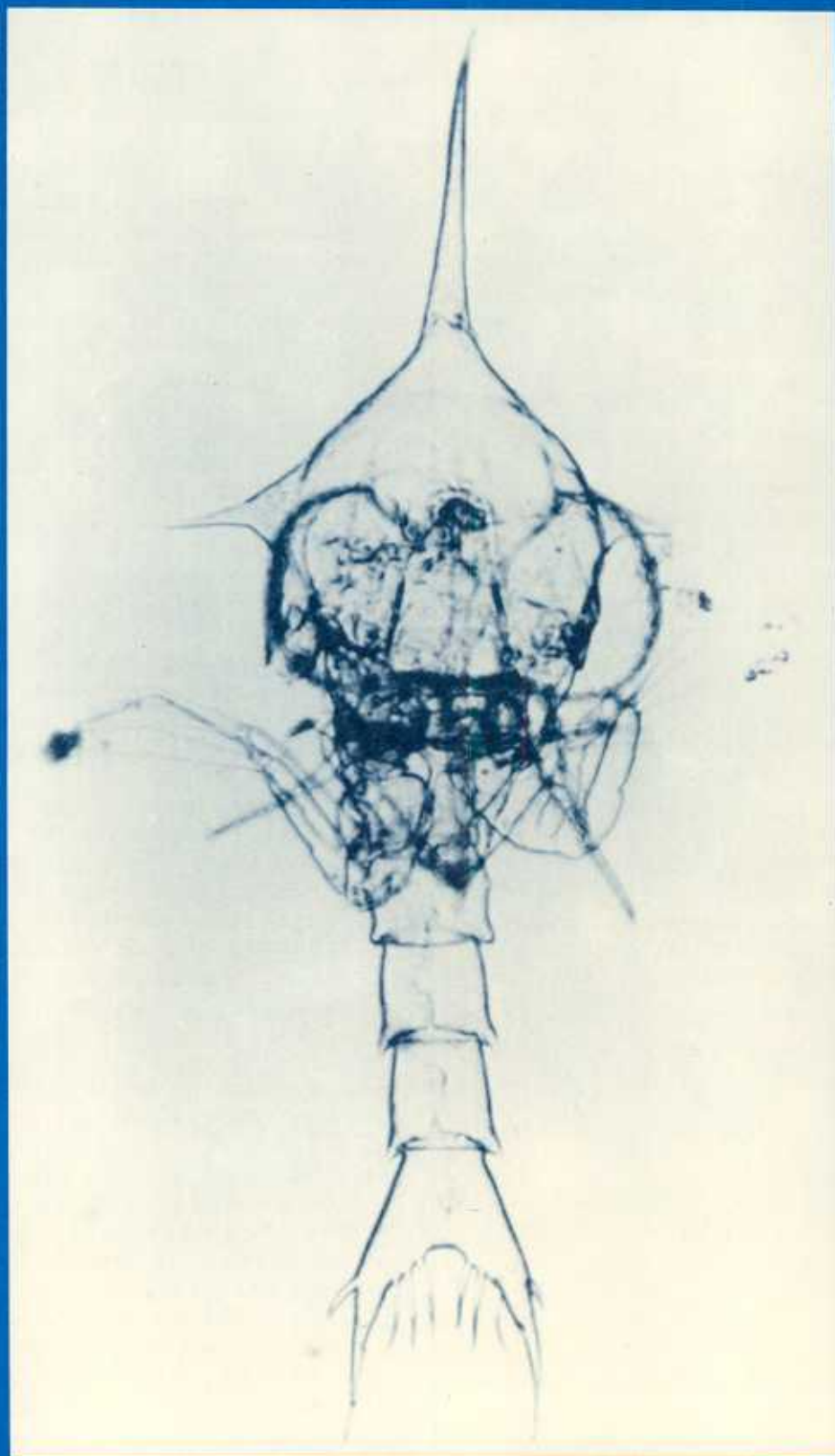


Marine
Resource

Bulletin

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Dredging for Blue Crabs:

Virginia's Winter Fishery

by Susan Schmidt

Small-craft warnings and wind chill factors do not beach the winter crab dredging fleet. During the mid-January freeze, one Perrin River dredger backed his boat out, dropping the heavy, metal dredges off the stern to break a path through the ice.

Fishermen may complain of the cold, but they are still out chasing crabs all winter. When the water gets cold, blue crabs bury themselves in the mud. There metal-toothed dredges tumble them out of hibernation. From December through March, dredgers are allowed to work the bottom of open Bay waters. Productive dredging grounds are in deep, high salinity waters of the lower Bay near and just north of the bridge-tunnel. Only on the ocean side of the Eastern Shore can dredgers go into creeks. Virginia law restricts a single dredge's width to 12 feet. Most boats carry two dredges which together cannot exceed 14 feet.

