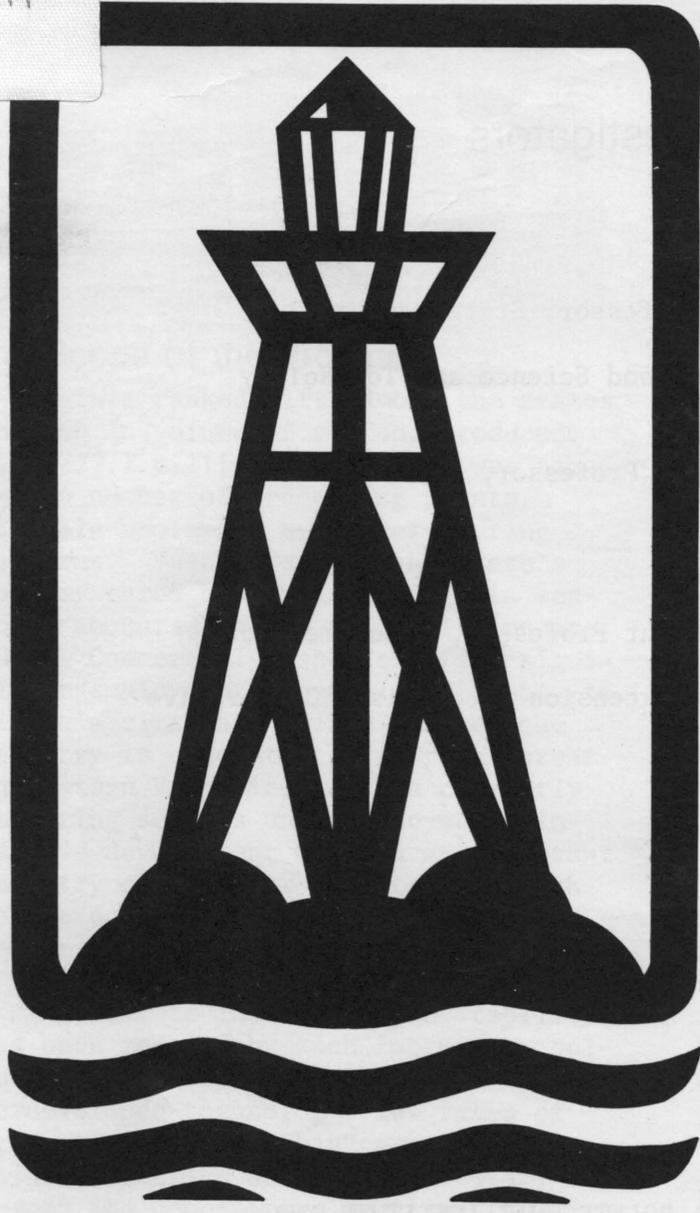


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Sea Grant at Virginia Tech

First Annual Report • November 1, 1971 to February 15, 1974

Principal Investigators

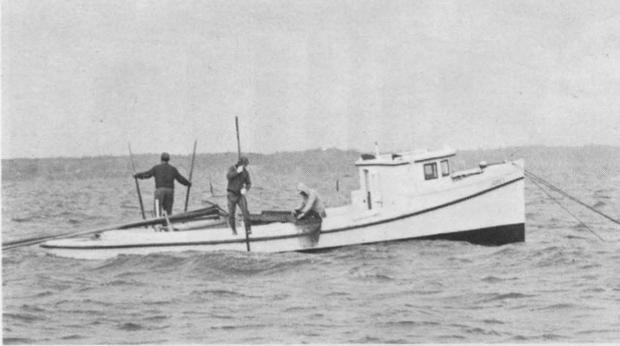
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STATE UNIVERSITY

The Seafood Industry in Virginia



The Scope of the Problem

Virginia ranked fifth among the states in 1969 in volume of seafood produced, with 277.7 million pounds. It was second in number of processing plants, with 314 wholesale and manufacturing concerns. Value added to the state's economy through marketing Virginia seafoods amounted to about \$25 million in 1971. Commercial fisheries offer significant employment--about 16,000 jobs--to Virginia citizens. Since much of the industry is concentrated in rural areas in eastern Virginia, an area currently suffering serious underemployment, intensive development of such an important industry could offer profitable growth to the economy and stimulate rural development of the Commonwealth.

The seafood industry's profitability has been reduced by such factors as pollution, disease, depletion, weather, underdeveloped technology, low rates of productivity, and "thin" management. Major corrective action is necessary to regain the competitive position the Virginia seafood industry once enjoyed.

One of the major factors affecting a wholesome seafood supply is the deterioration of the ecological system in the Chesapeake Bay region. Increases in population, industrial wastes, and pesticide run-off have lowered the productivity of the natural waters or rendered them unsafe. For example, state health department officials closed 17,000 acres of shellfish-growing waters in 1972. Freshwater flooding caused by hurricanes has caused serious unemployment. MSX disease, which became an acute problem in 1960, has significantly reduced the

oyster-growing areas. Such hardships have forced Virginia seafood processors to purchase oysters from Maryland growing areas and to pay the transfer cost to Virginia processing plants.

