MARINE RESOURCES OF VIRGINIA—

THEIR USE, CONSERVATION AND DEVELOPMENT

REPORT OF THE
VIRGINIA MARINE RESOURCES STUDY COMMISSION
To
THE GOVERNOR
And
THE GENERAL ASSEMBLY OF VIRGINIA

COMMONWEALTH OF VIRGINIA
Department of Purchases and Supply
Richmond
1967

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MARINE RESOURCES OF VIRGINIA—THEIR USE, CONSERVATION AND DEVELOPMENT

THE REPORT OF THE VIRGINIA MARINE RESOURCES STUDY COMMISSION TO THE GOVERNOR AND THE GENERAL ASSEMBLY OF VIRGINIA

Richmond, Virginia, October 23, 1967

TO:

HONORABLE MILLS E. GODWIN, JR., *Governor of Virginia*
and
THE GENERAL ASSEMBLY OF VIRGINIA

Virginia, being a seaboard State and possessed of large bodies of tidal waters, the mighty Chesapeake Bay and its tributaries, has been and presently still is richly endowed with marine resources. These resources consist of fish, crabs, oysters, clams and other shellfish, beaches, waterways, harbors, and waterfowl and constitute a large and important part of the economy of the Commonwealth. They give rise to commercial gathering and processing of seafood, waterborne commerce, recreational boating and fishing, swimming and hunting. However, under the twin burdens of increased industrialization of the State and a burgeoning population, conflicting interests in the use of our marine resources have arisen and increased in intensity and the preservation of these resources can no longer be left up to a bountiful nature. (See Appendix A)

Aware of the increasing complexities of these latter day problems in an area where the bounty of nature was once taken for granted, the General Assembly of Virginia, at its 1966 Regular Session, adopted House Joint Resolution No. 59, creating a Commission to study matters relating to the marine resources of Virginia. This resolution follows:

HOUSE JOINT RESOLUTION NO. 59

Creating a Commission to study matters relating to Marine Resources of Virginia, and to appropriate funds.

Whereas, Virginia possesses extensive marine resources, the extent and the potential of which are unknown; and

Whereas, with the increase in world population scientists have determined that in the foreseeable future the land will be inadequate to support the population of the world and the sea which covers more than seventy per cent of the earth's surface must furnish the additional food necessary to support such population; and

Whereas, marine biologists have testified on repeated occasions that the Chesapeake Bay, with its tributaries, is the most valuable single body of water in the entire world for its size in its ability and potential to produce marine resources and seafoods; and

Whereas, adequate knowledge of the great marine resources of Virginia is not readily available; and

Whereas, the commercial seafood and fisheries industry are an important and unique part of the economy of Virginia and should be encouraged and developed; and

Whereas, the recreational uses of the tidal waters of Virginia are constantly expanding and are an important part of the economy of Virginia and should also be encouraged and developed; and

Whereas, the rapidly expanding recreational uses of the tidal areas of Virginia have graphically brought into focus many conflicts between the commercial and recreational interests; and

Whereas, these conflicts must be resolved to the mutual benefit of each so that neither group will be unnecessarily regulated and restricted; so that proper conservation practices will be applied as to all marine resources; and so that all the marine resources of Virginia will be utilized to the maximum degree possible for the benefit of all; now, therefore, be it

Resolved by the House of Delegates, the Senate of Virginia concurring, That there is hereby created a Commission to be known as the Marine Resources Study Commission. The Commission shall consist of fifteen members; three members thereof shall be members of the House of Delegates; two members shall be members of the Senate; three members shall be representative of commercial fisheries in Virginia; three members shall be representative of recreational interests in Virginia; the Commissioner of Fisheries of Virginia, the executive Director of the Commission of Game and Inland Fisheries, the Director of the Virginia Institute of Marine Science, and the Director of the Virginia Saltwater Sports Fishing Association shall also be members of the Commission.

All members shall be appointed by the Governor who shall also designate the Chairman. Members of the Commission shall be paid the sum of twenty dollars per day for their services and shall be reimbursed for expenses incurred in the performance of their duties.

The Commission shall make a comprehensive study of the marine resources of Virginia; evaluate the present methods of uitlization thereof; determine whether proper conservation practices are being fostered under existing laws; make recommendations toward resolving conflicts between commercial and recreational uses of the marine resources of Virginia; and make recommendations for the long range preservation, use and development of the marine resources of Virginia.

The Commission shall hold such meetings and public hearings as it may deem necessary. All agencies of the Commonwealth concerned with marine resources shall assist the Commission in its study. The Commission may employ legal and secretarial personnel if needed.

For the expenses of the Commission and the conduct of its study there is hereby appropriated from the contingent fund of the General Assembly a sum sufficient not to exceed the sum of five thousand dollars.

The Commission shall complete its study and report to the Governor and General Assembly not later than November one, nineteen hundred sixty-seven.

Pursuant to this Resolution, the Governor appointed the following individuals to the Commission: E. Almer Ames, Jr., Attorney at Law and member of the Senate of Virginia, Onancock; Richard M. Bagley, President of Bagley Investment Company and member of the House of Delegates, Hampton; Russell M. Carneal, Attorney at Law and member of the House of Delegates, Williamsburg; Hugh C. Dischinger, Engineer, Hampton; J. W. Ferguson, Sr., Seafood Processor, Remlik; Walther B. Fidler, Attorney at Law and member of the House of Delegates, Sharps; William J. Hargis, Jr., Director, Virginia Institute of Marine Science, Gloucester Point; Milton T. Hickman, Commissioner of Fisheries, Painter; H. R. Humphreys, Jr., Menhaden and Food Fish Processor, Kilmarnock; W. P. Hunt, Seafood Processor, Hampton; Robert P. Hutchinson, Outdoor Editor, The Virginian-Pilot, Norfolk; William P. Kellam, Insurance and Real Estate Business, and member of the Senate of Virginia, Virginia Beach; Chester F. Phelps, Executive Director, Commission of Game and Inland Fisheries, Richmond; Claude Rogers, Director, Virginia Salt Water Fishing Tournament, Virginia Beach; and Walter J. Wilkins, Retired Businessman and Sport Fisherman, Norfolk.

The Governor designated Mr. Fidler to serve as Chairman of the Commission.

At its organizational meeting the Commission elected Senator Ames as Vice-Chairman. G. M. Lapsley and Wildman S. Kincheloe, Jr., served as Secretary and Recording Secretary, respectively.

At the organizational meeting the Commission considered an outline of various subjects prepared in advance by the Chairman. The Commission decided upon its approach to the study of the problems before it including the holding of public hearings. Six public hearings at locations in Eastern and Central Virginia were held as follows: Virginia Beach, Hampton, Warsaw, Accomac, Gloucester and the city of Richmond. The Commission visited and inspected various facilities within and without the State and accumulated from State and federal agencies a vast amount of material related to Virginia's marine resources. The Commission conferred with marine scientists and representatives of angling clubs, the U.S. Army Corps of Engineers, Federal Water Pollution Control Commission, State Water Control Board, Virginia Department of Health, U.S. Coast Guard, Commission of Fisheries of Virginia, Commission of Game and Inland Fisheries, Department of Conservation and Economic Development, State Council of Higher Education, several State-supported colleges and universities, motor boating and yacht club associations, the National Council on Marine Resources and Engineering Development and the National Commission on Marine Science, Engineering and Resources. The Commission held many meetings and several subcommittees were appointed to make preliminary studies and reports to the Commission. The Commission thoroughly studied all of the material assembled, the reports of the subcommittees and all of the suggestions and rceommendations made at the public hearings as well as recommendations of the individual members of the Commission.

Attached hereto as Appendix A is a review and summary of Virginia's marine resources and problems affecting them.

FINDINGS AND RECOMMENDATIONS

The Commission herewith presents the following findings and recommendations:

I. ADMINISTRATION AND MANAGEMENT

The Commission, after careful investigation and study, is of the opinion that the Commission of Fisheries of Virginia is the only agency in the State that has adequate background, information and capability to be the principal management agency of most of the marine resources of Virginia. The growing population pressures coupled with the broader demands upon the marine resources make it imperative that the mission of the Commission of Fisheries be broadened so that it will be prepared in the years ahead to more completely manage Virginia's principal marine resources. To this end this Commission recommends that the name of the present Commission of Fisheries be changed to "Marine Resources Commission". We further recommend that the present membership of the Commission of Fisheries be enlarged from five to seven members who shall be insofar as practicable representative of all of the users of Virginia's marine resources.

We are convinced that the Enforcement Branch of the Commission of Fisheries should and must be expanded so as to render a more complete service to those who use the marine resources of Virginia and to serve as a more effective tool in the protection and conservation of these resources. We, therefore, recommend that the Commission of Fisheries expand its enforcement personnel by not less than twelve men during the 1968-1970 biennium and that five additional boats, adequately equipped, be acquired for use by these additional enforcement personnel. The estimated cost of the nonrecurring capital outlay item involved in the acquisition of five additional boats is the sum of fifty thousand dollars. The estimated cost for salary, operating expenses and debris and litter control, hereinafter referred to in Part III of the Findings and Recommendations, is the sum of three hundred thousand dollars for the biennium.

