Marine Resource Bulletin

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Virginia Sea Grant at VIMS/College of William & Mary

SHED IN VIRGINIA

by Dick Cook

A Contemporary Review of the Historic Soft-shell Crab Industry

VIRGINIA HAS LONG BEEN a leading producer of blue crabs. In fact, the Tidewater area of the state is famous for the tasty crustacean, and for good reason. In 1982, hard crab landings in Virginia totaled 44,057,437 pounds worth $9,128,196 dockside.

The soft blue crab, the succulent molt stage of the same animal, *Callinectes sapidus*, is even more in demand as a gourmet item than the hard shelled form. Over the past decade, the National Office of Sea Grant has been actively promoting the development of this specialized fishing industry, worth $6.5 million in Maryland and Virginia in 1982.

Prices of hard crabs can fluctuate widely, depending upon the supply and demand at any given time. At the beginning of the season when crabs are scarce, prices are high. Later, when a large run of crabs is encountered and every crabber lands a surplus, prices can fall sharply. The reason is because live hard crabs cannot be stockpiled, and it is not economical to ship them more than a few hundred miles. They must be processed for later use by steaming, picking and freezing or pasteurizing the meat.

Soft crabs, on the other hand, can be shipped thousands of miles in live condition, and when frozen, keep for months with little or no flavor loss. Both of these characteristics can help forstall the chance of a market glut: shedders can ship to distant markets or simply hold frozen soft crabs back, releasing a steady supply to answer the demand at a given price.

For the most part, the Sea Grant effort in the soft crab industry over the last decade has taken the form of sponsored research to develop improved shedding, packaging and marketing techniques, plus advisory service seminars, workshops and field agent contacts. The first publication of its kind to deal with shedding soft crabs, entitled "Methods of Handling and Shedding of Blue Crabs, *Callinectes sapidus*," was printed under Sea Grant sponsorship at VIMS in 1974 (Marine Resource Advisory No. 8).

Commercial production of soft blue crabs began about 1850 in Crisfield, Maryland, spreading from there down Chesapeake Bay to the mid-Atlantic and Gulf Coasts over the next 100 years. Louisiana production, which went exclusively to New Orleans, began in the late 1800's to early 1900's.

The historical method of shedding crabs was crude and not very efficient. A shedder would fence off a shallow area of shoreline, catch some hard crabs and release them into the enclosure. He would feed them fish or other scraps, and go in periodically to look for soft crabs. There was a high mortality associated with the method because of cannibalism, deteriorating water quality, high temperature and low oxygen content. Such enclosures were termed "shedding pounds."

In the next stage, shedders began to recognize reliable shedding signs on the pre-molt crabs, termed "peelers." The most distinguishable sign was the changing color line on the paddle fins. A peeler several weeks away from molting was termed a "white sign" or "green" crab. As molting time drew closer, the whitish line near the margin of the backfin changed to pink, then to red. A "red sign" crab would shed within a matter of hours.

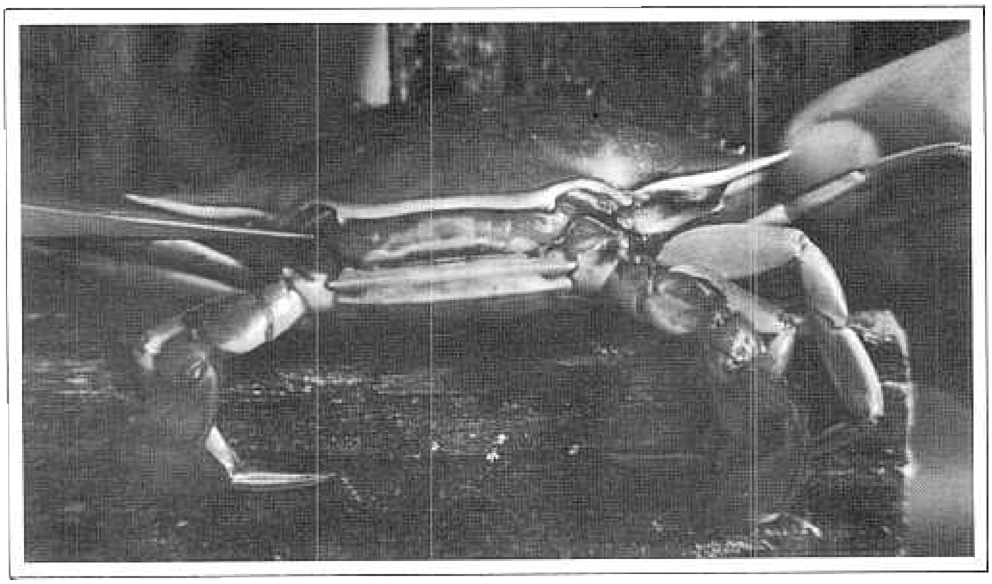
Peelers with the same color sign were eventually kept together in slatted, floating, wooden boxes within the shedding pounds. As time passed, shedders not only became more adept at reading peeler signs, but also learned how to selectively harvest peelers with the aid of towed scrapes and stationary traps called peeler pounds. The practice of holding large number of hard crabs indiscriminately was discontinued.

