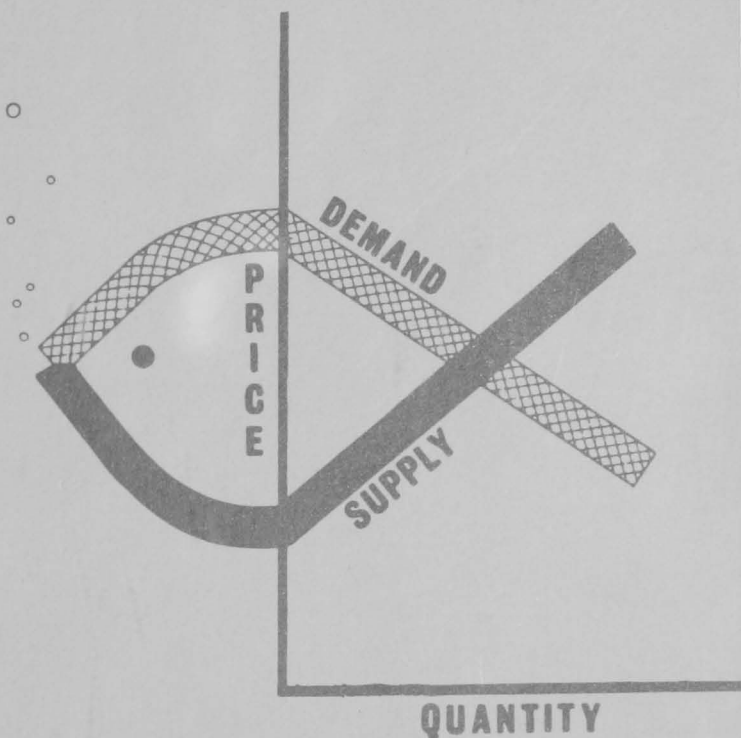


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PROGRAM OF DIVISION OF ECONOMIC RESEARCH, BUREAU OF COMMERCIAL FISHERIES, FISCAL YEAR 1969



UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

Circular 337

UNITED STATES DEPARTMENT OF THE INTERIOR

Walter J. Hickel, *Secretary*

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Philip M. Roedel, *Director*, BUREAU OF COMMERCIAL FISHERIES

Program of
Division of Economic Research,
Bureau of Commercial Fisheries,
Fiscal Year 1969

FREDERICK W. BELL, Chief

Circular 337

Washington, D.C. 20240
April 1970

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**Program of Division of Economic Research,
Bureau of Commercial Fisheries,
Fiscal Year 1969**

ABSTRACT

The Division studies the economic behavior of the U.S. fishing industry to provide information needed by Government policy makers and industry members to solve many of the problems facing the fishing industry. This first report describes briefly the organization and functions of the Division in relation to the Government's policies concerning the commercial fisheries.

The report summarizes (1) the projects completed in the Branch of Demand and Marketing Research and the Branch of Supply and Resource Use Research during Fiscal Year 1969; and (2) those projects included in Fiscal Year 1970 work program.

PREFACE

With the advent of many economic problems in the U.S. fishing industry, it became increasingly evident that economic research was needed both to provide industry with essential information and to use in BCF (Bureau of Commercial Fisheries) decision making.

The BCF Division of Economic Research came into existence in November 1964. In the past 5 years, the Division expanded from 2 economists to 10 economists. Two of the 10 economists were added recently as a result of the addition of many of the functions of the Division of Foreign Trade and Economic Services, which was dissolved.

As part of BCF, the Division of Economic Research has the responsibility for studying the economic behavior of the U.S. fishing industry. The general aim of this research is to aid decision making by both Government

policy makers and individual firms so that an optimal contribution to public welfare will be forthcoming from the fishery resources available to the U.S. economy. In addition to working with industry on various practical problems, the Division of Economic Research also cooperates with the BCF Division of Current Economic Analysis and the Office of Planning on a variety of problems facing the U.S. fishing industry.

The research program of the Division covers practically all U.S. commercial fisheries (table 1). The program has two parts: basic studies of economic behavior and applied studies of current economic problems. Both parts complement and enhance each other. Without the basic economic studies, few applied studies would be possible, because an on-going program of basic economic research is the foundation for applied studies.

Table 1.--Location and value of U.S. commercial fisheries, 1968

Fishery	Location	Value ¹
		<u>Million dollars</u>
<u>Finfish</u>		
Alewives.....	North and South Atlantic.....	1.0
Catfish, natural, and bullheads..	Mississippi River.....	2 7.0
Catfish, pond-reared.....	South Central States.....	2 3 9.0
Great Lakes.....	Great Lakes.....	2 6.0
Groundfish, Atlantic		
Cod.....	North Atlantic.....	3.5
Cusk.....	North Atlantic.....	.9
Flounder.....	North and South Atlantic, Gulf.....	13.9
Haddock.....	North Atlantic.....	9.3
Hake.....	North Atlantic.....	.1
Ocean perch.....	North Atlantic.....	2.4
Pollock.....	North Atlantic.....	<u>.3</u>
Total.....		30.4

See footnotes at end of table.

Table 1.--Location and value of U.S. commercial fisheries, 1968--Continued

Fishery	Location	Value ¹
<u>Finfish--Con.</u>		<u>Million dollars</u>
Groundfish, Pacific.....	Pacific Northwest, Alaska.....	² 7.4
Halibut.....	Pacific Northwest, Alaska.....	4.3
Industrial trawl fishery.....	North and South Atlantic, Pacific Northwest, Gulf.	² 3.1
Mackerel.....	North and South Atlantic, Pacific Southwest.	.5
Menhaden.....	North and South Atlantic, Gulf.....	8.0
Mullet.....	Gulf.....	2.6
Red snapper.....	Gulf.....	3.7
Salmon		
Chum.....	Pacific Northwest, Alaska.....	9.0
King.....	Pacific Northwest, Alaska.....	9.5
Pink.....	Pacific Northwest, Alaska.....	11.5
Red.....	Pacific Northwest, Alaska.....	13.2
Silver.....	Pacific Northwest, Alaska.....	<u>11.7</u>
Total.....		54.9
Scup.....	North Atlantic.....	2.5
Sea herring.....	North Atlantic.....	2.3
Tuna ⁴		
Albacore.....	Pacific Northwest.....	11.4
Shipjack.....	Pacific Southwest, Hawaii.....	9.3
Yellowfin.....	Pacific Southwest.....	24.1
Other.....	North and South Atlantic, Gulf, Pacific Southwest, Hawaii.	<u>2.5</u>
Total.....		47.3
<u>Crustaceans</u>		
Crab, blue.....	North and South Atlantic, Gulf.....	10.8
Crab, king and dungeness		
King.....	Alaska.....	25.5
Dungeness.....	Pacific Northwest, Alaska.....	<u>8.2</u>
Total.....		33.7
Lobster, northern.....	North Atlantic.....	25.2
Shrimp, Atlantic and Gulf.....	South Atlantic, Gulf.....	108.6
Shrimp, Pacific.....	Pacific Northwest, Alaska.....	3.1
<u>Mollusks</u>		
Clams		
Hard.....	North and South Atlantic, Pacific.....	11.9
Soft.....	North and South Atlantic.....	4.1
Surf.....	North Atlantic.....	<u>4.1</u>
Total.....		20.1
Mussel shells.....	Mississippi River.....	² 1.2
Oysters.....	North and South Atlantic, Gulf, Pacific Northwest.	29.8
Sea scallops.....	North Atlantic.....	15.7
<u>Marine mammal harvest</u>		
Fur seals.....	Alaska.....	² ⁵ 3.4
<u>Miscellaneous</u>		⁶ <u>29.9</u>
Grand total.....		471.5

¹ Preliminary exvessel value. ² 1967 value (1968 data not available). ³ Estimate. ⁴ Includes Puerto Rico. ⁵ Receipts from sales of sealskins. ⁶ Accounts for miscellaneous species and discrepancy between 1967 and 1968 values.

RELATION TO THE GOVERNMENT'S GOALS FOR COMMERCIAL FISHERIES

The Aquatic Living Commercial Resources Program of the U.S. Department of the Interior has the following goals:

- To provide for the growing and diversified U.S. demand for fishery products of suitable quality and at acceptable prices to the consumer;
- To develop a viable, competitive industry;
- To assure an optimum net contribution to the national economy;
- To seek the means for bringing more of the world's aquatic resources into economic commercial production for the benefit of all mankind; and
- To develop an adequate understanding of aquatic life and its environment.

Our total domestic utilization of fishery products was 17.2 billion pounds (round weight) in 1968, nearly triple the 1950 utilization of 6.3 billion pounds. Per-capita utilization increased from 41.6 pounds (round weight) to 85.7 pounds during the same period. We expect that by the year 2000 our total utilization of fishery products will be about 37 billion pounds.

Within the limits of economic feasibility and consistent with other national considerations and goals, it is in the national interest that domestic fisheries fill the U.S. needs for fishery products. Such production is particularly needed when the total of the direct Federal expenditures for fisheries and the costs of industry is equal to or less than the cost of obtaining fishery products from foreign sources.

Attainment of the goals requires the following activities:

- Bringing new resources into economic production;
- Increasing production through the expansion of aquaculture and fish farming practices;
- Providing the industry with reliable forecasts and improved information on the resources to permit better scheduling and utilization of harvesting and processing capital and equipment;
- Encouraging and assisting the States to adopt fishery management policies consistent with overall economic goals;
- Providing financial assistance for needed vessel capacity;
- Developing new harvesting and processing technology to bring new resources into economic production and substantially reduce the costs of present methods; and
- Cooperating with other countries in the economic management of the international fisheries.

Some of the most important problems facing the fishing industry are economic. To solve them, we need accurate and reliable measurements of the forces that affect prices, costs, gross and net incomes, consumer demand, imports, and competition between fishery products and other foods. To judge probable future trends, we need to understand the forces that affect the present economic situation. To make profitable adjustments in its operations, the fishing industry must have reliable statistical estimates of these factors and forces.

The Government (especially the Congress and the U.S. Department of the Interior) must have the results of economic research, including an evaluation of the benefits accruing to the taxpayer and the consumer, to test the likely economic impacts of proposed legislation and of other possible policies (fig. 1).

The Division of Economic Research has an important role in contributing to the economic goals of fisheries by providing, through its research program, essential information for the use of the Congress, the Department of the Interior, BCF, and other Federal and State agencies.

This kind of research calls for scientists in economics, statistics, mathematics, and econometrics. Such research in fisheries is very young, but we have learned a great deal in the past few years. Economists with aptitudes for scientific analysis may find the Division of Economic Research a good place to develop their abilities and to contribute significantly to the economic welfare of the country.



Figure 1.--Division Chief discusses relation of Bureau programs to Government Policy.

FACILITIES FOR RESEARCH

The Division of Economic Research is advantageously located adjacent to the University of Maryland in College Park, Md. (fig. 2). It occupies one-half of the top floor of the College Park Office Building. The location provides a campus atmosphere and environment that greatly contributes to the progress of economic research. Since each economist is also a member of the University of Maryland faculty (for a more detailed discussion see Affiliations with Other Organizations below), the Division has access to the University library and other facilities. Thus, the economists have an opportunity to interact with other economists doing fishery and related economic research at the University of Maryland.

The Division is well provided with computer services. For convenience of data processing, we installed a computer terminal with direct tie-in with two computer systems. Economists

who are interested in raw data listings, multiple regression runs, or other statistical analysis can obtain data and program recalls within minutes (fig. 3). Geological Survey of the Department of the Interior handles our large data-processing requests and provides reasonably fast service.

Other facilities and services conducive to research are provided. The professional staff members have individual offices. Each economist has one-half of a secretary's time and the equivalent of one full-time research assistant. The Division also maintains a seminar room for problem-solving discussions and presentation of academic papers. We maintain a statistical library and a full complement of economic journals and essential books on fishery economics and economics in general.



Figure 2.--University of Maryland campus.

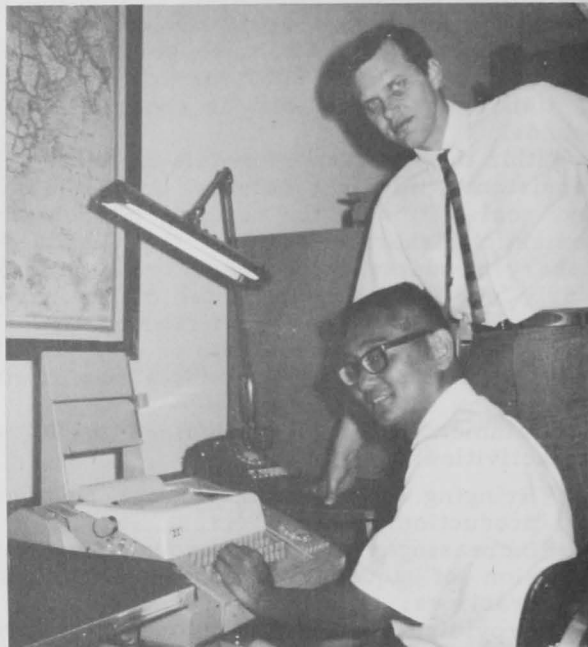


Figure 3.--Economists obtain instant retrieval from computer terminal.

