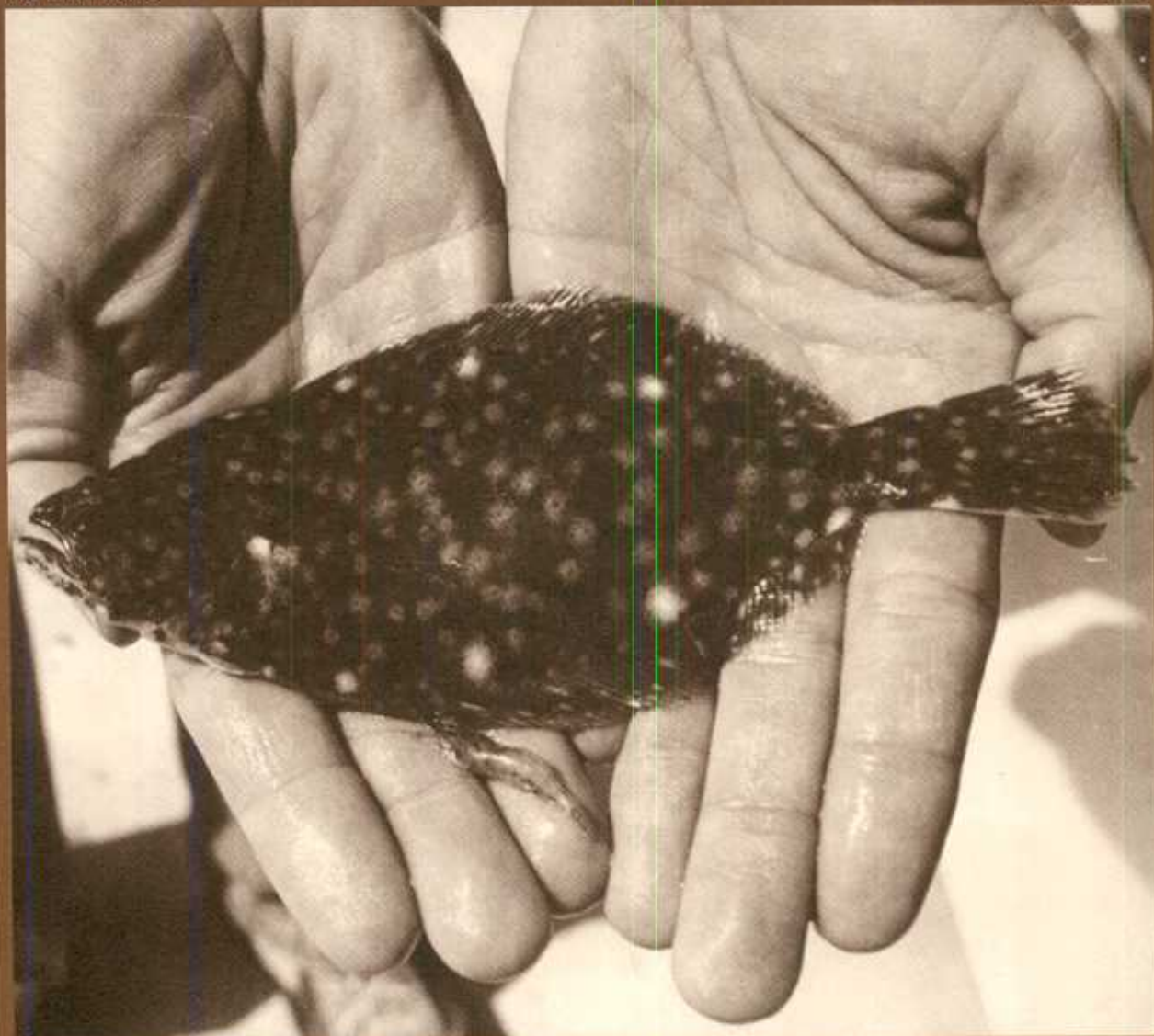




# Marine Resource Bulletin

VOL. XIV, NO. 2

SPRING 1982



*In This Issue -- flounder parasite • crab workshop • bluefish recipes  
• capsules for oysters • wavelets puzzle • spotlight on monkfish*

Virginia Sea Grant at VIMS/College of William & Mary



*By Dick Cook*

*Dr. Eugene M. Bureson, principal investigator in a Sea Grant project to examine the impact of a blood parasite on young summer flounder, displays one of the control fish used in the experiment.*

## BLOOD PARASITE CAUSES SUMMER FLOUNDER LOSS

Since 1978, a blood parasite or hemoflagellate, *Trypanoplasma bullocki*, has been known to cause mortality of yearling summer flounder in Chesapeake Bay and several other East Coast estuaries. The extent to which such mortality associated with *T. bullocki* can affect overall summer flounder stocks is a subject which has to concern both commercial and recreational fishermen in Virginia and other mid-Atlantic states.

Over the past 10 years, the summer flounder or fluke *Paralichthys dentatus* has ranked first in Virginia finfish trawler landings, both in number of pounds and in dollar value. This excellent food fish is also highly sought after by charter and head boat parties in the lower Chesapeake Bay and the shallow oceanside waters of the Eastern Shore.

According to Dr. Eugene M. Bureson, a senior marine scientist in the Department of Micro-

biology/pathology at VIMS, no one is certain at this time how long the parasite has been taking a percentage of young flounder, or just how serious the situation is.

Bureson has received 3-year Sea Grant Program support to determine the effects of parasite-caused mortality on the year class strength of summer flounder. Formerly, the investigator studied blood parasites in flounder for his dissertation subject at Oregon State University, before joining the VIMS staff in 1977.