Thus evolved the traditional method, which is still widely used in the Chesapeake Bay area today. The floating box was termed a "car," "shedder" or "float." Dimensions varied, but the float commonly was 12' long, 3' - 4' wide and 18" deep, with a stabilizing collar or wing about midway down to help hold the float at the proper depth. Slats were made of pine in the Bay region, cypress farther south.

In the mid-1950's soft crab production began to move out of the water. There were several advantages to this: Good water quality was easier to maintain, predators could be controlled better and the back-straining job of bending over partially submerged floats from a boat was traded for the relative comfort of culling from a standing position.

Shallow tanks were placed on sturdy tables or benches on a pier or shoreside. Tank dimensions commonly were 4' X 8' X 10". Constructed of marine or exterior grade 1/2" - 3/4" plywood, the tanks were easy to build and would last 10-15 years with reasonable care. Cost was around $100 each. Some shedders opted for tanks built of concrete or concrete blocks right on the ground. They were durable, but once in place, could not be moved. Also, a person tending such tanks did a lot of bending. Later, fiberglass came into use. Although more expensive ($200 - $250 per tank) than wood, fiberglass was light, durable, easy to move about and easy to clean.

Plumbing today is mostly with PVC pipe, which is nontoxic, readily available and easy to work with. The flow-through system, as it came to be known, utilized water from a nearby source which was pumped up, sprayed onto the shedding tanks, then simply allowed to return overboard. A 1-2 hp pump could service 10-20 tanks. It worked well in areas where water quality was good, but not



Dick Cook

A peeler crab in the "buster" stage starts to back out of its hard shell. This is a critical period for the soft crab, when water quality and temperature, plus the presence or absence of predators, can determine shedding success.

where dissolved oxygen levels were low or contaminants were present.

The latest advance in improving the shedding operation, and one which does not depend upon a shoreside location, is the closed recirculating system. According to Mike Oesterling, commercial fisheries specialist with the Virginia Sea Grant Program at VIMS, a closed system is most advisable in an area where poor water quality exists.

Basically, the closed recirculating system consists of a water supply which sprays into the shedding tanks, drains and passes in turn through a mechanical filter, biological filter, protein skimmer and aerator before being pumped back to the shedding tanks. It works like an aquarium.

Oesterling, who first worked with Florida crab shedders through the Sea Grant program in that state before coming to VIMS in 1981, anticipates a growing number of East Coast soft crab producers over the next few years.

Addressing the problems of the soft crab shedding industry in the Bay area was at first a task of organization. According to Oesterling, the problems fell in two categories: Water quality and availability (and condition) of peelers. He explained:

"Many of the soft crab producers in Virginia have a shedding operation set up on the edge of a shallow bay or creek. Such areas typically are subject to extreme temperature and salinity fluctuations, both of which can adversely affect survival of peelers and soft crabs. Also, shoreside operations which depend upon such water sources are subject to contaminants from pesticides, industrial discharges or other toxins which may wash in as runoff during heavy rains.

"Another problem the shedders have to contend with is securing a reliable source of peelers. There is good evidence that the ultimate success of a shedding operation depends upon the type of gear used to harvest peeler crabs and the care with which the peelers were handled initially. We need to increase waterman awareness in this area."

After surveying the existing literature in the field of softshell crab shedding, Oesterling consulted with peers in Sea Grant programs on the East and Gulf Coasts. These included marine scientists who have been active in improving general operational techniques and closed shedding system design. He next made it a point to become aquainted with shedding industry people in Virginia and scheduled several workshops, where such topics as shedding problems, current techniques and workable solutions were agenda items. The effort started to bear fruit:

Owen Bellamy of Poquoson, Virginia started from scratch in 1981, and with Oesterling's design help and early monitoring, set up a 12-tank flow-through shedding operation in an existing dockside building. Bellamy had not started out with the idea of shedding crabs; he had acquired a property adjacent to a fairly deep creek and simply wished to put it to work in some phase of marine culture. He contacted Oesterling with the idea of perhaps raising striped bass or culturing oysters. After discussing the options available to him, Bellamy chose soft crab production as his best choice.

With Oesterling's help, Bellamy set up a 12-tank flow-through system using sealed wood for the tanks and PVC plumbing. He then located a local source of peelers, and has successfully been shedding and marketing his soft crabs ever since.

Louis Whittaker of Reedville, Virginia already had a flow-through system operating in 1981. He contacted Oesterling for advice in converting to a closed recirculating system. Whittaker had a water quality problem and was losing a high percentage of his peelers. Acting upon Oesterling's advice, he converted six of his 24 tanks to a closed system design.

As Oesterling relates, the decision to partially change over the shedding system presented Sea Grant advisory services with an excellent opportunity to compare the flow-through vs. closed systems in the same physical location and using peelers from the same source. At the same time, Louis Whittaker, keeping meticulous records on every soft crab shed, was able to assess the comparative worth of the systems firsthand. Oesterling commented on the custom design of the experiment, pointing out that there were design problems that were eventually worked out:

"Louis was an ideal person to work with on this sort of thing. He constantly tinkered with the closed system to fine tune it and make it work better. He also kept careful track, for the record, of what he was doing. He has received a lot of publicity concerning the closed system, and has been most cooperative in sharing his ideas and experiences with others. Many people have visited the shedding operation and have come away encouraged to start their own."