RELATION TO OFFICE OF THE ASSISTANT DIRECTOR FOR ECONOMICS

The Division of Economic Research is one of three Divisions under the Office of the Assistant Director for Economics. The Division of Statistics and Market News carries out the vital functions of collection, tabulation, and dissemination of fishery statistics. Included in this Division is the Market News

Service, which has offices in major fishery centers in the United States. The Division of Current Economic Analysis keeps abreast of more recent developments such as prices, landings, and import fluctuations and is responsible for analysis of the impact of these short-run changes on the various U.S. fisheries.

DIVISION ORGANIZATION AND RESEARCH STAFF

The Division of Economic Research has two branches, because the basic research program is designed to explore the two areas of (1) demand and marketing analysis and (2) supply and resource use (fig. 4).

The Branch of Demand and Marketing Research is responsible for research on the basic factors influencing the demand for major fishery products. This research covers all U.S. fisheries and seeks to discover the

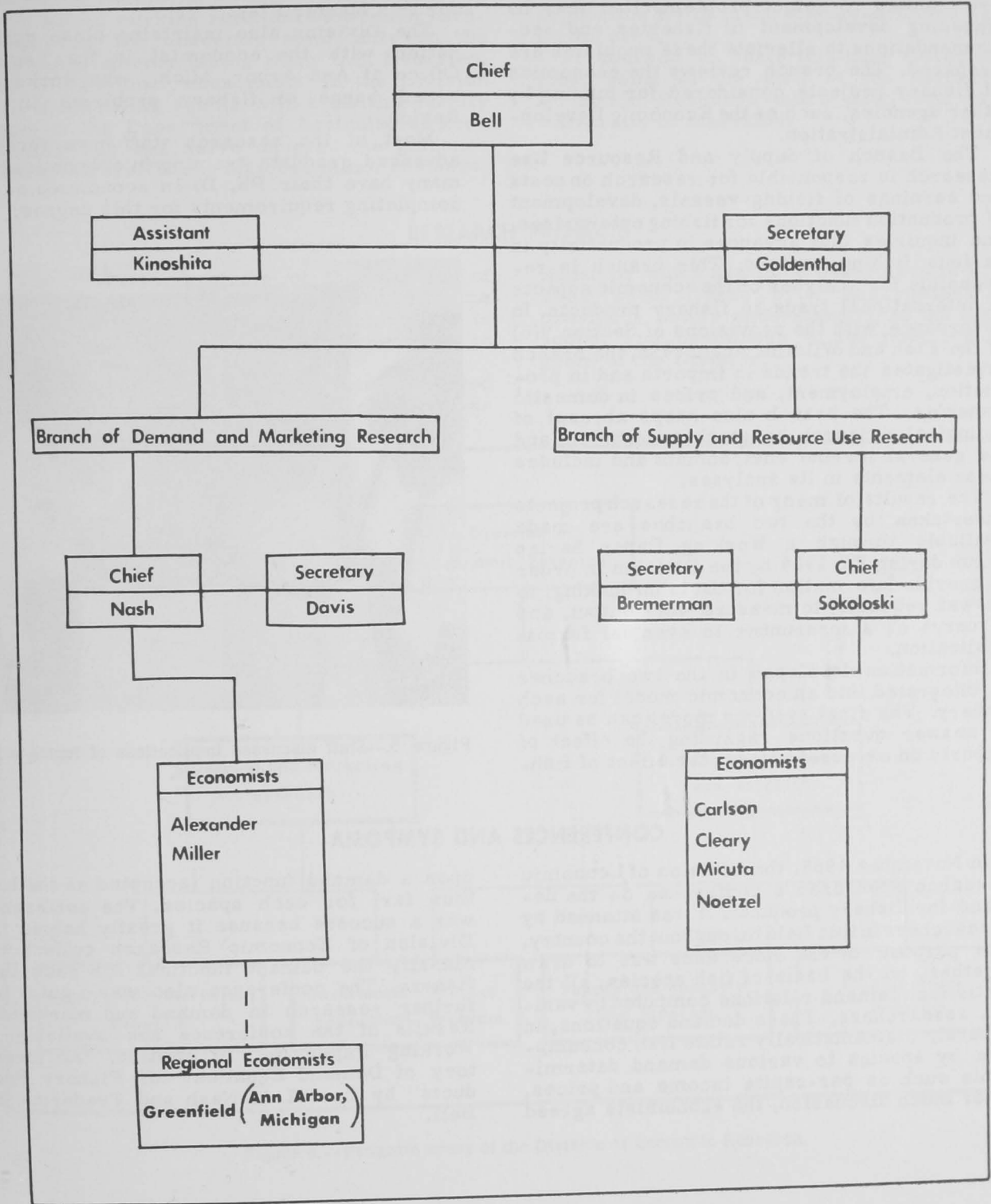


Figure 4.--Organization and staff of the Division of Economic Research.

effect of income and prices on the demand for fishery products. This branch also collects primary data on the consumption of fishery products and the distribution of the products through marketing channels. It analyzes the marketing of fishery products to determine how to improve efficiency in processing and distribution. The various marketing levels are studied to detect problems that may be impeding development of fisheries and recommendations to alleviate these problems are prepared. The branch reviews the economics of fishery projects considered for funding by other agencies, such as the Economic Development Administration.

The Branch of Supply and Resource Use Research is responsible for research on costs and earnings of fishing vessels, development of production functions for fishing enterprises, and inquiries into advances in productivity in various fishing sectors. This branch is responsible for analyses of the economic aspects of international trade in fishery products. In accordance with the provisions of Section 9(b) of the Fish and Wildlife Act of 1956, the branch investigates the trends in imports and in production, employment, and prices in domestic fisheries. The branch also keeps abreast of biological research on stock assessment and the general marine environment and includes these elements in its analyses.

The results of many of the research projects undertaken by the two branches are made available through a Working Paper Series begun during FY 1969 by the Division in order to provide information for decision making, to answer requests, to measure work output, and to serve as a forerunner to eventual formal publication.

Information developed in the two branches is integrated into an economic model for each fishery. The final systems model can be used to answer questions regarding the effect of imports on exvessel prices, the effect of fish-

ing effort on yields to capital, the effect of changes in technology on financial profitability, and the impact of Government programs on various fisheries (fig. 5). This approach conforms to the recently formulated BCF Master Plan, which is designed to assess the problems on a fishery-by-fishery basis. The Division's economic studies will provide valuable input for this Master Plan.

The Division also maintains close coordination with the economist in the Regional Office at Ann Arbor, Mich., who works on a broad range of fishery problems in that Region.

Most of the research staff have received advanced graduate training in economics, and many have their Ph. D. in economics or are completing requirements for this degree.

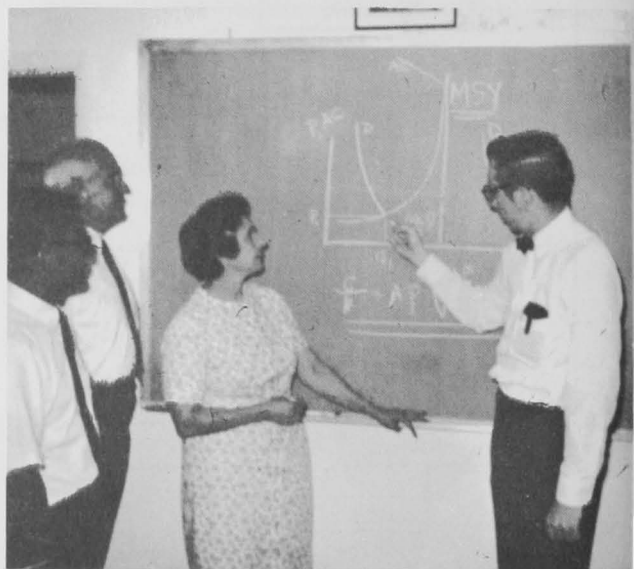


Figure 5.--Staff discusses implications of future world tuna demand.

CONFERENCES AND SYMPOSIA

In November 1968, the Division of Economic Research sponsored a conference on the demand for fishery products. It was attended by researchers in this field throughout the country. The purpose of the conference was to draw together, on the basis of fish species, all the statistical demand relations computed by various researchers. These demand equations, in general, mathematically relate fish consumption by species to various demand determinants such as per-capita income and prices. After much discussion, the economists agreed

upon a demand function (accepted as the best thus far) for each species. The conference was a success because it greatly helped the Division of Economic Research collect and classify the demand functions for each U.S. fishery. The conference also was a guide for further research in demand and marketing. Results of the conference are available in Working Paper No. 10 entitled, "An Inventory of Demand Equations for Fishery Products" by Darrel A. Nash and Frederick W. Bell.

AFFILIATIONS WITH OTHER ORGANIZATIONS

The University of Maryland, Department of Agricultural Economics, provides a unique opportunity for graduate and faculty research on the economics of commercial fishing and related industries. The Division of Economic Research moved to College Park in order to have better working relations between Government and the academic community on the crucial problems facing many U.S. fisheries. All professional economists in the Division are cooperating agents with a visiting faculty rank in the Department of Agricultural Economics and can serve on graduate guidance committees, either as major or minor advisers.

This progressive arrangement permits graduate students to work with experts in all areas of fishery economics in developing M.S. and Ph. D. theses projects. It is backed by a strong academic program in Agricultural Economics, Economics, Quantitative Methods, and supporting fields in the science-oriented Washington area.

In addition to their full-time Government jobs, some of the staff of the Division of Economic Research teach part time at the University of Maryland.

RESEARCH PROJECTS

The research projects of the Division of Economic Research are organized into the four fields shown in figure 6. Each project is the responsibility of one of the economists in the two branches.

Described below are the projects completed in Fiscal Year 1969 and those which were con-

tinued or which are to be undertaken in Fiscal Year 1970. These brief descriptions will provide a better understanding of the nature, scope, and usefulness of the research program of the Division.

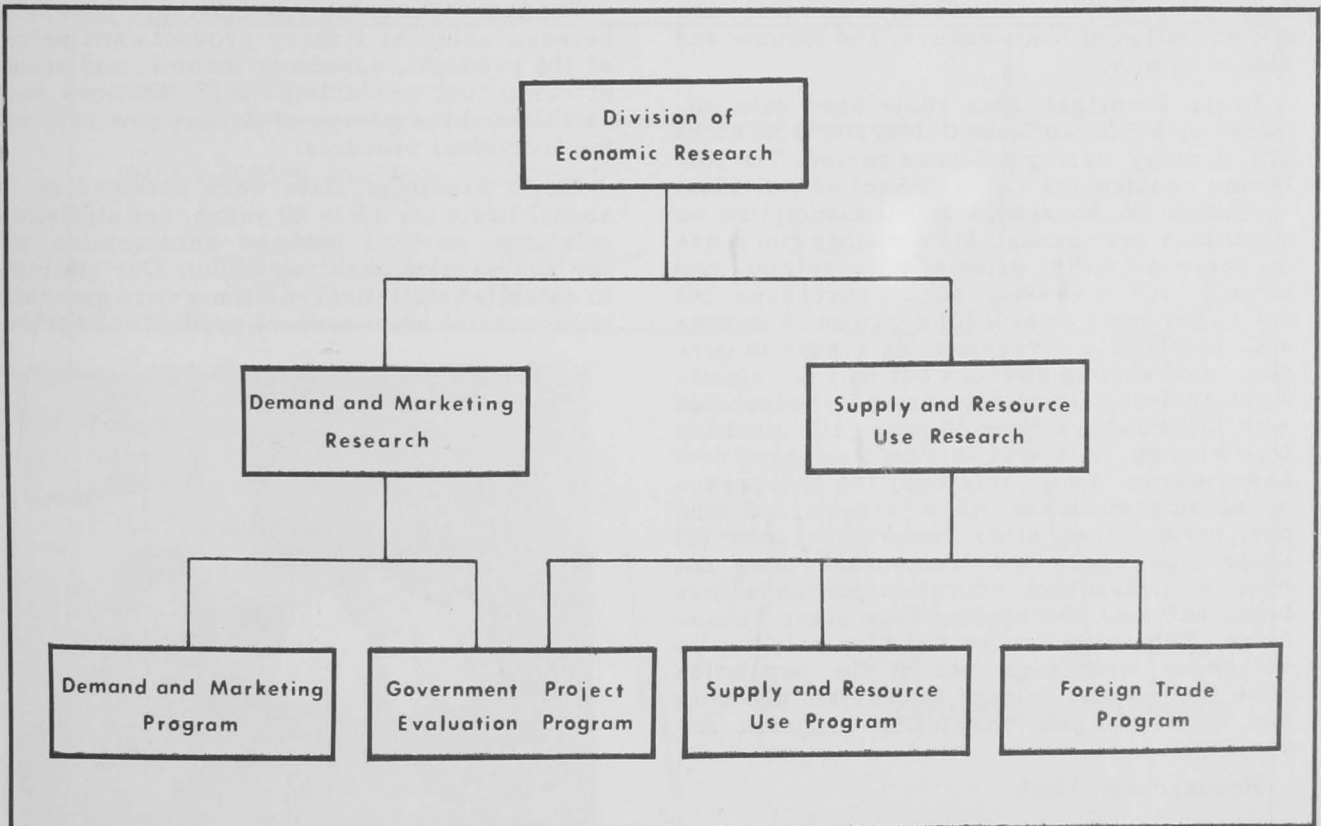


Figure 6.--Program areas of the Division of Economic Research.

