

Strategic Plan 1998-2005

Virginia Sea Grant

Virginia Graduate Marine Science Consortium



Sea Grant is a unique partnership with public and private sectors combining research, education, and technology transfer for public service. This national network of universities meets changing environmental and economic needs of people in our coastal, ocean, and Great Lakes regions.

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Introduction

By the year 2020, more than 16 million people will live in the Chesapeake Bay region—twice as many people as lived here in 1950. Virginia boasts roughly 5,000 miles of tidal shoreline in the Chesapeake Bay and along the Atlantic coast. Much of the projected growth and development will occur along these shores causing profound impacts on living and non-living marine resources. The environmental, economic, and social consequences of such projected growth pose a tremendous challenge.

Virginia Sea Grant is ready to meet this challenge with an infrastructure of regional, state, federal, and university partnerships, world class scientists and top-notch outreach capabilities to provide science-based solutions to address coastal and marine resource issues.

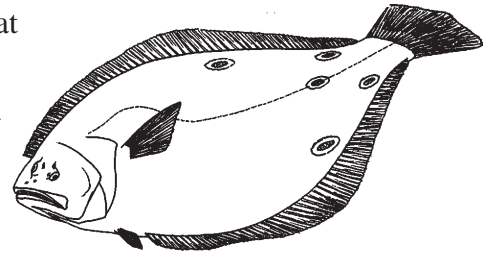
Virginia Sea Grant possesses two core strengths: (1) research capabilities at four consortium institutions that focus on Virginia's natural resources, and (2) a nationally recognized Marine Advisory Program (MAP). Virginia Sea Grant's major research areas have traditionally included aquaculture, commercial fisheries, seafood technology, and coastal ecology/habitat quality. The Marine Advisory Program possesses professional capabilities in the areas of marine-dependent industries, aquaculture, commercial and recreational fisheries, seafood utilization and safety, and a nationally recognized marine education program. These capabilities are not duplicated elsewhere in the public or private sectors. The Marine Advisory Program remains the ideal vehicle for transferring scientific advances into technological realities for industry and providing marine education for Virginia's students and the general public.

Successfully managing Virginia's marine resources will require solutions that support a delicate balance between competing demands, namely, a growing population, commercial and recreational fishing, an expanding aquaculture industry, and coastal development interests that involve water and habitat quality. Virginia's Strategic Plan addresses historically significant, current,

and emerging challenges facing the Commonwealth. An appropriate level of flexibility is also built into this plan so that the consortium can quickly refocus its efforts on important, emerging issues or on activities required to respond to regulatory actions.

Virginia Sea Grant History and Structure

Congress established the National Sea Grant College Program in 1966 to hasten the development, use, and conservation of the nation's marine and Great Lakes resources. The enabling legislation called for a network of Sea Grant Colleges that would conduct education, training, and research in all fields of marine study. Furthermore, the legislation specified that grants and contracts would go to "suitable public and private institutions of higher education, institutes, laboratories, and public or private agencies which are engaged in, or concerned with, activities in the various fields related to the development of marine resources." [PL 89-688 Sec. 204(c)]



The National Sea Grant Network has provided a powerful national capability in marine resource research and outreach that did not exist prior to 1971, when the Secretary of Commerce designated the first Sea Grant Colleges. More than twenty years later, there are now twenty-nine Sea Grant College programs in the coastal and Great Lakes states and in Puerto Rico. These programs are at the heart of a nationwide network of some 300 participating institutions that draw on the talents of more than 3,000 scientists, engineers, educators, students, and outreach specialists.

Virginia is blessed with extensive talents and potential for the study of marine resources at several of its universities. Recognizing this fact, the State Council of Higher Education in Virginia recommended in 1978 that a consortium be formed to utilize this talent; the Virginia Graduate Marine Science Consortium administers the Sea Grant program in Virginia today. The 1979 General Assembly passed the enabling legislation (*Code of Virginia*, Section 23-9.9:1) permitting the formation of the consortium. Any institution of higher education in Virginia that offers a graduate program in marine science is eligible to be a member of the Virginia Graduate Marine Science Consortium. Since January 1981, consortium members have included the College of William and Mary, Old Dominion University, University of Virginia, and Virginia Polytechnic Institute and State University.

Activities of the consortium are governed by a Board of Directors, which establishes all policies and procedures necessary to operate the program. The Board is composed of the presidents of the institutions of higher education that are members of the consortium, as well as the Director of the State Council of Higher Education.

The consortium's Academic Advisory Panel was an *ad hoc* body prior to 1982, but in that year each of the presidents of the member institutions formally designated two representatives for membership on this panel. The panel meets roughly on a quarterly basis to discuss matters of mutual interest relating to marine science, including Sea Grant. The panel also observes deliberations regarding review and selection of projects to be included in the program proposal to the National Sea Grant College Program Office.

Administered by the Virginia Graduate Marine Science Consortium, the Virginia Sea Grant College Program is a continuing program of marine-related research, education, and advisory services which is funded by the National Oceanographic and Atmospheric Administration's (NOAA) National Sea Grant College Program. Through the management described above, Virginia Sea Grant brings existing university expertise to

bear on issues facing the Commonwealth's coastal and marine resources users and managers as well as the general public.

Relationship to National Sea Grant Strategic Plan

This document represents the consortium's first strategic plan, and it comes on the heels of an overall effort among the Sea Grant College Programs to embrace strategic planning. This plan ties in directly with the objectives and goals set out in the National Sea Grant Network Strategic Plan 1995-2005 (Table 1, page 8).

Priority areas for Virginia Sea Grant are generated through the combined input of industry and user groups, and the Academic Advisory Panel as well as through consortium members' interactions with local, state, regional, and federal organizations. These organizations include: the Virginia Marine Resources Commission, the Virginia Marine Products Board, the Virginia Seafood Council, the National Fisheries Institute, the Virginia Department of Health, Division of Shellfish Sanitation, the Virginia Department of Agriculture and Consumer Services, the National Marine Fisheries Service, the Office of Coastal Zone Management, the Chesapeake Research Consortium, the Virginia Watermen's Association, the Virginia Department of Environmental Quality, the Chesapeake Bay National Estuarine Research Reserve in Virginia, and the Sea Grant Programs in Maryland, North Carolina, Delaware, New Jersey and New York.