Louis had attached a gravity drain to six shedding tanks, with the drain (PVC pipe) emptying into a large biological filter. This filter consisted of the bottom half of a 500-gallon septic tank sunk to ground level. A small head chamber was sectioned off at one end, while two wooden trays in the larger end held sunbleached oyster shell. Water draining over the shell was pumped out of the bottom of the head chamber. From there it was piped to a simple PVC protein skimmer. After leaving the protein skimmer, the water was gravity fed to a smaller biological filter which held whole sunbleached oyster shell in one tray and crushed shell in another. A second pump distributed water from this filter back to the shedding tanks, completing the cycle.

During the course of the 1982 season, Louis expanded his closed system to 12 tanks, and

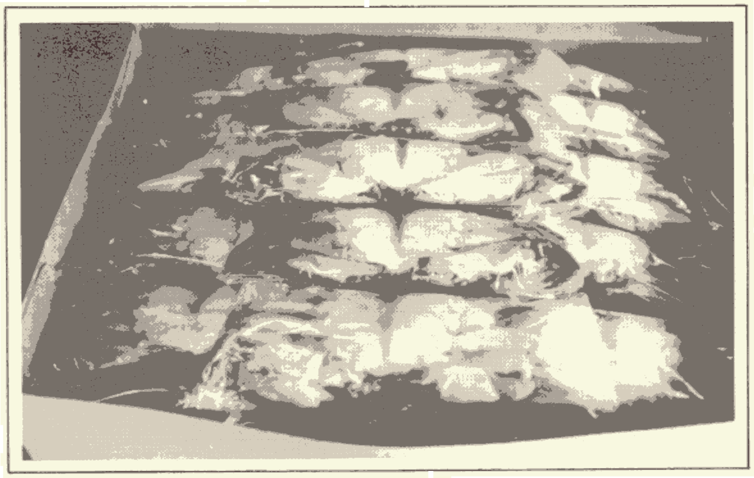
Bill DuPaul

VIMS commercial fisheries specialist Mike Oesterling monitors oxygen and pH of the water in Lewis Whittaker's closed design crab shedding operation.

by the end of the year he had all of his production tanks converted from flow-through to closed design. In 1982 Whittaker had experienced a 55 percent success rate in his flow-through system tanks and a 67 percent shedding success rate in his closed system. After converting totally to the closed, recirculating system, his overall success rate on peelers molting to soft crabs steadied at 65 percent. Additional benefits included a reduction in labor (no tank cleaning necessary) and improved water clarity.

Charles Stant of Oyster, Virginia was among those attending a soft crab shedding workshop at Warsaw in the spring of 1982. The purpose of the workshop was to gather together industry members and those interested in entering the fishery to exchange information on existing problems and other aspects of shedding soft crabs. Established shedders shared their knowledge and experiences, and attending scientists presented their findings on shedding system design and ways to alleviate problems.

Stant owned some waterfront property on a small tidal creek characterized by poor water quality in summer. Wishing to shed some crabs, he saw the closed system design as his best option. By the time his system was operational, however, the 1982 blue crab shedding season had come to a close.



Bill DuPaul

Cleaned, wrapped soft-shell blue crabs ready for freezing. The market for this delicacy is still expanding.

As Oesterling tells it, Stant knew that the rock crab (*Cancer irroratus*) was common in the area, and that it might provide a means of helping him fine-tune his system for the 1983 season. Also, Stant wanted to determine the feasibility of commercially exploiting the rock crab as a resource. Although previous VIMS Sea Grant work has centered on rock crabs ("Rock Crab: A Potential New Resource, Advisory Series No. 7; November, 1973) Stant was the first shedder to set up a commercial operation.

Historically, rock crabs were culled and discarded from the blue crab dredge fishery. Mid-December through January is the shedding time for male rock crabs larger than 2 inches. This species, unlike the blue crab, doesn't burrow into the bottom mud in winter.

Since there are no apparent shedding signs in rock crabs, Stant simply held them in his system until they shed out. Based upon his success in the winter of 1982, Stant plans to expand his rock crab shedding operation during the winter of 1983, and other shedders have expressed an interest in rock crabs also, following Stant's lead.

As mentioned previously, soft crabs command high retail prices, and can easily be shipped frozen over long distances. Members of the Virginia Sea Grant Advisory Service staff reasoned that the Virginia soft crab was a natural for a gourmet export item to Europe. Through contacts established by Dr. William DuPaul, head of Marine Advisory Services for the Virginia Sea Grant Program, trial shipments were arranged to European wholesalers and seafood brokers.

Additionally, Virginia soft crabs have been featured in frozen food trade shows, most recently ROKA (September 1983) in Holland. At that time soft crabs comprised a main course at an embassy dinner attended by major seafood buyers in Europe. The crabs were well received, providing a potential market list for the future.

