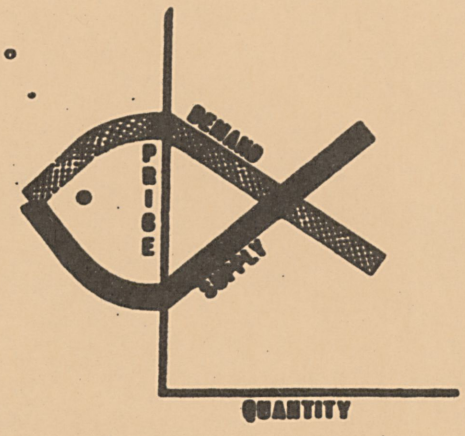

Productivity in the Seafood Sector of all Food Commodities

Edited by

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Productivity of Seafood Component of All Food Items

Working Paper

for

Productivity Commission

Contents

III. Opportunities to increase productivity

A. Removal of existing barriers

B. Technology improvement

1. Short run opportunities

a. Harvesting

b. Processing

c. Preservation

2. Long run opportunities

a. International commissions and agreements to optimally utilize the common property resource of the sea.

b. Continuous technological improvement

c. Retraining of fishermen

d. Market structure and organization

e. Development of untapped resources

f. Aquaculture

IV. What is the practical feasibility of opportunities for increasing productivity?

A. Technical problems

B. Social acceptance

C. Political problems

D. Investment market structure

E. Summary

V. What technical and financial assistance available and needed to raise productivity?

A. Organizations

1. Federal Government

2. State Governments

3. Private firms and universities

FORWARD

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II. What are the barriers to raising productivity? - John Vondruska

III. Opportunities to increase productivity - Erwin Penn

IV. What is the practical feasibility og opportunities for increasing productivity? - Fred Olson

V. What technical and financial assistance and needed to raise productivity? - Harvey Bale

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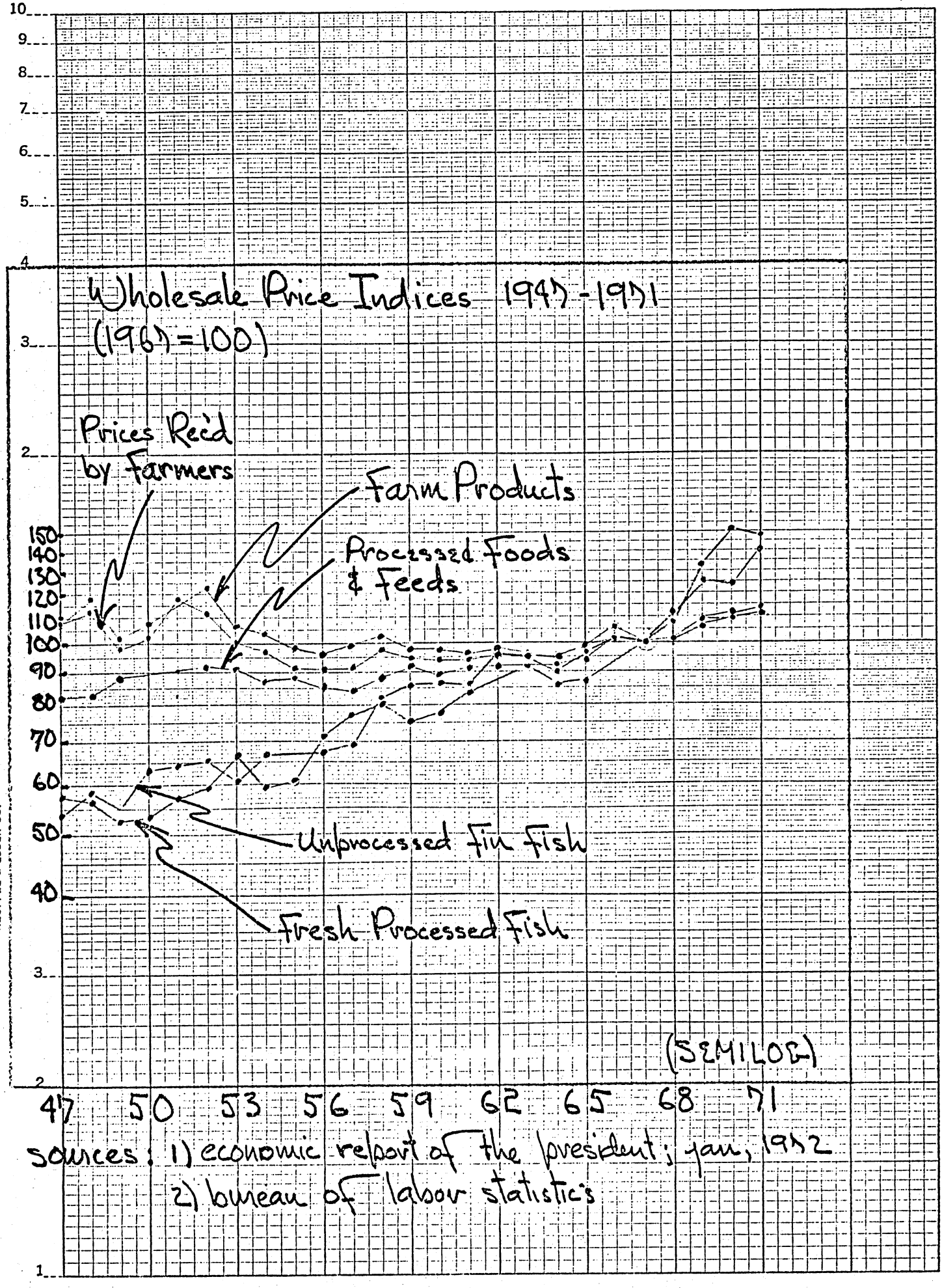
Preface

