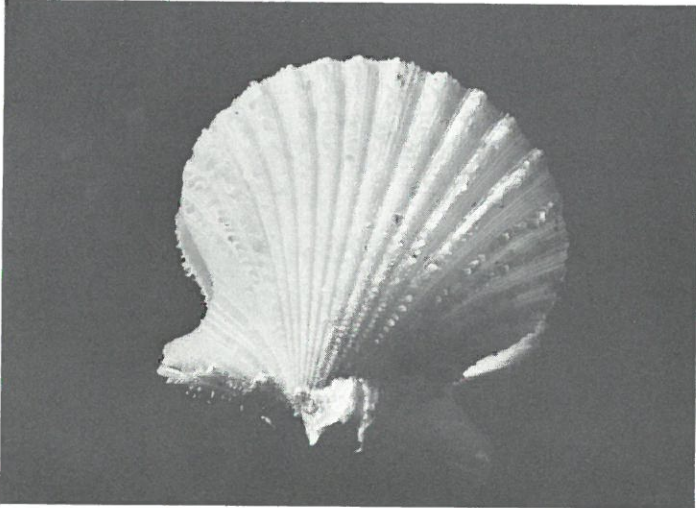
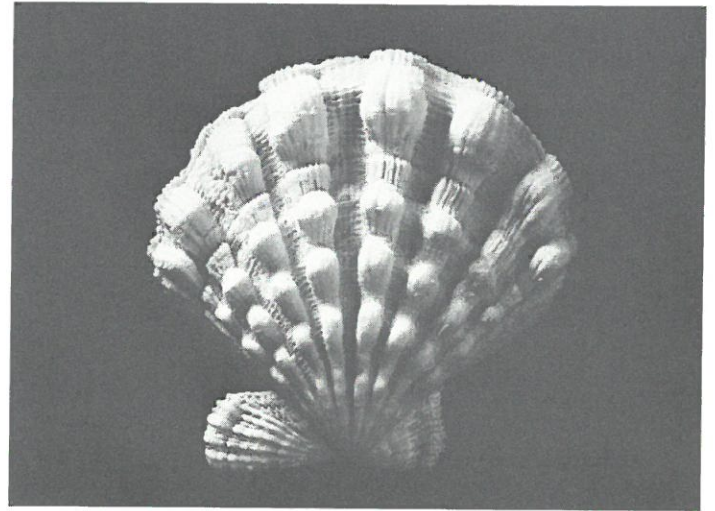


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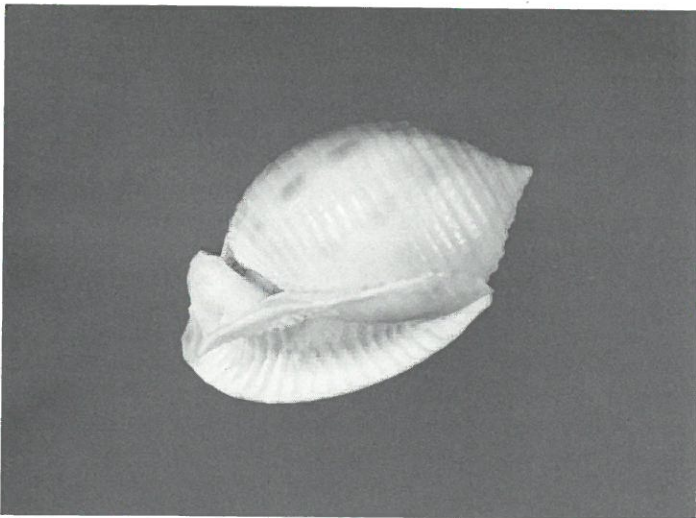
Photos by Ken Taylor