"In 1979 it was determined that a marine leech was the vectoring organism that transferred the blood parasite *T. bullocki* from fish to fish," Bureson explained, "and I knew that the leech, *Calliobdella vivida*, had originally been described in 1872. It was reported sporadically until an outbreak on Atlantic menhaden off South Carolina in 1973.

"We already knew several important things about the leech and the blood flagellate. Both were present along the East Coast, and parasites similar to *T. bullocki* were known to cause disease in other parts of the world. When I say disease, in this case, I'm referring to the effects on fish, only. Even if humans consumed a fish carrying the flagellate, which would be highly unlikely, no health hazard would occur. *T. bullocki* is fish specific."

Burreson explained that the blood parasite has not been found in any adult flounder examined, and that yearling fish that survive an infestation cast the flagellate out when their immune response is triggered by warming water temperatures. Flounder either are killed as a result of infestation or get through the encounter, likely not to be infested again, since adult flounder and the leech which transmits *T. bullocki* normally don't occupy the nursery areas at the same time thereafter.

"In 1979 I looked for the blood parasite in Virginia waters, where I expected it might be found. We picked it up in hogchokers first, then traced it to summer flounder. Hogchokers, we discovered, were actually a reservoir for *T. bullocki*. They are present in Chesapeake Bay year round, and most of those we have examined have been host to the blood parasite, although they don't seem to be affected by it.

"The leech which transmits the flagellate from one fish to another is also apparently unaffected by *T. bullocki*. The leech will take a blood meal from any fish it can attach to, not just hogchokers and summer flounder. The thing is, at the time the leech hatches out of its egg cases in November, practically the only hosts available to it in Chesapeake Bay are the hogchoker and the yearling summer flounder, which spends its first year in the Bay and nearshore ocean waters.



Burreson Photo

*Trypanoplasma bullocki*, the blood parasite present in young-of-the-year summer flounder in lower Chesapeake Bay, may be seen at left center in this 1500 X magnification. The oval objects are red blood cells.

"So the leech hatches, feeds on a handy hogchoker, picks up *T. bullocki* in the process, then drops off to digest its meal and wait for another host fish. In winter, that next fish eventually is going to be a small summer flounder."

The leech lives and feeds during the winter, lays its egg cases and dies in May, just about the time water temperatures begin to rise in earnest and adult fish start to return to the Chesapeake Bay nursery area. Burreson said that both Chesapeake and Delaware Bays are flounder nursery areas, but it is thought that Pamlico Sound in North Carolina is the principal nursery area for the fish, where samples taken in January 1982 off Hatteras Inlet showed a 70 percent infection rate.

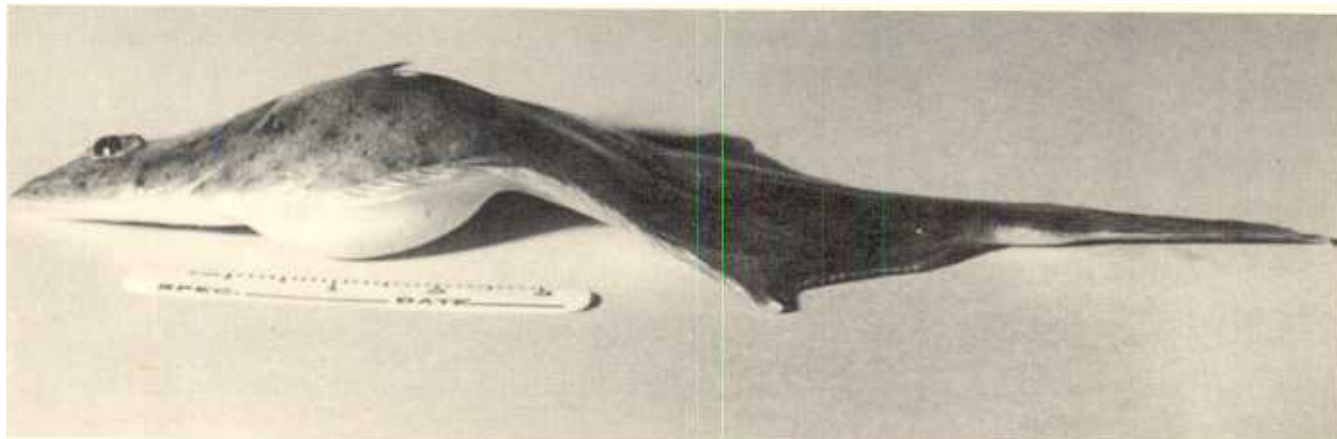
Laboratory experiments to further assess the lethal effects of *T. bullocki* on yearling summer flounder were begun in November 1980, and the first experiment was concluded in February 1981. Burreson said the results of the first experiment, plus monthly trawl catches examined for the lower York River and lower Chesapeake Bay, demonstrated 100 percent mortality of yearling summer flounder in the Bay that year. All of the fish contained *T. bullocki* and all were dead when brought up in the trawl. The percent mortality of yearling flounder that had migrated to the nearshore zone could not be estimated, according to Burreson, "but it was likely that some fish survived."

Burreson said that the 100 percent mortality in the Bay coincided with the severe cold snap in January 1981, and at a time when *T. bullocki* infestations in both experimental holding tank fish and those trawled from the York River were at a peak. Uninfected fish, those kept in the same tank as infected fish but separated by a barrier, survived the cold weather with no adverse effects, even though the water temperature was the same as the ambient York River water temperature at the time, about 0° C.

"I feel that *T. bullocki* was directly responsible for the mortality of summer flounder during that period," Burreson said, "and there is a strong indication that water temperature may be an important factor in survival. Studies conducted during the same period this past winter again showed 100 percent infestation of summer flounder sampled, although, perhaps because of milder water temperatures, not all of the flounder died.

