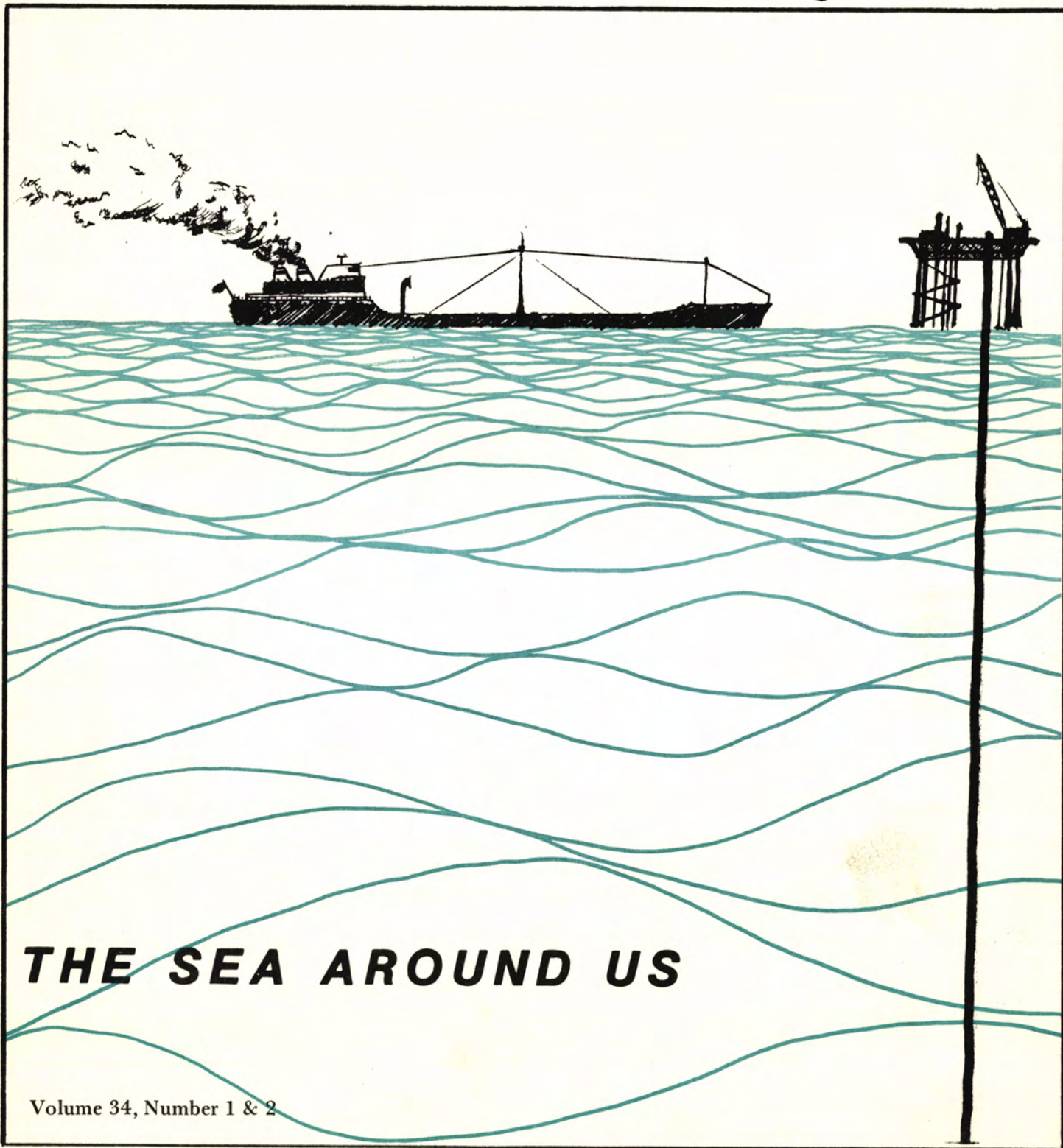


Nature Study



THE SEA AROUND US

Volume 34, Number 1 & 2

A JOURNAL OF ENVIRONMENTAL EDUCATION AND INTERPRETATION

Signs of Trouble



— photo by Alan Ascher

In 1941 Rachel Carson wrote *Under the Sea Wind*. This was followed by *The Edge of the Sea* in 1955 and *The Sea Around Us* in 1961. These beautiful natural history books provided us with glimpses of the complicated pattern of life in the oceans that surround and support us. They were, and are, good reading. They and other books like them should have alerted us to the importance and fragility of the ecosystem that we call Earth.

But humans have a long history of complacency; and in the 1940's and 50's talk about managing the fishways or polluting the oceans was greeted as a great joke by most people, including scientists. Practically everyone was certain that the oceans were so vast that they could not be affected, for better or worse, by any additions or physical changes except in restricted local areas which would ultimately be cleansed by the tides.

But the signs of trouble were soon visible. In 1947 Thor Heyerdahl, crossing the Pacific in an Inca-type raft, noted with dismay patches of pollution far out on the surface of the ocean. During the International Geophysical Year (1957-1958) scientists discovered DDT that had been washed from fields in the northern hemisphere in the bones and tissues of penguins in the Antarctic. This demonstration of the role of ocean currents, the interrelationships of the food chain, and the world-wide effects of human activity was earth shaking in its implications.

Today the great oceans of the world are being studied from top to bottom, shore to shore. They are looked on as a great reservoir of natural resources, to be exploited for raw materials and energy. Unless we look at this basic resource with care and understanding, our great "blue planet" is doomed to desolation.

— Helen Ross Russell, Editor

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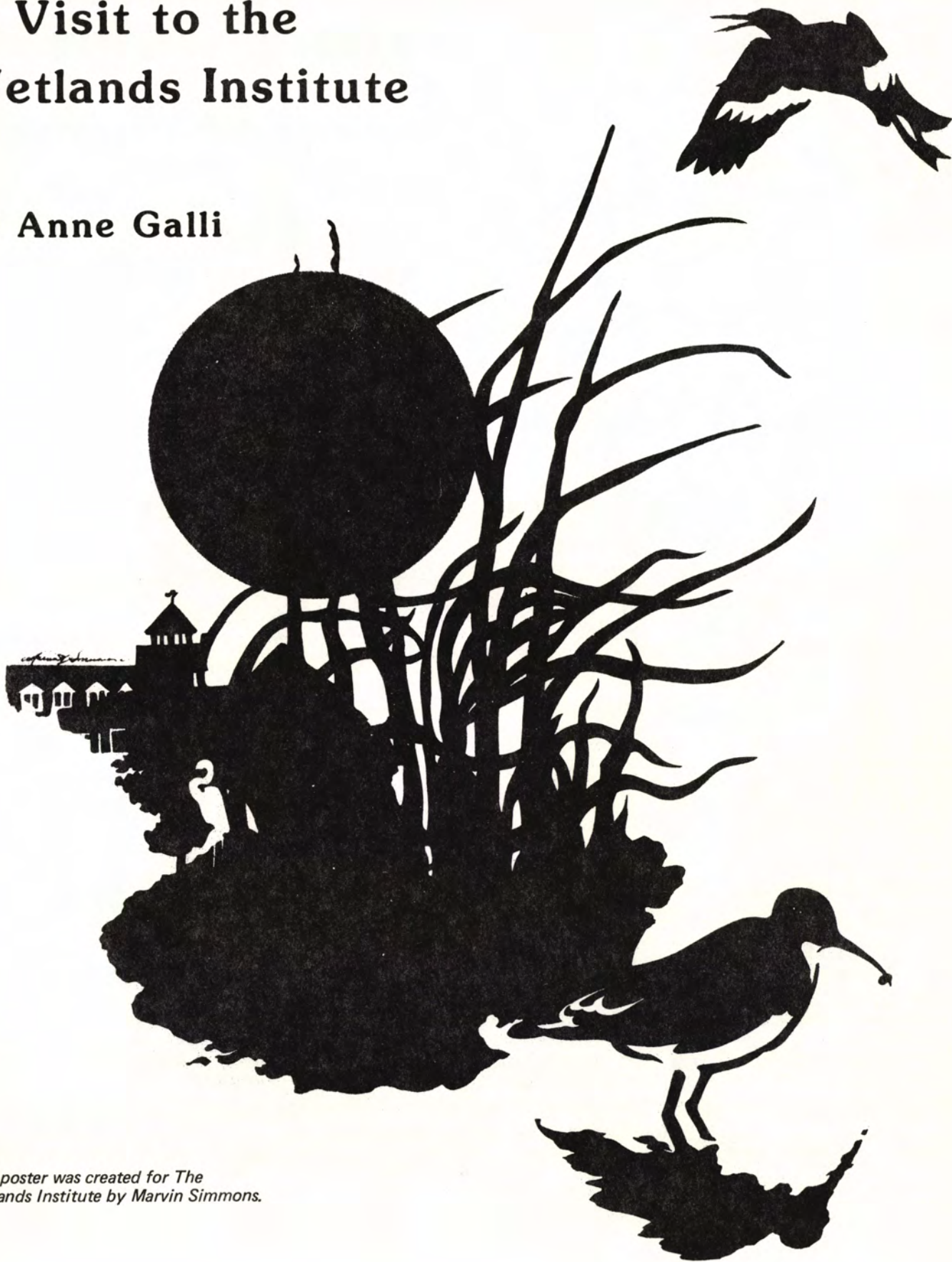
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A Visit to the Wetlands Institute

by Anne Galli



*This poster was created for The
Wetlands Institute by Marvin Simmons.*

THE COAST — the thin edge between land and sea — is an area known to many who vacation there annually. Yet the coast is much more than boardwalks, surf boards, bikinis, and suntans. The coast and its varied habitats — the beach, the barrier island, the salt marsh, and the back bays — are vital to our well-being.

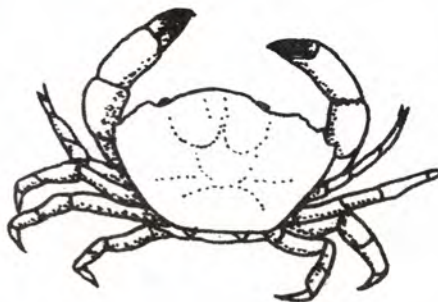
Recognition of the importance of coastal ecosystems, particularly the estuaries and their associated salt marshes, and the need to increase and disseminate information on them was the basis for the creation of the Wetlands Institute located on Stone Harbor Boulevard in Middle Township, Cape May County, New Jersey. Here the two processes of research and education interact in a dynamic way. The special situation existing at the Wetlands Institute results in up-to-date scientific information generated by research under the auspices of Lehigh University being incorporated into educational programs for the public.

A VISIT TO THE WETLANDS INSTITUTE can take many forms and provide many surprises. The individual visitor may browse leisurely through "Wetlandia — The Salt Marsh Inside." Here, surrounded by a myriad of salt-water tanks, display cases, touch tanks, and environmental game boards, the visitor becomes acquainted with the abundance and variety of life to be found along the coast. All interpretive displays focus on local flora and fauna. Microscopes are placed around the room so that a closer look may be had. Have you ever seen a baby horseshoe crab swimming around inside its egg? The egg is no larger than the head of a dressmaker's pin. A "hands-on" philosophy pervades this mini museum and visitors are encouraged to touch as well as to see. The Institute's observation tower provides a spectacular view of the surrounding coastal habitats. Look eastward to the Atlantic Ocean and the barrier island. Look westward across the sweeping expanse of salt marsh grass until your eye meets the forested edge of the

ANNE GALLI is public education coordinator of the Wetlands Institute at Stone Harbor in Cape May County, New Jersey.

upland interior of the Cape May peninsula. Take your binoculars or spotting scope and enjoy a rare "bird's eye" view of the many species of herons, egrets, shorebirds, and songbirds that fly in and out of the marsh.

A walk down the "Back Lane" leads through the salt marsh itself. Here, visiting groups, under the guidance of an interpretive naturalist or on their own, are encouraged to explore the salt marsh. To taste, touch, hear, and smell the real thing.



FREE PUBLIC LECTURES by experts touch on a variety of marine subjects and issues of critical concern, and have been a part of the Institute program from the start.

Credit and non-credit courses are also offered throughout the year. The traditional summer courses offered by Lehigh University, "The Biology of Marine Animals" and "Ecology of Wetlands," include lectures, daily field trips, laboratory work and a research experience.

Numerous non-credit courses are offered on a cost-covering basis for children and adults. One of the most popular adult education courses is "Marine Ecology" designed to give participants an understanding and appreciation of their surrounding marine environment. Lectures are complemented with slides and live marine animals and plants. In addition, participants take field trips to several habitats: a salt marsh, a tidal mud flat, the beach, and a floating dock. Other adult course offerings have included "The Natural History of Cape May County," "Birding in New Jersey," "What You Always Wanted to Know About Fish," "Philosophy and Environmental Problems," and "Astronomy."

WORKSHOPS and guided outdoor explorations are also offered throughout the year for the public. Topics include: "Gyotaku — The Art of Japanese Fish Printing," "Shell Safaris to the Atlantic Ocean and the Delaware Bayshore," "Dried Plant Arrangement and Christmas Wreath Making with Natural Materials" (weeds and grasses), and "A Bayshore Safari on the Full Moon" to observe mating horseshoe crabs and migrating shorebirds.