PROJECTS COMPLETED IN FY 1969

About 30 research projects were completed during FY 1969. The brief descriptions below give the purpose of the project, the basic findings, and the researchers. All of the researchers listed are BCF staff members except when otherwise indicated. The results of many of these projects have been reproduced and are available as Working Papers. Where applicable, the number of the pertinent Working Paper is included after the description of the project.

BRANCH OF DEMAND AND MARKETING RESEARCH

The projects completed in FY 1969 included studies such as demand for fishery products, analysis of factors affecting exvessel prices, benefit-cost analysis, the economic potential for irradiated fishery products, and the economic impact of mandatory fish inspection.

Analysis of the Demand Determinants for Various Fishery Products by Household

Purpose: To relate purchases of selected fishery products to such factors as price, age and education of homemakers, and income and size of family.

Basic Findings: This study used data obtained by Michigan State University from about 275 families during a 5-year period. The following conclusions on the effect of individual variables on household fish consumption or purchases were made: (1) A change (increase or decrease) in the price of tuna, salmon, and shrimp will inversely affect purchases but not to the same extent; (2) a change in income will result in a corresponding change in purchases of shrimp and tuna but may not significantly affect salmon purchases; (3) households with homemakers over 60 years old purchase less shrimp, tuna, and salmon than those with homemakers under this age; (4) one-person households purchase more salmon and tuna per person than other households; and (5) households where the homemaker does not have a high-school education purchase less tuna, salmon, and shrimp than other households. The study can be used by industry to determine what segments of the population have the highest demand for certain products and to adjust its marketing program accordingly.

Researcher: Nash

A Survey of Users of Fishery Products: Processors, Institutions, and Retailers

Purpose: To expand upon available marketing information and to obtain data from market

levels not now covered for use in fishery marketing research.

Basic Findings: Specific data were obtained on (1) utilization of fishery products at major distribution levels, (2) factors governing demand for fishery products, (3) use of fishery products relative to other food groups, and (4) quality control problems and need for advanced preservation techniques. The survey was made by mail questionnaires. Mailing lists were compiled from trade publications and directories, and from lists of processors and wholesalers published by BCF. The returned schedules were edited, and the information placed on computer tape for followup retrieval and analysis (fig. 7). The survey will provide a foundation for research to improve the efficiency in marketing fishery products.

Researchers: Miller, Nash

Temporal Analysis of Demand Determinants for Various Fishery Products at Wholesale

Purpose: To establish relations over time between sales of fishery products and prices of the products, consumer income, and prices of competing products. These relations were established for groups of fishery products and for individual products.

Basic Findings: Data were obtained on an annual basis for 15 to 20 years, and statistical relations derived between consumption and the above-mentioned variables. Our attempts to establish statistical relations were generally unsuccessful when several products and prices



Figure 7.--Staff reviews questionnaires of survey of institutional fish purchasers.

were combined, compared to those for individual fishery products or species. It was generally found that the percentage change in consumption for a given percentage change in price was higher for individual species than for most food products. Increasing incomes were related to increasing fish consumption, but the percentage change varied widely by species. The results show that for most of the fishery products analyzed, expanding the output will increase the revenue to industry. Government and industry can use the findings to predict consumption of fishery products.

Researcher: Nash

Analysis of the Economic Factors Affecting Exvessel Prices

Purpose: To help the fishing industry, the Congress, and Government administrators understand how economic forces affect fish prices.

Basic Findings: Economic and statistical analyses showed that prices of all important species of food fish were affected mainly by

changes in landings, imports, supplies of competing foods, consumer incomes, gradual changes in tastes and preferences, and by marked seasonal changes in demand. The study provides quantitative statistical measurements of the effects of these factors upon prices. Figure 8 shows the results of this research. Estimates as these can be used as a guide to sound policies for development, conservation, and international trade. (This analysis is available as Working Paper No. 22).

Researchers: Waugh (University of Maryland), Norton (University of Rhode Island).

Temporal Analysis and Demand Determinants for Shrimp at the Retail Level, and Economic Projections to 1990

Purpose: To investigate the nature of aggregate demand for and the retail price of shrimp.

Basic Findings: When income and prices of substitute food items are held constant, increases in shrimp prices result in less than

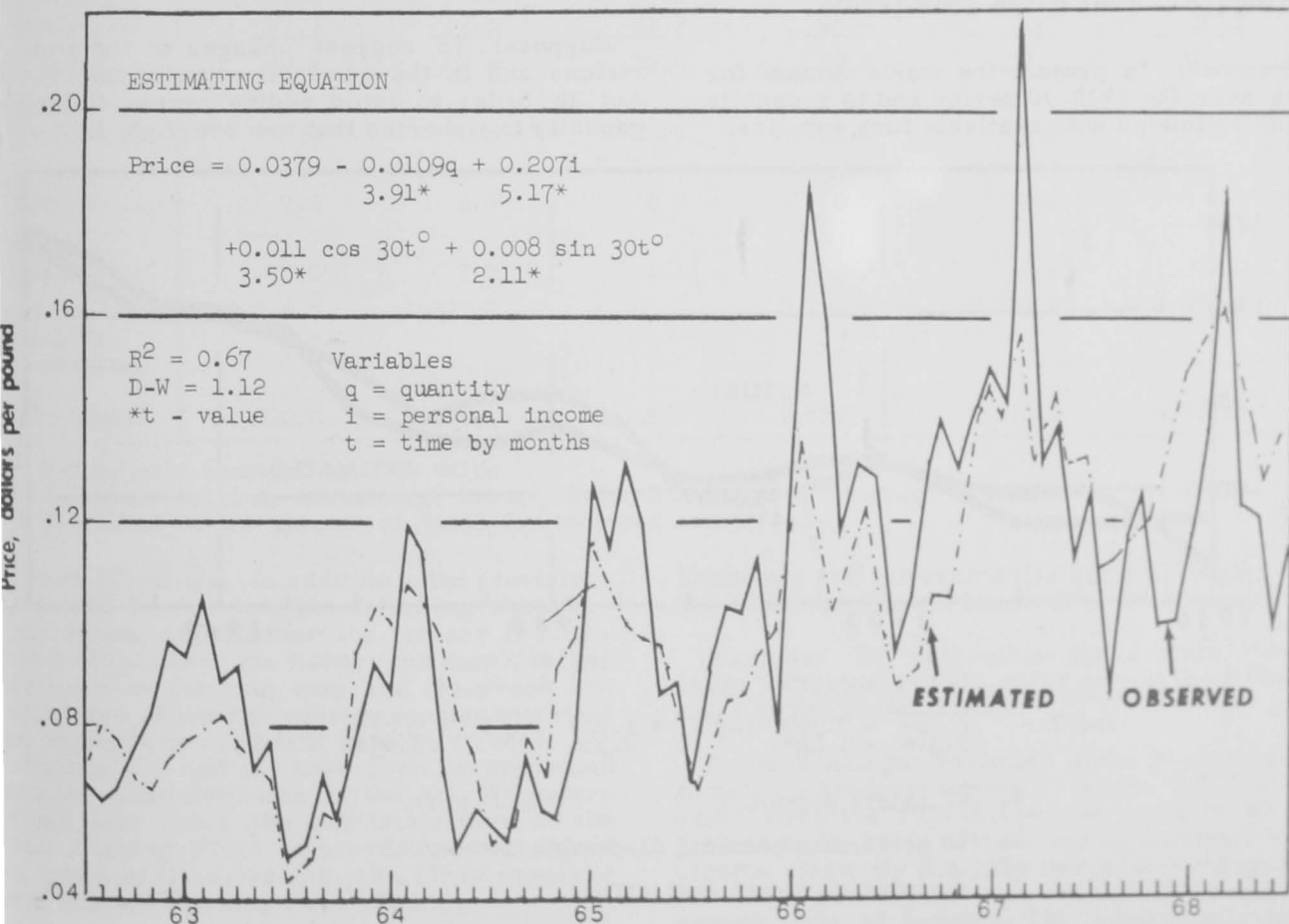


Figure 8.--Price equation for yellowtail flounder at New Bedford, by months July 1962 to June 1968.

proportionate decreases in per-capita consumption. An increase in per-capita income with no increase in prices will bring about a proportionate increase in per-capita consumption of shrimp. Figure 9 shows the predictive quality of the statistical analysis used. Total U.S. consumption of shrimp in 1967 was 254.9 million pounds (meat weight), and the per-capita consumption was 1.28 pounds. On the basis of the projections made in this study, total consumption of shrimp will reach 360 to 401 million pounds (meat weight) by 1980, and 488 to 585 million pounds by 1990. The per-capita consumption will reach 2 pounds (meat weight) by 1980 and 2.40 pounds (meat weight) by 1990. A greater understanding of the nature of demand and the potentials of future consumption can help industry managers plan their activities, including harvesting, processing, importing, and distribution. This understanding will also help Government administrators establish priorities. (The analysis is available as Working Paper 15).

Researcher: Cleary

Economic Projections of the World Demand and Supply of Tuna to the Year 1990

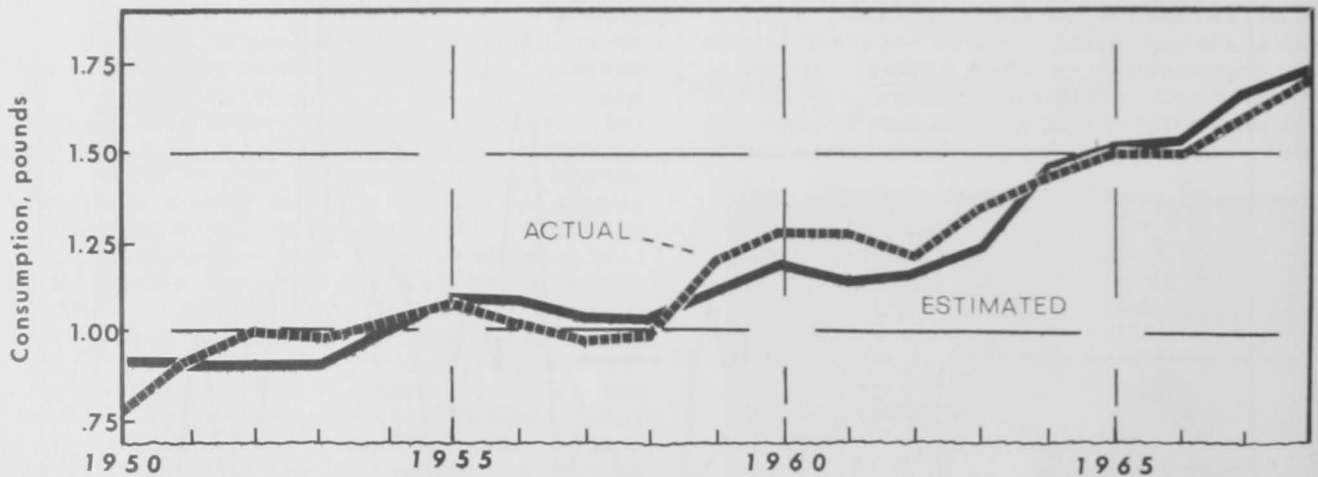
Purpose: To project the world demand for tuna over the 1970-90 period and to reconcile these estimates with available tuna supplies.

Basic Findings: When we consider the projected increases in world population and standard of living (i.e., per-capita income) over the next twenty years, we estimate that tuna consumption might rise from 1,320,000 metric tons (1,450,000 short tons) in 1966 to about 4,900,000 metric tons (5,390,000 short tons) in 1990, assuming the existence of 1966 relative prices throughout the projection period and available tuna supplies (table 2). However, if the maximum yield of tuna on a world basis is no more than 2,600,000 metric tons (2,900,000 short tons), and most of this larger yield can be achieved only by increased use of the skipjack resource, it is highly probable that costs and prices will rise and consumption will be somewhat reduced. The main thesis of this study is that the industry and Government should make a maximum effort to develop more efficient methods of locating and harvesting the underutilized skipjack resource. (This study is available as Working Paper No. 18).

Researchers: Bell, Kinoshita

An Economic Justification for Recommended Legislative Changes in the 1964 Fishing Fleet Improvement Act

Purpose: To suggest changes in the provisions and in the administration of the 1964 Act in order to avoid adding excess fishing capacity to fisheries that are overfished.



Estimating equation:

$$\text{Log } Y = \frac{2.250}{5.31*} - 0.390 \log X_1 + \frac{1.720}{9.34*} \log X_2 + \frac{0.0195}{1.03*} \log X_3$$

X_1 = retail price/CPI * t - values

X_2 = per-capita personal disposable income/CPI

X_3 = index of promotional effort

$R^2 = .90$ Durbin Watson Statistic = 0.97

Figure 9.--Per-capita consumption of shrimp, 1950-68.