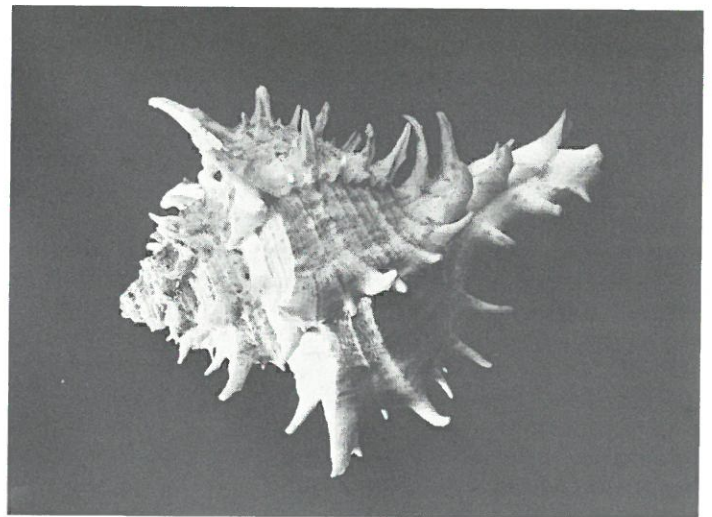
Prickly cockle



Lion's paw



Scotch bonnet



Giant Atlantic murex

To understand the life of the shore, it is not enough to pick up an empty shell and say, "This is a murex," or "That is an angel wing." True understanding demands intuitive comprehension of the whole life of the creature that once inhabited this empty shell: how it survived amid

surf and storms, what were its enemies, how it found and reproduced its kind, what were its relations to the particular sea world in which it lives.

—from *The Edge of the Sea*
by Rachel Carson



A curious animal and its house

Man has always been fascinated with the edge where land and water meet. Part of that fascination has been with seashells, the houses of soft-bodied animals called mollusks.

Mollusks, which predate man, are believed to be more than 600 million years old. Originally only marine animals, they have adapted to many different lifestyles and can be found in mud, sand, rocks, on land, and in fresh and salt waters. Worldwide, there are approximately 100,000 species, and in North Carolina, over 1,000 species are known to exist in estuarine and marine waters. Some familiar kinds are oysters, clams, scallops, and conchs.

The two largest classes of mollusks are gastropods and bivalves. Gastropods usually have a single spiral- or cone-shaped shell, and bivalves have two shells, or valves, hinged tightly with strong muscles. Bivalves are basically passive, filtering food from the water, and are the prey of gastropods. Lining the mouth of gastropods is a radular ribbon with teeth which, in whelks, acts like a scraping tool. With muscle contractions and suction, a whelk can pry open clams.

But gastropods aren't the only predators of bivalves, nor are they safe

from predation themselves. Man has been using mollusks for food since the first clam was cracked open and a delicious meat discovered inside. The shells of mollusks have also provided man with inspiration for greater functional and aesthetic purposes.

The early coastal Indians in North Carolina were dependent upon many mollusks for food. According to Lundie Mauldin, marine education specialist for Sea Grant, the oyster and clam shells left in refuse piles, or middens, are now clues for permanent or temporary Indian settlements in coastal areas. "There is a tale Down East in Carteret County," she says, "about a shell causeway from Harkers Island to Cape Lookout-Shackleford Banks. They say the Algonkian Indians who lived there centuries ago had dumped so many shells in the sound that they could walk across it." Although the Indians are gone now, the local people say that remnants of the causeway remain.

Indians were also some of the earliest shell collectors. Some of the hard, durable shells left over from a feast were attached to poles and used for digging, or sharpened on one edge and used for scraping. Conchs were

valued as ceremonial drinking vessels. The Indian money, called wampum, was made from circular shapes, cut out of clam shells, which were pierced and strung together. White wampum was considered less precious than the purple shells cut from the small, colored part of the shell. It is interesting that the Latin name given to the hard clam is *Mercenaria mercenaria*, which means "money."

Many other cultures throughout time have been fascinated with mollusks. Shells were found in the tomb of the Egyptian King Tut and among the artifacts of primitive African tribes. Roman senators wore togas bordered in purple from the dye of murex shells. Royalty used scallops and other shells to embellish the family coat of arms.