Courses are not limited to adults. During the summer a marine ecology class is offered for children in grades one to six. This five-day "Marine Ecology for Children" emphasizes local plants and animals, their habits, habitats and interactions. Members of the youngest age group participate in nature walks, story telling, arts and crafts. In past summers, this group has presented an end-of-the-week performance for family and friends. Rated on top of the list is a salt marsh food web comprised of children transformed into plants and animals. Rehearsal usually produces too many "laughing gulls" but, under the eyes of parents, the food chainers give a star performance. Older classes participate in longer field trips, laboratory work, and discussions. Bay and ocean waters are sampled for plankton and fish. Micro-worlds of attached life are discovered on jetty rocks and floating docks.

FIELD TRIPS are offered on a cost-covering basis to groups. Recently, students from Cleveland, Ohio, visited the Jersey Coast; explored its salt marshes and bayshore, and experienced for the first time the sounds and feel of the Atlantic Ocean.

Several educational brochures have been developed by Institute personnel and are available at nominal cost. An illustrated poster highlights local molluscs, a seasonal calendar describes the yearly cycle of a salt marsh, and a newly revised puzzle and games booklet entitled "Marsh Muddles" is a big attraction for children. A special commemorative Year-of-the-Coast poster is also available.

The Institute welcomes visitors Tuesday through Saturday from 9 a.m. to 5 p.m. Institute members receive newsletters, copies of new publications, and bookstore and course discounts.

□

TURTLE NIGHT IN TRINIDAD

by Anne Fuller & Mary Greiner



Eleven members of the American Nature Study Society on "Turtle Night" in Trinidad. Pictured left to right are: Dick Pough, Helen Ross Russell, Ruth Melvin, Anne Fuller, Margaret Elliott, John Gustafson, Mary Greiner, Lois Drury, Edith Kirk, Elizabeth Rohrer, and Paul Hafer. (Photo by Ian Lambie)

IT WAS "TURTLE NIGHT" in Trinidad — a night that we had looked forward to. For some it was the main reason for being in Trinidad at the time. After early dinner at the Asa Wright Nature Center, we were off to meet members of the Trinidad and Tobago Field Naturalists' Club at Valencia. Under the leadership of their president, Ian Lambie, eleven members of the American Nature

ANNE FULLER is a retired associate professor of biology at Western Michigan University.

MARY GREINER, a homemaker and amateur naturalist, has a special interest in birds.

Study Society were giving a night to the protection of an endangered species, the Atlantic Leatherback, *Dermochelys coriacea*, largest of all living turtles.

With two objectives, we were careening over the rough roads of northern Trinidad to remote Matura Bay on the east coast: first, to thwart any poachers at the egg-laying; second, to witness the egg-laying process and perhaps catch the event with our cameras.

Although the leatherbacks range throughout the tropical seas, there are few places where the females come ashore to lay their eggs in the manner of their peculiar life style. There have been reports from Costa Rica and very rarely from Florida. But the majority of the

dwindling species comes ashore on a two-mile stretch of the east coast of Trinidad known as Matura Bay, between the months of March and June.

IAN HAD TRIED to prepare us by a slide lecture on what the local organization was doing and where we could help them while experiencing a never-to-be-forgotten sight, should we be so lucky as to see one of the huge turtles coming out of the water. (We were hoping to see a turtle rather than a human poacher.)

It was dark when we arrived at the beach, having stumbled single file through a quarter-mile or so of tropical jungle. There was no moon, yet an effect of moonlight on the distant waves caught

our attention. It was the phosphorescent glow of marine organisms in the tropical waters. In this strange light, Ian assigned us in teams of two to patrol our section of the two-mile turtle nursery.

There were fifteen of us, so our stations were widely spaced and only our blinking flashlights maintained a link of communication. As the two of us paced off our assigned position at the beginning of the patrol area and the other thirteen disappeared down the far stretch of dark beach with an occasional blink of light, we were filled with a nervous expectancy. What if we met a band of poachers? The beginning of our position was a poachers' blind, so the local naturalists said. It was a hideout of palm fronds stuck upright in the sand above high-tide mark and against the black shapes of the island treeline.

Down the beach in the far, far distance the shoreline curved out to sea with forest down to the water's edge, or so we assumed, since there were dark patches where no blinking lights of our fellow watchers ever appeared. With the palm frond hideout as the far end of our area, we paced off about a quarter-mile of beach and found some rocks at high-tide mark where we could rest and wait for the next patrol to meet us every half hour or so.

In spite of Ian's lecture, we felt hopelessly ignorant of what to expect. What if a turtle appeared on the incoming tide? What would it sound like? Would it huff and puff? Would the huge shell scrape the beach? Would it wait for the lift of a wave to make the shore? We scanned the phosphorescent line of gentle waves for darker objects. We peered ahead, hoping and counting the flashes from the distant patrols to signal a turtle's approach — six flashes meant "turtle coming!"

Is that six? No, only three; someone probably stumbled over a log. Someone's being careless with his light. We were warned to use them sparingly; we might frighten an incoming turtle back to sea. Is there an encounter with poachers far ahead? Are we missing the excitement?

WE PACE OUR PATROL again, kicking up the phosphorescent sand and releasing the salty odors of the flotsam cast up by the last tide. A wave catches us below the knee. Clouds move across the sky and occasionally a constellation appears. Wish our star specialists were in

the next patrol. We're slightly more than 10° north of the equator. We should see the Southern Cross. Yes, there it is! Are those two bright stars next to it in Centaurus? Clouds again.

Our lights pick up a huge brown toad partially buried at the grass line — *Bufo marinus*? Time out for a flash photo. At least we'll have two records for the night, the poachers' palm frond hideout and *Bufo*.

We wait at our rock for the next patrol to come up. What had they heard from *their* next patrol? Nothing. No movement, neither turtles nor poachers.

We patrol our beach again, 10 P.M., 11 P.M., midnight. Faint flickers of lights in and out among the trees far down the beach, but no welcome six flashes. Soggy feet, caked in beach sand, carry weary bodies up the shore. Phosphorescent waves move toward us, but no dark bodies in the surf. The tide has almost reached our "resting" rock at the meeting point of our adjacent patrol.

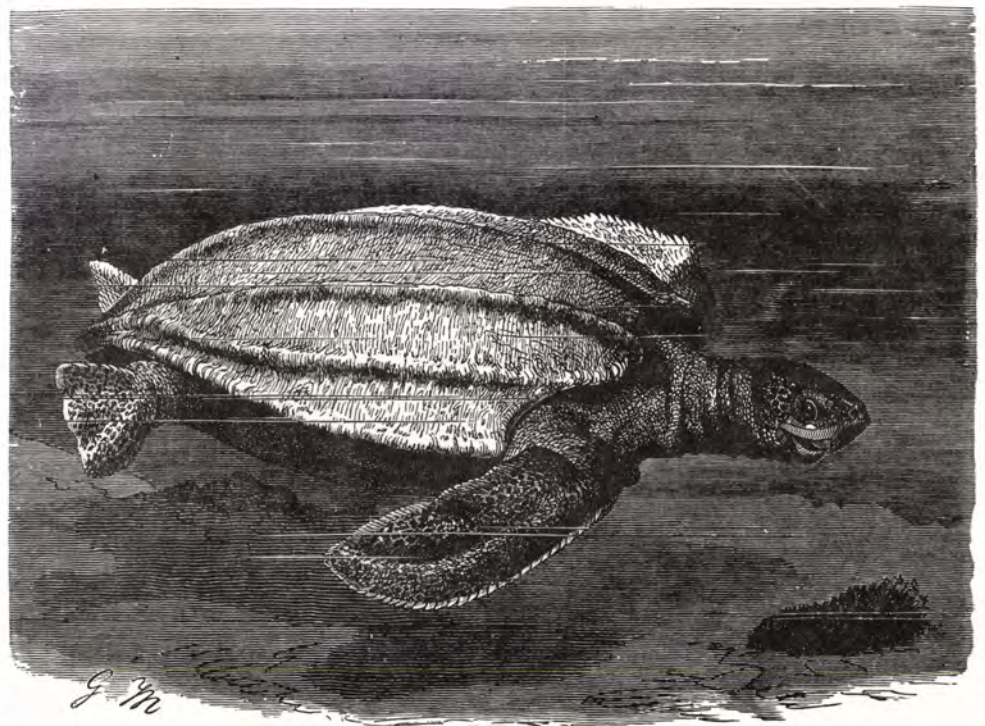
One o'clock, lights moving toward us far down the beach, but no six flashes. Lights congregating now. A lone figure looms out of the darkness and calls us to follow. The cars are waiting at another opening. We're giving up. No poachers, no turtles; they both knew better than we that the season of egg-laying is over. Yet

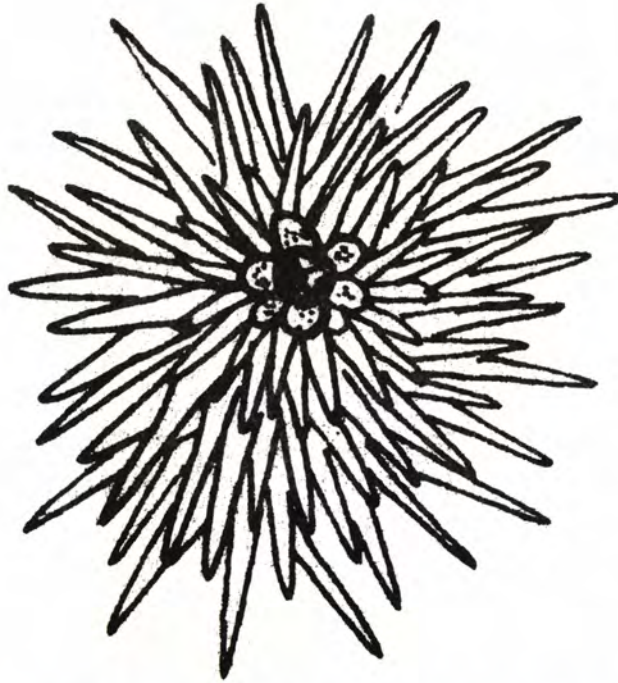
it's only the 30th of May; doesn't the season last through June? Is this an indication of the declining numbers of the species, thanks to poachers and oil pollution of their favorite nesting grounds?

WE DIDN'T WANT to give up. The night wasn't spent. Wasn't there still a chance we might have the treasured experience for which we had been lured to Trinidad? But our leaders, who were more interested in poachers, non-existent that night, thought our stint could be ended. Leaving the beach, we circle a huge rock — no, it's a turtle shell, at least four feet high, with the pungent remains where poachers had left their kill after extracting the meat they wanted and especially the succulent liver. How many egg nests had they also raided?

Disappointed and weary we gathered at the cars. Ian refreshed us with drinks stashed in his car trunk and the homeward trek began. Enroute we stirred up a nightjar, a nighthawk, a bat, and a lappe (paca). Home and bed at 3 A.M. No lights at the Asa Wright Center to tell us what a sorry oil-stained group we were. It took bottles of cleaning fluid and a morning of scraping to free our clothes, raincoats, and oil and mudcaked shoes from the evidence of our night's patrol.

But the memories persist. □





Purple sea urchin (Arabacia punctulata) uses its venom only in defense. If stepped on, the spines break off, releasing a toxin, and the intruder will feel pain and dizziness for several hours.

An Ounce of Prevention

by Karen Nolan

I LEARNED VERY EARLY that the best policy to follow when swimming is to watch out. Jellyfish were common along the beach where I swam as a child. "Don't go near it," my mother would warn, "or it will sting you." So, despite my curiosity over its odd shape and behavior, the possibility of pain induced me to watch it from afar.

Likewise, the sting ray's tail assumed mythical proportions of danger, and I felt safe from its reach only ten feet above it, crouched over the edge of a dock.

There are one thousand poisonous marine species in the world. Fortunately, the United States is familiar with less than a dozen. For the most part, these species use their toxin purely as defense, and the occasional case of poisoning occurs only by accidentally disturbing the creature.

A TOXIN IS A CHEMICAL substance used to either subdue a prey or in defense. Upon contact, the toxin is carried into the blood and body fluids and

will affect the entire body, including the nervous system and possibly the heart.

In some cases, humans may become poisoned without ever touching the animal. Some dinoflagellates cause the notorious red tides, those huge blooms on the sea surface that are the products of a protozoan population explosion. These one-celled animals release a nerve poison into the water which can, in great quantities, kill millions of fish, sea turtles, and other animals. The toxic material can also be blown onshore by the sea spray and irritate human eyes and respiratory tracts. In California, a mass poisoning of people who ate mollusks has occurred; the mollusks principally eat *Gymnodinium cage-nella*, one of the culprits of the red tides.

For the most part, however, the animal must be provoked. Most of the creatures are inoffensive by nature, lurking in rocks, seaweed, and the shallows, and strike out only if upset.