Additional information used to develop this strategic plan was drawn from documents produced by the Commonwealth of Virginia, members of the Consortium, and the National Sea Grant Network. Much of the information and priorities described for the Marine Advisory Program are described in greater detail in the "Virginia Sea Grant Marine Advisory Program 1999-2000" proposal. This proposal also describes many of the recent accomplishments and benefits of the Marine Advisory Program. This document and other pertinent documents are listed in the bibliography.

Table 1. Relationship of Virginia Sea Grant’s Strategic Plan to the National Sea Grant Strategic Plan.

National Sea Grant Strategic Objectives		Virginia Sea Grant Strategic Objectives	Virginia Sea Grant Key Action Items	Relative Priority	Page #
Economic Leadership	Develop Sustainable Aquaculture	Develop Sustainable Aquaculture	Aquaculture Systems Development	+++	7
			Priority Species Research	+++	8
	Revitalize Commercial Fisheries	Revitalize Virginia’s Commercial Fisheries	Blue Crab Studies	+++	9
			Bay Mouth Processes	++	9
			Oyster Disease Research	+++	10
			Harvesting	++	10
	Enhance Competitiveness of the Seafood Industry Through Advances in Seafood Technology	Enhance Competitiveness of the Seafood Industry Through Advances in Seafood Technology	Processing, Quality Assurance and Product Development	+++	11
	Coastal Economic Development	Enhance Marine Resource Economics and Business	Resource Utilization	+	12
			Economic Impact Assessment	+	12
			Coastal Business Development	Recreational Fisheries	+
Marine Trades				+	14
Coastal Ecosystem Health	Coastal Ecosystem Health	Toxics Research	++	15	
		Enhancing Coastal Waters	++	16	
Education and Human Resources	An Environmentally and Scientifically Informed Citizenry	Promote Marine and Science-Based Education	Building Research and Education Relationships	+++	17
			Promoting a Seafood Education Program	++	18
			Developing a State-of-the-Art Marine Education Center	+++	18
		Promote Marine Environmental Literacy Through Science-Based Communications	Enhancing Communications	+++	19

A. Economic Leadership

Goal: To provide scientific knowledge, advisory capabilities, and demonstration projects to support and stimulate Virginia's economic welfare through its seafood resources.

Objective #1 Develop Sustainable Aquaculture

Background

In response to declining wild fisheries, aquaculture is playing an important role in diversifying the use and development of marine resources in Virginia. The total sales for all saltwater aquaculture production in Virginia during 1997 reached \$17.4 million; freshwater aquaculture reached \$5.3 million. In Virginia, two species are predominant: the hard clam (*Mercenaria*) and soft-shell blue crab. This growth industry has promoted rapidly changing production technology, new target species, and expanding markets which taken together have further stimulated the industry. According to Virginia's 1995 Aquaculture Plan, marine and freshwater aquaculture could serve as a model for the Commonwealth's economic vision and provide growth and jobs. This plan also states that aquaculture should be a high priority for increasing Virginia's competitiveness in the Mid-Atlantic region for high-quality food.

Aquaculture's continued outlook in Virginia is encouraging for several reasons. Wild stocks are dwindling due to over-fishing and habitat loss and destruction. Per capita consumption of fishery products is expected to rise with increased public concern about health and diet. Also, seafood imports are increasing, which produces a substantial trade deficit. Lastly, aquaculture products are readily accepted into existing marketing channels where consumer demand is high. The potential for developing aquaculture in Virginia is great, but there are challenges that must be addressed. The National Research Council (1992) stated that in order for marine aquaculture to become successful

in the United States several topics must be addressed: policies for resolving coastal (space and resource) user conflicts; new technologies to mitigate adverse environmental impacts; appropriate technologies (both biological and engineering) to enable positive economic development for aquaculture operations; and dependable and predictable (quality, consistency of supply, market and consumer acceptable) domestic and export markets for marine aquaculture products.

Virginia Sea Grant has developed two main priorities in marine and estuarine aquaculture: developing and refining aquaculture systems and selecting priority species.

Key Action Item #1: Aquaculture Systems Development

In Virginia, farm ponds and cage culture are the most typical types of freshwater aquaculture systems; shoreside and adjacent in-water facilities including on-bottom planting are the most common marine systems. The two major problems facing freshwater and marine aquaculture production in the Commonwealth are the requirement for abundant, high quality water sources and the need to minimize the environmental impacts of production facilities. Limited supplies of high-quality water dictate the need for improved recirculating systems, particularly for broodstock, holding, breeding and nursery facilities. To date, recirculating systems have been used primarily for freshwater species, but developing recirculating systems for marine finfish is an emerging opportunity.

Research Strategies: Production system design and operation of recirculating systems for finfish and soft-shell blue crab will be the major emphasis. This research will improve environmental controls, enhance system hydraulics to accommodate water quality, quantity and flow rates; address fish health issues; and develop better feeding handling systems. Another important research area will include ecological evaluations of potential aquaculture sites, the impact of aquaculture on natural environments, and the impact of land use practices (i.e. agriculture) on aquaculture.

Outreach Strategies: Outreach activities will continue to be closely integrated with ongoing and planned research in recirculating systems.

Marine Advisory Program professionals at VIMS and Virginia Tech

will continue

to study

the best

recirculat-

ing system

configura-

tion for

culturing

summer

flounder. In addition, the Advisory Program will

continue to sponsor its well-received biannual

International Recirculating Aquaculture Confer-

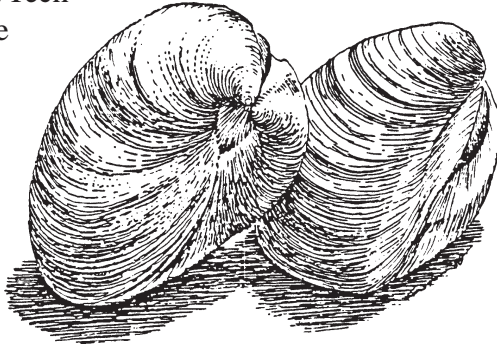
ences. The Third International Recirculating

Aquaculture Conference will be presented in July

2000. The MAP will also further develop its

Aquaculture Education Program for Secondary

School Systems.



