1942

Report of the Virginia Fisheries Laboratory of the College of William and Mary and the Commission of Fisheries of Virginia (1941)

Virginia Fisheries Laboratory

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RICHMOND
Division of Purchase and Printing
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For the Year Ending June 30, 1941

WILLIAMSBURG AND YORKTOWN
VIRGINIA

RICHMOND
DIVISION OF PURCHASE AND PRINTING
1942

VIRGINIA FISHERIES LABORATORY

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J. BROOKS MAPP†.....*Commissioner of Fisheries of Virginia*
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JAMES W. MILLER.....*Dean of the Faculty*
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JOHN H. LOCHHEAD, Ph.D.....*Associate Biologist*
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ROY P. ASH, Ph.D.....*Research Associate*
Assistant Professor of Biology, College of William and Mary
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B. B. SHEPHERD, M.A.....*Research Assistant*
Graduate Assistant, College of William and Mary
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*Died February 2, 1941.
†Took office February 19, 1941.

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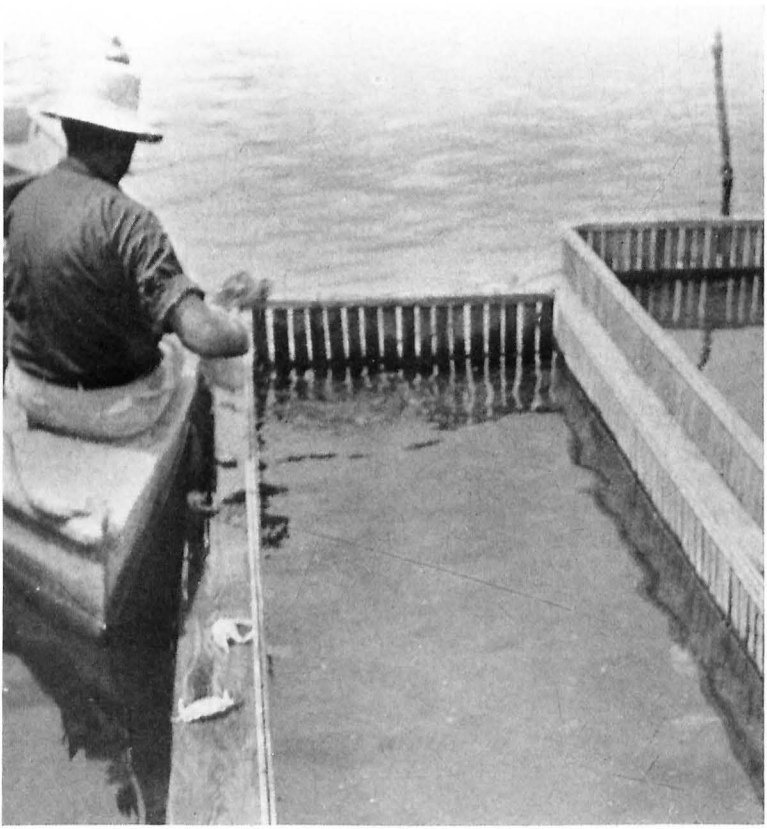
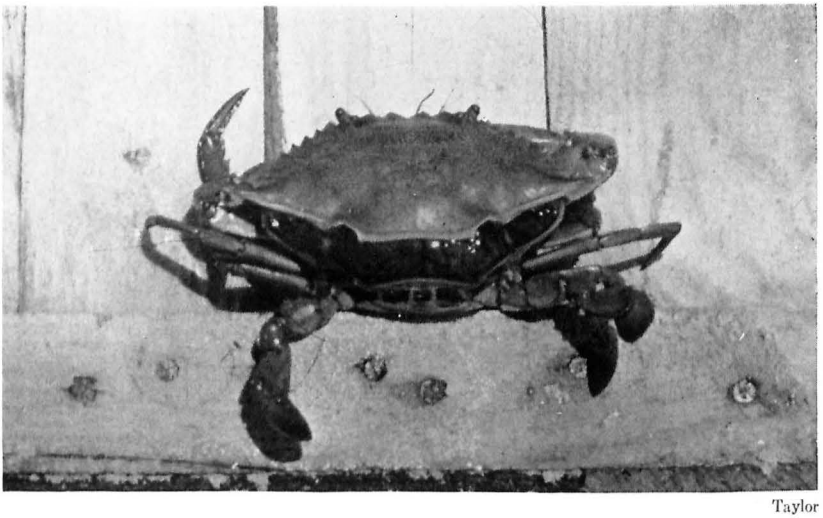