To finance this expansion of enforcement, we recommend that the necessary funds be appropriated to the Commission of Fisheries from the unrefunded gasoline taxes imposed on marine users. It is estimated that during the calendar year 1966 about 20,050,000 gallons of gasoline were used to propel boats in Virginia, which yielded approximately $1,403,500 in motor fuel taxes. Only $210,610 of this amount was claimed and paid as refunds. Thus, the approximate amount unclaimed for refund was $1,192,890, or 85% of the total taxes. In the same calendar year 54,364 boats were registered in Virginia and there were 2,711 documented vessels as reported by the Fifth Coast Guard District, amounting to a total of 57,075. The total Tidewater registration was 42,956, which, after adding the 2,711 documented vessels, amounts to a total of 45,667. Thus, the Tidewater total is 80% of the State total. Considering the pattern revealed by the foregoing figures, it is obvious that the amount of motor fuel taxes paid by marine users and unclaimed by them for refund in any year is far more than ample enough to sustain an appropriation from the motor fuel taxes to the Commission of Fisheries of $150,000 in each year of a Biennium.

§ 28.1-23, relating to the authority of the Commission of Fisheries to make regulations, should be amended to extend such authority to the taking of seafood. This section should be further amended to empower the Commission to establish a license commensurate with other licenses, not to exceed $100, for any device used for taking or catching seafood that is not otherwise mentioned in Title 28.1; and to provide that violation of any Commission regulation shall be a misdemeanor punishable by a maximum fine of $1,000 and a maximum jail sentence of twelve months, either or both. This section presently authorizes the Commis-

sion to make regulations "to promote the general welfare of the seafood industry and to conserve and promote the seafood and marine resources of the State", provided such regulations do not conflict with provisions of statutory law. Specific authority is needed to make regulations concerning the taking of seafood, since unusual conditions and situations frequently arise which are not expressly covered by statute. By the same token, devices for taking or catching seafood may come into use which are not covered by the licensing statutes. The section presently does not prescribe punishment for violations of the Commission's regulations.

This Commission has become aware of the desirability for more widespread enforcement of the safety provisions, in Tidewater Virginia, of the Motorboats and Watercraft Safety Act which was adopted in Virginia by the 1960 Session of the General Assembly. This Commission particularly calls to the attention of law enforcement agencies other than the Commission of Game and Inland Fisheries, which is primarily charged with the enforcement of the Act, that § 62-174.17 specifically gives every other law enforcement officer of the State and its subdivisions authority to enforce the provisions of this Act. We call upon all other law enforcement agencies to assist the Commission of Game and Inland Fisheries in the enforcement of this Act.

§ 28.1-2, relating to which counties and cities constitute Tidewater Virginia, should be amended, in view of recent incorporations of cities and consolidations of counties with cities, to delete the counties of Norfolk and Princess Anne and the city of South Norfolk and to add the cities of Chesapeake, Colonial Heights, Fairfax and Falls Church.

Erroneous internal cross references in subparagraph (11) of § 28.1-179 should be corrected. This section relates to the removal, transportation, etc., of shellfish from polluted ground. The subparagraph provides that when the Commission of Fisheries deems an emergency to exist, it may make rules and regulations, for protection of the public health, which relate to shellfish from condemned areas, without complying with the requirements of §§ 28.1-124 and 28.1-125. The references should be to §§ 28.1-24 and 28.1-25.

II. RESEARCH AND EDUCATION

The Commission is convinced that the tidal or marine waters of the Commonwealth and their biological, chemical, geological and physical attributes are of paramount importance to the welfare of its people, industry and to the future. Proper use, management and preservation of these valuable natural resources are essential functions of the State government. To accomplish these goals, research in marine science (oceanography) must be a continuing activity of the State. Education of marine scientists, technicians and research assistants is also important. The Commission is convinced that continued and expanded support of marine science (oceanography) from the General Fund is justified.

Evaluation of the proper role for Virginia in research and education in the marine sciences necessitated a rather comprehensive review of the present and proposed programs of the several State-supported institutions involved. In this review, the Commission interviewed representatives of the Virginia Institute of Marine Science, the principal marine science activity of the Commonwealth, the University of Virginia, the College of William and Mary, Old Dominion College, and the Council of Higher Education at some length. We also received and reviewed supporting materials and documents from all parties. Included among these ma-

terials were the various reports involved in the Council of Higher Education's study. This phase of the study occupied a considerable portion of the Commission's time during the spring, summer and fall of 1967.

The primary justification for investment in oceanography from the General Fund is the need for research, applied and basic research, which will provide information required for adequate use and conservation of all the marine resources. Education of marine scientists and marine technicians is an important activity that can be carried out in conjunction with research using the facilities and scientists involved.

The problems facing Virginia's marine resources and their public and private users and managers are becoming more numerous and serious. They steadily increase in scope and size. To conduct research of the type needed by the Commonwealth requires a strong, well-staffed and adequately housed and equipped centralized research group—a research institute such as that existing in the Virginia Institute of Marine Science, hereinafter referred to as VIMS.

This Commission is impressed with the splendid work done in recent years by VIMS, especially in marine research. The lack of knowledge and demand for answers in the field of oceanography or marine science is so pressing that we strongly urge expansion of the programs, personnel, equipment and facilities at the Virginia Institute of Marine Science at Gloucester Point and Wachapreague. Specifically, we recommend (1) addition of personnel in administration, in the physical aspects of marine science, and in applied marine science and engineering; (2) construction of a student dormitory; and (3) construction of a marine technology demonstration facility. Because of the importance of the waters of the Continental Shelf to the Chesapeake Bay and its resources and to the coastal areas of Virginia and because its waters contain as yet untapped resources that will be of great value, the Commission *urges* that a research vessel for VIMS be funded from the General Fund in the next biennium.

Sound economic development of the Chesapeake Bay and its tributaries requires the ability to experiment with proposed engineering modifications in advance of their accomplishment. In the hydraulic model of the tidal James an excellent facility for this work has been developed. The Commission strongly recommends that it be retained and that funds for its retention and for its use in research and teaching be provided for VIMS.

The Commission also feels that the prompt construction of the proposed hydraulic model of the Chesapeake Bay by the Corps of Engineers should be promoted and encouraged. It will be an invaluable tool in providing the necessary information so badly needed to plan intelligently for proper management of the resources of this important body of water. Because of the importance of this facility to the State, Virginia's participation in the expenses of gathering the physical and chemical data necessary for construction and verification of this model is justified. The Commission urges that the budget of VIMS be augmented to provide for this activity in 1968-70 and for future use of the Bay model on Virginia's behalf.

There is a serious lack of fundamental information about the marine environment and its resources. This lack places limitations on the ability of public and private bodies of the Commonwealth to plan for and use its marine resources properly. Thus, expansion of the research activities of VIMS, mentioned above, is justified. Equally serious and perhaps more

pressing is the lack of significant ability and effort on the part of VIMS in research and engineering activities designed to translate research results into techniques and processes useful to the commercial fisheries and recreational fisheries, to public management agencies and to industry. Accordingly, we recommend much stronger development of applied marine science and engineering capabilities in the Institute. To allow full use of Federal funds available on a matching fund basis for this work, adequate budgetary provisions should be made in VIMS' budget for 1968-70.

A considerable amount of work has been done in the field of higher education in marine science and oceanography by the colleges and universities in Virginia primarily in connection with the Virginia Institute of Marine Science. There is additional need for education in oceanography in Virginia, especially in technological aspects. We recommend strengthening of these programs for VIMS and its affiliates.

Because of the special geographical location of Old Dominion College on the Norfolk Peninsula and because its faculty and administration are keenly interested in participating in the oceanographic activities of the State, we recommend that Old Dominion College be allowed to offer courses and grant degrees in oceanography at the Master's level. We recommend and *urge* that Old Dominion College, as it expands its oceanographic program, affiliate with the Virginia Institute of Marine Science and take useful advantage of its personnel, library and facilities. We further recommend and *urge* that the research activities of the College be coordinated with those of the Institute and its other affiliates to prevent unnecessary duplication of effort and to make the results more useful and more widely available. The Institute should cooperate with Old Dominion College and the Virginia Polytechnic Institute and other State-supported institutions in any allowable manner as provided by law.

Substantial advantage to the marine resources of Virginia and to public and private users and managers can accrue if the research and educational activities in marine science be geared to the existing State-supported oceanographic program as provided in Chapter 9 of Title 28.1 of the Code of Virginia. The present organization of VIMS with provisions for suitable affiliation provides a most economical and productive arrangement which should, if properly operated, provide maximum benefits at minimum cost to the taxpayers of the Commonwealth. We recommend that no substantial change be made in the present law relative to provisions for financing, administration and control of the Virginia Institute of Marine Science. No changes in the several important missions, which are basic and applied research, engineering, and education in the marine sciences, of the Institute should be made. We are of the firm opinion that the present arrangement, providing for affiliation with one or more colleges or universities, is a good one and gives the citizens of Virginia the benefit of diversity of knowledge and capability that comes from affiliations with more than one college or university. This benefit would be substantially lost if the research and educational facilities of the Virginia Institute of Marine Science were placed exclusively under the control and direction of one college or university.