Key Action Item #2: Aquaculture
Priority Species

Currently, the most commonly cultured species in the Commonwealth are oysters, hard clams, bay scallops, and soft-shell blue crabs. Other cultured species include catfish, freshwater trout, hybrid striped bass, and tilapia. Bivalves will likely be the dominant species for marine aquaculture expansion, as natural stocks continue to decline. Several bivalves are good candidates for aquaculture research, including bay scallops, ribbed mussels, soft clams, and surf clams. Marine finfish that have been recognized as having good potential for aquaculture in Virginia include, black sea bass, summer flounder, cobia, and weakfish.

Research Strategies: Virginia Sea Grant will continue to support inter-institutional, regional, and nationally oriented aquaculture research on priority species such as hard clams, soft shell blue crabs, and oysters. Oyster research will focus on improving off-bottom culture techniques for producing single (cultchless) oysters,

selecting broodstock for desirable traits, examining the potential for genetically manipulated oysters, and identifying ways to predict the best growth areas. Hard clam research will focus on refining the broodstock selection, spawning, and nursery areas, and improving the final grow-out.

Finfish culture research will emphasize spawning modification techniques to allow continuous reproduction; evaluation of genetic strains and hybrids to determine the best taste, size, survival rate, and resistance to disease; and responses of fish in closed systems to determine behavioral stresses under high-density conditions. Other priorities include, developing a closed-system diet for optimum growth, survival, and product quality; developing a better understanding of disease epidemiology; and improving harvesting techniques.

Virginia Sea Grant is part of a Mid-Atlantic task force comprised of several Sea Grant programs looking at ways to develop summer flounder aquaculture. Virginia will contribute expertise in developing recirculating system techniques and also studies on prevention and medical treatment protocols for bacterial and viral diseases in cultured summer flounder.

Outreach Strategies: The Marine Advisory Program will continue to be closely linked to the research activities described above and will focus its efforts on finfish, shellfish, and soft-shell blue crab culture. Summer flounder and cobia are the two primary finfish species that will receive the most attention. For example, the Advisory Program will develop protocols for holding juvenile cobia, including growth and survival on prepared diets, water quality concerns, overwintering information, disease diagnostics, and, ultimately, cost-benefits. Advisory specialists are working to expand the soft-shell blue crab industry and to further solidify its position within the overall blue crab fishery through educational and demonstration programs and publications. The MAP will continue to offer assistance on shedding facility construction, and maintenance and operation of recirculating water systems, and work closely with the Virginia Soft Crab Producers Association.

In shellfish aquaculture, the Marine Advisory Program will continue to work with the Virginia Shellfish Growers Association as appropriate. The Marine Advisory Program will play a major role in the continuation of a “Master Oyster Gardener” program initiated in 1998 in cooperation with the Tidewater Oyster Gardeners Association and will study the culture of soft-shelled clams (*Mya arenaria*) to provide hard clam growers an alternative product and market.

Objective #2 Revitalize Virginia’s Commercial Fisheries

Background

Current research and advisory activities focus on the physical and biological processes underlying early transport, feeding, growth, and survival of economically important finfish and shellfish species in the Chesapeake Bay and the Mid-Atlantic region. Two key commercial species, the blue crab and the eastern oyster, have received considerable research and management attention in recent years through the Virginia Sea Grant core program and through the nationally funded Sea Grant Oyster Disease Research Program respectively. While blue crab and the eastern oyster will remain important research topics for Virginia Sea Grant, the program will also encourage new research on other commercially important species.

The consortium will be particularly interested in supporting finfish and shellfish research in the following areas: improving predictions in yields, age-class strength and long-term population status; innovative approaches to understanding stock relationships; determining the relationships between habitat and species production; managing habitats for multiple uses; restoring/enhancing heavily exploited stocks; and assessing the impacts of hybridized, genetically modified or

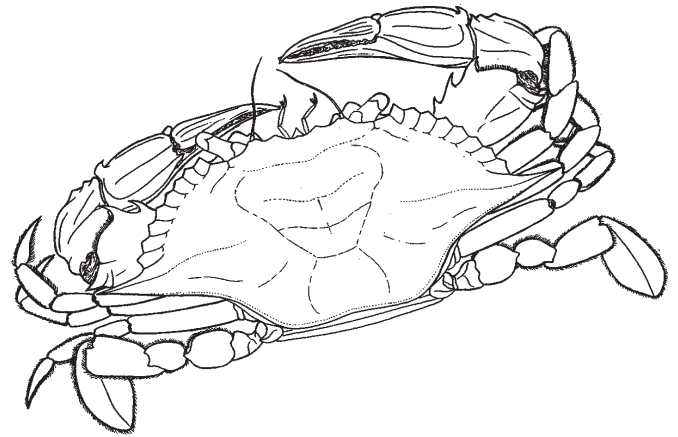
non-indigenous organisms upon native stocks.

Additional areas of strong research and advisory interest include: developing innovative approaches to multi-species management; gear selectivity; bycatch reduction; assessing the effects of fishing gear on habitat; alternative harvesting strategies; and multi-disciplinary investigations of ocean systems and their effects on fisheries recruitment.

Key Action Item #1: Blue Crab Studies

The health of Virginia’s blue crab fishery is of great concern to a wide sector of the public—from watermen to restaurant chefs. Unfortunately, severe population fluctuations, loss of nursery habitat, lack of food, increased fishing pressure, and decreased landings indicate an uncertain future for this popular species.

Research Strategies: Research goals pertaining specifically to blue crabs include understanding the physical and biotic processes, particularly at the mouth of the Chesapeake Bay, which control blue crab larval recruitment and juvenile dynamics, and understanding linkages to habitat ecology.



Key Action Item #2: Bay Mouth Processes

This new priority reflects a growing awareness of how physical and biogeochemical processes impact living resources and water quality in the Chesapeake Bay. It is vital to understand these relationships in order to effectively and accurately

manage fisheries and promote water quality. Many commercially important species, and the forage taxa that support them, spawn and initially develop on the continental shelf at the entrance to the Chesapeake Bay or in the lower part of the estuary. Exchange processes at the bay mouth are important to species recruitment, yet we have little quantitative information relating larval and postlarval flux to physical processes at the bay mouth. Understanding the relationship of bay mouth processes to recruitment will support more informed management decisions by state and federal agencies.