Chesapeake Bay blue crabs are harvested in pots in the summer and by

dredge in the winter. According to Paul Anninos, assistant director of Fisheries Management at the Virginia Marine Resources Commission (VMRC), the percent of hard crabs taken by dredge in recent years was 13 to 25 percent of the total poundage and 15 to 30 percent of the total dollar value. In 1983-84, the total hard crab harvest was 46,104,200 pounds, worth \$11,912,451. Dredge volume was 6,292,500 pounds (13.65 percent of the total), worth \$1,912,451 (17.3 percent of the total).

Dredging is hard work, risky both physically and financially; one day a dredger can catch the 25-barrel limit, or he can work all day to find three barrels of crabs which do not cover his expenses. However, like their fathers, some Chesapeake Bay watermen choose dredging as an alternative to oystering during the winter.

Processors are willing to pay a higher price for winter crabs to ensure a year-long supply. To clean crabs of grit they must roll and wash them. Typically, crab dredgers catch more than processors can pick in December, and prices are low. Later in the season, as crabs are scarcer, prices may climb to \$50 a barrel by March. In the 1984-85 dredge season, the supply in December was fantastic, and the average price per barrel paid to the crabber was \$18 to \$27. By mid-January, as the catch dropped, watermen were getting \$45 a barrel.

The crab population in the Bay is highly productive, but harvest varies widely year to year, and no one can predict precisely how many crabs will be caught. Fluctuation in crab stocks causes uncertainty among watermen, processors, and fisheries managers. Prices rise and fall as the supply

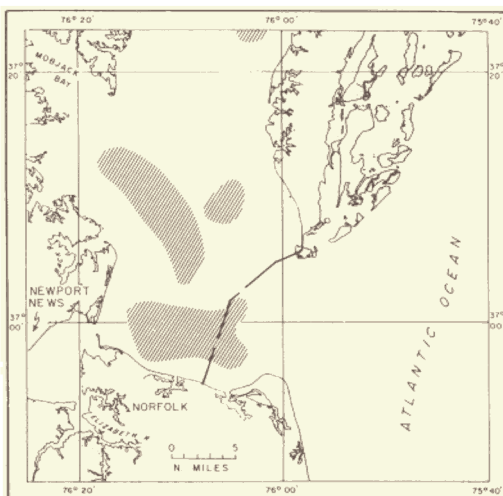


Chart of commercial crab dredging areas in the southern Chesapeake Bay.

shifts. The number of crabbing licenses keeps rising, and some Virginia dredgers worry about competition from Maryland boats.

Some understanding of population dynamics may temper concerns that winter dredging and out-of-state fishermen exploit crab stocks. Blue crabs produce a large number of young, have rapid growth, early maturity, and high mortality.

Each female crab can produce two million larvae. After emerging from the female's orange-brown egg clusters, crab larvae go through 7 to 8 shrimp-like stages, called zoea, in 30 to 50 days. Zoea hatched in June to August enter the next metamorphic stage, called megalopae, by October. Megalopae can last 5 to 67 days as temperature and salinity vary. Juveniles, which finally resemble crabs, molt 20 times before they become adults, ready for reproduction and for harvest.

The crab's life cycle influences where and how fishermen catch it. Before winter, adult females scurry south to higher salinities at the Bay mouth, ready to spawn when waters warm in the spring. Adult males which hibernate in deeper channels of fresher waters further north escape the dredges.

Because crabs move north and south seasonally, disregarding the Virginia-Maryland border, a recent court decision said out-of-state fishermen could harvest crabs in Virginia waters. As of October 1982, Maryland crabbers could follow females south for winter dredging and early spring potting. In the 1984-85 winter season Virginia has granted dredge licenses to 116 Virginia boats

and to eight Maryland boats.