Marine snails of the genus *Conus* are favorite targets of shell collectors. A mollusk with a spirally-coiled shell, the snails are equipped with a harpoon-like tooth which bites. A mild case of snail bite will

be no worse than a bee sting. The venom can, however, cause much more severe pain, partial paralysis, visual problems and even collapse. Unfortunately there is no specific antivenin and medication to relieve the symptoms is prescribed.

Sea urchins, or hedgehogs, are attractive, globular-shaped animals bristling with long, sharp spines. Their skeletons are hard shells, and most species have five double rows of tube feet which are found on the upper and lower portions of the body.

THE URCHINS LIVE in the shallows of rocky shores and feed on algae, small marine animals, and detritus. Their venom is used only in defense; if stepped on, the spines break off, releasing a toxin, and the intruder will feel pain and dizziness for several hours. More severe stings will cause abdominal cramps. However, since there is no treatment, it is fortunate that the effect is minor.

The long-spined, diamond-shaped sting ray is commonly seen slowly undulating through the shallows of seas and bays. This species buries itself in the sand and if

KAREN NOLAN is secretary of ANSS.

annoyed, will whip its spine into the intruder's flesh. The tail becomes hooked into the skin by means of a barb and detaches from the ray.

The toxin in the barb causes a blanching about the wound, soon followed by redness and swelling. Pain, nausea and fainting may occur. If the wound is severe, there is liable to be convulsions and irregular breathing. If stung, clean the wound of all pieces of the spine and soak in hot water for 60 to 90 minutes to deactivate the toxin.

The jellyfish is 95 percent water. If it becomes stranded on a beach, it will soon dissolve into nothing more than a puddle. Long threadlike tentacles, which drift for yards beneath its gelatinous bell-shaped body, are studded with toxin-containing nematocysts. Usually, the human will swim into the tentacles which, in the case of the Portuguese Man-of-War, can be 30 feet long, and feel a sudden pain.

The severity of the poisoning depends upon the type of jellyfish and how many toxin cells are discharged. The most poisonous jellyfish are found in the coral seas, but even the milder jellyfish of the temperate zone can cause loss of consciousness if enough toxin is released.

The victim will feel pain, muscle cramps, shortness of breath and can go into shock. Treat the wound with ammonia and alcohol to deactivate the toxin. Cover it with sand or flour which adhere to the tentacles and will make them easier to remove. Then simply scrape them off. Analgesic creams and antihistamines are also beneficial.

SCORPIONFISH are the most dangerous fish of North America. Three species, the California scorpionfish, the Norway haddock, and the barbfish, are found in U.S. waters. Typically, the fish lie concealed on the sea bottom, among reefs and crevices and snap at small fish. Their poison, a defensive measure, is found in its spines, particularly around the dorsal fins.

The genus contains some of the most beautiful as well as the most ugly species of fish in the world. The California scorpionfish has a huge repulsive head and large rounded pectoral fins. Decorated with warts, flaps and frills, its dull mottled color conceals it among the seaweeds of the Pacific Coast.

The barbfish is found on the Atlantic coast from New Jersey south. Also bear-

ing hooks and barbs, it is more colorful than the California scorpionfish, having patches of blue on the head, red on the mouth and throat, and a motley of red, yellow, brown and purple patches on its body and fins.

In the North Atlantic is the Norway haddock, which is also called the rosefish because of its lovely red color. Scorpionfish poisoning is most likely to occur to scuba divers and fishermen. A touch brings an intense local pain and blistering, with some swelling and local tissue deadening.

Lastly, there are the sea snakes. Many people mistake eels and lamprey for snakes, but there is just one venomous sea snake in the United States. The Yellow-bellied seasnake, *Pelamis platuris*, is found from the Gulf of California south.

SEASNAKES DIFFER from land snakes by having a stouter body that is flattened from side to side, a paddle tail, and nostrils on a broad snout. Fangs are located at the back of the mouth, and are used to numb the fish, eels, frogs and other small creatures it preys upon. Sea snakes are shy and inoffensive creatures who usually hunt at night. Although their venom is highly toxic, they are so docile that there are few occurrences of sea snake poisonings.

However, swimmers and fishermen of the southeastern United States should be aware that some land snakes, including the Eastern Diamondback Rattlesnake, swim among the offshore islands.

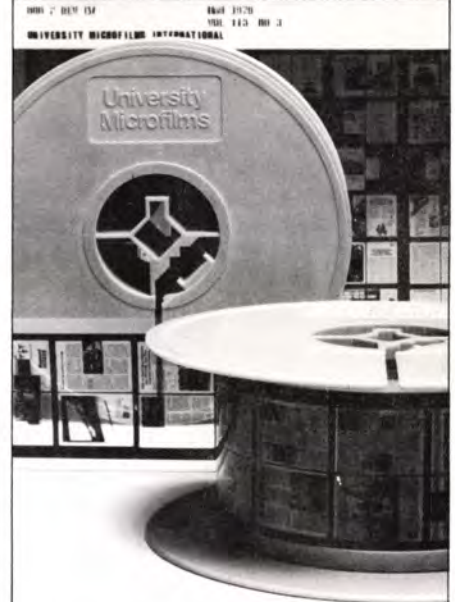
The best means of avoiding a case of marine poisoning is to simply keep the eyes open. By being conscious of your surroundings, you can prevent a lot of suffering. □

FISH FOR FOOD AND COSMETICS

Russia and Japan refused to sign the ten-year moratorium on whales drawn up by the United Nations Conference on the Environment in Stockholm in 1972 because they "need them for food." Most of the Russian catch is used to feed ranch raised sable and mink. These furs are exported to the entire fashion world without any restrictions, on the premise that ranch raised fur never endangers a species.

About ten percent of the Japanese catch is used for human food. The balance goes for margarine and pet food, and cosmetics.

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JAMAICA BAY --

ten years later

by Joan Rosner

September 12, 1970 was one of those glorious late summer days — sunny, crisp, clear. More than one thousand teachers, with their families and friends enjoyed this day at Jamaica Bay Wildlife Refuge. They'd come to New York City's world-renowned preserve to attend a "Teach-In-For-Teachers."

The refuge was threatened by the expansion of nearby Kennedy Airport, and the teach-in was a demonstration of the teachers' belief in the refuge, both as an educational facility and as a natural area.

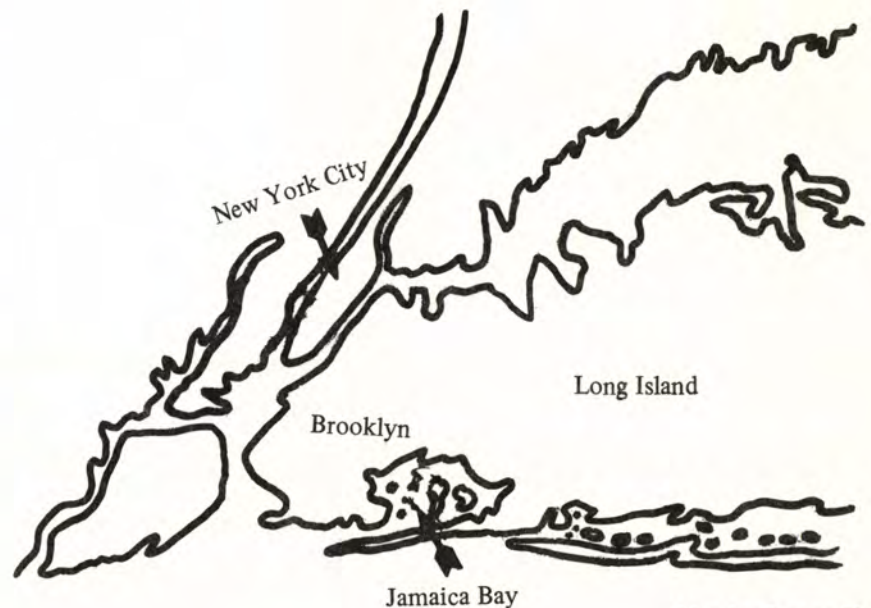
Naturalists guided the visitors through the sanctuary's freshwater pond, salt marshes and uplands. Teachers who had used the bay as a school program spoke with others about its abundant advantages. Representatives from the National Audubon Society and the Limnologists Society underscored the bay's educational, recreational, and ecological significance to New York City. Government officials listened.

Various circumstances had provoked this public demonstration of teachers' concern. Earth Day had occurred five months before, and many people were encouraged to voice their opinions about environmental problems. That day had proven that it was neither necessary nor advisable to leave these matters to the experts. It had also shown that the public could sway official decisions when people banded together and made their opinions known.

THE CONTROVERSY over Kennedy Airport expansion was two years old in the summer of 1970, and if anything, was more volatile than ever. The teachers who used Jamaica Bay as an ecology laboratory realized that the controversy added a new dimension to their role as teachers. They could not limit themselves to just interpreting the bay's natural wonders. They found it necessary to enter a new arena, and one where they had little expertise: environmental activism. The choice was to fight for their "last frontier" or watch it be bulldozed into a "lost frontier."

The teach-in was spearheaded by city educators and community leaders who had attended two particular summer ecology workshops. Graduates of the workshops at Audubon Center of Greenwich, Connecticut, and the Watson Ecology Workshop of two Queens school districts were committed to the idea of learning to appreciate the ecology of their own neighborhoods, and to share their enthusiasm with their students. They had developed skills and techniques to demonstrate the ecology of parks, vacant lots, and school grounds.

Through their recognition of the New



Map by Donna King

JOAN ROSNER is a teacher in the New York City area.

Jamaica Bay Wildlife Refuge lies just south of New York City.

York neighborhood as an ecology laboratory, they extended the definition of "classroom" to include all those wonderful areas without walls which existed within a short bus ride of their schools. Jamaica Bay Wildlife Refuge was one of these sites.

JAMAICA BAY — THE STRUGGLE FOR CONTROL

Jamaica Bay is considered by many to be New York's "last frontier." A stranger in town, seeing densely populated, frenetic Manhattan, might be surprised to find that within a short subway ride from Times Square there is "a strange corner of primitive romance with wide skies, long reaches of water, and low grassy and mysterious islands."

The bay was so characterized, and correctly so, during the public hearings concerning the use and abuse of the 26-square-mile parcel of urban wetlands bordering Long Island's most populated counties, Queens, Kings, and Nassau.

The obvious reasons for leaving the bay natural are that it is a nutrient trap, a well-stocked nursery for shell and finfish, and a feeding and nesting place for an extraordinary number and variety of birds. Nevertheless, there is a long history of controversy concerning control of the only unused space in the world's largest city.

The Park Association of New York stated in a report in May, 1968:

"Increasingly, the Jamaica Bay area is where the Metropolitan Region shoves its problems — where it haphazardly dumps its wastes, flies its loudest planes, houses its overspill, mines for sand requirements, and takes its days off. The strain has long since begun to show. More and more, the bay is polluted, noisy, underserved and scarred. It is less and less the great recreation and conservation resource it is uniquely equipped to be."

Oddly enough, the very encroachment which for decades had frittered away the wetlands, helped to bring about an important turning point in Jamaica Bay's history. During the 1930's, two members of Mayor LaGuardia's official family, the Commissioner of Sanitation and the Commissioner of Parks, found the wetlands desirable but for vastly different reasons.

THE SANITATION Department needed the marshland to dump the city's refuse. The Parks Department foresaw disastrous consequences in such a use. Robert Moses, the Parks Commissioner, presented an alternate plan, in which he suggested purifying the bay water and developing "six sparkling white beaches and green-shaded waterfront parks."

In 1938, Jamaica Bay was placed under the jurisdiction of the Park Department by the State Legislature. Although the plan to build bathing beaches never materialized, the crusade that Moses led was a giant step toward preserving the habitat, and the first milestone along the road to establishing the National Park Service's Gateway National Recreation Area in the early 1970's.

JAMAICA BAY IS WHERE
NEW YORK SHOVES ITS
PROBLEMS — WHERE IT
DUMPS ITS WASTES, FLIES
ITS LOUDEST PLANES,
HOUSES ITS OVERSPILL,
AND TAKES ITS DAYS OFF.

HERBERT JOHNSON — THE LEGEND

The teachers' demonstration was also the result of an event which occurred in 1953, but which influenced the character of the bay for decades. In that year, the Jamaica Bay Wildlife Refuge was established, and marked a reversal in the pattern of man's impact on his environment.

Robert Moses negotiated a shrewd *quid pro quo* in 1951. He worked out an agreement with the Transit Department to build a series of dikes forming two fresh-water ponds in the bay, in exchange for permission to dredge sand and construct an embankment for subway tracks to the Rockaways.

Herbert Johnson was brought in as resident director of the new preserve, and given a small staff, unlimited time, and free rein. During his tenure as director from 1951 to 1972, Johnson transformed the bay into the largest refuge of its kind in the world, and the only one to have a subway running through it.

Jamaica Bay is located at the intersection of the migration along the Atlantic Flyway and the migration from Michigan and Canada. As a result, hundreds of bird species find the refuge a well-stocked hostelry during their trip, due to Herb Johnson's knowledge and his planting program. Some species found it an attractive nesting area. For instance, in 1961, three pairs of glossy ibises nested, and a decade later, there were over 100 pairs. Similar success has been noted among snowy and common egrets, terns, skimmers, herons, teals, gallinules and others.