International competition puts further stress on the domestic industry. Depletion of fish stocks by foreign nationals has almost driven Virginia ocean fishermen out of business. Some species of ocean fish are depleted to the point that fishermen of those species find it unprofitable to go to sea. Early in 1972 there were only 16 trawlers registered in Virginia. Higher wages and other factors cause a higher cost structure than in the foreign industry. Another problem is the price competition from imported fish in the domestic market.

Conflict among the interests of the commercial seafood industry, sports fishermen, and other vested interests along the waterways of the state present problems relative to long-range planning.

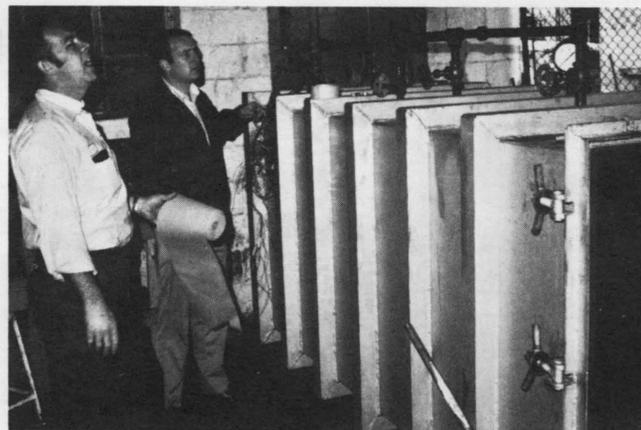
The seafood industry is beset by obsolescence. Production and marketing methods have changed little in 25 years. The state of technology, industry organization, and tradition combine to make the basic marketing system very inefficient. Watermen operate small economic enterprises and as individuals have little control over supply or demand. Production processes primarily utilizing hand labor and prevailing low wage rates contribute to low productivity in processing plants. Yet wage rates are kept low because of the low productivity from the small-volume processing plants, which causes low-poundage shipments and subsequent inefficiency in transportation.

Creative marketing methods are lacking. Little thought is given to marketing planning, and the industry does not generally take into account economic conditions before beginning a new marketing season. Marketing managers are primarily order-takers, and management, more concerned with technical factors, fails to set meaningful goals for sales, profits, and

growth. Instead of considering the quantity of the raw product available, managers still establish the market based on the price variable technique. Merchandising efforts are limited to product labelling, and resources devoted to research and development are almost nonexistent. Promotional efforts are weak, limited to trade associations' advertising through four-color brochures, and their effect is often lost because of poor merchandising. Until the VPI&SU market research study, the industry did not know the pattern of product flow from Virginia to its marketing areas.

Management in most firms consists of only one or two individuals, who usually perform operating functions as well. Processors buy raw products from watermen with cash, and sell their processed pack to wholesalers on credit-- a practice which causes severe cash flow problems at peak production seasons.

Fortunately, consumers seem willing to pay high prices per unit of seafood product. This is the principal factor that keeps the industry going.



Continued pressure to meet rising health and safety standards increases costs within the industry.

The seafood industry in Virginia lacks organizational unity; there are as many organizations as there are species (crabs, clams, oysters, *etc.*) to market. Thus the influence of the industry is diluted at the state and federal level.

All these problems have driven capital and human resources away from the seafood industry during the last 20 years. Many members of the industry have advised their children to stay out of the seafood industry and find employment elsewhere.

Purpose of the VPI&SU Program

Through the efforts of the VPI&SU Extension Division and field staff, the Food Science & Technology and Agricultural Economics Departments, and the State Technical Services, the group within the industry most needing technical assistance has been identified. This group is the seafood processors, particularly those processing shellfish and crustaceans. The type of service this group most urgently needs has also been identified -- that is, an advisory service able to provide technical assistance.

In the beginning period of the Sea Grant program at VPI&SU, a start was made in meeting these needs.