Taylor

TAKING SOFT CRABS FROM SHEDDING FLOATS

Taylor

Buying Peeler Crabs



Taylor

Crab Shedding Its Shell

Report of the
Virginia Fisheries Laboratory
of the
College of William and Mary and the Commission of Fisheries of Virginia

by CURTIS L. NEWCOMBE, *Director*

I. INTRODUCTION

The Virginia Fisheries Laboratory conducts investigational and instructional work in aquatic biology and conservation. The aim of the research work is to find out ways and means for improving the tidewater fishery resources of Virginia through learning how the supply may be maintained or increased, and also harvested so as to assure maximum utilization consistent with long range conservation. This program calls for practical studies on the water conditions affecting local variations in abundance, rate of growth, and reproductive habits of commercial species; the relative importance of different areas for fishery operations; successful artificial and semi-artificial cultural practices; and satisfactory methods for preserving the fisheries against predators and uneconomical methods of fishery practice. Educationally, the laboratory program serves to provide a center for the dissemination of facts about the biology of the Virginia fisheries, the nutritional and direct economic values of seafood and their importance to community welfare. High school and college students are reached by these programs of research and instruction.

II. RESEARCH PROGRAM

The investigational work of the Laboratory includes: firstly, field studies of the environmental factors affecting local and seasonal variations in abundance of certain of the commercial fisheries; and secondly, laboratory experiments to afford an understanding of biological relationships that are not revealed by field observations. Attention has been given mainly to (1) the following mollusca—oysters, mussels,

clams, screwborers, and periwinkles, all of which have economic importance; (2) the principal commercial crustacean of Virginia waters—the blue crab; (3) the fin fishes—shad and catfish; and (4) physical and chemical conditions of local waters.

Oysters

In the spring of 1941, a program was started to determine the best methods for culturing oysters under natural conditions in local waters. Temperature and salinity records, larval collections and oysters for gonad examination were taken at regular intervals. Each week "culch" materials were planted and shells were examined for "spat." The gonads were well developed in early June and a few had started to spawn in parts of the York and James Rivers in early June. At the end of June a large percentage of the population was spawning. A few oyster larvae developed as early as the first week in June. By June 13th, counts indicated numbers around twenty-five straight line and umbo stages per gallon of water. Until the last of June, no oyster larvae were found in the waters of Mobjack Bay. The preliminary observations from the different parts of the York River indicate a marked variation in the numbers of oyster larvae in the water and also in the time that they first appear. No strike was found before the end of June but a few straight line larvae were in the waters at Seaford. These observations are being continued.

Weather conditions during the late fall of 1940 were mild and field experiments showed that growth continued until late November and was resumed in April, 1941. Oysters from 1940 strike fall into two principal size groups. At the end of the growing season about December 1st, the average lengths of these two groups were one-half and one and one-half inches. At this time it is not possible to state definitely the best months for growth. Experiments have been set up to show the areas best suited to growth as well as for strike and fattening purposes. Also, efforts are being made to show whether or not seed transplanted from the James River and Chincoteague to the York River grow and survive as well as native stock. These oyster studies are being carried out by Mr. Winston Menzel, Assistant Biologist, and Mr. B. B. Shepherd, Research Assistant of the Laboratory.

Mussels

The ribbed mussel, *Volsella demissus*, used commercially in Virginia since 1940, has been intensively studied to determine the available supply and such facts about its biology and the method of its collection

as are needed to establish wise conservation measures. This mussel occurs in the intertidal zone in three different types of communities. Those on the seaside occur in unit groups called "tumps" consisting of numerous mussels embedded in small mounds of mud with a dense growth of reeds. On the western shore of Chesapeake Bay, they occupy a narrow strip of shore line usually about a yard wide whence the term "strip-formation." In some localities, they occur in dense mats of uniform surface. It has been found that they grow much slower than oysters and probably require about six or seven years to reach a commercial size. Their methods of reproduction are essentially the same as those of the oyster. The sexes are separate and they start to spawn at a length of around one inch. In 1941, spawning began shortly after the middle of June and continued into September, with one peak at the beginning of the season and two subsidiary peaks at monthly intervals. Various culture methods have been tried in the field at Seaford, Fox Hill, Kings Creek (Cape Charles), Elkin Island near Oyster, and at Chincoteague.