THE REFUGE FLOURISHED. A two-mile path was constructed around West Pond, and every year more than 50,000 visitors were able to watch the fresh-water fowl to their right and salt-water birds to their left. Prolific stands of Japanese pine, Rosa rugosa, autumn olive, bayberry, chokeberry, and pyracantha grew dense.

Johnson, who took justifiable pride in the refuge, never tired of leading tours. He especially enjoyed involving youngsters in bird-watching, but he was painfully aware that more children should have the opportunity to visit Jamaica Bay. He also knew that the children should have more of a preparation for their visit.

Johnson was not alone in this conviction. Other naturalists and educators saw the need for a sustained educational program for elementary and secondary school children. Thus, in 1968, Dr. Carl W. Buchheister, president emeritus of the National Audubon Society, undertook a pilot program with several teachers from the Audubon Center's ecology workshop and two fourth-grade inner-city classes. The program proved that, first of all, age was not a factor to consider in planning an ecology field trip. He also demonstrated that students could quickly grasp such ecological concepts as habitat, adaptation, interdependence, and the web of life. Perhaps most important, the children could, like adults, find sanctuary in a secluded place. They experienced an exhilarating feeling of release and "decompression." The effect on the human psyche was well expressed by two youngsters in that pilot program. One little boy from Bedford Stuyvesant said, "What I liked the most was sitting on the beach just looking and thinking. It felt so good to be alone."

(continued on page 22)

"MARINATING" OUR URBAN YOUTH



The New York City Coast offers students a variety of marine habitats to explore. At South Shore High School in Brooklyn, students follow a nature trail to the beach.

by Alan Ascher

NEW YORK CITY has approximately 578 miles of shoreline. This includes 320 miles of piers and bulkheads, 17 miles of developed beaches and an array of coastal salt marshes. Added to this, there are resources such as Gateway National Recreation Area, the New York Aquarium, the South Street Seaport, the American Museum of Natural History, and many others. All of this provides one of the richest resources in the country for the study of the marine environment.

Over the past decade there has been a vast increase of interest in the marine environment. Perhaps it was our past experience with the destruction of the shoreline that turned educators to this area. At every level of education, one can find teachers involved in marine studies. There are courses in marine science, marine biology, marine heritage, marine literature, and even marine cuisine.

The New York State Marine Education Association was founded to provide a mechanism for communication among

ALAN ASCHER is a teacher at South Shore High School Brooklyn, New York, and New York City District Director of the N. Y. S. Marine Education Association.

teachers interested in marine and aquatic education. Its annual conference each May attracts over 250 teachers from the New York metropolitan area. Last January a student conference was held at Kingsborough Community College in Brooklyn, attracting over 500 secondary school students from the area. Students attended workshops on everything from "Sharks" to "Munching on Algae."

STUDENT INTEREST in fishing, whales, sharks, and other critters of the sea creates excellent motivation for marine studies. On the elementary school level two exemplary programs include the Ecology Center at Community School District 22 in Sheepshead Bay, Brooklyn, and the "Asphalt Green" at the Fireboat House on the East River in Manhattan.

The District 22 Ecology Center was the brainchild of Doris Hazelcorn. The center, funded by the local school district, provides a district-wide program. Students visiting the center find marine artifacts, marine aquaria, and an array of audio-visual materials on marine life. The experience at the center is an initiation to basic ecological principles, and it prepares the students for the outdoor activities at the

beach or at the aquarium.

In Community School District 2 on Manhattan's east side is the Fireboat House. Initiated by a community group called the "Asphalt Green," the Fireboat House was developed into an environmental center for students in the local school districts. Through the knowledge, dedication, and skill of Rose Blaustein (science coordinator), the center offers a variety of programs. "Ships of the Harbor" is just one of the topics which can be studied in several visits to the center. Many ships can be seen from the pier at the back of the building. "Seagulls," another topic, is enhanced by a collection of stuffed seagulls. Of course, the view of the river gives youngsters an opportunity to learn more about the habits of the gulls. Marine materials are found throughout the center, but a highlight is a four-foot diameter "touch tank." Inside one can find and handle a variety of marine invertebrates. Certainly, for many of the children this is their initial experience with animals from the sea.

On the junior high school level there are a variety of programs. Some of the noteworthy programs include Halsey J. H.S. in Brooklyn, Joan of Arc J.H.S. in

Manhattan, East Harlem Maritime J.H.S. in Manhattan, Goddard J.H.S. in Queens, and I.S. 162 in the Bronx. Each of these programs is a science-oriented program in which marine science has been "infused" into the traditional curriculum. Maintenance of marine aquaria and extensive field studies are an integral part of each. At East Harlem Maritime J.H.S., students participate in a three-year marine-oriented program. It is a special attraction to students in the area. The Joan of Arc program under the direction of Peter Rentof

are programs for all different grade levels and interests. Courses include state-approved course in marine biology (used in lieu of the state-required course), oceanography, environmental science, marine careers, and advanced marine science.

At John Dewey High School, Lou Siegel and Harold Silverstein have used a vast array of research instrumentation to study local waters. Hatch water analysis and a specialized auto analyzer is used to make in-depth laboratory studies. A 24-foot flat-top research vessel is used for

samples are collected during the trip over.

South Shore High School in Brooklyn has been involved in a required course in environmental science for most ninth year students. Visits to local beaches such as Dead Horse Bay and the Jamaica Bay Wildlife Refuge have been a highlight of this program. Some students also continue their study of the marine environment in a marine biology course taken in lieu of regular biology. Students participate in field trips to ocean and bay beaches where they compare these two dynamic environments. What do high school students do to study a local beach? Among the many activities are transect studies of beach, dune, and marsh; they seine for local invertebrates and small fish; they collect plankton samples using small inexpensive nets; they chemically analyze water samples. While time at the beach is limited, much has to be accomplished quickly. These brief field trips become the basis for the entire course.



In shallow waters, students observe crabs.

participates in a week-long camping experience on Fire Island where they have an unusual opportunity to study the flora and fauna of the National Seashore. Josephine Casey's Goddard J.H.S. class has spent a great deal of time doing extensive studies of nearby Jamaica Bay. An interdisciplinary team of teachers at I.S. 162 in the South Bronx have designed an entire program based on the New York City waterfront. At Halsey J.H.S. in the Bushwick section of Brooklyn, Linda Faucetta teaches marine science as part of a three-year environmental program.

IN THE HIGH SCHOOLS there

studies in the shallow waters of Jamaica Bay. Some students have even been involved in presenting impact statements based on their studies of Coney Island and Jamaica Bay.

At Beach Channel High School in Rockaway, Maxwell Cohen (science chairman) has been involved in the only city high school specifically designed for the study of the marine world. Built on the shore of Jamaica Bay, its students have ample opportunity to study the intricate relationships of the bay. A small fleet of inflatable craft are used to transport classes onto nearby tidal marshes. Marsh flora and fauna are analyzed and plankton

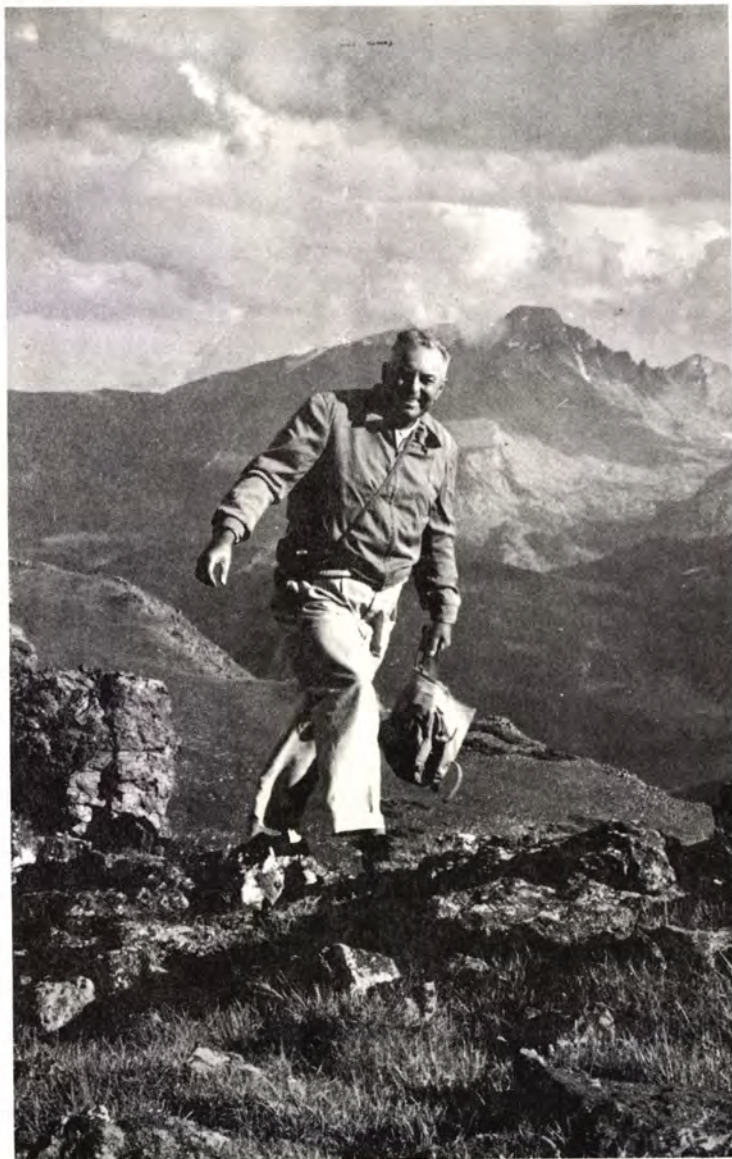
ANOTHER ASPECT of the marine program at South Shore High School is the involvement of students in the development of a nature trail at Gateway National Recreation Area. (The trails were actually completed by students in a summer Youth Conservation Corps program.) A 1½ mile trail goes through upland vegetation, around sand dunes, down a sandy beach to a salt marsh. Hundreds of elementary school students use these trails on ranger-guided interpretive walks. In 1976 and 1977, the students who worked on the trails acted as guides for elementary school classes. This type of peer teaching has been used effectively in subsequent years.

Strong supportive programs offer valuable resources to local teachers. The American Museum of Natural History, the New York Aquarium, Alley Pond Environmental Center, and Gateway National Recreation Area are just a few of the places that offer programs and exhibits that broaden the nature of teacher programs.

The New York City coast offers students a variety of marine habitats to explore. Here they can view the interrelationships that keep an ecosystem going. Here too, they can see the effects, both positive and negative, that humans have had on their coastline. □

EDWIN WAY TEALE :

Nature Writers' Exemplar



EDWIN WAY TEALE: *Nature Writers' Exemplar*

RICHARD B. FISCHER is Professor of Environmental Education at Cornell University.

by Richard B. Fischer

When William Beebe passed away several years ago, someone commented that his death was like the falling of a giant forest tree. And so it was with Edwin Way Teale, who took leave of his world of insects and wildflowers, seasons and sunsets on October 18, 1980. His writing enriched our lives much as the creative act of writing enriched his own. As members of a society which he twice served as President, we were particularly saddened by his passing. For unlike many of his legion of admirers, we were a bit closer to Teale, we were perhaps a bit more in tune with his messages, and we were certainly *privileged* to know this exemplar among nature writers.

Edwin Way Teale, like Thoreau and Burroughs before him, consciously sought to be a chronicler of the natural scene. Even as a schoolboy, he wrote nature compositions. Two years after earning the M.A. from Columbia University (1926) he joined the staff of *Popular Science Monthly* as a feature writer. That paid handsome dividends, for besides gaining writing experience he was taught photographic techniques by one of the magazine's own photographers. And we know how attractively Teale supplemented the word pictures in his books with actual pictures of his subject matter.

It is relevant to note that photography also interested Teale at a very early age. In his autobiographical *Dune Boy* he relates how he picked 20,000 strawberries on his grandfather's farm in order to earn enough to buy a \$3.75 kit comprising camera, film, chemicals and paper from Sears Roebuck.

Like Burroughs, who guarded a United States treasury vault while he wrote his classic *Wake Robin*, Teale's thoughts while working at his Manhattan *Popular Science* desk were elsewhere . . . He had become infatuated (what other word accurately characterizes the interest?) with insects and with what he called their Lilliputian world. By 1937 he had amassed enough knowledge — the similarity to J. Henri Fabre is inescapable — and sufficient illustrative material to bring out *Grassroot Jungles*. Although not his first book, this volume created a sensation in the special literary world which we of ANSS inhabit. Its dust jacket, featuring a praying mantis, gave birth to Teale's image as a modern day "Homer of the insects." In many minds, Teale and the praying mantis were synonyms.

Teale was moving inexorably toward the realm of the free lance writer. With more and more assignments to write feature articles for other publications, and growing impatience with the clockwork requirements of his regular job, he left *Popular*

Science in 1941. Eva Gordon once told me that he considered that day the second most important day in his life. (The most important in Teale's life was June 2, 1899, the day he was born in Joliet, Illinois.)

