

# Marine Resource Bulletin

VOL. XIII, NO. 1

WINTER 1981

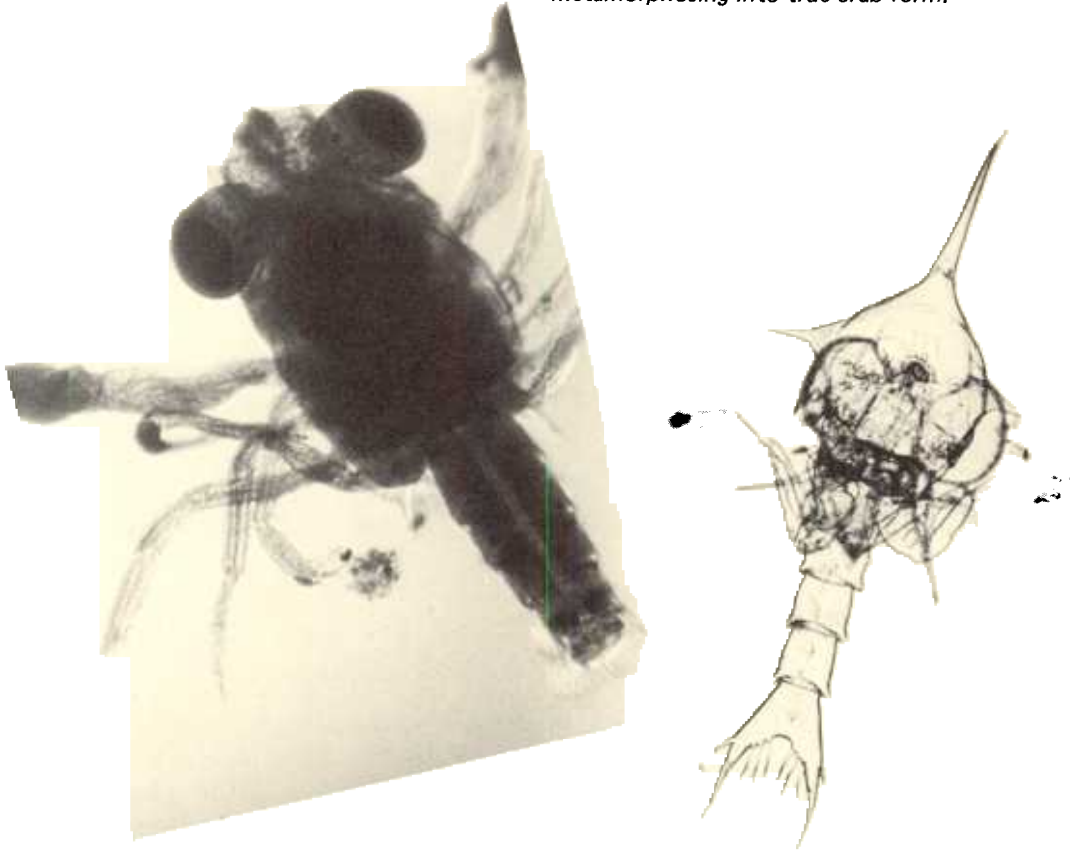


*In this issue - In Search of the Blue Crab • Marine Science for the Handicapped •  
Virginia's Clamming Industry • Conservation Short Course • Virginia Sport Diving Workshop*



A SEA GRANT ADVISORY SERVICE OF THE COLLEGE OF WILLIAM AND MARY

*Zoea (r)* is first larval stage of the Atlantic blue crab (*Callinectes sapidus*). *Megalopa (l)* is last larval stage before metamorphosing into true crab form.



PHOTOGRAPHS: SHERM GARRISON

## In Search of the Blue Crab

Little is known about the distribution and movement of the Atlantic blue crab in its larval stages of life, and now research is turning up some surprising information.

A research project designed to trace the movement and distribution of blue crab larvae at the mouth of Chesapeake Bay is turning up some surprising information that promises, in the long run, to benefit Virginia watermen.

Chesapeake Bay, among its other celebrated attributes, is world renowned as a source of delicious seafood, especially its oysters and blue crabs are practically legendary among gourmets. The life history of the oyster, including factors which determine seasonal populations, has fairly well been documented. Barring environmental calamity, if there is a good "strike" of oyster larvae in an area in a particular year, the success of the harvest 2 or 3 years later is fairly predictable. Such population predictions of blue crabs, however, are another matter.

Comparatively little is known about the distribution and movement of the Atlantic blue crab (*Callinectes sapidus*)

in its larval stages of life, from zoea through megalopa, and yet it is this shadowy area of knowledge that is vital to any 1 to 2-year prediction of the species' population abundance.

To this end, two Old Dominion University researchers, Anthony J. Provenzano (principal investigator) and John R. McConaughy of the ODU Department of Oceanography, received National Sea Grant funding for their work through the VIMS Sea Grant Program. The marine scientists are attempting to determine to what extent crabs spawned at the mouth of Chesapeake Bay become part of the commercial crab fishery within the Bay itself.