Research Strategies: Initial priorities include generating fundamental observations to support modeling. Some of these observations include: determining realistic boundary conditions for modeling physical processes and flux of materials; delineating water motion in the lower bay and adjacent shelf at scales relevant to recruitment processes, productivity and water quality issues; and determining the individual influence of tides, wind, season, and bathymetry on the physical processes of the bay mouth. Subsequent work will emphasize the exchanges of water properties (salt, heat, dissolved oxygen, nutrients, minerals, sediments, and contaminants) as they impact recruitment of important finfish and shellfish stocks.

Key Action Item #3: Oyster Disease Research

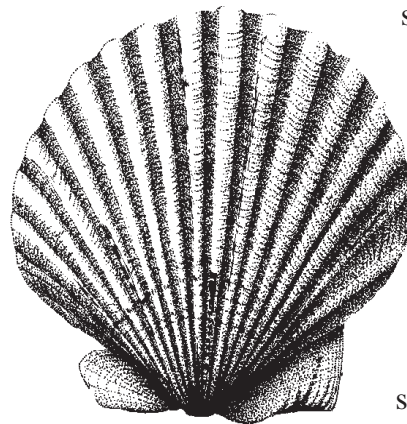
It is generally agreed that the collapse of the Chesapeake Bay oyster fishery is due to a combination of over-fishing, habitat depletion, environmental stresses (primarily increased loadings of suspended sediment), and two persistent diseases: the pathogens *Haplosporidium nelsoni* (MSX) and *Perkinsus marinus* (Dermo). The recovery of the Chesapeake's oyster industry will be pursued on several fronts with an array of nationally (e.g. Sea Grant's Oyster Disease Research Program) and regionally coordinated research programs, hatchery production, the evaluation of modified grow-out strategies, and an evaluation of non-native species for the restoration of oyster stocks.

Research Strategies: Determine the distribution and intensity of oyster diseases; understand the dynamics and pathological mechanisms of oyster diseases endemic to the Chesapeake Bay through combined research/modeling efforts; study environmental influences on disease processes; study parasite life cycles and host-parasite interactions; develop diagnostic methods; assess potential oyster reef restoration strategies; construct economic assessments of the industry; assess mechanisms of disease resistance; and evaluate potential candidate species (or genomes) of non-native oysters likely to succeed in the environment.

Key Action Item #4: Harvesting

Interest and concern about fisheries bycatch has increased, as have regulations governing the release of undersized individuals; it is clear the Marine Advisory Program needs a greater focus in this area. The issues surrounding the management

and utilization of the sea scallop resource from Virginia to New England will continue to dominate our activities. These issues include bycatch, area management strategies, gear selectivity, and alternative harvesting strategies.



Outreach Strategies: The Marine Advisory Program will focus on two primary areas, bycatch reduction and gear development. Advisory Service staff will continue research to reduce bycatch of summer flounder in sea scallop dredges. The MAP will also continue to develop pots and traps suitable for shrimp and flounder capture in Chesapeake Bay and coastal waters. Results obtained from work with North Carolina Sea Grant during 1998 will be used to test gear in Virginia.

Objective #3

Enhance Competitiveness of the Seafood Industry through Advances in Seafood Technology

Background

Virginia's fish and shellfish industry faces increased challenges from state, federal, and international food safety regulations, declining resources, stricter environmental regulations and other pressures. So that the industry can remain economically viable, Virginia Sea Grant will provide scientific information and technical demonstrations on quality assurance and food safety, processing technology, product development, and marketing and business management techniques. These activities will help industry maintain environmental quality; develop new practices to increase production efficiency and conserve resources; and take advantage of changes in domestic and international fisheries production and utilization. Presently, marketing has a minor role in Virginia Sea Grant. However, conditions in the seafood industry are historically quite fluid; the need for marketing studies could change. One study will examine the demand for all flounder products.

In order to be competitive, the Virginia commercial fish and shellfish industries have restructured their harvesting, processing, distribution and marketing strategies to maintain current markets, as well as open profitable alternative markets. Virginia Sea Grant's research and advisory priorities will include quality assurance and food safety, processing technology, and product development.

Key Action Item #1: Seafood Processing, Quality Assurance and Product Development

The demand for increased seafood quality and safety has been reinforced by the U.S. FDA and international groups, such as the European Common Market. Processing technology will

continue to be a major focus, as it becomes imperative to reduce resource use and waste generation, increase processing efficiency, and improve business management. New product development is important as traditional fisheries are regulated to reduce harvests; new products also provide fishermen new opportunities for domestic and international trade. Processors benefit because value-added products increase profitability even when resource supplies are constant or low. Finally, new products offer the chance to supply higher-priced, expanded markets.

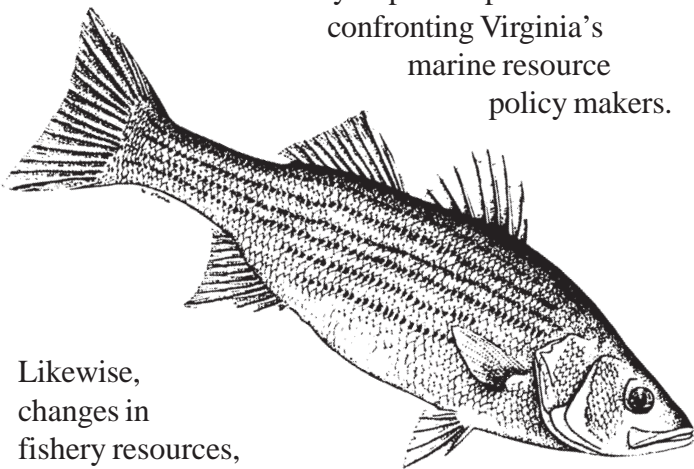
Research/Outreach Strategies: Research and advisory strategies are combined here because historically (and for the foreseeable future) MAP staff and non-MAP scientists have collaborated on projects to ensure that the results are directly translated to industry and/or to policymakers as appropriate. Specific plans include: developing value-added products; validating and verifying thermal processes; evaluating the sensory characteristics of processed blue crab meat; testing histamine production in Scombroid or Scombroid-like fish; and developing a package study for crabmeat pasteurization. HACCP-related activities include: performing audits of HACCP programs at selected seafood processing firms; conducting HACCP Alliance and Interstate Seafood Shippers Conference HACCP workshops; developing and presenting HACCP educational programs; and assisting in the creation of a Standard Sanitary Operating Procedures training curriculum and manual. Planned symposia or conferences include a pasteurization workshop for crab processors, an international symposium on the presence and significance of *Listeria monocytogenes* in ready-to-eat foods, a smoked seafood conference (presented with other Sea Grant programs) and a distance learning course related to seafood microbiology/seafood safety. Additionally, the blue crab processing manual will be updated. The University Committee of the National Fisheries Institute will develop cooperative programs with industry and food regulatory agencies to define food safety concerns and develop research and demonstration programs to address the issues.