Artists have borrowed many of the graphic qualities of seashells, from the classic painting by Botticelli of the goddess Venus coming out of the sea on a scallop (The Birth of Venus, c. 1480) to the stylized, bright yellow trademark of Shell Oil Company. A scallop was chosen to represent the company in honor of its founder, Marcus Samuel, who collected seashells as a hobby.

Architecture has also copied the beautiful designs of many shells throughout the ages. The wentletrap, whose name is derived from the German word for spiral staircase, has been duplicated countless times. Frank Lloyd Wright, who designed the Guggenheim Museum in New York as a continuous spiral ramp, is quoted as saying, "In . . . shells we see the housing of the life of the sea. It is the housing of a lower order of life, but it is a housing with exactly what we lack—inspired form. In this collection of houses of hundreds of small beings, who themselves built these houses, we see a quality which we call invention."

Mollusks have also been used in the actual construction of buildings and roads. Shells are composed of many layers of calcium carbonate, which is limestone. Years ago, crushed oyster shells were used to make a mortar which is called tabby. When Fort Macon in Carteret County was built in

1826, tabby was used to bind the fort's 10 million bricks. The Spaniards used coquina shells in Florida 300 years ago when they built Castillo de San Marcus in St. Augustine. Today, limestone-rich shells are crushed and used commercially for building homes and roads.

But man hasn't forgotten that first experience of tasting the animal inhabiting the shell. Mollusks are a very significant part of the seafood industry and a food much in demand. In 1979, over four million pounds of oyster, clam, sea scallop and bay scallop meats were landed in North Carolina. And, this year, calico scallops were harvested off Carteret County for the first time in eight years. Advanced technology in managing and harvesting mollusks increases landings each year.

For species like the calico scallop, North Carolina is the northernmost range. But this colorful mollusk may

share its waters with other species from New England or the Caribbean. North Carolina has the unique distinction of being the dividing line between the northern and southern marine fauna. For the serious collector, this means paradise of shells. Dredging, hurricanes and winter storms wash in many offshore mollusks, such as the Scotch bonnet, that would otherwise be inaccessible.

The Scotch bonnet was declared the state seashell in 1965 by the act of the General Assembly. North Carolina honored its early Scotch settlers by choosing this pale-colored gastropod, and became the first state to designate an official state seashell.

From the delicate coquina found on local beaches to the crusty oyster, mollusks and their shells have played an important role in history. Though relatively small in size, these complex animals and their houses still stir our imaginations today.

Calico appears, Renews mystery

For several North Carolina fishermen, 1980 will be remembered for the return of calico scallops and a bountiful harvest. This year marks the first landings of calico scallops in the state since 1973. A mystery mollusk, the calico still creates excitement with each sporadic return.

According to Jim Tyler, information and education coordinator for the North Carolina Division of Marine Fisheries, the only productive calico scallop bed in the state lies 17 miles off Carteret County. "When the exploratory fishing research vessel, Dan Moore, was monitoring the bed and found the abundance," he says, "we of course reported it to the fishermen." The season opened in March, but the supply lasted just a few weeks.

"During the first week," Tyler explains, "approximately twenty boats were working the bed, with more boats coming in. For three days, our records show that approximately thirty-six thousand bushels were brought in, or approximately twelve thousand gallons, which sell for thirty dollars a gallon at the markets."

The occurrence of calico scallops in

Photo by Jim Tyler



Loaded down with calico scallops, this boat heads home

North Carolina is still a mystery, according to Hugh Porter, assistant professor of Marine Ecology and Malacology at the University of North Carolina's Institute of Marine Sciences in Morehead City. The major beds are found in Florida off Cape Canaveral and in the Gulf of Mexico. Also, North Carolina is the northernmost range for the calico scallop.