The 17-mile-wide mouth of Chesapeake Bay historically has been the major wintering area for most of the female blue crabs within the estuary. When water temperatures rise sufficiently, usually in late April, the females emerge from their dormant state



in the bottom mud. The eggs, carried on the female's body, soon hatch into tiny free-swimming larvae called zoea, which molt through six or seven stages to the megalopa stage before metamorphosing into the true crab form.

The prime question has always been - how many of these larvae, if any, eventually become part of the Chesapeake Bay commercial blue crab fishery? Also, do some of the larvae originate at sources other than the Bay mouth? These questions are still partially unanswered, but the research efforts of Provenzano and McConaugha have brought the scientific community markedly closer to their goal.

There are good and bad crab harvest years in Chesapeake Bay, and both types are difficult to predict as much as a year ahead of time. In the past it has been done only after the small crabs themselves are present in the Bay. This type of forecasting, although valuable in itself, doesn't give a waterman much lead time to finance or otherwise plan his season. Accurate prediction, as far in advance as possible, could be a real help to watermen and processors alike.

The ODU investigators decided that one thing they had to do was establish a number of sampling stations during the spawning season, keeping in mind the major water circulation patterns and wind tendencies at the Bay mouth region and several miles offshore. Both current and wind influence lateral distribution of larvae.

It is common knowledge among marine scientists that crab larvae can move up and down in the water column, but are not strong enough swimmers to move against the tide or even the forces of moderate winds pushing surface waters. Provenzano and McConaugha set out to determine whether or not the larvae exhibited any preference for particular locations within the water column itself, all the way from the neuston (first few centimeters of surface water) to the epibenthos (just above bottom). Also, they wanted to find out if time of day was significant in influencing the greatest abundance of larvae within the water column.

Several interesting facts turned up. The team, using samplers they designed for the project, plus already established sampling gear, discovered that the overwhelming majority of early stage crab larvae were to be



*The "Neuston Sampler," designed by the ODU blue crab research team specifically for sampling the ocean's neuston layer, is brought aboard by ODU graduate students operating the device in Chesapeake Bay waters.*



*Left to right, John McConaugha and Anthony Provenzano look on as ODU graduate student Harry Winnik examines a sample containing crab larvae collected from the mouth of Chesapeake Bay. The investigators hope to aid watermen by designing a system that will accurately predict future Bay crab populations.*

found in the neuston layer, within the first 10 centimeters of surface water. This finding was significant because the neuston, as a separate layer, had not been sampled for crab larvae by most previous research efforts.

Provenzano was delighted, therefore, to find that the easiest strata to sample was also the most indicative of the whereabouts of crab larvae "in time and space." Additionally, over the course of sampling 14 stations during the second year of the project, it was found that peak numbers of larvae were present in the water column during the hours of darkness or early morning, from slack high tide through peak ebb tide. This supported the previously held hypothesis that the net movement of crab larvae hatched in the Bay mouth area was seaward.

Associated with the ebbing tide were a rise in temperature (because of outflowing warmer Bay water) and drop in salinity (influence of fresh water from feeder rivers). These two factors may help trigger hatching. Also, preliminary examination of the various samples supports the belief that blue crab larvae from the Bay mouth tend to develop offshore. In the samples taken close to the Bay mouth, only the zoea and megalopa stages are showing up under microscopic scrutiny, while in the samples taken at the offshore stations, ALL stages of crab larvae are present.

The extent to which these larvae return to the Bay as crabs has not yet been determined, nor is it apt to be within the bounds of the present project. The final year of the project, 1981, will be devoted to sample analysis. It is likely, say the researchers, that strong winds and/or currents, occurring during the times when megalopa stage larvae are numerous in the water column, may influence the number of small crabs that will be available to the Bay fishery. For instance, with most of the crab larvae being present in the neuston layer, that strata of water most influenced by wind, a strong offshore wind sustaining for several weeks might well blow a significant number of larvae too far offshore, losing them to the Bay fishery.

All of this is supposition at the moment, but the accomplishments gained in the ODU larvae survey thus far will certainly bring longer range prediction of crab populations in the lower Chesapeake Bay closer to realization.

— Dick Cook

PHOTOGRAPH: DAVID JOHNSON

PHOTOGRAPH: DICK COOK

# Questions and Opinions about Virginia's Clam Industry

“P  
eople have always had good feelings about the hard clam fishery,” said VIMS scientist Mike Castagna, who operates his renowned clam hatchery in Wachapreague, Virginia. Castagna remembers during the Depression years when a man could always depend on clamming for a good day’s wages. Clammers would pay 5 cents to be towed out to the clam beds, and they’d be sure to make at least 54 cents a day. “There was no pressure put on clams in those days,” Castagna said.

These days, things are different. A man can still make a good day’s wages clamming, “as much as \$30,000 to \$35,000 a year depending on how hard he wants to work,” said Roy E. Davis of Davis Seafood in Poquoson. But not everybody has good feelings about Virginia’s clam industry.