Objective #4 Enhance Marine Resource Economics and Business

Background

Commercial fishing is extremely important to Virginia's economy. Virginia is the third largest producer of seafood in the United States, and boasts 92 commercially valuable species. Estimated conservatively, commercial landings produce an annual impact on the local economy of \$250-\$300 million. Unfortunately many of Virginia's fisheries are declining or fluctuating drastically. Disturbances that affect the Chesapeake Bay ecosystem such as declining stocks, introduction of non-indigenous species, and habitat loss or degradation must be predicted or assessed to ensure sustainability of the resources for the future.

Managing marine resources for the future is a vitally important problem confronting Virginia's marine resource policy makers.



Likewise, changes in fishery resources, regulations, or problems associated with processing or marketing are felt quickly by watermen, processors, and local businesses. Development of successful, resource economics research and advisory efforts will ensure that the Commonwealth receives the maximum possible sustainable benefit from its marine resources. Benefits include: improved resource management and utilization, industry-sensitive regulation of the seafood industry, better economic development of coastal communities, and increased seafood sales and improved net returns to processors and distributors.

In the next five years, Virginia Sea Grant's resource economics program will emphasize two key action items: resource utilization and economic impact assessments. Two ancillary priorities include regulatory compliance (addressing the economic benefits and costs of complying with HACCP) and business management (developing economic analyses of fisheries-related industries and seafood market research).

Pending additional funding, a long-term objective is to create a sustainable development program for the Eastern Shore that will create new business opportunities, increase economic development, and provide jobs.

Key Action Item #1: Resource Utilization

Outreach Strategies: For the next several years, Virginia Sea Grant will provide information to resource managers to determine the economically optimum utilization of Virginia's marine resources. Virginia Sea Grant will also provide information to industry to improve their decisions surrounding resource utilization and increased profits. Two long-term resource allocation objectives will be to develop local and regional input/output models to delineate the economic ramifications of changes in resource utilization, the environment, and to assess the economic impact of fisheries bycatch.

Key Action Item #2: Economic Impact Assessment

An increasing issue of significant importance for resource allocation is economic impact assessment. That is, what are the economic ramifications of changes in resource utilization and the environment?

Outreach Strategies: The Marine Advisory Program will focus on the broader implications of the Magnuson-Stevens Fishery Conservation and Management Act as modified by the Sustainable Fisheries Act (SFA). Prospective MAP activities will include: helping the industry and federal government develop a scallop vessel

buy-back program; examining some of the economic aspects of spatial area management (particularly relative to the opening of an area, or areas, which have been closed); developing a strategy for monitoring and dealing with the potential economic impact of *Pfiesteria*; and analyzing a U.S. Army Corps of Engineers policy prohibiting the aquaculture of any animal in any area which presently or historically has supported submerged aquatic vegetation (SAV) growth. It has been recently suggested that cownose rays may actually do more damage to SAV than culture activities. The MAP will examine the economic impacts and net social benefits from the Army Corps of Engineers policy and the presence of cownose rays.

Objective #5 Coastal Business Development

Background

Along its coastal areas, Virginia faces growing conflicts between expanding development and increasing demand for improved water quality to support water recreation and the businesses that support these activities. Virginia Sea Grant has provided useful and impartial information to recreation user groups and associated service industries on socioeconomic, biological and resource management issues, as well as safety education. Sea Grant also strives to assist resource users and local, state, regional, and federal resource management agencies by supplying data and information to help answer management questions and resolve user conflicts.

The marine recreation and trades element of the Marine Advisory Program focuses primarily on outreach needs associated with recreational fisheries, although minor efforts also address mixed, public/private use of community waterfronts and shorelines for recreation and tourism activities, including marinas. Historically, Marine Advisory Program priorities have evolved from a primary focus on marine trade concerns in four subject areas: recreational fisheries; marine trades;

waterfront development and access; and safety education for recreational and commercial vessel operators. Currently, the two major priorities are recreational fisheries issues and marine trades. Other issues are addressed on an as-needed basis.

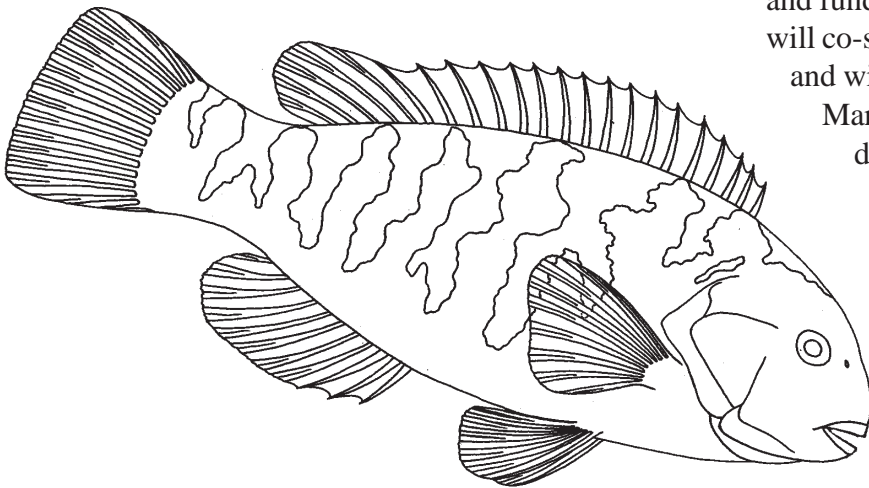
Key Action Item #1: Recreational Fisheries

Rapidly evolving fishery management plans for both offshore and coastal finfish have focused the angling community's attention on the resource management process. Angling leaders are concerned that information on a given species' life cycle, or on a species-specific (or rather a multi-species recreational) fishery is out-dated, or not available. As a result, the marine recreational fishing community demands that fishery researchers and managers acquire and apply more current, comprehensive data to the management process. Of particular importance is data on species-specific hook-release mortality rates under typical angling conditions. In this regard, the recreational fishing community will continue to challenge managers' models and estimates for determining estimated annual fishing mortality attributed to the recreational fishery.