A moment ago we alluded to Teale's intense dissatisfaction with "the tyranny of time." Indeed, his feelings were so intense that he wrote one of my favorite volumes based on this theme: *Days Without Time*. A quote from his introductory chapter sets out his philosophy at the same time that it provides an example of his exemplary prose.

"The centrifugal force of civilized life draws us out thin, stretches us to the ultimate of our resiliency. Days out-of-doors give us release. They permit us to contract back to the center of life. In the natural world, the circle of each succeeding year brings with it variations of eternal themes. Events occur in endless, but varied, repetition. The fall of the tree, the swoop of the hawk, the tilt of the buzzard in a windy sky, the song of the hermit thrush at evening, the opening of a windflower, the eddy of a woodland brook —

all these events for days without time. They might have occurred during any one of a thousand or ten thousand years. Ticking clocks and factory whistles have little to do with the eternal recurrence of these eternal themes."

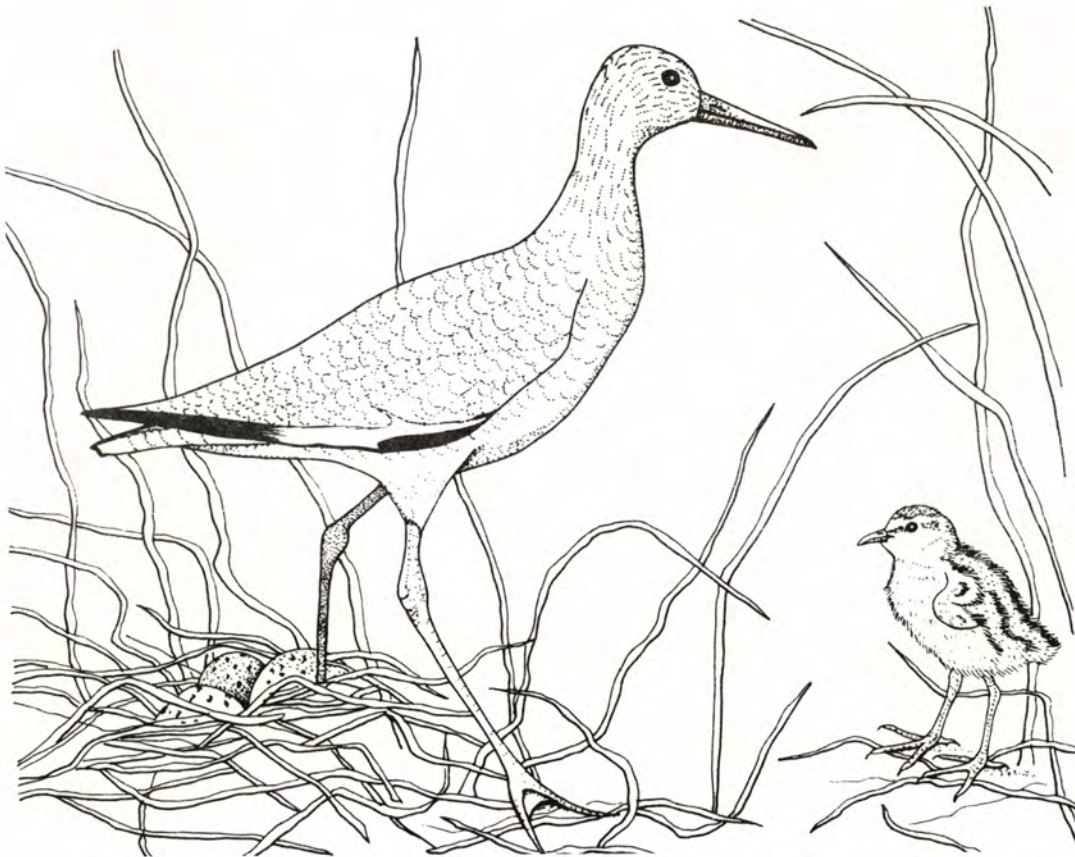
We must return to Teale's abiding interest in insects. Like Farbe and our own Robert McClung, his writing bears the stamp of authenticity. One of his own exemplars in these matters was Gilbert White of Selbourne, who admonished naturalist/writers to know their own parish. Another was Henry David Thoreau, who insisted that books should be based on observations. Teale did indeed study the insects in his own parish. While living on Long Island, he leased some land (for \$10 a year) in order to develop an insect garden. His observations resulted in *Near Horizons*, his second major work.

Dip into *Near Horizons* and you, too, will come away delighted and impressed. For by 1942, Edwin Way Teale was an accomplished entomologist. Indeed, at various times he served as President of both the New York and the Brooklyn Entomological Societies.

Publication of *The Golden Throng*, subtitled "A Book About Bees" in 1943, finally established Teale as one of America's great nature writers. As more of his fine prose graced the literary scene, recognition and honors were bestowed upon him. First was the John Burroughs Medal (1943), followed by other literary awards (including the Pulitzer Prize) and honorary doctorates. We conferred the Eva L. Gordon Award on him in 1965.

There is little point in continuing Teale's literary chronicle, particularly since good summaries are available in reference works. Unfortunately, however, the standard accounts do not convey any sense of Teale's personality. He was a warm, friendly, but modest individual, traits that *do* come through in his writing. He was a contented human, ready to share knowledge and opinions with others.

Edwin Way Teale, America's most widely read nature writer, has passed on. But he has left us a rich legacy of superb writings, writings which, imbued with his sensitivity and accuracy, will take their place among the world's great nature classics. □



— Lisa Beard

PRIME TIME:

Working at a Nature Center Fifty Years Ago

by Ruth Yarrow



Fifty years ago the staff of the Museum and Nature Trails at Bear Mountain, New York, attempted to reach tens of thousands of weekend and holiday visitors from New York City in the spring and summer months. These were largely young men and women of all nationalities who travelled from the city on crowded boats, trains, and busses and who had very little knowledge of nature.

Problems faced by the staff included finding suitable material for trail labels, picking up wind-strewn Sunday newspaper supplements, and repairing the results of some vandalism. Their major problem sounds familiar today: to reach the visitors by helping them enjoy a day's outing and at the same time to teach them something.

Their successes included creating signs that helped people read the landscape (for example, seeing the growth of two neighboring saplings as a race for light), arranging live exhibits, and building a labeled Geology Stone Wall with sample specimens to take home.

Their story is told in Signs Along the Trail: The Museum and Nature Trails at Bear Mt., N.Y., William H. Carr, New York, 1927.

We asked Mildred Rulison, former Pioneer Counselor at Bear Mountain, to share her experience as a naturalist at probably the first trailside museum. Here is her story.

—RUTH YARROW is a contributing editor of Nature Study.

Back in 1929 I was asked by the Rahway, N.J., Girl Scout Council, "How would you like to be a Pioneer Counselor at our Girl Scout Camp?" To prepare for this offer, I enrolled in the outdoor education and camping course which the Columbia University Teachers College had been teaching for nine years. Leaders in outdoor education taught the course. They included the Director, Dr. E. K. Fretwell, who led the Boy Scouts of America on a Camporee to England about that time; Fay Welch, a red-headed man who taught camping at Columbia; and Julian Salomon, who had written a book on Indian Craft.

Then, in 1930, Ruby M. Jolliffe, head of the Camping Department for the Palisades Interstate Park Commission, asked me to join the nature staff of the Commission, starting as a counselor at one of the organized camps and then directing several of the Regional Nature Museums. I worked there for ten years. "Jolly," as we called Ruby Jolliffe, remained my close friend until her death. In fact, all the people working there were like one big family.

Many well-known people, especially scientists and educators of the day, gave their time to the Bear Mountain project. The staff was inspired to feel a growing love and respect for the beautiful highlands of the Hudson and the Ramapo Mountains by such teachers as "Cap'n Bill" Vinal, "Uncle Bennie" Hyde, Bill Carr, Ruby Jolliffe, and Clyde Fisher.

Fisher's wife, Princess Te Ata, told beautiful Indian stories about creation. Averill Harriman and Major Welch gave parties and told their stories to the staff. Eleanor Roosevelt talked to many of the campers on our lake. John Burrough's son Julian entertained the staff and showed us two houses his father had owned north of Bear Mountain. New York University faculty helped us with lichens; Hunter College and others gave help on mosses. In short, this was prime time for outdoor education.

I have many memories. One that stands out was speaking to over 300 boys from the sidewalks of New York City at the *New York Tribune* Fresh Air Camps headed by Dr. Fraser. It was quite an experience. As naturalists we wore gold conservation badges and took a conservation oath. The boys thought I was a "G. I. woman."

The Bear Mountain Trailside Museum and trails in the Harriman section of the Palisades Interstate Park grew out of the teaching trails started by Frank E. Lutz, Curator of Insect Life at the American Museum of Natural History. He tried to house insects in wire cages along tree branches. The leaves were eaten and the cages had to be moved; wind and rain destroyed his connected trail. So the staff decided to put a roof over it and call it Trailside Museum. In 1927 it became the outdoor education center for the American Museum of Natural History and has been called the "Granddad of Trailsides." □

GOOD READING

for Environmental Education

Sea Mammals by Dorothy Childs Hogner. Ill. with aquatint etchings by Patricia Collins. Thomas Y. Crowell, New York, 1979. 80 pp. Hardcover \$7.95.

For the year of the coast, sea mammals are an important subject. A reference book with ample clear illustrations of species off our shores would be useful for older children. Also valuable would be an engaging account of the major sea mammal groups highlighted with descriptions of adaptations of selected species and accounts of the threats to their survival. *Sea Mammals*, unfortunately I think, attempts to be both.

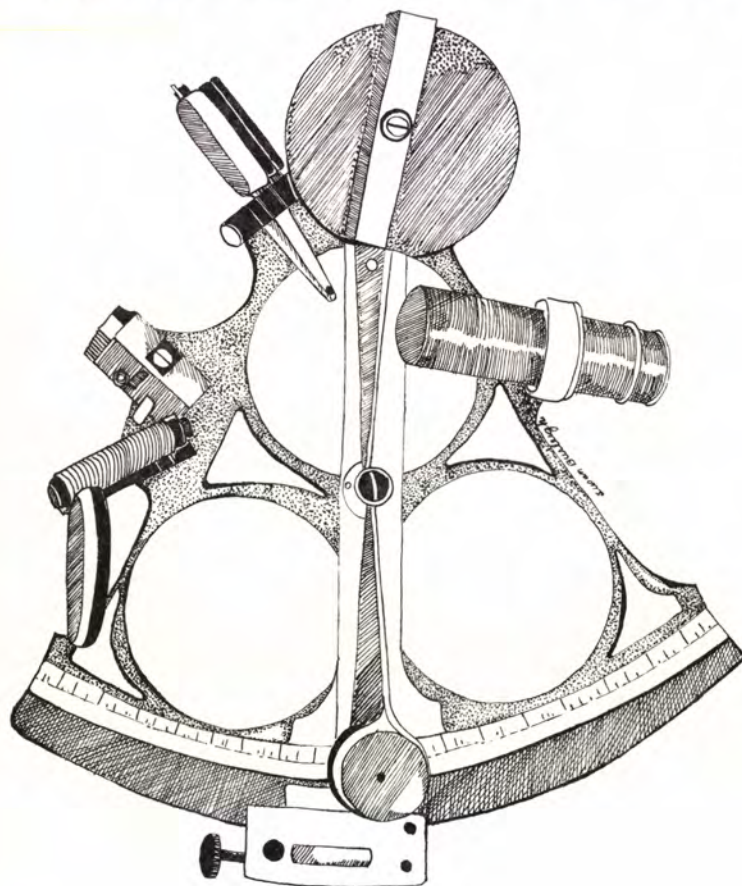
The main impediment to being a successful reference book is a lack of clear illustrations. The bulk of the text is descriptions of over thirty different species of sea mammals. Reading through the book, I soon found the physical descriptions blurring together. If this were clearly

a reference book, I would not read it from cover to cover, but would enjoy sampling the text together with its illustrations. But of the twenty aquatint etchings in *Sea Mammals*, at most half a dozen clarify the descriptions. The majority illustrate some interesting fact, for example a floating sea otter opening shellfish by smashing them on a rock held on its belly. But while the illustrations are attractive, several, such as one of the birth of a dolphin, are unclear. An illustration of the blue whale eating krill is clearly misleading; it looks as if eight of the tiny creatures would fill up much of the mouth of the largest animal that ever lived! Most of the species described in the book are not illustrated adequately for a reference book.

The book is stronger as a general account of sea mammals. The author includes good details, such as the 300,000

hairs per square inch on the fur seal's coat which actually keep water from reaching the animal's skin. She gives up-to-date accounts of the interaction of sea mammals and our own species, such as the tuna fishing method that cost 154,000 porpoises their lives in 1975. Unfortunately the taxonomic organization of the book and the resulting descriptive repetitions, such as the mention five times that fur seals can move their hind legs forward, interfere with the interesting narrative.