Higher wholesale and consumer prices, especially in the food sector, have focused attention on developing ways of stabilizing or reducing these prices. Increasing productivity per unit of input is one of the best ways of stabilizing or reducing prices in the long run.

This is especially important in the seafood sector because wholesale prices of fresh processed fish and unprocessed fin fish have risen much faster than wholesale prices of farm products and processed foods and feeds (figure 1).

The purpose of this working paper is to identify what has been the growth in the labor productivity in the seafood industry, barriers against and opportunities for future growth, practical aspects of achieving this growth in the short and long run, and indicate studies needed and how to accomplish this growth.

Methods of increasing total seafood production which would lower prices were not included in this paper unless they also would increase productivity -- which is the case for aquaculture. Other methods of lowering prices such as lowering tariffs or removing quotas, income payments, subsidies, etc., also are not part of this paper.



sources: 1) economic report of the president; jan, 1972
2) bureau of labor statistics

I. Data and research base

A. Coverage

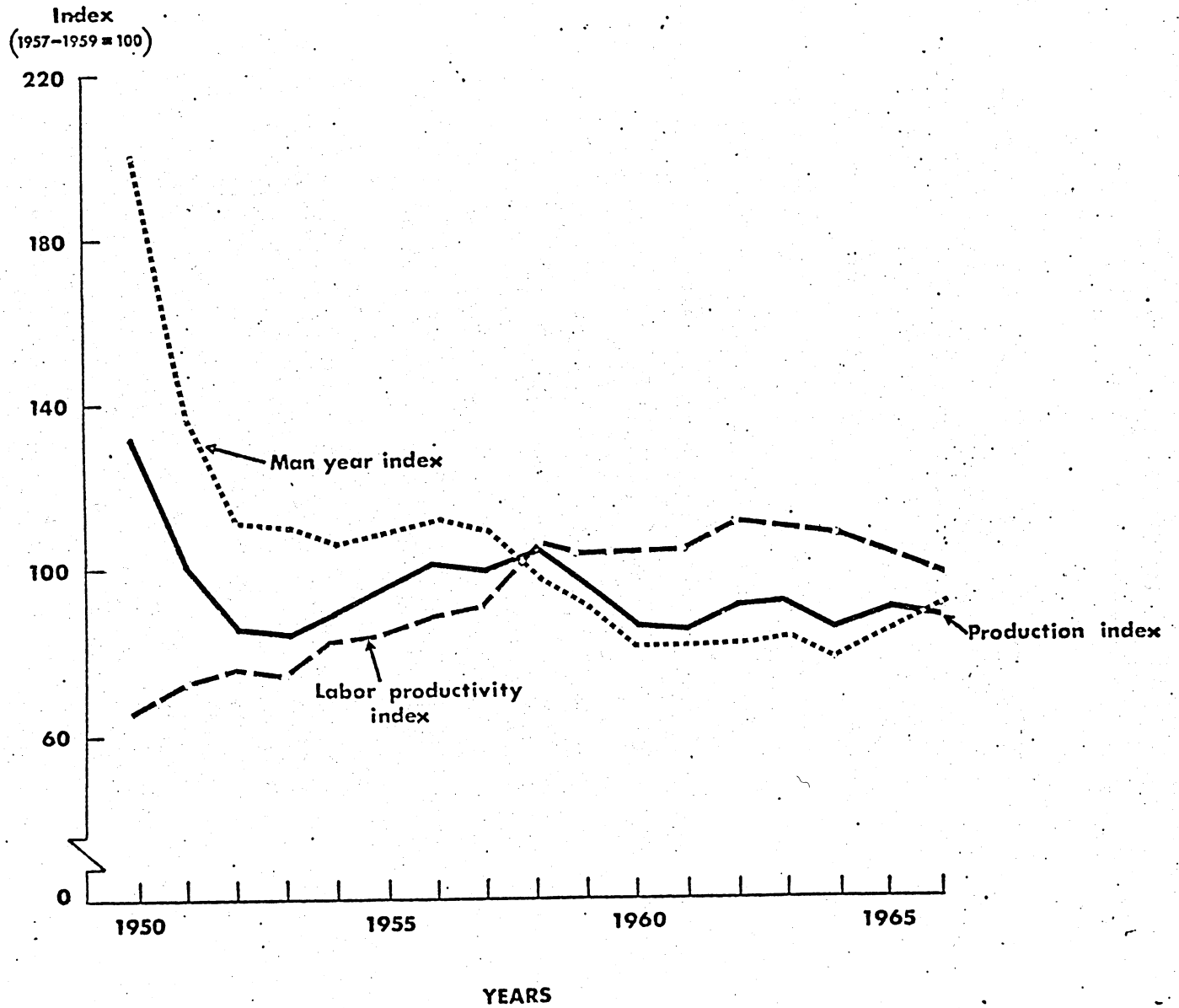
1. Production (harvesting sector)

