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VIRGINIA FISHERIES LABORATORY
YORKTOWN, VIRGINIA

VIRGINIA FISHERIES LABORATORY AND DEPARTMENT OF BIOLOGY
COLLEGE OF WILLIAM AND MARY

Director's Desk

CONTRIBUTION NO. 5

CONSERVING OUR SALT-WATER FISHERIES

WORK OF THE VIRGINIA FISHERIES LABORATORY

CURTIS L. NEWCOMBE

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Conserving Our Salt-Water Fisheries

Work of the Virginia Fisheries Laboratory[1]

By CURTIS L. NEWCOMBE

Director

EVEN the casual visitor to many of our small Tidewater Virginia fishing communities will see signs of diminishing prosperity. A prosperous era has been succeeded by a period of lower economic and social levels.

What are the underlying causes of this declining trend? In facing this problem, so broad in its scope and so serious in its effect, the Virginia Fisheries Laboratory has, during the past year, effected an organization for analyzing conditions in our commercial fisheries and for disseminating facts about them and the need for their conservation.

Virginia has a big stake in the seafood business and with proper methods of utilization this asset may be greatly increased. The fisheries of Accomack, Mathews, Northumberland, and Lancaster counties, the four largest-producing counties of Virginia, have an average value per county of about half a million dollars annually, the average population of these counties being approximately 15,000. Of the total volume of production of the two Chesapeake states, Virginia produced in 1939 more than 80 per cent, or over 262,000,000 pounds of seafood and other marine products, valued at four and one-half million dollars. Maryland's output was about 61,000,000 pounds, worth about two and one-half million dollars.

While some of Virginia's fisheries are expanding, as a result of increased demand or better gear, others are experiencing downward trends of production.

The Yorktown Laboratory

For example, the shad fishery has shown a decline from more than 6,000,000 pounds in 1929, valued at nearly one and one-half million dollars, to around 3,500,000 pounds in 1939, valued at one-third of a million dollars.

The General Assembly of 1940, recognizing the need for conservation studies of the marine resources of Virginia, appropriated funds to the Commission of Fisheries and the College of William and Mary to initiate this work. The late G. Walter Mapp, then commissioner of fisheries and rector of the college, saw and appreciated the great part that scientific management is destined to play in the conservation and adequate utilization of the fishery resources and the advantages of bringing the facilities of the commission and the college to bear on the solution of the problems of the fisheries. Under his influence and that of President John Stewart Bryan, the Virginia Fisheries Laboratory was established on July 1, 1940, to develop and conduct the research and educational programs. Field studies are centered at the laboratory in

[1] *Contribution No. 5* of the Virginia Fisheries Laboratory and Department of Biology, College of William and Mary.

Yorktown and the teaching work is conducted at the College of William and Mary in Williamsburg, experimental work being carried on in both locations. The Commission of Fisheries has continued to give fullest support to the work of the laboratory under the commissionership of J. Brooks Mapp.

THE LABORATORY'S *research program* aims to find out biological information about the local commercial species that is needed to permit a more intelligent utilization of the fisheries. Through field and laboratory experiments practical methods are sought for improving conditions in the shellfish, the fin fish, and the blue crab fisheries. Thus far the oyster and its enemy the screwborer, the mussel, and the blue crab have been stressed. In addition, this program aims to develop gradually an improved system of fishery statistics as a basis for regulating fishing intensity in the interests of conservation.

Regarding the oyster, the Commission of Fisheries needs more information on the productive characteristics of the different oyster bottoms, the grounds that favor the attachment and survival of the young larval oysters and those best suited for good growth. The oyster planters recognize the same need. The laboratory has made a start in this direction. During the past summer representative oyster areas were selected for regular examination of the condition of the oysters, the abundance of larvae in the water, and the conditions most favorable for securing the best "strike" of young oysters. Clean shells (culch) put down at random and without regard to the spawning condition of the brood stock yielded fewer than sixty-five young oysters per bushel of shells, whereas "culch" properly planted, when the numbers of larvae in the water were known to be adequate, gave several thousand "spat" (young oysters recently attached) to the bushel. This shows how much effort may be wasted and loss incurred by oyster operations carried on without an understanding of local and seasonal conditions.