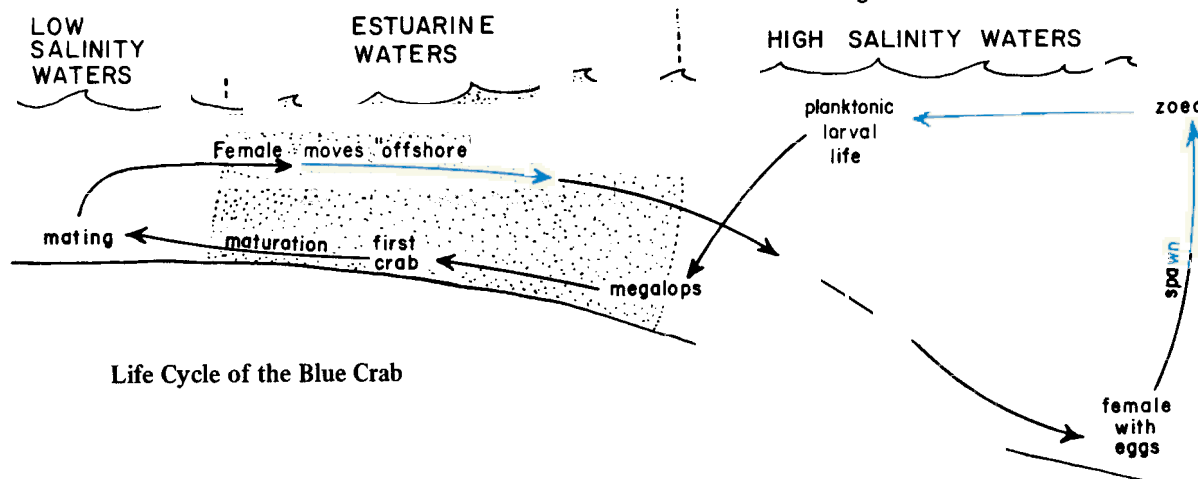
Eighty-five percent of dredged crabs are females. Some suspect that dredging females causes wider variations in crab populations. There is, however, no scientific evidence that winter dredging affects the number of crabs harvested in the next two years. It is more likely that environmental factors influence subsequent year stocks.

To many, the Chesapeake Bay means blue crabs, and Sea Grant is helping sponsor research to learn more about the crab's population dynamics.

The molting and reproductive cycles of the crab are well known, but scientists need to know more about the movement of early stages of crabs. If crab zoea are swept out to sea on surface waters, how do they return to the Chesapeake Bay? In what habitats do post-megalopal juveniles find shelter and food during the year?

Virginia scientists are studying the crab's early life stages in various habitats. John McConaughy and Donald Johnson at Old Dominion University (ODU) are measuring offshore wind and currents to determine how crab zoea return to the Bay. Robert J. Orth and Jacques van Montfrans at Virginia Institute of Marine Science (VIMS) are observing the role of seagrasses and marshes in protecting juvenile crabs.

To provide industry predictions, Willard Van Engel, also at VIMS, estimates adult population by counting juvenile crabs caught in river trawl surveys. Phillip Mundy, formerly at ODU, and Paul Anninos at VMRC are analyzing adult commercial catch data to provide a technique for monitoring performance during a season.



Life Cycle of the Blue Crab

Mike Oesterling

people on the water

"If he doesn't go out, a fisherman can't make a living," said Vendell Kellum, Jr., crab dredger in Gloucester County.

His day on the water can last 15 hours in sub-zero weather, and it was hard to find crabs in January.

"There were plenty of crabs for potting this fall because of the warm water," Kellum said, "but we started dredging too soon and scattered them. The state needs to postpone the opening of dredge season until the water is colder than 47 or 48 degrees."

Vendell Kellum carries his son, Timmy, 19, as crew on Kelly's Pride to tend the two dredges on the stern.

"I've got to hustle," Timmy Kellum said. He has to watch out for the chains that can damage hands or limbs while emptying dredges. "My father can't keep his eye on me when he's in a channel."

"Our speed with dredges down is three knots," Timmy said. "And the crabs were running on the bottom faster than three knots, against the tide. Imagine how fast they go with the tide."

Kellum's other son, Eric, 18, crews for his uncle, William Lloyd Templeman on Mary Arlene.

"The turbulence from a heavy wind will roll crabs out of the bottom," Templeman said. "They won't have enough life to dig back in and will die of the cold."

Templeman suggests that Maryland measure how many crabs hibernate north of the state line near Tangier Sound, "A lot they think they're going to catch in the spring will die anyway over the winter."

William Weston, owner of Martin and Richardson Seafood in Newport News, says crabs are scarce this winter, "Mother Nature has her hand in it. One storm can kill more than we can harvest in six weeks."



A winter dredger off Cape Charles loads barrels of crabs. Courtesy of the Mariners Museum in Newport News, Va.

Mrs. Jody Adams, owner of Old Dominion Seafood also in Newport News, pays more for winter dredged crabs than those potted in summer, but cannot sell them for more.