Labor productivity in the harvesting sector of the U.S. fishing industry increased 3 percent a year from 1950 to 1966 compared with a 10.2 percent increase in poultry and 3.5 percent increase in meat -- the chief competitors of fish (see figures 1 and 2 and Appendix table 1). There have been exceptional increases in several fisheries, the Gulf of Mexico blue crab fishery, the Gulf of Mexico menhaden fishery and in the Altantic clam dredge fishery (see Appendix table 2). Six of the 17 fisheries studied, however, had negative time trends, with the Atlantic and Gulf of Mexico oyster fishery exhibiting a 3.1 percent decline in labor productivity.

2. Processing Sector

Labor productivity data are collected by the Bureau of Labor Statistics for the canned and cured seafood industry (SIC 2031) and the fresh or frozen packaged fish industry (SIC 2036). Output per man-hour for the two industries have advanced 2.8 percent and 3.4 percent per year, respectively, over the 1958-69 period. The series is not published due to some inconsistencies in the data.

Figure 2.--Production, Man-Year and Labor Productivity Indices for all U.S. Fisheries, 1950-66



The canning and preserving industry (SIC 203), as a group, advanced 3.3 percent per year during 1957-67.

3. Transportation and distribution

Productivity data on service industries are very limited or nonexistent for fishery products. Limited information on wholesale and retail sectors are published in the Census of Business every 4 or 5 years.

