

# COAST WATCH

## Squid: from tall tales to the table



*It swam backward toward the "Nautilus" and at great speed, watching us the while with its huge staring green eyes. Its eight arms (or rather, feet) were twice as long as its body and twisted like the snakes in the Furies' hair. . . . The monster's mouth, a horned beak like a parrot's, opened and shut vertically. Its tongue was of horn substance and furnished with several rows of pointed teeth. It came forth quivering from this veritable pair of shears. What a freak of nature it seemed, a bird's beak on a mollusk!—Jules Verne, *Twenty Thousand Leagues Under the Sea**

"It was an immense cuttlefish," writes Jules Verne. But modern biology would identify this freakish creature, trying its best to devour the *Nautilus*, as a giant squid. And indeed, the yarns of mariners and the literature of poets and writers throughout the ages are peppered with accounts of the giant squid—often endowed with a ferocious nature and the strength to pull large vessels beneath the waves.

While writers and mariners enhanced the size, ferocity and abilities of the squid, the real life and biology of the squid may be stranger than fiction. After all, the squid possesses eyes like a

*From the window of the Nautilus, a giant squid*

*Continued on next page*

human, fins like a fish, arms like an octopus, a beak like a bird, and power like a jet.

The giant squid, found worldwide, can reach an overall length of 60 feet and weigh as much as two tons. Scientists are just beginning to delve into the biology of this mysterious and illusive deep-sea creature. Researchers believe their populations may be on the increase because the populations of their major predator, the sperm whale, are declining.

But it's not the giant squid that fills the nets and snags the jigs of fishermen from Japan, northern Europe, Spain, South America, Mexico and now, the United States. The giant squid is not tasty at all, but many of the smaller species are. Squid is a prized seafood in southern Europe, Africa and the Far East.

The squid is a mollusk, a phylum of creatures which includes the clam, whelk and conch. Unlike its cousins, the squid has no visible shell. But imbedded in the mantle is a soft internal plate called a pen, the remains of a once more developed shell.

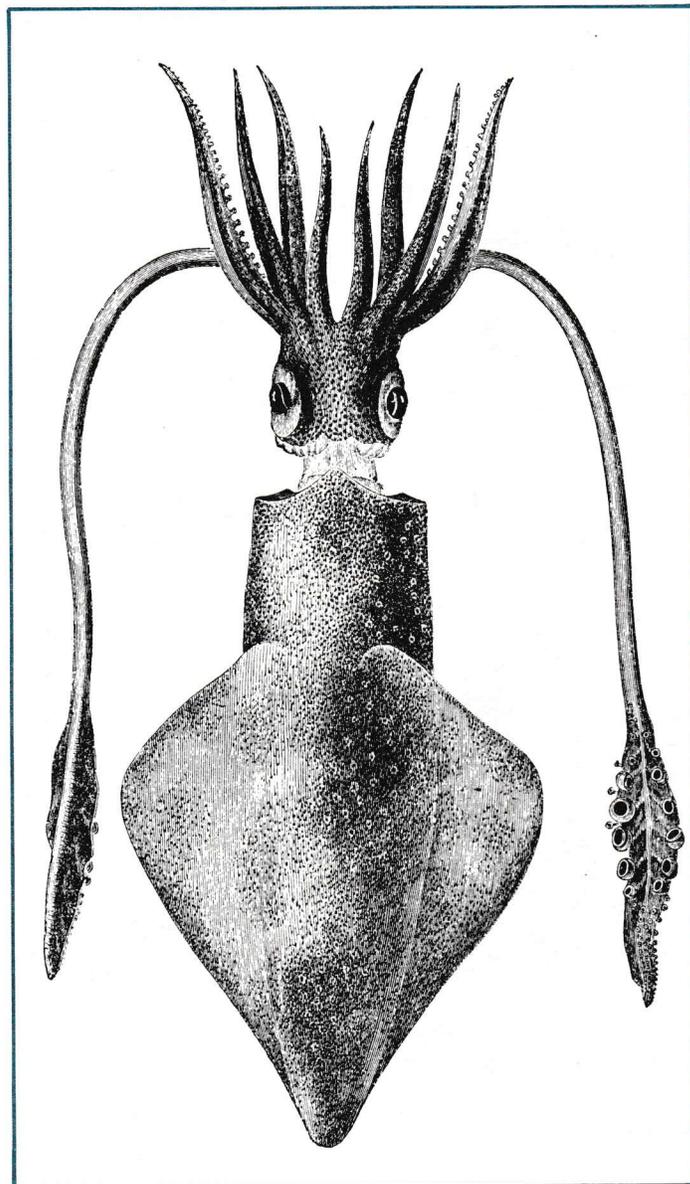
Along with the octopus, cuttlefish and nautilus, the squid belongs to the cephalopod class, which means its arms extend from its head. From the squid's head flow eight arms and two tentacles. The inner surface of each arm is flattened and covered with stalked, cup-shaped adhesive discs that act as suction cups. Suckers also are found on the flattened ends of the tentacles. The highly mobile tentacles seize the squid's prey, which is drawn toward the mouth; the arms aid in holding the prey.

