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CHESAPEAKE BAY has long been famous for its oysters. Shared by Maryland and Virginia, this natural resource contributes greatly to the economic life of about thirty Tidewater counties.

Virginia oyster grounds extend approximately half way up the bay and reach far up the numerous tributaries. In addition, there are thousands of acres of oyster grounds on the Sea Side of the Eastern Shore.

Despite the magnitude of the acreage adapted for growing oysters, comparatively little effort has been made to find out just how valuable the industry is to the state or to explore its possibilities for development. Federal statistics indicate that Virginia ranks as the No. 1 oyster-producing state, the yield amounting to at least 5,000,000 bushels annually. Still, it is recognized that the state's oyster grounds are capable of a much higher level of production than is witnessed today.

According to records of the Virginia Commission of Fisheries there were nearly 12,000 oyster tongers in Virginia in 1907, whereas, in 1940, there were only 2,640. On the basis of available information, it may be stated conservatively that the present volume of production can be doubled in a comparatively short time if a progressive program of development is applied. This capacity for expansion is significant because a greater production of high quality oysters means more employment and a higher level of living in Tidewater.

Through a program of education in Virginia's Tidewater communities, the public is being made increasingly aware of the importance and potentialities of the oyster industry. At the same time, by scientific research and experimental demonstration, the most profitable methods of growing oysters and of rehabilitating oyster grounds are being determined. These joint programs of research and education are sponsored by the Virginia Commission of Fisheries and the College of William and Mary through the work of the Virginia Fisheries Laboratory. Results of these studies, in progress since 1940, suggest a comprehensive program for developing the fishery. Improved use of the vast oyster grounds in Virginia will depend in large measure upon test demonstrations to guide oyster farming and oyster rehabilitation programs.

LIFE HISTORY OF THE OYSTER

Oysters spawn in Virginia waters from June until October. Millions of reproductive cells are expelled into the water, where egg and sperm cells unite to form a *fertilized egg*. As the fertilized egg grows, it forms a mulberrylike *ball of cells* with hairlike cilia that cause movement. After about thirty hours a so-called *straight-line larva* is formed that is about 1/400 of an inch in length. It possesses

[1]For assistance in the development and presentation of the general oyster program, thanks are expressed to O. A. Bloxom of Battery Park, chairman of the Advisory Group of the Virginia Fisheries Laboratory.

two similar minute shells. After three or four days this larva grows into an *umbo stage larva* in which the two shells are not only different in shape from those of the straight-line larva but are different from each other. This peculiarity helps to differentiate oyster larvae from other bivalve larvae such as those of clams and mussels.

After spending about eight or ten days in the water, carried about by currents, the umbo larva becomes attached ("strikes") and grows on a suitable object if such is present. Materials serving for attachment of larvae are called "culch" and the oysters that have struck are known as "spat." Oyster shells constitute good culch provided they are not covered with growths of fouling organisms, which develop rapidly in the warm waters of Chesapeake Bay and prevent a large "strike" of oyster larvae.

The oysters reach a marketable length of three and one-half to four inches in about three years.

Public and Private Oyster Grounds

Oyster grounds, sometimes called oyster rocks or shoals or bars, are divisible into two distinct types, depending upon how they are used.

