

Virginia 82 Sea Grant

A Program of Service to Virginians

THE NATIONAL SEA GRANT PROGRAM, a federal-state-university funding venture operating out of the National Oceanic and Atmospheric Administration (NOAA), is about to begin its 14th year of involvement in Virginia. Like the many similar Sea Grant programs in coastal and Great Lakes states, some of which have been in place since 1966, Virginia Sea Grant is mandated to work toward the wisest development and use of the Commonwealth's marine resources.

Attention is given not only to the highly visible and obvious areas of fish and fishing, but also to such marine-related topics as waste disposal and treatment, weather, parasites and diseases of commercially important marine organisms, erosion, food preparation, marine education for youngsters and adults and even cold water survival for victims of marine accidents.

In fact, it probably is safe to say that if salt water touches it or forms a connection in any way, Sea Grant has already been there or will be in the future, providing there is a resources problem that needs attention.

How does the Sea Grant Program in Virginia work? Basically, like this:

First a problem is identified. This can occur in one of several ways. A Sea Grant advisory or extension agent may hear, "You guys really ought to do something about this..." from a group of watermen or other resource users, or he may perceive the problem on his own, through normal work routine. Advisory and extension agents are "go-between" people. That is, they interact between the people with the problem and the sources of information that can address the problem.

Once such a problem is identified, the agent then contacts a specialist in that particular discipline at any of the cooperating institutions. The specialist might be a marine scientist, food preparation expert or resource economist, for example. The specialist then can develop a research project in response to the problem or he can provide the agent with information which is already available.

A third way for a problem to come to light is during the course of research by a marine scientist working on another topic of emphasis. He or she may wish to investigate the new problem more

thoroughly, and may turn to Sea Grant for approval and subsequent funding.

At this point the researcher, later to be known as an "Investigator", submits a proposal outlining the problem, his suggested course of investigation and the anticipated benefits of his work to the state, region or nation.

Each project proposal is reviewed for scientific merit as well as potential application of the results to a problem. The Director of the Virginia Sea Grant Program, making use of the review comments, then prepares a package of the best proposals to be sent to the National Sea Grant Office for evaluation.

Finally, a Sea Grant site review team travels to the state to examine the results of studies which were funded during the preceding 12 months, and to examine new or continuing proposals for the coming year. In most cases, projects are completed and results made available to users within 3 years.

YESTERDAY

Before 1981, Virginia proposals submitted to the Office of Sea Grant came from several institutions of higher learning within the state. Among these were Virginia Institute of Marine Science of the College of William and Mary, Virginia Polytechnic Institute and State University, the University of Virginia and Old Dominion University.

As of January 1981, Sea Grant efforts in Virginia have been administered by the Virginia Graduate Marine Science Consortium. The four institutions previously mentioned are full voting members. Requirement for a full membership is the presence of a doctoral degree program in marine science. Institutions without such programs may qualify for associate membership by obtaining research funding through the Virginia Sea Grant Program.



The Virginia Sea Grant Program is mandated to work toward the wisest development and use of the Commonwealth's marine resources. This tidewater scene bespeaks long tradition.

Bringing together the full potential of Virginia researchers, educators and extension/advisory capabilities to address marine-related issues in the Commonwealth is the main idea behind the Consortium.

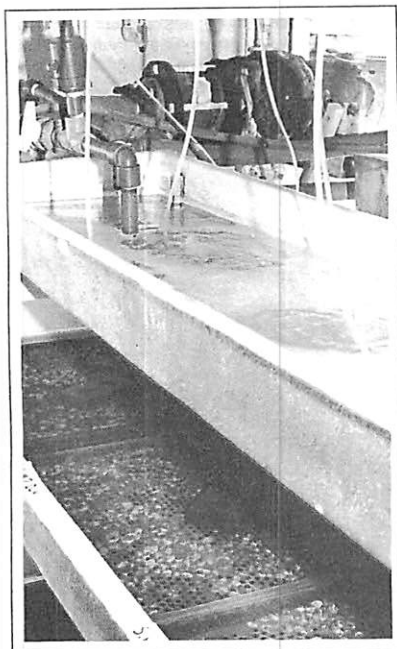
NOW

Sea Grant in Virginia will involve work detailed in 27 approved projects during 1982. Four are in the category of Aquaculture, five in Fisheries and Oceanography, six in Marine Environmental Research, six in Marine Resource Utilization and four are in Marine Advisory Services and Education. Two additional proposals cover Program Administration, under Consortium Director Dr. William Rickards.

The following are descriptions of the approved projects and their anticipated benefits.

aquaculture

—Cultivation of oysters and hard clams, two commercially important species among many in Virginia's marine waters, has been proved technically possible. Even so, commercial "farming" of these animals has not been realized on a large scale because such activities are not yet economically feasible. The Virginia Sea Grant Program in 1982 is supporting research efforts aimed at providing information which will address problems in nutrition and selective breeding of oysters and clams. Information resulting from these research efforts will assist in putting this emerging industry on a profitable plan.