Squid, which are carnivorous, eat crabs, fish and even other squid. The mollusks dart into a school of fish, seize their prey, and bite a chunk out of the fish's neck, severing the nerve chord and killing it instantly.

In a world of "eat and be eaten," the squid also is prey for many ocean creatures—sharks, whales and swordfish. But two defense mechanisms help many squid survive. The squid can change the color of its body to blend with its background. And squid can emit an inky cloud of fluid which creates a screen for escape.

Squid are among the ocean's fastest swimmers as they jet propel themselves forward and backward. The mantle muscles of many large squid are so powerful that when they contract and force out a jet of water, it is like a blast from a fire hose.

The squid also possesses giant nerve fibers in its mantle which allow it to carry messages at a rate



*One of many species of squid*

of 50 miles an hour. (The nerve fibers in humans carry messages at a rate of  $4\frac{1}{2}$  miles per hour.) A squid can sense danger and jet off in five-hundredths of a second.

And if you get a chance to look a squid in the eye, it may see you almost as well as you see it. Squid, which are equipped with a camera eye much like a human's, see better than any other animal without a backbone and better than many that do have backbones.

While scientists know a lot about the anatomy of the squid, they know very little about the habitat preference and breeding habits of the many species of squid that live in the oceans.

—Kathy Hart

# Dockside, the new catch is squid

G.R. "Moon" Tillett and his son, Billy Carl Tillett, two Wanchese fishermen, know how to catch all the squid they want. But the problem comes in finding a market for the eight-armed mollusks.

In the summer, the Tilletts net what they commonly call "summer squid" or *Illex*. In the winter, it's "winter squid" or *Loligo*. Last summer was the first time the Tilletts had fished specifically for squid. This winter they're catching the cephalopods as a bycatch.

Billy Carl Tillett captains the boat, the *Linda Gayle*, while his father mans the telephones, negotiating the prices their catch will bring. The Tilletts get an average of 20 cents a pound for summer squid and 35 cents a pound for winter squid. "They tell us they're using the summer squid for bait," says Moon Tillett. "But I know those squid have some food value."

Last summer, Billy Carl Tillett netted anywhere from 7,000 to 60,000 pounds of squid in a two-day trip. His father says their records show that between July and October they caught over one million pounds of squid. "We had the best fishing summer ever," says Billy Carl Tillett. "It was profitable and showed us something else we could do. It was better than trying to shrimp around here, where you make just enough to keep your head above water."

In 1981, North Carolina fishermen landed 278,290 pounds of squid in this state with a dockside value of \$91,652. In 1982, 135,935 pounds of squid were landed for a dockside total of \$43,884. Figures for the 1983 catch were not available from the N.C. Division of Marine Fisheries, but Moon Tillett estimates that Wanchese fishermen netted between four million and five million pounds of the mollusks last year.

In a management plan approved in December 1983, the Mid-Atlantic Fishery Management Council in cooperation with the National Marine Fisheries Service, the New England Fishery Management Council and the South Atlantic Fishery Management Council, set the allowable catch for the *Loligo* fishery at 44,000 metric tons and the *Illex* fishery at 30,000 metric tons. The allowable catch is reassessed yearly and can be modified if biological circumstances warrant.

Most North Carolina fishermen trawl for squid. Billy Carl Tillett uses a fly net lined with a shrimp net. The wide-mouth net herds the squid into the tailbag. The cost of outfitting their boat for squid was minimal since the Tilletts already owned their nets. "We didn't want to sink money into fishing for squid until we knew the fishery would pay off," says Billy Carl Tillett.