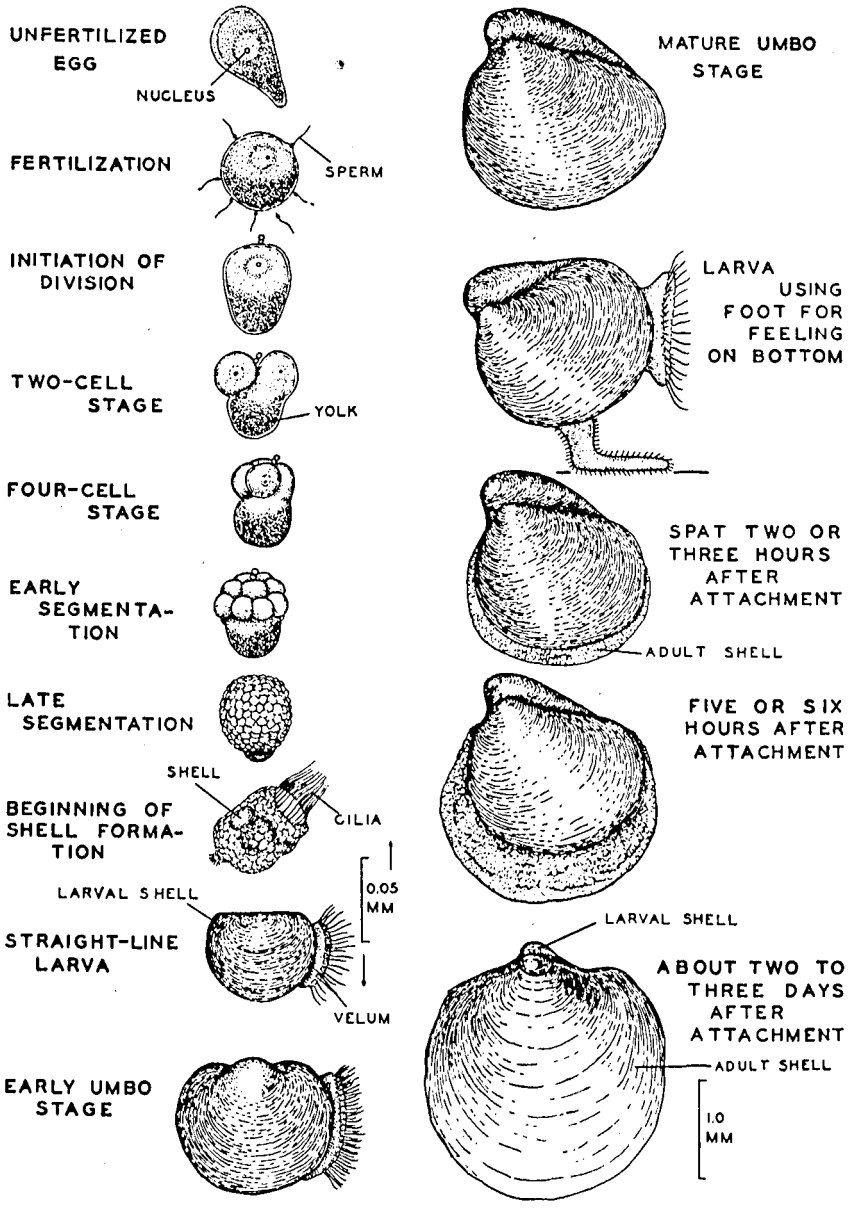
Public Rocks are those that were set apart by the Baylor Survey of 1894 for the exclusive use of the public, whereas areas lying *outside* the Baylor Survey are available for leasing by private individuals. These two types of oyster grounds comprise an acreage of approximately 201,000 and 400,000 respectively, according to the report of J. B. Baylor made to the Governor of Virginia in 1895. To quote from the amended act authorizing this survey: "All areas of Chesapeake Bay and its tributaries not embraced in the survey of the natural oyster beds, rocks, and shoals authorized by the Act shall be construed to be, in all courts of the Commonwealth, barren area and disposable by the Commonwealth for the purpose of planting or propagating oysters thereon, under Section 2137, *Code of Virginia,* as amended and re-enacted by Act approved February 25, 1892."

Public rocks are used mainly by tongers who pay an annual license, whereas private or leased grounds are those rented from the state for an annual fee of $1 per acre. In 1894, there were about 20,000 acres of leased ground. Today 75,000 acres are under lease.

Methods of Oystering

The methods by which oysters are produced from public grounds differ from those employed by private planters. Oysters are removed from public beds mainly by *hand tongs* and from private grounds by machine-operated *dredges.* The productivity of public beds depends to a large extent on the amount of culch they possess. Some have a great deal more than others, depending upon natural conditions or upon the amount of oysters and shells removed by tonging. When the natural supply of shells becomes exhausted and mud accumulates, the ground is unsuited for producing oysters without the aid of oyster culture.

The responsibility for maintaining the public rocks in a productive condition rests with the state. To this end there has been in effect since 1929 a rehabilitation program, and during this period more than 3,000,000 bushels of shells have been planted for culch. A Cull Law governing removal of oysters also helps maintain the productivity of the bars. The Cull Law, applied to public beds, requires: (1) that all shells not having spat must be returned to the oyster rock from which they were taken (this part of the law is popularly referred to as the "Rough Cull Law") and (2) that, except for those beds on the Sea Side of the Eastern Shore, the James River seed



Early developmental stages of the oyster. Drawn, from various sources, by J. G. Mackin

area, and one or two others, all oysters under three inches in length must be returned (this is called the "Three-Inch Cull Law"). The "Rough Cull Law" helps to maintain a supply of culch on the oyster rocks, while the "Three-Inch Cull Law" favors the maintenance of brood stock and a higher standard of oyster production.