It has been found that larval mussels will not strike and survive except on "culch" containing small crevices. Transplantation experiments have shown that mussels thrown on the surface of the mud do not survive well. However, when properly implanted and protected from enemies, survival is good. Under artificial field conditions, the blue crab has been found to be a destructive enemy.

The mussel studies have been conducted by Dr. J. H. Lochhead, Associate Biologist and C. M. Coker, Assistant Biologist of the Laboratory. The histological work on the shellfish was done by Dr. R. P. Ash, Research Associate, assisted by Emma J. Bourquin.

Clams

During the year, observations were made on the distribution and growth of the hard-shelled clam, *Venus mercenaria*, and the soft-shelled clam, *Mya arenaria*. The last mentioned bivalve while abundant commercially in the New England States is not taken in the Chesapeake Bay to any great extent. Its rate of growth is much greater than that of the hard-shelled clam. Areas observed in Mobjack Bay and near Seaford have indicated local concentrations numbering as high as 50–60 per square foot and ranging in size from one-half to four inches in length. Generally, however, they are much less numerous and are restricted to local areas where the soil conditions and tidal level are favorable. Histological studies have shown that they spawned as late as November in 1940 and ripened earlier in the spring than the oyster and the mussel.

The hard-shelled clam is taken in commercial quantities throughout Tidewater Virginia. In sampling numerous, widely separated areas of the lower Bay, it has not been possible to locate a sizeable natural bed of small clams suitable for seed purposes. It seems quite definite that the seed grounds, if such occur, are very localized. Men in the clam business are dependent to a large extent on outside sources for seed clams. There is, therefore, a need for cultural methods that will assure a constant and adequate supply of natural seed. Although the growth experiments now being conducted at Oyster, Kings Creek and Seaford are as yet incomplete, they do indicate a very slow rate of growth as compared with the soft-shelled clam or "butterfish" and the oyster. This shows again the need for suitable cultural methods to meet the local demands of the industry.

Screwborers

Field observations have shown that the screwborer, *Urosalpinx cinerea,* is widely distributed in waters of the state having a salinity of twelve or more parts per thousand. They were found up the James River about as far as the river bridge, up the York River a short distance beyond Queens Creek and in greatest abundance and largest size throughout the seaside of the eastern shore. With respect to salinity toleration, controlled laboratory experiments have shown that salinities below twelve parts per thousand are distinctly unfavorable for their survival. Thus, at ten parts per thousand, their survival time under experimental conditions was less than eight days. It seems that in nature they can be expected to survive short periods of freshet. Embryos are less resistant to low salinity than adults. There is evidence that screwborers are unnecessarily distributed due to oyster transplantation work. In an effort to reduce this means of spreading the most important local enemy of the oyster, laboratory experiments are seeking to develop an improved method for preventing their dispersal. Results to date seem to indicate that screwborer embryos in the capsules attached to the oysters may be killed by submergence for one minute in copper sulphate solution* having a strength of one part in 500 without injury to the oysters. Rotenone was also tried and preliminary results indicate that a concentration as small as three parts in 1000 are effective in a fraction of a minute immersion. Possibilities of spraying infected shells with these toxic chemicals to facilitate field use of this method are being explored by Winston Menzel.

*Engle working at the Milford laboratory of the Fish and Wildlife Service in Connecticut reports positive results using copper sulphate.

Periwinkles

In view of new possibilities that have developed for the chemical use of the common periwinkle, *Littorina irrorata*, quantitative data have been obtained relative to their abundance and size distribution. They occur in the intertidal zone principally in areas of beach grass on which they feed. In winter, they are most abundant in the mud at the base of the grass stems. A one-foot cross-section of intertidal zone inhabited by periwinkles and measuring fifty feet in width yielded 613 fair-sized specimens *i.e.* about twelve per square foot. The width of the zone containing periwinkles varies greatly. Assuming an average width of twenty-five feet, one mile of shoreline may be expected to yield around 200 bushels. Picking by hand, one person can gather about two and one-half or three bushels per eight-hour day.