Kenny Daniels, who owns a neighboring fish company, faced marketing problems when he entered the fishery a few years earlier. In 1979 Daniels equipped one of his boats with an onboard blast freezer. His crew froze the squid as soon as it was caught and washed, just as the foreign fleets do. "We had a beautiful product," Daniels says. "But we couldn't get rid of it. We couldn't find a market for it."

But Daniels is ready to try again. He plans to outfit two more vessels with onboard freezers to complete a fleet of three boats that will fish for squid this summer. Daniels says he will do his own marketing, hoping to sell his frozen product to a restaurant or supermarket chain.

By freezing onboard, Daniels has eliminated one problem that faces the Tilletts—spoilage. The Tilletts have no onboard freezer so they must quickly ice their catch and head for port. They've learned two days is the maximum time they have at sea during hot summer days. During the 1983 summer when Oregon Inlet was unnavigable, the Tilletts delivered their squid to a seafood distributor in Virginia. This winter the inlet is open, and the Tilletts are bringing their catch home to Wanchese.

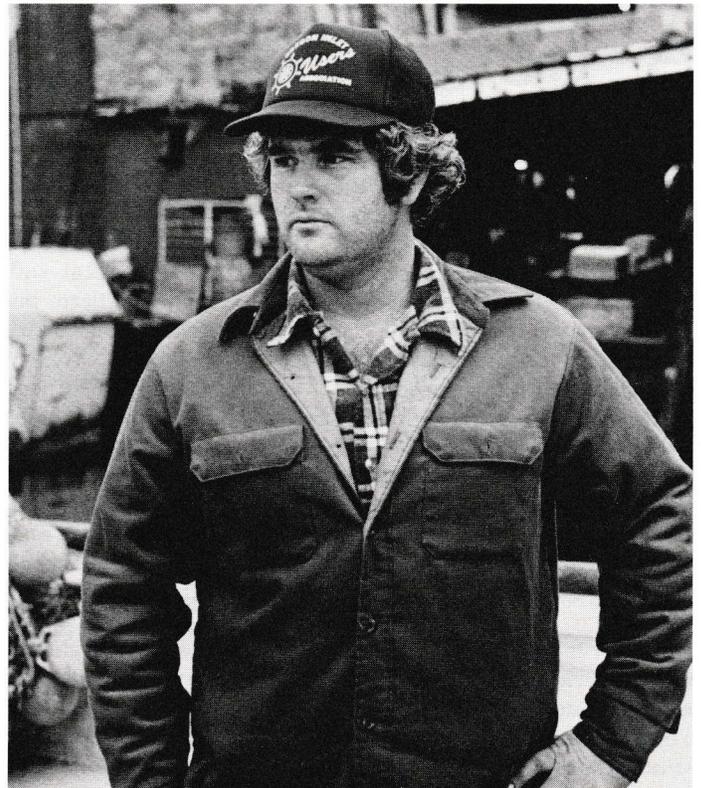
To locate schools of squid along the ocean floor, Billy Carl Tillett uses a white-line depth recorder with a scope. But he admits even fancy electronics don't always turn up a bountiful catch. He would like to know more about the squid's habits—how they're affected by weather and currents.

In January, UNC Sea Grant and the South Atlantic Fishery Development Foundation sponsored a workshop in Manteo to help fishermen learn more about how to fish, handle and market the mollusks. Gilbert Voss, a teuthologist (a scientist who studies cephalopods) at the University of Miami, told an audience of 30 fishermen that there are four kinds of squid found along the North Carolina coast—*Loligo paelei*, sometimes called the longfin or winter squid; *Doryteuthis plei* or arrow squid; *Lolliguncula brevis* or brief squid; and *Illex illecebrosus*, called the shortfin or summer squid.

Warren Rathjen of the National Marine Fisheries Service's Gloucester, Massachusetts office, says a fisherman's past experience will be his most valuable tool in predicting the location of squid during certain seasons of the year.