Marine science (oceanography) deals with the oceans and their tributaries, i.e., the tidal waters of the world. Of direct importance to Virginia are the Chesapeake Bay and its tributaries and the contiguous waters of the Atlantic Ocean. This is a vast area. The waters of the sea are difficult to research in. The problems of developing an adequate understanding of these waters and their resources are great. It is essential that the research institutions assigned the task of studying this last global

frontier be adequately staffed and supplied. A critical mass of personnel and equipment, which is very expensive, is required to have a productive research unit. If there is a shortage of funds for this purpose, the Commission urges that priority of assignment of these funds be assigned to the programs of VIMS and its affiliates since this would be in the best interest of the marine resources of the Commonwealth.

This Commission has recognized an almost complete lack of training or educational facilities below the college level in the Commonwealth of Virginia in the field of marine resource and fishery technology. We, therefore, recommend that the State Department of Education, in cooperation with Federal programs available, promptly approve and offer courses in vocational fisheries in the high schools in selected areas in Virginia. We also recommend that courses in marine science, marine conservation, and vocational fisheries be offered in one or more of the technical or community colleges in Eastern Virginia. Effort should be made to provide this service to as wide an area as possible but duplication should be avoided. One or two good programs, centrally located to the areas where such services are required, would be better than several inadequate ones. VIMS should assist these programs in any reasonable and feasible manner possible.

III. POLLUTION AND WATER QUALITY

Increased Federal activity in the matter of stream and water pollution is obvious. The response of the State Water Control Board and its staff to these new requirements and this new challenge is commendable. It is imperative that the Commonwealth of Virginia do what is necessary to maintain State control of water quality standards and their implementation on the local level. This Commission has reviewed the projected increased activities of the State Water Control Board for the next biennium as well as the estimated cost thereof. We conclude that these projections are reasonable and that the increased activities are absolutely essential to maintaining State responsibility in this field. We, therefore, strongly recommend that the budgetary requests of the State Water Control Board for the 1968-1970 biennium be approved in their entirety.

Virginia has a serious and growing problem from boat and marina type pollution. This Commission feels that we do not have at this time a problem resulting from recreational boats using open waters, but there is a serious problem resulting from boats at marinas and other places where boats, congregate, which must be corrected. Any laws or regulations relative to the installation or operation of marine toilets or other disposal means for sewage and other pollutants resulting from use of boats should be as near as possible uniform with the laws or regulations of other states along the Atlantic seaboard. For this reason, we recommend against a legislative act that defines these new laws or regulations in detail since they may need to be changed or altered with some frequency at first. We also feel that the State Water Control Board should be the agency charged with controlling boat pollution. We, therefore, recommend that the State Water Control Board be given specific and permissive legislative authority to control by regulation the discharge of sewage and other wastes from both documented and undocumented boats and vessels, on all waters of the State.

This authority to the State Water Control Board should specifically include nonnavigable waters of the United States as well as navigable waters within the Commonwealth of Virginia. The State Water Control Board should consult with and coordinate its regulations with the Depart-

ment of Health, the Commission of Game and Inland Fisheries, and the Commission of Fisheries. Enforcement authority should be given to every law enforcement officer of the State.

The State Health Department should be given broader and clearer specific authority over sewerage facilities at marinas and other places where boats congregate, whether the establishment serves food or not. The State Health Department should adopt by regulation minimum requirements for sewerage facilities adequate to serve the number of slips and people which the marina or boat facility is designed to accommodate.

In this connection, § 62-2.1 of the Code of Virginia should be amended to provide that the Commission of Fisheries shall not issue a permit for construction of a marina until the applicant presents the Commission of Fisheries a plan for sewerage facilities approved by the State Health Department which are adequate to serve the number of slips and people which the marina is designed to accommodate. Also, the State Health Department should be vested with the power and duty of enforcing compliance with such plans.

The matter of garbage, trash, dead animals, cartons and containers, boxes, boards and general debris being cast into the streams, creeks, rivers and bays of the Commonwealth of Virginia has grown to be a problem of considerable proportions in some areas of the State and the problem is certain to become more acute.

§§ 62-183, 62-183.1 and 62-187.1 of the Code of Virginia partially cover this problem but affect only specifically designated areas of the State and prohibit only a limited number of the activities mentioned above. We, therefore, recommend that all three of these sections be repealed and that a general statute of uniform application be enacted making it a misdemeanor to cast, throw or dump any garbage, refuse, dead animals, trash, cartons, containers, lumber, boxes or other debris into any of the waters of this State. All law enforcement officers of the State should have authority to enforce this new provision.

This Commission is aware and has taken note of the instances of oil spillage in certain areas of Tidewater Virginia which have been damaging to the marine resources. We are not making recommendations for additional legislation in this field at this time since corrective legislation is now under consideration in the Congress applying to all navigable waters.

In regard to the trash, etc., we recommend the appropriation of the sum of $10,000 for the Biennium to the Commission of Fisheries for the purpose of conducting an intensified campaign to prevent and discourage the throwing of litter and trash into the tidal waters of the State. This sum would be included in the $300,000 item hereinbefore mentioned in Part I of the Findings and Recommendations. This problem has become particularly acute in the Tidewater Area due to the ever increasing number of pleasure craft using the waters in that area. People on these boats are prone to heedlessly toss bottles and cartons, and other litter and trash, overboard. This campaign would include efforts to educate the public in this respect, such as the posting of placards at establishments and places where boats are moored.

IV. MARSH LANDS AND WETLANDS

We recognize and appreciate the value of marshes and wetlands to the marine resources of Virginia. The day is rapidly approaching when

Virginia must be in a position to protect its marshes and wetlands from mutilation and destruction. Each year acres of marsh and wetlands, valuable to the State's marine economy, are drained, dredged and filled in or built upon for commercial or other purposes. Many of these wetlands are absolutely essential to the life cycle of most of the marine animal species found in Virginia. Their virtual destruction would convert most of our marine waters to barren wastelands as far as fish, oysters, crabs and waterfowl are concerned.

The first step in a sensible and effective program of wetlands preservation is the accurate identification of those marsh and wetland areas within the State which must be preserved to maintain the productiveness of the various waterways of the State. These areas should be accurately identified and their relative importance assessed. Such information is not now available. Before the State can given intelligent thought to methods for preserving and protecting these essential marshes and wetlands, such a study and survey of these areas must be made.

We, therefore, recommend that the Virginia Institute of Marine Science be directed to make a study of all marshes and wetlands in Virginia and assess their relative importance to the marine resources of the State. These studies should be coordinated closely with the Commission of Game and Inland Fisheries and the Commission of Fisheries.

V. CRABS AND CRABBING

This Commission has carefully studied the present and past crab populations in the State as well as the methods employed in harvesting crabs in Virginia. We are convinced that the present methods, equipment and seasons employed in Virginia for the taking of crabs are not materially affecting the crab populations in the State. The short life span of the crab and its unusual ability to reproduce itself under near normal conditions influences our conclusion. Present crab populations are at a good level. This Commission is of the opinion that the license required by § 28.1-165 of the Code of Virginia for each crab trap or crab pound is excessive in relation to other license fees and such section of the Code should be amended by reducing the license fee from $4 to $3 per year.

§ 28.1-173 of the Code of Virginia should be amended to require every owner or user of a crab trap or crab pound to completely remove the said trap, lead, poles and gear from its location not later than December first of each year under the penalty of not being issued a license for a subsequent year until it is done.

The proliferation of crab pots throughout the tidal waters of Virginia is creating an ever increasing problem to the other users of our waters that must be recognized. Identification of the owner of the crab pot is a necessary first step in any control effort. The Commission therefore recommends that a new statute be enacted, to be effective January one, nineteen hundred sixty-nine, requiring any crabber, for whom a license is prescribed in Virginia, to display and maintain the current license number, issued to such crabber by the Commission of Fisheries, on the float or stake attached to each pot employed by such crabber in a legible and visible manner in figures of not less than one inch in height.

The Commission further recommends that a new statute be enacted making it unlawful to place or maintain any crab pot in navigable channels having navigation aids installed or approved by any agency of the United States Government, and providing that any crab pot located in

accordance with this recommendation shall relieve the owner of any civil responsibility for so locating the same.

VI. FISH AND FISHING

A. Menhaden Fishing.

Much of the apparent conflict between recreational fishermen and menhaden fishermen has been difficult for the Commission to assess. The mere presence of menhaden fishing vessels in the waters of Virginia seems to be objectionable to some. This Commission recognizes the menhaden industry and its basic fishing operations as a valid use of the waters of the State. It further recognizes the very considerable economic benefits to the State derived from this old industry, which should be protected. The ever-increasing recreational use of our waters brings the frequent claim that the setting of purse nets in and of itself tends to scare off spot and other sport fish. In addition, many recreational fishermen assert that the pumping of menhaden fish from the net in water solution, and the attendant discharge of this surplus water over the opposite side of the menhaden vessel, attracts sharks, which in turn scare off other fish. We recognize these complaints are serious ones to the recreational fisherman and should be approached dispassionately and factually. However, the Commission believes that sufficient scientific facts are not now available to intelligently resolve these conflicts. We, therefore, recommend that the Virginia Institute of Marine Science be directed to make a study of the effect of the menhaden fishery operations on recreational fishing in Virginia and report its findings to the Governor and General Assembly of Virginia when the study is completed; with, at least, an interim report being made by the time of convening of the 1970 Regular Session of the General Assembly.