"I figure on a loss January to June. Crabs that I buy for \$4 a bushel in the summer can go as high as \$30 a bushel in the winter," Adams said. "I have to make enough June to December to offset the winter. I buy dredged crabs to keep my pickers employed in the winter and to keep my customers supplied."

"The industry is overworked," Templeman said. "Too many people are going in. There should be limits so the remaining few can make a living."



Predicting Blue Crab Populations

Since 1956 Willard Van Engel has used a trawl net survey program to study the life history and abundance of fish and invertebrate stocks of the lower Bay. Van Engel is a crustaceologist, or crab specialist, at VIMS. Monthly from May to December, he supervises the counting of small crabs in deep channels of several rivers. Trawls are hauled at five-mile intervals in ranges of salinity from the river mouth to 35 or 50 miles upriver. Van Engel's teams have sampled the York River since 1956, the James since '64 and the Rappahannock since '68.

The smallest juvenile crabs Van Engel catches are 1/4 inch (6 mm) and the largest are adults. Crabs hatched in June can reach legal harvest size of five inches their second August, 14 months after hatching. Crabs hatched in late August may not reach five inches until June of the third year, 26 months after hatching. Van Engel uses his trawl count to indicate year class strength. For example, crabs hatched from June to August 1983, the 1983 year class, will be harvested from August '84 through the summer of 1985.

Van Engel says man's fishing has very little effect on the crab population.

"There is no evidence of any long-term change in the number of of blue crabs in the Bay," Van Engel said. "Although the commercial catch varies from season to season and year to year, these variations result from short-term changes in the quality of the environment. Water temperature, salinity, dissolved oxygen, the quantity and quality of food affect reproduction, growth, and the rate of


survival of every stage in the crab's development."

Under Sea Grant funding Paul Anninos and Phillip Mundy are studying the pattern when and where crabs are caught commercially. Anninos has data available at VMRC. Mundy, formerly at Old Dominion University (ODU) and now at the University of Alaska, devised the performance curve evaluation for fisheries stocks.

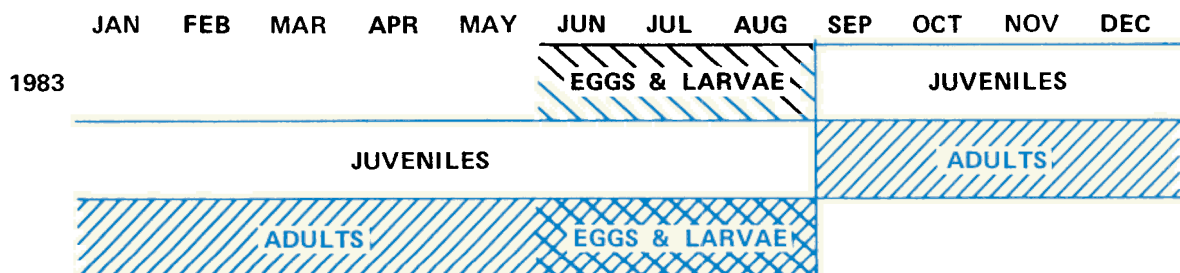
A performance curve plots the timing of a year's catch cumulatively. The pattern of harvest year to year is predictable. The shape of the performance curve is similar even if crab stock is low.

"Regardless of a 30 or 40 million pound catch," Anninos said, "the mean date, when 50 percent of the harvest has been caught, always falls within the second week of July."

The performance curve shows what proportion of a year's total harvest is caught by any date. For example, January and February catch data, available by the end of March, represent 20 percent of the year's catch. It may be possible to predict the year's total harvest by multiplying the first two months' catch by five. If such prediction techniques prove reliable, they could indicate the need for conservation measures.

According to Anninos, the Chesapeake Bay blue crab does not need immediate management action. The performance curve for crabs was drawn as a model because good data existed for 100 years. He says that VMRC may tackle a fishery management plan for blue crabs in the 1986-88 biennium. S.S. 

Progress of the 1983 year class - Chesapeake Bay Blue Crab





This blue crab megalopa at approximately 45 days is 1/10 inch (3 mm) long, magnified in this picture 32 times.



Susan Schmidt

To determine the concentration of blue crabs offshore, John McConaughy will count the larvae in this tray of samples under a microscope.

Offshore Larval

Do blue crab larvae which leave the Chesapeake Bay join a mid-Atlantic nursery stock which supplies North Carolina sounds and Delaware Bay, or do larvae spawned at the Bay mouth form a distinct population that returns only to the Chesapeake Bay?