Virginia is faced with declining clam production and stiff competition from New York, New England states and North Carolina. Use of the hydraulic escalator dredge, called the “most efficient machine ever invented for lifting shellfish out of the water”, has enabled those states to dominate the Middle-Atlantic hard clam market. As a result, Virginia packers and wholesalers are importing more and more clams each year.

“Virginia’s clam industry does have a future, but only with some modernization,” Tommy Shackleford of Shackleford-Thomas Seafood in Severn said. “If you have to go to



*Clammer Roy Haywood unloads day's catch of clams at Shackleford-Thomas Seafood docks in Severn, Virginia. Each burlap sack contains 250 unwashed, ungraded clams. The clammers are paid a certain price per clam.*





*After clams are unloaded at the Shackleford-Thomas Seafood docks, the vast majority are washed, graded, and shipped 250 per bag for places like Florida, Chicago, Cleveland, Detroit, and Philadelphia. Left, clam foreman Roosevelt Foster puts shipping tags on bags of clams ready for market. Below, clam shucker Catherine Smith at work. After being washed and packaged, most of the shucked clams go to a large restaurant chain in the Washington, D.C. area.*

other states to get a product that you already have, it means you're not taking advantage of your own resource."

Clams are still harvested in Virginia by the traditional methods of hand tonging, patent tonging, raking, treading, and signing. In February 1981, the General Assembly passed a bill that banned the use of the hydraulic escalator dredge for clam harvesting in Virginia.

"It's hard to compete with neighboring states using methods that we've used in the past," said Shackelford. "The dredge may not be the only method, but we definitely need modernization in the harvesting end of the clam industry."

Major questions need to be answered before innovative actions are taken. Can Virginia clammers, using traditional harvesting practices, profitably compete with the greater volume of production from other states? What effect would attempts to increase Virginia's production of hard clams have on the resource? What would consequences of hydraulic dredge use be? Would mechanization lead to over-harvesting and the end of Virginia's hard clam industry, or would effectively managed use of new technology bring production back to competitive levels and re-establish Virginia in the nation's hard clam fishery? Answers to these questions are difficult, but they must be considered if any developmental program is to be of true benefit to the industry. The industry is aware of the fallacy in the idea of an inexhaustible supply. The industry is also aware of the need for more com-



PHOTOGRAPHS: KYM YOUNG

petitive production, more aggressive marketing, and better management of Virginia's hard clam fishery.

Tom J. Murray, VIMS Sea Grant resource economist, points out that Virginia's hard clam production is primarily marketed on a national level in competition with the product of other clam producing states. Virginia's relative share of the total U.S. clam market has been steadily decreasing for the last decade. For example, in the early 1960's Virginia produced about 1/6 of all the hard clams in the U.S. In 1979 Virginia's hard clam harvest made up just 1/20 of the U.S. landings.

Murray also points out that buyers usually don't differentiate between hard clams from Virginia and hard clams from the rest of the Mid-Atlantic and New England clam industries. This ready substitutability and Virginia's lowering production rate puts Virginia's hard clam producers in the position of price takers.

"There is a premium paid in the hard clam market place for the producers who can provide a supply which is consistent and competitively priced," said Murray. "If effectively managed, supply increases of Virginia hard clams may serve to provide net economic benefits to Virginia by increasing both total revenues of the fishery and increased average prices for the product."

Consumer demand for hard clams nationwide seems to be increasing significantly with peak demands occurring Christmas through February, and on Labor Day.

The small, more succulent "necks" and "cherries" are, in most areas, served raw or steamed. (The term "cherrystone" originated in the Chesapeake area in the vicinity of Cherry-stone Creek.) Larger clams, called "chowders", command a considerably lower price and are nearly always used in preparation of chowders or in canned or minced clams.

"Virginia packers can sell twice the number of cherrystones that they get and four times the number of littlenecks," said Castagna. "The Virginia harvest is now 60% chowders and 20% littlenecks and cherrystones. Better management of the fishery could bring in 60% necks and cherries."

While the need for management of Virginia's hard clam fishery is clear, the appropriate choice of alternative management mechanisms is not.

"We need to take a hard look at what's going on and why," William P. Hunt, Jr. of Seafood Harvesters, Inc. in Poquoson said. "With all the knowledgeable people and agencies involved, it speaks poorly for us if we can't manage Virginia's hard clam fishery effectively."

Although Virginia's hard clam industry has shown a general decline, it is not as depressed as other commercial fishing industries. Clam diseases that affect production are virtually nonexistent. Once a clam is large enough (10 to 15 millimeters), it is safe from most predators.

"The price of clams is just now catching up with inflation," said Castagna, "Clamming has come into its

own as an industry since the 1950's."

Can Virginia hold its own in the nation's clamming industry? Competition is stiff. Longterm goals can only be realized if biological, social, and economic factors are closely scrutinized.