Outreach Strategies: Two specific activities planned include re-activating the recreational fishing forum as a one-day event and supporting catch and release fish tagging programs. Specific catch and release fish tagging programs may include: organizing a national symposium on catch and release in marine recreational fisheries, continuing research on tautog hook-release mortality, and jointly organizing a regional conference on tuna and billfish to enhance information sharing between the East Coast research, management and angling communities.

helping resource managers better understand the very significant proportion of boating access demand met by industry marinas, practical operational problems warranting consideration in striving to reduce environmental impacts of such operations, and the positive economic impacts associated with marinas and boatyards.

Outreach Strategies: Efforts will continue to respond to selected marina/boatyard needs. The Virginia Association of Marine Industries (VAMI) has requested assistance in collecting basic economic data on marinas; this project will require help from industry leaders to better define, plan, and fund the effort. The Marine Advisory Program will co-sponsor VAMI's Annual Education Seminar and will work with VAMI and the Tidewater Marine Trade Association of Virginia to determine what specific, economic information is needed by the Virginia marina industry.



Key Action Item #2: Marine Trades

The marine trades, especially marinas and boatyards, face constantly evolving coastal management programs aimed at conserving both the quality and quantity of shoreline and waterway resources. These resources are exponentially impacted by growing coastal populations and increasing recreation/tourism activities fostered by a robust economy. Marina owners depend on trade associations and good working relationships with outreach programs such as Virginia Sea Grant to keep up with environmental and permitting requirements. At the same time, trade associations may require assistance from Virginia Sea Grant in the form of research to accomplish specific surveys and data assessments. Such efforts are often aimed at

B. Coastal Ecosystem Health

Goal: To understand and support the complex array of factors influencing the physical health and economic balance of the Chesapeake Bay coastal environment.

Objective #1 Coastal Ecosystem Health

Background

The Chesapeake Bay is an ecosystem under stress. The bay has undergone tremendous changes in the last hundred years, primarily due to the activities of humans. Due to over-harvesting and disease, the oysters have been decimated. Historically, oysters held an important ecological function: as filter feeders they cleansed the waters of excess phytoplankton, which otherwise would proliferate and reduce the oxygen levels in the water. Low oxygen, disturbance or other factors prevents important habitat species, such as submerged aquatic vegetation (SAV) from growing; large, flourishing SAV beds are important to many species such as blue crabs.

In the last century, new, chemical compounds have been introduced to the bay from industrial, agricultural, urban, and household sources. Large doses of these toxic compounds are harmful to marine organisms, but scientists are not yet sure of the effects of long-term exposure at very low concentrations or the effects of exposure to several chemicals at the same time.

Virginia Sea Grant has invested ten years conducting research on the environmental effects of toxic compounds in the Chesapeake Bay. These studies have been implemented through the Chesapeake Bay Environmental Effects Committee's (CBEEC) Toxics Research Program. CBEEC is a unique partnership between NOAA's Chesapeake Bay Office, the Maryland and Virginia Sea Grant Programs, and the EPA's Chesapeake Bay Program Office. CBEEC's goal is to provide the scientific context necessary for resource managers to make

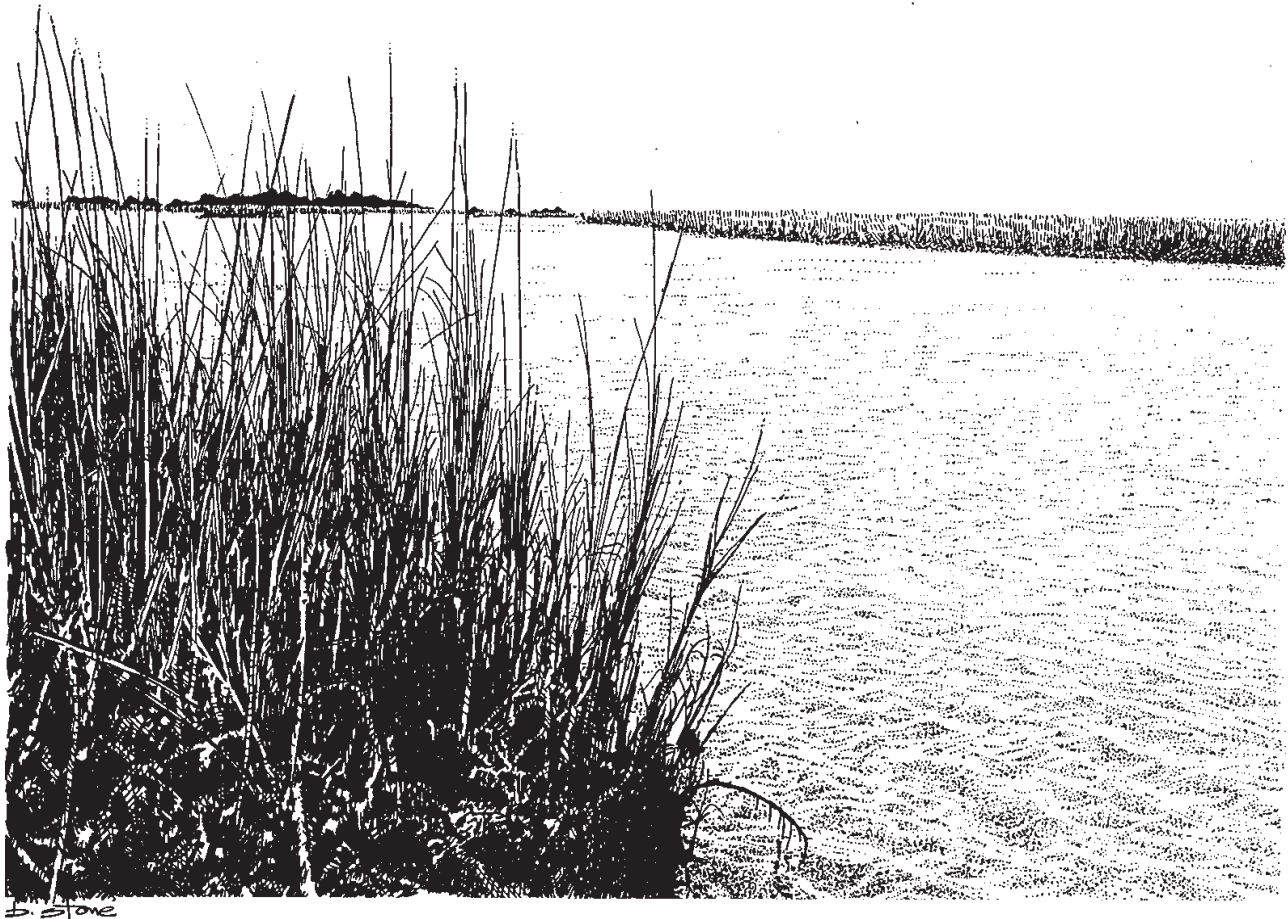
sensible decisions regarding Chesapeake Bay's living resources that are affected by toxic substances.