"The calico scallop, when it does oc-

cur in commercial quantities off the North Carolina coast, will occur in large, dense beds," Porter says. "We do not know what causes those beds to occur out there. Some of the dealers and fishermen will tell you that once they spawn, they start dying," he explains. "We don't know. We also don't know whether the scallops repopulate

Continued on next page

the area if given a chance to spawn.”

“Another theory,” Porter continues, “is that our calico scallop beds come up from Florida. The juvenile scallops may be spawned off the Florida coast and brought up to our waters by the Gulf Stream. For some reason, they are dropped out as juveniles here.”

The calico scallop beds have been known for years by fishermen, according to Porter. “Years ago,” he explains, “they would occasionally bring in some. But, it’s only been recently that we have had automatic shucking machines for calico scallops. Up until the advent of these machines, all scallops had to be shucked by hand.”

The process patent for the first

scallop shucking machine in the state was held by Elmer Willis, a Carteret County seafood processor. In the mid-60’s, Willis refined the process for the scallop industry. When the calico scallops are sent through the machine, the first step involves a steam treatment which opens the shells slightly. Then, the shells are agitated vigorously, causing the muscle and viscera to fall out. This part of the scallop then goes through a series of rollers that separate the viscera from the muscle, the part actually eaten.

“There are five to seven shucking machines in the area,” Tyler says, “primarily in Carteret County with some in Onslow. Many were running

twenty-four hours a day, and I’ve been told they can produce something like one hundred to one hundred and fifteen gallons an hour. There are still some people Down East actually hand shucking them because you do get more meat. The machine does have a little bit of waste,” he says.

In spite of its unpredictable nature and limited supplies, the calico scallop is still a popular catch for both fishermen and seafood processors in North Carolina. Years between harvests doesn’t dull the enthusiasm and eagerness generated when a season is finally announced. And, it just may be another eight years before they return to this traditional bed to set.