"We've got to strike a balance between what we take and what we leave," George DeMarco of Gourmets Delight Deviled Clams in Mathews said. "A sufficient repletion program-- a consistent supply of new clams-- is what Virginia's hard clam fishery lacks. We've got to have a new philosophy and a new way of thinking about the clam industry. We need a base to build on."

— Kym Young



*Clam boats wait to unload and gas up at the docks. In foreground are patent tongs used to scoop clams from the bottom.*

PHOTOGRAPH: KYM YOUNG

## Conservation Short Course Offers Sound Natural Resource Education

Sound natural resource education in Virginia takes on ever-increasing importance as citizens become more involved in making complex resource and management decisions. The Virginia Resource-Use Education Council is offering a three-week conservation short course this summer at Virginia Polytechnic Institute and State University, Longwood College, Virginia State University, or the College of William and Mary.

During the three week course, students will learn the basics of geology, soil and water, marine life, forestry and wildlife. Topics range from the complex ecological forces at work along Virginia's coast, on to a study of the resources of the forest and a look at the economic and aesthetic value of wildlife heritage.

The course is designed to help the teacher do a better job in presenting environmental concepts in the classroom. Though the course is aimed at teachers, supervisors and administrators, other interested persons including leaders of resource related associations and members of local planning commissions are encouraged to attend.

Five quarter hours credit will be given for satisfactory completion at Virginia Polytechnic Institute and State University; three semester hours credit will be given for satisfactory completion at Virginia State University, Longwood College, and the College of William and Mary. Credits may be used toward endorsement in Biology or Earth Science, and the course can also be used for certificate renewal credit. Qualified students may apply for graduate credits.

Thirty scholarships are offered at each institution covering all tuition and fees, supplies and materials. A generous allowance toward board and

room is provided for those who stay on campus. Applications will be accepted until all scholarships are filled. Scholarship recipients will be notified by return mail. Alternate courses will be suggested if the one applied for is filled.

For further information about scholarships and scheduling, contact Bernard L. Parsons, Virginia Resource-Use Education Council, VPI & SU, Sietz Hall, Blacksburg, VA 24061.

## Marine Science for the Handicapped

Every summer since 1977, physically handicapped eleventh and twelfth grade students have studied marine biology, navigation, coastal ecology and oceanographic techniques at the Marine Science Consortium's Wallops Island Station near the Assateague Island National Seashore Park in Virginia.

This innovative program, sponsored by the National Science Foundation (NSF), has opened the door to a career in the sciences for more than eighty determined young blind, deaf, and wheelchair bound students. The teenagers have proved that they can excel away from their homes at a sophisticated and demanding marine science curriculum, in which they may, for instance, compare the sounds of the toadfish with the song of the humpback whale.

The students and their instructors and counselors integrate their abilities and use a variety of communication skills: sign language and visuals, braille maps and tactile exhibits, and close individual attention. As part of the program, students tour the



PHOTOGRAPH: KEVIN GRAY

*Summer '80 College of William and Mary conservation course participants identify fish from trawl catch aboard the 115-foot VIMS research vessel Retriever. Education specialists with VIMS Sea Grant Marine Advisory Services conduct the cruise every summer.*

Virginia Institute of Marine Science laboratories. Sea Grant Marine Advisory Service education specialists take students through VIMS remote sensing, crustaceology, pathology, ichthyology, and physical oceanography labs where VIMS scientists lecture, demonstrate equipment, and answer questions for the students. This is the only program in the country which allows the handicapped to visit a research institute while receiving classroom instruction in the marine sciences.

Dr. Edward Keller, director and founder of the Marine Science Program for the Handicapped, has begun recruiting outstanding physically impaired pre-college students for the session which will be held this summer from July 1 to August 5.

To obtain application materials, you may write or telephone Dr. Keller at the following address: 237 Brooks Hall, West Virginia University, Morgantown, WV 26506 (304-293-4380). Deadline for receipt of applications is May 15.



# Seatrout

Four species of seatrout are caught in the Southeastern United States: Spotted seatrout, gray trout, white trout, and silver trout. Seatrout is also known as "weakfish" because of its delicate mouth tissue and tender flesh. Known for their tasty, tender white meat and low caloric content, seatrout are easily prepared.