"More information is needed about the role of temperature in mortality," Burreson emphasized, "and about the incidence of *T. bullocki* infestations in flounder that migrate offshore in fall. Some of those which linger longer than normal probably pick up the leech. A lot of the fish are migrating as the leeches are hatching. We have

Clinical signs of a heavy infestation of *T. bullocki* in yearling summer flounder include anemia and abdominal swelling, seen here.



Burreson Photo

no proof that all infestations are fatal, or whether mortality occurs only in infected fish subjected to temperatures below 2° or 3° C."

Further experiments will be conducted on young of the year flounder in 1982. Burreson said that the difference in the procedure from the past year will be one of temperature control, where formerly there was none. This winter, when the ambient York River temperatures drops below 5° C., the temperature in the experimental flow-through tank will not be allowed to drop further. Then the survival of flounder taken by trawl will be compared to survival of the infected test fish.

At present, no hard and fast conclusions can be drawn from the work Burreson is conducting,

and it is not yet known whether *T. bullocki* infections should be given special consideration in assessment of flounder stocks. Even so, the Mid-Atlantic Management Council, responsible for formulating a summer flounder management plan which sets guidelines for harvesting the species, is interested. Natural mortality is factored into the maximum sustained yield (MSY) when designing a typical management plan for any species: a certain percent of any organism will die of "natural causes." What isn't known at this time is whether *T. bullocki* has always caused some natural mortality, or whether it is something relatively new that may cause managers to refigure natural mortality estimates for stocks of summer flounder available to both the commercial and recreational fisheries.

## CRAB WORKSHOP STRESSES MARKETING

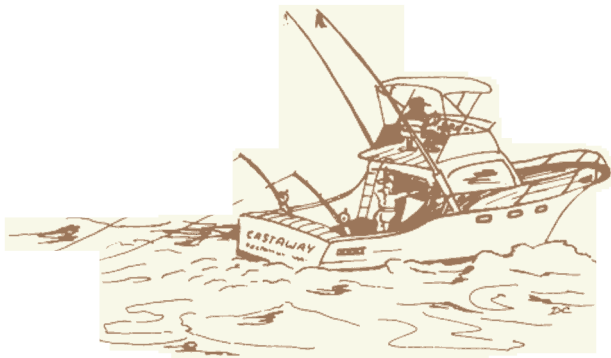
There are many different operational designs for shedding soft crabs, with the differences based upon personal preference, available cash and location. The important thing is, they all work. That was the consensus of opinion of more than 100 crab shedders and other interested persons who attended a softshell crab workshop April 3 at Rappahannock Community College in Warsaw, Virginia.

The workshop, sponsored by the Virginia Sea Grant Marine Advisory Service, involved a sharing of knowledge on the subject, and those in the industry were able to provide advice to save potential crab shedders time, money and headaches. Coordinator of the workshop was Michael J. Oesterling, Commercial Fisheries Advisory Specialist at VIMS.

Crab shedders were advised not to be afraid of hard work, since, said Oesterling, "the time may come when traditional East Coast markets (such as those in New York and Maryland) will become saturated with the product, and shedders will need to start looking for new markets. People just now getting into the business should put plenty of effort into marketing."

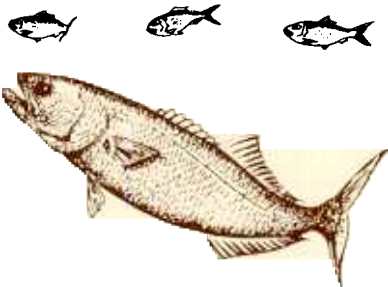
Also discussed were the pros and cons of marketing the crabs fresh or frozen. "It all depends on how much time the shedder can spend on marketing" Oesterling said. "Marketing frozen crabs is more expensive, due to refrigeration costs, but frozen crabs can be kept until a good market price can be had. Fresh crabs involve no freezing or packing costs. When you come right down to it, marketing success depends on customer preference, and that can change within the course of a season."

# FISH HOUSE KITCHEN



Bluefish are eagerly awaited in Virginia waters each spring by commercial and recreational fishermen alike. Drawn by rising temperatures of nearshore waters, the blues move up along the Carolinas, finally to enter Chesapeake Bay in late April or early May. As these hungry predators pursue the schools of forage fish, anglers shake off winter doldrums to join action with one of the sportiest and tastiest of Virginia's seafare.

To help you celebrate your catch, here are three recipes from the kitchen of Laurie Dean, Sea Grant Home Economist with the VPI&SU Seafood Processing and Extension Unit in Hampton, VA.



## BLUEFISH-TOMATO CUPS

3 cups flaked bluefish  
1 cup chopped celery  
2/3 cup chopped green pepper  
1/4 cup chopped onion  
2 t. curry powder  
1 t. salt  
1 cup mayonnaise or salad dressing  
6 tomatoes  
salad greens  
chopped parsley

Combine all ingredients except tomatoes, salad greens and chopped parsley. Toss lightly. Chill. Cut each tomato into 5 or 6 sections almost to the stem end and spread apart slightly. Fill each tomato with bluefish salad. Garnish with chopped parsley. Serve on salad greens. Makes 6 servings.