The Blue Crab

Studies were made on the distribution of crab larvae in the waters of the lower Bay. The occurrence of larvae of about ten different species of crabs has made it difficult to recognize with certainty those of the blue crab. It has been necessary therefore to study the recognition characteristics of the several species. Sufficient progress has been made to permit a reliable identification of three zoeal stages of the blue crab. These larvae occurred in by far the greatest numbers in the region of Cape Henry.

Numerous experiments were tried in an effort to discover a method for hatching out blue crab eggs artifically removed from the parent. It is now possible to hatch out over 3,000 eggs in a tray 9 by 8 inches. A 90 percent hatch was regularly obtained. Promising results for large scale hatching were obtained by suspending in open offshore waters individual sponges protected against possible enemies by wire screening. Successful methods were devised for removing sponges from crabs at commercial houses and for transporting them in good condition to the Laboratory. In the examination of large numbers of sponges, it was observed that in a high proportion of them the individual eggs were infected by a parasite believed to be a fungus. The possible effect of this organism on the development of the eggs was investigated. The importance of this parasite may be considerable since out of 137 sponges examined at random 54 were infected. Efforts to rear the larvae of the crab were beset with many difficulties. Although the larvae were found to be delicate, it was possible to rear them through from the first to the second true zoeal stage. These larval studies were carried on by Dr. M. S. Lochhead, Dr. S. H. Hopkins, Mildred Sandoz, and Rosalie Rogers.

Fin Fishes

During the year, about 100 species of local fishes were collected for the laboratory collection at Yorktown. Cooperative work with the Fish and Wildlife Service included assistance in tagging of shad during May, 1940. In the spring of 1940, catfish studies were begun by Winston Menzel working in the region of the James River and its tributaries. Although annual catches during the last five years have been fairly uniform, fishing effort has been greatly increased. There is evidence that the average weight per fish now being taken is one pound or less as compared with nearly two pounds several years ago. While there still seems to be an adequate number of small fish, the decline in supply of large, marketable fish is pronounced. Analyses of stomach contents reveal that in the spring catfish feed principally on herring and vegetable matter including pickerel weed, algae and roots of various plants. Throughout the year they take different aquatic insects, worms, and a variety of small fishes particularly small menhaden in the fall season.

Hydrography

Conditions on local and nearby oyster rocks have been analyzed in light of their favorability for growth, fattening and food of oysters. During October 1-15, 1940, the temperatures at Yorktown were around 19 to 20 degrees Centigrade, critical points in the spawning of oysters. By November 1st, they had dropped to 15 degrees Centigrade and to 10 degrees Centigrade by December 1st. In the following spring, the temperature reached 8.5 degrees Centigrade by April 1st and 14 degrees Centigrade by April 15th. Spawning temperatures around 20 degrees Centigrade were reached by about May 20th.

The monthly salinity variations at Yorktown ranged from about 17 to 23 parts per thousand. A sector taken at flood tide up the James River in the middle of June gave a salinity of about 19 parts per thousand over Nansemond Ridge, 13 at the Bridge, 10 at Days Point, 6 at Mulberry Point, 5 at Deep Water Shoal about the upper limit of oyster rocks, and 2.5 at Hog Island Point. The results in the York River emphasize the importance of the food and turbidity factors in effecting growth and survival of oysters. Counts of diatoms and protozoans, important as oyster food, showed marked local and seasonal variations. During the fall of 1940, the green-gilled condition was common in oysters over large areas of the York River. At this time there was a heavy growth of diatoms particularly *Skeletonema*. Turbidity measurements have shown that bottom waters of the York have, generally, a higher turbidity than those near the surface.

At a depth of 6 feet over Bellrock on the York River, there is a reduction in amount of light available for plant growth to about one percent of that at the surface. This reduction occurs at 14 feet near Yorktown, 28 feet in the middle of the Bay and about 40 feet off Cape Henry.

Results to date attach major significance to turbidity and to growth of sedentary organisms as factors affecting the oyster "strike" and especially survival of "spat" in the areas studied. During the fall of 1940, a fairly good strike was obtained on experimental "culch" and survival was better than during the summer. This result is correlated with lower turbidity and fewer competitors in the fall season. Professor A. R. Armstrong and Dr. Galen Ewing are engaged in these studies.