With funding from the Virginia Sea Grant College Program, John R. McConaughy and Donald R. Johnson are studying the recruitment of blue crabs and the mechanisms for their retention within the area off the Bay mouth. Johnson, a physical oceanographer, measures wind and current, and McConaughy, a biological oceanographer, charts crab larval distribution. Sea Grant funds their teamwork at Old Dominion University (ODU) as part of a cooperative program, involving the Universities of Maryland and Delaware.

Crab larvae are hatched at the mouth of the Chesapeake Bay from June to August on a nighttime ebbside, according to McConaughy. Early zoeal stages respond to light, gravity and pressure. By moving toward light and away from the bottom, zoea are swept offshore by surface currents.

In his biological sampling, McConaughy has found all stages of larvae in the upper meter of water. The highest concentration was 30,000 first-stage larvae in one cubic meter during spawning at the Bay mouth. He found zoea and megalopae in the Bay mouth area and found intermediate zoeal stages at seaward stations, but never in the Bay. This indicates that larval development may occur outside the Bay and that juveniles re-enter the Bay to provide future harvests.

Johnson's physical measurements indicate that the current on the mid- to

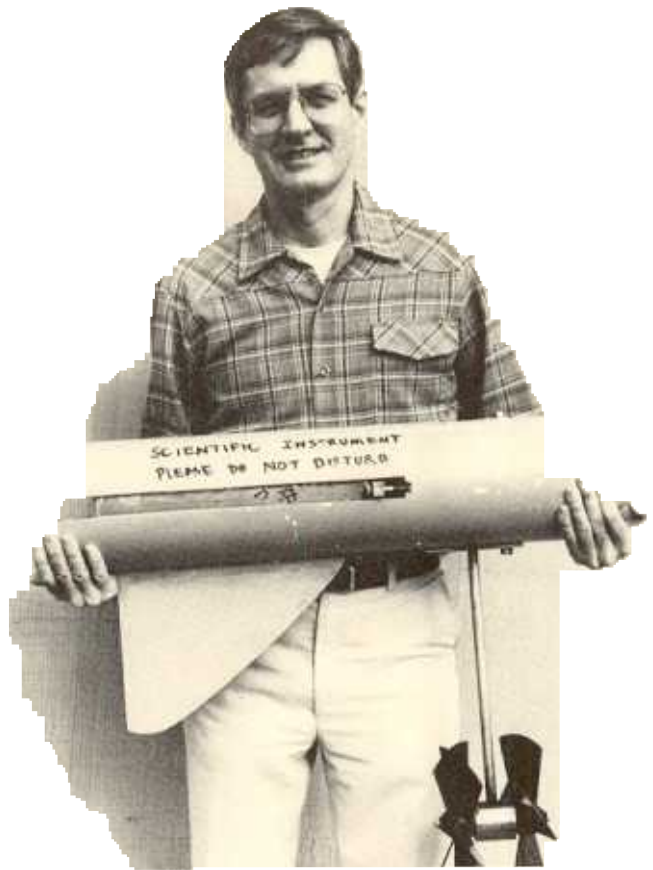
Crab Movement

outer-continental shelf flows southward all year. In July and August during the peak of crab spawning, winds are most likely light and variable. However, if wind stress is long and strong enough to the northeast and against mid-shelf flow, then crab larvae can be retained on the ocean shelf to be carried by on-shore currents back into the Chesapeake Bay.

Seasonal wind stress is generally similar in pattern from year to year, but varies in intensity. Fluctuations in annual crab harvests around a stable population suggest that variations in the offshore environment determine future crab harvests in the Bay. As wind directions change in September, the shoreward wind stress may transport larvae toward the Bay as a retention mechanism. However, McConaugha and Johnson doubt that wind is the major force for reinvasion of the estuary by megalopae and juvenile crabs.

Johnson is refining a model of the effect of the Chesapeake Bay plume on blue crab larval movement. The plume or tongue of water which flows out the mouth of the Bay on each ebbtide is distinctive in its salinity, suspended sediments and other properties. This plume flows southeast over the continental shelf in front of Virginia Beach. Depending on ocean currents and the volume of freshwater runoff in the Bay, the width and path of the plume vary. The western edge of the plume is usually one-half mile off the beach, and the seaward edge may range from 3 1/2 to 9 miles offshore.

McConaugha believes that megalopae, cued by the Bay plume, change their behavior and begin to migrate in the water column in response to tidal phases.



Susan Schmidt

Don Johnson measures the Chesapeake Bay plume with a current meter.