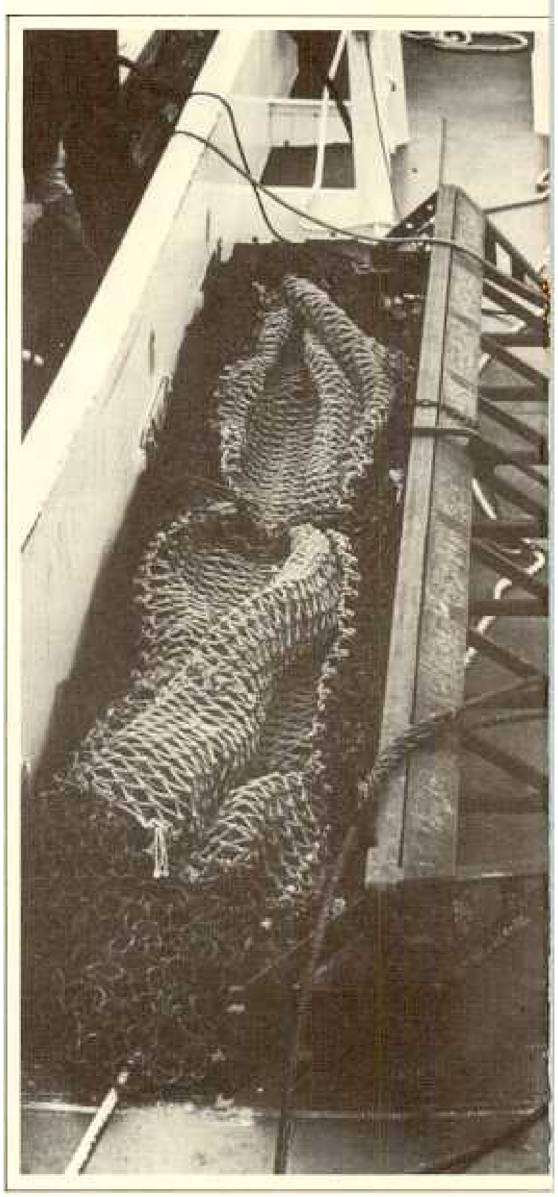
Oesterling is now putting the final touches on a comprehensive publication, soon to be out, which should prove valuable to existing and potential shedders. The title is "Manual for Handling and Shedding Blue Crabs (*Callinectes sapidus*)." The manual describes historic, traditional and state-of-the-art shedding techniques, and contains more than 40 photos and line drawings.

Oesterling and economist Ron Grulich will be conducting an industry survey designed to help characterize the shedding industry in Virginia. The resulting report will describe economies of scale useful in determining the most profitable method of operation under varying conditions. Results will be forthcoming in 1984.

by Dick Cook

Designs on the Drag

Bob Brigham U. S. F. & W. S.



Above, Sea scallops are picked out of the rubble pile collected by a standard scallop drag (center photo). Mortality may be high among undersized scallops, even those which are returned to the sea.

THE SEA SCALLOP *(Placopecten magellanicus)* is a much sought-after shellfish whose delicious meats bring premium prices at seafood markets. For example, the ex-vessel price paid in Virginia on October 21, 1983 was $7.25 per pound. Despite the luxury price tag, the demand for scallops is increasing. The value of the resource (21.3 million pounds worth $78.2 million nationwide in 1982) coupled with the cyclical nature of sea scallop populations, prompted Federal Government action last year to place the first constraints on an industry characterized by boom and bust periods of harvest success.

In 1982, for example, Virginia's 2.2 million pounds harvest brought $8.4 million dockside. Just two years earlier, landings at Virginia ports totaled 21 million pounds worth $23 million.

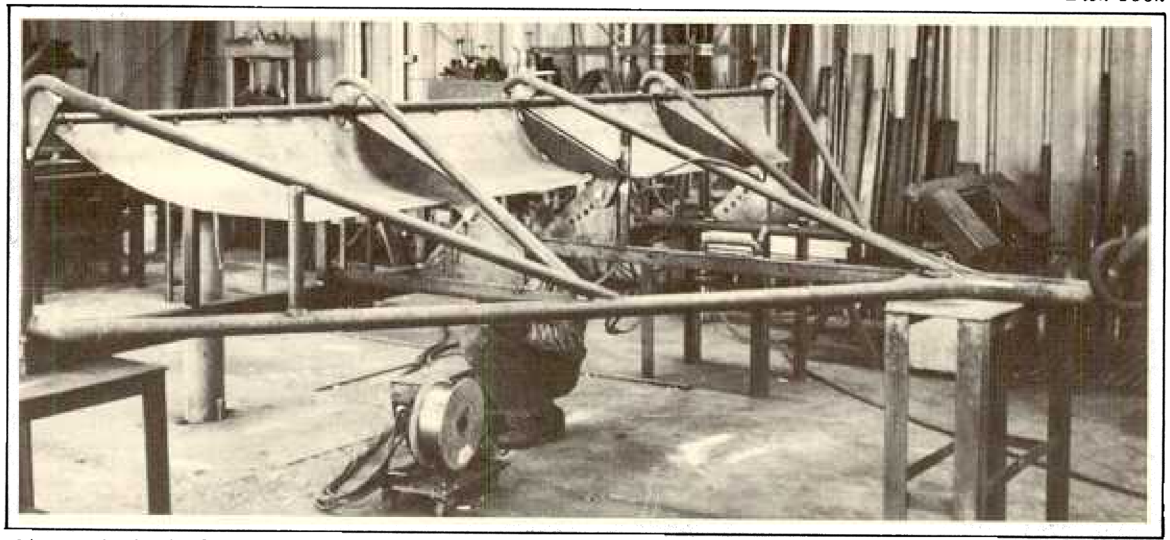
The period 1976-1980 was the latest peak, with the 1979 national harvest topping 31 million pounds. Some 115 scallop vessels made 842 trips from Virginia ports that year. By 1982 the nationwide harvest had dropped by 10 million pounds, and many scallop vessels were left high and dry financially.