Several current Sea Grant projects in Virginia are concerned with the economical nutrition of young oysters in a hatchery environment.

Utilization of Brewery Wastes for Oyster Mariculture

Investigator — David S. Gussman,
VIMS/William & Mary

This study of the feasibility of using brewery wastes, and micro-organisms cultured on brewery wastes, as food for hatchery-raised oysters in larval and adult form began in 1981. Sea Grant sees this project as a way to significantly reduce operating costs of an oyster hatchery, while at the same time providing a cost effective method of disposing of the liquefied wastes that are a byproduct of brewing beer. During 1982, activities will center around survival and growth of oysters fed brewery wastes alone and those fed microorganisms which have been cultured on the brewery wastes.

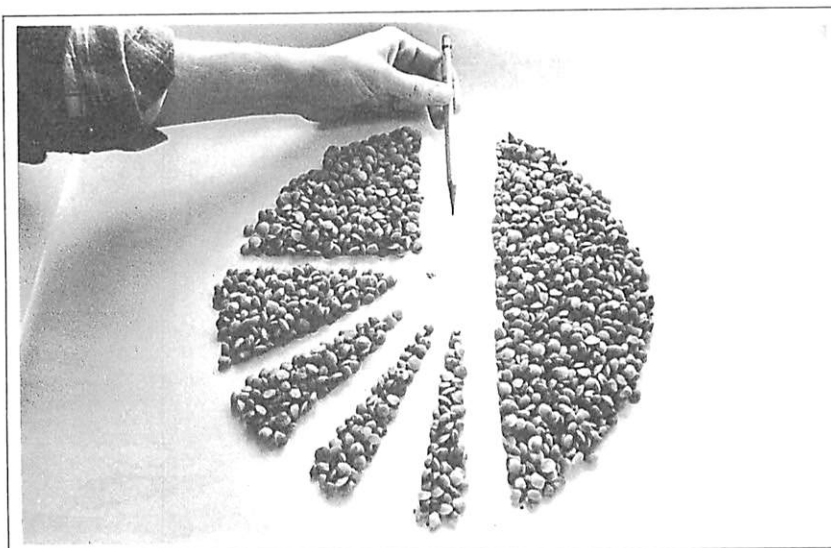
Suspended particles in brewery wastes, such as yeast cells or finely ground grain, could be consumed by oysters as supplemental feed. Overall, brewery wastes are an excellent potential nutrient base for culturing oysters in a hatchery system because, unlike the wastes generated by sewage treatment facilities, brewery wastes lack heavy metals, pesticides and hydrocarbons. This project is being conducted in cooperation with Anheuser-Busch, Inc., of Williamsburg.

Artificial Food for Oyster Larvae

Investigator — Kenneth L. Webb,
VIMS/William & Mary

Present production of oyster spat in a hatchery environment is both chancy and expensive, primarily because of the need to grow algae for oyster larvae food. This project, begun in 1981, is attempting to examine the chemical composition of known successful algal foods for oyster larvae, and then to develop a micro-encapsulated artificial diet based on essential ingredients. The work in 1982 will center around feeding four experimental diets to larvae in a hatchery situation. If successful, this

The hard clam, important as a Virginia seafood item, is being produced in several areas experimentally. Steps are now being taken to increase growth rates and reduce feed costs.



work could facilitate large scale, low cost production of oyster spat in hatcheries.

Supplemental Feeds for Growing Hard Clam Seed

Investigator — Michael Castagna,
VIMS/William & Mary

Another project aimed at reducing the costs of growing shellfish in a hatchery situation is a cooperative effort, begun this year, between VIMS and the University of Rhode Island. Attempts will be made to develop more economical methods of growing post-set hard clams to a usable size; to develop methods to increase the growth rate of hatchery-reared hard clam seed; and to increase the density of seed clams per unit of flowing seawater through the use of manmade supplemental feeds.

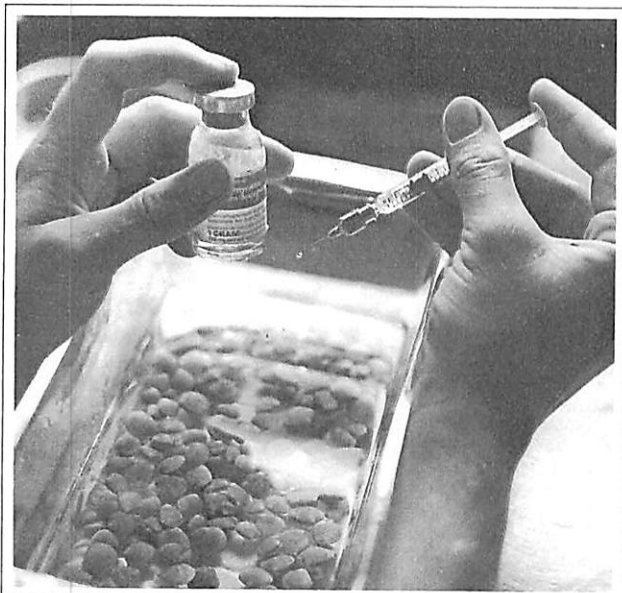
Virginia's hard clam fishery, a major contributor to the overall harvest of seafood, depends upon natural recruitment. Clams are harvested at present over a large area, and as natural stocks are depleted, an inexpensive cultured clam seed hatchery operation could well be the only means of insuring a continuing and viable clam industry within Virginia.