Virginia Sea Grant will continue its work with CBEEC and also consider, as a priority, research that addresses the ecology of coastal waters.

Key Action Item #1: Toxics Research

In 1998, CBEEC developed a five-year plan to ensure that CBEEC-funded research addresses critical, scientific questions and resource management needs. The plan delineates key changes for the types of research CBEEC will fund, the extent to which these studies are coordinated, and the ways in which scientific data are organized and communicated. CBEEC identified one overarching programmatic goal in its plan, which is to develop a predictive understanding of the bioavailability and adverse effects of chemical contaminants on populations and communities of living resources in Chesapeake Bay.

Research Strategies: CBEEC's major scientific priority over the next five years will be to support research on sediment contamination. The research will focus on two primary objectives: estimating chemical bioavailability (contaminant exposure), and measuring and predicting corresponding effects on organisms, populations, and whole communities. To address these objectives CBEEC will quantify the ecological risk imposed by contaminants on the habitat and resources of Chesapeake Bay; assess contaminant effects and their implications to management of Chesapeake Bay resources; and determine the potential to mitigate or remediate these effects.



B. Stone

Key Action Item #2: Enhancing Coastal Waters

Virginia has a wealth of living and non-living resources contained within its nearly 5,000 miles of tidal shorelines. Nearshore habitats are critical to the health of the Chesapeake Bay and provide nursery grounds and habitat for many commercially and ecologically valuable species. Currently, the function and role of many nearshore habitats, and the impact of human disturbance in these environments are not well understood.

Research Strategies: Virginia Sea Grant will place a priority on determining the function and role played by wetlands in the life cycles of commercial species, as well as the role of wetlands in the productivity of coastal waters. Additional emphasis will be placed on the ecological functions of tidal freshwater systems and understanding and reducing the impacts of human activity upon estuaries and other coastal ecosystems.

Developing a quantitative watershed-scale understanding of nutrient dynamics, organic matter cycling, flows of materials and energy between estuarine habitats and the pelagic zone, and the effects of these processes on community structure will also be a priority.

C. Education and Human Resources

Goal: To achieve a scientifically and environmentally informed citizenry.

Objective #1 Promote Marine and Science-based Education

Background

In the last twenty-five years, Virginia Sea Grant's Marine Education Program has evolved from a field trip service for school children into a multifaceted grant and contract-supported program serving a variety of audiences, and built on content and expertise from research and academic programs.

Virginia Sea Grant's current marine education program serves a large and diverse audience, and reflects the priorities of the funding agencies that support projects and staff. Some projects are part of the Sea Grant national network. Most are supported in cooperation with various local, state, and national agencies and organizations. All receive some, if not all, of their funding from sources other than Virginia Sea Grant; Virginia Sea Grant serves as a catalyst in marine education funding and programming and coordinates the various elements of the Marine Education Program.

Virginia Sea Grant's Marine Education Program has developed three major priorities: building research and education relationships, promoting a seafood education program, and developing a state-of-the-art marine education center.

Key Action Item #1: Building Research and Education Relationships

The Marine Advisory Program sponsors outreach activities which serve the specific needs of targeted groups of educators, and provides them

with the knowledge and skills to successfully include marine education in their curricula.

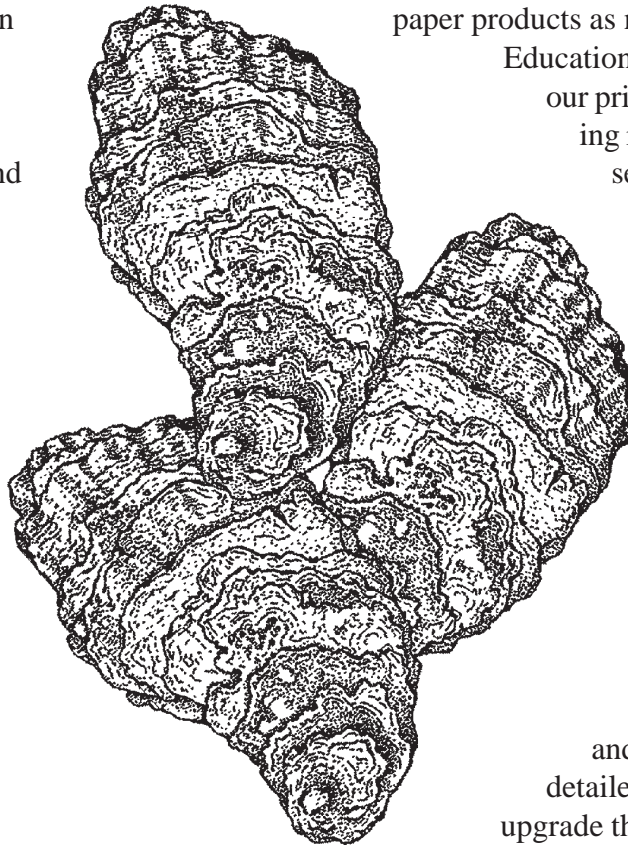
Within education there is also a growing emphasis on real data, interaction with real research and scientists, and the use of electronic technology as a science education tool. Driven by systemic efforts to reform education and public pressure, science education is moving away from teaching science as a series of textbook, factual memorization exercises, and toward student investigations of natural phenomena and current environmental issues relevant to their lives and interests.