This is a difficult subject for a naturalist other than a marine biologist to write about because of the difficulty of obtaining first hand experience. Dorothy Childs Hogner has made a valiant attempt but hopefully next time she will either find suitable and sufficient illustrations for a reference book, as in her book *Weeds* (Crowell, 1968) or will write a lively general account, such as her *Earthworms* (Crowell, 1953).



A Field Guide to the Atlantic Seashore (from The Bay of Fundy to Cape Hatteras) by Kenneth Gosner. Houghton Mifflin Co., Boston, 1979. (\$12.95).

This recent Peterson guide is a pearl! True to the Peterson style, the author keys the most commonly found invertebrates and seaweeds according to their usual characteristics. Excellent black and white drawings and color plates are grouped in a center section that a grade schooler could easily use. Separate in-depth descriptions of the animals and plants include a most helpful list of similar species, noting their distinguishing qualities. The end papers give pictorial definitions of the relatively few scientific terms used in the book.

The author encourages the reader to pursue more than just the answer to "whatizzit?" by describing the habitat behavior and gustatorial possibilities of each species. Gosner's respect for the living organisms he catalogues is evident in the guidelines he sets down in the chapter on collection and preservation. Beachcombers of all ages will enjoy using this handy guide as much as the author obviously enjoyed preparing it.

Album of Whales by Tom McGowen. Illustrated by Rod Ruth. Rand McNally, Chicago, November 1980. 61 pp. Hardcover \$6.95.

The second paragraph of this new book begins "It may surprise you, and please you, to learn that you're actually related to these fascinating creatures." Tom McGowen writes the whole book with wonder and enthusiasm so that facts about whales become surprising and pleasing.

McGowen's description of nine groups of whales includes realistic details that help young readers imagine the whale's world which few of us will see first hand. For example, he takes you into the mouth of a feeding baleen whale with this description: "But the wriggling krill can't get through the tangled, hairy mat formed by the inside edges of the baleen, so they stay trapped in the whale's mouth and are swallowed." He uses vivid analogies such as "It's hard to imagine an animal as heavy and long as a box car leaping clear out of the water as it turns somersaults, but humpbacks have been seen doing just that!" McGowen's frequent explanation points are well-justified by the excitement both in the facts and in his writing.

The full-page color illustrations are clear, bright and dramatize the text beautifully. Aside from one drawing of the Ganges River dolphin, which can mislead the observer into seeing this eight-foot mammal as much larger than an elephant, the attractive line drawings also enrich the text.

The initial general chapter and the concluding chapters on Whale Babies and the Future of Whales complete this attractive, informative album for older children on "our big cousins in the sea."

— Ruth Yarrow

Barnacle and His Friends by Munroe, West Yarmouth, Mass., Northeast Edition (\$2.25).

Youngsters will enjoy this ecologically flavored paperback beach guide. The cartoon critter, Barnacle, describes his world at the bottom of a salt marsh as fiddler crabs stomp by his door. He then introduces his varied friends from mollusks to northern corals to crabs and their cousins. The black and white illustrations are less clear than they might be, but the appealing text compensates.

Conflicts Along Our Seacoast (a filmstrip series about coastal zone management issues.) Weiss, Project Oceanology, Avery Point, Groton, Ct. 06340, 1978, (\$15.00).

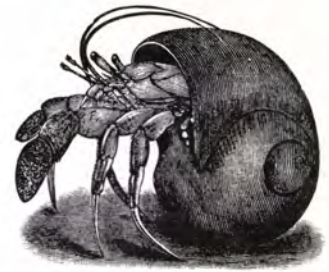
That the year of the coast is not entirely a celebration is illustrated in the filmstrip series *Conflicts Along Our Seacoast*. Titles in the set indicate the variety of issues considered: Land Use and Growth, Natural Resources, Water Pollution, and Energy and Progress. The latter incorporates the best features of the filmstrips. The complexity of real life issues is well documented by interspersing frames of newspaper clips with photographs of the events noted such as a thermal pollution episode at a nuclear power plant. This approach does, however, have the disadvantage of becoming out of date as new issues develop and as research offers more conclusions on such questions as the effect of temperature changes on fish breeding. Excellent thought provoking questions in the text (such as "What is progress?") makes the series a valuable tool for use with high school and adults.

The Beachcomber's Book by Bernice Kohn. A Pullin Book, 1975 (\$1.95).

A summer at the beach can last all year long if you try the many projects in *The Beachcomber's Book*. This packable paperback invites the playful, artistic and nutritious use of beach combings, for ages eight and older. Clear directions accompanied by well-done drawings simplify the construction of permanent sand paintings, beach glass ornaments, and shell mobiles. The chapter on making shell collections would have pleased me more with some comments on deciding how much to collect or in fact whether to collect live shell animals solely for their shells. Recipes for a less controversial use of sea life follow. Delicious suggestions for beach plum jam, sea lettuce salad, and an old-fashioned clambake and others include species from both east and west coasts. Though there are sketches in the text, lack of detail and scale might suggest the use of a field guide for collecting edibles. If you have ever collected bayberries, you will appreciate the clever way to expand a letter sealing quantity of wax into a respectable candle. *The Beachcomber's Book* offers months of fun for only \$1.95.

Little Whale, by Ann McGovern. Four Winds Press, 1979 (\$7.95).

These easy to read childhood adventures of a humpback whale have charmed my 4 year old into giving *Little Whale* favorite book status. Even at story-circle distance, John Hamberger's full color illustrations encourage young listeners to swim with the one ton baby until she becomes an adult at age 5. (Suggestion for a multi media program: use the recorded "Songs of the Humpback Whale" as background music.) On a simply but eloquently worded post script, the author explains the possibility of an unhappy ending to the story. "Extinct means there are no more." Of the several whale books available for young children, this is one of the best.



Small Oceans, a 4-H Guide to the Art of Setting Up, Maintaining and Observing a Marine Aquarium, No. 4-H 108. Available from Bulletin Distribution Center, Cottage A, Thatcher Way, University of Massachusetts, Amherst, Mass. 01003.

First hand views of a starfish gliding on tube feet, sea anemones at lunch, decorator crabs preening themselves and sea cucumbers unfurling their tentacles reward the successful manager of a marine aquarium. *Small Oceans* describes each step in setting up a marine aquarium from obtaining the right equipment to deciding on the types and numbers of compatible residents. Small-scale ecocatastrophes may be avoided by the helpful advice in the section on aquarium first aid. The author encourages the whole process of decision making and observation as a rich source of ecological teachable moments. To a young person with a Small Ocean, a question such as "How does a crab eat?" generates an exciting venture in discovery.

GOOD READING

Earthways of the Shore (Tape No. 2 in a series of 12 Earthways tapes produced for Charlotte's Web), WGBH Radio, Boston 02134 (\$6.00).

Earthways presents a different approach to the inbetween world of the shore for aquanauts age six and over. Verbal images of armies of mud-colored snails and a galaxy of star fish tickle the listener (possibly with *Barnacle* in hand to help visualize the sharp-edged razor clams) into imagining his own treasure hunt to the "seam that joins earth to ocean." Seaweed ice cream and shoreline graveyards are explained in a dramatized visit to the beach. Kids are bound to come away with questions that encourage closer observation on a real trip to the coast. (The opposite side of the tape is Earthways of the Sea.)

Gigi: a baby whale borrowed for science and returned to the sea by Eleanor Coerr and Dr. William Evans, 1980. G. P. Putnam, 128 pp., 30 ill.

The story of Gigi goes beyond a simple recitation of facts and figures. The narrative begins when the decision is made to catch a baby gray whale and raise it in captivity. The merit and far reaching importance of the knowledge that would be gained from such a move is weighed objectively against the opposition to it. As preparations for the operation commence at Sea World in California we are introduced to the gray whales and their habitat in the Arctic. Winter begins and the whales start their long migration south to Baja, California, where they will mate and give birth. The journey is described fully and interestingly. The narrative recounts not only the physical attributes and the evolutionary adaptations of the grays, but also illustrates the whales' interaction with other forms of marine life. A coherent picture of the marine ecosystem is presented.

Upon the grays' arrival in Scammon's Lagoon in Baja, California, the authors describe the intricacies of the birth of a whale and its earliest experiences. The relationship between mother and calf is sketched out plainly and creates a further understanding of the whale as a feeling

creature. After choosing the right baby whale, as regarding size and age, the scientists give chase and succeed in capturing Gigi. The return trip to Sea World with Gigi on board ship is an arduous one and again the authors are informative about the physical make-up and requirements of the baby whale.

The arrival of the baby gray at Sea World is both exciting and frustrating for the scientists. Gigi refuses to eat and it is only after the establishment of a rapport with a trainer that she finally does. The whale's relationships with the various humans who feed and study her are described as they develop into mutual trust and affection.

Given such an excellent opportunity of studying a whale's habits and capabilities at close range, the scientists perform a number of experiments. For example; they observe her feeding habits, her sensory equipment, and determine her breathing efficiency and capacity. These experiments are documented clearly and the results analyzed, not only pertaining to whales, but also as applicable to humans.

Eventually Gigi outgrows her man-made environment and must be returned to the sea. Because of her immense size the project takes on full scale military proportions. By implanting a radio device the scientists hope to monitor her progress and to gauge her ability to reenter her natural environment. They are able to monitor her for two months after her release, during which time Gigi begins her long migration north to the Arctic.

The saga of Gigi is filled with facts that are presented in an interesting and entertaining manner. The material is geared for students junior high level and up, with some biology background. This background is necessary not only for understanding the terminology, though there is a glossary, but also to enable a grasp of some of the major concepts presented. The book provides enough stimulating information to warrant further study and research. Gigi appears as an integral part of the environment both in her interactions with other marine life and with humans. The marine ecosystem and food web are explained in some detail and

serve as a cohesive background for the narrative.

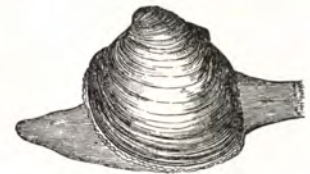
One fault is the authors' use of both the metric and English systems of measurement. The presence of the better known system negates any inclination to learn or utilize the metric alternative.

— Andree Jannette

Ecosystems and Resources of the Massachusetts Coast by Carl Carozzi *et al.* Massachusetts Coastal Zone Management Program, State Office of Environmental Affairs, Boston, Mass. 1975.

This excellent pamphlet includes sections on local coastal geology, life systems, and coastal resources. Five inventory maps follow showing the ecological and cultural classification of the Massachusetts coast.

We hope that material available through the Office of Coastal Zone Management in each of the coastal states is of such fine quality.



The Wild Edge—Kopper (*The Life & Lore of the Great Atlantic Beaches*), 1979, Times Books (\$2.95).

Billed as a combination "field guide, wildlife appreciation and beachcomber's handbook" on the cover, I found it difficult to enjoy because of the terrifically self-conscious quality of author's style. After wading through what he had for supper, and the discussion of nude sunbathers' rights I finally got to some rather amusing insights such as "Left to their own devices, scallops sit on the bottom, dining on a puree of micro organisms at their leisure and peering all around like tourists." Detailed information on selected flora and fauna of the Atlantic Beaches combines the journalist author's observations with library research he undertook (without footnotes or bibliography, however).

— Frances Lamey Ludwig

NEWS

and Notes -- along the coast

WHERE EAGLES SOAR AND INCOMES SINK

Several hundred years ago the Atlantic Region — Northern New England and the Canadian Atlantic provinces — was an area of rich coastal and marine resources. Heavy exploitation of those resources has left the region with a fragile resource-based economy including fishing, pulp and paper, and tourism, and with chronic unemployment and low income. But it remains the eastern North American stronghold for the Atlantic salmon, moose, bear, lynx, caribou, bald eagle, and osprey. Off-shore where the Gulf Stream and Labrador Current converge, whales, seals, giant bluefin tuna and basking shark roam. Off-shore islands support extensive seabird colonies.

In this unique region, the Atlantic Center for the Environment (c/o The Quebec Labrador Foundation, Mill Road, Ipswich, Mass. 01938) is trying to convey environmental information to the people. The Center attempts to involve the public through 1) summer environmental education courses at low cost for local participants; 2) workshops in information and education techniques for a wide variety of interest groups; 3) publications, meetings and conferences disbursing environmental information and news; 4) environmental research and consulting for requesting agencies; 5) graduate and undergraduate internships in field ecology, environmental policy and environmental education.

The region's people are nearly powerless to influence resource decisions which confront them with increasing frequency and complexity. The sensitivity of the center's staff to the local people's predicament is indicated by their inclusion of a Newfoundland fisherman's lament in the center's introductory brochure:

Now the men that makes the law
can sit at home and drink port wine,
But what about us poor boys
who haul the fishing line?

DEEP IN THE MARSH OF TEXAS

One of the largest remaining stretches of unprotected coastal marshland in Texas is now protected. Early last year, the Nature Conservancy announced its purchase of 42,000 acres of Texas coastland known as the McFadden Ranch, which it then transferred to the U.S. Fish and Wildlife Service for the creation of a national wildlife refuge. The land is located 20 miles southwest of Port Arthur, Texas, and borders Sea Rim State Park and the Gulf of Mexico.