Genetics of Growth and Reproduction in the Hard Clam

Investigator — S. Laura Adamkewicz,
George Mason University

This cooperative project between George Mason University and VIMS, initiated in 1982, will furnish information necessary for controlled breeding of the hard clam. These programs are attempting to select clams which exhibit superior growth rates and reproductive capabilities. This research effort was prompted by the general decline which has characterized the commercial catch of hard clams in recent years. Any long term hatchery program will require this type of information if it is to be successful.

The general decline which has characterized the commercial catch of hard clams in recent years prompted current research efforts.



fisheries and oceanography

—Wise utilization of marine resources in Virginia demands a thorough knowledge of the life cycle, distribution and population structures of the organisms being harvested. Also needed is information on the harvesting industry and the effects of supply and demand on these fisheries. The following projects have been designed to contribute information upon which more reliable management decisions can be made.

Phytoplankton Assemblages Within the Chesapeake Bay Plume

Investigator — Harold G. Marshall, ODU

The investigator presently has a contract with the National Marine Fisheries Service (NMFS) to analyze phytoplankton samples from the northeast continental shelf waters of the United States. One purpose of the current work is to establish a monitoring program for detecting trends in phytoplankton population shifts and densities that relate to changing environmental conditions. This Sea Grant project would allow the investigator to complement on-going work with additional samples of phytoplankton taken from Chesapeake Bay waters and to enhance the value of an existing program while providing initial data on conditions within the Bay.

Economic Assessment of Virginia's Chesapeake Bay Fisheries

Investigators — Leonard A. Shabman and Oral Capps, Jr., VPI & SU

The objectives of this continuing study are fourfold: (1) to estimate the structure of consumer

and processor demand for blue crabs, oysters and food finfish; (2) to evaluate economic factors influencing the harvest of Virginia's blue crabs, oysters and food finfish in the inshore waters; (3) to estimate the contribution to regional employment and income of the blue crab, oyster and food finfish industries in the Virginia part of Chesapeake Bay; and (4) to utilize the results of the study to address selected fishery policy issues.

Completion of this work will assist the industry in: providing a continuous flow of seafood products to market; improved market coordination between watermen and consumers; and a more uniform flow of raw products to processors. Furthermore,

analysts, resource managers and legislators will benefit from the more complete data base this study will provide when changes in fishery management regulations and programs are considered.

An Evaluation of the Fishery Potential of Anglerfish

Investigators — John A. Musick and James Colvocoresses, VIMS/William & Mary

Over the past decade, several species of fish that traditionally were culled from commercial catches off Virginia and other East Coast states have been landed and marketed in increasing quantity.

The anglerfish (monkfish, goosefish) has long been considered a delicacy in France, where a steady market for its palatable flesh exists. Because of its rather gruesome appearance, however, Americans have turned to other, more traditional species for their seafood in the past. With current inflationary prices on those favorites, though, domestic customers are discovering that some of the fish they used to turn down, including the anglerfish, taste just as good and cost less than the normal fare.

Until recently, the anglerfish was primarily a by-catch of the scallop fishery. Now, with the development of a domestic market for anglerfish, there exists a potential danger for over-harvesting, since little is known of its population biology. This new project is designed to provide biological information about the anglerfish so that the basis for management of the fishery can be established.

Mortality of Juvenile Summer Flounder

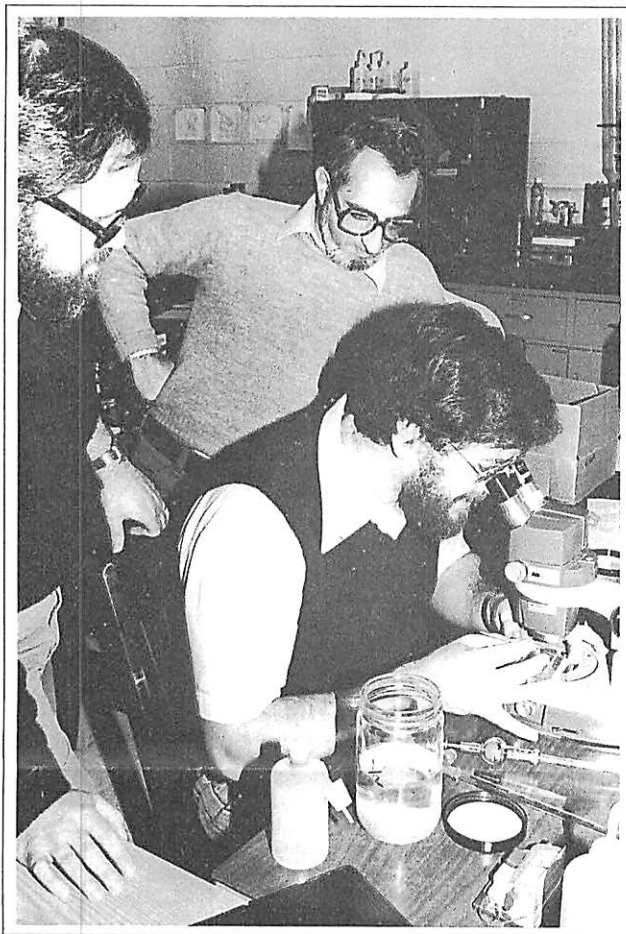
Investigator — Eugene M. Bureson, VIMS/William & Mary