Reading a clam’s life in the rings of its shell

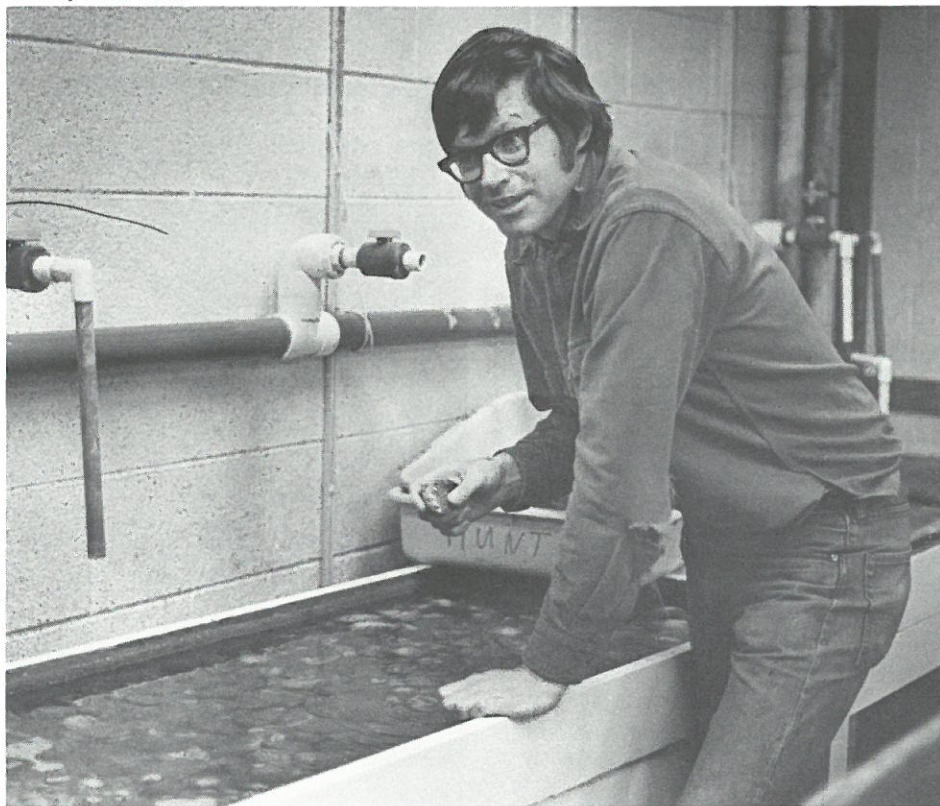
Photo by Cassie Griffin

To determine the age of a tree, you count the number of rings in a cross section of the trunk. For each growth period, a ring is added—a thick one for a healthy year and a thin one for leaner times. The rings reveal the tree’s life history and the environmental forces it faced. This information can be used in forest management. Using a similar technique, a Sea Grant researcher is recording the life histories of hard clams.

By studying cross sections, Charles H. Peterson has been discovering certain data that can be used in the management of hard clam resources in North Carolina. The harvest of hard clams in North Carolina has increased dramatically in just the last couple of years. Commercial landings of clam meats jumped from 892,000 pounds in 1978 to 1,455,000 pounds in 1979. Demand for seafood is part of the reason, but new means of mechanical harvesting, such as clam kicking, have made deep-water and older beds more accessible to the clammer.

“It has really become imperative,” Peterson says, “to address whether we need to worry about managing the stocks and whether we will be able to continue the level of harvest we are currently applying to the population.”

With Sea Grant support, Peterson, an associate professor at the UNC Institute of Marine Sciences in Morehead City, has been studying the hard clam in Carteret County for over two years. To find an aging technique,



Charles Peterson checking on young clams in the lab

he and his assistants marked clams that were placed under natural conditions and measured them periodically. In the first years of study, approximately 80 percent of the clams displayed a common new growth line. Last year, when the clams were examined again, another new growth line had been added.

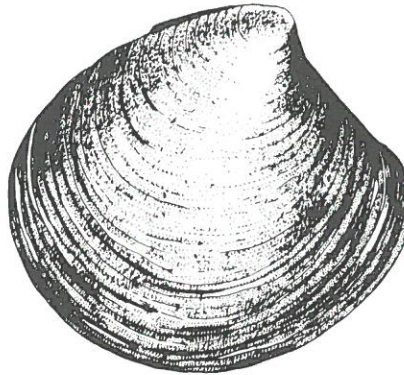
Hard clams, like all mollusks, grow by producing more shell. Calcium carbonate is secreted in the glands of the mantle and laid down periodically as the clam grows. Also, organic materials of different hardnesses are added to the shell during the growth cycle. When Peterson etches his shell cross sections with acid, the areas rich in

organics dissolve at different rates and leave a distinct pattern. Peterson describes the etched shell as "a relief map almost like a fingerprint that tells you the different areas and shows you the growth lines."

According to Peterson, the lines revealed in the section display not only annual features, but other physiological and environmental features as well. "You can see daily growth lines on many mollusks, and you can see sub-daily patterns," he explains. "You can even see the rise and fall of the tides. There are lines matching the lunar cycle of spring tides and neap tides. And, there are annual lines as well, coinciding with certain annual events the clam may experience, such as spawning. By collecting at different times, we can also identify the time of year that that feature is laid down in the shell, and that gives you an even more specific marker."

The aging technique used by Peterson is not new, however. It has been used extensively on hard clams, but

only in northern areas. There the annual feature, a cold check, is laid down during harsh winter weather. It was believed that aging hard clams wouldn't be possible south of Cape Hatteras in milder climates until Peterson found a similar feature.



"It turns out that we have a summer feature here," the researcher says, "that is an annual event—the heat check. We've just recently collected and analyzed our second-year collection, so we are now quite certain that this is indeed annual and that it's go-

ing to be a useful marker and aging technique." It has also been determined that the summer feature is laid down in the Carteret County clams between May and October.