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*Photo by Kathy Hart*



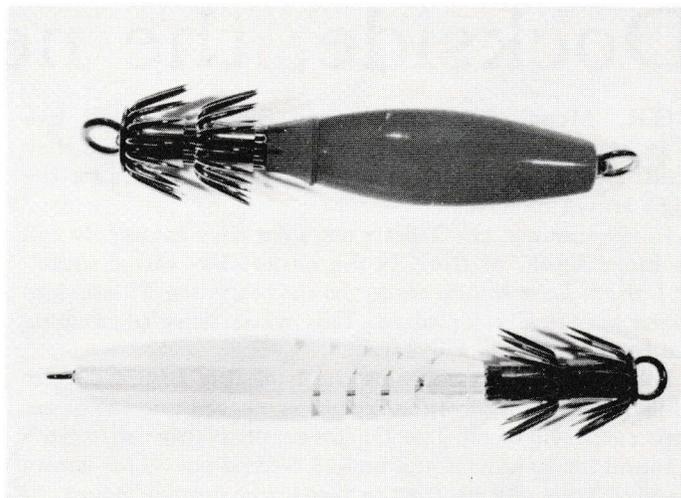
*Billy Carl Tillett on the Wanchese docks*

"The time of day has a definite impact on the production of squid, but dependent on what type of gear or fishing approach you use," Rathjen says. "If you're using bottom trawls, they're likely to be most effective during the time of day when there's bright light. The squid would be expected to be close to the bottom then. Characteristically squid will move off the bottom during hours of darkness."

At night, Rathjen says another method, squid jigging, frequently used by the Japanese, is more productive. An automated squid jig is used along with a light that is immersed in the water to attract small fishes and crabs, which in turn attract squid. The automatic jig consists of a reel, a roller and a strong monofilament line weighted at the end and rigged with a series of six to 10 squid jigs about three feet apart. A squid jig is a circle of barbless hooks, which snag the mollusks as the line is moved up and down. Jigging results in less damage to harvested squid than trawling, which sometimes crushes and tears the cephalopods.

In fishing experiments conducted by the New York Sea Grant Extension Program, fishermen and extension specialists learned that the squid jigging devices caught limited quantities of *Loligo* squid, but worked well for catching *Illex* squid. Converting a 50-foot boat for squid jigging costs between \$10,000 and \$30,000. Advisory agents concluded that until a stronger market for *Illex* squid developed and a higher quality harvest demanded, conversion to squid jigging was not economically sound.

Voss says the greatest potential for the U.S. squid fishery lies in the harvest of the brief squid, which prefers an inshore habitat. "I really think that the small inshore squid has tremendous promise because it occurs in large numbers," Voss says. "It's close in, so we don't have long runs out to the fishing grounds and back. It could be done by bay



*Jigs like these are used to snag squid*

boats. All it would take is to develop a larger market as they have done in Texas, where it is being sold in supermarkets."

Moon Tillett hopes the squid fishery goes the way of the shrimp fishery. "I remember when they brought shrimp in by the netfuls and threw 'em away," he says. "Sixty years ago shrimp just weren't eaten. They called them 'old bugs.' I think squid has the same potential.

"I swore I wouldn't live long enough to eat squid. But I ate a handful last summer fried in the deep fry. They tasted just like clam strips. If they're tender, I don't think you could tell the difference."

—Kathy Hart

## A better image, a bigger market

The squid has an image problem. And it's not just the Jules Verne syndrome. It's the soft body, the eight arms and two tentacles, the big black eyes. And, that name. Squid.

Spaniards eat calamares. Italians eat calamari. The Japanese make ika a part of nearly every meal. But will Americans eat squid? Chances are they will—if marketing succeeds.

For over 30 years, Gilbert Voss, a biologist at the University of Miami, has made squid his business. While you may turn up your nose at mention of the ugly cephalopod, Voss speaks of squid with admiration. He wants us to do more than study the squid; he wants us to eat it.

"Squid is one of the major fisheries of the world, and there are areas in which squid has been eaten since classical times," says Voss. He thinks Americans could learn something from those other nations.

For example, squid is as much a part

of the diet in Japan and Spain as the hamburger is in the United States. Japan is the world's largest squid market, with an annual consumption of about 600,000 tons, over half the world's total squid production. Consumers there pull packages of dry, shredded squid from vending machines. While the Japanese prefer their squid uncooked, they also consume large quantities of squid in dried, cured, salted and canned forms.

In northern Europe and South America, the squid is gaining in popularity. But, so far, in the United States, squid is served mainly as an ethnic food.

Voss says a successful fishery will require a healthy market here in the United States. And, the key to the success of the U.S. market is going to be public acceptance of squid. The way to do that is easy, he says. Get every American to try squid just once.

Some of the hurdles have already

been overcome. Ten years ago, fishermen tossed their incidental catches of squid overboard, or they used them as bait. Now, more and more fishermen are fishing specifically for squid. North Carolina fishermen say they have no problems catching the squid; it's just a matter of finding a market.