III. EDUCATIONAL PROGRAM

Three months after the opening of the Laboratory and with the beginning of the 1940-1941 academic year at the College of William and Mary, the instructional work in Aquatic Biology started. The Laboratory has been fortunate in having on its staff as Research Associates, Dr. Roy P. Ash, Dr. Albert L. Delisle and Professor Alfred E. Armstrong of the College faculty, who have offered courses in their respective fields of Biology and Chemistry.

Through the generous offices of the College summer school, instruction and research work in Aquatic Biology was offered during the 1941 summer session.

The educational program of the Laboratory has included an additional aspect aiming to acquaint the high school students, their teachers and parents, particularly in the tidewater communities, with the common forms of marine life, their economic importance and value as a source of food. At the instigation of the late Commissioner G. Walter Mapp, an educational marine exhibit and accompanying descriptive matter were assembled and the Commission of Fisheries arranged for having this exhibit displayed in over twenty-five high schools before approximately 8,000 pupils from November to May. This phase of the Laboratory's work has clearly shown a wide-felt appreciation and need for more educational work in fishery biology. There are upward to twenty-five counties in tidewater Virginia that derive a large percentage of their income from the fisheries. In from fifteen to twenty counties it has been estimated that from forty to fifty percent of the school population comes from homes the support of which is to a large extent dependent on the local fisheries. Despite this condition, little instruction is provided in fishery biology according to our best information. Furthermore, no descriptive materials in the form of pamphlets

or booklets on fishery subjects are made available to the schools for use of the teachers and pupils. The teachers have cooperated splendidly in this program and repeatedly requested laboratory materials, literature and other forms of assistance so that they may be in a better position to acquaint their classes with the local fisheries. The exhibit work was conducted by J. R. Melson, Laboratory Demonstrator.

To stimulate general interest in and appreciation for seafood products, exhibits of living and preserved materials are displayed at the laboratory in Yorktown. It is conservatively estimated that over two thousand persons visited the laboratory during the year.

IV. EQUIPMENT

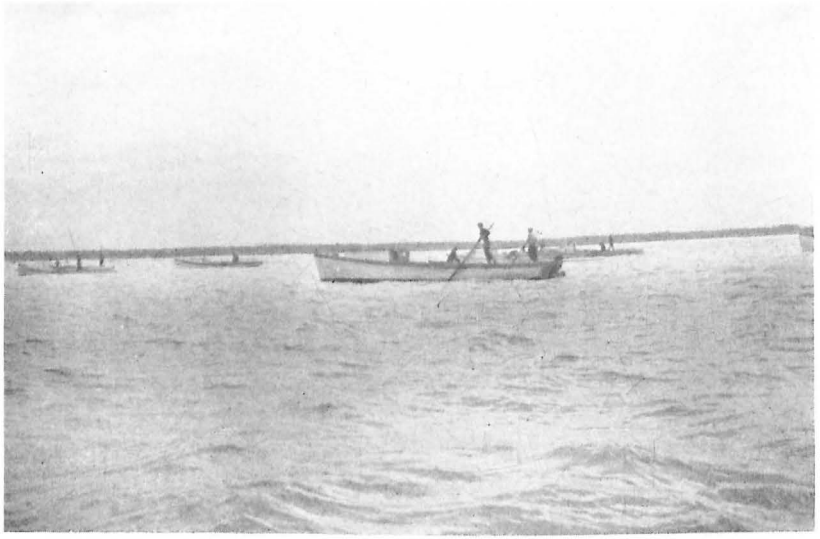
The Laboratory was handicapped during the first summer months of operation by lack of collecting nets and other sampling equipment necessary for field studies. By the end of the year, however, seines for collecting fish, plankton nets for taking oyster and crab larvae, Nansen-Knudsen water bottles for water samples, a pH meter, a spectrophotometer for chemical studies and a submarine photometer for light measurements were obtained.

The College Departments of Biology and Chemistry at Williamsburg have provided necessary supplies and equipment for the laboratories of instruction and research in Aquatic Biology. In December, 1940, the Commission of Fisheries assigned to the Laboratory the boat "Agnes Hope" and in June, 1941, arranged for the purchase of a new truck to meet transportation needs.