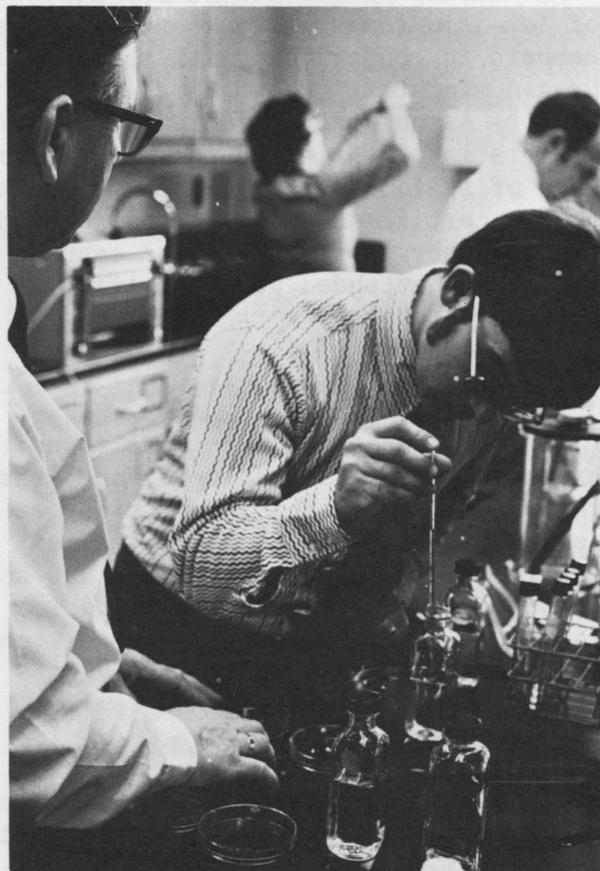
FOOD SCIENCE AND TECHNOLOGY

Prior to the Sea Grant program at VPI&SU, extension and research activities on marine food bioproducts were handled through the Department of Horticulture. This work, conducted by Drs. William F. Cooler and Anthony Lopez of that department, made it evident that in order to provide the assistance the seafood industry needed, additional human resources would be necessary. Therefore, an Extension position devoted entirely to marine food bioproducts was established in 1969 in the Virginia State Technical Services.

Also, a grant was requested and received from the Office of Sea Grant in November 1971 for \$54,800 to establish a Marine Advisory Program in cooperation with the then-existing extension programs being conducted by the Virginia State Technical Services and the Cooperative Extension Service. The original grant was intended to be effective from November 1, 1971, through February 15, 1974. The grant made possible the establishment of the Marine Extension Agent to serve both agents and seafood processors in the coastal cities and counties. The establishment of the Sea Grant program provided for educational programs, technical and popular publications, and problem-solving activities.

Technical Short Courses

Two three-day courses were developed with other extension personnel in the Department of Food Science and Technology. The first was directed to Waste Management and Pollution Control, and the second to New Food Product Development. The conferences provided an opportunity for industry management to meet and interact with private consultants, governmental agency representatives, and large food processing plant executives. This method of technology transfer was effective because most of the information was presented by representatives of food processing companies.



Laboratory Short Course

A Microbiological Techniques in Food Quality Control laboratory short course was developed and presented on three occasions. Representatives from the seafood industry participated in both the lecture and laboratory sessions. The major objective was to teach managers and supervisors how to distinguish among food-borne microorganisms so that they would understand health reports and the public health significance of microbiological species. A second objective was to demonstrate the simplicity of microbiological quality control techniques in order to develop interest in the establishment of in-plant quality control laboratories.

Subsequent to these courses, several plants have established quality control laboratories or have contracted for the services of a consulting laboratory. It has also been observed that companies have become more aware of quality control and have made changes in plant operating procedures to help improve quality.

Training Short Courses

A Better-Process School for processors of low-acid foods was presented by staff members in cooperation with the Food and Drug Administration and the National Canners Association. Those seafood processors involved in the thermal processing of seafood were urged to attend and obtain certification. All managers and retort supervisors of seafood canning plants who attended were certified as retort operators.

Workshop

Two presentations were made to unit extension agents attending a Food Preservation Workshop. The information presented included market form, species available, grade and standards, and home processing and preservation methods. This activity was the first in-service training program given to unit agents having responsibility in the family resources area.

A one-day in-service training program was presented to Extension agents in the coastal zone. The purpose of the conference was to introduce unit extension agents, who traditionally have been involved in agricultural projects, to programs involving marine bioproducts. This initial contact was designed to introduce many of the problems facing seafood processors and to discuss alternatives and assistance available through the Sea Grant Project. The conference was not an end in itself but was intended to be the start of a succession of conferences. The ultimate goal is to train the agents so they will be prepared to assist in educational programs and to transmit technical and scientific data on a local level.

New Course

A senior-level and graduate course was developed on the VPI&SU campus on the utilization of marine bioproducts as food sources. The course includes information on all aspects of the commercial seafood industry from defining growing-water areas through ultimate

consumption. The course is required for all students enrolled in the Fisheries Science Program and serves as an elective in the Food Science and Technology Department.



APPLIED RESEARCH

Crab Pasteurization, Container

A process was developed for the bulk pasteurization of crab meat. The new process utilizes flexible films, rather than metal containers or a packing material. There are several advantages of this new system:

1. The container cost is greatly reduced. A metal one-pound container costs between 10 and 15 cents, whereas the flexible film can hold six pounds of crab meat and costs only 3 to 4 cents.

2. The containers are convenient to use in subsequent manufacturing plants, since a plant worker can open six pounds of the product in less time than was required to open a single one-pound metal container.

3. The container is well suited to damp storage since corrosion cannot occur.

4. The container requires a minimum of storage space, and dampness or saltiness in the storage atmosphere have little effect on the container.