The Commission recommends that no restrictive legislation be enacted, except as hereinafter recommended, as to either recreational fishermen and menhaden fishermen until the above study is made.

The Commission is anxious that as many opportunities for conflict be avoided as possible. Obviously, Saturdays and Sundays during the summer season find the tidal waters more widely used by sport fishermen than the other days of the week. We feel that the menhaden fishermen should be compensated in fishing days if any restrictions are imposed as to fishing on such Saturdays and Sundays. The Commission, therefore, recommends that purse seining in Virginia waters be prohibited from midnight Friday to midnight Sunday of any week from the beginning of the purse seining season through Labor Day. We further recommend that the beginning of the season for purse seining be changed from the last Monday in May to the tenth day of May.

B. Enforcement.

This Commission is of the opinion that several sections of Title 28.1 could be helpfully, efficiently and effectively enforced by all law enforcement officers in the State if they were authorized to do so. The Commission therefore recommends that § 28.1-50, relating to the taking of channel bass and rockfish, and § 28.1-53, relating to the distance nets may extend across bodies of water or channels, be amended so that each section may be enforced by any game warden or any other law enforcement officer of this State.

C. Fishing Devices

In order to protect a large, dormant stock of food and sport fish in their winter habitat, the Commission recommends that a new statute be enacted prohibiting the use of sunken gill nets, snatch hooks, grab hooks, or gang hooks, for the taking or catching of fish in the Rappahannock River below the Downing Bridge at Tappahannock, in the James River below Jamestown Island, in the York River below the town of West Point, and in the Piankatank River below the Cobbs Creek Bridge, between January one and March fifteen of any year; such prohibition to specifically apply to residents and nonresidents alike and the statute to be so drafted that it will be a limitation on the type of nets and gear used and not a limitation as to the type of fish.

In order to protect flounder and channel bass, which are tremendously important to the sport fishery of the seaside of the Eastern Shore of Virginia, the Commission recommends that § 28.1-48 of the Code of Virginia be amended to prohibit the setting of fish pots and fish trotlines on the ocean side of Accomack and Northampton Counties and to further provide that the inspectors of the Commission of Fisheries may confiscate any fish pots and fish trotlines set in such area.

In order to equalize license fees, the Commission also recommends that § 28.1-48 be amended to: (1) change the license tax on pound nets from $6 to $10; and (2) make the $5 fee presently applicable to gill nets (other than stake gill nets) up to 400 feet applicable to such nets up to 600 feet.

D. Fish Size Limits.

The Commission recognizes that § 28.1-49, relating to size of fish that may be caught, is practically impossible to enforce. At the same time we recognize that there may be some beneficial effects from the law as it exists. Studies by marine scientists, both federal and state, are now being conducted to determine whether minimum and maximum sizes are necessary to preserve the various species of fish. Until these studies are completed we do not wish to recommend strengthening or repealing this section. We, therefore, recommend that no changes be made in this section.

E. Fishing Preserves.

The Commission carefully considered the occasional demands heard in the State for the establishment of fishing preserves of one kind or another. It is convinced that the establishment of fishing preserves is not a wise practice, is not conducive to the widest and most productive uses of our waters and is not a conservation measure as far as marine resources are concerned. The principle of multiple use of our waters should be the established long-range policy of the State. We, therefore, recommend against the establishment of fishing preserves in any of the public waters of the Commonwealth.

VII. PROMOTION OF VIRGINIA SEAFOOD PRODUCTS

Although the potential of Virginia's seafood industry is as great as that of any of the other Atlantic seaboard states, and greater than some, this potential is not being realized because of the absence of a State-supported promotional program. This situation applies to both the domestic and foreign market. In other words, Virginia is "missing the boat" in not promoting its seafood products as vigorously as many of the other Atlantic seaboard states are doing. It is stating the obvious to say that

State funds devoted to this purpose will be justified many times over by the resultant benefits to the overall economy of the Commonwealth afforded by a more prosperous seafood industry. Furthermore, federal funds are available for this purpose on a matching basis with State funds at very favorable ratios—some are 3 federal to 1 state.

We, therefore, recommend that the General Assembly appropriate to the Commission of Fisheries the modest sums of $10,000 in each year of the biennium to match Federal funds for use in such a promotional program. We further recommend that the Commission of Fisheries be authorized to make the resulting Federal and State funds available to appropriate agencies or organizations, from time to time, which the Commission deems to be adequately constituted to prosecute an efficient program for the promotion of Virginia seafood products. The Commission of Fisheries is to maintain a continuing observation of the promotional program conducted by any agency or organization to which it has channeled such funds, in order that the Commission might be assured that efficient use is being made of the funds. Furthermore, the invoices and vouchers upon which expenditures of such funds are based must be submitted to the Commission for audit.

VIII. MARYLAND-VIRGINIA BOUNDARY LINE IN POCOMOKE SOUND

The Maryland-Virginia Line from the District of Columbia to the Atlantic Coast off Popes Island was established by the Black-Jenkins Award of 1877, and in 1929 this Award was surveyed and marked, by the Mathews-Nelson Survey, in its entire length from the District of Columbia to the Atlantic Coast, with the exception of approximately seven miles in Upper Pocomoke Sound, in Accomack County, Virginia and Worcester County, Maryland. Controversy has arisen on many occasions in this area about the exact location of this Line. In fact, recent U. S. Coast and Geodetic survey charts are in conflict as to such location.

We recommend that the Maryland Department of Chesapeake Bay Affairs and the Virginia Commission of Fisheries, with the assistance of their engineering departments, be authorized to establish, mark and identify this portion of the Line in an acceptable engineering manner; that after these two Agencies have agreed upon an acceptable boundary line, they report the specific metes and bounds of such Line to the Governor of each State; that if the Governors approve such boundary Line, they be requested to submit the necessary legislation to the next session of their respective legislatures to establish such line as the boundary between the two States in these specific waters. We further recommend that an appropriation of $10,000 be made to the Commission of Fisheries for the 1968-1970 Biennium to establish and maintain permanent markers and buoys on the Maryland-Virginia Boundary Line from Smith's Point to the Atlantic Coast, conditioned upon a similar appropriation by the General Assembly of Maryland to the Maryland Department of Chesapeake Bay Affairs for the same purpose.

IX. OYSTERS AND CLAMS

The Commission recommends amendments as indicated in the hereinafter enumerated sections of the Code of Virginia.

§ *28.1-83,* relating to areas in which the use of patent tongs for taking of oysters is prohibited. Subparagraph (3) of this section reads "In the Nansemond River above a line drawn across its mouth". This does not sufficiently identify the boundaries of the prohibited area and should be replaced by a specific description of the area outlined by the Engineers of the Commission of Fisheries.

§ *28.1-89,* relating to tax on export of unshucked oysters. This section should be amended to exempt from the provisions thereof the sale of seed oysters to the Potomac River Fisheries Commission. Since Virginia watermen work in the Potomac River and reap the benefits from seed oysters exported from Virginia, the Potomac River Fisheries Commission should not have to pay an export tax.

§ *28.1-91,* relating to oyster buyer's license. The last sentence of this section imposes a license fee of $50 on any person buying oysters which are to be planted, processed or marketed outside this State. This should be clarified to make such license fee applicable only to buying oysters for such purpose from the catcher.

§ *28.1-108,* relating to assignments of oyster planting grounds to riparian owners. This should be amended to provide that the ground assigned an owner in front of his land shall be between his highland property lines extended. This will clarify the section, which in this respect at present is confusing to the Engineers of the Commission of Fisheries, and the courts and attorneys.

§ *28.1-110,* relating to ground for clams, should be repealed. This section serves no useful purpose, as its provisions are covered in other sections.

§ *28.1-116,* relating to rights of owner to waters within lawful survey. Section 62-2 should be amended by the addition of a paragraph defining the phrase "lawful survey" as follows: "For the purposes of this section 'lawful survey' shall mean the boundaries of any land, including submerged lands, held under a special grant or compact as required by § 62-1 whenever such boundaries shall have been determined by generally accepted surveying methods and procedures and evidenced by a plat or map thereof recorded in the clerk's office of the court wherein deeds are recorded in the county or city wherein such land lies." Section 28.1-116 should be amended to include a cross-reference to this definition as added to § 62-2.

§ *28.1-119,* relating to tax on handling oysters. This section should be amended to delete all references to barreling of oysters. § 28.1-91 imposes a license tax on oyster buyers. The license tax imposed by § 28.1-119 on persons engaged in buying oysters for marketing in barrels is, therefore, a duplicate license tax and should be eliminated.