The fish parasite *Trypanoplasma bullocki* has



Harvesting and marketing Chesapeake Bay seafood is a business which involves thousands of people, including watermen, boat builders, bankers and grocers. Economic assessment for Virginia's Bay fisheries is under way.

The Atlantic blue crab continues to be a subject of Sea Grant research in Virginia. Scientists hope to be able to predict future crab harvests by studying larval populations.



been implicated in the mortality of nearly 100 percent of the yearling summer flounder that remain in lower Chesapeake Bay over the winter. This new project will attempt to assess the impact of this hemoflagellate (a one-celled parasite in the host's blood) on overall summer flounder stocks in lower Chesapeake Bay and Virginia's nearshore ocean waters. Further, the study will attempt to assess the relationship between water temperature and flounder mortality caused by this parasite.

The summer flounder is important both commercially and recreationally to Virginia. Any serious reduction in flounder stocks would mean considerable loss of revenue to the commercial fishery and charter boat operations. The information derived from this research will be used by the Mid-Atlantic Fisheries Management Council in its summer flounder management plan.

Distribution and Recruitment of Blue Crab Larvae in the Mid-Atlantic Bight

Investigators — John R. McConaughy and Anthony J. Provenzano, ODU

The Atlantic blue crab fishery in Chesapeake Bay suffers extreme fluctuations, making any long range planning by harvesters and processors

difficult to impossible. A reliable method of prediction would be a valuable asset to managers and planners, alike. The purpose of this follow-up to Sea Grant studies on blue crab larval dynamics is to determine the eventual fate of the larvae hatched at the mouth of the Bay. Do they form a distinct population which recruits mainly to the Bay, or are they carried well offshore by wind and current action, eventually to recruit to a number of estuaries along the Mid-Atlantic area?

Only after the population dynamics of the blue crab are thoroughly understood, through research such as this project affords, can an effective management plan for the species be designed.

marine environmental research

—Modern focus is increasingly being directed toward examining pollution of the environment and its impact upon natural resources. Another

consideration is severe weather and its impact upon water-oriented business and recreational activities. Aspects of these problems will be analyzed within this program area.

Hydraulic Model Verification of Marina Pollutant Fields

Investigators — Carvel Blair and George Hecker, ODU

The purpose of this work, using the Chesapeake Bay hydraulic model maintained by the U.S. Army Corps of Engineers in Maryland, is to provide an improved basis for establishing marina buffer zones.

Buffer zones are areas of presumed pollution near marinas from which shellfish may not be removed except by special permit. In Virginia, the extent of a buffer zone for any particular marina has been based on the number of boat slips in the marina. The researchers in this project believe a more accurate way to establish buffer zones is through a simulation study of a marina's water depth, water velocity, harbor shape and salinity level, as well as the business's unique polluting activities.

This continuing project will also establish the limits within which the Chesapeake Bay model, insofar as it may be used, can serve as a tool for predicting water quality in any given area of the estuary.

Representative Marinas as Sources of Fecal Coliforms

Investigators — Howard Kator and Paul Hyer, VIMS/William & Mary

Fecal coliforms are the presently accepted water-borne bacterial indicators of wastes from warm-blooded animals, including humans. Marinas, with their associated intensive human use, are potential contributors to the fecal coliform bacteria load. Virginia's current regulations dealing with establishment of marina buffer zones may be inappropriate owing to real differences in water depth and movement and marina usage patterns.