Table 2.--Projections of total world tuna consumption based on increases in population and per-capita income for selected countries,¹ 1970, 1975, 1980, 1985, and 1990

(Round weight)

Country	1966 Actual	1970	1975	1980	1985	1990
	-----Thousand metric tons-----					
United States						
Canned.....	382.8	511.3	671.6	845.3	1,055.8	1,318.4
Japan						
Raw.....	353.0	382.2	486.9	620.6	790.1	1,005.6
Canned.....	25.8	20.9	13.6	8.9	5.8	3.8
Total....	378.8	403.1	500.5	629.5	795.9	1,009.4
E.E.C. ²						
Canned.....	159.0	210.5	281.4	382.8	522.5	713.4
China (Taiwan)						
Raw.....	38.0	35.1	44.1	56.0	71.0	90.3
Canned.....	6.8	12.8	27.7	63.7	146.0	334.7
Total....	44.8	47.9	71.8	119.7	217.0	425.0
Peru						
Raw.....	50.2	98.7	137.3	194.7	275.1	387.4
Spain						
Raw.....	31.8	30.3	50.5	73.1	105.8	153.2
Canned.....	37.8	19.1	21.9	24.4	27.3	30.5
Total....	69.6	49.4	72.4	97.5	133.1	183.7
Canada						
Canned.....	9.7	11.6	15.2	19.5	25.0	32.1
U.K.						
Canned.....	7.6	6.5	6.5	6.3	6.2	6.0
Turkey						
Raw.....	16.0	7.0	4.1	2.3	1.2	0.6
Total selected countries.	1,118.5	1,337.0	1,760.8	2,297.6	3,031.8	4,076.0
World total ³ .	1,320.0	1,604.4	2,113.0	2,757.1	3,638.2	4,891.2

¹ Prices held constant at 1966 value.

² Comprises Belgium, Luxembourg, France, Federal Republic of Germany, Netherlands, and Italy.

³ Projected at 120 percent of total for selected countries.

Basic Findings: In addition to the provisions contained in the Act, the following should be considered: (1) whether the fishery is regulated; (2) whether the fishery can supply larger harvests in the long run; and (3) where expenditures of limited subsidy monies will yield the highest social benefit relative to cost.

Points (1) and (2) have been incorporated into the administration of the Act. We determined how much the administrators of the 1964 Fishing Fleet Improvement Act spent on types of fisheries (fig. 10). (This report is available as Working Paper No. 5).

Researchers: Bell, Carlson, Nash, Sokoloski

Economic and Governmental Factors Behind the Different Growth Rates of U.S. Fisheries

Purpose: To determine the factors that cause differing growth rates among the fisheries of the United States.

Basic Findings: Variation in the percentage growth in landings among 17 major U.S. fisheries over the 1957-67 period could be explained on the basis of the following factors: (1) income elasticity (i.e., the percentage changes in real per-capita income); (2) annual growth rate of imports; (3) productivity of resource base; and (4) expenditures by BCF. The variation in fishery growth rates was

(IN MILLIONS OF DOLLARS)

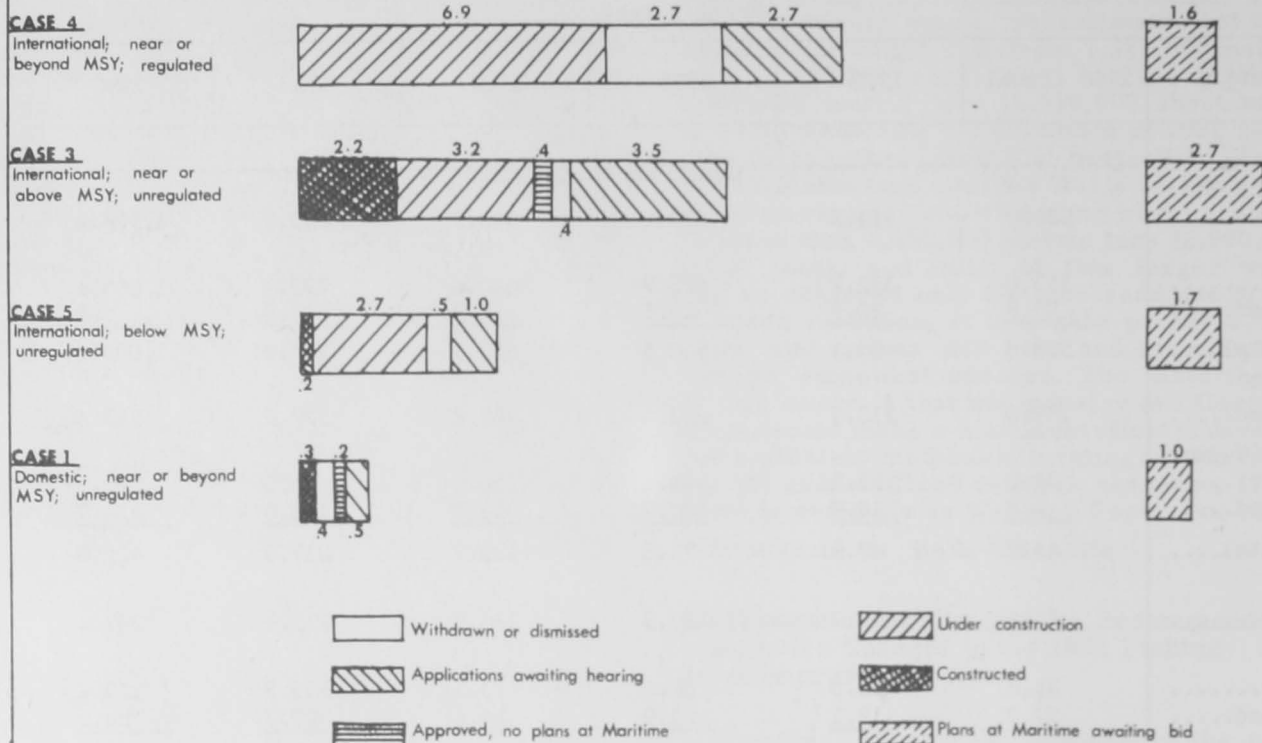


Figure 10.--Disposition of funds under the 1964 Fishing Fleet Improvement Act, by case.

positively related to income elasticity, productivity of the resource, and BCF expenditures; and negatively related to the growth rate of imports. As a result of this study, we tentatively estimated that BCF expenditures among the fisheries have an average benefit-cost ratio of two to one. (The report is available as Working Paper No. 13).

Researcher: Bell

Benefit-Cost Analysis for Various Gear Projects Undertaken by BCF

Purpose: To estimate the benefits that would accrue from investing public funds to advance the technology of trawling.

Basic Findings: We analyzed how a newly designed trawl system would affect the operation of 21 otter trawl vessels of the Boston offshore fleet. The development program was divided into six phases: harvest system, trawl design, automated shipboard handling of fish, chemical treatment to extend shelf life, moisture loss inhibition, and harvesting and handling system to utilize all the fish caught. The total project would require expenditures of about \$500,000 over the course of 3 years. We

calculated individual benefit-cost ratios for all phases of the program, both with the full system and independent of the full system.

Measured in terms of increments to the gross total product and the reallocation of manpower resources into more productive channels, the benefits possible from completing the full program would produce a benefit-cost ratio of between 14:1 and 17:1. Thus, each dollar of investment in the trawl system project would yield benefits of at least \$14, and up to \$17, as applied to the 21 Boston vessels. The area of greatest payoff would be the development of a system to harvest the total catch. To be most valuable the system would have to produce protein meal for human consumption. Developed independently, a protein meal system would have a 40 to 1 payoff; developed as part of a full system it would have a 55 to 1 payoff.

The findings of this study were used to determine which projects would have the highest economic payoffs to industry and could be undertaken at the BCF Technological Laboratory in Gloucester, Mass. (This study is available as Working Paper No. 26).

Researcher: Miller.

Market Potential and Economic Feasibility for Irradiation of Selected Fishery Products

Purpose: To evaluate the commercial feasibility of producing irradiated products from pond-reared catfish, frozen shrimp, Pacific sole, red snapper, blue crab meat, clams and oysters; to estimate the rate of return on the costs (private and Government) of developing a commercial irradiation process; and to estimate the benefit-cost ratios.

Basic Findings: Catfish--Substantial dividends in terms of direct public benefits could be obtained by processing these products with low-dosage irradiation. However, freezing offers a feasible alternative method of preservation and the magnitude of benefits would be scaled to the mix between the output of frozen products and irradiated products. In addition, to minimize processing costs a fairly substantial quantity would have to be available for irradiation. The feasibility of irradiation processing for catfish appeared to be quite speculative, and the Government decided to forego intensive research on this method. (This report is available as Working Paper No. 2).

Frozen shrimp--Irradiation processing would integrate well with present methods of manufacturing frozen shrimp products. Data from the U.S. Food and Drug Administration indicate that about 11 percent of the shrimp products are withdrawn from the market because of spoilage. Investment in irradiation facilities that could eliminate about half of this spoilage loss would bring excellent financial returns to the industry. In each of six designated geographical areas from South Carolina to Texas, the marginal efficiency of capital (internal rate of return) from investment in irradiation plants ranged from 32 percent to nearly 300 percent, computed over an investment life of 15 years. (The internal rate of return is the rate of compound interest at which the present value of a project investment would have to be invested now to yield the earnings of the project investment over its life). We also calculated the social rate of return, which included the return on investment in plant facilities plus the research and development costs incurred by the Government (table 3). On this basis, the internal rate of return was about 99 percent. The outlook for irradiation-processed shrimp warranted continued Government investment in research and development to bring the process to a commercially feasible level. (This report is available as Working Paper No. 16).

Pacific sole--The resource can support a catch considerably higher than the relatively static 40 to 45 million pounds per year. The profitability of significant expansion, however, is questionable for several reasons: (1) The

several species of sole and flounder caught command very different market prices, (2) harvesting and processing are done within strict price and volume agreements between fishermen and processors, (3) much of the production is marketed regionally without highly organized markets, and (4) the volume of fish processed in any one location is not sufficient to justify the commercial operation of an irradiator. The Government will not proceed with technical research on irradiation of Pacific sole. (This report is available as Working Paper No. 11).

Other selected species--Preliminary market surveys indicated that irradiation processing of red snapper, blue crab meat, clams, and oysters would not be economically feasible at the present time because of unstable supplies, acceptable alternative methods of preservation, and other reasons. Technical research on irradiation of the above species was not undertaken.

Researchers: Miller, Nash.

Economic Effects of Minimum Quality Standards for Plants That Process Frozen Shrimp

Purpose: To determine how the imposition of mandatory inspection and minimum product quality standards would affect the capital requirements and the rate of return to investment.

Basic Findings: Contamination of frozen processed shrimp with food spoilage bacteria has been the subject of study by the U.S. Food and Drug Administration and other agencies. The levels of contamination depend on sanitary conditions in the plant. To reduce the level of contamination, changes are required in plants with unsatisfactory conditions of sanitation. These changes refer to improvement of the cleanliness of workers and improvement of the equipment. The necessary changes will require a considerable capital outlay even for small processing plants. However, if as much as two percent of frozen processed shrimp can be saved from spoilage at current market prices, it will be to the economic advantage of these firms to install the improved practices. (This report is available as Working Paper No. 25).

Researchers: Nash, Miller.

BRANCH OF SUPPLY AND RESOURCE USE RESEARCH

In F.Y. 1969, 14 studies were completed. These studies covered a variety of subjects, such as the analysis of fishing vessel operations and design, development and application of economic models to fisheries, and the eval-

Table 3.--Estimated social rate of return and benefit-cost ratio from investment in shrimp irradiation process, 1970-85

Year	Social costs			Gross social benefits ¹	Operating costs ²	Net social benefits ³	Cash flow ⁴
	Research & development	Plant equipment & source investment	Total				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
-----Thousand dollars-----							
1970..	170		170				-170
1971..	180		180				-180
1972..	365		365				-365
1973..	100		100				-100
1974..	75		75				-75
1975..		6,501	6,501				-6,501
1976..		1,033	1,033	24,364	6,805	17,559	16,526
1977..		62	62	25,819	7,095	18,724	18,660
1978..		61	61	27,399	7,443	19,956	19,895
1979..		51	51	28,430	7,589	20,751	20,750
1980..		56	56	29,736	8,000	21,736	21,680
1981..		1,688	1,688	31,235	8,300	22,935	21,247
1982..		44	44	32,265	8,509	23,756	23,712
1983..		73	73	34,010	8,854	25,156	25,083
1984..		69	69	35,629	9,177	26,452	26,303
1985..		63	63	37,128	9,476	27,652	27,591
Marginal efficiency of capital (rate of return) = 99%							

Benefit-cost ratios

Interest rate	Benefits	Costs	Ratio
Percent	Thousand dollars	Thousand dollars	
4	147,424	8,401	17.5
6	120,691	7,537	16.0
8	99,463	6,792	14.6
10	82,490	6,144	13.8
15	53,020	4,861	10.9
20	35,236	3,924	9.0
25	24,118	3,223	7.5

¹ Derived from spoilage loss savings of 6 percent of total output of processed shrimp products.

² Assumes irradiation source cost @ \$.40/curie, source efficiency 30 percent.

³ Column (4) minus column (5).

⁴ Column (6) minus column (3).

uation of certain State and Federal programs and proposals affecting the fishing industry.

Costs and Earnings in the Boston Large-Trawler Fleet

Purpose: To provide industry and Government with information on the economic performance of the Boston-based large trawler haddock fleet (vessels of at least 150 gross tonnage).

Basic Findings: Over the 10 years 1957-66, average annual landings per vessel dropped 10.3 percent. The average price for fish, however, increased 11.4 percent. Thus, the average gross revenue of \$246,000 per vessel remained unchanged. There were positive correlations among fishing effectiveness (expressed in terms of quantity landed per day at sea), the size of the vessel, and particularly, the horsepower of the main engine of the vessel. In addition, the larger vessels spent more days at sea than the smaller ones. As

a result of the combination of these factors, the average annual landings of the largest vessels were more than twice the landings for the smallest vessels. Annual operating profits (before depreciation and taxes) for the last 3 years studied ranged from \$1,500 for the small vessels to \$62,000 for the largest vessels.