§ *28.1-124,* providing that oysters shall be culled as taken. The third paragraph of this section should be amended to provide that all oysters and shells having passed from the culling board to the inside of the boat shall be subject to inspection according to the provisions of this section and if found to include oysters less than the prescribed size and/or shells, the entire cargo shall be considered as not having been culled as taken. This amendment is for the purpose of clarity. The present wording can be interpreted as meaning that, under certain circumstances, oysters would not have to be placed on the culling board.

§ *28.1-132,* providing penalties for taking or catching oysters or clams with dredges, scrapes or instruments other than ordinary or patent oyster tongs, or by hand except as provided by law. The section should be amended to delete reference to clams; and to make the provisions thereof applicable also to such taking or catching in a manner other than provided by regulations of the Commission of Fisheries. Since both the Commission of Fisheries and the Seafood Industry of this State are anxious to promote and encourage the taking and marketing of softshell

clams, it is desirable that the taking of clams not be subject to the provisions of this section. The penalties prescribed by the section should be made applicable to taking oysters in a manner contrary to Commission regulations as well as contrary to law.

§ *28.1-134*, relating to dredging or scraping on private oyster-planting ground. The third paragraph of this section, relating to marking of such ground, should be amended to provide that, when such ground is not properly marked, the inspector may suspend the dredging permit until the ground is properly marked. This will strengthen enforcement of compliance with marking requirements.

§ *28.1-137*, relating to theft of oysters, clams, shells, etc. This section requires revocation of the licenses to take or catch finfish or shellfish issued to any person convicted for any violation of taking oysters from public ground, and provides that no new licenses shall be issued to such person for a minimum of one year or a maximum of five years after conviction, in the discretion of the Commission of Fisheries. The section should be amended to prescribe a minimum of one month and a maximum of two years, as the present penalty in this respect is too severe.

§ *28.1-160*, relating to license tax for buying, marketing and shipping clams, scallops and bivalves other than oysters. This section imposes the tax prescribed therein upon every person engaged as a principal in such business. The section should be amended to impose the tax on every person engaged in such business, even if not as a principal. It is important that all buyers be licensed, and especially necessary in control of the marketing of clams from restricted areas.

X. PROMOTION OF SPORT FISHING

It is recommended that the promotional budget for the Virginia Salt Water Fishing Tournament for the Biennium 1968-70 be approved in its entirety.

This function of the Department of Conservation and Economic Development has done an outstanding job in promoting and successfully publicizing this valuable aspect of Virginia's marine resources and we urge continued expansion in the years ahead.

The Tournament has made the word "Citation" something of household usage throughout Tidewater Virginia and many, many are the proud anglers from other states who have their Virginia trophies hung on their office and den walls.

We also feel moved to stress the importance, to the sport fishing industry in particular and the tourist industry in general, of the time, effort and funds expended by the Tournament in obtaining editorial space in the Nation's leading outdoor-type magazines.

Certainly the promotional effort has more than paid for itself by obtaining publicity in a manner which cannot be placed on a monetary basis and would be exorbitant even at existing advertising space rates in these same publications.

The Virginia Tournament has been so successful it has been copied by our bordering states of Maryland and Delaware, certainly a noteworthy compliment.

XI. OFFSHORE SPORT FISHERY

Members of the Cape Henry Billfish Club, a group of prominent sportsmen interested in the offshore sport fishery of Virginia, appeared before the Commission to urge greater attention to the problems and interests of this fishery and the species, white and blue marlin, dolphin, bluefish and others, on which it depends.

Study indicated that the major species in which the fishery is interested occur mostly in the waters over the Continental Shelf. It was learned further that three groups, one directed by Dr. Frank J. Mather of Woods Hole Oceanographic Institute, another by Dr. Donald P. DeSylva of the University of Miami, Institute of Marine Science, and a third conducted by Dr. William Hassler of North Carolina State University, are concentrating on Atlantic billfishes. In addition, personnel of the U.S. Bureau of Sport Fish and Wildlife, Sandy Hook Biological Laboratory, are studying these and other big game species.

Since it appeared undesirable to duplicate these ambitious programs of study on species that are seasonal visitors to Virginia's offshore waters, the Commission has recommended that the Virginia Institute of Marine Science (VIMS) (1) actively cooperate with existing programs in any feasible way, (2) augment them where possible and necessary, and (3) keep abreast of developments in these research projects. The Commission also feels that VIMS should (1) continue its exploratory fishing projects, (2) continue the practice of aiding fishermen in finding fish, and (3) continue and expand its studies of fishes of the Continental Shelf. In particular, we recommend that the present series of studies of the various biological, chemical and physical features which are important in determining the distribution of these species in the Virginian Sea being conducted by VIMS' marine scientists, be continued and expanded. To aid in this work the research vessel, mentioned in Part II of the Findings and Recommendations, will be needed.

CONCLUSION

The Commission wishes to express its appreciation to the officials and agencies of both the government of the Commonwealth of Virginia and the United States government for the assistance which they rendered during the conduct of this study. The information which they furnished, both in writing and in conference with the Commission and its Committees, was of inestimable value to the Commission in its efforts to resolve the problems presented for its consideration. The Commission is also grateful to the many individuals and representatives of interested groups who appeared at the public hearings and gave the Commission the benefit of their experience and suggestions.

We respectfully urge that the General Assembly enact the necessary legislation and make the necessary appropriations to carry into effect the recommendations in this Report.

Respectfully submitted,

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APPENDIX A

THE MARINE RESOURCES OF VIRGINIA

Except for casual mention of marine fishery products, when development, use and conservation of natural resources are considered soils, forests, mineral resources, and wildlife receive the chief attention, often in that order. The spectrum of marine resources has been badly neglected. Though no one will deny the importance of the terrestrial resources, it is necessary and timely that the marine resources receive their portion of Virginia's attention. This need is becoming increasingly apparent. Dramatic events of recent years have demonstrated that our tidal waters are not as inexhaustible or indestructible as was once thought.

ECONOMIC ASSETS OF MARITIME VIRGINIA

Maritime or Tidewater Virginia consists of those counties, cities and towns located at the fall line and eastward to the sea. Included are approximately 33—about a third—of her counties and the largest cities and suburban areas. Almost 60 per cent of the people live in Tidewater, where the greatest population and industrial growth in Virginia has occurred. About seven billion dollars change hands in Maritime Virginia each year. Much of this commerce is directly related to activities oriented toward marine resources. The capitalized value of marine resources, whether self-renewing or depletable and of marine oriented industrial, residential and commercial activities is great, exceeding several hundred billions. For a breakdown of the economic assets of Maritime Virginia to 1965 see Attachment I.

VIRGINIA'S MARINE RESOURCES

The Marine Waters

The *marine waters*, themselves, are important. Virginia has responsibility over or ready access to over 13,000 square miles of sea water. These waters serve as sea lanes, as highways, to float and facilitate movement of the merchant and naval fleets of the United States and half the countries of the globe. They receive, remove and purify, within limits, the wastes of these fleets. They provide water to cool the power plants and clean and succor the sailors. It is because of the importance of these waters to coastal and international commerce and communications that the major industrial units, the military bases and the major communities of eastern Virginia have arisen. Growing recreational fleets make use of their attributes.

People are fascinated, rested and restored or rejuvenated by the ageless, limitless, inconstant face of the sea. This attribute in itself is of great, though not readily calculable value to society. The combination of the sea, sand and sun is usually irresistible. Hundreds of thousands of people are attracted to the shorelines of the State, partially because of the water. Williamsburg, Jamestown and the towns, homes and river plantations of the James and other estuaries are made more attractive by the proximity of attractive waters and shorelines.

The waters of the sea, especially the brackish waters of the estuaries serve as processing and, more generally, cooling waters for industry and shipping. Estuarine and marine waters also receive, to dilute, disperse and transform, it is hoped, the waste materials and waters from the major cities. For example, they are used variously as primary, secondary

or tertiary and final sewage treatment plants for Richmond, Petersburg, Hopewell, Newport News, Norfolk, West Point, Fredericksburg and the metropolitan Washington complex and the major industries of the State. Wastes of *all* types, including agricultural and radioactive materials, reach the estuaries and the sea. This use has saved communities and industries millions of dollars but has often been a wasteful and destructive process. We have not hesitated to put marine waters to this use—we should recognize their service in any accounting of valuable marine resources.

Because they function as an almost universal solvent, the waters of the sea receive, dissolve, hold and sometimes release, most of the important elements and compounds known. Because of this, it is a rich natural nutrient for life from the lowest to the highest forms. Marine waters with their special properties support profuse and diverse forms of life which in themselves are interesting and useful resources.

In addition, the waters of the sea serve as storehouses of energy, moderators of weather, determiners of climate and as the central reservoir of 90 per cent of the earth's water. The ocean is the ultimate source of water—it is our greatest water reservoir.

Marine waters, especially the less salty estuarine waters, will be increasingly used for drinking, irrigation and process water. To do this, special techniques of capturing less salty, surface waters or of desalting the marine or estuarine waters will have to be developed.

Valuable though they are, these waters also are the cause of economic loss and death. Destruction of real property by slow erosion or swift storm damage is not uncommon. Loss of life and property on land and ships and their cargoes at sea are frequent.