Accordingly, in August McConaugha will measure vertical migration of crab larvae at three stations -- the Bay mouth at the bridge-tunnel, 5-10 miles offshore, and the Light Tower on the continental shelf. If he verifies that there is no vertical migration at the Light Tower and there is vertical migration at the Bay mouth, he will try to find where the behavioral change begins.

Johnson and McConaugha continue to refine biological, wind and current data for the blue crab larval model to help understand annual fluctuations in Chesapeake Bay blue crab harvest. Ocean research is expensive, and the logistics of scheduling a 65-foot ship difficult. Adverse weather can often upset scientific sampling design. A major objective of the model of blue crab recruitment is to reduce the requirement for field sampling. While some field sampling will always be needed, the model will help to define the most cost-effective scheme. S.S.



Grassbeds and Marsh Creeks...

Juvenile Crab Habitat Use

During fall recruitment do crabs enter the Bay as megalopae or early juveniles, and what habitats do they prefer? VIMS biologists Robert J. Orth and Jacques van Montfrans are studying blue crab ecology in seagrass beds and tidal marsh creeks.

Specialized sampling gear has enabled Orth and van Montfrans to discover significant areas of crab habitat that have been previously overlooked. With a cylindrical drop net and suction pump, they remove all early-stage crabs from a three-square-meter bottom. Van Engel's trawl net excludes the tiny, early-stage crabs and is used in deep river channels, not shallows. By working in different areas with complementary

equipment, Orth, van Montfrans, and Van Engel are now covering habitats where young crabs occur.

Over the past two years in Little Monday Creek, Orth and van Montfrans have found average densities as high as 90 crabs per square meter in grassbeds and only 7 per square meter in a marsh creek. Except in summer, densities of blue crabs were 5 to 10 times higher in the grassbeds than marsh creeks. In addition, the fall recruitment pulse is stronger in grassbeds than marsh creeks. In the grassbed densities were uniformly high in fall, winter and spring, but in the marsh creek densities declined to zero over the same period.

Working in Little Monday Creek, scientists vacuum young blue crabs trapped by sampling nets.



Susan Schmidt



Susan Schmidt

Jacques van Montfrans (left) shows Bob Orth some early-stage crabs he sampled in a grassbed.

Most crabs found over the winter in the grassbed were less than an inch (25 mm) wide, indicating that grassbeds may be an important winter nursery area for young blue crabs. Crabs appear to move from grassbeds to marsh creeks in the spring, as grassbed abundance drops toward mid-summer.

Under Sea Grant funding in 1985 Orth will be adding marsh creek sites in lower salinity regions of the York River. Orth and van Montfrans will try to determine whether blue crabs are moving into these shallow habitats as megalopae or post-larval crabs. During the recruitment period from August to October, they will intensify sampling to weekly or even daily.

Through crab-tagging Orth and van Montfrans will examine how different habitats affect the survival of early blue crab stages. They will determine residence times, migration, mortality and production of these crabs in different habitats. External tags used in earlier studies have been lost when a crab sheds. For their mark-and-recap-

ture study Orth and van Montfrans have tested a fish-tagging method on crabs as small as .8 inches (20 mm). They will inject a magnetized, microwire tag, measuring .05 by .001 inches (1.5 by .25 mm), into the backfin muscle of captured crabs. They will release the tagged crabs in a small, tidal marsh creek and try to recapture them for the next several days. Tagged crabs can be identified electromagnetically.

Orth's involvement in transplanting seagrass has lead to an interest in the relationship between seagrass beds and crabs. Although the evidence is circumstantial at best, Orth noticed that the decline of Chesapeake Bay species of submerged aquatic vegetation during the late 1960's and early 70's was followed by a decline of commercial landings of blue crabs in the 70's. If Orth and van Montfrans can show that grassbeds are important to crabs, then there would be greater impetus not only to restore lost grassbeds, but also to preserve and protect existing beds still found in the lower Bay. S.S.



Seasoning Crabs



Every Chesapeake Bay cook has a recipe for steaming crabs. Some guard traditional family recipes; others buy Old Bay* or J.O.* seasonings. Spices can enhance Chesapeake Bay blue crabs.

Piecing together the blue crab's life cycle is marine science. So too the blending of spices can be precise as a science. Creating a seasoning is reached through experimenting, and just like scientific formulae, recipes can be recorded on computers for replication.

Two family companies near Baltimore prepare seasonings for steaming blue crabs. The Baltimore Spice Company makes Old Bay, and J. O. Spice Company blends J.O. seasoning. Both companies also market spices used in commercial food curing and preserving.