Assuming that 50 percent of the construction cost of new vessels which might enter this fishery will be subsidized, we expect a rate of return on investment (before taxes) of 6 percent for small vessels and 17 percent for large vessels (table 4). Without a construction subsidy, new vessels of the same type as those in the study could not be operated efficiently enough to yield a rate of return sufficient to attract new capital. (This study is available as Working Paper No. 7).

Researchers: Noetzel, Norton (University of Rhode Island)

Table 4.--Main characteristics and financial performance of Boston trawlers by size classification, 1957-66

Item	Vessel class			
	A	B	C	D
Characteristics:				
Length in feet ¹	99	98	111	120
Gross tonnage ¹	163	218	241	238
Horsepower ¹	420	500	525	800
Crewmen ¹	13	15	17	17
	----1,000 dollars----			
Equity capital ²	142	209	224	283
Gross revenue, per vessel.	195	221	299	408
Profits, per vessel:				
Before taxes.....	8.6	5.2	24.9	48.9
After taxes.....	6.7	4.0	19.4	31.9
Return on investment, per vessel:				
	-----Percent-----			
Before taxes.....	6.1	2.5	11.1	17.2
After taxes.....	4.7	1.9	8.7	11.3

¹ Average of the vessels in each class.

² Assuming a 50 percent construction cost subsidy and zero amount of borrowed capital.

Application of Investment Model to Catfish Farming

Purpose: To use a theoretical mathematical model to determine optimum investment planning in the channel catfish farming industry of Arkansas.

Basic Findings: With initial average profits of \$0.20 per pound and initial price of land, including buildings and equipment, close to \$800 per acre, the initial investment policy of a hypothetical firm engaged in catfish farming would be the continuous purchase of additional capacity. Higher initial average profits would result in larger maximum capacities, up to a limiting size, beyond which further increases in profits would result in increases in net worth but not in capacity. The investment policy of the firm was determined to be very sensitive to initial prices of capacity higher than \$800 per unit, and no new capacity would be added if prices reached \$1,500 per acre. Profit accumulation and, therefore, investment decisions appeared to be sensitive to changes in the interest rate paid for financing additional capacity. (This report is available as Working Paper No. 1).

Researchers: Thompson, Mange (Contract with University of Missouri, BCF Contract No. 14-17-0007-503).

Determination of the Optimal Groundfish Vessel Design for New England

Purpose: To design an optimal vessel for the Georges Bank fishery and to measure this optimum in terms of return on investment, taking into consideration climatic and biological conditions and differences in engineering practices and types of gear.

Basic Findings: The optimal vessel, as determined by this study, contains many characteristics of the design and construction of both the Old Colony and BCF's Delaware II, two new vessels. The general configurations are also similar (fig. 11 and table 5). Notable exceptions are that the optimal vessel has a boom to assist in hauling and dumping the cod end and a 120-foot headline length net in addition to more standard size nets. The large net and the standard net could be interchanged depending on weather. Our suggestions on the possible return on investment correspond with recent performances of the Old Colony despite a lesser resource base than we assumed in the study.

Both the design itself and the computer program used to generate this design provide additional information to assist BCF in formulating and enacting programs that affect the harvesting sector of the fishing industry. (This report is available as Working Paper No. 3).

Researchers: Ocean Research Corporation (BCF Contract No. 14-17-0007-788), Sokoloski (monitor).

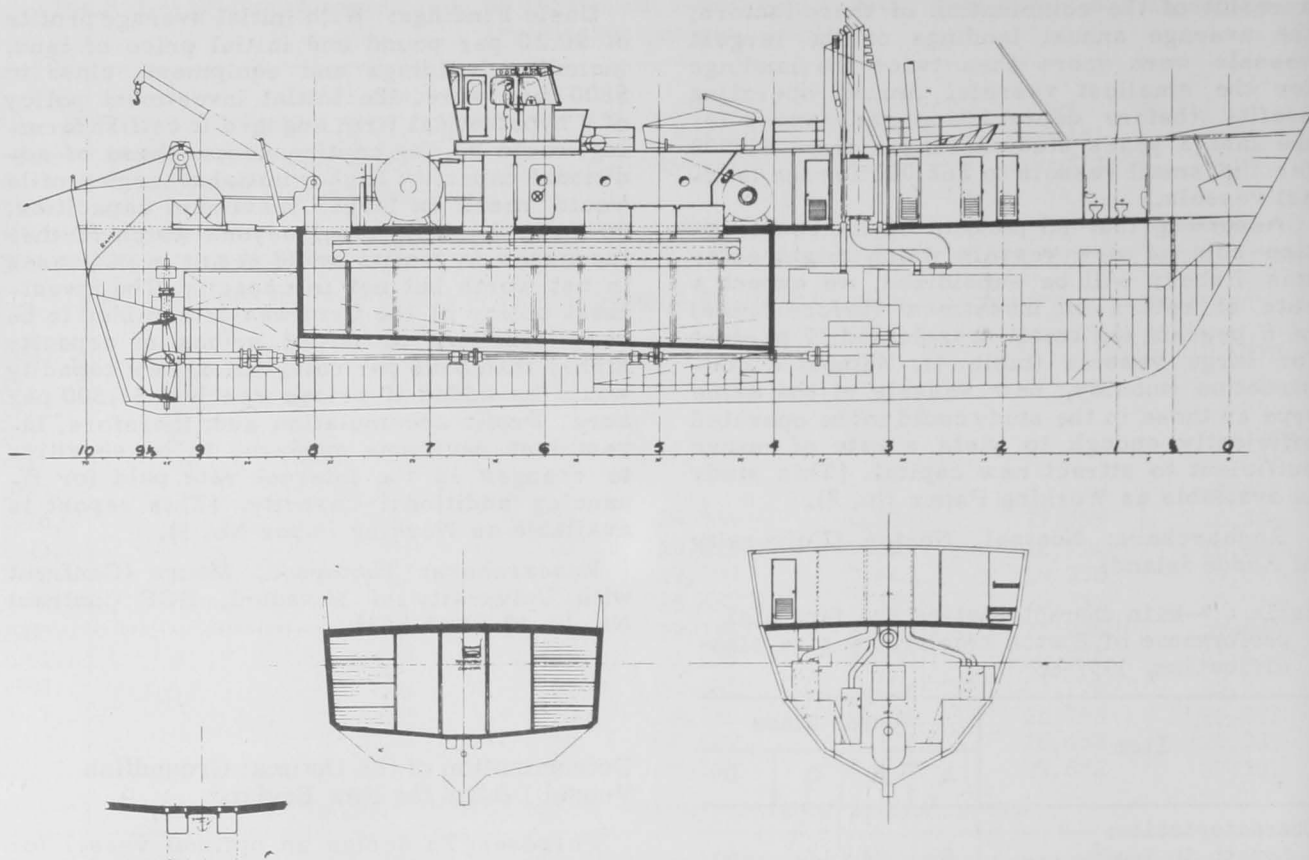


Figure 11.--Design for optimal groundfish vessel.

Table 5.--Characteristics of an optimum groundfish vessel

Characteristic	Unit	Quantity
Length, waterline.....	Feet.....	116.0
Length, overall.....	Feet.....	125.2
Beam.....	Feet.....	28.7
Depth (from main deck)	Feet.....	16.0
Cubic number.....	Cubic feet.	53,315
Size of fish hold.....	Cubic feet.	11,386
Displacement, at departure.	Tons.....	507.4
Displacement, at arrival with full load.	Tons.....	600.6
Fuel and oil capacity.	Tons.....	50.6
Fresh-water capacity..	Tons.....	7.4
Main engine, continuous shaft.	Horsepower.	1,030
Auxiliary generator...	Horsepower.	112.9
Trawl winch.....	Horsepower.	110
Vessel speed.....	Knots/hour.	12.5
Size of crew.....	Number.....	16
Accommodations.....	Berths.....	19
Owners' investment....	Dollars....	835,000
Gross revenue ¹	Dollars....	705,000
Return on investment..	Percent....	11.1
Crew's share.....	Dollars/man	21,850

¹ For net with headline length of 85 feet.

The Economics of Polish Factory Trawlers and Freezer Trawlers

Purpose: To provide the U.S. fishing industry with information on the economics of the operation of Polish factory trawlers and freezer trawlers in the Northwest Atlantic.

Basic Findings: During the 5 years, 1961-65, a factory trawler spent, on the average, 270 days at sea per year. Almost 97 percent of the production of factory trawlers originated in the Northwest Atlantic fishing grounds. The catch per vessel averaged 4,688 metric tons (5,157 short tons) per year, from which 1,879 metric tons (2,067 short tons) of frozen fish and fillets, 495 metric tons (544 short tons) of fish meal, and 111 metric tons (122 short tons) of fish oil were produced. Products landed in home ports averaged 853 metric tons (938 short tons) per trip. The average rate of return was estimated as 8.2 percent of the vessel's construction cost.

The U.S. fishing industry can use this information in planning and operating vessels of this type in the Northwest Atlantic. (This report is available as Working Paper No. 9).

Researcher: Noetzel

Bio-Economic Model of a Fishery

Purpose: To reconstruct the economic model used historically in fishery economics (Gordon model) into a model more compatible with classical microeconomics.

Basic Findings: Starting from a simple fish population model and the theory of the interaction of fishing activities with a fish population, we built a model that shows the decrease in the quantity landed by one vessel as more vessels are added to the fleet. We made simple assumptions regarding costs of operations and developed a series that compared the cost of producing 1 pound of fish with the costs of producing additional quantities of fish. We then developed the relation of cost to demand and the criteria for proper management of a fishery under static conditions. Lastly, the criteria for management of two species fisheries or two location fisheries were shown.

There is great potential for improving the management of the nation's fisheries. This improvement requires a sound theoretical basis for applied analysis. This project was designed to provide this foundation. (This report is available as Working Paper No. 12).

Researcher: Carlson

An Economic Analysis of Mackerel Vessel Operations

Purpose: To describe and document the economic conditions of the San Pedro mackerel fleet, and to present a model with which prospective vessel owners may predict cost and earnings under varying conditions of catch composition.

Basic Findings: Little relation was found between gross revenue and vessel characteristics such as capacity, horsepower of the main engine, or age. Three possible causes for this lack of relation may be: the nature of the fishery, difficulty of catching the fish, and insufficient information on fishing effort and landings. In general, the fleet operates under unhealthy economic conditions. The fact that few vessels showed reasonable returns to capital and labor in recent years, coupled with current estimates of large under harvested stocks off the California coast, indicates that it is economically feasible to expand the fleet by using surplus vessels from other fisheries. At present catch rates and fish prices, new vessel construction would not be economically feasible, even with a construction subsidy. This situation might change if catch rates and efficiency can be increased through technological improvements.

Researchers: Noetzel, Perrin

Groundfish Trade Investigation Under Section 9(b) of the Fish and Wildlife Act of 1956

Purpose: To assess the role of imports of groundfish on the domestic groundfish industry.

Basic Findings: U.S. landings of groundfish declined 25 percent over the 1954-67 period. During this same time, total groundfish imports increased sharply. Imports were 107 percent higher in 1967 than the annual average of the 1954-56 period. As a result of the rapid increase in imports, the exvessel price of groundfish was about 1.6 cents per pound lower than it would have been had the relation of imports to total consumption during the 1953-67 period been the same as during the 1947-52 period. The lowered exvessel price of groundfish, due to imports, coupled with rising production costs, caused a decline in domestic production and a corresponding attrition of capital and labor. (The results of this investigation are issued as The Effects of Imports on the United States Groundfish Industry, report of the Secretary of the Interior to the President and the Congress, May 1969).

Researchers: Van Meir, Norton (University of Rhode Island)

An Incentive Plan to Aid Distressed Fisheries

Purpose: To develop an incentive mechanism to accelerate the development of fisheries for underutilized species, with particular emphasis on providing a profitable alternative to a depressed fishery.

Basic Findings: An incentive program may be designed to use price as the main factor for stimulating fishermen to catch underutilized species. This stimulation is provided by a supplementary increment to the market price received by fishermen, as shown in table 6. This incentive program would accomplish the twofold aim of providing sufficient profits to support the additional costs (and risks) of conversion to the new fishery and ensuring a continuing supply of fish to the wholesale and retail segments of the industry. The program will be complemented by developing markets for the products of the new fisheries. In addition, financial assistance will be provided for any necessary conversion of gear, vessel, and processing equipment. Programs may be designed for as long as 3 years and then terminated when these new fisheries can be considered self-sufficient, or when it is realized that the problems of development are then insurmountable. Such a program could assist New England haddock fishermen whose livelihood is being jeopard-

Table 6.--An example of the operation of the price incentive mechanism

Example	(1) Recent average market price	(2) Guaranteed price	(3) Incentive increment	(4) Individual landings price	(5) Total price to fisherman (3) + (4)
	-----Cents per pound-----				
Fisherman					
A: Average.....	4	6	2	4	6
B: Below average.....	4	6	2	2	4
C: Above average.....	4	6	2	6	8

Fisherman A, with average fish, receives 6 cents per pound, the guaranteed price. Fisherman B, with below average fish receives 4 cents per pound, or 2 cents at the market plus the incentive increment of 2 cents, which is the difference between the fixed price and the average monthly landings price. Fisherman C receives 8 cents per pound, or 6 cents for his above average fish plus the 2-cent increment.

ized by a depleted resource and could help any other fishermen in a similar situation elsewhere. (The report is available as Working Paper No. 14).