The oyster grounds of Virginia are now producing annually around 3,000,000 bushels, a quantity which can be greatly increased under proper management. The greatest number taken is from a little over 60,000 acres of private grounds, which represents a small part of the total acreage capable of growing high quality oysters. It is generally recognized that much of the state's best acreage is each year decreasing in productivity or is being rendered useless for producing oysters. Facts clearly show the need for careful study of local oyster problems to assist the industry in much the same way as the demonstration farm serves agriculture. In connection with the oyster work the laboratory is investigating practical means of controlling the infestations of the oyster drill, estimated to cause a loss to the state of more than $150,000 annually. During the transplantation of oysters, drills (screwborers) or their eggs are not infrequently carried to uninfected ground. In this way the pest has been widely spread. Steps are being taken to encourage trapping of drills and screening of oysters to rid the beds of this enemy. Throughout the summer, experiments were conducted on the use of cheap toxic substances sufficiently concentrated to kill the eggs of the drill without harming the oyster to which they are attached. It was possible under laboratory conditions to kill the eggs by submerging the oysters bearing them for one minute in a solution of copper sulphate, one part in 500. After demonstrating in the laboratory and in the field on a small commercial scale the effectiveness and the practicability of improved control measures, it is necessary to get their trial and adoption by the oystermen.

During the past two years, the ribbed

mussel, *Volsella demissus,* has come into prominence because of its value as a source of provitamin. In view of the immediate demand for more mussels and the almost complete lack of previous work on their biology, the laboratory is concentrating on those research problems having direct bearing on mussel production.

The yield of blue crabs has been fairly uniform in Virginia during the past decade. The hard crab population that enters directly into the fishery of the lower Bay is composed of some male crabs, unspawned females ready to spawn or nearly so, and females that have spawned one or more times. The relative abundance of these population groups varies through the different geographical areas. To establish crab sanctuaries intelligently and to regulate the crab fishery in such a way as to assure a high, permanent level of production, more facts are needed concerning the composition of the crab population. There is need to know definitely how many "sponge" crabs are required to "seed" the Bay adequately. At present it is believed that more crab spawn should be saved, but it is not possible to state precisely how much saving must be practiced or how this saving may best be accomplished. During the past two summers the laboratory has investigated with some success ways of removing crab eggs (sponges) at the commercial houses, transporting them to the laboratory, and hatching the larval crabs for distribution to water suited to their development. This artificial hatching of blue crab eggs was first accomplished during the summer of 1940. Last summer it was found possible to hatch out over 3,000 eggs in a tray eight by nine inches, and a 90 per cent hatch was regularly obtained. Promising results for large-scale hatching were obtained by suspending in open offshore waters individual "sponges" protected by wire screening against possible enemies.

THE FIN-FISH PROGRAM OF THE LABORATORY calls for close coöperation with the shad program of the U. S. Fish and Wildlife Service. During the last five years there has been a relatively low catch of shad in Chesapeake Bay and also a low price level. What steps are being taken to preserve this highly important fishery, to restore former production and also price levels? In general, two methods are employed aiming to restore the shad fishery, namely, operation of hatcheries and regulation of the intensity of fishing.

In usual hatchery practice, eggs are stripped from the shad, hatched, grown to the fry stage, and then released to natural waters. At this stage many are devoured by enemies in the river waters where the young shad remain until fall. At present the Commission of Fisheries is conducting experiments to find a satisfactory, large-scale method for holding young shad in ponds and floats protected from predators during the summer months. When released in early fall, the young fish are about three inches in length, better able to survive and ready to start their seasonal migrations down the rivers to the sea. Thus far the results of these experiments are promising.

Perhaps the most effective method for bringing back the shad is through intelligent regulation of the catches. There is evidence that the decline in Virginia's shad catch is due to too great intensity of fishing. This simply means catching fish too soon, frequently before they have reached maturity.

R. A. Nesbit, federal fish expert, has assembled data showing the relative numbers of shad of different ages in the Hudson River and in the Chesapeake and North Carolina area.

By reading the age of the shad from the scales, it is known that fish which escape being caught may go to sea and return to the rivers for spawning for as many as five successive years. Thus there

Mending the Nets

Virginia's salty waters yield a livelihood for thousands, but intelligent conservation measures are called for if nature's bounty is to be maintained and increased

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are five year-classes and the fisherman has in all five chances at the fish. In the Hudson River 60 per cent of the total population of shad are caught each year, and 40 per cent are allowed to spawn. In the more southern region, 90 per cent are caught and only 10 per cent are left to spawn. In either case it is estimated that 80 per cent of the shad that go to sea return to the rivers to spawn the following year. Thus, for every 1,000,000 fish in their first spawning year, there are in the Hudson 320,000 in their second year of spawning as compared with only 80,000 in Chesapeake Bay. Fish in their third, fourth, and fifth spawning years are even less abundant in Chesapeake Bay as compared with the numbers found in the Hudson.