## GRILLED BLUEFISH FILLETS

2 lb. bluefish fillets  
1/2 cup catsup  
1/4 cup melted fat or oil  
3 T. lemon juice  
2 T. liquid smoke  
2 T. vinegar  
1 t. salt  
1 t. Worcestershire sauce  
1/2 t. powdered mustard  
1/2 t. grated onion  
1/4 t. paprika  
1 clove garlic, finely chopped  
3 drops liquid hot pepper sauce

Cut fillets into serving-size portions and place in a single layer in a shallow baking dish. Combine remaining ingredients. Pour sauce over fish and let stand 30 minutes, turning once. Remove fish, reserving sauce for basting. Place fish in well-greased, hinged wire grills. Cook about 4 inches from moderately hot coals for 8 minutes. Baste with sauce. Turn and cook for 7-10 minutes longer or until fish flakes easily when tested with a fork. Serves 6

## BLUEFISH IN PUFF SHELLS

1 lb. cooked, flaked bluefish  
1 cup finely chopped celery  
1/2 cup mayonnaise or salad dressing  
2 T. chopped onion  
2 T. chopped sweet pickle  
1/4 t. salt  
1/8 t. white pepper  
Puff shells

Combine all ingredients except puff shells. Mix thoroughly. Cut tops from puff shells. Fill each puff shell with approximately 2 teaspoonfuls of salad. Makes approximately 55 hors d'oeuvres.

## PUFF SHELLS

1/2 cup boiling water  
1/4 cup margarine or butter  
1/8 teaspoon salt  
1/2 cup flour  
2 eggs

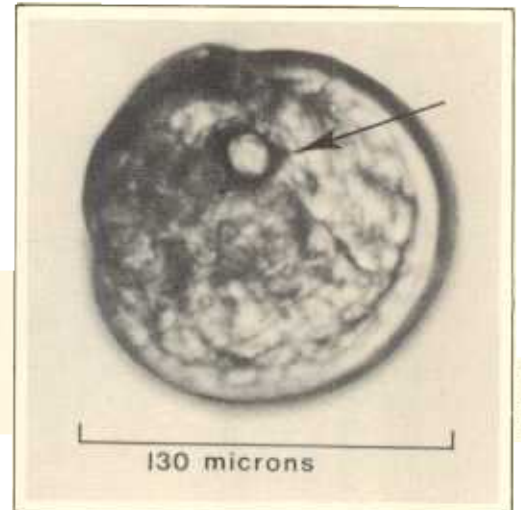
Combine water, butter, and salt in a saucepan and bring to a boil. Add flour all at once and stir vigorously until mixture forms a ball and leaves the side of the pan. Remove from heat. Add eggs, one at a time, beating thoroughly after each addition. Continue beating until a stiff dough is formed. Drop by level teaspoonfuls on a well-greased cookie sheet, 15 by 12 inches. Bake in a very hot oven, 450° F., for 10 minutes. Reduce heat to 350° F., and continue baking about 10 minutes longer. Makes approximately 55 puff shells.

# Capsule Diet for Larval Oysters

By Rebecca Clark



D. Cook Photo



J. Thompson Photo

Left, VIMS researchers Fu-Lin E. Chu and Dr. Kenneth L. Webb have found that larval oysters will eat artificial food in capsule form (above). Below, Chu and Webb examine a mylar sheet covered with spat (Juvenile oysters which have attached).



Researchers at the Virginia Institute of Marine Science (VIMS) believe that one of the major difficulties in commercial seafood hatcheries is the fact that the larvae depend upon live organisms for food. In the case of oysters, certain types of algae are necessary, but are expensive to produce and maintain in a culture environment.

VIMS scientists have for the past two years focused their attention on developing an artificial diet for larval oysters, and to date have found that larvae will eat food in tiny capsules, similar to the "time release" capsules we humans take for illness. Larvae that eat microencapsulated food grow nearly as rapidly as larvae eating the costly algae. With further diet improvements, they may grow better.

In the past, according to literature on the subject written by VIMS scientists, dependence upon live algae has obstructed investigations into the nutritional requirements of bivalve molluscs and crustaceans during their planktonic larval life.

During the last decade, much information has been gained on larval nutrition. Although there is still much to be learned, the investigation by Dr. Ken Webb and his colleagues, Fu-Lin E. Chu and Dan Hepworth, has revealed that oysters can produce some nutrients on their own from other food components. With that in mind, the scientists are learning what can be eliminated from the microencapsulated diet formula.

Artificial food has been found acceptable to a number of marine organisms that are filter-feeders. But, according to research, non-encapsulated food is subject to disintegration and bacterial contamination. Hence, an encapsulated diet. Webb, Chu, and Hepworth have concentrated their efforts on defining the biochemical components of the living algae used as oyster food, and on techniques to encapsulate these materials in a form acceptable to oysters. They will determine exactly what the oyster larvae needs; and what the larvae can produce from other foods.

The VIMS researchers will test diets composed of mixtures of fatty acids, amino acids and carbohydrates, and a diet of encapsulated cells of

the three types of algae on which larval oysters are normally fed. The three algae are *Chlorella* sp., *Pyramimonas virginica*, and *Pseudoisochrysis paradoxa*, or for short, the CPP diet.

In 1982 and 1983, research will also focus on various combinations of the fatty acid and amino acid diet, along with a diet of soybean extract mixed with cod liver oil and glucose. Microcapsules filled with cod liver oil were found to be rich in fatty acids. Investigators also found that cod liver oil has a fatty acid composition similar to that in the CPP algal diet.

To determine which diet was best, the scientists studied the protein amino acid, lipid fatty acid and carbohydrate compositions of the algal diet throughout the larval cycle.