The process and container have been adopted by several seafood companies in Virginia, and processors outside Virginia have shown interest.

Container for Fresh Oysters

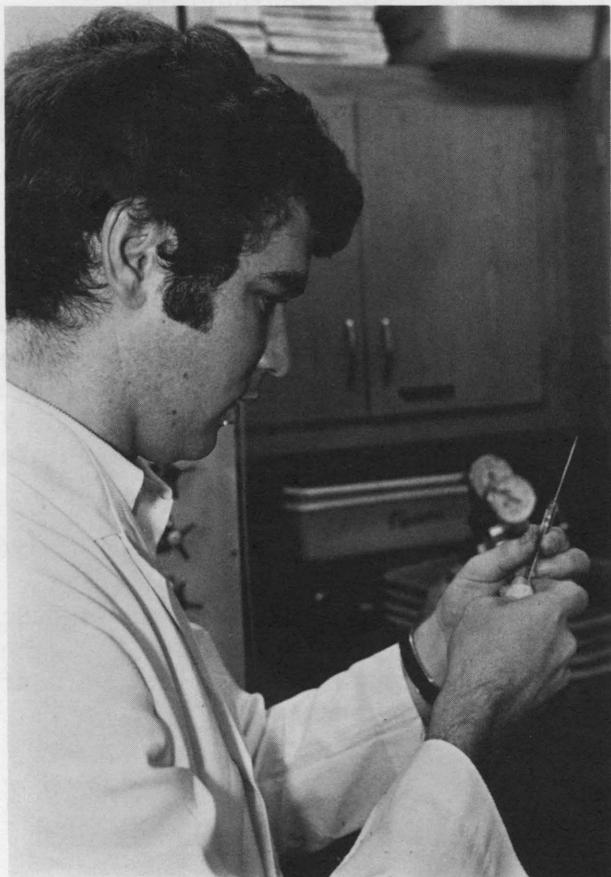
A new plastic container for marketing fresh oysters was developed. Several oyster processors were marketing their product in glass containers and were

experiencing significant breakage in shipment and retailing. A high impact polystyrene container, approved for food use by the U.S.D.A., was selected. Petitions were made to the appropriate regulatory agencies for its use as an oyster container, and a tamper-proof seal was developed. Trial shipments were made, and the container was eventually adopted by the industry.

Pickled Herring Storage

River and sea herring are caught during a limited fishing season in Virginia. In order to have the product available for retail markets on a year-round basis, it is necessary to assemble and inventory supplies. The herring are filleted and stored in 55-gallon barrels with an acetic acid--salt solution. After six months of storage, amorphous nodules begin to appear on the fillets and grow to 2-3 mm in size. Consequently, the fillet has no market value.

Research was initiated to determine the chemical composition of the nodules and the chemical or biochemical mechanism



responsible for their formation. Instrumental and chemical methods of analysis proved the nodules to be over 99% tyrosine. Investigation is continuing in an attempt to elucidate the mechanism of formation. Several processing changes are under consideration that should effectively reduce or eliminate nodule formation.

Beefish Burgers

This project was a cooperative research effort between the VPI&SU Sea Grant and the Gloucester Massachusetts Technology Center of the National Marine Fisheries Service. Minced fish flesh was mixed with ground beef and spices to produce an acceptable fish-beef burger. The product was fed to students at the VPI&SU campus, who evaluated it for flavor, odor, texture, and appearance. Samples containing 35% and 25% fish were preferred over the all-beef patties.

Utilization of the Rock Crab

This project was co-sponsored by the VPI&SU Sea Grant and the Virginia Seafood Council. The rock crab, *Cancer irroratus*, is an underutilized species in Virginia. The crabs congregate near the mouth of the Chesapeake Bay during the winter and are caught during dredging for surf clams. Because they have little market and economic value, they are returned to the water.

In order to find some use for this resource, the claws of the rock crab were processed into crab fingers and marketed in restaurants on the Gulf Coast. The crabs were successfully sold as an expensive gourmet food item. Demand for the product during the testing period exceeded the supply.

The proximate composition, amino acid profile, macro- and micro-elemental composition, pesticide content, and industrial organic contaminant level were determined. The meat contained 87.5% crude protein on a dry weight basis, a 1.2% ethen extract, and a 4.4% crude fiber and 13.4% ash content. The amino acid content was determined on an amino acid analyzer after two time-hydrolysis

periods. The elemental analysis was conducted by neutron activation analysis for 42 macro- and micro-elements. The samples did not contain excessive amounts of mercury, arsenic, or copper. Pesticides and industrial organic contaminants were present in quantities less than 0.1 ppm.

An organoleptic evaluation was determined on four market forms of crab fingers: fresh, frozen, pasteurized, and canned. The fingers were acceptable in the fresh, frozen, and pasteurized states but unacceptable when canned. A shelf-life study of pasteurized crab fingers (heated to an internal temperature of 185° for one minute) indicated that a storage time of three months was feasible.