V. ADMINISTRATION

The Laboratory has functioned under the joint administration of the Commission of Fisheries and the College of William and Mary, while the U. S. Fish and Wildlife Service cooperated in the program. Through the aid of a Research Grant from the American Philosophical Society, studies were carried out on certain physical and chemical conditions affecting the supply of available oxygen in the Bay waters. The Laboratory was fortunate in having the cooperation of the E. I. duPont de Nemours and Company in developing the shellfish aspects of the research program. This Company provided a subsidy which made possible an extensive conservation study of the biology of the ribbed mussel involving the addition of several members to the Laboratory staff.

The Laboratory has received requests for information on subjects related to oyster practices and general problems involving the pollution

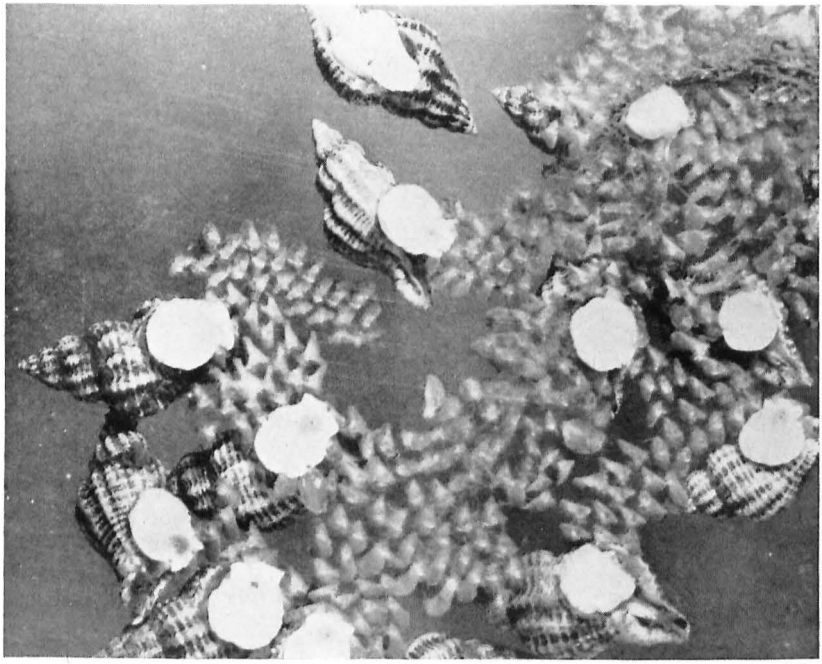


Taylor

OYSTER TONGING ON A STORMY DAY IN JAMES RIVER

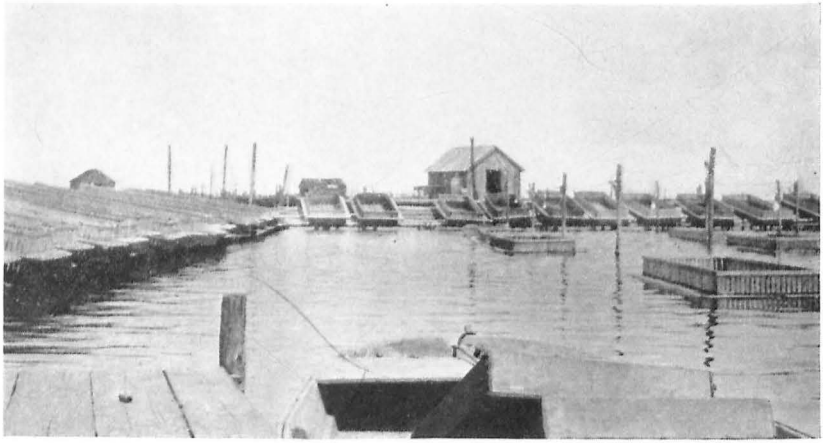
Coker

FISHING A POUND NET ON CHESAPEAKE BAY



Coker

Screwborers and Their Egg Capsules



Taylor

Crab Shedding Floats on Eastern Shore

of the estuarine waters of the Bay. Its facilities have been used for determinations arising out of these inquiries.