Current Federal regulations, effective since May 1982, are designed to help stabilize the supply of sea scallops while protecting the future of the resource. Choosing one of several alternate strategies as presented in their Atlantic Sea Scallop Management Plan, the New England Fishery Management Council recommended a meat count/shell size restriction, the first such regulation American scallopers have had to work under, and one which experts say will cause some harvesting gear changes. The Council is a regional policy-making organization in the National Oceanic and Atmospheric Administration (NOAA). Cooperating organizations on the East Coast are the Mid-Atlantic and South Atlantic Councils.

The National Marine Fisheries Service (NMFS) implements and enforces Council poli-

N. M. F. S. Photo

Dick Cook



Above, the hydrofoil dredge designed by Advisory Services gear specialist Phil Cahill at VIMS shows promise of reducing both trash load and fuel cost.

Sea Scallops are coldwater bivalves which can move from the path of slow predators such as starfish by jetting water from their shells.

Bob Brigham U. S. F. & W. S.

Federal Rules Governing Scallop Harvest are Prompting Some Changes in Gea

cy. According to Richard Seamans, Deputy Chief of the Northwest Region for NMFS, the scallop plan stipulated a maximum of 40 scallop meats per pound and a minimum 3 1/4" shell height from May 15, 1982 to May 15, 1983; a 35-count, 3 3/8" shell height from May 15, 1983 to December 31, 1983; and a 30-count, 3 1/2" shell height after January 1, 1984. Because of a recent decline in scallop landings, however, the count will be held at 35 per pound until May 15, 1984, at which time it will be re-evaluated.

A coldwater bivalve, the sea scallop is found on the continental shelf from the Gulf of St. Lawrence to Cape Hatteras, North Carolina. Ideal water temperatures for sea scallops are around 10 degrees C. (50 degrees F.). They cannot survive temperatures higher than 68 degrees F. Consequently, scallops are found from just below the low tide mark out to 10 fathoms off the coast of Maine, and from 30-60 fathoms off the coasts of Virginia and North Carolina.

The U. S. offshore scallop fishery began off Long Island in the early 1920's, spreading to Georges Bank by the early 1930's. The principal northwest Atlantic scallop ground historically and continuing to the present, Georges Bank lies within the 200-mile Fisheries Conservation Zone established by the U. S. in 1976. Part of the Bank also lies within the 200-mile conservation zone of Canada, and where the zones overlap, both Canadians and Americans may work the scallop beds.

The primary harvest gear used in the offshore scallop fishery is known variously as a "drag," "rake" or "dredge." Most scallopers refer to it as a New Bedford or offshore drag. The gear in its present form remained virtually unchanged since 1948.

In operation, two drags are towed simultaneously at 3-4 knots speed by a typical 90-ft.

scallop vessel. Each drag consists of a heavy metal frame to which is attached a bag knit with steel rings and rope mesh. Dimensions, construction and stock used for drags may vary from boat to boat, depending upon skipper preference. Frames may be 10'-13' wide. Complete with a heavy steel bale extending forward and a pressure plate on top of the frame (see photo), a complete drag can weight 1,300-1,500 pounds empty, and up to 4 tons when filled with scallops, rock and other debris.

The animal this gear is designed to catch, the sea scallop, is disturbed from its bed by the turbulence created when the cutting bar of the frame glides just over the ocean floor. A scallop, especially a juvenile less than 2 1/4" in shell height, can move several yards by repeatedly clapping its shells closed, jetting water out. Although research has shown that some juveniles successfully evade capture by moving from the path of an oncoming drag, a large percentage are captured.

Adult scallops on the other hand, those larger than 3 1/4", tend to be less mobile. Such adults will lie in shallow depressions and often are passed over by the cutting bar. Teeth have been added to the cutting bars of some drags, but the advantage of the teeth digging larger scallops out may be offset by the drag's tendency to frequently hang up on obstructions on rough bottom.

Before size and meat count limitations were imposed on the fishery, most scallopers simply cleaned what the drags brought up, icing the meats down after they were washed and placed in cotton sacks. Those vessels fishing close to port, especially in colder weather, often took their catch home in the shell. No one worried about size, and it was not unusual for meat counts to run over 50 to the pound.

Many of these, of course, were juvenile scallops, taken before they had had a chance to reach full spawning potential. Scallop abundance on any particular bottom, like that of oysters, is largely determined by environmental factors. Even so, many researchers and fishermen feel that the present drag takes the animal which is the future of the fishery before it has had the opportunity to make its contribution.

Lt. Cdr. (NOAA) Ron Smolowitz, Commanding Officer of the NOAA Research Vessel *Albatross IV*, is also the resident gear expert with the Northeast Fisheries Center in Woods Hole, Massachusetts. Smolowitz thinks design changes are definitely in order to improve drag selectivity.

"Ideally, scallop gear should maintain a balance between resource conservation, harvest efficiency and economic meat yield per scallop landed," Smolowitz said.

He thinks that the present dredge is inefficient on larger scallops and very destructive to pre-recruits, or scallops too small to be harvested legally. Also, throwing a small scallop overboard once it has been culled from a catch is no guarantee that it will survive, despite the good intentions of the fisherman. Because a scallop cannot close its shell tighty the way an oyster or clam can, it can get packed with sand or mud in the catching and handling process. If this happens, or if it gets buried in sediment when the trawl passes, it dies.