INFORMATIONAL SYSTEM

One of the basic objectives of the Sea Grant Project at Virginia Tech is the dissemination of information -- not just technical and scientific but also consumer-oriented -- to members of the seafood industry and also to the general public, through Extension agents, Home Demonstration Leaders clubs, Home Economics teachers, food editors, *etc.* A number of projects were instituted to carry out this objective.

Seafood Tip Line

The Seafood Tip Line was established in cooperation with the Virginia Seafood Council as a pilot project to determine the feasibility of consumer information on seafood and seafood products. Each message was designed to last from 1 to 2 minutes, and concerned topics such as styles of pack, current seafood species available, standards of identity, and purchasing information. New programs were proposed weekly. The Tip Line messages will be published for use by unit Extension personnel in the consumer telephone lines.

Annual Conferences

Programs were designed in order to transmit information to food editors and school lunch managers and supervisors. The information dissemination



is primarily in the form of an annual conference; however, written reports are also used when appropriate.

Computer Program

Information on 300 seafood processors in Virginia was assembled and computerized. It can be provided according to
alphabetical order
zip code order
county order
city order.

The program can also be used to produce a current mailing list on pre-gummed labels. The list has been used by the State Water Control Board and the Virginia Seafood Council in their information dissemination activities.

Cooperation with Other Agencies

Information on processing plant waste effluent was distributed for the State Water Control Board, since the agency did not have a mailing list of seafood industry companies and personnel.

Marine Advisory and Educational Council

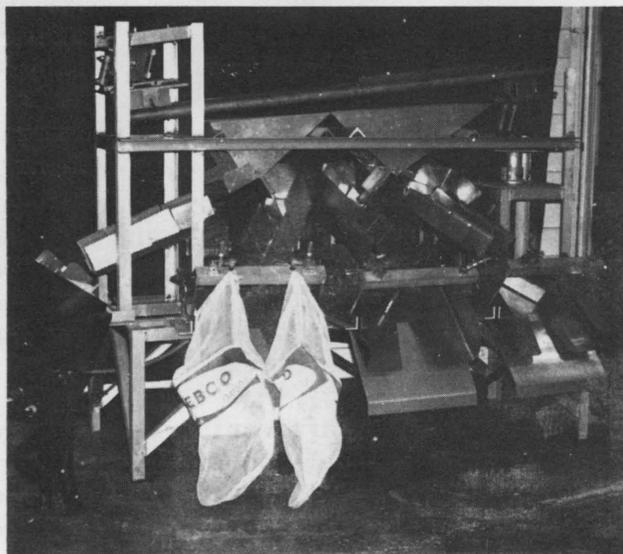
An advisory group to the Dean of the College of Agriculture and Life Sciences at Virginia Tech was established. The Council consists of industry members and representatives of state, federal, and trade associations concerned with marine food resources. The purpose of the Council is to determine extension and research priorities and to assist the University in the development and presentation of marine educational programs.

Television Show

A monthly Sea Grant television show was established in Hampton, Virginia. The purpose of the program is to discuss activities of the Sea Grant project and to present consumer information on seafood products.

Quality Control Program

Assistance was given to those companies which requested help to establish quality control programs and laboratories in their plants. The increased awareness of quality resulted in the production of seafood products with increased quality assurance.



ENGINEERING

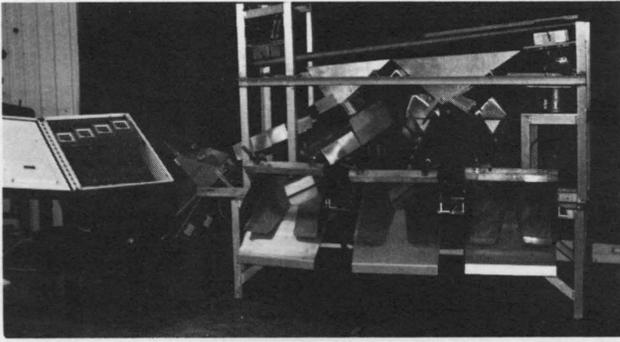
Objectives of the Sea Grant Project at Virginia Tech include assistance to fishermen and seafood processors in solving their technical and engineering problems, specifically to upgrade efficiency, sanitation, pollution control, waste management, good manufacturing practices, safety, *etc.*

Oyster Opening

One of the major labor problems confronting seafood processors is that of opening fresh oysters. To date, no technique has been developed to automate or even semiautomate this operation. Those operations that have been developed either partially or wholly cook the oysters so that they are suitable only for further processing in foods such as soups. While no funds were provided specifically for research in this area, an effort was made to determine the different methods that had been tried and the results obtained from these methods.

Two processes were found to have some possibilities, however remote. The first was to use a material such as lactic acid in the water surrounding the oyster so that, after a period of time, the lactic acid will act as an anesthetic causing the oyster to relax and remain in the open or semi-open position. Some preliminary tests in this area gave results that may have possibilities for development.