Peterson says his research is needed because there is no basic biological data available for managing hard clam resources. "We've been working on this aging technique so that we can look at the natural populations that are now being harvested by clambers in the state and find out what their age distribution is," he says. "In other words, if people are hauling in, on the average, three-year-old clams, that implies that the renewal rate, the rate at which those clams will replace themselves, is a great deal more rapid than if they are harvesting twenty-year-old clams. That," he continues, "is an important statistic that has been unavailable to people interested in management of shellfisheries in the state, and specifically of the hard clam catch. It's just a question of how long they need to grow into the size class that is legal to harvest."

The man Of 100,000 Seashells

Across the country, when people cite an expert on the subject of clams, mussels or scallops, the expert's name is likely to be Hugh Porter. This man knows his mollusca.

A native of Pennsylvania, Porter came to North Carolina 25 years ago to work on an oyster project under Al Chestnut at the UNC Institute of Marine Sciences in Morehead City. There, Porter discovered some boxes of shells, and his curiosity got the better of him.

"I quickly got interested in some boxes of seashells that no one was paying any attention to," Porter says, "and decided to put them into a collection before they got lost. There was a lot of them I'd never seen before. Well, it has just grown from a continuing and developing interest. Now, I think

Photo by Cassie Griffin



Hugh Porter at the Institute of Marine Sciences

Continued on next page

my major interest is trying to understand what molluscan fauna is present in North Carolina waters and in what environmental conditions it occurs."

The small collection at the institute grew over the years with species brought in by commercial fishermen, friends and colleagues of Porter's. Drawers, shelves and boxes of shells were numbered, catalogued and filed, and the assistant professor was named curator of invertebrates. Porter estimates that he now has between 100,000 to 200,000 shells (many still in boxes) with over 1300 different species from around the world. In this vast assemblage are 735 species native to North Carolina, including marine, freshwater and land mollusks.

According to Porter, a seashell is the recorded history of the living mollusk. "You can tell something of under what conditions it's living," he explains, "whether it's recent-living or it's been buried for some time. You can get an idea of what type of environment if

you have live shells, such as the northern or southern fauna.

"The reason we have this collection," he continues, "is it serves as a base for any people doing studies. Also, the collection serves as a repository of identified material collected from specific locations throughout the state."

Porter believes that an accurate record of the flora and fauna of an area can define the ecosystem. Currently, Porter is using this idea to define Lake Waccamaw. As consultant on the molluscan fauna of this area for the Bureau of Land Management, he has discovered some new species. "We have in Lake Waccamaw itself," he says, "at least five different kinds of mollusks that occur nowhere else in the world. The most common, a freshwater mussel called the Waccamaw Lance, occurs in densities of forty to sixty per square meter at times. You can hardly walk in parts of the lake without cutting your feet."

The exceptional environment in the lake area comes from its isolation from other water systems, Porter says. When the Carolina bays were split off, lakes like Waccamaw became completely enclosed. "Consequently, the forms that have gotten into the lake have had a long time to develop and become different species. The whole Lake Waccamaw and Waccamaw River area is a small estuary. And, it's just a real interesting and special environment."

Porter doesn't confine his interest in mollusks and seashells to this office in the institute. He and his wife Pinky, also an avid shell collector, are charter members of the North Carolina Shell Club, at whose meetings he often lectures. Vacations frequently take them to places where the shelling is good. Porter has also co-authored the state's only seashell guide book, *Seashells common to North Carolina*, which is published by the UNC Sea Grant College Program.

Field trips, displays and special events

If you are interested in learning more about mollusks and shells, there are several places in North Carolina that offer activities suitable for all ages. This summer when you're vacationing at the coast, take the opportunity to learn something new about some of its oldest inhabitants.

The Hampton Mariners Museum in Beaufort has the largest collection of North Carolina shells on display in the state. Saltwater aquariums also house many live mollusks with other marine animals in natural habitats. In addition, the museum sponsors field trips, lectures, films, demonstrations and other activities year-round. All activities are listed in the calendar which is published every four months.

