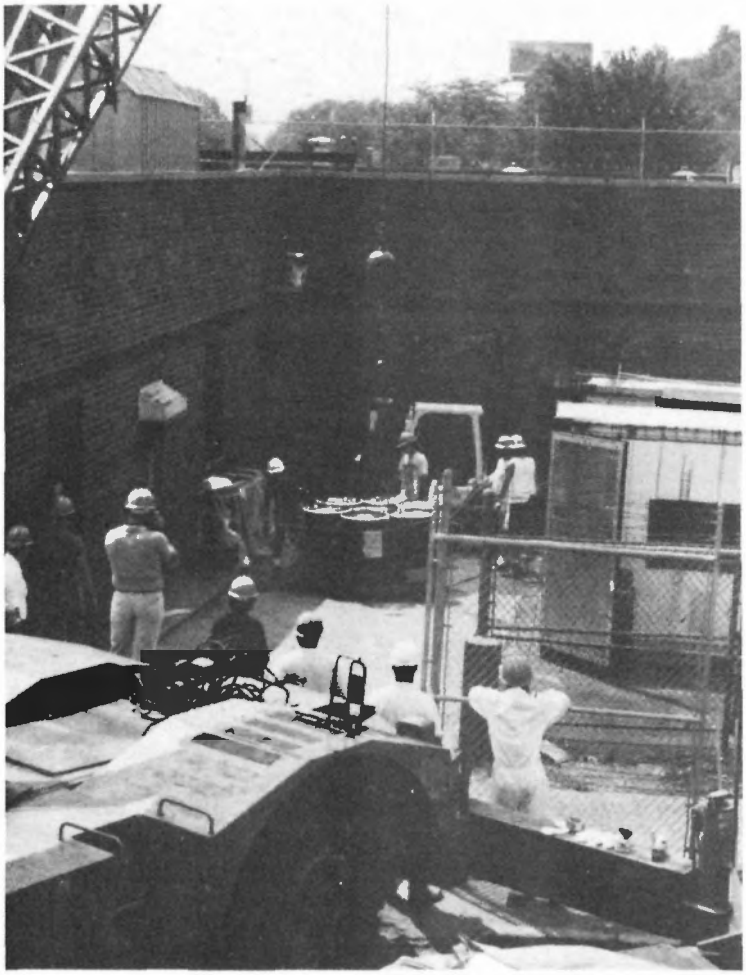
Fortunately, the acute radiation hazard did not extend beyond the building. However, there was a definite potential for hazardous radioactive materials to be taken from the building, exposing many unsuspecting people to possible harm. For example, if someone were to break into the building and steal some of the radium sources or contaminated equipment, the thief could be in serious trouble. Furthermore, anyone coming into contact with the stolen goods would be at risk from radiation exposure.

The potential for such an incident was illustrated by an event that did occur in the early 1980s. A significant amount of radioactively contaminated gold, used to package a radiation source, was discovered to be missing—either lost or stolen—from the very same Radium Chemical Company facility. Following this discovery, the state offered free testing of jewelry to allay the public's fears and, in fact, found some contaminated items in New York City. Although the origin of the contaminated gold was never positively established, many suspected the source to be the Radium Chemical Company.

There was also the possibility of radioactivity being spread as a result of a fire at the building. Fire could be caused by an arsonist, by cars or trucks crashing into the building from the adjacent roadway, or by someone carrying out one of a number of bomb threats that were received. The primary danger from radioactivity spread by a fire would be a possible increased long-term risk of cancer.

However, if a fire were preceded by an explosion, some of the actual radium sources could be dispersed, possibly causing severe injury. In the event of a fire, the expressway would have to be closed immediately and, depending upon atmospheric conditions, health authorities could be required to take immediate steps to protect the public over an area extending one-half mile

(Kahn is a Public Affairs Specialist with EPA's Office of Radiation Programs.)



EPA Region 2 photo

Queens, New York, found itself with a hot spot of radioactive waste after Radium Chemical Company became insolvent. Special containers were designed to encapsulate the radium sources for transportation to disposal sites.

from the building. There would be no time to evacuate the area. On two occasions over the years, cars did crash into the building, but, fortunately, no radiation escaped into the surrounding neighborhood.

Due to the seriousness of the situation, Acting Regional Administrator William J. Muszynski requested that Superfund's Environmental Response Team, a headquarters operation, take responsibility for directing the removal action. To perform the field work, a team of people was drawn together from EPA's Region 2 office and various components of the Office of Radiation Programs, with support from contractor personnel.

With the team assembled and the support organization established, work began on removing the radium. The first order of business was sorting and rearranging the chemical wastes according to type and storing them for future removal, if they were not radioactively contaminated. The ethyl-ether was carefully placed in special explosion-resistant containers and stored separately.