The area, composed mainly of marsh with some upland and open water, supports 13 threatened or endangered animal species. Researchers say the area may be the most important feeding and wintering site for waterfowl on the Central Flyway.

SEAWEED MARKET RISES

The simplest forms of plant life, the algae, are found both in fresh water and marine environments. In the latter site they are known as seaweeds, although the only resemblance they bear to land weeds is the profligacy with which they grow on some coasts.

In the 18th and 19th centuries, seaweeds constituted a major source of iodine, potash, and soda, but these industries died out with the introduction of new sources and more efficient techniques of isolating these elements. Today, a number of seaweeds are harvested and exploited commercially for organic materials they contain. Many if not most red algae make their cell walls, which constitute 30 to 60 per cent of the dry weight of the plant, out of galactose polymers (rather than cellulose). These are easily extracted from the seaweeds after harvest. One group of these polymers, agar, is used primarily in microbiological laboratories as a gelatinous support for growing

bacteria. The United States imported over a million metric tons of seaweed for agar in 1972; the estimate of the world agar market in 1972-73 was 6000 metric tons worth \$15-20 million.

Carrageenans, another group of these red algal polymers, are commercially important as gelling agents, as milk product stabilizers, and in applications requiring a very viscous substance as in cough syrups. "Irish moss," the common name for several of these seaweeds, has been harvested for over a century and used in making milk-based puddings and a multitude of other food products. It is also used in dentifrices, shaving creams, pharmaceuticals, in the textile industry, in paint manufacture, and in the tanning of leather. These applications have led to the practice of marine farming on a commercial basis, particularly in Japan, and in the ocean off the coast of Hawaii and the Philippines.

Various species of large brown algae, commonly called kelp, have been exploited in much the same way for their alginic acid content. Alginates are also used in food additives but find other applications in textile, pharmaceutical and paper manufacture. An industry is developing around rapidly growing kelp of the Pacific coast of North America.

A WHALE OF A SAIL

Sailing on a 144-foot square-rigger, undergraduates and interested volunteers take to the ocean to learn about life below the waves. This program, operated by the Ocean Research and Education Society (64 Commercial Wharf, Boston, Mass. 02110), offers courses on board in marine mammals and animal navigation with credit available. Expeditions depart for 5, 6, or 7 weeks in August, November, January, March and April of 1981-82. In addition, lecture programs on the society's whale research and marine ecology programs will be available in mid-fall.

A REEF GROWS IN WASHINGTON

Long accustomed to the political shoals and reefs of the nation's capitol as we monitor the stops and starts of congressional bills on behalf of the environment, naturalists can only rejoice at a new reef — a nonpareil public information and education tool. No villains here, nor lobbyists, nor special interest predators. Predators, yes, but the natural kind, and corals, over 200 species of other animals and plants, 3 tons of limestone, and 3,000 gallons of moving water.

On October 15, 1980, the Smithsonian opened the first coral reef community within a museum isolated from the sea. With basic problems overcome by innovative technical design, Smithsonian scientists hope many other institutions in

the United States will undertake reef system exhibits to enhance current behind-the-scenes research and to build public interest and support for an endangered and misunderstood ecological zone.

The new exhibit, sure to be one of the most popular ever presented to us by "the Nation's Storehouse," grew out of the research of Walter H. Adey whose attempts to simulate the coral reef environment began in 1974. His original aim was to study the effect of grazing animals on reef plants. In order to provide a study site outside the tropics and the 50-fathom zone, new sources and techniques in lighting, wave action, and recycling of nutrients were essential. Here in Washington, halide lamps create the intensity of the tropical sun, waves are maintained by centrifugal pumps and container design,

and algal turf on a plastic screen maintain the chemical balance.

This latter invention is unique in combining a man-devised ecological niche with a living mat of red, brown and green algae which filters carbon monoxide, ammonia and nutrients and releases oxygen. This scrubber replaces older, power driven aeration devices. However, its potential usefulness goes beyond this simulated reef to applications in algal culture and biomass studies so that Adey has applied for a patent.

The exhibit is innovative in several ways. First, the special equipment — wave generators, lamps, and monitors are displayed and explained to visitors. The reef is divided into ocean slope, shore slope and lagoon areas which emphasize the narrow but rich transition zone between



— Lisa Beard

open ocean and the land. As an example of a public exhibit grown from scientific studies and in use for ongoing studies, this reef has few peers in science museums. Windows along the sides display the scientists and technicians themselves in a labeled laboratory. The public viewer comes away with a clearer understanding of scientific exploration in a special no-longer distant environment.

The reef tank is valuable for observing and recording species behaviour particularly the grazing, reproduction, sex change, and competition of reef fishes. The flowering of turtle grass — a specially adapted angiosperm — has been observed. The morphological uniqueness of *Pilinia*, a green alga with septal plugs also found in the red algae and the fungi is under investigation. Smithsonian scientists believe *Pilinia* is a colonizing genus which may be vital to reefs scoured by hurricane or animal abrasion.

The development of the coral reef exhibit has provided basis for simulation of other ocean modelling. Plans now call for an exhibit of a cold water communities of the northeast and northwest United States.

The new exhibit at the Smithsonian will go far in instructing the American public on the unique reef environments found along the warmer coasts of the United States and its territories. The recent colorful postage stamp issues, the creation of reef national parks and monuments, popular government publications and this innovative exhibit all together demonstrate how science and the public interest can be used for the betterment of both sectors. And scientist Adey has demonstrated how complex ecological systems can be built away from natural sites to speed laboratory studies.

(Note: The Superintendent of Documents has printed a colorful coral reef poster depicting sea life among coral reefs of the U.S. reef park and monuments. Item No. 103Z0, Stock No. 024-005-00759-8, \$2.25. Available from Public Documents Distribution Center, Dept. 20, Pueblo, Colo. 81009.)

— Marie F. Long

A WEEK OF FUNDY

If exploring the New Brunswick coast appeals to you, you might look into the week-long ecology course which is offered annually by the Sunbury Shores Arts and Nature Centre (P.O. Box 100, St. Andrews, N.B. E0G 2X0), together with the Huntsman Marine Lab and the Government of Canada Biological Station. Sessions on a fully equipped research vessel are interwoven with laboratory sessions and visits to the aquarium and research centers in the area. While a number of eminent instructors participate, learning is maximized by emphasis on discussions. Topics include the myriad creatures of the plankton and the fish, birds, whales and men dependent on them, the great tides, islands and rocky shores of Fundy and their abundant life, and new implications for international fisheries.

— Ruth Yarrow

CONSULTATION CONSULTANTS PROVIDES TEACHER AIDS

Sewickley, PA, February 11, 1981 . . . A variety of teacher aids on energy and the environment are available from Conservation Consultants, a non-profit, educational service organization based in Sewickley, Pennsylvania.

Materials include inexpensive curriculum activities for elementary and secondary students, a solar energy kit containing hands-on activities for the classroom and a series of film strips for high school students covering energy, water, food and population, solid waste and land use. A teacher aid list is available free. Please include a stamped, self-addressed envelope to cover postage.

Conservation Consultants was founded in 1978 to provide schools, communities and individuals with information on energy and the environment. In addition to developing curriculum, the organization operates an energy resource center, facilitates workshops for teachers and administrators and sponsors a high school environmental problem solving project called "Action On Environmental Problems By Students." For more information on these programs and the free teacher aid list contact Conservation Consultants, 417 Thorn St., Sewickley, PA 15143, (412) 741-3533.

INTERNATIONAL MOUNTAIN SOCIETY

The International Mountain Society was recently incorporated in the State of Colorado as a non-profit organization dedicated to achieving a better balance between human welfare, mountain environment, and development of resources. The Society has evolved from the work of the 1974 Munich and 1976 Cambridge Conferences, the International Geographical Union's Commission on Mountain Geology, the United Nations University Programme on Natural Resources, the UNESCO Man and the Biosphere Programme, the International Union for the Conservation of Nature and Natural Resources, and many other organizations. This work has contributed to the growing recognition that the over-use and abuse of mountain land has not only caused economic losses but also has become a major threat to human survival.

The term "mountain" is used by the International Mountain Society in a broad sense. It is interpreted to include uplands and steep slopes at lower elevations. Some of the many problems facing the world's mountain lands and peoples include population pressures, mismanagement of both renewable and non-renewable resources, deforestation, and uncontrolled growth of tourism. Mountains influence life support systems for about four hundred million people and affect the welfare of many millions more. In many areas, the Society's concern lies as much with the problems facing upland people as with the physical habitat in which they live.

Mountain problems *can* be solved and a rational world-wide, interdisciplinary approach to these problems is urgently needed. The Society aims to help develop such an approach by furthering international collaboration, encouraging basic and applied interdisciplinary research, disseminating and applying knowledge that may help solve mountain land-use problems, and helping create research centers and national organizations throughout the world.

These objectives will be pursued, in part, by co-publishing with the United Nations University, with additional support from UNESCO, a quarterly scientific journal entitled MOUNTAIN RESEARCH and DEVELOPMENT. Subsequently, the Society will prepare an inventory of institutions conducting research on mountain

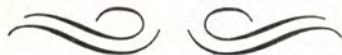
areas and a register of individuals possessing professional, technical, and scientific skills relating to mountain environments. The Society will also encourage the exchange of experience and expertise on mountain issues and organize meetings and workshops.

The journal, MOUNTAIN RESEARCH and DEVELOPMENT, will be interdisciplinary in nature, that is, will embrace a wide range of disciplines in the natural and human sciences, architecture, engineering, and technology that are concerned with highland areas. The Journal will include not only papers of pure and applied research but also letters, commentaries, book reviews, reports of meetings and field activities, and professional announcements. The first issue will appear in May, 1981.

Officers of the International Mountain Society include President, Professor Jack D. Ives, Mountain Geocologist, U.S.A.; Vice-President, Dr. Corneille Jest, Anthropologist, France; and Vice-President, Professor Dr. Heinz Löffler, Limnologist, Austria. In addition, the Society is guided by a council of scientists, engineers, architects, and administrators representing the mountain countries of the world.

Membership of the International Mountain Society is open to all individuals for an annual subscription of \$25, to students for \$18, and to institutions for \$45. Two additional membership categories are available: Contributing Member, \$1,000 and Benefactor, \$5,000 or more. All members will receive the quarterly journal, MOUNTAIN RESEARCH and DEVELOPMENT as well as all other benefits of the Society. The Journal will be produced with 90% of the membership dues. Non-members may subscribe to the Journal. Memberships, subscriptions, contributions, and gifts to the International Mountain Society are gladly received. The Society has applied to the United States Internal Revenue Service for recognition as a tax exempt non-profit corporation that is a public charity and not a private foundation.

All subscriptions and inquiries should be addressed to: International Mountain Society, P.O. Box 3148, Boulder, Colorado 80307, U.S.A.



CEA CONFERENCE

The Conservation Education Association's 28th annual conference will take place August 2-6, 1981, at Warren Wilson College in the Blue Ridge Mountains of North Carolina. CEA members, and anyone interested in communicating conservation understandings are welcome to attend.

The theme of the meeting, "LAND * PEOPLE * CULTURE," will focus on the diversity of ways people view and interact with their surroundings. Featured speakers will include Eliot Wigginton and students from Rabun Gap, Georgia, who participate in his *Foxfire* program.

In keeping with CEA tradition of active involvement in learning, the 1981 conference's offerings of cultural and environmental education will be largely workshop and field oriented, from storytelling to computer simulation, stream studies to solar designs. Daylong trips will provide opportunities to explore Blue Ridge Mountain ecology, Appalachian Folk Art, *Mother Earth News* and other alternative lifestyles efforts in the southern mountains, or a look at a city—Asheville—and its river—the French Broad—by raft.

For families who attend, there will be a children's program of outdoor recreation and exploration each day.

Further, a preconference seminar, "Styles for Environmental Learning in the 1980's," will convene at the conference site July 31-August 2. Designed for teachers and leaders of youth groups, it will focus specifically on new ways environmental understandings can be woven into the humanities and social studies as well as the sciences. By attending both the seminar and the conference itself, teachers can elect to receive two graduate Education credits from either Western Carolina University or Murray State University.

For CEA Conference registration information, write to Jean MacGregor, Warren Wilson College, Swannanoa, NC 28778.



CALLING ALL AUTHORS

In 1974 the ANSS set up an exhibit of books written by its members. Seventy to one hundred books were exhibited in arboreta, nature centers, schools, and museums as well as at workshops and conferences.

An exhibit of this type eventually wears out and needs to be replaced. First vice president Talbert Spence is in the process of assembling an entirely new collection. To be effective, all ANSS members should be represented. We can use only two books from each author. Please mail, or have your publisher mail your *two* most recent or your *two* best books to:

American Nature Study Society
Book Exhibit
Attn: Talbert Spence
Wave Hill Center
for Environmental Studies
675 W. 252nd Street
Bronx, New York 10471

MORE ABOUT WARREN WILSON COLLEGE

Warren Wilson College sits on a 1000 acre campus in the Swannanoa Valley near Asheville, NC. Begun in 1894 as the Asheville Farm School for Appalachian boys, it is now a four year liberal arts college whose coeducational student body comes from 38 states and 24 foreign countries. Its 450 students participate in a unique work program which literally runs the school—from farm to food service, plumbing to print shop. The college offers undergraduate degree programs in environmental studies, environmental management, and environmental education.