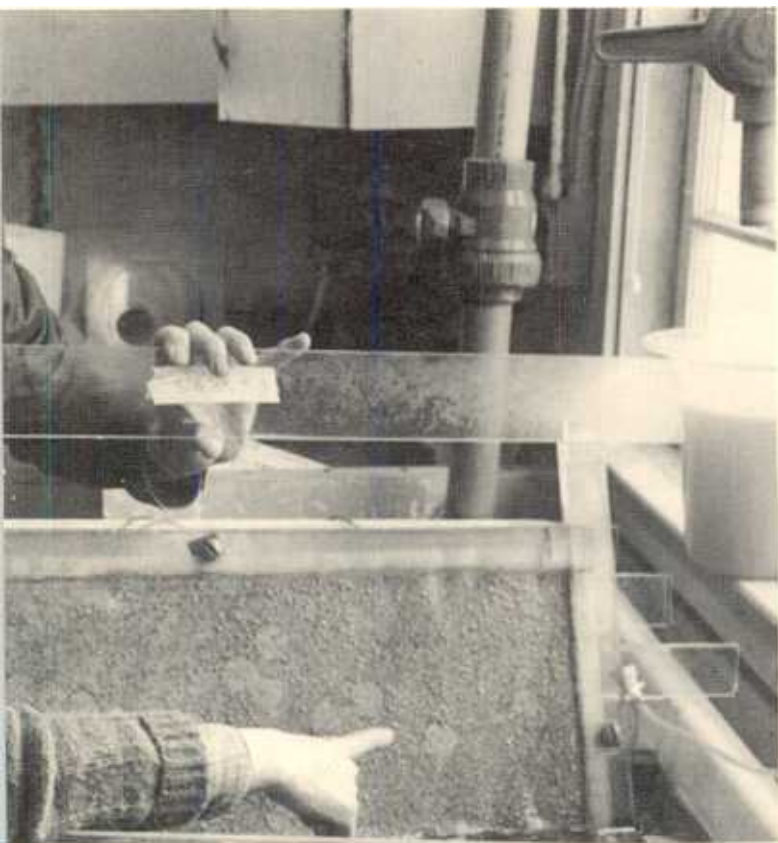
According to research objectives, "a comparison of the composition of the CPP diet and of the larval oyster tissue will provide a preliminary understanding of the contribution of the dietary components to good oyster growth."

A microencapsulated diet may help make healthier seed oysters, though the research findings may not be immediately useful to the Virginia oyster industry. However, if scientists can come up with a more economical way to produce hardier (i.e. more disease resistant) seed, commercial oyster growers would have an alternative to their present source of seed, which is tonged from natural beds.

Sea Grant and the Virginia Institute of Marine Science have been involved in various aspects of oyster culture since the 1960's. Research has included, in addition to artificial food, the breeding of disease-resistant oysters and design of an oyster seed hatchery system.

"We know very little about oyster nutrition," Webb said. "A successful artificial food would enable us to give defined diets to the organism, and find its nutritional requirements. I think we have a long way to go before we have mariculture-produced oysters in Virginia." He added, "This project might produce good technology to have available in Virginia in case the James River doesn't produce enough spat."

The Sea Grant project to develop artificial food for larval oysters is scheduled to run through December 1983. When asked if his research on nutrition will be finished by the end of 1983, Webb said, "I hope we don't run out of research ideas by then. Good scientific research often raises more questions than it answers."



D. Cook Photo

# SEA GRANT PUBLICATIONS

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



**TIDE GRAPHS FOR HAMPTON ROADS, VIRGINIA and TIDE GRAPHS FOR WACHAPREAGUE, VIRGINIA** - Published quarterly. Free subscription obtained by written request.

**COMMERCIAL FISHING NEWSLETTER** - Published quarterly. Free subscription obtained by written request.

**"FISH " LEAFLETS** (shad, black sea bass, croaker, spot, clam, oyster, soft crab, blue crab, flounder, tuna, sea trout, monkfish and bluefish) - Life history, recreational and commercial importance information, plus tempting recipes for each! Free.

**THE PRESENT AND POTENTIAL PRODUCTIVITY OF THE BAYLOR GROUNDS IN VIRGINIA (Vols. I and II)** - Dexter S. Haven, James P. Whitcomb and Paul C. Kendall. SRAMSOE No. 243. Vol. I, 167 pages. Vol. II, 154 pages plus 64 charts. \$10.00 for both volumes.

**AUDIOVISUAL AIDS AND PUBLICATIONS AVAILABLE FROM THE VIMS SEA GRANT MARINE EDUCATION CENTER** - 40 pages. \$1.00.

**FISHY ACTIVITIES FOR YOUR SMALL FRY** - Mary E. Sparrow, Frances L. Lawrence and Ronald N. Giese. Educational Series No. 28. 36 pages. \$2.00.

**CLIMATE SCALE ENVIRONMENTAL FACTORS AFFECTING YEAR CLASS FLUCTUATIONS OF CHESAPEAKE BAY CROAKER, *Micropogonias undulatus*** - B.L. Norcross and H.M. Austin. Special Scientific Report No. 110, 72 pages. \$2.00.

**A DESCRIPTION OF THE COMMERCIAL MARINE FISHERIES OF VIRGINIA** - James Zaborski. SRAMSOE No. 233, 24 pages. First copy free to Virginia residents; all others \$1.00.

**WATERFRONT FESTIVALS: Catalysts for Maritime Heritage and Waterfront Redevelopment** - Jon Lucy. VIMS Contribution No. 1017. 8 pages. 25 cents

**MANUAL FOR GROWING THE HARD CLAM *Mercenaria*** - Michael Castagna, John N. Kraeuter. SRAMSOE No. 249, 110 pages. \$3.00.

**NONTRADITIONAL MARINE EDUCATION ACTIVITIES: a planning guide** - Elizabeth A. Cornell. Educational Series No. 32. 11 pages of text, plus 9 MSM (Marine Science Methods) insert lesson plans. \$1.50 per issue inclusive.

**THE MARINE TURTLES OF VIRGINIA: with notes on identification and natural history** - John A. Musick. A field guide. 24 pages. \$1.00.