Grounds outside the Baylor Survey are used for growing oysters by planting shells, where necessary to get a suitable hard bottom, and then putting down seed oysters, bought largely from tongers working in the famous James River seed area. Around 400 or 500 bushels of seed oysters, which cost, before the war, from 30 to 35 cents a bushel, can be planted with profit to the acre and at least a bushel-for-bushel yield of market oysters may be expected at the end of three years. Some oystermen plant shells for culch and grow their own seed. This practice is not now extensively followed, but it should be encouraged. Planters usually take up their oysters by means of large power dredges. These are dragged over the bottom and bring up as many as eight or ten bushels per haul.

After the ground is cleared of the current year's stock, seed oysters may be planted again to be harvested during the third or fourth succeeding year. Use of ground in private oyster culture is thus more intensive than from that in growing oysters under the more natural conditions on the public rocks.

Problems of the Oyster Industry

An analysis of trends in the oyster industry shows that: (1) public oyster rocks are now producing fewer market oysters than formerly and employing fewer persons; (2) the private oyster industry is growing a great many more oysters than formerly and is leasing more ground; and (3) seed grounds, such as those in the James River, are tending to be diminished.

Virginia needs to solve two main problems of the oyster industry. One is that of building up and maintaining the public rocks at a higher level of production with respect to both quantity and quality of oysters. The second is that of stimulating a greater development of oyster grounds by private industry. The solutions of these two problems are interdependent.

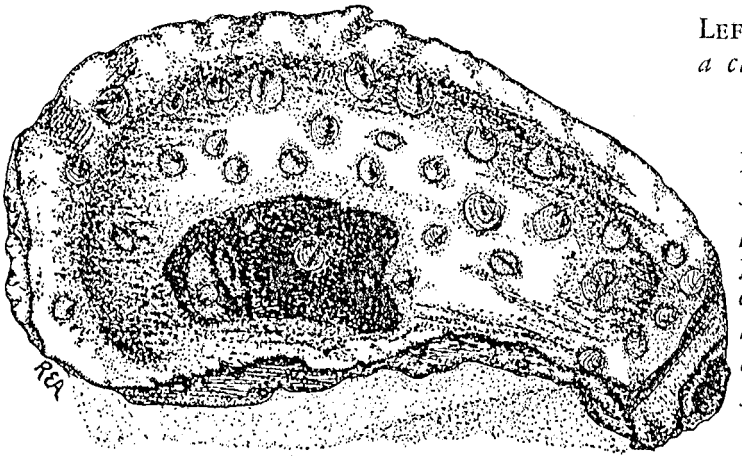
Baylor Survey or public rocks produce both seed and market oysters. For both purposes they require the planting of large quantities of shells for culch.

The James River public seed area, comprising about 25,000 acres, is set aside by law as a natural seed bed and provides the main source of seed for the planting industry. The maintenance of this ground is promoted by the "Rough Cull Law" and some shell planting. It produces from 1,000,000 to 2,000,000 bushels of oysters annually, however, so that extensive shell plantings may reasonably be considered necessary for its maintenance.

Other public oyster grounds of the state, amounting to more than 100,000 acres, are used principally for the production of market oysters and are subject to the "Three-Inch Cull Law." This law does not apply to the 65,000 or more acres of public rock on the Sea Side of the Eastern Shore. The "Rough Cull Law," however, does apply to these Sea Side rocks, as it does to the James River seed areas.

The problem with regard to rehabilitation of the public rocks is to find out where, when, and how to plant culch economically to replace that which has been gradually removed through the years.