MEET A MEMBER

of the American Nature Study Society

Chestnut Ridge, Carroll, Ohio
Thanksgiving Day, 1980

Dear Friends in ANSS:

The American Nature Study Society has been important to me for a long time, it seems. I discovered it at the AAAS meetings in Washington, D.C. in 1968 (I think!). I was looking for stimulating discussions related to my interests and for kindred souls and I found them in the ANSS sessions. There was even more, for a field trip was planned, not specifically geology, my special interest, but a field trip! I believe we went to the National Arboretum that year. Another highlight was an evening program called *Lenses On Nature* where members shared their best nature photography. Later I was to learn about the rich heritage bestowed upon ANSS by Liberty Hyde Bailey and his "Nature Study Idea," Capt'n Bill Vinal, E. Laurence Palmer, Anna Comstock and others of the Cornell group. My first *Nature Study* revealed more of the philosophy as well as practical field and classroom helps.

My interest in ANSS grew with involvement. Isn't it always thus? I served on the Board, and then was asked to run for the second vice president position. I consent-



Heading a geology field trip – 1978

ed thinking there was no chance for a neophyte from the Midwest being elected, but I was. This event led unbelievably and irrevocably to the chairmanship of the

program committee for the 1974 meetings in San Francisco. How exciting it was to be involved with the loyal Californian members who helped plan those meetings and field trips. It rained as we followed the San Andreas fault but we saw the giant redwoods, the National Seashore, and many other choice places. I will never forget the friendliness and cooperation of Herbert Wong, Christian Nelson, Esther Railton and others.

A still bigger and more frightening experience was to come. The progression led to the presidency. Panic almost overcame me at the thought of following Helen Ross Russell in that position. But the Society survived and so did I. When we concluded our annual luncheon at the unique setting of the Boston Aquarium I realized that ANSS and the fascinating people with whom I had worked would live forever in my mind and heart.

The pattern has changed but the *Nature Study* journal with its rich contributions to environmental education, as well as other important projects, persist. The "Nature Study Idea" continues to be important in today's terribly uncertain world and it must live on in us.

Always in ANSS,
Ruth W. Melvin

JAMAICA BAY – ten years later (continued)

A classmate, a little girl, skipped down the path singing out, "I love it here! I wish I could watch the birds forever."

GATEWAY NATIONAL RECREATION AREA

Dr. Buchheister's project spurred several Queens and Brooklyn school districts to set up natural science programs, using trips to the refuge as a focal point. One May morning in 1969, two classes were at the refuge when New York's Mayor John Lindsay and U.S. Department of Interior Secretary Walter Hickel were discussing plans for creating the Gateway National Recreation Area. The two men took a helicopter ride and hovered over

the refuge. Several weeks later, Secretary Hickel announced the proposal for the National Recreation Area. The teachers like to think that the sight of sixty third-grade students in Jamaica Bay underscored the fact that the area must be protected.

However, the airport controversy was not yet resolved. The National Academy of Sciences gathered and analyzed the data concerning the issue. New York City's Parks, Recreation and Cultural Affairs Administration, the agency responsible for the refuge, prepared an exhaustive report on the controversy. Despite the recognition that the airport was overcrowded, the report concluded: "Jamaica

Bay is an invaluable naturalistic and recreational resource, and the filling in of a major part of it for aviation purposes would be incompatible with these present and future uses of the bay."

The National Academy of Sciences also decided against airport expansion. Congress accepted the proposal for Gateway National Recreation Area, which now plays a significant role in New York City's environmental education programs.

We teachers, who met on that September day in 1970, may be only very small cogs in the success story of preserving Jamaica Bay, but it feels good to know that we were in there, adding our muscle. □

TIPS for Teachers



— Lisa Beard

by Anne Cloutier

VISIT

AN

AQUARIUM

Those of us not fortunate enough to live near the ocean may be within traveling distance of the next best thing — an aquarium. The following ideas for an aquarium field trip and follow up activities are provided by the Education Department at the New England Aquarium, Boston, Mass.

ANNE CLOUTIER is program co-ordinator at Pocono Environmental Education Center, Dingmans Ferry, PA.

GENERAL THEMES FOR AN AQUARIUM VISIT

Before your field trip, your class should discuss one or two themes, such as locomotion or protective coloration. This will encourage your students to look more closely at the exhibits. Such a theme will provide a point of reference for your field trip that can relate to your in-school curriculum. Your chosen theme can be reinforced by attentive observation of the animals, studying the labels and graphics, and follow-up class discussions.

SCIENCE

CLASSIFICATION

- What groups (phyla) of animals are represented in the aquarium? **What** makes each group unique?

PHYSIOLOGY

- **Observation** — Choose one animal in each gallery and determine how it eats, how it moves, how it breathes, and the purpose of its coloration.
- **Locomotion** — How many different methods of locomotion use by aquarium animals can you find?
- **Respiration** — Observe and record how aquatic animals breathe. Examples: painted turtle, eel, shark, barnacle, otter, feather duster worm.
- **Reproduction** — Usually a captive environment like the aquarium is too unlike an animal's natural habitat to encourage it to mate and reproduce successfully. Look for eggs, egg cases, or young in the aquarium exhibits that are proof of successful births here.

- **Senses** — Choose an aquarium animal from each of the following groups and determine which sense(s) each relies on most: mammal, bird, reptile, fish, invertebrate.

SKELETONS

- Discuss the advantages and disadvantages of endo- and exo-skeletons for aquatic animals.
- Invertebrates (animals without backbones) are considered to be primitive because they don't have strong endo-skeletons. However, they are so well-adapted that they make up 97 per cent of all the animals in the ocean. As you go through the aquarium, look for the invertebrates and note how they protect themselves.

ADAPTATION

- What can you determine about a fish's environment or habits by studying its physical features?
- **Shape** — The shape of the body and fins of a fish determine its speed and maneuverability. Try to figure out what body shapes are best for swimming rapidly, turning sharply, swimming close to the bottom, living in crevices. Find other specialized shapes and their functions.
- **Fins** — Identify and draw the fins of a number of different fish. Describe what each fin controls (swimming, diving, turning, balance) on each specimen you choose.
- **Feeding** — What special devices can you observe in aquarium animals that aid in feeding?
- **Size** — The struggle for survival is one important function of all organisms. Try to determine how size in five animals plays a vital role in their survival.
- **Coloration** — Color in aquatic animals can benefit them in many ways. Find animals that use color to conceal, advertise or disguise. Camouflage is an effective method of protective coloration. Find some animals in the aquarium employing this adaptation.
- **Protection** — Except for fast-swimming pelagic fish, most marine animals need places to hide from their predators. How many animal homes or hiding places can you discover in the aquarium tanks?
- **Weapons** — Often marine animals have "weapons" that they use to

protect themselves or to capture prey. Find as many examples as you can of these marine warriors.

- **Symbiosis** — Symbiosis is a relationship in which members of two different species live together.
 - Commensalism:** One member of a symbiotic pair benefits and the other is not harmed.
 - Mutualism:** Both organisms benefit by living together.
 - Parasitism:** One member of the partnership benefits to the detriment of the other.
 Find examples of each.
- **Evolution** — Through evolution, the structures of many aquatic animals have changed to become more useful for the functions they perform: hunting, eating, mating, hiding, avoiding predators. Find some examples of each.
- **Environment** — Define an environment. There are a variety of aquatic environments in an aquarium. How many can you find?

ART

- Sketch some of the animals in the aquarium that appeal to you.
- Draw shapes of fish and suggest the advantages of each.
- Choose a gallery to illustrate on a mural in the classroom. Have each child sketch a different animal and then paint it on a mural. Let the rest of the class guess what it is.
- Draw the color patterns of various animals. Name the animals and probable reasons for their color and patterns.

LANGUAGE ARTS

- Find examples of the descriptive common names given many marine animals and explain their derivation (starfish, snapping shrimp, whale shark).
- Write a story of how various animals might behave at night when the aquarium is dark, quiet and deserted.
- What new words did you encounter in the aquarium?
- Find some aquarium animals you like. Describe what their lives might be like if they were back in their natural habitats.

MATH

- Estimate the number of fish in the aquarium. Design a sampling technique so you don't have to count each one.
- Find the biggest and the smallest animals in the aquarium.
- Find the animals that live in the shallowest and deepest parts of the ocean. How does pressure vary with depth?

SOCIAL STUDIES

- What animals in the aquarium does man use commercially? What are they used for?
- Which of these animals are now protected from over-use by man?

MARINE CAREERS

- Identify as many different careers as possible within the aquarium. You may interview staff members or volunteers to help with your task.

FOLLOW-UP ACTIVITIES

SCRAP BOOK

Students can draw and color their favorite aquarium animals. The pictures can be cut out and put into an aquarium scrap book. Not only will the students have a record of their visit, but they can learn about animals that they may not have seen.

FISH PRINTING

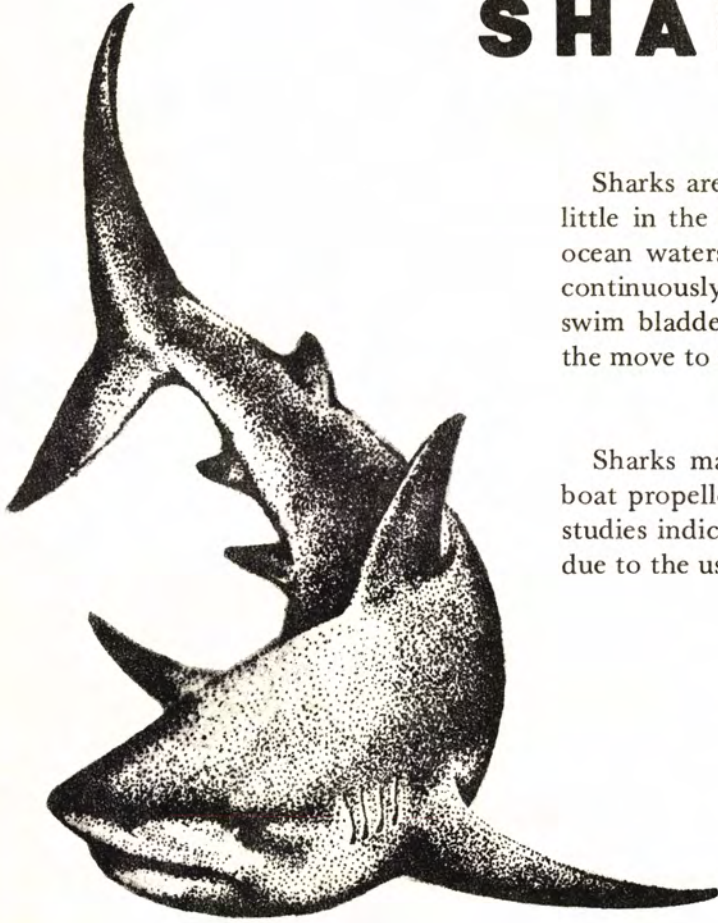
Buy a whole fish. After talking to students about this fish's body shape and color, you are ready to print it. You will need absorbant paper and water-based paint in many colors. Paint your fish and press the paper on top of the painted surface to create a print. Sea shells and seaweeds make lovely prints as well.

FANTASY FISH

Ask your students to choose a fin, tail, and body shapes to create fantasy fish. Have them create fast fish, slow fish or the funniest fish they can imagine. Then have them explain what each fish can do with such adaptations.

These ideas and activities are geared to elementary and junior high school levels, but can be adapted to any grade or age level. □

SHARKS



Sharks are among the oldest creatures on earth and have changed little in the 300 million years that they have been swimming in the ocean waters. A peculiarity of most sharks is that they must swim continuously to stay afloat because they don't have the air-filled swim bladder that other fish have. Many species must also stay on the move to obtain enough oxygen to stay alive.

Sharks may accidentally eat anything: cans, bottles, pots, anchors, boat propellers, and logs have been found in their stomachs. Recent studies indicate that they are the most efficient predators in the sea due to the use of senses which other marine animals don't possess.

Only a few species of sharks are potentially dangerous to humans. Although a shark attack usually becomes a national news story, the odds of being bitten by a shark or even seeing one while bathing at a Florida beach are extremely remote — less than being struck by lightning.

However, there are common sense precautions that anyone can take to avoid shark bite:

- Heed the advice of lifeguards.
- Avoid swimming at night.
- Swim or dive with a companion and/or remain with a group of swimmers whenever possible.
- Do not provoke a shark; amazingly some individuals have brought on attacks by senseless actions, such as trying to catch sharks barehanded.
- Wounded fish or humans may attract sharks; twenty-five percent of all shark attacks have been made on spear-fishermen.
- Bright or flashy colors may sometimes arouse the curiosity of a shark where a dull color would not.
- Leave the water when a shark is sighted.
- Do not wade with a stringer of fish attached to you — especially in the Keys.

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