Shorelines, Beaches and Bottoms

The waters of the Virginian Sea and the estuaries are bounded and contained by shorelines and bottoms which, themselves, play important roles in the ecology of the marine environment and in the economy of the Commonwealth.

There are over 4,000 statute miles of tidal shoreline in Virginia. These vary from salt marshes and muddy flats to sandy ocean and river beaches and high bluffs. Some are stable—some are not.

Shorelines are economically and aesthetically valuable. They offer peaceful and healing pleasures. Residential shore is extremely valuable, often costing over $100 a linear foot, unimproved.

Pleasure beaches are particularly valuable not only in cost per linear foot but attractiveness to recreationist elsewhere and to fishermen. So valuable are they that expensive engineering works whose sole function is to protect the beaches and resort properties and costly programs of beach replenishment are justified. To rememdy damage caused to Virginia Beach by the "Ash Wednesday (1962) Storm" cost over ten million dollars and a replenishment program is underway. Submarine sand has become a valuable resource for beach building and nourishment.

Though, perhaps, not as aesthetically pleasing to most as sandy shores or high bluffs, tidal marshes are nonetheless extremely valuable. Because of their high plant and animal productivity, they supply a great deal of nutrient material to the main streams as their annual cycles of growth, death and decay continue endlessly. Many tidal flats produce

as much converted energy per acre as farm land of highest productivity and they do it without any effort by man. Tidal marshes are important "respiration areas" and play significant roles in the overall circulation and energy balance of our estuaries. Salt marshes now serve as nursery areas for many species of fishes, crabs and other marine animals. Marshes support shore and wetland birds and mammals. Hunters derive great enjoyment and spend about $3,500,000 each year to hunt in Virginia's tidal lowlands.

Shorelines are being occupied at an increasing rate. The era of untrammeled beaches is rapidly ending. Marshes are being drained and filled. Virginia *must* be careful that wetland destruction does not destroy the useful and aesthetic attributes of our marine areas. More public beaches must be provided and "virgin" wetlands must be set aside.

Bottoms from the low water line seaward are obviously as extensive in area as the waters they underlie. Virginia's marine bottoms are valuable, containing many useful natural attributes and resources. The nearer the surface of the water they lie the more valuable they are, within limits. Natural growth and culture of valuable shellfish, such as oysters, hard clams and soft clams, makes many acres of bottoms extremely valuable. Those not preserved to the public, *i.e.*, outside the Baylor Survey boundaries, are much sought after by private planters as oyster leases from the Commonwealth. Perhaps the most productive oyster grounds in the world have been those of the lower James estuary which have served as oyster seed beds and original sources of over 75 per cent of all oysters grown in lower Chesapeake Bay for many years.

In addition to serving as beds and sources of shelter, support and nutrients for important marine animals, Virginia's tidal bottoms contain valuable deposits of gravel which have been dredged for use in construction and commerce for some time. Furthermore, fossil and recent but overlain, submerged oyster shell reefs have been exploited for years, not only for oyster repletion programs, but also to manufacture lime and chicken feed and for other industrial uses.

Sand has long been used in construction projects. The islands of the Chesapeake Bay Bridge-Tunnel and much other commercially valuable land have been built of submarine sand.

The bottoms also serve as substrates for many bacteria and animals and plant which may be themselves necessary to the ecological web of these marine environments or may serve as food or attractants to important fishes and crabs.

The bottoms of Virginia's estuaries, bays and sea are natural resources of great value. These bottoms can become contaminated by silt, chemical and radioactive wastes. Nursery areas and clam, oyster and crab beds can be destroyed completely. Being essentially non-renewable resources, gravel and shell can be depleted. Contamination and destruction must be prevented and over use of shell and gravel resources must not be allowed to occur. These things can be accomplished only if we understand processes and results of contamination and if we know what our usable stocks of resources are. We do not as yet!

Marine Organisms

In the past, most talk of Virginia's marine resources has centered around marine life, more specifically those marine organisms that could be caught, processed and marketed for a profit. We have seen above that there are many useful marine resources other than the biological. How-

ever, because they are living, transient and greatly variable in quantity the fishery resources have received much attention.

Many fishes and several molluscs and the blue crab are economically valuable and are now being utilized. Others could be utilized were markets developed or new capturing and processing techniques perfected. Still others could be utilized or utilized more efficiently were adequate cultural, aqui-or mariculture, and processing techniques developed.

Many plants and animals, though not directly useful to Virginia, are—nevertheless—necessary to the food chains (the web of life) that supports other valuable fishes and processes. Some marine animals and plants, for example, certain jelly fish, shipworms and grubs, fouling organisms, oyster drills, oyster worms, red-water organisms and parasites, are "natural resources in reverse." They disrupt man's marine-oriented activities and affect his plans and economy. Even they have a place in the natural scheme of things which it may not be wise to unbalance too readily by their mass destruction.

Molluscs—oysters, hard clams, soft clams, surf clams, mussels, scallops, snails, squid

Of all the groups of marine organisms represented in the marine environment the molluscs are the most valuable. The rich, actual or potential, economic fauna includes the Atlantic oyster, hard clam, soft clam, surf clam, sea scallop, mussels, whelks and conchs and other small snails. Some squid are caught and sold for bait and food. Almost all of these could probably stand heavier exploitation (see Attachment II).

The molluscs are also most likely prospects for actual farming or mariculture. It is not surprising, therefore, that oysters and hard clams are being crudely farmed and that it is on these species that actual breeding and controlled hatching and rearing work is being done by science and industry. All things considered, Virginia's oyster production could be increased in a short period of time with very little effort. Some of the techniques and scientific know-how are available.

As far as is known, all marine animals are sensitive to the wastes of society but because they are largely fixed in position and cannot readily escape, molluscs are especially vulnerable to long-term contamination of their home waters. Though small amounts of domestic sewage may be beneficial, which possibility should be considered and utilized where possible, large amounts are detrimental as are almost all industrial and radioactive wastes. Estuarine and coastal waters must remain as pollution-free as possible.

Finfishes

Many species of fishes live in Virginia waters. Many are already exploited and many more could be utilized were markets available or were the need for additional protein really great (see Attachment III). Only four or five are being exploited to or beyond their probable maximum capacity.

Indications are that at present levels of exploitation man's activities have little effect on population levels of most fishes. Natural factors of hydroclimatology are of greater significance. However, long-term changes in water quality or in the nursery and spawn-

ing areas may be affecting the finfisheries, especially those whose survival depends upon the availability of special, often restricted, waters and bottoms for parts of their life histories.

Crustacea

Virginia predominates in production of the blue crab. Though the supply fluctuates, it has generally been adequate to meet demands. Delicious crab products are, or should be, well known to everyone. The population might be exploited more heavily. Lobster is also caught and other crustaceans might be used (see Attachment IV). Crustacea are susceptible to overfishing, pollution and destruction of nursery and spawning areas by siltation and engineering changes.

Other Organisms

Though not commercially exploited or perhaps even exploitable, many miscroscopic marine plants and invertebrates are useful as food for higher organisms. In addition, their qualitative and quantitative distribution may serve to indicate water quality. Quite often groups interested in maintaining natural waters are not brought into action until some plant or animal has clearly indicated poor conditions, *e.g.*, severe mortalities of fishes and invertebrates, plankton blooms, macroalgae destruction.

Virginia still possesses a wealth of useful marine organisms. From them she derives revenues at landing of about 22 million dollars. About 10,000 people are directly involved. At wholesale and retail the amounts of money and people involved double and triple. Seafoods have long been a part of the Virginia scene, a part worth preserving not only for the delightful variety they provide but because they will be really needed to feed future Americans as they are needed now to feed the undernourished here and abroad.

An especial value of these resources is the fact that they are largely self-renewing. That is, they replenish themselves regularly with very little capital investment from man. Were we to back calculate their capital value to Virginia at 10 per cent per annum, it is plain that an investment of $200,000,000 dollars, a too conservative figure, would be required as the capital investment in any manufacturing industry in order to produce such an annual sum. It is in this way that comparisons should be made when plans are being made for industrialization and development of the marine resource systems.

Sport Fishing

Marine organisms are more useful and perhaps more heavily exploited for recreational and aesthetic purposes than for commercial reasons. Though some are at times nuisances and replusive, like jelly fish and watermilfoil, it is likely that most of the fascination of marine waters would not be there were animals and plants gone. Sport fishermen are rapidly rivaling commercial exploiters as users and sources of pressure on fishing stocks. Though estimates are available for sport fishing expenditures they tell only part of the story.

Though not strictly aquatic or marine, ducks, shorebirds and certain furbearing mammals are regular inhabitants of tidal marshes. Each year 15,000 sportsmen spend over three and one-half million dollars to enjoy

these self-renewing resources of Virginia tidal marshes. Thus, not only is marshland valuable and essential as nursery areas for many marine organisms but it is also useful recreationally. Aesthetically, marine marshes are beautiful, wild, often lonely places where many wonderful birds and animals can be seen, photographed, hunted and enjoyed.