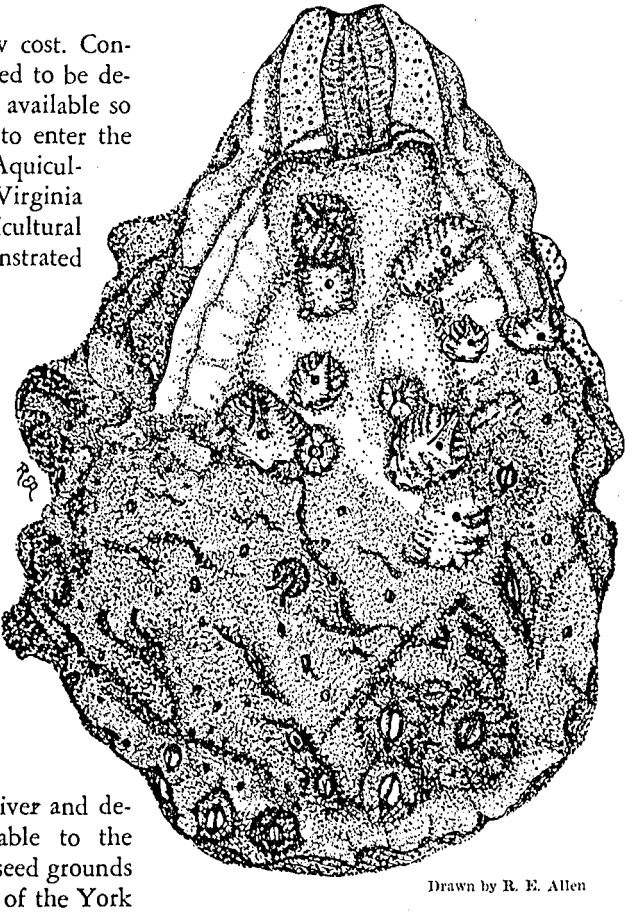
Development of unused ground outside the Baylor Survey that is capable of producing oysters offers further possibilities for expanding the industry. Many acres can be converted into good growing



LEFT: *Oyster spat on a clean oyster shell*

BELOW: *An oyster shell the lower part of which is fouled by an encrusted sponge. On the upper portion of the shell are several oyster spat*

grounds at comparatively low cost. Conversion methods and costs need to be determined and made generally available so as to stimulate more people to enter the business of oyster culture. Aquicultural guides are needed in Virginia quite as much as the agricultural guides which have long demonstrated their effectiveness.



Drawn by R. E. Allen

A PROGRAM FOR THE OYSTER INDUSTRY

Available information on the characteristics of Virginia's oyster grounds, on the availability of culch materials, and on current laws and public opinion, as well as on conditions for growing, handling and marketing oysters, indicates that Virginia needs a well-defined oyster development program aimed toward: (1) improving the condition of the seed grounds of the James River and developing and making available to the public significant acreages of seed grounds in other waters, such as those of the York and Rappahannock rivers; (2) efficient planting of thousands of bushels of oyster shells on the public bars; (3) finding means of controlling and, if possible,

eradicating the screwborer; and (4) conducting a continuing study looking to the solution of all the varied problems involved in the production of oysters.

Law enforcement is absolutely essential to the success of any part of this program. It is the *sine qua non* of a healthy and prosperous oyster industry, being a necessary aid to both tonger and planter.

IMPROVING THE SEED GROUNDS

The need for improving the seed areas and for establishing new seed grounds is well recognized. These improvements, if made, will provide more work for tongers, more seed for the large planters, and available seed for the small planters who are often dependent for their supply on what they are able to tong. Seemingly, there is scarcely a single factor that does more to stimulate private oyster planting than an abundant and easily accessible supply of seed oysters. Under such conditions, tongers are able to develop gradually into small-scale planters, with the result that their social and economic levels may be greatly bettered.

To bring about these several changes efficiently, potential seed areas need to be located and developed. The undertaking is a difficult one because of seasonal variations in conditions affecting strike and survival of young oysters and because marked differences in conditions for growing oysters exist in different rivers and even in different parts of the same river. During the past five years, much information on these limiting factors has been attained.

Yearly records indicate that strike of commercial proportions occurred every year on the seed areas of the James River. Annual fluctuations were greater in the York and Rappahannock rivers, but there seems to be no reason for believing that the variations are such as to hinder a shell-planting program. There was a commercial strike in the Rappahannock River during 1941, 1942, and 1944. Thus, it would appear that natural conditions are favorable for undertaking to increase the state's production of oysters by planting shells for culch.

REHABILITATING THE PUBLIC ROCKS

Seasonal records show that there are marked differences in the amount of strike and survival of spat throughout the growing months of any one year. This difference tells an important story with respect to when the state and the oystermen should plant their shells in order to get the best strike and survival of young oysters.

Data from the James, York, and Rappahannock rivers indicate that there is a late summer and early fall strike (August 15–October 1) that survives well and hence is of primary importance to the industry. Even during years when the late strike was less than that of July, it still showed up better in November than the more abundant but earlier strike. July strike is subject to destruction by competitive and fouling organisms.