A California seafood company has been marketing squid for over 20 years. Pat Flanagan, vice-president of General Fish Corporation in San Francisco, says his company concentrated on a very small market in California, selling mainly to ethnic groups. During that 20-year period, the most squid the company produced was about 500,000 pounds per year. But, Flanagan says they succeeded in establishing a market.

Flanagan believes that restaurants will be the key to the squid's success in this country. Once the cephalopod makes it to the menu, people will begin to accept it, he says.

Red Lobster, a nationwide chain of 370 seafood restaurants, is already promoting squid. Restaurant managers think squid, listed on the menu as calamari, may go the way of the snow crab and popcorn shrimp, two other seafoods made famous by Red Lobster.

In 1983, the chain imported less than half a million pounds of squid for processing into squid rings, says Debby Coudert, Red Lobster public relations representative. The company purchased the squid already cleaned and cut it into rings.

Coudert says the restaurant chain has a panel of researchers who found squid was being offered in other seafood restaurants throughout the country. "And, we're continually looking for new seafood products and ways of tapping other resources in the ocean," Coudert says.

As more and more restaurants begin serving squid, grocery stores will begin to carry it—a key in improving its public perception. Gilbert Bullock, assistant manager of the seafood department of a Big Star store in Raleigh, says squid sells well in his store. The squid is caught in North Carolina waters and shipped to his store daily. Bullock says he sells about 20 pounds each day.

While most of his customers are Oriental or European, some Americans are willing to give squid a try, says Bullock. "The ones who don't know how to cook it are the ones who don't come back," he adds.

Bullock says he has been selling squid for 99 cents per pound for two years—a good buy when compared with other more popular items. Consider the cost of fresh salmon at \$5.99 per pound and flounder fillets at \$2.98 per pound.

As the market for squid grows, the fishery will have to grow with it, says Warren Rathjen, of the National Marine Fisheries Service in Gloucester, Massachusetts. Rathjen says the Japanese squid fishery represents the state of the art. Since World War II, the fishery there has automated to the extent that physical manpower is no longer required, says Rathjen. "We're literally light years behind in our ability to understand how to fish for and use squid," he says.

Even with a healthy domestic market for squid, the United States fishery will ultimately be competing

*"Squid is one of the major fisheries of the world, and there are areas in which squid has been eaten since classical times."*

—Gilbert Voss

Photo by Kathy Hart

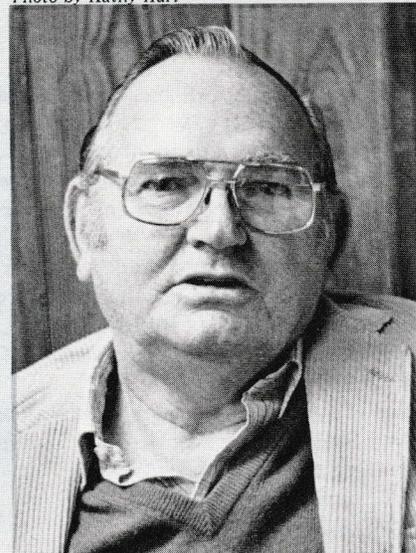
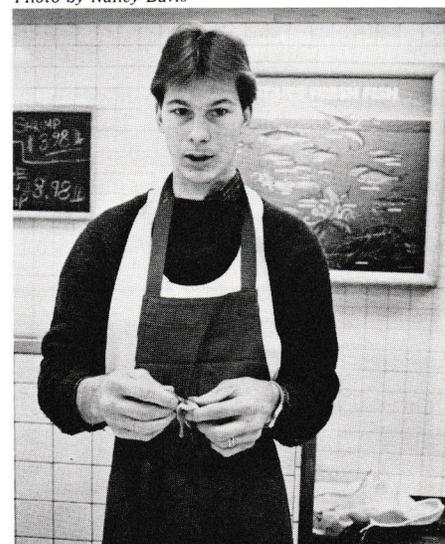


Photo by Nancy Davis



Gilbert Bullock

with other squid-producing nations. This is where the squid will face a foe more formidable than its image, says Voss. "The primary problem in the squid market today is international politics. It's not a lack of demand."

For example, Spain uses a variety of ploys to exclude other countries from becoming their competitors in the squid fishery. They have a large, government-subsidized, high seas fleet. Some of the ships fish within the 200-mile limit off the U.S. coast. By sailing some of those vessels under flags of other countries, they can catch more than the quota they are allowed under their own flag.