**RECREATIONAL BOATING IN VIRGINIA: a preliminary analysis** - Tom Murray and Jon Lucy. SRAMSOE No. 251, 31 pages.

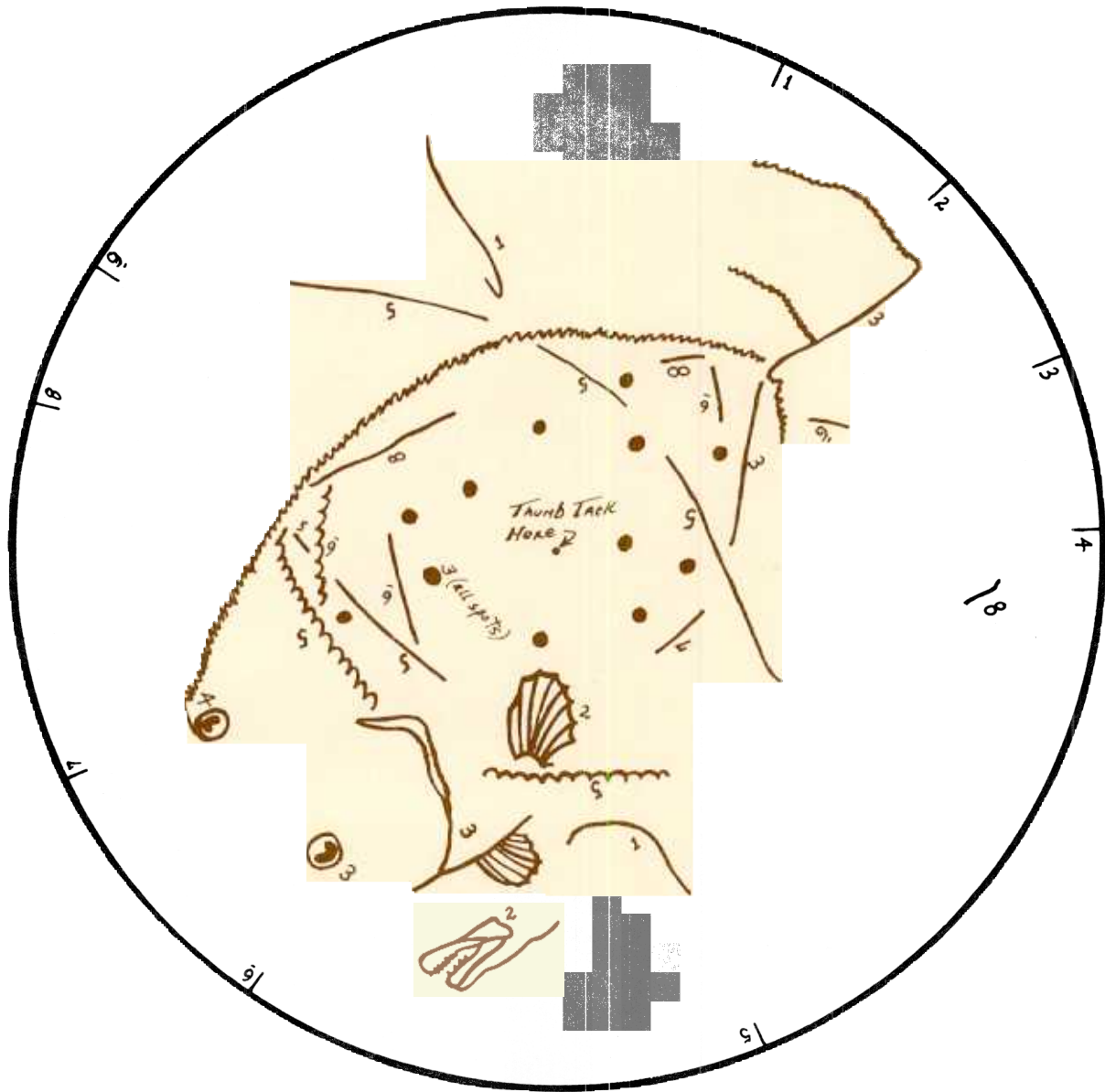
This report provides an overview of the status and significance of recreational boating in the state. Activities associated with Virginia's nearly 140,000 registered pleasure boaters generated \$120 million in direct economic impact during 1980. 26 pages. \$1.00.

**HANDLE WITH CARE: SOME MID-ATLANTIC MARINE ANIMALS THAT DEMAND YOUR RESPECT** - Jon Lucy. Educational Series No. 25. 22 pages. \$1.00.

**VIRGINIA'S CHARTER AND HEAD BOAT FISHERY: analysis of catch and socioeconomic impacts** - Anne R. Marshall and Jon A. Lucy. SRAMSOE No. 253. 90 pages. \$2.00.

This publication represents the first documentation of the charter and head boat industry in Virginia, a \$6 million - plus business. Vessels and equipment, economic structure, effort and catch and factors affecting the future are explored. Valuable to fisheries and resource managers.