MARINE RESOURCE PROBLEMS

It has been shown that Virginia has a vast treasure of aesthetic and economic wealth in her marine waters. Indeed it is certain that a great part of Virginia's actual and potential wealth is marine oriented.

The marine environment is complex. Most of Virginia's marine resources are located within, along or under the major estuaries and the coastal lagoons or the shallow reaches of the Virginian Sea. Here the shallow bottoms have their greatest effect on the currents and on the contents, chemistry and biology of the brackish and salt waters above them. These coastal waters receive soil eroded from the land with its minerals and, as a consequence, are usually richer than those of the deep oceans.

Many factors interact to give coastal waters their natural characteristics. Because of this inherent complexity, they are difficult to understand and manipulate intelligently.

Complex User Requirements

Because of their proximity and accessibility, the coastal waters are the most used and exploitable of all the waters of the world ocean. Many users wish to take their "cuts." Sometimes these uses are in real or apparent conflict with each other and some uses are temporarily or permanently damaging.

Engineering Projects

Engineering projects such as channel enlargement and realignment and dam construction on our estuaries are numerous and increasing. Each year sees dozens of channel projects: Over 400 small and large dams are proposed for the Potomac system alone for the next several years.

Reservoir construction and operation are not the only engineering difficulties that marine resources must face. Also involved are fill and drainage of salt marshes, erosion and filling of shorelines and waterways, bridge and island construction and siltation resulting from engineering projects. Engineering activities may pose severe threats to marine resources. Conversely, they may also be planned and operated so as to enhance those resources. It is possible by proper planning, to minimize adverse effects.

Contamination

Increasing populations and industrialization along our tidal rivers *inevitably* will be accompanied by increasing contamination—this cannot be escaped. The problem is one of degree. Pollution can and must be controlled and minimized. Difficulties in setting allowable tolerances for marine water quality are encountered because we lack the detailed information concerning the physiological responses of the organisms necessary to set such limits.

Shoreline Use

Virginia's shorelines are rapidly being occupied. Usable shoreline is diminishing. In many areas the most valuable shores are already gone. It is important that those remaining be husbanded wisely. Only the bare minimum of degradation must be allowed. For this reason plans for the use of this land should and must be developed well ahead of pressures.

It is a happy characteristic of our system that enterprise is encouraged and that individuals, communities and industries and even states promote their own interests, growth and development. Often these promotions create unforeseen and unfortunate pressures on the natural environment. Often they create pressures that are contrary to, or augmented by, the desires of existing users.

Exploitation of Marine Organisms

Destruction or degradation of the marine habitats by poorly conceived and operated engineering projects, by contaminants and siltation serve to eliminate or reduce marine organisms. Also important are the harvesting activities of man.

As has been mentioned above (see also Attachments II, III and IV) most commercial or sport species of finfish and molluscs in Virginia waters are not being exploited to their fullest. However, a few are and great care must be taken not to eliminate these. We must always be careful not to exceed that fine point beyond which rational exploitation becomes too heavy and destructive. Because survival and success of marine animals and plants depends upon so many factors, complete understanding of these factors is necessary and continuous surveillance obligatory.

In the past, heavy dependence has been placed upon regulation of fishing pressures by law. With more adequate knowledge this approach has been shown to be fruitful only in a few cases. Often the restrictions have served no useful purpose. It is especially important that laws and regulations and other management decisions and devices be based upon the resources themselves and not upon uninformed whim, opinion or pressure.

In order to successfully make use of and conserve the living marine resources, it will be necessary to learn more about their ecological requirements and their physiological responses. In addition, a continuous and careful monitoring of the stocks of all major species is needed.

For many species, it seems unlikely that we can really do much to increase their numbers. They must, of course, be protected from overutilization and from the problems of environmental destruction. Some species can be increased by special practices such as utilizing productivity generated by human or industrial wastes or by other environmental improvements. Especially susceptible to purposeful culture are the molluscs which probably will be hatched, reared and grown under controlled conditions to get as far away from the vagaries of nature as possible. A substantial start has been made. In the meantime, we can, if we will, double production now merely by revising archaic practices and following more modern procedures.

THE FUTURE

We have seen that the Commonwealth's marine resources are very valuable and much more important to her economy than most acknowledge or even suspect. Virginia is truly a maritime state. Because of their complexity and the multiple, often conflicting demands of their users, wise

use and development of these resources will require careful planning and management. Rapidly increasing population levels in the maritime counties and burgeoning industrialization increases the necessity for prompt action.

We must recognize that increasing populations and industrialization entail costs—costs in environmental degradation which must be detected and minimized, if possible. Some destruction cannot be prevented. Progress, growth and industrialization cannot be halted but they must be controlled. It is wise and businesslike to do so. The cost of failure is aesthetic and economic loss.

In planning local or statewide promotional and developmental activities, careful attention should be given to all the ramifications of any course of action. It has been shown that new uses of or additional pressures on the marine resources may degrade those resources and be detrimental to their desirable attributes and contrary to the interests of previous users. We must be sure, for example, that increasing industrialization on an estuary will not destroy an important fishery resource or interfere with an established and important tourist or recreational industry, unless we *wish* to sacrifice those activities. Some uses *are* mutually exclusive no matter how they are planned and carried out. Others can be made compatible with careful planning. Still others are compatible from the outset. Though we may be satisfied to allow one established economic use to disappear in favor of another, we must know what we are about.

One thing is certain, progress and virgin, pristine conditions *are* incompatible. If Virginia has any areas which should be preserved in this condition, they must be set aside at once.

Resource Engineering

Because of the increasing complexity, urgency and magnitude of these resource management problems, it would be wise to bring such techniques as Operations Research, using high speed digital and analogue computers, to consider the variables, evaluate the possibilites and present a rated list of most likely decisions for further consideration by human decision groups.

Through the use of all adequate modern techniques, it should be possible to improve the results of and shorten the time for decision making. This might be called Resource Engineering.

Resource Planning and Zoning

In these times when a project to benefit one area along a tributary might adversely affect other economic interests, often some distance away, it is important that official bodies and plans concerned with evaluation of an entire river system be developed. The most critical areas for this type of activity are the James River system—and the Potomac River system, estuaries in Virginia under greatest pressures.

Knowledge

To solve present and future problems, maintain and improve the marine resources, permit better planning for development and use—no matter what the mechanism for decision making—it will be necessary to have accurate and complete information about the resources. While Virginia's scientists and others have made a good start on acquiring accurate and complete information about resources and we know much more than when effective work was begun less than twenty years ago, it is apparent that we must learn more. The frame of reference for our studies and

decisions have changed drastically in the last twenty years and new variables are being constantly introduced by man himself. Because of these things and the urgent need to prevent irreparable damage, it is essential that information be developed at a much more effective rate than that of the present. This will require an enlarged, improved and continued research effort. Neither society nor nature are static. Increasing interaction between the two constantly causes changes in the systems science must study.

Continuing research, improved decision making and planning, in that order, are necessary to the wise use of Virginia's marine resources. Also important will be continuous efforts toward improvement in the regulations and enforcement operations of the various state management agencies involved. Education of the citizenry and public officials and development of replacement scientists and new techniques are vital.

ATTACHMENT I

OUTLINE OF STATISTICS ON THE MARINE RESOURCES OF VIRGINIA AND ASSOCIATED ECONOMIC ACTIVITIES

(These data from the 1962 publication entitled "Maritime Virginia" issued by the Virginia Institute of Marine Science have been revised where necessary and possible by information from a similar study now underway. Though precise figures are often difficult to obtain, this information can be considered as reasonably accurate.)

I. POPULATION OF MARITIME VIRGINIA—1965

Total Population of Virginia (estimated)	4,424,637
Population of Maritime Virginia (estimated)	2,590,000
Percent of Total in Martime Virginia	58.5%
25-year Increase for Virginia	62.27%
25-year Increase for Maritime Virginia	124.5%
25-year Increase for Remainder of Virginia	21.07%
Land area in Martime Virginia	11,599 sq. mi.
Per Cent of Virginia Land Area in Maritime Region	29%

Over 58% of all Virginians live in the Maritime Area!

According to predictions from reliable sources, the tidal James River will experience a 37% growth in population by 1970 (500,000 people).

II. SEAFOOD INDUSTRY

Number of Employees	9,400
Estimated Value of Capital Equipment	$200,000,000
Poundage Caught	503,000,000 lbs.
Catch Value (a record)	$ 26,800,000
Value of Maunfactured Fishery Products	$ 34,000,000
20-year Average Annual Catch (1945-65)	358,329,748 lbs.
20-year Average Annual Catch Value	$ 20,190,805

III. VALUE OF SALT-WATER SPORT FISHING

1965 Estimated Value	$ 40,000,000
1955 Estimated Value	24,601,500
10-year Increase	15,398,500
	or 62.6%

Virginia is famous for its salt-water sport fishing, a form of recreation that has increased by an estimated 62.6% in the past 10 years.