Thus far, records show that shells planted for culch by the state in the bay area to build up the public rocks should be put down in August. Several of the competitive organisms, by that time, have passed their peaks of abundance and therefore do not greatly molest the young oysters that are establishing a foothold on suitable culch materials.

Years of abundance witness some spat on the shells of live oysters that have accumulations of silt and organisms which do not favor a good strike. In 1941, there was a heavy strike and survival of young oysters in the Rappahannock River. Had there been more and better culch available, the value of the strike would have been correspondingly greater. While the Rappahannock River is, potentially, one

of the best market oyster producing areas of the state, there are other areas that can be rehabilitated on a sound economic basis. They need culch planted at the proper time and place to enable them to grow oysters.

Shell planting in a particular area needs to be preceded by a careful study of the ground to determine: (1) the type of bottom, (2) the amount of brood stock present, (3) the amount of culch present, and (4) the amount of strike that occurred during the two or three years preceding. These are the principal factors that will indicate the success or failure of a shell planting program. They must be analyzed and evaluated.

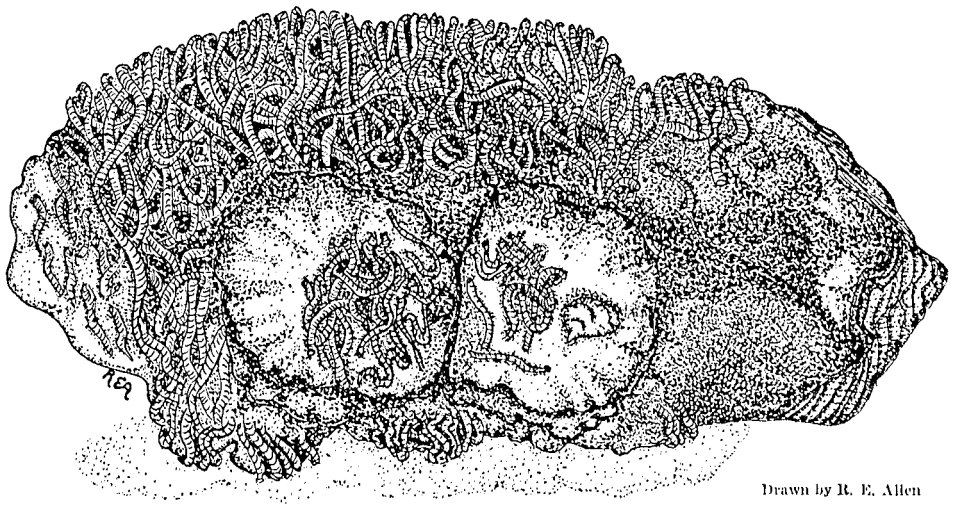
CONTROLLING THE SCREWBORER

The destruction of thousands of bushels of oysters annually by a marine snail, called the oyster drill or screwborer, renders large acreages of otherwise valuable ground not usable by planters or tongers.

Early in the century, the occurrence of drills in Virginia appears to have been limited largely to the Sea Side and their number was not sufficient to cause appreciable damage to the oyster crop. Transferring Sea Side seed to Chesapeake Bay during past years has undoubtedly hastened the spread of drills. Now they are in most waters of the bay and rivers that have a salt content high enough to permit their reproduction and growth, namely about fifteen parts per thousand. Their numbers vary on different grounds. For example, records taken in 1944 from Nansemond Ridge, a productive public oyster rock at the mouth of the James River, showed that more than 40 percent of the oysters were killed by drills; and on the Sea Side it is not uncommon to find a 70 percent mortality. Methods of controlling this pest are being studied.

CONTINUING STUDY OF OYSTER PROBLEMS

The need for more information on the relative productivity of the different oyster bars and on the best means for using them could be met by a comprehensive biological survey of the grounds, setting forth: (1) rocks now productive; (2) rocks now producing a few oysters but in need of shells or brood stock or both to



Drawn by R. E. Allen

An oyster shell fouled by calcareous tubes of a common tubeworm and by two jingle shells

save them from further deterioration; (3) nonproductive bars that can be rehabilitated by cultural means; and (4) nonproductive bars that because of excess sand or mud or for other reasons are not considered good investments as far as state rehabilitation is concerned.