Another priority was the detailed site characterization and radium inventory, which were begun in March 1989 and completed in April. In June, the actual removal was begun by personnel from Chem Nuclear Systems, Inc. For some of this work, protective clothing was necessary, sometimes in combination with several types of breathing protection apparatus. To aid in picking up the awkwardly shaped lead pigs and emptying them of their dangerous contents, a special, remotely controlled apparatus (dubbed a pig flipper), with supporting equipment, had to be improvised.

In addition, special containers were designed for encapsulating the radium sources for transportation to disposal sites. These 1,600-pound containers were 55-gallon drums filled with concrete, containing a core vessel of steel surrounded by an inch of lead and another 1/4 inch of steel; each container had a special lid. It took 36 containers to haul away approximately 10,000 radium needles to a site in Nevada. Also, 150 drums and steel boxes of contaminated debris were removed to a low-level radioactive waste disposal site in Richland, Washington.

As a follow-up to the removal action, EPA recommended that the state conduct health surveys of former Radium Chemical Company employees and test their homes. One precedent for such follow-up would be the studies done in Ottawa, Illinois, of the women who worked at Luminous Processes, Inc., painting radium on watch dials in the early 1900s. Based on those studies, many cancers caused by ingested radium have become textbook cases of occupational hazards that existed earlier in the century. Interestingly enough, Luminous Processes was owned by the father of Radium Chemical Company's present owner.

Meanwhile, the Region 2 Public Affairs Office began implementing a public information program. The first priority was to contact all of the adjacent businesses and explain the situation to their employees. Once this was accomplished, and the immediate neighbors were satisfied that they would not be exposed to excessive radiation, the next step involved contacting civic and community groups representing interests of the nearby residential areas.

In addition, a walk-in public information center was set up at the site to reinforce the message that there was no hazard outside of the building. The public information program helped calm any apprehensions about the Agency's actions.

Now that the acute radiation hazard has been removed, the Agency is evaluating the Radium Chemical site for listing on the Superfund National Priorities List. Once listed, the site will be subject to studies to determine the best method of decontaminating the building and making the site useful again.

The Agency's quick action at the Radium Chemical Company site provided a valuable opportunity for EPA personnel to gain field experience in handling radiation emergencies and to test different organizational approaches to problem-solving. Both kinds of experience could prove important, since the Radium Chemical site is only one of dozens of radioactively contaminated sites around the country, although none may be as potentially dangerous as the Queens location. There may also be many unknown sites remaining to be discovered. □

Fisher

Davies

Sidamon-Eristoff

Crampton

Gleason

Linda J. Fisher is the new Assistant Administrator for Pesticides and Toxic Substances at EPA.

Prior to her appointment, she served as Assistant Administrator for the Office of Policy, Planning, and Evaluation since January 1988, where she had primary responsibility for developing the Agency's position on global climate changes. Fisher joined the Agency in July 1983 as Special Assistant to the Administrator for Solid Waste and Emergency Response.

From January 1985 to January 1988, Fisher served as Executive Assistant and Chief of Staff for Administrator Lee M. Thomas. She was the principal policy liaison with Congress and the White House during the rewriting of the Superfund law in 1986.

A 1974 graduate of Miami University of Ohio, Fisher earned her master's of business administration from George Washington University in Washington, DC, and her law degree from Ohio State University's College of Law in 1982.

J. Clarence ("Terry") Davies is the EPA's new Assistant Administrator for Policy, Planning, and Evaluation.

Davies served as an advisor to EPA from 1973 to 1981 on the Executive Committee of the Science Advisory Board and from 1986 to 1989 on the Science Advisory Board's Integrated Environment Management Subcommittee. Since 1976, he has served as the Executive Vice President of the Conservation Foundation.

When the Council on Environmental Quality was created in 1970, Davies began a three-year assignment as Senior Staff Member. During 1969 and 1970, he was a consultant to the Ash Commission, where he co-authored the reorganization plan to create EPA.

He is a 1959 graduate of Dartmouth College and earned his doctorate in American government from Columbia University in 1965. He was a faculty member at Bowdoin College from 1963 to 1965 and at Princeton University from 1967 to 1970.

Constantine Sidamon-Eristoff is the new Regional Administrator for EPA's Region 2, which is headquartered in New York City.

Eristoff has been a member of the Metropolitan Transit Authority of the State of New York since 1974. He is a practicing attorney, specializing in environmental, land-use, and administrative law.

From 1968 to 1973, Eristoff was Administrator of the New York City Transportation Administration. He has been Commissioner of the New York City Department of Highways, an assistant to the mayor of New York City, a Commissioner of the New York State Judicial Commission on Minorities, and has served on the New York Governor's Council on the Hudson River Greenway.