Researchers: Carlson, Sokoloski

The Relation Between Vessel Subsidy Percentages and the Rate of Return on Investment for Various Technologies and Scale Levels: The Groundfish Fishery

Purpose: To examine how various levels of vessel construction subsidies affect the rate of return on investment for a Boston trawler fishing on Georges Bank.

Basic Findings: Techniques of systems analysis were applied to six representative designs of vessels: three side trawlers of 160 to 260 gross tonnage, and three sterntrawlers of 260 to 425 gross tonnage. At zero subsidy level, only the stern trawlers show a small net profit (from 1.4 to 5.5 percent of total assets); for the three side trawlers, costs are just covered by revenue (no return on investment). At subsequent subsidy levels: 30, 40, 50, and 60 percent of construction costs, the rates of return for the smallest stern trawler are: 8.7, 10.1, 11.9, and 14.4 percent, respectively. These rates are decreasing with growing capacity of a stern trawler (the largest stern trawler shows only an 8.6 percent return at the 60-percent subsidy level). For larger vessels, a correspondingly higher productivity does not offset the fixed charges against the larger capital investment. This situation is due to the particular nature of the constraints of labor (existing lay system), and the nature of the product (fresh fish in ice, requiring short trips with excessive unutilized capacity).

This study provides the Government with guidelines for allocating vessel construction subsidy funds to the fishing industry. (The report is available as Working Paper No. 4).

Researchers: Marine Technology, Inc. (BCF Contract No. 14-17-0007-957), Noetzel; Project monitors: Bell, Nash, Sokoloski

Economic Feasibility of Seafood Processing in the Inner City of Milwaukee

Purpose: To investigate the economic feasibility of creating jobs within the inner city of Milwaukee by processing fish and shellfish harvested in the coastal areas of the United States.

Basic Findings: Given certain prerequisites, a seafood-processing operation in Milwaukee could prove feasible. Marketing efforts by industry and BCF have demonstrated that aggressive promotion increases the demand for quality seafood in the Midwest. A reliable source of supply has usually been the major factor in developing successful Midwestern markets. Several sources of unprocessed seafood from Alaska, the Gulf of Mexico, and New England are promising, but they need to be made more reliable. Although transportation will be important in the total cost it should not be prohibitively high for most seafood items, unless there is direct competition with the same item processed near the point of landing. Because the success of a processing operation is sensitive to price margins, it is necessary to develop and maintain a reputation for dependable volume and quality. This effort will require not only aggressive marketing but also capable management of the production. By combining BCF expertise in

sources of raw material, processing, marketing, and economics, we can advise private groups and other Government agencies on the economic feasibility of expanding income and employment by developing a seafood processing industry. (This report is available as Working Paper No. 19).

Researcher: Cleary

An Economic Evaluation of Columbia River Anadromous Fish Programs

Purpose: To evaluate the benefits and costs of the continuing public program that is aimed at maintaining Columbia River anadromous fish (salmon) runs.

Basic findings: Available information does not support the contention that the Columbia River anadromous fishery will be lost in the next few years. We calculated the appropriate amount of resources, justified by economic criteria of consumer welfare, that should be committed to preserving or improving Columbia River anadromous fish runs. Our analysis indicated that if a benefit-cost analysis had been made in the 1930's (assuming today's data could have been estimated then) the anadromous fish program would not have been justified economically. If past costs are not included in the benefit-cost calculations, the benefit-cost ratio indicates that continuation of the Columbia River anadromous fish program is economically justified. The ratio of benefits to costs discounted to the year 2000 is 1.66 to 1.00.

Such economic analysis serves an important role in weighing alternative uses of our Nation's natural resources and in providing criteria for the justification of expenditures on public work projects. (This report is available as Working Paper No. 17.)

Researcher: Richards (formerly affiliated with BCF Division of Economic Research).

An Economic Analysis of Policy Alternatives for Managing the Georges Bank Haddock Fishery

Purpose: To analyze various management schemes for the haddock fishery to enable society to achieve economic and efficient allocation of resources to fishing.

Basic Findings: A management policy with the goal of maximum net returns above costs would produce dramatic profits for the individual vessel. At the same time, it is most limiting in terms of use of the resource (57 percent of the maximum sustainable yield). A policy of maximization of economic rent, however, raised the utilization of the resource

to about 98.9 percent of maximum sustainable yield. This policy turned out to be the most liberal approach to utilization of the resource that was consistent with efficient use of limited economic resources. (This report is available as Working Paper No. 21).

Researcher: Van Meir

Economic Impact of the Closure of Lake Superior and Parts of Lake Michigan

Purpose: To determine the extent of economic hardship that Upper Great Lakes commercial fishermen have suffered because of prohibition (instituted in 1968) of large-mesh gill nets in Michigan and Wisconsin waters of Lake Michigan.

Basic Findings: We estimated that gill net restrictions in Lake Superior and northern Lake Michigan have adversely affected the income of at least 200 commercial fishing operations providing full or part-time employment for 250 to 350 fishermen. Further gear restrictions and closures in the Upper Great Lakes, could affect adversely the income of over 300 commercial fishing operations. Steps should be taken to incorporate a limited entry program into the overall fisheries management programs of the Great Lakes States.

The details of phasing out part of the existing fishery must be planned and must be reconcilable with overall management programs. (This report is available as Working Paper No. 6).

Researcher: Cleary

Some Elements of an Evaluation of the Effects of Legal Factors on the Utilization of Fishing Resources

Purpose: To determine those items that are basic to an investigation of legal (institutional) barriers to the optimum utilization of fishery resources.

Basic Findings: The complex mix of local, State, and Federal laws relating to the management of fishery resources represents a paradoxical attempt to assure that these resources remain available to all citizens while, at the same time, trying to conserve the resources by limiting the fishing effort. If labor and capital are not limited in their access to the resource, conservation must be attempted by limiting the quantity harvested, using less efficient techniques, closing areas or seasons, or by other actions. The results are piecemeal ad hoc conservation at the price of inefficiently harvested products and higher costs to the

consumer. Compounded by the activities of many overlapping management agencies, the overall thrust is to maximize the number of U.S. fishermen trapped in an inefficient industry that is unable to compete with fishermen of other nations that also supply the United

States with fishery products. Specific suggestions are given for research and management (including regional commissions). (This report is available as Working Paper No. 8).

Researcher: Sokoloski

FISCAL YEAR 1970 PROGRAM

During FY 1970, the Division's research program will consist of studies in the following major areas of fishery economics:

1. Fishery-by-fishery analyses of demand, consumption, marketing, and operating efficiency.
2. Studies of the effects of economic, social, and political barriers.
3. Foreign trade.
4. Policy and benefit-cost analyses.

A brief description of the studies in each of these categories to be completed or initiated in FY 1970 follows.

FISHERY-BY-FISHERY ANALYSES OF DEMAND, CONSUMPTION, MARKETING AND OPERATING EFFICIENCY

The following studies of demand and the factors that affect demand will provide information for more efficient marketing of fishery products. Additional studies, such as the potentials for expanded markets and economic analyses of fishing, processing, and distributing methods, will be useful in determining where improvements are needed to have an economically viable fishing industry and to assure adequate supplies of fishery products.

Analyses of Fish Consumption in Households in Relation to Various Social, Demographic, and Economic Characteristics

Purpose: To provide a data base for comprehensive and detailed studies of the relation between household purchases of fishery products for home use and purchases away from home and the principal economic and demographic factors affecting these purchases.

Data on food purchases and prices were obtained from a personal interview survey by the U.S. Department of Agriculture during 1965 and 1966 and from a Michigan State University study of the purchases of about 275 families. These data were useful for testing many hypotheses on how economic and other household characteristics affect fish purchases. These data, however, lack either certain socioeconomic characteristics or sufficient detail. An additional survey will provide

complete information on fish purchases from about 1,500 families. We will obtain the characteristics on income and household size; age, education, and occupation of household head; age and sex composition of household members; and race, religion, and geographic distribution of households. Table 7 shows the preliminary results for the first quarter of this survey. The fishing industry will find these results useful for directing the marketing of fish among consumer groups with the desired household characteristics. The data will also satisfy a variety of industry and Government needs for information.

Researchers: Market Facts, Inc., (BCF Contract No. 14-17-0007-970), Nash

Analyses of Factors Affecting the Demand for Selected Species of Shellfish

Purpose: To specify and estimate structural relations of the variables affecting the demand for clams, crabs, oysters, scallops, and shrimp at different market levels; and to estimate the impact of the variables on prices of these species.

Multiple-equation models will be used to specify the interrelations of the factors affecting prices, landings, and movements of the different species of shellfish at the exvessel, wholesale, and retail levels, as well as for imports and for stocks. The models will be useful in evaluating the impact of (1) changes in supply and prices and (2) Government policies, such as vessel subsidy and price support programs, that are in effect or under consideration.

Researchers: Sun (University of Maryland, BCF Contract No. 14-17-0007-965 (G)), Doll (University of Missouri)

Consumer Demand Analyses for New England Groundfish With Special Emphasis on the Long-Run Impact of a Recent Roman Catholic Church Decree

Purpose: To determine long-term reactions of consumers to the decree of Catholic Bishops of the United States that Catholics may eat

Table 7.--Relation between per-capita consumption of selected species of fish and shellfish and various socio-economic characteristics, February, March, and April 1969

FISH	Specialty Items				Fresh and Frozen									Canned						Grand total	
	Clam chowder	Oyster stew	T.V. dinners	Total	Shrimp	Oysters	Had-dock	Flounder, sole	Hali-but	Ocean perch	Cod	Cat-fish	Total	Salmon	Tuna	Sar-dines, Maine	Sar-dines, im-ported	Shrimp	Oysters		Total
	<u>Pounds per capita</u>																				
<u>Race</u>																					
Negro.....	0.0	0.1	0.1	0.2	0.7	0.1	0.2	0.2	0.1	0.7	0.1	0.1	2.2	0.7	1.1	0.3	0.0	0.0	0.0	2.1	4.5
White.....	.1	.0	.2	.3	.3	.1	.2	.2	.1	.2	.2	.1	1.4	.4	.8	.0	.1	.0	.1	1.4	3.1
Other.....	.0	.1	.1	.2	.7	.2	.1	.3	.0	.0	.7	.0	2.0	.2	.8	.0	.0	.3	.0	1.3	3.5
Not specified.....	.1	.0	.5	.6	.2	.0	.0	.0	.1	.1	.1	.0	.5	.3	1.0	.0	.0	.0	.0	1.3	2.4
<u>Religion</u>																					
Catholic.....	.1	.0	.2	.3	.4	.0	.2	.2	.1	.2	.2	.0	1.3	.4	.9	.1	.1	.1	.0	1.6	3.2
Jewish.....	.1	.0	.3	.4	.3	.0	.2	.6	.3	.1	.2	.0	1.7	.8	1.5	.1	.1	.0	.0	2.5	4.6
Protestant.....	.1	.0	.2	.3	.3	.1	.2	.1	.1	.2	.2	.1	1.3	.4	.7	.1	.0	.0	.1	1.3	2.9
Other.....	.4	.0	.0	.4	.6	.1	.6	.1	.1	.1	.2	.0	1.8	.2	.7	.0	.0	.1	.0	1.0	3.2
Not specified.....	.0	.0	.4	.4	.1	.1	.1	.0	.1	.3	.0	.0	.7	.1	.7	.0	.0	.0	.0	.8	1.9
<u>Income per capita</u>																					
Under \$1,000.....	.0	.0	.1	.1	.2	.1	.2	.1	.1	.2	.1	.1	1.1	.4	.7	.1	.0	.0	.1	1.3	2.5
1,000-1,999.....	.1	.1	.1	.3	.3	.1	.2	.1	.1	.3	.2	.1	1.4	.4	.7	.1	.1	.0	.1	1.4	3.1
2,000-2,499.....	.1	.0	.2	.3	.1	.0	.1	.1	.1	.2	.2	.0	.8	.4	.6	.0	.1	.0	.1	1.2	2.3
2,500-2,999.....	.1	.0	.2	.3	.4	.1	.2	.2	.1	.2	.1	.0	1.3	.5	.8	.1	.0	.1	.0	1.5	3.1
3,000-3,499.....	.1	.0	.2	.3	.3	.0	.2	.2	.1	.2	.2	.0	1.2	.3	.8	.0	.0	.0	.0	1.1	2.6
3,500 & over.....	.3	.1	.3	.7	.4	.1	.3	.3	.2	.2	.2	.0	1.7	.6	1.2	.1	.1	.1	.1	2.2	4.6
<u>Occupation</u>																					
Professional & semi-professional.	.1	.0	.1	.2	.2	.0	.1	.1	.1	.2	.1	.0	.8	.3	.6	.0	.0	.0	.0	.9	1.9
Proprietors, managerial.	.1	.0	.1	.2	.2	.1	.2	.1	.1	.2	.1	.0	1.0	.3	.7	.0	.1	.0	.1	1.2	2.4
Clerical & sales....	.1	.0	.3	.4	.3	.1	.1	.3	.2	.2	.2	.0	1.4	.5	.8	.1	.1	.0	.0	1.5	3.3
Craftsmen, foremen..	.1	.1	.2	.4	.4	.1	.2	.2	.2	.2	.0	1.5	.5	.8	.1	.1	.0	.0	.0	1.5	3.4
Head operative.....	.0	.0	.1	.1	.2	.0	.2	.1	.1	.1	.1	.9	.3	.4	.0	.0	.0	.0	.0	.7	1.7
Service workers, & laborers.	.1	.1	.2	.4	.4	.1	.3	.3	.1	.3	.2	.2	1.9	.8	1.2	.1	.1	.1	.1	2.4	4.7
<u>Education</u>																					
Less than 4 years of high school.	.1	.1	.1	.3	.3	.1	.2	.2	.1	.3	.2	.1	1.5	.6	.8	.1	.1	.1	.1	1.8	3.6
Less than 4 years of college.	.1	.0	.2	.3	.3	.1	.2	.2	.1	.2	.2	.0	1.3	.4	.8	.1	.0	.0	.1	1.4	3.0
College graduate....	.1	.0	.1	.2	.3	.0	.1	.2	.1	.2	.1	.0	1.0	.3	.6	.0	.0	.0	.0	.9	2.1
Not specified.....	.1	.0	.2	.3	.0	.0	.5	.0	.0	.7	.0	.0	1.2	.1	1.2	.0	.0	.0	.0	1.3	2.8
<u>Region</u>																					
New England.....	.2	.0	.2	.4	.4	.1	.6	.2	.1	.0	.2	.0	1.6	.3	1.1	.1	.0	.1	.0	1.6	3.6
Middle Atlantic....	.1	.1	.2	.4	.3	.0	.3	.3	.1	.1	.2	.0	1.3	.4	.9	.1	.1	.1	.0	1.6	3.3
E. North Central....	.0	.0	.1	.1	.2	.0	.2	.1	.1	.3	.2	.0	1.1	.4	.6	.0	.0	.0	.0	1.0	2.2
W. North Central....	.0	.0	.1	.1	.1	.0	.2	.0	.1	.3	.1	.0	.8	.4	.6	.0	.0	.0	.1	1.1	2.0
South Atlantic.....	.2	.1	.1	.4	.3	.2	.2	.2	.0	.3	.2	.0	1.4	.5	.7	.1	.0	.0	.1	1.4	3.2
E. South Central....	.0	.1	.1	.2	.3	.2	.1	.1	.0	.5	.2	.5	1.9	.8	.7	.1	.0	.0	.1	1.7	3.8
W. South Central....	.0	.0	.0	.0	.4	.1	.0	.2	.0	.3	.1	.2	1.3	.5	.7	.1	.0	.0	.1	1.4	2.7
Mountain.....	.1	.1	.5	.7	.6	.1	.1	.1	.9	.2	.3	.0	2.3	.8	1.4	.1	.1	.1	.2	2.7	5.7
Pacific.....	.2	.0	.3	.5	.2	.1	.1	.2	.3	.1	.2	.0	1.2	.4	1.0	.0	.1	.1	.1	1.7	3.4