According to Nesbit's findings, in order to change the conditions in the Chesapeake to those prevailing in the Hudson, it would be necessary to use one-third less gear for catching the fish. In its first year of operation such a scheme would entail catching actually one-third fewer fish. But as the years went by the numbers of older fish would steadily increase. Because more fish were being allowed to spawn, more could thus return to the ocean, and, of these, 80 per cent (according to Nesbit) would come back to the rivers the following year and so contribute to the numbers of the next year-class available for catching or spawning. Over a five-year period, for every 1,000,000 fish in their first spawning year entering the Bay, a total of 879,051 fish would be caught, including many large ones, as compared with the 978,258 fish, with few large ones, which are being caught under existing conditions.[2] The 879,051 fish would undoubtedly weigh more than the larger number caught as a result of present fishing intensity in Chesapeake Bay. This, as has been noted, would be with

[2]The figures used may have an appearance of undue precision. This is because they are taken from a tabulation worked out mathematically by Mr. Nesbit on the basis of percentages which are believed to correspond closely with the facts, and have not been rounded to give the appearance of representative rather than exact figures.

Coker

Fishing a pound net on Chesapeake Bay

the use of one-third less gear, so that the cost of fishing in proportion to the weight of fish taken would be greatly decreased. The fishermen in Chesapeake Bay are now buying half again as many nets as they need, an extra cost which represents a total loss. In the long run, the excess gear not only fails to catch any more fish but it prevents a recovery of the fishery.

PERHAPS THE MOST IMPORTANT NEED for determining the best way to rehabilitate a fishery is adequate statistical information. Such information is an essential tool to successful fishery management. The present statistical data consist mainly of total production figures, and these provide little more than a relative basis for comparing the volumes of the several fisheries. The total catch records provide scant information on the total supply in the water unless the *fishing effort* expended is also known. For a measure of the fishing effort, records are needed of the daily deliveries of each boat, the size and type of boat and the amount and type of gear used, the number of men employed, the length of their employment, and the number of hauls made with each net each day in each location. The object of getting these statistical data is to measure the yield in terms of a *unit of fishing effort*. It is this statistic that is depended on to tell whether the supply of fish is maintaining a fairly constant level, or increasing or decreasing.

Taking a small but important local fishery as an example, it has been found that the annual catch of catfish in the James River area has, during the last five years, maintained a fairly uniform level of around 600,000 pounds, valued in 1939 at about $27,000. However, available data seem to indicate that the average weight of the individual fish caught has dropped during the five-year period from about one and one-half pounds to one pound and that the amount of gear used (i.e. operating cost) has nearly doubled!

In Chesapeake Bay, there are several declining fisheries that need analysis from the point of view of intensity of catch, fishing effort expended, and spawning reserve in much the same way as the catfish and shad fisheries are being investigated. Each fish has its own particular problems and requires individual treatment, but the principles are essentially the same.

The Virginia Fisheries Laboratory, in coöperation with the Maryland and federal investigative units, aims to develop an improved statistical system which will make possible more efficient and economical management of the great fisheries which Chesapeake Bay is capable of supporting.

THE *teaching program* OF THE LABORATORY includes college instruction, high school demonstration, and public exhibit aiming to acquaint a large part of the population with the conservation needs of Virginia's marine resources. The instructional work is conducted in the department of biology at the College of William and Mary. In addition to the regular undergraduate instruction, courses in fishery biology stressing the aspects of the subject treated in this article are offered. There is, consequently, an opportunity for the high school graduate with fishery interests to receive college training in this branch of applied biology. The curriculum also includes courses of instruction for the graduate student who wishes to specialize further in the subject and to meet the requirements for the master of arts degree. In summer, courses in the conservation of aquatic resources and related subjects are offered. Encouragement and assistance are given to high school teachers of Virginia to interest their students in the biology and conservation of local forms.

Demonstration material illustrating the biology of local marine forms is made available to high schools and pamphlets are issued to give the students a better understanding of the materials presented. The laboratory has made a motion picture film in color showing the anatomy and early life history stages of the oyster, crab, and mussel, and also methods employed by the industry in taking and handling these forms. A biological exhibit open to the public throughout the year is maintained at the Yorktown laboratory.

These several methods of disseminating knowledge of the fisheries are serving a common aim. That purpose is to enable people to understand the conservation problems of the fisheries and to apply this understanding toward the economic and social betterment of their communities.