The other method that appeared to have potential is to apply high heat to the contractor muscle for a very short period of time so that the muscle is caused to relax without actually being cooked. The laser at the Naval Ordnance Laboratory, Silver Spring, Maryland, was used to check out the feasibility of this process. From this very short test, this approach was determined to be neither technically nor economically feasible at this time.



Clam Counter

As a result of close contact with the seafood processors, it became apparent that there is an overwhelming need for a machine to sort and count clams automatically. This is also, like oyster opening, presently a hand operation in most plants. Processors themselves have tried to develop a machine to count clams. However, most have failed because of their lack of basic engineering knowledge and their failure to use proper materials for the environment in which the machine must work. Sea Grant Project personnel worked with private enterprise to develop such a machine.

Because of the lack of well-defined specifications, and because of the difficulty in evolving these specifications from information provided by processors, three different engineering models of a clam sorter were made and tested.

We now have full knowledge of what such a machine must do, and of the environmental conditions under which it must operate, which include salt water, salty air, sand, and high moisture. However, unfortunately the company with which we were working at the time went bankrupt and so this project was terminated for lack of funds.

Conferences

A conference on the Occupational Safety and Health Administration (OSHA) regulations was held at Old Dominion University in January, 1973. Major emphasis was placed on noise control requirements and techniques, since this is an area that requires technical assistance. Despite the worst snow storm in the history of Norfolk, 34 persons attended.

Noise Surveys

In order to determine the extent of the noise problem throughout the seafood processing industry, several plants of varying sizes were surveyed. In general it was found that the larger plants do have noise problems that will require a major effort, while many of the smaller processors may have one or two areas that can be cleaned up without major problems. Since noise reduction in a processing plant is an investment on which there is no measurable return, it is most difficult to persuade processors to make such investments. However, as a result of this work, State Technical Services is now in a position to provide assistance if OSHA should cite them for noise.

EPA Requirements

Each of the major processors on both the Eastern Shore and the mainland was visited, in order to discuss with them the new Environmental Protection Agency (EPA) permit requirements.



Miscellaneous Activities

In order to develop full engineering support for the Sea Grant program, representatives from the Engineering Mechanics, Industrial Engineering, and Engineering Technology Departments of VPI&SU went to the coast for a two-day visit to see firsthand the problems and potential for engineering involvement.

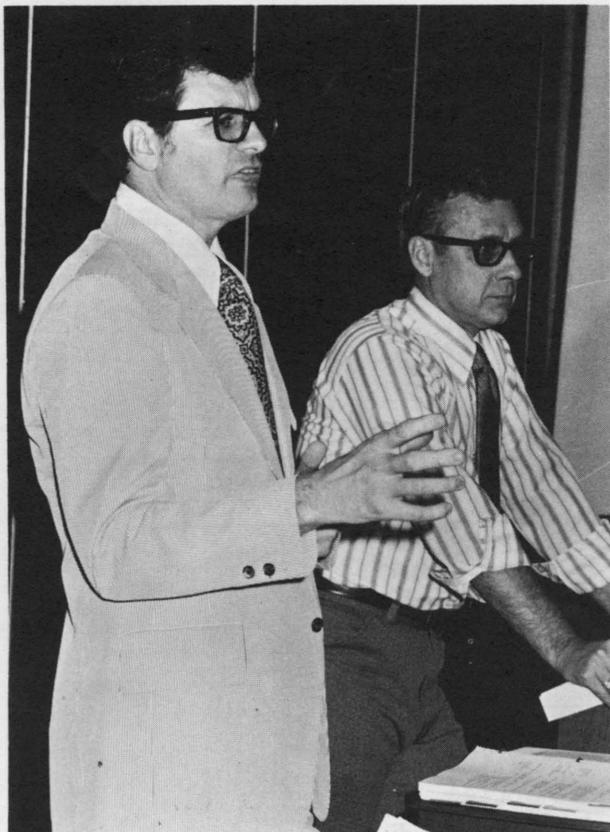
Specific information in such areas as pressure vessel codes, proper material selection, noise abatement, *etc.* has continued to be provided to seafood processors and fishermen, as requested.

AGRICULTURAL ECONOMICS

Programs planned in this area of expertise to aid the seafood industry have four objectives:

1. to determine the effectiveness of and suggest improvements in transportation, distribution, and merchandising of Virginia seafoods;
2. to provide economic education so that the seafood industry may become part of successful rural development in Tidewater Virginia;
3. to provide data and information for public policy decisions, such as utilization of common property resources of the Chesapeake Bay;
4. to develop a Marine Advisory Service through an interdisciplinary program in economics, food technology, and engineering.

The main focus of the program was directed toward the 300 seafood processing and marketing firms in Virginia, each employing from 20 to 100 workers. Early work included in-plant visits to determine the nature and scope of the problems and the best means by which to attack them.