¹ Other socio-economic characteristics such as age of head of household, household income, and age of children in household were not included in this table, although available.

meat on Fridays. The main hypothesis is that such a lifting of restriction has had no long-run effect on the demand for New England groundfish. This study is based upon monthly observations on exvessel prices and other demand determinants over the 1957-68 period. The results of this inquiry will help establish the need for BCF marketing programs and aid industry in reacting to possible changes in the demand for groundfish products. Figure 12 shows the results of the impact of the decree in the short run.

Researchers: Bell, Kinoshita

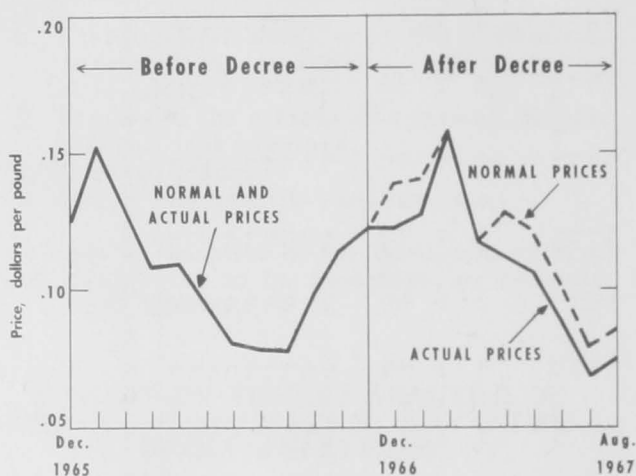


Figure 12.--Effect on prices for seven New England fish and shellfish species before and after the Roman Catholic decree on meatless Fridays.

Demand for Fish: A Multiple Market Approach

Purpose: To estimate how the consumption of some of the major fishery products is affected by changes in the prices for a particular fishery product, for other fishery products, and for other consumer goods.

The study will show how purchases of fishery products fit within the overall goal of satisfying the total desires of consumers, subject to the constraint on disposable income. The expanding demand for fishery products will be compared with estimates of the quantity that could be harvested from the fishery resources. We will determine the optimal distribution of capital and labor among fisheries to meet the expected demand.

The results of the study can be used for decisions on the allocation of construction subsidies and other BCF expenditures for fishery development.

Researcher: Fullenbaum (University of Maryland student working on Doctoral Dissertation)

Economic Projections to the Year 2000 of the Demand for Major U.S. Fishery Products

Purpose: To make long-range demand projections for the major U.S. fishery products.

On the basis of completed demand analyses, we will obtain information on the variables that affect fish consumption. To make projections of fish consumption, we will project these variables (where not adequately done by other agencies) and incorporate them into the demand relationships.

Long-range projections are essential to Government policy development. These projects will be a prime ingredient of the Master Plan. To have a voice in planning the future, we must understand what effects the present trends will have. We can then work toward changing any undesirable trends.

Researchers: Waugh (BCF Contract No. 14-17-0007-965(b)), Bell, Nash

An Analysis of Marketing Margins at Various Levels of Distribution for Major U.S. Fishery Products

Purpose: To determine the margin added at each level of distribution for major fishery products so that we can compare the marketing margins of various fishery products and of other food products.

Differences in marketing margins may exist among fishery products and at different levels of distribution. Marketing margins for fishery products may also differ from margins for other food products. Where differences are marked, we will make a detailed analysis of the costs and apparent profits that make up the margin. In this manner, specific areas for improved efficiency will be revealed and we can formulate remedies.

Inasmuch as fishery products compete with other food products in the marketplace, our goal is to streamline the distribution process throughout all phases.

Researchers: Miller, Nash

Marketing Analysis of Fishery Products at Three Levels: Processors, Institutions, Retailers

Purpose: To determine: (a) the utilization of food fish resources by type of process, type of consumer, and the geographic location of major consumer types; (b) the principal factors governing demand for various fishery products by various consumer groups; and (c) need for the development of new preservation techniques to reduce spoilage loss and to improve the quality of the product.

We hypothesize that consumption patterns for fishery products differ markedly among the major user groups (hospitals vs. schools, for example). The variations relate not only to species but also to methods of processing and preservation. We also hypothesize that various user groups have different problems of quality control and have particular needs for improved preservation techniques. To test these hypotheses, we will use data obtained from a mail survey of the three segments of industry. We have designed the study to provide information on marketing problems and to determine how to improve processing and marketing.

Researchers: Nash, Miller

A Framework for Analyses of the Distribution System for Fresh Salmon

Purpose: To determine whether improvements can be made in the distribution system for fresh salmon and if potentials exist for market expansion.

We will study all stages of the distribution system from landings to retail stores and will develop a simulation framework to describe the present system and to evaluate the effects of proposed changes. The model will identify the costs of individual processing and distribution operations and the costs and profits of groups of operations. By quantifying the costs, we will provide a basis for comparing the relative efficiencies of individual firms operating at any stage in the system. Data for the model will be obtained from producers and processors of fresh salmon and from distributors and transportation companies. This project is designed to detect opportunities for improving the marketing of fresh salmon and will provide a model for studying the distribution of other fishery products.

Researchers: Oregon State University (BCF Contract No. 14-17-0007-991), Miller (monitor)

Investigation of Alternative Market Outlets for Stonington, Conn. Fisheries

Purpose: To determine whether new processing plants or new markets can revitalize the local fishing industry, which has been declining in recent years.

The fishing vessels based at Stonington, Conn. are day boats, and the fish, when landed, are among the freshest along the Atlantic Coast. After landing, however, the fish deteriorate in quality as they are trucked to the Fulton Fish Market for marketing and distribution. We are studying the potential markets for whole fish shipped directly from Stonington to nearby population centers. We will study

whether select restaurants might be potential outlets for this high-quality fish. Perhaps there will be ways of reducing the costs of marketing and providing a higher quality product.

Researcher: Nash

Design Study for New England Shrimp Vessel

Purpose: To design an optimum vessel for the developing New England shrimp fishery. This optimum is to be finally measured not only in terms of the vessel's return in investment but also whether it meets the special requirements of climate, biology of the shrimp, and differences in engineering and gear design.

This study will test the hypothesis that the development of this fishery can be accelerated considerably by using vessels designed specifically for New England shrimping. We will combine all existing knowledge on the technology of shrimp fishing, the location and distribution of existing stocks, and sundry environmental variables. Much of this information will result from ongoing programs of the BCF Exploratory Fishing Base at Gloucester, Mass.

This fishery has developed rapidly. The information generated in this study, particularly the advisability of converting existing vessels or building new vessels, will help BCF contribute to this development. This information will also be valuable to the shrimp fishery in Alaska where the species and many technical aspects are similar.

Researchers: Ocean Resources, Inc. (BCF Contract No. 14-17-0007-997), Sokoloski (monitor)

An Analysis to Determine Optimum Shrimp Fishing Effort by Area

Purpose: To determine the necessary conditions under which the fleet can catch a certain quantity of shrimp from a given area and make these catches at the least cost.

We will test the hypothesis that more efficient use of capital and labor can be achieved through allocation of fishing effort in time and space. Using linear programming techniques for minimizing an objective function, we will present a model for the Dry Tortugas shrimp fishery. This model will enable us to decide how to allocate the existing fleet (by size classes) to three Florida ports that are close to the fishing grounds in such a manner that the total costs of production will be minimized.

This analysis will be a foundation for a larger project to devise an economically logical plan for the allocation of effort among fishing grounds and landings among ports.

Researcher: Sokoloski

An Economic Analysis of the Relative Efficiency and Earnings of Shrimp Vessels

Purpose: To determine the relative efficiency of Gulf shrimp vessels, with respect to vessel characteristics (size, horsepower, and age); the migratory character of the fishery; and the size of transshipments of catch.

We will test the hypothesis that the return to capital and labor is positively correlated with certain vessel characteristics and with the migratory character of fishing. Revenues and costs of operation will be analyzed with respect to size, horsepower, and age of vessels, and with respect to local and migratory fisheries. We will study the extent of transshipment practices on various fishing grounds and the effects of these practices on revenues and costs. We will use statistical analysis to determine what size of vessel will yield the highest returns to capital and labor.

In making decisions on investments and in achieving the maximum economic benefits from the input of capital and labor, the prospective shrimp vessel operators should consider not only maximization of physical production (which seems to be the present trend) but also production costs.

Researcher: Noetzel

An Analysis of the Determinants of Landings for (a) New England Groundfish Vessels; (b) West Coast Tuna Vessels; (c) Gulf Shrimp Vessels

Purpose: To estimate the relation between vessel landings and vessel characteristics. Once this relation is established, the estimated equation may be used to predict the impact of different kinds of vessels on the resource base and to serve as a device to estimate standard fishing days. Data will be obtained directly from the BCF Division of Statistics and Market News.

Researchers: Bell, Carlson

Estimation of the Cost of Production for (a) New England Groundfish Vessels; (b) West Coast Tuna Vessels; (c) Gulf Shrimp Vessels

Purpose: To estimate the relation between vessel costs and various vessel characteristics and operating patterns. Once this relation is established, we may use the estimated equation to predict changes in cost of production as the characteristics of the fleet change. Data will be obtained from the BCF Division of Statistics and Market News, and the U.S. Bureau of the Census. This project will also explore profitability patterns for the various fisheries.

Researchers: Bell, Carlson

The Acquisition, Tabulation, and Development of Vessel Data on Cost and Earnings

Purpose: To gather all data on vessel operations collected within BCF and to establish procedures for collecting future data from individuals throughout the United States.

All studies on the economics of harvesting within the United States must relate to costs and earnings. Often studies of a given fishery must include self-contained attempts to obtain cost and earnings data at the time of that particular study. We have begun this project in an attempt to obtain data from all sources, as these may be developed, without regard to a particular immediate need. The goal is to develop a recurring, comprehensive fund of data that will be able to support future individual studies or inquiries.

The development of this fund of data will be of great value to those responsible for formulating fishery policy.

Researcher: Sokoloski

Factors Behind the Trend in Output Per Fisherman for Selected Fisheries

Purpose: To explore the behavior of output per fisherman over the last 25 years. A hypothesis is that output per fisherman is related to technological innovation in the industry and the pressure (standard fishing days) on the fishery resource. This study will become a useful guide for judging the effectiveness of BCF and vessel designers in improving efficiency in the various U.S. fisheries.