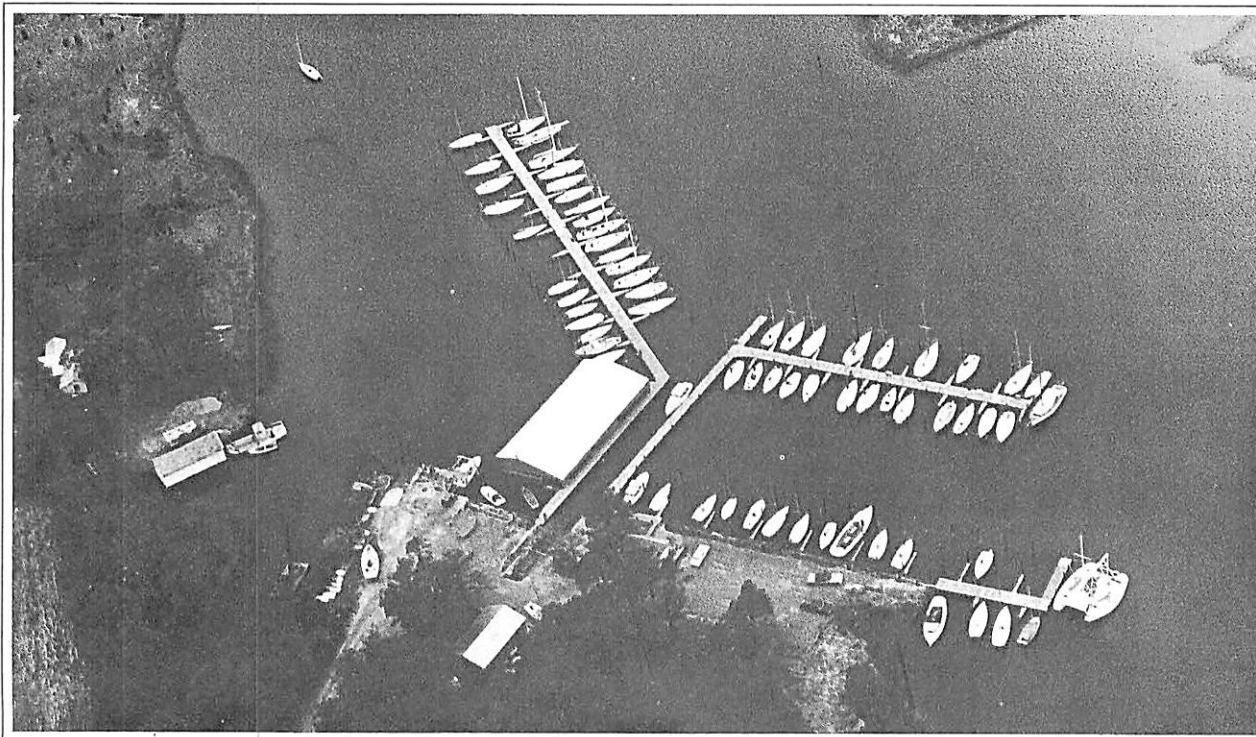
This project, begun in 1980, will permit the comparison of fecal coliform levels from two tidal creek marinas of differing complexity, size and usage over the same seasons of the year to test the concept of buffer zone standards. The results of this work can be coupled with the Chesapeake Bay hydraulic model studies. This will provide scientific and regulatory agencies and industry with representative baseline data concerning marinas, buffer zones and pollutant fields.

Geology and Geochemistry of Coastal Sedimentation

Investigators — George F. Oertel and George Wong, ODU

The role of wetlands in the natural scheme of things is just now being appreciated. Marshes and other wetlands, in which Virginia abounds, are protected by law for their value as nursery areas for fish and wildlife and for erosion control. Little is known, however, of a typical small wetland's value as a natural "sink" for pollutants and heavy metals.

This study has been examining the sedimentation rates in selected wetlands by analyzing the



Marinas as sources of potential pollution are just now coming under critical Sea Grant scrutiny. The "buffer zone" concept needs updating, say researchers, who explain that water depth, velocity and salinity must be factored in.

relative rates of accumulation of lead-210 and cesium-137. Results will furnish information for the practical aspects of waterfront and wetland management, and should lead to a better understanding of the processes that control the rates of siltation, wetland evolution and the uptake of chemical elements by natural systems.

This information will be particularly beneficial to forming policy and management decisions where patterns and rates of sediments and pollution accumulation and mixing must be known. Examples are areas in or around inlets.

Sand Shoal Deposits in Lower Chesapeake Bay

Investigators — John D. Boon III and David A. Evans, VIMS/William & Mary

Sand and sediment movement in lower Chesapeake Bay and its tributaries is a continuing natural process that costs millions of dollars to alter annually. Regulatory agencies are constantly making decisions relating to dredging, waste disposal and containment of harmful contaminants introduced to bottom sediments. A shoreline property owner sees the effects of sand movement, too, when the beach he owns one month becomes the property of another in succeeding months.

This continuing project will permit a better understanding of how sand and sediments move in the lower Bay area.

A new technique, Fourier Grain Shape Analysis, has been used successfully to trace the movement of distinctively shaped quartz sand grains. By identifying the sources of certain of these sand beds and by using computer technol-

Understanding how and where sand and sediment move in lower Chesapeake Bay is information that will benefit not only property owners but dredging and waste disposal regulatory agencies, as well.



ogy, researchers hope to delineate the dominant areas and directions of sand and sediment movement in the Lower Bay. An understanding of these processes will benefit governmental and private decision makers relative to construction, containment and dredging in the lower Bay.