A popular educational experience at the museum is the Summer Science School for students entering fourth through eighth grades. Organized like field trips, courses range in subject matter from fish and fishing to elemental oceanography. Pinky Porter will be teaching a course on collecting and identifying seashells this summer.

For more information on the

museum and its activities, write Hampton Mariners Museum, 120 Turner Street, Beaufort, N.C. 28516, or call (919) 728-7317. Museum memberships are available.

Live mollusks in saltwater aquariums are also on display at the North Carolina Marine Resources Centers at Roanoke Island, Bogue Banks and Fort Fisher. This summer, seashells will be the theme at the Fort Fisher Center, with programs ranging from shell stitchery to collecting and identifying shells. Shells will also be featured at Bogue Banks in several films, field trips and demonstrations. All three centers have staff on hand to identify and answer questions about any shell brought in. For more specific information on activities, contact each center: Marine Resources Center/Roanoke Island, P.O. Box 967, Manteo, N.C. 27954, or call (919) 473-3493; Marine Resources Center/Bogue Banks, Atlantic Beach, N.C. 28512, or call (919) 726-0121; Marine Resources Center/Fort Fisher, General Delivery, Kure Beach, N.C. 28449, or call (919) 458-8257.

One of the state's finest shelling areas is Cape Lookout National Seashore. Park Naturalist Ted Ameen has four regular programs this summer: "lighthouse history talk," "wilderness hike," "exploring the national seashore" and "fish with a ranger." Shelling will be included on some of the walks. Cape Lookout is accessible only by boat or the summer ferry service. For a ferry schedule and more information, write Cape Lookout National Seashore, P. O. Box 690, Beaufort, N.C. 28516, or call (919) 728-2121.

And, if you would like to meet other shell collectors, the North Carolina Shell Club has over 400 members. Membership dues are \$5 for adults and fifty cents for students. In addition to scheduled meetings and activities, the club sponsors a biannual shell show. This year's event will be held October 22-24 at Independence Mall in Wilmington. For more information, write the North Carolina Shell Club, Inc., Carolyn Smith, Recording Secretary, 5300 Fair Oak Road, Durham, N.C. 27712.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454).



As summer approaches, many beach communities are gearing up for the rush of tourists. But being prepared for summer visitors means more than opening up restaurants closed during the winter and cleaning up rental property. It also means preparing for the beach accidents that occur every year when you mix folks unfamiliar with beach hazards with elements like rip currents, undertows and intense heat.

That's why Dennis Regan, Sea Grant's recreational advisory agent on Roanoke Island, is organizing beach safety clinics for Dare County emergency personnel. For the first meeting on May 6, Regan invited town and county officials, police, lifeguards, emergency medical technicians (EMTs), National Park Service personnel and personnel from the Outer Banks Medical Center. He hopes these groups can work out a cooperative, county-wide emergency procedure that will provide fast aid for beach victims.

In a second meeting to be held in June, sponsored by the Dare County Chamber of Commerce, Regan and others will acquaint Dare County summer employees with emergency procedures and potential dangers on the beach. These employees, who often have contact with tourists, can pass along information about potential beach hazards.

And in a final meeting on June 17, those directly responsible for beach

safety, lifeguards and EMTs, will be provided with in-depth information for recognizing beach hazards like rip currents and for following correct emergency procedures.



Divers all over the United States have a new friend to protect them. DAN, or Diving Accident Network, is a 24-hour telephone service designed to help provide quick treatment for the victims of diving accidents.

By dialing 1-919-684-8111, divers are connected with trained physicians on duty 24 hours a day at Duke University Medical Center. Information on the accident is recorded, and the caller is either given direct advice from the physician or information on the nearest regional coordinator. Duke serves the southeastern region, and coordinators of the other six regions in the network are in Pennsylvania, Wisconsin, Louisiana, Washington, California and Hawaii.