Outreach Strategies: Several teacher courses and workshops will be sponsored including Operation Pathfinder, a graduate course on oceanography and coastal processes for in-service and pre-service educators, the VIMS Mini Marine Science School, and demonstration workshops associated with the Oyster Reef Restoration project. The Bay Team will continue to provide on-site demonstration lessons on current issues, teaching materials, and teacher seminars to K-12 classes across Virginia. In addition, other ongoing activities will continue to include hosting the Virginia/District of Columbia National Ocean Sciences Bowl, co-sponsoring the Virginia Governor's School, producing the Teacher Advisory Series, and working closely with the Mid-Atlantic Marine Education Association (MAMEA).

Key Action Item #2: Promoting a Seafood Education Program

Seafood continues to be a popular menu item for home and restaurant dining, and current nutritional guidelines recommend seafood as an important part of a healthy diet, however, the general public and food service professionals are often confused by media reports and misinformation on seafood safety, quality, and availability. Consumers need a reliable and up-to-date source of information on seafood topics. The Virginia Sea Grant Seafood Education Program helps meet this need by communicating current research on seafood topics in a useful and timely manner through seminars, symposia, cooking classes, and publications.

Outreach Strategies: The Seafood Education Seminar series will be conducted annually or twice annually to provide the general public with information on seafood preparation, nutrition, and fisheries research through cooking demonstrations by chefs and presentations by scientists. Current research on topics of interest to the public, such as Chesapeake Bay oysters, seafood safety, and aquaculture, will be covered in the seminars.



Key Action Item #3: Developing a State-of-the-Art Marine Education Center

The Marine Education Center presently houses a small collection of print materials and audiovisuals on marine and environmental science. The Center's collection is available for use by staff, students, and educators. Most requests for information are currently received by telephone or via mail. However, during the last few years, electronic media have become an important means for disseminating information. Most schools in Virginia have access to and use the Internet; many families also own computers and have access to email, CD-ROMs, and the World Wide Web. The growing availability of computer-based communications opens exciting new opportunities for widely disseminating marine education information rapidly and inexpensively.

Outreach Strategies: Although we still use paper products as needed, the Virtual Marine Education Center (VMEC) has become our primary means for disseminating information, and currently serves about 5,000 visitors each month. Recently, the site has been expanded to include The Bridge, a major national web project. With continuing support from Sea Grant and other partners, we plan to further extend the Bridge's resources by incorporating new, quality materials as they are produced.

Print media and audiovisuals are still needed and used by educators. A detailed plan will be developed to upgrade the Marine Education Center into a modern educational media center in keeping with the changing needs of clients in search of current resources and information.

Objective #2

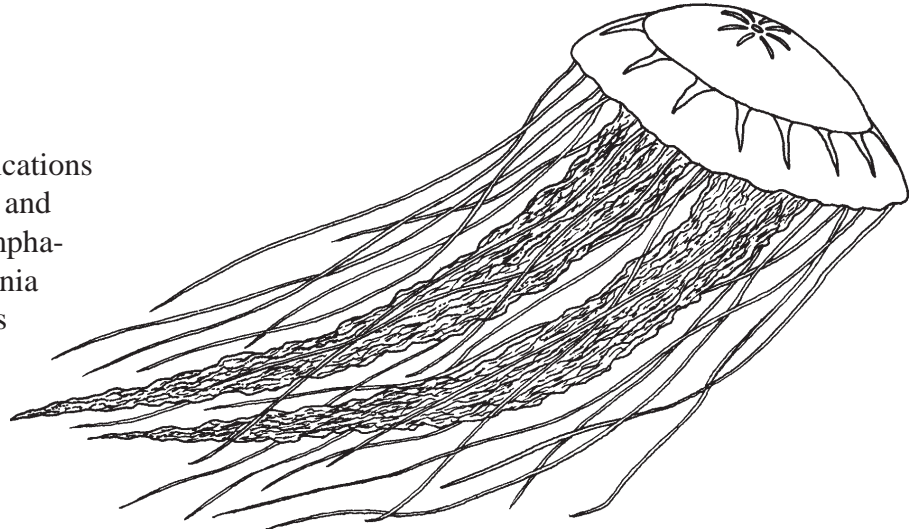
Promote Marine, Environmental Literacy through Science-based Communications

Background

Virginia Sea Grant Communications products and services are developed and disseminated to reflect the strong emphasis on outreach we have within Virginia Sea Grant and to reflect the progress of the Virginia Sea Grant Program as a whole. Virginia Sea Grant's communications network is spread between three consortium institutions: the University of Virginia, the Virginia Institute of Marine Science, and Virginia Tech. Virginia Sea Grant's communications program incorporates several areas of expertise including publications, media relations, and advisory-related outreach. The program serves four major client groups including resource users (the fishing community, seafood processors, coastal residents, and other marine-related industries), decision-makers (local, regional and national resource managers, legislators), and information users (industry, academia, news media, environmental organizations, K-12 educators, informal educators and the general public).

Key Action Item #1: Enhancing Communications

Virginia Sea Grant publishes three regular newsletters: *Tideline*, *Waterfront News*, and *CFAST*, and one magazine: *Marine Resource Bulletin*. These publications are all targeted to different audiences. In addition to these publications, Virginia Sea Grant maintains several websites, develops radio Public Service Announcements, and provides editorial, and public relations services to support the administrative, research, and advisory functions of the program as a whole.



Outreach Strategies: In addition to continuing to produce the products mentioned above, Virginia Sea Grant communicators will focus on several new activities to enhance the overall communications impact. To improve the communications program, an overall evaluation of the ways in which research and advisory-generated information is conveyed to client groups will be conducted to determine whether the basic products we have developed and distributed over the years meet the needs of our client groups.

The communications program will develop an advisory brochure and web pages to highlight the talent and capabilities within the Marine Advisory Program. An updated, Virginia Sea Grant exhibit will be produced for use at conferences, seminars, and other events. Other activities will include: increasing Virginia Sea Grant's visibility by working with the public relations offices of the consortium member institutions to obtain greater media coverage, using distance learning methods to educate seafood processors and inspectors, expanding exposure for selected print products by producing downloadable versions on our website, and working with the Mid-Atlantic Sea Grant Regional *Pfiesteria* Outreach Program.

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