Researcher: Bell

A Systems Analysis of the Haddock and Yellowfin Tuna Fisheries

Purpose: To begin an experimental phase of a more elaborate system or simultaneous equation framework needed to analyze selected fisheries. The project will specify and estimate the demand function, cost function, and biological yield function for the fisheries for yellowfin tuna and haddock. In this way, we may see the vital interaction of the above functions and just how well they describe the growth pattern for the fisheries.

Researchers: Bell, Carlson

Basic Economic Indicators for All Master Plan Fisheries

Purpose: To assemble and present statistics that indicate the economic condition of each Master Plan fishery.

We will present data on the costs of labor and capital devoted to each fishery along with the number of fishermen and vessels involved.

Historical price series for fishery products and short and long run consumer demand indicators will be included. The tables on maximum sustainable yields by regions of the world oceans will show the biological potentials of the fisheries. The studies will also contain information on trade flows, barriers to trade, and Government programs related to the fisheries.

Researchers: Kinoshita, Bell

The Wages of American Fishermen: A Survey of All Master Plan Fisheries

Purpose: To determine the annual wages received by fishermen in selected fisheries.

This study will use cost and earnings data collected by BCF Division of Economic Research. The results will be a useful guide to the economic performance of the individual fisheries.

Researchers: Bell, Kinoshita

STUDIES OF THE EFFECTS OF ECONOMIC, SOCIAL, AND POLITICAL BARRIERS

We will undertake studies such as the following to attempt to determine the extent existing regulations affect the U.S. fishing industry.

The Effect of Certain Federal and State Statutes on the U.S. Fishing Industry

Purpose: To identify the Federal and State statutes that affect the fishing industry and measure their effects on harvesting efficiency.

We may hypothesize that gross inefficiencies in harvesting are prevalent in many of our domestic fisheries because of some of these governing statutes. This study will (1) catalog these laws by State, region, and fishery; (2) associate these laws with a specific harvesting technique; (3) determine the optimum technique in the absence of these laws; (4) place a dollar figure on the cost of this regulated inefficiency; and (5) suggest the most economic compromise between economic optimum and necessary regulation. The ultimate goal will be to suggest the most effective national and regional structure for the management of all fisheries, with the emphasis placed on simplicity through the maximum possible use of common guidelines.

Researcher: Sokoloski

An Economic Analysis of Fishery Regulation of Halibut

Purpose: To determine the optimum fishery management policy for regulating the North-

west halibut resource. Consideration will be given to alternative fishery management schemes for regulating the use of the halibut resource.

Researchers: University of Minnesota (BCF Contract No. 14-17-0007-993), Bell (monitor)

Estimates of the Economic Benefits of Limited Entry to Fishermen, Vessel Owners, and Society: A Generalized Model Applied to the U.S. Northern Lobster Fishery

Purpose: To examine the economic impact of limiting entry in the northern lobster fishery on the returns to vessels. To describe the interaction between consumer demand, technology, and yield from the resource an economic model will be formulated. The economic impact of various management strategies will be calculated. The results of this study will serve as a useful guide for further regulations regarding the northern lobster fishery.

Researcher: Bell

Survey and Evaluation of Regulations Affecting the Salmon, Halibut, Pacific Groundfish, and Anchovy Fisheries

Purpose: This study will (1) catalog regulatory laws by State, region, and fishery; (2) associate these laws with a specific harvesting technique; (3) determine the optimum technique in the absence of these laws; (4) place a dollar figure on the cost of the regulated inefficiency; and (5) suggest the most economic compromise between economic optimum and necessary regulation. The ultimate goal will be to suggest the most effective national and regional structure for the management of these fisheries, emphasizing simplicity through the maximum possible use of common guidelines.

Researchers: West Coast University (to be selected), Sokoloski (monitor)

Survey and Evaluation of Regulations Affecting the North Atlantic Groundfish, Oyster, and Menhaden Fisheries

Purpose: This study will (1) catalog regulatory laws by State, region, and fishery; (2) associate these laws with a specific harvesting technique; (3) determine the optimum technique in the absence of these laws; (4) place a dollar figure on the cost of the regulated inefficiency; and (5) suggest the most economic compromise between economic optimum and necessary regulation. The ultimate goal will be to suggest the most effective national and regional structure for the management of these fisheries, with the emphasis placed on simplicity

through the maximum possible use of common guidelines.

Researcher: East Coast University (to be selected), Sokoloski (monitor)

The Economic Impact of Various Management Schemes on the Yellowfin Tuna Fishery

Purpose: To explore the economic impact on fishermen's wages and return to vessels as a result of various management schemes. We will use systems approach to evaluate the economic behavior of the yellowfin tuna fishery. We will also calculate the expected wages and profits resulting from various management strategies.

Researchers: Carlson, Bell

A Survey of Recent Contributions to Fishery Management Theory

Purpose: We will examine recent contributions to fishery management theory to determine if, in fact, there is sufficient justification for abandoning certain traditional elements of fisheries theory. We will also evaluate the impact of these recently published and unpublished contributions on present and contemplated management policy.

Researchers: Sokoloski, Carlson

FOREIGN TRADE

This will include additional investigations under Section 9(b) of the Fish and Wildlife Act of 1956.

Sources of Competitiveness of Foreign Fishery Products: Determinants of the Supplies of Fishery Products to the United States

Purpose: To examine the imported fish and fishery products that affect the U.S. market, and, further, when these have been identified and quantified, to ascertain which supply factors in the originating country have contributed causally to this flow of imports.

The primary hypothesis of this study is that their lower production costs and less favorable opportunities for employment of labor and capital in nonfishery enterprises will tend to give the foreign fishermen and processors a comparative advantage over their U.S. counterparts. A subsidiary hypothesis is that government subsidies to foreign fisheries have distorted the relative cost relation between the U.S. and foreign fisheries. As the first source of foreign competition to be investigated, we have selected the Canadian North Atlantic fishery (finfish). We will develop a statistical

model to place the various determinants of trade in perspective.

The findings of this study should help the Federal Government develop assistance and trade policies for the domestic fishing industry.

Researchers: Cleary, Micuta, Sokoloski

Section 9(b) Trade Investigations: (a) Oysters (b) Fresh-Water Herring and Chubs; (c) Fish Meal

Purpose: To determine how imports of oysters, fresh-water herring and chubs, and fish meal affect consumption trends; retail, wholesale, and exvessel prices; and the profitability of operations in the respective segments of the U.S. fishing industry.

The hypothesis in this study is that significant recent changes in prices or quantities (or both) of imported oysters, herring, chubs, and fish meal are related to domestic pricing and profitability for respective domestic fisheries. We will attempt to document the interrelation of imports and domestic prices. We will use data from our existing studies, the BCF Division of Statistics and Market News, and the U.S. Tariff Commission to describe and analyze trends in pricing, consumption, harvesting, and distributing programs in exporting countries.

Researchers: (a) and (b) Sokoloski, Cleary, Micuta, Charbonneau; (c) Olson

POLICY AND BENEFIT-COST ANALYSES

Government and industry policy makers must have a considerable amount of information to enable them to formulate and administer sound policies that affect the fishing industry. Some of the studies included in this section will provide valuable information for their use. Other studies will develop procedures for benefit-cost studies for commercial fisheries.

Benefit-Cost Analysis as Applied to Commercial Fisheries Programs

Purpose: To provide BCF with a systematic procedure for use in evaluating the economic benefits and costs associated with scientific and technological research projects. We will attempt to demonstrate how economic benefits vary depending on the nature of the fishery and the particulars of the proposed program. The study can be a useful guide for those interested in applying the same procedures to their programs.

Researcher: Bell

A Study of the Financial Structure and Needs of the Commercial Fishing Industry

Purpose: To determine current and future financial needs of the fishing industry and to improve the efficiency of the financial structure.

Adequate sources of long-term investment capital and short-term working capital are important factors in the overall performance of a firm. This study will determine whether any segments of our domestic fishing industry are hindered in achieving optimum economic efficiency because of inability to find money at reasonable interest rates, to find capital improvement funds, or to offset periodic disruptions of internal cash flows. We may also consider other financial problems such as insurance availability and cost.

This project will provide greater understanding of the financial needs and problems of the fishing industry. Such information is needed by commercial banks and financial institutions and by Government agencies that have the responsibility for providing financial assistance to the industry.

Researcher: Cleary

Economic Impact of Alternative Safety Programs on the U.S. Fishing Industry

Purpose: To ascertain the ability of certain U.S. fishing vessels to finance certain hypothetical alterations needed to meet safety requirements.

The hypothesis to be examined is that a certain percentage of vessels will have no cash reserve and no borrowing ability and will, therefore, be forced to leave the industry if tighter safety standards are imposed. At the request of the U.S. Coast Guard, we will estimate this impact for different sets of safety standards. Data sources will include all recent studies of vessel economics, information collected by BCF Division of Loans and Grants, and supplemental surveys (the confidential nature of all of this information will be respected). Also, lending institutions will be questioned about their criteria for granting loans to determine which vessels will need to rely on Government assistance, and finally which vessels will not even qualify for this aid under present requirements. This study will have a significant impact on U.S. Coast Guard safety programs and possibly also on BCF needs for supplying financial assistance.

Researchers: Carlson, Noetzel, Sokoloski

COOPERATION WITH OTHER GOVERNMENT AGENCIES AND ORGANIZATIONS WITHIN BCF

During FY 1969, the BCF Division of Economic Research cooperated with many other Government agencies in exploring areas of common interest and importance. As part of a larger project by the U.S. Department of Agriculture and the U.S. Atomic Energy Commission, the BCF Branch of Demand and Marketing Research completed an extensive project on the economic feasibility of irradiation treatment of catfish, shrimp, and Pacific groundfish. Personnel from the Division also helped edit and process the "1967 Census of

Commercial Fishing", made by the U.S. Bureau of the Census. The Branch of Supply and Resource Use Research began a joint study with the U.S. Coast Guard to assess the economic impact of alternative safety standards on the U.S. fishing industry.

With the National Center for Fish Protein Concentrate and the BCF Fishery-Oceanography Center at La Jolla, Calif., we have undertaken joint studies on costs and earnings in the mackerel fishery. In addition, Division

economists are helping the BCF Technological Laboratory in Gloucester, Mass., to evaluate the economic feasibility of a microwave oyster shucker.

The Division also cooperated with faculty members of the Universities of Maryland, Rhode Island, and Missouri in research studies on the fishing industry.

WORKING PAPER SERIES

The following is a listing of the Working Papers produced in the Division. These Working Papers are not official publications of BCF, and the analytical techniques used and conclusions reached in no way represent a final policy determination endorsed by BCF. Limited quantities of the following Working Papers are available from the Division of Economic Research, Bureau of Commercial Fisheries, 7338 Baltimore Ave., Room 209, College Park, Md. 20740.

No.	Title and Researchers	No.	Title and Researchers
1	An Application of an Investment Model to Channel Catfish Farming, R. Thompson and F. Mange	14	A Price Incentive Plan for Distressed Fisheries, A. Sokoloski and E. Carlson
2	The Development of Catfish as a Farm Crop and an Estimation of Its Economic Adaptability to Radiation Processing, D. Nash and M. Miller	15	Demand and Prices for Shrimp, D. Cleary
3	Design Study: An Optimum Fishing Vessel for Georges Bank Groundfish Fishery, A. Sokoloski (Project Monitor)	16	Industry Analysis of Gulf Area Frozen Processed Shrimp and an Estimation of Its Economic Adaptability to Radiation Processing, M. Miller, D. Nash, and F. Schuler
4	The Relation between Vessel Subsidy Percentage and the Rate of Return on Investment for Various Technologies and Scale Levels: The Haddock Fishery, D. Nash, A. Sokoloski, and F. Bell (Project Monitors)	17	An Economic Evaluation of Columbia River Anadromous Fish Programs, J. Richards
5	An Economic Justification for Recommended Legislative Changes in the 1964 Fishing Fleet Improvement Act, F. Bell, E. Carlson, D. Nash, and A. Sokoloski	18	Economic Projections of the World Demand and Supply of Tuna, 1970-1990, F. Bell
6	The Economic Impact of Current Fisheries Management Policy on the Commercial Fishing Industry of the Upper Great Lakes, D. Cleary	19	Economic Feasibility of a Seafood Processing Operation in the Inner City of Milwaukee, D. Cleary
7	Cost and Earnings in the Boston Large Trawler Fleet, B. Noetzel and V. Norton	20	The 1969 Fishing Fleet Improvement Act: Some Advantages of its Passage, Division of Economic Research
8	Some Elements of an Evaluation of the Effects of Legal Factors on the Utilization of Fishery Resources, A. Sokoloski	21	An Economic Analysis of Policy Alternatives for Managing the Georges Bank Haddock Fishery, L. Van Meir
9	A Report on the Economics of Polish Factory Trawlers and Freezer Trawlers, B. Noetzel	22	Some Analyses of Fish Prices, F. Waugh and V. Norton
10	An Inventory of Demand Equations for Fishery Products, D. Nash and F. Bell	23	Some Economic Characteristics of Pond-Raised Catfish Enterprises, J. Greenfield
11	Industry Analysis of West Coast Flounder and Sole Products and an Estimation of Its Economic Adaptability to Radiation Processing, D. Nash and M. Miller	24	Elements Crucial to the Future of Alaskan Commercial Fisheries, D. Nash, A. Sokoloski, and D. Cleary
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