At the same time, the Spanish refuse to buy American-caught squid because it would hurt their fishery, says Voss. By placing high taxes on imported squid, they make it too expensive for Spanish companies to buy imported squid. And, they demand sea-frozen squid, virtually excluding all U.S. vessels because few are equipped for such ocean processing.

Japan is equally interested in protecting its fishery from American intrusion. They don't like to buy U.S.-caught squid because they say the squid are not of top quality since they're not jig-caught. While this is partly true, says Voss, the trawl-caught squid could be processed into products that don't require the finest quality. "The idea is to keep the American fishery at a low level so that they can say, 'Well, you can't utilize it, therefore we get the major part of the catch,'" says Voss.

"The market has become very political. To get away from this, we're going to have to have two kinds of markets—a local U.S. market and a foreign market," says Voss.

One possibility for American fishermen trying to break into the foreign market is the joint venture. Under such an arrangement, a U.S. vessel catches the squid and sells it to a foreign vessel, waiting nearby, where the catch is processed at sea. Voss says that fishermen may make some money off of joint ventures, but they may be hurting themselves in the long run. He advises U.S. fishermen to concentrate on developing their fishery to the point where they can catch, process and market their own catches.

—Nancy Davis

# More ways than one to cook squid

As a seafood, squid has a long list of virtues. It's nutritious, inexpensive, versatile and easy to prepare. It has a firm texture, it's high in protein and low in fats, and it tastes good. And, as much as 80 percent of the squid is edible—a large amount when compared to most other seafoods.

When purchasing squid, look for signs of freshness. Color spots on the mantle or skin should be distinct and sharp. The color of the mantle should be bright, like fresh fish. The eyes should be clear and bright and the flesh should be firm and without an odor.

Joyce Taylor, Sea Grant's seafood agent at the North Carolina State University Seafood Laboratory in Morehead City, offers these recipes for squid.

## *Fried Squid, Greek Style*

2 lbs. whole squid	1 egg, beaten
2 Tb. lemon juice	2 Tb. milk
1 tsp. salt	1 cup flour
1/8 tsp. white pepper	Fat for frying

Clean squid and cut into 1/4-inch strips. Cut tentacles into 1-inch pieces. Sprinkle with lemon juice, salt and pepper. Combine milk and egg. Dip squid into milk and roll in flour. Place in a single layer in hot oil in skillet. Fry at 350 degrees for 3 to 5 minutes. Turn and fry 3 to 5 minutes more. Drain and serve with lemon wedges. Serves 3 to 4 people.

*Photos by Steve Wilson*

## *Squid Chowder*

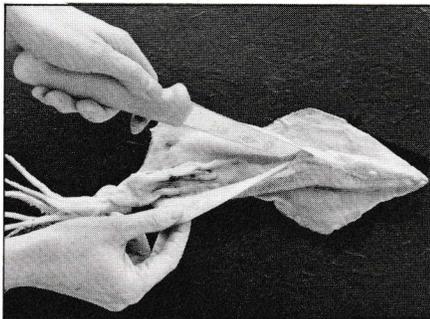
2 lbs. whole squid	1/4 cup chopped parsley
1 cup chopped onion	1 1/2 tsp. salt
1/4 cup cooking oil	3 cups cubed potatoes
1 6-oz. can tomato paste	1 quart water

Clean squid and cut mantle into 1/4-inch strips. Cut tentacles into 1-inch pieces. Cook onion in hot oil until tender. Add squid and cook for 5 minutes. Add water, tomato paste, parsley, salt and pepper. Simmer for 10 minutes. Add potatoes. Cover and simmer for 20 to 30 minutes or until potatoes are tender. Stir occasionally. Serve with French bread. Serves 5 to 6 people.

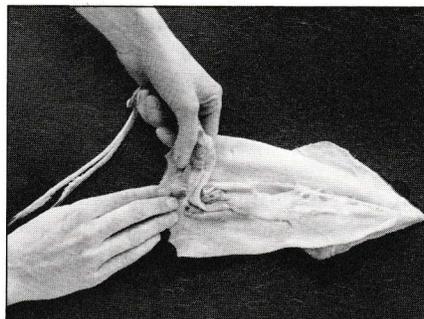
## *Squid Salad*

2 lbs. whole squid	1/2 cup chopped red onion
2 cups boiling water	1 clove garlic, crushed
2 tsp. salt	1 Tb. chopped parsley
1/2 cup salad oil	1 tsp. salt
1/4 cup lemon juice	1/4 tsp. pepper
1 cup celery	