Resource Management Workshop

A case study featuring a Virginia firm was developed from the marketing surveys to pinpoint the problem of a small, independent seafood processor. A series of alternative courses of action available to the firm were formulated.

Topics covered included the state of the Virginia seafood industry, the consumer seafood preference survey, the state of the national industry, and the case study.

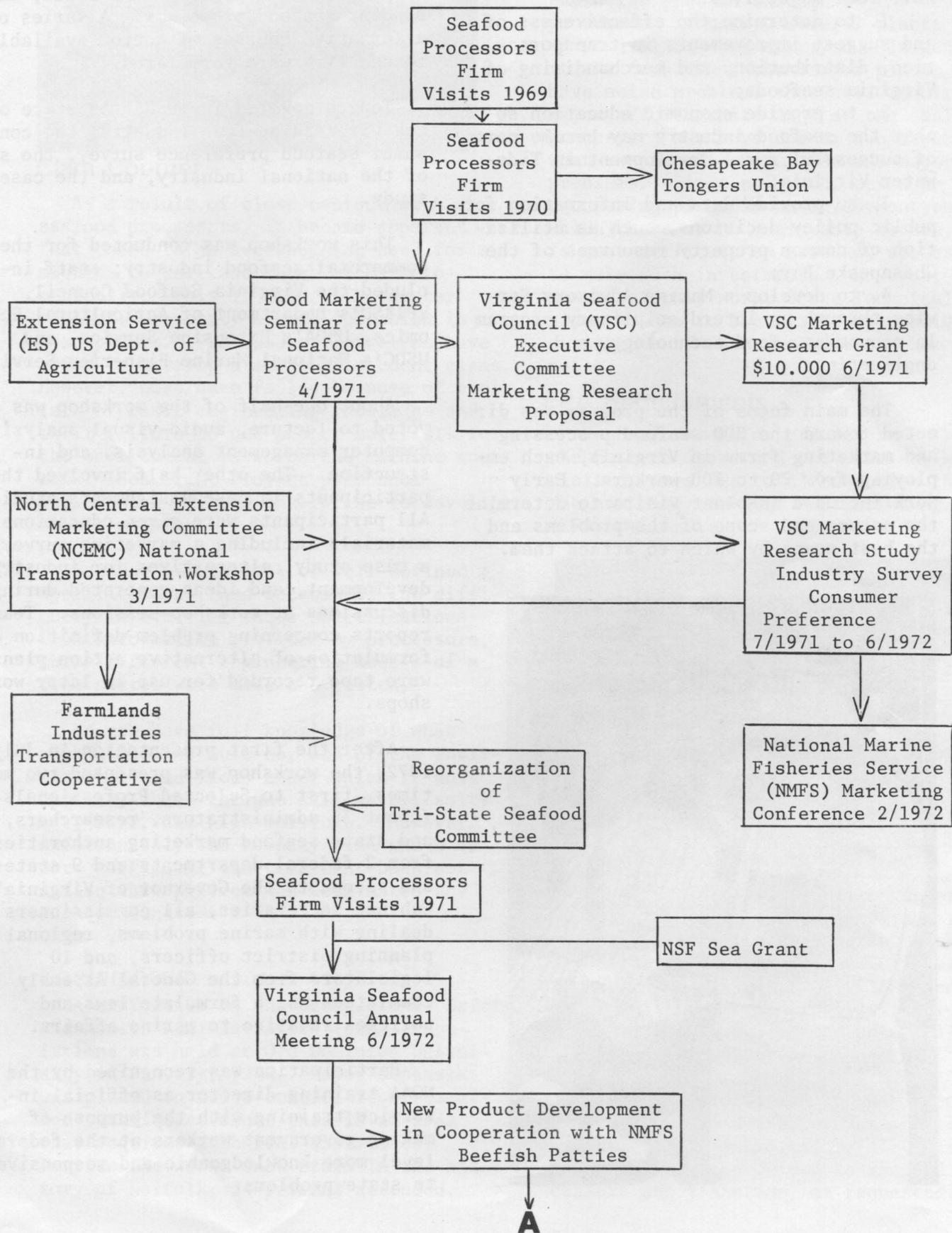
This workshop was conducted for the commercial seafood industry; staff included the Virginia Seafood Council, VPI&SU's Department of Agricultural Economics, USDA's Extension Service, and USDC's National Marine Fisheries Service.