## Pan-Fried Trout

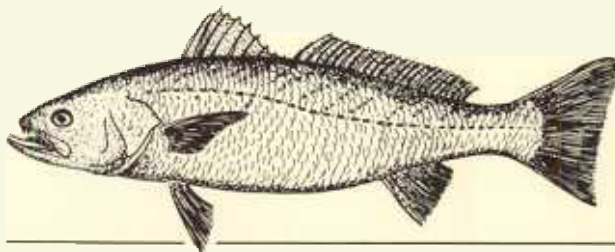
6 pan-dressed seatrout  
1 egg, beaten  
2 tablespoons milk  
1 teaspoon salt  
1 teaspoon chili powder  
1/8 teaspoon liquid hot pepper sauce  
1/2 cup cornmeal  
1/2 cup all-purpose flour  
Cooking oil for frying  
Hot Chili Sauce

*Thaw fish if frozen. Clean fish thoroughly and dry. Combine egg, milk, salt, chili powder and liquid hot pepper sauce. Combine cornmeal and flour. Dip fish into egg mixture and roll in cornmeal mixture. Place a single layer of fish in hot oil in a large fry pan. Fry at moderate heat, 360 F., approximately 4 to 5 minutes. Turn carefully and cook 4 to 5 minutes longer or until brown and fish flakes easily when tested with a fork. Drain on absorbent paper. Serve with Hot Chili Sauce. Makes 6 servings.*

## Hot Chili Sauce

1 cup chopped onion  
1 cup chopped green pepper  
1 clove garlic, minced  
1 tablespoon margarine or butter, melted  
1 can (8 ounces) tomatoe sauce  
1/4 cup catsup  
1 teaspoon chili powder  
1/4 teaspoon salt  
1/4 teaspoon pepper  
1/8 teaspoon liquid hot pepper sauce

*Cook onion, green pepper and garlic in margarine until tender. Add tomato sauce, catsup, chili powder, salt, pepper and liquid hot pepper sauce. Cover and simmer 15 to 20 minutes or until flavors are blended. Makes approximately 2 cups sauce.*



## Trout with Mustard Butter

2 pounds seatrout steaks, fresh or frozen  
3 cups water  
3/4 cup lemon juice  
6 tablespoons margarine or butter, melted  
3 tablespoons lemon juice  
4 teaspoons prepared mustard  
3/4 teaspoon salt  
1/2 teaspoon paprika  
Chopped parsley

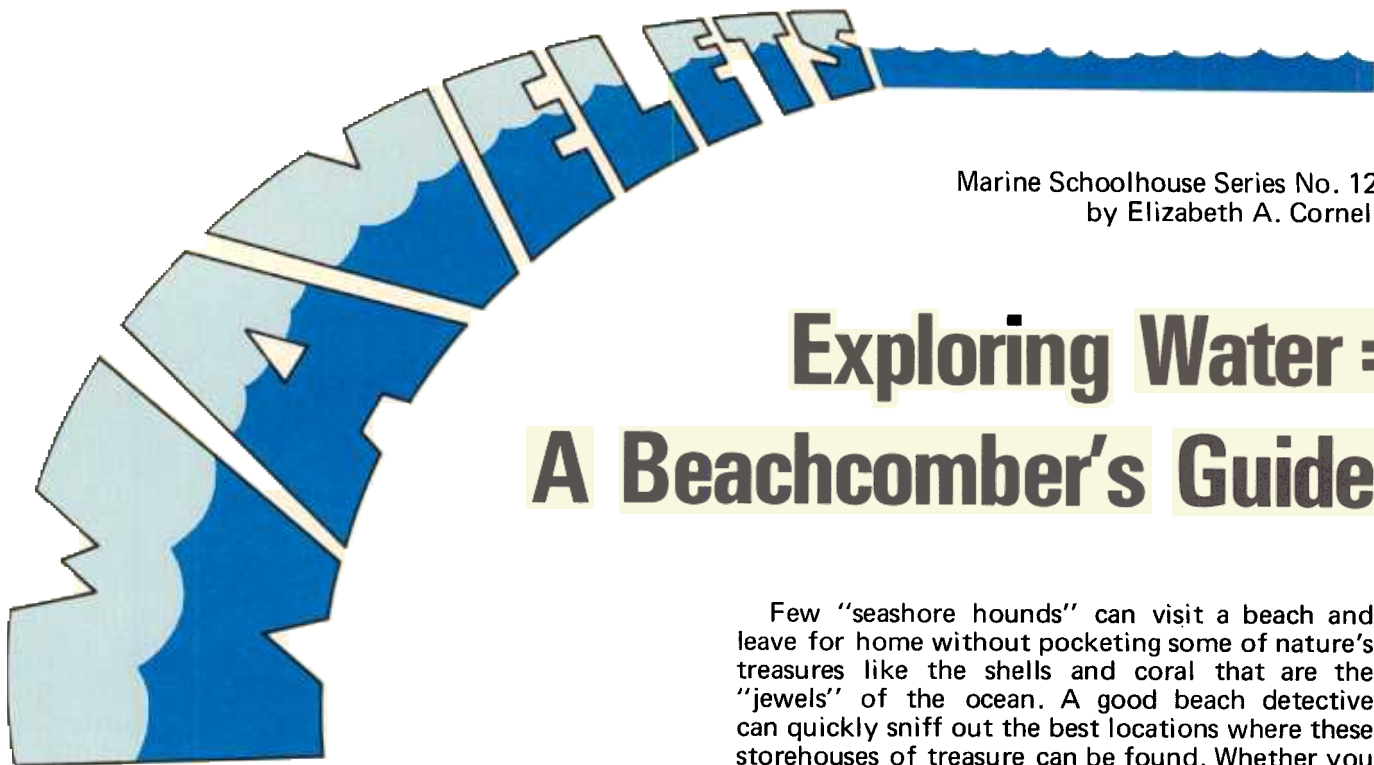
*Thaw fish if frozen. Combine water and 3/4 cup lemon juice. Place steaks in lemon-water and marinate 20 minutes. Combine margarine, lemon juice, mustard, salt and paprika; mix well. Place steaks on a well-greased baking pan, approximately 15 x 10 x 1/2 inches. Brush generously with mustard mixture. Broil 4 inches from source of heat for 4 to 6 minutes; turn carefully. Brush generously with sauce and broil 4 to 6 minutes longer or until fish flakes easily when tested with a fork. Sprinkle fish with parsley. Warm remaining sauce and serve with fish. Makes 6 servings.*