Each coordinator has a recompression chamber operated by trained technicians with a physician on call. If that region is unable to help the victim, he is referred to the nearest region that can. Transportation arrangements will be made for the victim if necessary.

So, remember this number next time you go diving: 1-919-684-8111 (collect, if necessary). It could save your life.



Measuring less than three inches long and weighing less than an ounce, tiny elvers can be hard to catch. But this year over 11 pounds or 46,000 of the worm-like creatures were netted in North Carolina waters for culturing at the North Carolina State University Aquaculture Demonstration Project in Aurora. The elvers presently are being held in holding tanks at the facility

while they are adapting to special feeds. Later, they will be transferred to grow-out ponds where the eels should reach market size in 10 to 14 months.

Can an eel from New England prosper in the sunny south? Several pounds of Maine elvers arrived at the aquaculture project in April. This year, researchers there will compare the growth rates of the Maine elvers with those of elvers found in North Carolina. The idea is to see whether either group fares better than the other, when both are cultured under the same conditions.



New England fishermen have for some time practiced clam aquaculture successfully. There, a hard clam grows to marketable size in three to seven years.

But warmer waters and longer growing seasons in North Carolina enable clam aquaculturists here to harvest in as little as two years. These favorable conditions, plus an increase in prices and a decrease in harvest from natural hard clam beds, have stimulated interest in raising clams here.

To meet the demand for information specifically on North Carolina clam aquaculture, Sea Grant has published *Clam Gardening*. Written by John E. Foster of the NCSU Aquaculture Demonstration Project, this publication gives the interested clam grower an overview of the aquaculture process. Specific information is given on obtaining and raising seed clams, leases and permits, location requirements and management of the garden. The appendix lists additional references and material suppliers.

If you are interested in commercial clam aquaculture and would like a copy of this free publication, write UNC Sea Grant, P.O. Box 5001, Raleigh, N.C. 27650. Ask for publication UNC-SG-81-03.

Continued on next page

Do you know that over 1,000 different kinds of seashells can be found in North Carolina's estuarine and marine waters? Do you know that North Carolina was the first state to designate a state seashell? Do you know what shellfish makes a delicious soup? These topics and many more are covered in the Sea Grant publication *Seashells common to North Carolina*.

Compiled by Hugh J. Porter and Jim Tyler, this booklet is a handy field guide for identifying shells found on North Carolina beaches. A descriptive paragraph on each shell listed gives its range, physical characteristics and locations where it is most commonly found. Photographs or illustrations are also included for most seashells.

Seashells common to North Carolina is available for fifty cents per copy. To obtain this field guide, write Sea Grant. Ask for publication UNC-SG-72-09.

Every fisherman needs good, accurate records to report his taxes and manage his business. So, the National Oceanic and Atmospheric Administration's National Marine Fisheries Service developed a booklet to help the fisherman.

Fishermen's Simplified Recordkeeping Sheets are intended for the fisherman who keeps his own books. Separate sheets are included for trip expenses (fuel, ice, food) and manage-

ment expenses (payroll, taxes, insurance). Each booklet contains enough account sheets for a full year.

For a copy of this free booklet, write Sea Grant. Ask for Fishermen's Simplified Recordkeeping Sheets.



When recreational fishermen use North Carolina's sounds, they also contribute to local businesses. Expenditures for fuel, ice, bait, tackle, meals and lodging can add up. This summer, they will be asked to contribute in another way—by answering the questions of three Sea Grant researchers.

The researchers involved in the study are Peter Fricke, an East Carolina University sociologist, Leon Abbas, Sea Grant's recreational economics specialist, and James Sabella, a University of North Carolina at Wilmington anthropologist. They will be doing a socio-economic study of sound fishing in North Carolina, collecting data on who the fishermen are, where they are from, how much they spend locally on fishing trips, and the type of fish they catch. This information, the researchers feel, will be useful for local and regional planners in determining the impact of sound fishermen upon their communities.

“please don't let
me expire . . .”

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