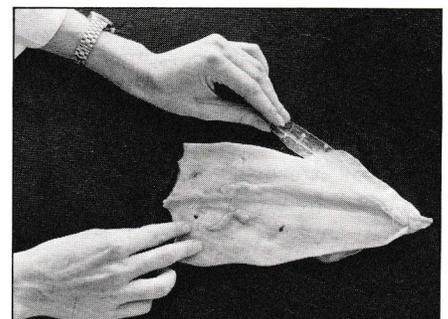
Clean squid and cut mantle into 1/2-inch pieces. Place squid in boiling, salted water. Cover and simmer 5 to 10 minutes until tender. Drain and rinse in cold water. Combine remaining ingredients, cover and refrigerate for several hours. Makes about 2 cups.



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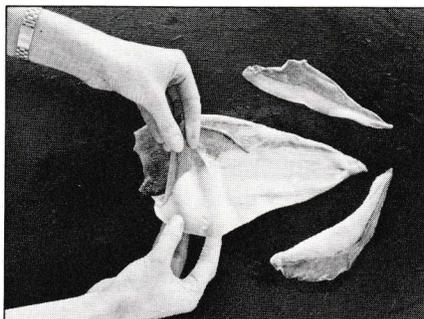
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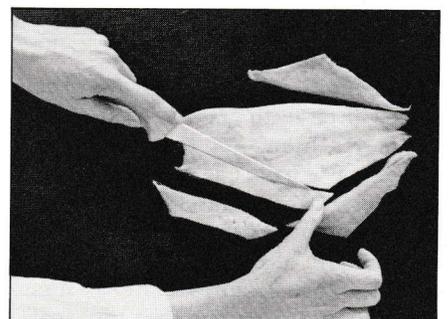
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5.



6.

## *Cleaning a squid*

1. Thaw frozen squid. From opening in mantle, cut lengthwise. 2. Spread inside of mantle open flat. Grasp head and arms and pull off intestines. Cut tentacles away from head. 3. Remove pen and

scrap away any remains. 4. Turn mantle to other side. Pull off fins. 5. Remove outer membrane from mantle and fins. 6. Rinse. Cut mantle and fins diagonally into strips.

# 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).



In one Manteo classroom, high school students are learning how to hang a gill net, build a crab pot and dig for clams. Marine occupations is the course.

And the students enrolled may be tomorrow's fishermen, boatbuilders and charter boat captains.

In the classroom, the students learn about oceanography, marine biology, first aid and boat safety. Outside of the classroom, they learn by doing. "We'd like to say we probably spend at least sixty percent of the time somewhere out on the water or out on the beach," says Algie Campbell, the marine occupations instructor at Manteo High School.

Students learn firsthand how to trawl for shrimp, read a depth recorder and angle for marlin. "Now I can hang a net, and fish with nets and do commercial fishing if I like," says Tammy Holton, a 17-year-old student in the class.

Lundie Spence, UNC Sea Grant's marine education specialist, says more coastal high schools are adding marine occupations to their curriculum. If you would like more information about marine occupations courses, contact Spence at UNC Sea Grant, Box 8605, Raleigh, N.C. 27695-8605. Or call, 919/737-2454.

Sam Thomas, UNC Sea Grant's Seafood Specialist at the NCSU Seafood Laboratory in Morehead City, will conduct a blue crab pasteurization

workshop for industry members on May 10 from 8:30 a.m. to 5 p.m. at the seafood laboratory. Thomas will present the basic principles of pasteurization, including the most up-to-date techniques. He'll also cover regulation requirements and provide guidance in setting up quality control in a crab plant.

For more information, call Thomas at 919/726-7341 or write NCSU Seafood Laboratory, P.O. Drawer 1137, Morehead City, North Carolina 28557.



Those slender, dark, worm-like creatures wiggling their way up North Carolina's coastal rivers are elvers or baby eels. UNC Sea Grant

collects the wild elvers to stock ponds at the Aquaculture Research and Demonstration Center in Aurora. But this year, the program needs some help locating the elusive elvers.

Randy Rouse, UNC Sea Grant's aquaculture advisory agent, says the elvers usually accumulate behind dams or spillways—any place that stops their upstream migration. And he adds, that they're usually most visible in the early morning or late evening.

If you see a large concentration of elvers, call Rouse at 919/322-4054.