Interactions of Heavy Metal and Organic Pollutants with Sediments

Investigators — John G. Dillard and Lucian W. Zelazny, VPI & SU

The proposed dredging of Hampton Roads to accommodate large deep draft vessels has drawn opposition from watermen claiming it would physically destroy shellfish growing areas. Previous studies have shown such fears to be unwarranted. However, there is a danger of the dredging releasing metal ions and toxic organic materials from bottom sediments into the water, and these may contaminate both shellfish and drinking water. Information resulting from this new study is essential to predicting the impact of dredging activities upon estuarine water quality, and may be used to manage dredging schedules and locations in a more rational manner.

Improved Weather Forecasting for Tidewater Virginia

Investigators — Patrick J. Michaels, UVA, and Roger Pielke, Colorado State University

The main objective of this new Sea Grant-sponsored research is to improve our understanding of the eastern Virginia climate system, with an aim toward more accurate weather forecasting for Tidewater Virginia.

Techniques for composing high resolution, county-based weather forecasts for 6, 12 and 24 hours will be developed. Remote sensing from satellite-based radar will be used to develop more accurate and timely weather forecasts for the study area than any that are presently available. This type of high resolution forecasting will benefit commercial and recreational boaters and should help decrease the number of boating fatalities due to severe weather events. Information from the study will be used by the agencies responsible for issuing weather forecasts to the public.

from these projects will assist the industry in providing more wholesome and acceptable products for the consumer. A final aspect of marine resources utilization being addressed this year is the development of techniques to assist the deep ocean mining industry in detecting worthwhile deposits of strategic or critically needed minerals.

Uptake of Heavy Metals by Chitin and Chitosan

Investigator — James P. Wightman, VPI & SU

The substance known as chitin makes up a major portion of the shell waste produced by crab and shrimp processing. A derivative of chitin, chitosan, has long been known to attract heavy metal ions. There is a strong possibility that such crab and shrimp processing waste can effectively be used to remove heavy metals from industrial wastes, but a study of the mechanisms of interaction between the chitinous materials and heavy metal ions is necessary before widespread promotion of the concept is possible.

This continuing project will accomplish that intermediate step. At present, crab processing plants in Virginia and elsewhere see the scrap as a liability byproduct of their operations. In the future that same scrap may be in demand by industry.

Seafood Waste as Ruminant Feed

Investigators — J.P. Fontenot and George J. Flick, VPI & SU

This Sea Grant project, begun in 1981, involves combining seafood processing wastes with other underutilized substances in silos, and determining the feasibility of using this silage as cattle feed. Some animal feed is already being made from fish parts, but the amount of fossil fuel necessary to produce the dried product makes the process less cost effective than a successful ensilage method would appear to be.

The researchers will attempt to determine the palatability of ensiled seafood processing wastes

and crop residues to cattle as well as the digestibility of beneficial organic compounds present and the efficiency of nitrogen utilization in the mixture. If successful, this project would provide a revenue-generating solution to some of the present waste disposal problems faced by seafood processors in Virginia and elsewhere.

Fish Soluble Nutrients for Crop Fertilization

Investigators — Louis H. Aung and George J. Flick, VPI & SU

The purpose of this follow-up research is twofold: (1) to evaluate the effects of fish soluble nutrients on the yield of soybeans and other important food crops under field conditions in Arkansas, Virginia and West Virginia; and (2) to ascertain the chemical composition of soybean and corn grains derived from fish soluble nutrient fertilization.

This work will benefit both the Virginia menhaden industry and agriculture by demonstrating the feasibility of using soluble fish processing wastes rather than expensive petroleum-based fertilizers in crop production. Menhaden processing in Virginia generates approximately 56 million gallons of waste water effluent annually. If successful, the project will help alleviate the growing problems of storage and disposal of such wastes and will lessen indiscriminate pollution of land and water by the dumping of such wastes. It also will provide a relatively inexpensive source of high-quality nutrients for agriculture.

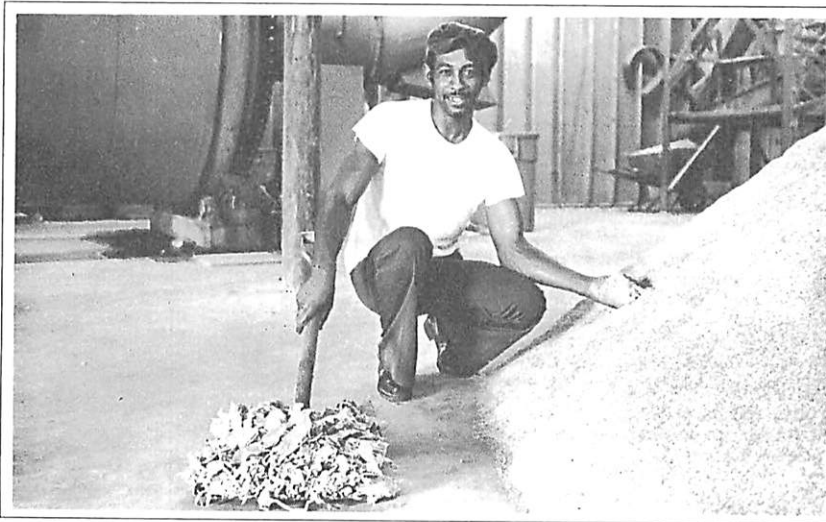
Standardizing Seafood Portions For Fast Food Restaurants