## Trout Amandine

2 pounds trout fillets, fresh or frozen  
1/2 cup all-purpose flour  
1 teaspoon seasoned salt  
1 teaspoon paprika  
2 tablespoons margarine or butter, melted  
1/2 cup sliced almonds  
2 tablespoons margarine or butter, melted  
2 tablespoons lemon juice  
1 tablespoon chopped parsley  
5 drops liquid hot pepper sauce

*Thaw fish if frozen. Cut fish into serving-size portions. Combine flour, seasoned salt and paprika. Roll fish in flour mixture and place skin side down in a well-greased broiler pan, approximately 13 x 10 inches. Drizzle 2 tablespoons margarine over fish. Broil approximately 4 inches from source of heat for 8 to 10 minutes or until fish flakes easily when tested with a fork. While fish is broiling, cook almonds in remaining 2 tablespoons margarine until golden brown, stirring constantly. Remove from heat and stir in lemon juice, parsley and liquid hot pepper sauce. Pour sauce over fish. Serve at once. Makes 6 servings.*





Marine Schoolhouse Series No. 12  
by Elizabeth A. Cornell

# Exploring Water : A Beachcomber's Guide

Few "seashore hounds" can visit a beach and leave for home without pocketing some of nature's treasures like the shells and coral that are the "jewels" of the ocean. A good beach detective can quickly sniff out the best locations where these storehouses of treasure can be found. Whether you are just a casual visitor or a serious beachcomber, these guidelines will help you understand and organize your seashore hunts.

A beach detective *observes* the evidence and makes deductions (or *inferences*) from the clues she finds: Who left these tracks? What lived in this shell? Who visited this beach recently? Where did these bones come from? What's growing on this shell, and why? How did this shell get worn down to this funny shape?

Suppose you wish to *collect* objects to examine (make *observations*). First, you must find some specimens to examine.

Objects such as shells, seeds and litter are deposited on the beach by water, wind and animals, including humans. Let us focus our attention on objects deposited on the beach. Where are the best places to look? Is it better to look near or in the water, or in the grasses? There is a *scientific way* to find out and at the same time collect specimens and *data*.

These questions we wish to answer are: What objects and what specimens are found where? And in what numbers? Stated more scientifically and in ecological and biological terms, what are the specimens' *distributions* and *abundances*?

## MATERIALS

You will need these supplies: pencil, paper, marker, four hula hoops, four cardboard boxes with sturdy bottoms and no holes, ruler or metric stick, a sheet or blanket is optional, plastic bags (in which to take home specimens), and field guides (perhaps *A Field Guide to the Atlantic Seashore*, by Gosner, Peterson Field Guide Series or *Seashores* by Zim and Ingle, Golden Guide).

## ACTIVITY

To answer the question, "what do you find where on the beach?" scan the shore for a short

*Moon Snail*



distance and decide where you would like to *survey* the *populations* of objects. Pick a section of beach and place the hoops as illustrated in Figure 1.

Space the hoops evenly with the first hoop bordering the water and the last hoop in the grasses. Measure and record the distance between each hoop. Label your boxes one through four to correspond with the hoops. Carefully pick up all objects deposited on the beach which you find within the area of each hoop and place in the corresponding boxes (Place objects found in hoop one into box one). Do not collect any of the growing plants. Do collect live animals which have been deposited on the beach only if they are not harmful to you and you are not harming them. For example, it is safe to pick up snails but fish will die out of the water. After you have finished gathering the four populations of objects, carry your boxes to a location where you can spread out your collections. Here is where a sheet or blanket may come in handy.

Starting with Box Number One, empty out the objects onto your working surface and group them into those that are manufactured and those that are natural. Look in the bottom of the box and in the manufactured objects pile. Do you see any living organisms like spiders, insects, larvae or amphipods? These animals sometimes use our litter as homes in which to live. This is one instance in which litter may be useful to organisms and not harmful. Try to identify all the objects.

Study the sample table in Figure 2. Reproduce the headings in the sample table and fill in the columns with your data. Repeat the procedure in the previous paragraph for all the boxes.