Quoting from Baylor's 1895 report to the Governor of Virginia, "That portion of the area of Chesapeake Bay properly called natural oyster rock is now surveyed. Outside of this natural oyster area, there are at least 400,000 acres of barren area disposable by the Commonwealth for the propagation of oysters." While much of this acreage can never be developed into oyster ground, there is a considerable acreage suitable for growing oysters. These grounds should be located, evaluated and made known to prospective oyster planters. Such a study of the quantity of oysters on the state grounds and the condition of these grounds is an essential part of the oyster rehabilitation work projected by the Virginia Fisheries Laboratory.

The manner in which the oyster crop is removed also merits attention. Shells thrown overboard during tonging in compliance with the Rough Cull Law contribute to the maintenance of the rocks. The practice of "roughing" oysters, as disregard of the Cull Law is called, continues and until it is stopped the productivity of the bars will continue to decrease. On purely theoretical grounds the Cull Law is, in itself, not likely to constitute a perfect guarantee against a lowering of the productivity of natural bars that are subject to intensive tonging. But under normal conditions of tonging, supplemented by carefully regulated periods of opening and closing of the rocks and by a judicious shell planting program, it is believed that productive rocks may be maintained and unproductive bars converted into productive ones.

The purpose of an oyster development program for the public oyster grounds of Virginia is to ascertain and provide the conditions that will enable man to utilize that which nature provides for growing oysters. For example, an abundant supply of oyster larvae in the water is wasted if the culch necessary for its attachment is lacking. Proper management practice involves a timely planting of shells, a proper rotation of open and closed seasons for particular bars, and a rigid enforcement of the existing Cull Law. These steps enable natural factors to operate toward the development of a productive bar. The extent to which an oyster rock becomes self-producing and self-supporting indicates largely the success of its rehabilitation.

The private oyster business is faced with the problem of getting a good supply of seed and of maintaining its planting grounds in a productive condition. At present, most planters depend on the James River for seed oysters. These are planted on ground free from pollution and as nearly as possible without screw-borers. An investigation of the pollution problem is being undertaken by the laboratory of the U. S. Fish and Wildlife Service at Hampton Institute and great progress in the disposal of wastes in the whole Hampton Roads area is being made by the Hampton Roads Sanitation Commission.

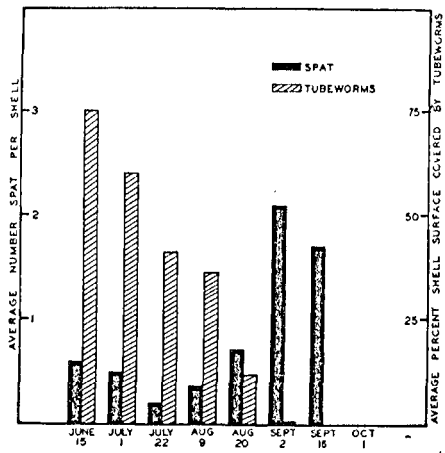
Summary of Needs

In review, seven major needs are recognized as a basis of an adequate program for rehabilitating the oyster industry of Virginia:

1. A biological survey of the oyster rocks is needed to determine their productivity under present conditions. Such a study will show what steps need to be taken to rehabilitate the public rocks and also to grow oysters more extensively on

grounds outside the Baylor Survey.

2. Production from the James River seed beds needs to be increased. These are the best seed beds in the nation, but



How fouling of culch by tubeworms reduces the amount of oyster "strike"

their productivity can be greatly increased by intensive planting of shells.

3. Additional seed areas should be established in other waters, such as the York and Rappahannock rivers, where there is a demand for seed stock. This would stimulate the development of a larger small-scale planting industry where there is ground outside of the Baylor Survey suitable for planting oysters.

4. At least 1,000,000 bushels of shells needs to be planted annually on the public rocks. This would assure their development and provide, under efficient management, for their self-maintenance.

5. A method must be found for reducing the damage done by screwborers, which now render some of the state's best oyster grounds unusable.

6. The state's machinery for managing the public oyster rocks and for enforcing the laws that relate both to private and public oyster grounds is in need of strengthening.

7. Consistent efforts must continue to be directed toward combatting the problem of pollution. Forward strides have been made in recent years by the Hampton Roads Sanitation Commission for the treatment and disposal of waste matter that in past years has threatened some of the most productive oyster grounds of Chesapeake Bay.

THE OVERALL PICTURE OF THE OYSTER industry of the state offers good reasons for optimism. Never before has there been such a concerted effort to iron out the difficulties of those engaged in making a livelihood from this natural resource. Such collaboration of effort and unity of purpose augur well for Virginia's important stake in the nation's oyster production.