Eristoff earned his bachelor's degree in geological engineering from Princeton in 1952, and his law degree from Columbia Law School in 1957.

In a recent reorganization at EPA, three new Associate Administrator positions were created:

Lewis S. W. Crampton is the Associate Administrator for the new Office of Communications and Public Affairs.

Since January of this year, Crampton served as the Special Assistant to the Administrator on solid waste and emergency response issues. Previously, he was Director of the Agency's Office of Management Systems and Evaluation from 1981 to 1984.

A former Commissioner of the Massachusetts Department of Community Affairs, Crampton has served as Executive Director of the National Institute for Chemical Studies. He has worked as an environmental consultant to the National Safety Council, the Arthur D. Little Company, the Rand Corporation, the University of Pittsburgh, the Chemical Manufacturers' Association, ABT Associates, and the National Environmental Technology Applications Corporation.

Crampton earned his bachelor's degree from Princeton University's Woodrow Wilson School of Public and International Affairs in 1965, and his master's degree from Harvard University in East Asian Studies in 1967. In 1972, Crampton earned his doctorate in Urban and Regional Planning from the Massachusetts Institute of Technology.

Judith I. Gleason is the Associate Administrator heading the Office of Regional Operations and State/Local Relations.

Prior to joining the Agency, Gleason was an associate at the Kirkland and Ellis law firm's Washington, DC, office. From 1975 to 1983, she worked on the staffs of Congressman William S. Cohen (R-ME), Congressman Paul N. McCloskey, Jr. (R-CA), and Congresswoman Marge Roukema (R-NJ) and served as Administrative Assistant for McCloskey and Roukema.

In 1971, Gleason earned her bachelor's degree in English from Bucknell University in Lewisburg, Pennsylvania. She earned her law degree from the University of Virginia School of Law in 1986.

Quinn

Vogelgesang

Hecht

Beardsley

Patrick Quinn is the Associate Administrator of the Office of Congressional and Legislative Affairs.

Quinn first came to the Agency in 1986 as Assistant to the Deputy Administrator. Since 1987, he has been the Director of EPA's Office of Congressional Liaison. Prior to joining EPA, Quinn served for one year at the U.S. Department of Agriculture as Assistant to the Deputy Secretary.

Quinn earned a bachelor of arts degree in history from the University of Virginia in 1978. From 1978-80, he served as legislative assistant to Senator John H. Chafee (R-RI).

Quinn also worked as legislative liaison for the Washington, DC, office of Seyfarth, Snaw, Fairweather, and Geraldson, a Chicago-based law firm, before becoming, in 1983, Executive Vice President of the National Council of Agricultural Employees, a trade association representing the fresh fruit and vegetable industry.

Last issue, *EPA Journal* reported the nomination of **Timothy B. Atkeson** as Assistant Administrator for International Affairs. Since then, he has been confirmed by the U.S. Senate, and two Deputy Assistant Administrators have been appointed:

Sandy Vogelgesang, a Senior Foreign Service Officer at the Department of State, is on special assignment to the Agency as a Deputy Assistant Administrator for International Affairs.

At the State Department, she served as a member of the Policy Planning Staff for former Secretaries of State Henry Kissinger and Cyrus Vance and as a Special Assistant on Policy Planning for the Soviet Union and East and West Europe. Vogelgesang has also served as Minister-Counselor for Economic Affairs at the U.S. Embassy in Canada and held positions in the Bureau of European and Canadian Affairs, the U.S. Embassy in Helsinki, and the Bureau of Economic and Business Affairs.

Vogelgesang earned her bachelor's degree in history from Cornell University and her doctorate in International Economics and Politics from the Fletcher School of Law and Diplomacy.

Alan D. Hecht was Director of the National Climate Program Office at the National Oceanographic and Atmospheric Administration prior to joining EPA as a Deputy Assistant Administrator for International Affairs.

From 1976 to 1982, Hecht was Program Director of the Climate Dynamics Research Program at the National Science Foundation. He is co-chair of the Climate Working Group for the U.S./U.S.S.R. Bilateral Committee on Environmental Protection and a member of the World Meteorological Organization's working group on climate research.

Hecht was chief editor of the *Journal of Climate*, an associate editor of *Climate Change*, and an editorial board member of *Climate Digest*. He earned his bachelor's degree from Brooklyn College in 1966 and his doctorate in geological sciences from Case Western Reserve University in 1971.

The new Deputy Assistant Administrator for Policy, Planning, and Evaluation is **Dan Beardsley.**

Beardsley joined EPA in 1980 and has been in the policy office since then, except for a brief assignment at The Conservation Foundation, where he worked on Eastern European environmental issues. At EPA, he started the Regulatory Integration Division, eventually became responsible for waste policy analysis, and has written about and sponsored conferences on risk assessment/risk management issues.