## DISCUSSION:

1. Is there any difference in the numbers and kinds of objects which you found in the four different locations?
2. Can you hypothesize how the different objects arrived on the beach?
3. How could you determine which objects were deposited by motions of the water: tide, currents, wave action?
4. Can you make some inferences from observing your collection of objects? What kind of crowd visited the beach? For example: adults, children, pets? What do they do while visiting the beach: eat, drink, play?
5. Can you design some experiments to test your hypotheses for how different objects are deposited in different locations on the beach? For example, if you were to place "marked" whelk egg cases (paint with a dot of nail polish) in the same locations as the hula hoops on a breezy day, where do you expect to find them in one hour, two hours, the next day, the next week? Do the tide and wind play a role?
6. Would you get different results (i.e., different table of observations) if you collected objects from a different beach?

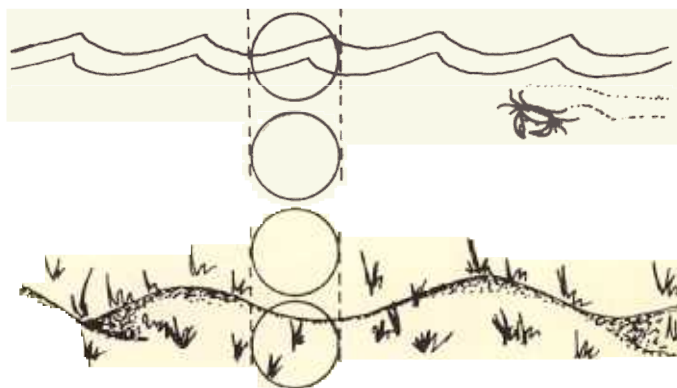


Figure 1. Survey Areas on the Beach

BOX	OBJECT	ABUNDANCE	HOW DO YOU THINK IT WAS DEPOSITED ON THE BEACH?
1	sponge	1	water (waves, tide)
	sea star	2	water
	paper bag	1	human
	dead fish	1	water
2	oyster shell	5	water
	scallop shell	2	water
	horseshoe crab	1	water & own locomotion
	bottle	1	human
3	blue crab shell	6	water & wind
	spiders	3	own movement
4	bottles	2	human
	driftwood	1	water
	skull of rodent	1	own movement, wind & water
	frisbee	1	human

Figure 2. Sample Table, Beach Survey of Deposited Objects



Periwinkle



# SEA GRANT PUBLICATIONS

*The publications listed in this section are results of projects sponsored by the VIMS Sea Grant Marine Advisory Program. Order publications from Sea Grant Marine Advisory Services, Publications Office, Virginia Institute of Marine Science, Gloucester Point, VA 23062.*

**SHORELINE EROSION IN VIRGINIA.** *G. Anderson and S. Hardaway. Educational Series No. 31. \$1.00.*

Virginia has over 5,000 miles of shoreline. The different shore types occurring in the Tidewater region include the low-lying barrier islands of the Eastern Shore, the ocean front headland-barrier spit of southeastern Virginia, and the shores of Chesapeake Bay estuaries which range from high bluffs to tidal marshes. Shoreline migration, or shoreline erosion, in Virginia is a process which has been operating for several thousand years. This illustrated publication helps put the process of shoreline erosion in Virginia in perspective. Photographs, diagrams, maps, and tables illustrate text on cause and effect of erosion, coastal processes, shore protection methods, vegetative control, and more.

**HANDLE WITH CARE: Mid-Atlantic Marine Animals That Demand Your Respect.** *J. Lucy. \$1.00*

Generally speaking, the marine organisms found along middle Atlantic shores are not considered threatening to people. However, some of these animals can cause problems, like aggravating stinging nettles or unpredictable sharks and stingrays. This illustrated publication describes nuisance and potentially harmful marine animals and is presented to help coastal residents and visitors become aware of how problems might develop, how they can be avoided, and how certain injuries should best be treated if they occur.

**THE CHESAPEAKE: a BOATING GUIDE to WEATHER.** *J. Lucy, T. Ritter and J. LaRue. Educational Series. \$1.00.*

**A PRELIMINARY EVALUATION for a SHARK FISHERY in VIRGINIA.** *SRAMSOE No. 234.- J. A. Colvocoresses and J. A. Musick. First copy free to Virginia residents, all other copies \$1.00.*

**LOCATION of FOREIGN FISHING VESSELS HARVESTING SQUID in the MID-ATLANTIC REGION of the UNITED STATES: 1970-1976.** *SRAMSOE No. 235.- J. Zaborski. First copy free to Virginia residents, all other copies \$1.00.*

**HEALTH CARE for SEAFARERS.** *HHS Publication No. (HSA) 80-2016.- by the Public Health Service, A Guide to Care and Services.*

The purpose of this booklet is to tell the seafarer of his eligibility for care, what care PHS provides, and how and where to get care. These are only general guidelines on the rights and responsibilities for obtaining care from the Public Health Service (PHS).