UNC Sea Grant and the N.C. Marine Resources Center on Roanoke Island are sponsoring a recreational boat show May 12 and 13 at the center in Manteo. The show will feature a complete selection of recreational boats and accessories, with an emphasis on sailing. Educational programs on topics such as boater safety, first aid, hypothermia and boat maintenance will be offered in conjunction with the show.

For more information, contact Rich Novak at 919/473-3937 or write Novak at P.O. Box 699, Manteo, N.C. 27954.



More lawyers today find themselves representing clients on environmental law issues. But because of its newness and complexity, some lawyers find themselves struggling to represent their clients adequately.

That's why UNC Sea Grant, the Institute of Government and the North Carolina Bar Foundation decided to sponsor a conference that would acquaint attorneys with the many facets of environmental law. The conference will be held May 18 and 19 at the Marriott Hotel in Raleigh.

The topics to be addressed at the conference are: common law remedies for environment degradation, administrative procedure and environmental law, water quality, water use rights and conflicts, local planning and zoning, and development in environmentally sensitive areas.

For more information about the conference, contact Walter Clark at UNC Sea Grant, Box 8605, Raleigh, N.C. 27695-8605. Or call, 919/737-2454.



The Rachel Carson National Estuarine Sanctuary will be dedicated April 22 at the Duke University Marine Laboratory on Pivers Island overlooking the

sanctuary site. The Rachel Carson Sanctuary is the first site to be dedicated in the N.C. National Estuarine Sanctuary System, a multiple-site system that is part of the National Estuarine Sanctuary Program. The sanctuaries will provide a natural field laboratory for public and scientific study and preserve one of our nation's most valuable ecosystems.

The public is invited to the dedication. For more information, contact Kathy Henderson at the Office of Coastal Management in Raleigh (919/733-2293).

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In February the Coastal Resources Commission established an Outer Banks Task Force to study the severe erosion occurring along northern North Carolina beaches. Jay Langfelder, head of the Department of Marine, Earth and Atmospheric Sciences at North Carolina State University (NCSU) and a coordinator for UNC Sea Grant's coastal studies was appointed chairman of the committee.

John Fisher and Margery Overton, two Sea Grant researchers and members of the NCSU Department of Civil Engineering, along with Spencer Rogers, UNC Sea Grant's coastal engineering specialist, are members of the task force's technical subcommittee. The task force is seeking to find the technical solutions and funding necessary to combat the erosion problem.

UNC Sea Grant Director B.J. Copeland is accepting research proposals for the program's 1985-86 funding cycle. If you're a researcher at an academic institution or state agency and would like to submit a proposal, call the Sea Grant office in Raleigh for the necessary forms. The telephone number is 919/737-2454. All proposals must be submitted by May 1.

Frank Thomas, project director for UNC Sea Grant's work at the NCSU Seafood Laboratory in Morehead City, and Joyce Taylor, Sea Grant's marine agent at the lab, have received a grant from the Mid-Atlantic Fisheries Development Foundation to develop a slide show and a script on seafood care and handling. The slide show will be used by extension and advisory agents in the mid-Atlantic states. It will focus on the proper methods of selecting, preserving and dressing fresh seafoods.



March is the beginning of crab-shedding season in North Carolina. If you're thinking of expanding your crab operation to include a crab-shedding facility, you'll want to order *A Guide to Soft-Shell Crabbing*. Written by Wayne Wescott, UNC Sea Grant's advisory agent in Manteo, the 32-page book is designed for the layman who is considering crab shedding. It includes sections on blue crab biology, identifying and handling "peelers," harvesting methods, shedding methods and more.

In addition to diagrams and illustrations, five color photos will depict the various stages of peelers. These photographs will enable the novice to recognize the subtle signs of a blue crab preparing to shed.

For a free copy, write UNC Sea Grant, Box 8605, Raleigh, North Carolina 27695-8605. Ask for publication number UNC-SG-84-01.

*Predictive Growth Model for the Meat Weight (Adductor Muscle) of Bay Scallops in North Carolina* by Robert Kellogg, NCSU Department of Economics and Business, and Dennis Spitsbergen, N.C. Division of Marine Fisheries, develops a model to predict the meat size for bay scallops. The growth model can be used to suggest season openings that will attain optimal growth of the scallops. For a copy of this publication, send \$2 to UNC Sea Grant, Box 8605, Raleigh, North Carolina 27695-8605. Ask for publication UNC-SG-WP-83-6.

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