B. Previous studies in fisheries

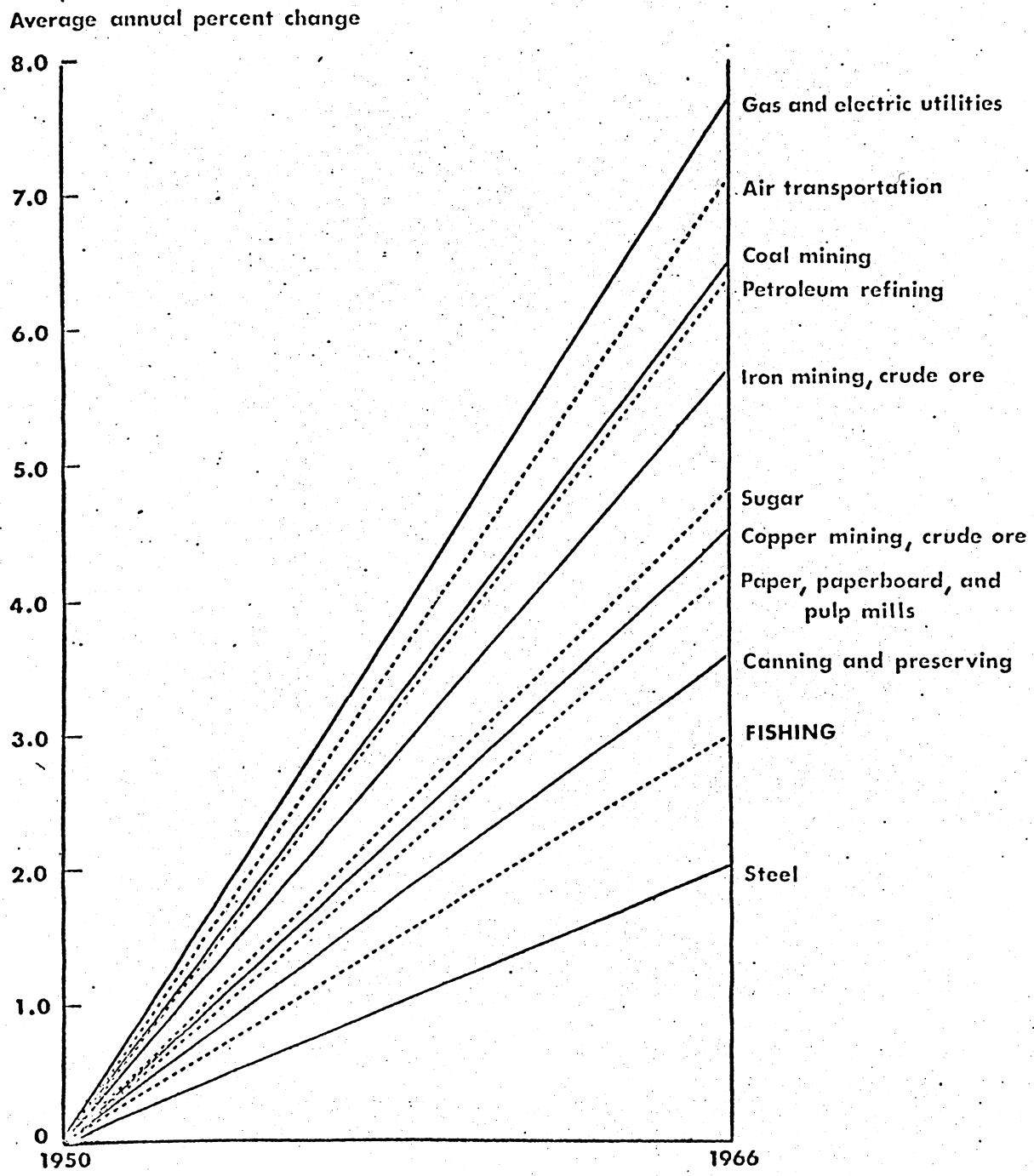
The only studies of the harvesting sector were by Bell and Kinoshita (forthcoming), where the above tables and figures were and The Measurement and Analysis of Labor Productivity Changes in United States Fisheries Olson (1970 unpublished). Penn (1971) reported on marketing margins for major species that reveal the component parts of the price of seafood in Price Spreads and Cost Analyses for Finfish and Shellfish Products at Different Marketing Levels (forthcoming).