Research on dredges used in the Scottish fishery for a different species of scallop showed that overall dredge efficiency was low, varying 14-27 percent. The Scottish dredge used a fixed-tooth bar which, divers observed, pushed up a mound of rubble in front as it was towed, shoving large scallops aside. When the fixed bar was replaced with a spring-loaded bar, the problem of the mound of rubble being pushed up into the dredge mouth was eliminated. Even so, the Scottish research concluded that dredge efficiency and selectivity of the teeth and meshes could vary widely, depending upon the type of bottom being fished.

Phil Cahill, gear specialist with the VIMS Sea Grant Marine Advisory Program at Gloucester Point, is working toward the same goal as Ron Smolowitz at Woods Hole. Cahill, a former commercial fisherman with experience in both the New England fishery and on the Alaska grounds, is working with several industry partners to develop a better dredge for scallops, and likes the spring-loaded toothed bar as first described in the Scottish effort. Cahill also is incorporating a hydrofoil or curved pressure plate on top of the dredge instead of the standard straight wedge design. He claims the hydrofoil will keep a lighter dredge down on bottom with greater efficiency, thereby reducing fuel consumption and length of towing cable needed (which saves setback and recovery time).

"I'm also increasing the belly ring size to reduce the amount of trash and small scallops taken," Cahill said. "This hopefully will reduce juvenile scallop mortalities while shortening the culling time for the crew on deck. Also, the overall weight reduction (300-400 pounds) will make our experimental drag easier to handle on deck in rough weather."

Cahill is working with Calvin Hudgins Welding, Inc., in Seaford, Virginia to produce several experimental drags, and another industry partner, Wells Scallop Company, has already tested one of them against a conventional drag on sandy bottom off Cape May, New Jersey.

Once adjusted properly and towed side by side with the conventional drag, the experimental drag, this one with larger rings and a hydrofoil, caught scallops on a one-to-one basis with the conventional drag. A toothed cutting bar was removed when it was found that the teeth

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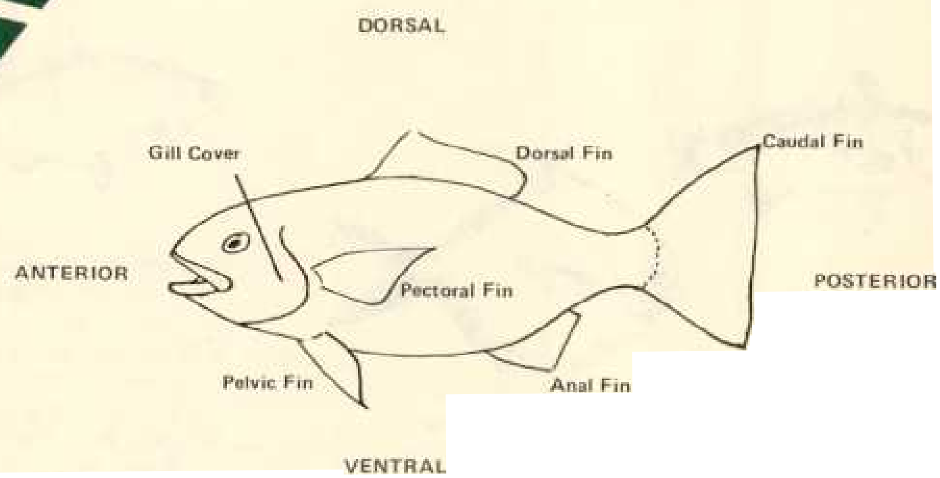
WAVELETS

Marine Schoolhouse Series No. 21

by Mary E. Sparrow
and Frances L. Lawrence



FISH FINS AND THEIR FUNCTIONS

Have you ever really watched fish swimming in an aquarium? They seem to move so easily. Can you tell which parts of the fish's body are doing the work of swimming? If you pay close attention, you may observe several body parts moving in different ways. How do fish go forward, turn, stop, start, back up and change speed? Like people, fish use their muscles to produce movement, but instead of arms and legs, fish have fins. Watch what each fin does as you observe a swimming fish.

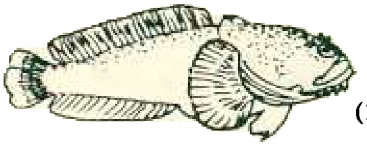
The word DORSAL means the back (or top) side. Dorsal fins are the ones on the top of the fish. VENTRAL means the bottom (or belly) side. Most fish have a pair of PELVIC FINS on the ventral side. ANTERIOR mean towards the front and POSTERIOR means towards the tail. The ANAL FIN is on the ventral side, posterior to the pelvic fins. On most fish, PECTORAL FINS are behind the GILL covers, one on each side of the body. The CAUDAL FIN is the tail fin.

Dorsal and anal fins serve as keels, keeping fish upright in the water. Sometimes fish fold these fins close to the body for fast swimming. Fish that swim fast usually have narrow, pointed pectoral fins; slower swimmers have wide pectoral fins. These fins help the fish to turn and stop. Some fish have pelvic fins that assist with steering, but others either have no pelvic fins or have pelvic fins that are adapted to special tasks. Fish with FORKED (shaped like a " < ") or cresent (shaped like a "C") caudal fins are usually fast swimmers.