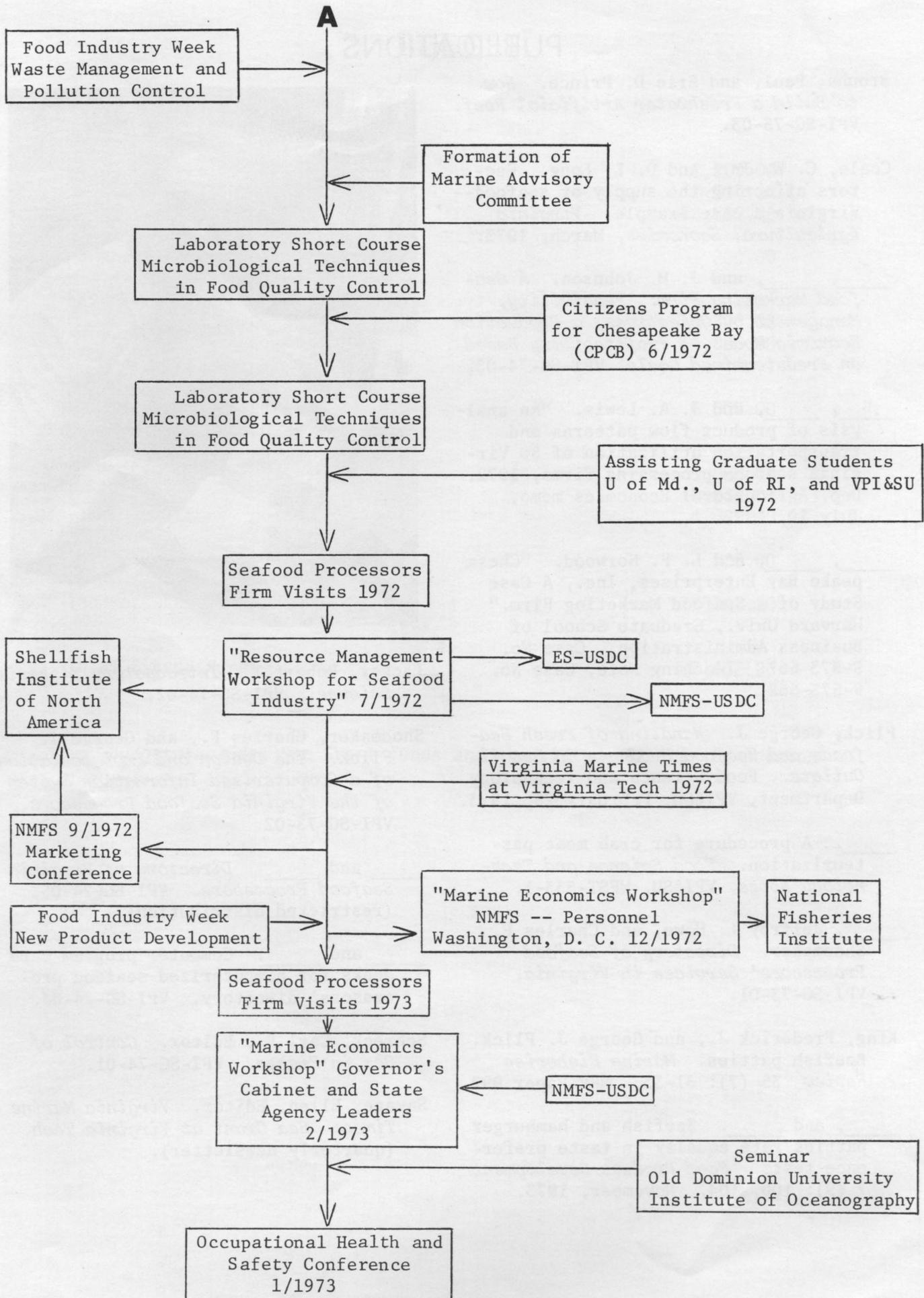
About one-half of the workshop was devoted to lecture, audio-visual analysis, computer management analysis, and instruction. The other half involved the participants in case assignments studies. All participants were given educational materials including a marketing survey, a case study, alternatives for industry development, and ideas generated during discussions at workshop sessions. Team reports concerning problem definition and formulation of alternative action plans were tape recorded for use in later workshops.

After the first presentation in July, 1972, the workshop was presented two more times, first to Selected Professionals (about 35 administrators, researchers, and state seafood marketing authorities from 2 federal departments and 9 states) and second to the Governor of Virginia's Cabinet secretaries, all commissioners dealing with marine problems, regional planning district officers, and 10 legislators from the General Assembly committees which formulate laws and policies relative to marine affairs.

Participation was recognized by the NOAA training director as official in-service training with the purpose of making government workers at the federal level more knowledgeable and responsive to state problems.

FLOW CHART--DEVELOPMENTAL SEQUENCE OF EXTENSION
ECONOMICS PROGRAM FOR THE SEAFOOD INDUSTRY 1969-1973





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BUDGET*

Salaries and Wages	
Principal Investigator	8,400.00
Faculty Associates	12,500.00
Extension Agent	20,500.00
Permanent Equipment	200.00
Expendable Supplies and Equipment	
chemicals, media	300.00
supplies for workshops	4,000.00
Travel	
in-plant visitations	6,000.00
Publications	
Directory	3,000.00
Handbook	10,000.00
Newsletter	4,000.00
Radio and Television	500.00
Indirect Costs	17,862.20
Total Expenditures	87,402.20

* Budget includes Sea Grant funds and the state cost sharing portion.