Dottie Martin manages J.O. Spice Company founded by her father James Ozzle Strigle in 1946. Strigle had worked in Chicago packing meat, but knew all about crabs from growing up on Tangier Island, home of many crab fishermen.

Gustave Brunn, a German Jewish refugee, set up a spice shop across from the Fish Market in Baltimore in 1939. Having operated a spice company near Frankfurt for 19 years, he knew spices from all over the world, but learned about crabs when he moved to the Chesapeake Bay. He noted which spices the seafood dealers were buying and started experimenting. Ralph Brunn is now executive vice-president of his father's company, the Baltimore Spice Company.

These crab spices burn your tongue if tasted straight. Old Bay and J.O. blend some of the same spices like pepper, celery seed, mustard, laurel leaves, paprika, mace and ginger, but use different proportions. J.O. adds salt, thyme and cinnamon; Old Bay Seasoning also uses pimento, cloves, cardamon, cassia and MSG.

Chloe Anderson, president of Zatarain Spice Company across the river from New

Orleans, recommends boiling seafood "because the flavor gets into the meat." Zatarain Crab Boil Mix*, like J.O. and Old Bay, blends mustard and laurel leaves and adds coriander, cayenne, dill and allspice as well.

Some cooks are careful as chemists; others add a "pinch of this and a dash of that." Every one who enjoys eating seafood should experiment with blending spices when cooking crabs.

Steamed Crabs

Virginia Conway, Kilmarnock

Pull the backs off live crabs so seasonings can go through. Put crabs in a kettle, then spread a layer of salt, black pepper, Old Bay and celery seed. After another layer of crabs, repeat the seasonings until the kettle's full. After the last layer of crabs, pour in a cup of vinegar and then the last seasonings on top. Put a pressure cooker on 15 pounds for 7 minutes, or a regular pot for 20 minutes.

Variations of this traditional steaming recipe abound. Instead of vinegar, Capt. Fred Haynie of Reedville steams crabs with apple juice; Raymond Shackelford of Bena has used beer.

Another variation is to boil the crabs (or crawfish as they do in Louisiana) with Zatarain's Crab Boil.

Tangier Crab Cakes

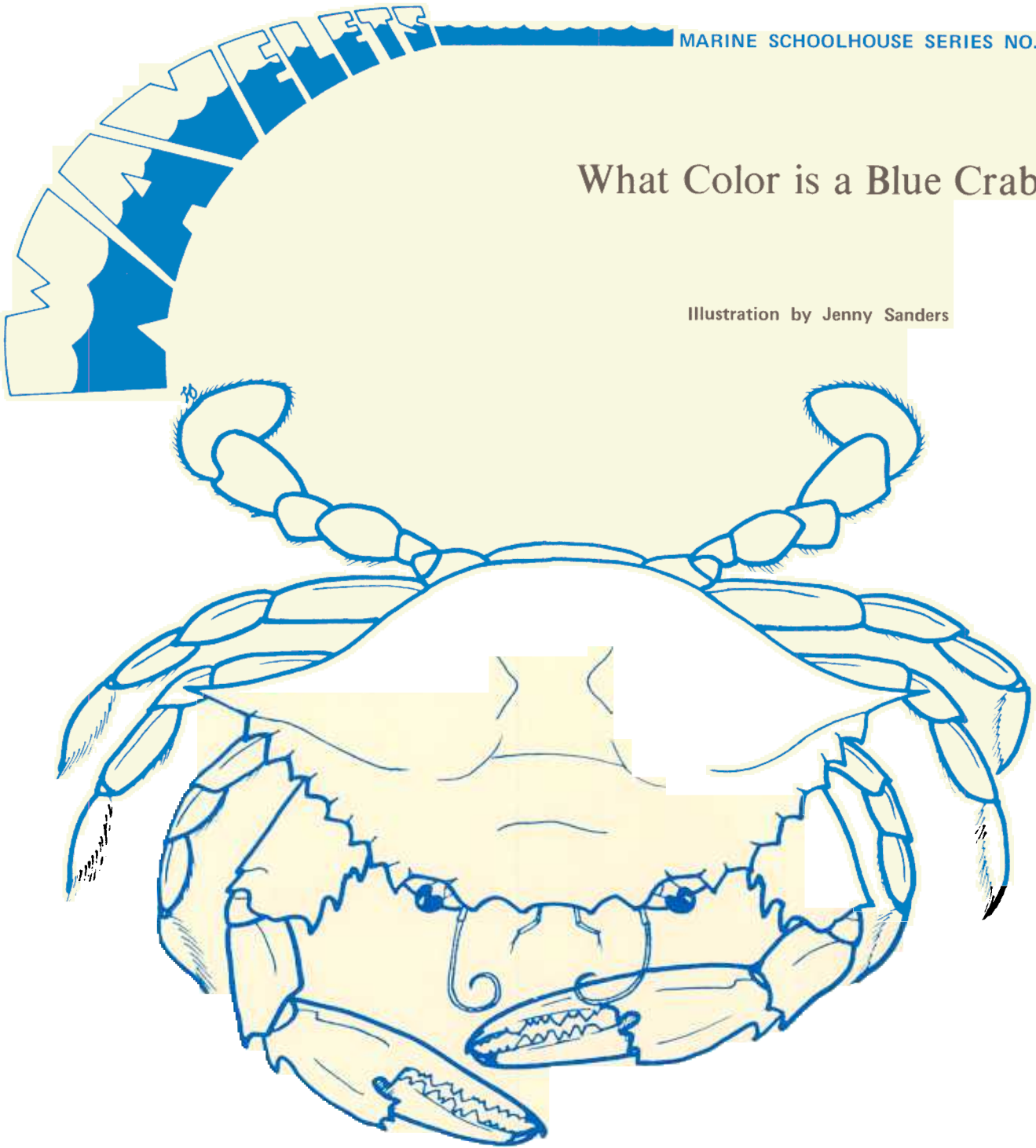
mix, form cakes, and fry:

- 1 lb. crabmeat
- 1 tsp. @ J.O. Seasoning, baking powder, mustard
- 1/4 tsp. @ salt, parsley flakes
- 3 tsp. mayonnaise
- 20 drops Worcestershire sauce
- 1 beaten egg
- 1 1/2 slices crumbled bread moistened with 3 tsp. milk

* Mention of any brand name is not an endorsement.

What Color is a Blue Crab?

Illustration by Jenny Sanders



Full-grown blue crabs exhibit many, varied colors other than blue. In fact, the blue crab's scientific name, Callinectes sapidus, translates as beautiful, savory swimmer. Evaluating the beauty of a crab is not a scientific procedure, but a matter of personal taste. However, scientists use color to help identify living things. To study the coloration of crabs, you will need:

1. A live crab (sold at most seafood markets).
2. A many-colored set of pencils, markers, or crayons.

Does the crab have red claws? If so, she is a female.

A thin, red line close to the edge of the second section of the backfin means the crab is a peeler, about to molt (shed) its shell.

Does your crab have a very white underside? If so, it probably molted recently.

Color in the line drawing of the blue crab. How many colors did you use? Compare your observations with someone else's.

Announcements

NMEA '85 Conference

Virginia Sea Grant will co-sponsor the 1985 annual conference of the NATIONAL MARINE EDUCATORS ASSOCIATION July 30-August 3 at the College of William and Mary in Williamsburg, Va.

The program will cover the Chesapeake Bay, seafood education, aquarium operation, maritime heritage, marine science, and related humanities, providing professional development opportunities for teachers of all academic disciplines.

Among one-day field trips will be a research vessel cruise, a tugboat ride and paper mill tour, fossil collection, and a tidal marsh canoe trip. An exhibit hall will demonstrate new materials in marine education, aquarium supplies, and scientific equipment. Special events are scheduled each evening; discount passes to Williamsburg attractions will be available.

The registration fee for NMEA members is \$60.00; for non-members, \$80.00. For information, contact Sue Gammisch, Virginia Sea Grant College Program at VIMS, Gloucester Point, VA 23062; (804) 642-7169.

SeaVUE '85

Virginia Sea Grant is sponsoring the fifth annual Southeast Virginia Underwater Expo (SeaVUE '85) April 20 at the Chamberlain Hotel in Hampton. Award-winning cinematographer Stan Waterman will host the evening film festival.

During the day-long expo, sportdiving enthusiasts can choose from concurrent seminars on underwater safety, travel, and photography. Exhibitors will include the national Diver's Alert Network (DAN), equipment manufacturers, and dive-related travel agencies.

For more information on SeaVUE '85 contact Jon Lucy, Sea Grant Marine Advisory Services, VIMS, Gloucester Point, VA 23062; (804) 642-7166.

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Susan Schmidt, Editor

Cover Note

At 20 days, this fourth-stage blue crab zoea is 1/25 inch (1 mm), magnified in this picture 250 times. Photo: Sherm Garrison, ODU. Crab larvae spawned at the mouth of the Chesapeake Bay move offshore during the summer, and after metamorphosis to megalopae, early juveniles return to spend the winter in eelgrass beds.

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