The number, shape and position of fins can provide clues to the identity as well as the swimming behavior of fish. Look at the drawings of fish on the back of this page. Use the fin discriptions to name each fish. Answers are given in the box below.

ANSWER KEY

1. mummichog	6. cod	11 spadefish
2. toadfish	7. pipefish	12. sheepshead
3. croaker	8. lizardfish	13. harvestfish
4. gizzard shad	9. flounder	14 stickleback
5. northern puffer	10. cuskeel	15. sea robin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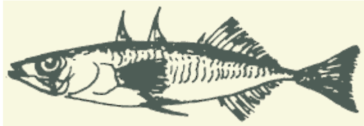
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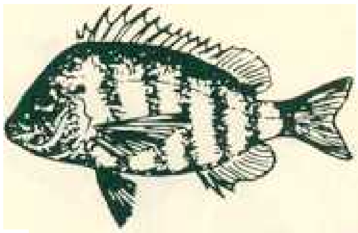
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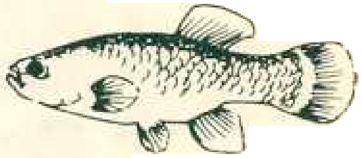
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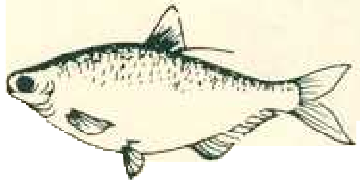
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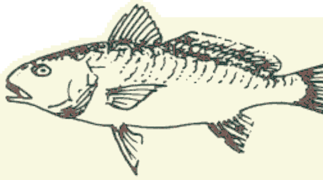
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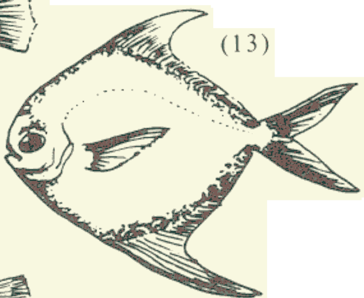
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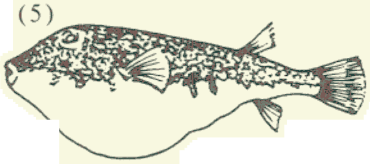
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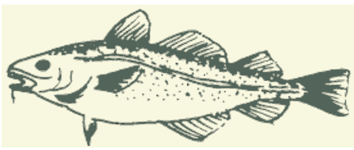
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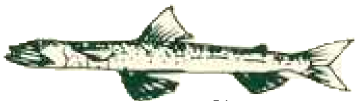
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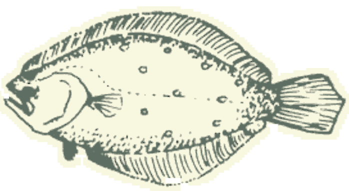
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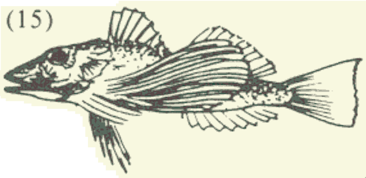
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Sea robin *(Prionotus evalans)* - pectoral fin larger than other fins, reaching almost to the caudal fin
Flounder *(Paralichthys dentatus)* - one dorsal fin running the entire length of body; small pectoral and pelvic fins
Gizzard shad *(Dorosoma cepedianum)* - dorsal fin looks like a check-mark ( )
Lizardfish *(Synodus foetens)* - two dorsal fins, the posterior one very tiny
Mummichog *(Fundulus heteroclitus)* - dorsal, caudal, pectoral and pelvic fins all rounded
Cod *(Gadus morhua)* - three dorsal fins, all about the same size
Stickleback *(Gasterosteus aculeatus)* - anterior dorsal fin is made up of two short spines
Pipefish *(Syngnathus fuscus)* - fan-shaped caudal fin, no anal fin
Harvestfish *(Peprilus alepidotus)* - forked candal fin, no pelvic fins
Sheepshead *(Archosargus probatocephalus)* - long dorsal fin, short anal fin, both with spines

Croaker *(Micropogon undulatus)* - dorsal fin in two parts, anterior part triangular and posterior part long; caudal fin slightly pointed in middle
Cusk eel *(Rissola marginata)* - pelvic fins string-like, below the eye
Toadfish *(Opsanus tau)* - large, broad, fan-shaped pectoral fins; short skin-covered spines anterior to a long dorsal fin
Spadefish *(Chaetodipterus faber)* - crescent-shaped caudal fin
Northern puffer *(Sphoeroides maculatus)* - single dorsal fin is similar to anal fin, both are small and close to caudal fin

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(Continued from Page 8)

bent, rendering them ineffective, on the first drag. The towing cable on the experimental drag was considerably shorter, however, cutting back on recovery and set-back time, thanks to the hydrofoil. Also, there was a net 15 percent less trash in the experimental drag over the 10-tow preliminary trial. On its best tow, the experimental drag caught 40 percent less trash then the conventional drag, according to Cahill.

Billy Wells, Manager of Wells Scallop Company recently voiced some observations concerning scallop gear:

"It's my understanding that the present drag only catches 10%-15% of what it goes over. That leaves a lot of room for improvement. We need to benefit from industry experience in other countries, and I think the experimental drag we started testing is a step in the right direction.