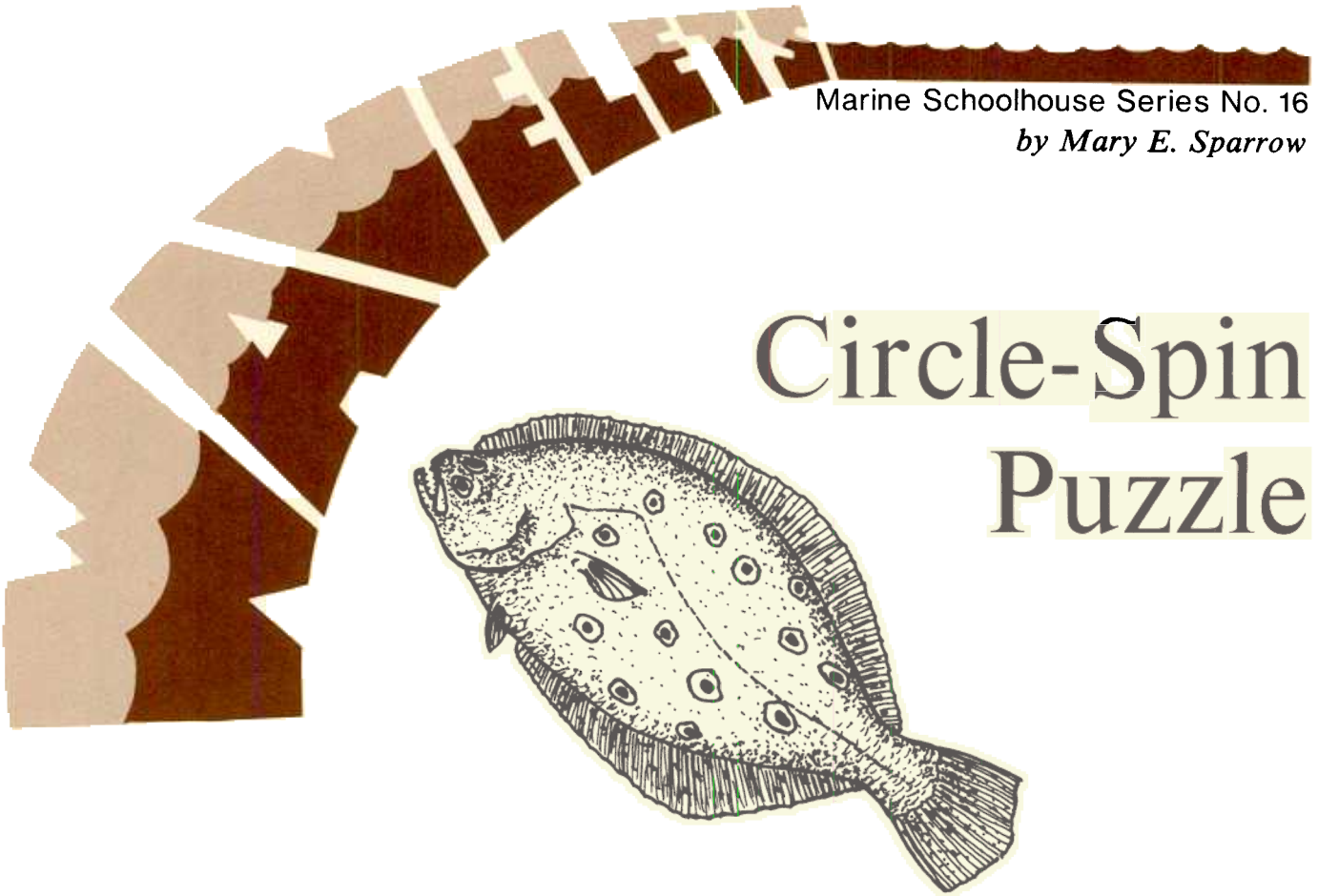
**THE CHESAPEAKE: A BOATING GUIDE TO WEATHER** - Jon Lucy, Terry Ritter and Jerry La Rue. Educational Series No. 25. 22 pages. \$1.00.



**Directions:**

1. Cut out circle-spin puzzle around outer margin.
2. Place puzzle on a sheet of paper with a piece of carbon paper between puzzle and paper.
3. Thumb-tack through center (use a piece of cardboard underneath to protect desk or table top)
4. Pencil a mark on paper at top of circle.
5. Swivel circle until Number 1 on circle edge is on the mark. Then trace over all thick solid lines marked "1".
6. Swivel circle to Number 2. Repeat until all lines have been traced. Do this for each number, all around the circle.
7. Lift circle and carbon and see the fruits of your effort!

# Circle-Spin Puzzle



The summer flounder or fluke, *Paralichthys dentatus*, is a bottom-dwelling fish that belongs to a group known as "flatfishes." Most fish with which we are commonly familiar are symmetrical. That means their physical structure is exactly the same on each side. The eyes are located one to each side and so are the paired pectoral and pelvic fins. The flounder, in its very early stages of life, is a symmetrical fish. As it develops, however, its body changes. This change, or metamorphosis, results in the gradual movement of one eye to the opposite side. The fins extend from head to tail and the mouth twists. This type of change is typical of flatfish. Flatfish, such as the flounder, are described by scientists as being "dorso-ventrally compressed," which means flattened from top to bottom.

The markings and color patterns of the flounder are influenced by the color and nature of the bottom surface on which the fish lies. The top or left side of the fish is generally some shade of brown or olive color with small, round dark spots scattered about. The fluke has the ability to change the color of its left side (the top side) to match the color of the bottom surface on which it lies. The right (or bottom) side of the fish is creamy white. This color combination camou-

flages the summer flounder, making it difficult for predators to see the fish from above or below.

The flounder is a predator itself, possessing a large mouth and many sharply pointed teeth, good for holding its prey. It also is a strong swimmer. The fluke has the habit of burrowing in the sand with only its eyes protruding. There it will lie motionless, waiting for prey to swim close. Flounder feed on other fish, squid, worms and crustaceans.

Summer flounder range from New England to Florida and begin to appear in the lower Chesapeake Bay by March. As Bay waters warm, the fish move up the Bay. Summer flounder are the most important finfish caught commercially in Virginia, both in number of pounds and dollar value. They are most often caught with trawl nets pulled behind large fishing vessels. Recreational fishermen catch many flounder with hook and line. The fish's delicate flavor makes it a prize catch for anyone's dinner table.