Investigators — Robert L. Ory and George J. Flick, VPI & SU

Fast-food restaurants which serve fish are experiencing difficulty in producing uniformly acceptable portions. Some portions are being rejected by customers as overcooked, while others are described as undercooked.

marine resources utilization

—For decades, one of the problems which has plagued the seafood industry is waste disposal. In the past, seafood wastes associated with cleaning and packing houses were simply buried or dumped overboard. These alternatives, in many cases, no longer exist. Sea Grant currently is investigating methods for turning such material into useful byproducts. Also in 1982, selected aspects of seafood product quality will be studied. Results



Crab scrap and other seafood processing wastes are being tested as livestock and poultry feed and crop fertilizer. If successful, a traditional disposal problem may become an asset.

marine advisory services and education

—The Sea Grant Marine Advisory Service effort in Virginia is a multi-disciplined, public service network aimed at assisting the seafood industry, educators, recreationists and the general public concerning marine activities. Specialists and area agents establish and maintain dialogue with a variety of interest groups that have at least one thing in common . . . they have a connection, however remote, with Virginia's marine environment.

Marine Advisory Services

*Investigators — William D. DuPaul,
VIMS/William and Mary and
George J. Flick, VPI & SU*

The overall goal of the Marine Advisory Service effort is to foster better utilization of marine resources. There is a continuing strong emphasis on assisting the commercial fishing industry through workshops, meetings, displays and demonstrations on topics ranging from new technology to modern financing, from tax structure to general business management, from export development to seafood preparation and marketing.

Another audience of the Marine Advisory Service is composed of students and teachers. Marine education specialists work within the state education framework to identify needs, educate the educators and supply training materials where needed. These specialists also conduct short courses, workshops, seminars and field trips for groups of students and teachers, and offer assistance to individual teachers in obtaining visual aids and other marine-related materials. The Marine Education Materials System (MEMS), a nationally acclaimed information retrieval network with headquarters at Virginia Institute of Marine Science, is a computer-based service providing access to a broad range of marine and freshwater related materials.

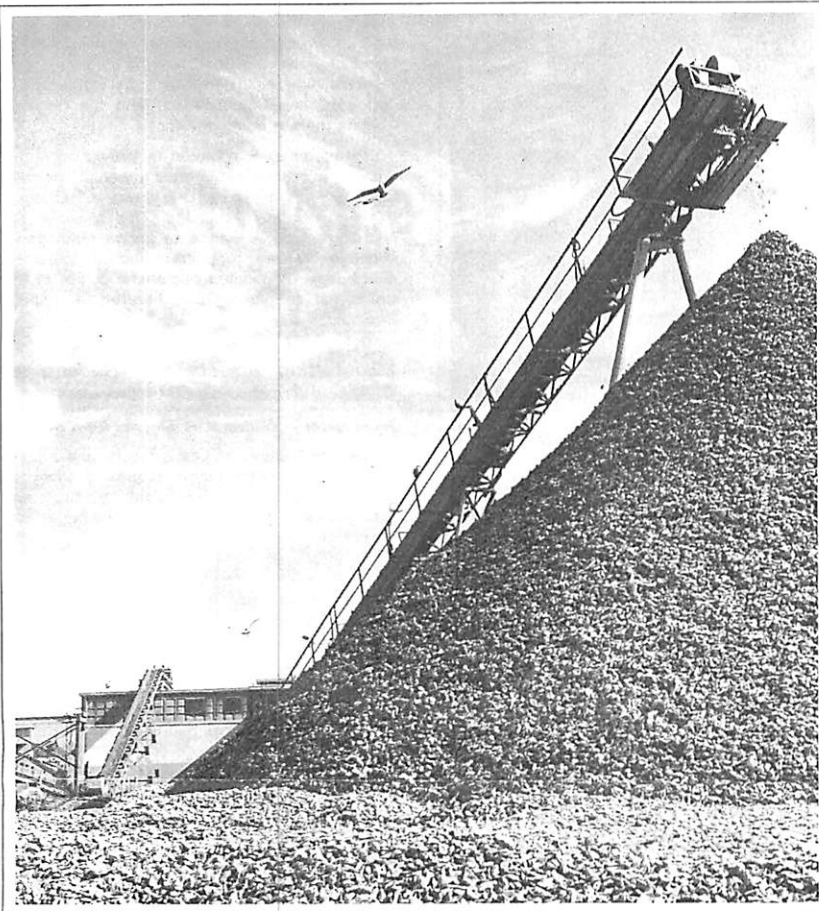
In other areas, specialists and area agents routinely conduct workshops and conferences for seafood retailers and restaurateurs, with such topics as marketing, sanitation, product stability, preparation and attractive serving techniques providing points of focus.