"Right off, however, it's apparent that the toothed cutting bar needs to be spring-loaded, to help eliminate the problem of bending teeth. Also, the drag is still too heavy. We need to lighten it to impove ease of handling and fuel efficiency."

Wells also explained why the first field test was limited.

"This experimenting with new gear can be costly right now. Scallops are at an historic high in price, and no one I know is going to sacrifice an entire trip on untried gear when you can stay with conventional drags and make a decent living.

"I think help from the state or federal government in fuel subsidies would make industry members a lot more willing to test the experimental gear thoroughly."

"We have a ways to go, admittedly," Cahill said, "but at least the preliminary results are encouraging. We intend to explore some different designs over the course of the study. Hopefully, we'll have the testing done by next spring."

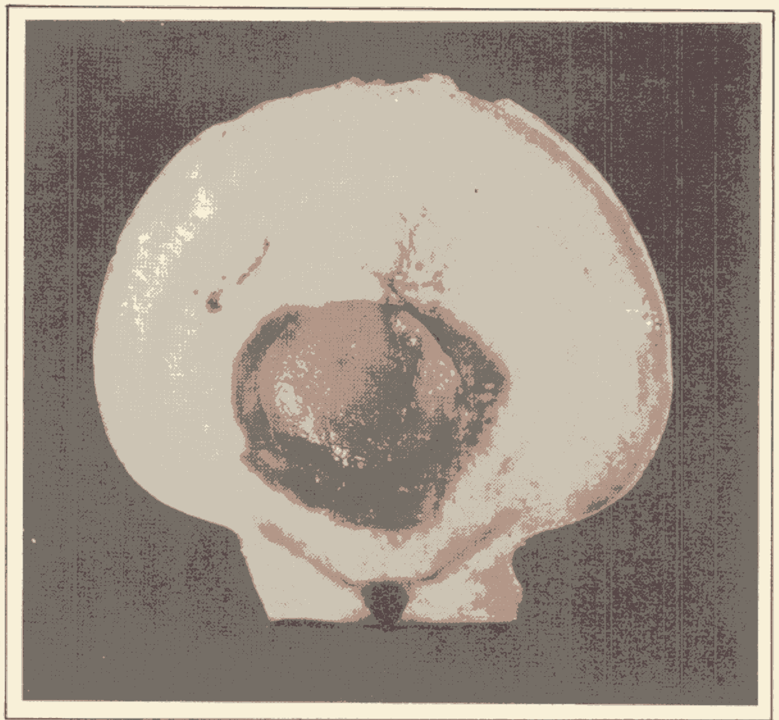
Cahill's Sea Grant sponsored work will be capped with a publication of his findings and recommendations.

Back at Woods Hole, Ron Smolowitz is working with NMFS survey drags, trying different modifications, he explains, "as far as the budget will allow."

Smolowitz emphasized that the problem is to develop a gear which will take the size scallop preferred by the consumer, without destroying pre-recruits or habitat, and do it in an economically viable manner.

Smolowitz and Cahill agree that the expected economic pinch scallopers were expected to feel as a result of the size and meat-count regulations has been softened by the high dockside price supported by an increasing consumer demand.

The scallop meat prized by seafood gourmets is actually the adductor muscle, shown here still attached to one shell. In most cases, scallops are cleaned at sea, where the meats are bagged in 50-pound lots and stored in crushed ice.



Bob Brigham U. S. F. & W. S.

"In the long run," Cahill explained, "both the resource and the industry will benefit. The supply and price are expeced to stabilize, with the fishing effort dictated by simple economics. A scalloper isn't going out there if he can't make a profit. If he has to change his gear to do it, he probably will. I hope the gear work we're involved in will help him do that."

Smolowitz feels that video technology will likely change scalloping methods in the future.

"Except for a few net recorders and stress monitors, all our fishing electronics are aboard ship these days. More of it needs to be employed down there where the gear is working, so the fishermen can get a more accurate idea about what is going on.

"On a smooth bottom, I think cutting bar modification is the key. Right now the sweep chain is doing all the fishing on the drags I've seen used. We need to keep the cutting bar down low enough so the resulting water turbulence will lift the larger scallops out of their depression beds. On rocky bottom we probably need to think in terms of totally different gear," Smolowitz concluded.

Cahill thinks that fishermen, traditionally slow to change their methods, will be comparatively quick to adopt a gear change resulting in improved efficiency, providing it can be adequately demonstrated.

SEA GRANT PUBLICATIONS

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PRICE FLEXIBILITY ANALYSIS OF VIRGINIA HARD CLAMS. Andre Kvaternik, William DuPaul and Thomas Murray. SRAMSOE No. 266, 66 pages. $2.50.

SHORELINE EROSION IN VIRGINIA. Scott Hardaway and Gary Anderson. Educational Series No. 31, 25 pages. $1.00.

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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 CHESAPEAKE: A BOATING GUIDE TO WEATHER. Jon Lucy, Terry Ritter and Jerry LaRue. Educational Series No. 25, 22 pages. $1.00.

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Dick Cook.......................................Editor

Cover Note

A blue crab sheds its hard shell, and emerges soft and appreciably larger than before. This delicacy is the focal point of an expanding market produced by a seafood industry now undergoing modernization. Photo by Bill DuPaul.

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