From 1969 to 1972, he was chaplain at the University of Florida and pastor of a Congregational church. In the next four years, he directed drug rehabilitation programs for the City of Atlanta. From 1976 to 1978, he managed criminal justice programs for the National League of Cities, and from 1978 to 1980, he was special assistant to the Director of the Federal ACTION Agency.

Beardsley is an alumnus of the Yale Divinity School and of Kalamazoo College, where he earned a bachelor's degree in philosophy. □

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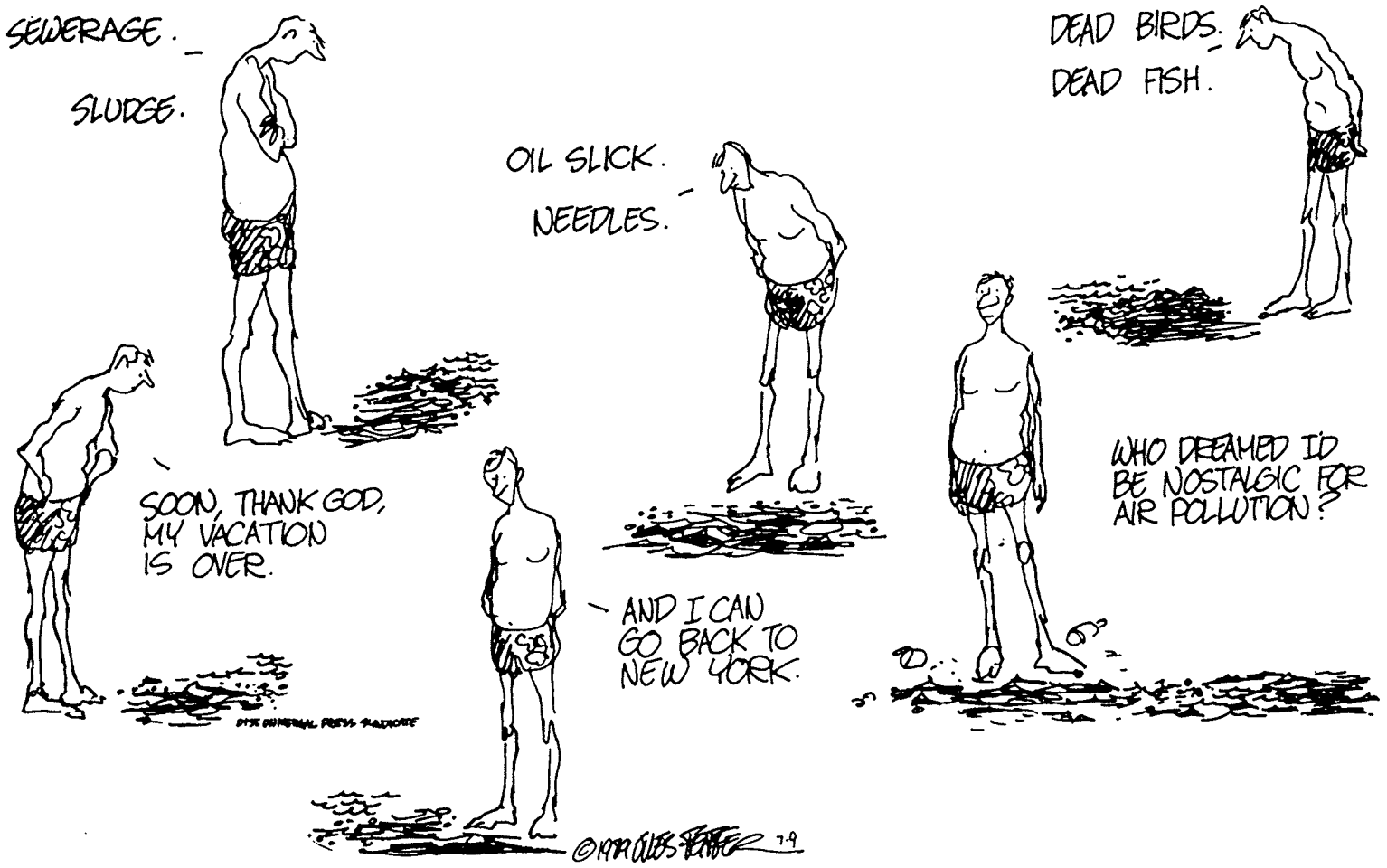

Back Cover: Peeking through sand dunes on the Outer Banks of North Carolina. Photo by Everett C. Johnson for Folio, Inc.