Word gets out to the public on all of these activities through a vigorous interaction of the Sea Grant communications program with area newspapers, radio and TV contacts, plus institutional films, slide programs and special publications. Also, there is an active publications production effort which provides free and low cost books, brochures and special papers of interest to the many target audiences served by the Marine Advisory Service.

Virginia Marine 4-H Program

*Investigators — Richard F. Booker and Barry W. Fox,
Virginia State University*

The overall objective of this project is to develop a comprehensive information and education



Waste shell piles near oyster and crab processing plants have been shown to be sources of bacteria which can be carried by air currents back into the plants. Design changes could minimize chances of such transfer.

The fast-food restaurants that sell fish portions fry the pre-battered portions in deep fat for a predetermined time and temperature. Variability in the cooked fish may be due to inconsistent thickness of the portions or variations in the battering process, cooking time, or oil temperature. Standardization of the size, thickness and cooking procedures for the battered fish portions should help alleviate the problem.

This new project holds promise for expanding the sale of fish products in fast-food restaurants throughout the nation.

Air Quality in Seafood Processing Plants

Investigator — Donn R. Ward, VPI & SU

Marine food products are inherently very perishable. Efforts to control or eliminate sources of bacterial contamination are essential in marketing wholesome products. Previous research has indicated that, in crab and oyster processing plants, the waste shell piles which accumulate outside the buildings can become a tremendous source of bacteria, which could be carried into the plants by air currents. Such bacteria can adversely affect the quality of the product being processed.

Virginia currently has 142 certified oyster shucker-packers and 37 certified crab processors—more than 60 percent of the seafood processing plants operating in the state. Information derived from this new study of the bacteria levels present near selected waste shell piles will be helpful to processors in designing or modifying their plants to minimize the effects of air-borne contamination.

Acoustic Sounding for Manganese Nodules

*Investigators — Allen H. Magnuson and
Karl Sundkvist, VPI & SU*

Manganese nodules are rocklike concretions found in varying concentrations on the deep ocean floor in many parts of the world. Besides manganese, which makes up the bulk of each rock-like nodule, varying amounts of other recoverable and sometimes strategic elements, including nickel, copper and cobalt, often are present. The development of an acoustic technique (using sound waves) to locate and assess concentrations of nodules will allow the emerging deep-ocean mining industry to more quickly and more economically determine the location of worthwhile deposits.

Marine field trips for teachers and young people of all ages are a standard part of the marine education effort in Virginia.



program making use of print, mass media and in-service education programs for 4-H'ers and volunteers in marine education subjects.

This year-old project already has more than 5,000 4-H'ers enrolled through community and special summer camp classes. A significant amount of work in the coming year will entail coordinating activities with existing marine education projects at various Sea Grant project facilities in Virginia.

Specific project areas will be continuing development of marine education modules, guides, records, books and visual materials that will be used in 4-H programs; and to conduct in-service marine education programs for extension agents and in-school volunteers.

A Union List of Serials in Marine Science Libraries

Investigators — M. Janice Meadows and Susan O. Barrick, VIMS/William & Mary

This project will enhance the interlibrary loan system whereby libraries borrow books and obtain

photocopies from one another. Librarians determine the likeliest locations for these loans by use of tools known as "union catalogs," which list titles of books or serials and designate the libraries which report holding these particular titles. In this case, a listing of serial publications and the libraries holding them is being developed.

Through a system known as "networking", the costs of purchasing reference materials are held down while available working library collections in the network are expanded. This provides researchers greater access to library holdings at considerably lower cost. The project also will allow distribution of updated microfiche copies of the union list to participating libraries at regular intervals.

Combatting Insects and Rodents in Seafood Processing Plants

Investigator — William H. Robinson, VPI & SU

The application of pesticides in and around seafood processing plants require a thorough knowledge of and respect for the chemicals and methods used. At present, the amount of training,



Keeping in touch with resource users is the name of the game for advisory specialists and extension agents. With Sea Grant help, solutions to problems come easier.



A vigorous program of cooperation with seafood harvesters and marketers marks the advisory service effort in the Commonwealth.

experience and ability of persons using these techniques in seafood processing plants ranges from minimal to excellent. The overall objective of this Sea Grant project, initiated in 1981, is to design a standard training program for plant managers and employees, including a training manual and visual aides. The program should insure the use of reliable, effective and sanitary methods of pest control. The results will be distributed nationwide.

By DICK COOK
Virginia Sea Grant Program
at VIMS/College of William & Mary

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