Books, pamphlets and periodicals in the field of fishing biology have been generously donated to the Laboratory and considerable improvement has been made in the literature now available at Williamsburg and Yorktown for fishery research.

VI. PUBLICATIONS

During the first year of operation of the Laboratory, several papers have been published by its personnel, being based in some cases on work done elsewhere as well as here. These contributions include:

Davis, Donald W., 1941 Biology at the College of William and Mary before the War between the States. *The Virginia Journal of Science*, Vol. 2, Nos. 2 and 3.

Lochhead, John H., 1940 The egg shells of the brine shrimp, *Artemia*. *Anat.* Rec. Vol. 78, Supplement: 75-76.

Lochhead, John H., 1941 Artemia, the "brine shrimp." *Turtox News*. Vol. 19: 41-45, 1 fig. (with M. S. Lochhead).

Newcombe, Curtis L., 1940 An experimental study of certain quantitative plankton methods. *Ecology*, Vol. 21, No. 3, July (with R. A. Littleford and B. B. Shepherd).

Newcombe, Curtis L., 1940 A physical, chemical and biological investigation of the layer of low oxygen content in the deeper water of the Chesapeake Bay. *Year Book of Am. Phil. Soc.*, 1940.

Newcombe, Curtis L., 1940 Studies on the phosphorus content of the estaurine waters of the Chesapeake Bay. *Proc. of Am. Phil. Soc.*, 1940.

Newcombe, Curtis L., 1940 Observations on the conservation of the Chesapeake blue crab, *Callinectes sapidus* Rathbun. *The Va. Journal of Science*, Vol. 2, No. 1, 1941 (with E. H. Gray).

VII. ACKNOWLEDGMENTS

The work of the Laboratory has been helped greatly by numerous persons in official and private capacities interested in the advancement of knowledge of fishery biology in Virginia. To all these individuals, the Laboratory expresses sincere thanks. The writer wishes to take this opportunity to acknowledge, on behalf of the Laboratory staff, the kindly assistance and great personal interest in each phase of the fishery program given by the late Honorable G. Walter Mapp, Commissioner of Fisheries and Rector of the College of William and Mary.

Special acknowledgment is made to Dr. D. W. Davis, Head, Department of Biology, for helpful counsel in all aspects of the Laboratory's work; to Dr. R. G. Robb, Head, Department of Chemistry, for use of space and equipment; to Dr. R. C. Young, Head, Department of Physics, for loan of apparatus; to Dr. K. J. Hoke, Dean of the Summer School, and to Mr. M. L. Carper, Curriculum Counselor, for advice and assistance in all educational matters; and to Dr. E. G. Swem, Librarian of the College, for help in all matters pertaining to the literature needs of the different studies.

During the summer of 1940, Dr. Herbert F. Prytherch, Director of the Fish and Wildlife Service Laboratory in Beaufort, N. C., conducted oyster studies in Virginia waters and gave valuable assistance to the Laboratory's work. Also, the Laboratory is indebted to Dr. W. S. Calcott, Director, Jackson Laboratory of the E. I. duPont de Nemours and Company for advice and assistance in the development of the mussel program.

State fishery officials and officers, private citizens and men in the seafood industries of the State have cooperated most generously in a variety of ways. Special thanks are expressed to Captain L. Selden Taylor, Superintendent of Boats and Conservation, for valuable assistance and cooperation; to Inspectors L. M. Callis of Seaford, W. C. Crockett of Willis Wharf, W. D. Steelman of Chincoteague, and Frank Garrow of Denbeigh, Virginia; and to Mr. E. C. Crockett of Seaford, Mr. George Elliott of Hampton, Menzel Brothers of Toano, Mr. R. N. Steelman of Oyster, Mr. Graham Evans of West Point, Mr. W. T. Quinn of Hampton, and Mr. Bernard Thomas of Yorktown, all of whom have contributed greatly to the practical studies conducted on the marine fisheries.

Several guest investigators worked at the Laboratory and contributed to the research on several important aspects of the fisheries. These include Dr. Margaret Lochhead of Williamsburg, Professor Herman DuBuy of the University of Maryland, Professor Mildred Sandoz of Mangum Junior College of Oklahoma, and Dr. Galen Ewing of Blackburn Junior College in Illinois.