**TAX GUIDE FOR COMMERCIAL FISHERMEN.** *Department of the Treasury, Internal Revenue Service. Publication 595 (Rev. Nov. 80).*

Tax Guide for Commercial Fishermen is for the commercial fisherman who is a sole proprietor and who reports profit or loss on Schedule C (Form 1040).

**COMMERCIAL FISHING NEWSLETTER.** *Quarterly. Subscriptions available without charge.*

**THE ECONOMIC IMPACT and STATUS of VIRGINIA'S OFFSHORE FISHING INDUSTRY.** *SRAMSOE No. 225. W. DuPaul and S. Baker. First copy free to Virginia residents, all other copies \$1.00.*

**THE MARINE TURTLES of VIRGINIA.** *J. A. Musick. Field guide. \$1.00.*



ILLUSTRATION DICK COOK

**TIDAL WETLAND PLANTS of VIRGINIA.** *Gene Silberhorn. Booklet. \$3.00.*

**SENSING THE SEA.** *Ellen Odell-Fisher and Ronald N. Giese. Curriculum guides, grades K-One (OR) Two-Three. \$2.00 each.*

**VIRGINIA MSD PROBLEMS and OPTIONS.** *Jon Lucy. Advisory No. 19. Free.*

**THE ECONOMIC IMPACT of the SEA SCALLOP (*Placopecten magellanicus*) FISHERY in VIRGINIA.** *SRAMSOE No. 222.- W. DuPaul and S. Baker. First copy free to Virginia residents, all other copies \$1.00.*

**A REPORT to the OYSTER INDUSTRY of VIRGINIA on the BIOLOGY and MANAGEMENT of the COWNOSE RAY (*Rhinoptera bonasus*, Mitchill) in LOWER CHESAPEAKE BAY.** *SRAMSOE No. 216.- J. Merriner and J. Smith. First copy free to Virginia residents, all other copies \$1.00.*

**SHARK AS SEAFOOD.** *Prized for centuries on foreign tables, shark meat has made its American debut. Free brochure.*

**OFFSHORE PIPELINE CORRIDORS and LANDFALLS in COASTAL VIRGINIA, Vol. I and II.** *SRAMSOE No. 190.- A. Rooney-Char and R. Ayres. \$5.00 for both volumes.*

# FIRST VIRGINIA SPORT DIVING WORKSHOP

The first VIRGINIA SPORT DIVING WORKSHOP is scheduled Saturday, May 9, at the Yorktown Victory Center from 10 a.m. to 6 p.m. The workshop, FREE TO THE PUBLIC, is sponsored by VIMS Sea Grant Marine Advisory Services and the Virginia Research Center for Archaeology.

The Virginia Sport Diving Workshop is designed to bring together representatives of Virginia's diving fraternity to exchange information on issues of interest to divers, dive clubs, dive shops, and other diver service operations.

The workshop agenda will include the following:

Overview of advanced diver certification programs and certification liability problems

Diver interaction opportunities with three Virginia research programs: the VIMS Eelgrass Transplanting Project, the VMRC Artificial Reef Program, and the Virginia Research Center for Archaeology (VRCA) Yorktown Shipwreck Program.

- Viewing of Yorktown Shipwreck Artifacts
- Underwater Medicine: The latest information from the Atlantic Submarine Force Senior Diving Medical Officer

## Panel Discussion: Pros and Cons of Regional Diver Services

Following Workshop sessions, participants will adjourn to the VIMS campus overlooking the York River at Gloucester Point for a "Decompression Time Film Festival." The Yorktown Victory Center's cafeteria will be available for lunch.

In order to not exceed the seating capacity of the Victory Center facilities, it is necessary that persons planning to attend the workshop register with VIMS. Please write Diving Workshop, Sea Grant Marine Advisory Services, VIMS, Gloucester Point, VA 23062 or call (804) 642-6131, Ext. 297.

## Marine Resource Bulletin

A Sea Grant Advisory Service

VOL. XIII, NO. 1 WINTER 1981

William J. Hargis, Jr. .... Dean, Director  
Maurice P. Lynch.....Sea Grant Director  
William D. DuPaul..... Head, Advisory Services

Kym Young..... Editor

The Marine Resource Bulletin is a Sea Grant Marine Advisory Service published quarterly by the Virginia Institute of Marine Science, School of Marine Science of the College of William and Mary. Subscriptions are available without charge. Address all inquiries and comments to the editor.

## Cover Note

Clam boats at Brown's Bay tie up after a day's work. The clambers have unloaded their clams (foreground) in burlap sacks on the dock of Shackleford-Thomas Seafood in Severn, Virginia.

Photograph: Kym Young

VIRGINIA INSTITUTE OF MARINE SCIENCE  
Gloucester Point, Virginia 23062

ADDRESS CORRECTION REQUESTED

BULK RATE  
U S POSTAGE  
PAID  
Gloucester Point, Va.  
PERMIT NO. 6