The art activity on the reverse side was adapted from Mauldin, L. and D. Frankenberg. 1978. COASTAL ECOLOGY, Unit Three. North Carolina Marine Education Manual. UNC-SG-78-14-C.

# VIMS Monkfish STUDY

By Rebecca Clark



D. Cook Photo

*A dramatic increase in monkfish landings in Virginia over the last 5 years has sparked a Sea Grant project being conducted at VIMS by marine scientists Dr. John A. Musick (left) and James A. Colvocoresses. Abundance, seasonality, habitat and reproductive potential of monkfish will be examined.*

As inflation continues to eat into food budgets, consumers more and more are looking for economical food sources. Even though most species of fish have traditionally been considered nutritious dollar stretchers, many people are still slow to try anything new where food is concerned. These days, however, fishermen and retail grocers are attempting to overcome that customer reluctance by attractively marketing some of the lesser-appreciated but excellent-tasting fish varieties found in Virginia waters. One of these is the monkfish.

Currently, several marine scientists at VIMS are involved in a 2-year Sea Grant sponsored project to determine the abundance, seasonality, habitat and reproductive potential of monkfish stocks. By next year the scientists, John A. Musick and James A. Colvocoresses, hope to make the first estimate of how large a fishery can be sustained on the species.

The monkfish belongs to a group known as anglerfishes, which, according to Musick, also includes a similar species which has been popular as seafood in Europe for centuries. Up until 5 years ago, the monkfish, common in Virginia's continental shelf-waters, was virtually ignored by most commercial fishermen. They simply handled it as a by-catch when fishing for sea scallops and other traditional species.

"We knew there were European markets for shark and monkfish," said Colvocoresses, "but now domestic markets are developing for these fish. Americans are finally becoming aware of them as seafood."

Musick and Colvocoresses are being assisted in the monkfish study by graduate student Michael Armstrong. So far, the scientists have taken samples for studies of age, growth, reproductive capability, habitat and seasonal availability and distribution.

The VIMS researchers want to describe areas of monkfish abundance in relation to commercial size. Until fish reach a certain size, they are of little or no value to commercial fishermen. Monkfish generally are found from Nova Scotia to just south of Cape Hatteras.

In 1980, the monkfish catch in Virginia waters represented approximately one percent of the world catch. While the figure may seem small, it is significant, considering that monkfish harvests were nonexistent in Virginia just a few years ago.

European fisheries for monkfish are being overfished, resulting in smaller and smaller catches. Declining catches have, in turn, led to higher prices. Those increased prices have provided

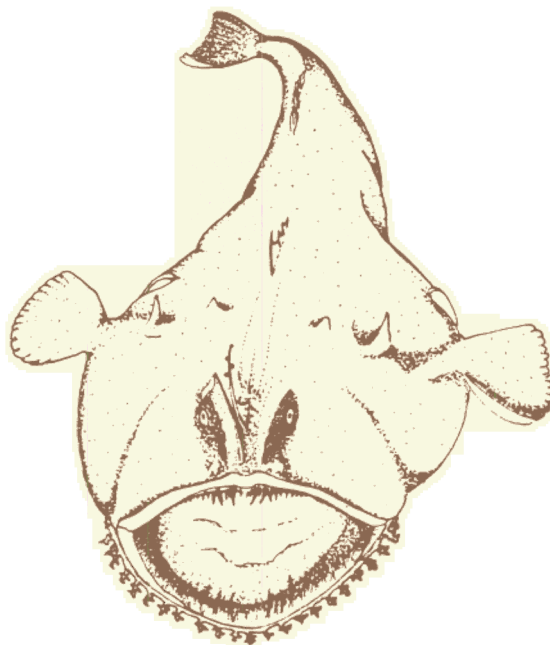
(Cont. Page 12)

American fishermen an incentive to export their catch.

"Our fishermen know the monkfish has a value overseas, so what they once threw overboard is now being landed. They know the export market is there, and that even counting shipping costs, a profit can be made," Colvocoresses explained.

Landings of monkfish in Virginia have dramatically increased over the past several years, from zero in 1976 to about 800,000 lbs. of filets worth \$360,000 in 1981. The fish are headed, gutted and the filets iced at sea. At retail, monkfish filets sell for about \$2.19 - \$2.50 per pound.

Some gourmets compare the taste, texture and color of prepared monkfish to lobster. With increased attention focused on this and other underutilized species, Sea Grant agrees that stock abundance and growth, reproductive potential and harvest projections must be accurately figured to make optimum use of the resource.



## Marine Resource Bulletin

A Sea Grant Advisory Service

VOL. XIV, NO. 2 SPRING 1982

Dr. Frank O. Perkins . . . . . Dean/Director,  
Virginia Institute of Marine Science

Dr. William Rickards . . . . . Director,  
Virginia Sea Grant

Dr. William D. DuPaul . . . . . Head,  
Advisory Services

The Marine Resource Bulletin is a quarterly publication of the Marine Advisory Service of the Virginia Sea Grant Program, which is administered by the Virginia Graduate Marine Science Consortium, with members at William and Mary, Old Dominion University, University of Virginia and Virginia Polytechnic and State University. Subscriptions are available without charge. Address all inquiries and comments to the editor.

Dick Cook . . . . . Editor

## Cover Note

The summer flounder, a Virginia favorite, currently is the subject of a blood parasite study. The object just beneath the fish is a grass shrimp, a natural food provided flounder in the study. Dick Cook Photo

Virginia Institute of Marine Science  
Gloucester Point, Virginia 23062

Address Correction Requested

Non Profit  
Organization

U.S. POSTAGE PAID  
Gloucester Point, VA  
Permit No. 6