IV. SHIPPING IN VIRGINIA—1964

	1953	1964	%Change
A. Total Waterborne Commerce	40,600,000	71,000,000	+ 74.9
Value of cargoes	$1,080,000,000	$1,805,000,000	+ 67.1
B. Impact of Waterborne Commerce on the Virginia Economy			
Employment	46,800	53,208	+ 13.7
Wages	$159,825,444	$308,782,104	+ 93.2
Net Corporate Income	12,887,942	12,756,740	— 1.0
Taxes Received from Railroads	4,092,000	5,969,777	+ 45.9
Motor fuel taxes from trucking firms	49,602	314,149	+533.3
Est. Corp. Income Tax	605,602	812,232	+ 34.1
Est. Corp. State & Local Taxes	2,232,366	13,636,771	+510.9
C. Shipbuilding and Ship Repair			
Average employment	18,249	20,988	+ 15.0
Gross wages	$81,755,548	$152,964,434	+ 87.1
State Business Income Tax	701,031	926,153	+ 32.1
Other State and Local Taxes	2,008,810	6,015,449	+199.5
Inventory Purchases	60,710,150	81,576,931	+ 34.4
Business Sales or Receipts	161,025,118	288,696,770	+ 79.3

V. VALUE OF MILITARY TO MARITIME VIRGINIA

Number of Installations	11
Estimated Number Employees—Military and Civilian	165,000
Estimated Number Fleet-Based Personnel	45,000
Estimated Annual Spending by Military for Payroll Goods and Services in Maritime Area	$2,200,000,000

VI.	ESTIMATED VALUE OF TOURIST TRADE—1965	
	Number of Out-of-State Tourists to Maritime Virginia	20,000,000
	Tourist Dollars Spent in Maritime Virginia	$500,000,000
	Number of Businesses in Maritime Area Partially or Wholly Dependent upon Tourist Trade	18,000
VII.	ESTIMATED VALUE OF WETLAND HUNTING—1965	
	Waterfowl Hunters	14,720
	Expenditures by Hunters	$ 3,429,760
	Average Yearly Hunters Expenditures	$ 233
VIII.	VALUE OF SHORE-BASED INDUSTRIES—1965	
	Number of Shore-Based Industries	987
	Number Industrial Employees in Maritime Virginia	151,000
	Industrial Payroll in Maritime Virginia	$800,000,000
	Value Added by Manufacture in Maritime Virginia	$1,648,500,000
	Increase in Industrial Employment 1950-1965	47.8%

ATTACHMENT II

USEFUL AND POTENTIALLY USEFUL MARINE MOLLUSCS

Species	*Actually Used* *Overused*	*Underused*	*Potentially Useful*
C. virginica (Virginia Oyster wild stocks)	X		
V. mercenaria (hard clam)		X	
Mya arenaria (soft clam)		X	
Mytilus edulis (blue mussel)			X
Modilus demissus (ribbed mussel)			X
Spisula solidissima (surf clam)		X	
Rangia cuneata (marsh clam)			X
Placopecten magollaritus (sea scallop)			X
Aequipecten irradians (bay scallop)*		X	
Busycon canaliculatum (conch)		X	
Busycon carica (knobbed conch)		X	
Squid			X

Sea scallops—limited numbers off coast, some have been landed at Hampton

Busycon—shipped cooked to New York City by some dealers

*Bay scallop—(might be reintroduced)

Rangia—thousands of bushels now around Jamestown.

M. demissus—animal food

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ATTACHMENT III

MARINE AND ESTUARINE FISHES OF COMMERCIAL OR SPORT IMPORTANCE

SPECIES

Scientific Name	Common Name	Commercial Importance	Sport Importance	Level of Exploitation
Carcharhinus milberti	Sand bar shark	Minor	None	Probably underexploited
Megalops atlantica	Tarpon	None	Minor	Stocks unknown
Alosa aestivalis	Blueback or glut herring	Major	None	Underexploited
Alosa mediocris	Hickory shad	Minor	Minor	Underexploited
Alosa pseudoharengus	Alewife	Major	None	Underexploited
Alosa sapidissima	American shad	Major	Moderate	Adequate, perhaps near maximum
Brevoortia tyrannus	Menhaden	Major	None	Near maximum level
Gadus morhua	Cod	Minor	Minor	Virginia stocks perhaps temporary
Urophycis regius	Spotted hake	Minor	None	Underexploited
Urophycis chuss	Squirrel hake	Minor	None	Stock not known
Merluccius bilinearis	Silver hake	Minor	None	Probably underexploited
Anguilla rostrata	American eel	Minor	None	Underexploited
Mugil cephalus	Mullet	Minor	None	Stock minor in area
Centropristes striatus	Black sea bass	Major	Moderate	Exploitation moderate, not maximum
Roccus americanus	White perch	Minor	Moderate	Underexploited
Roccus saxatilis	Striped bass	Major	Major	Exploitation adequate-near max.
Pomatomus saltatrix	Bluefish	Moderate	Major	Moderate, not overexploited
Rachycentron canadum	Cobia	Minor	Major	Exploitation adequate
Seriola spp.	Amberjacks	None	Minor	Underexploited
Coryphaena hippurus	Dolphin	None	Moderate	Underexploited
Orthopristis chrysopterus	Pigfish	Minor	Minor	Probably underexploited
Bairdiella chrysura	Silver perch	None	Minor	Underexploited
Cynoscion nebulosus	Spotted weakfish	Minor	Moderate	Stocks minor
Cynoscion regalis	Gray weakfish	Major	Major	Exploitation adequate

ATTACHMENT III—Continued

MARINE AND ESTUARINE FISHES OF COMMERCIAL OR SPORT IMPORTANCE

SPECIES

Scientific Name	Common Name	Commercial Importance	Sport Importance	Level of Exploitation
Leiostomus xanthurus	Spot	Major	Major	Exploitation moderate, not max.
Mentioirrhus saxatilis	Northern whiting	Moderate	Moderate	Probably underexploited
Pogonias cromis	Black drum	Moderate	Major	Exploitation adequate
Sciaenops ocellata	Red drum	Minor	Major	Exploitation adequate
Micropogon undulatus	Atlantic croaker	Major	Major	Stock temporarily lost
Stenotomus chrysops	Scup	Major	Minor	Exploritation probably maximum
Chaetodipterus faber	Atlantic spadefish	Minor	Minor	Stock rather limited
Tautoga onitis	Tautog	Minor	Minor	Probably underexploited
Euthynnus alletteratus	Little tuna	None	Moderate	Underexploited
Sarda sarda	Atlantic bonita	None	Minor	Underexploited
Ruthynnus pelamis	Oceanic bonita	None	Minor	Underexploited
Scomberomorus cavalla	King mackerel	Minor	Minor	Stock rather limited
Scomberomorus maculatus	Spanish mackerel	Moderate	Minor	Stock probably underexploited
Scomber scombrus	Atlantic mackerel	Moderate	Minor	Exploitation adequate at present stock level
Thunnus thynnus	Bluefin tuna	Minor	Minor	Stocksize unknown in local waters
Xiphias gladius	Swordfish	Major	None	Level unknown
Makaira albida	White marlin	None	Major	Stock probably underfished
Peprilus alepidotus	Harvestfish	Moderate	None	Probably underexploited
Poronotus triacanthus	Butterfish	Major	None	Exploitation adequate
Paralichthys dentatus	Summer flounder	Major	Major	Exploitation near maximum
Pseudopleuronectes americanus	Winter flounder	Minor	Minor	Local stock small but expanding
Sphaeroides maculatus	Northern puffer	Minor	Moderate	Stock underexploited

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ATTACHMENT IV

CRUSTACEANS OF ECONOMIC VALUE IN THE CHESAPEAKE BAY AND THE ADJACENT CONTINENTAL SHELF WATERS

I. Species actively exploited
   1. Blue crab, *Callinectes sapidus.* In all saline and brackish waters of Maryland, Virginia, and in inshore waters of the shelf; exploited as hard crabs, soft crabs and peelers (for bait), and crab meal from the picking residues.

II. Species giving substantial financial return, but fishing is incidental to other fishing operations.
   1. Northern lobster, *Homarus americanus.* On the Continental Shelf.

III. Species which do not contribute significantly to the economy, because catch is small, local and seasonal. These species are economically valuable in other areas of the U. S.
   1. Edible shrimp (3 species) *Penaeus setiferus, P. duorarum, P. aztecus.* Caught in fish pound nets, by hand dipnet, and small seine, at mouths of Virginia rivers.
   2. Rock crab, *Cancer irroratus.* Caught incidentally in deep waters of the Bay and on the Continental Shelf. Cooked for crab meat extraction.

IV. Species which are abundant and are exploited, but do not contribute significantly to the economy here or elsewhere.
   1. Grass (glass) shrimp, *Palaemonetes sp.* (3 species). Found in Chesapeake area; used as chum (bait) in fishing.

V. Species which are relatively abundant, and not presently exploited in the Bay area. Other, similar species are exploited in other areas of the U. S.
   1. Sand shrimp, *Crangon septemspinosa.* Small-sized shrimp, 1-2 inches, most numerous near mouths of Virginia rivers, in fall, winter and spring. Used in other areas of U.S. as bait and for shrimp meal (seasoning).
   2. Fiddler crabs, *Uca sp.* There are three species abundant in marshes throughout the Bay area. Used in other areas as bait for tautog.

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