C. Data problems

1. Input

1. Labor inputs in terms of the number of fishermen reported by the National Marine Fisheries Service (NMFS) leaves much to be desired. The number of fishermen is not adjusted for the extent of employment during the year. For example, the Bureau of Labor Statistics

Figure 3.--A Comparison of the Rates of Growth in Labor Productivity for Selected Industries, 1950-66



collects detailed information on hours worked for most industries in the economy. This makes it possible to compute a standard work year consisting of work hours. No comparable series is available from the NMFS. The NMFS does report full and part-time fishermen, but this is not sufficient to adequately adjust for the extent of employment. In a small number of fisheries the length of the season, number of fishing days and days at sea are available, but are not sufficient to obtain an overall labor requirement index based on hours, days, weeks or months worked.

2. Fishing effort and effort per fishermen

When they are available and reliable effort series take into considereation the technological change and capital investment per worker. In a recent study (Capitalization in U.S. Fisheries by Bell, et. al. 1972) only a few effort series were acceptable.

3. Outputs

Productivity is usually measured by physical output, in relation to a fixed base. In some cases value weights would better illustrate the changes.

II. What are the barriers to raising productivity?

A. Common property resource

The fishing industry is unique in the food sector in that nearly all of the resources are common property. Anybody has open access to these resources unless some conservation/ management regulation has been imposed. Not only does a U.S. commercial fisherman have to share his resource with other U.S. fishermen but outside of 12 miles he also has to share it with foreign fishermen. Both labor and vessel costs of many of these foreign fishermen are lower than U.S. fishermen costs. On top of all this the U.S. commercial fishermen must must also share his market with the foreign fishermen, (about two-thirds of the fishery products that we consume are imported).

In this type of climate the U.S. fisherman is unable to invest in his resource to make him more productive like the farmer is able to add fertilizer and make land improvements to make the farmer more productive.

Furthermore, since the fisherman does not own his resources he must harvest them as soon as they become available because if he does not his competing fishermen will harvest them leaving nothing left for him. On the other hand the farmer

farmer can harvest his crops, livestock, and livestock products in the optimal manner and not have to grab his share of a common pie away from his neighbor. This type of production climate results in too much equipment and labor and therefore lower than necessary productivity.

B. Legal

1. Legislative and Regulative Inefficiencies

Too many fishermen can mine or destroy future production of valuable fishery resources. When a fishery resource becomes scarce or is fished beyond what is considered to be its maximum sustainable yield (MSY) then State governments and International Commissions and Agreements have set up legislation and regulations on fishing areas, seasons, landing quotas, gear, etc., which nearly always ignor labor and capital considerations resulting in an inefficient use of labor and capital.

This is not a surprising result because the same organizations or individuals in most States also regulate sport fishing and other wildlife. An objective with a sports resource is to spread it among as many people as possible. Catch quotas, seasons, gear inefficiencies, etc., are consistent with

a sports objective but not with the labor productivity objective of a commercial fisherman.

2. No Foreign Built Vessels

The prohibition against the use of foreign built hulls, 5 net tons and over, by U.S. commercial fishermen, dating back to 1793 law, is also a forminable obstacle in those fisheries where foreign built hulls are lower cost than domestic built hulls. This would be the same as prohibiting farmers from using foreign tractors; truckers from using foreign trucks; airlines from using foreign planes; etc., this barrier would be unimportant if U.S. commercial fishermen did not share their markets or production areas with foreign fishermen; but they share both.

3. High Liability Insurance

The Jones Act includes commercial fishermen under maritime law. Interaction of the jury system associated with maritime law and economic conditions in some parts of the country have caused high liability claims and high liability insurance costs.

C. Institutional

There is a traditional "lay" system in each fishery which determines the division of the gross receipts from each trip between the vessel owner and crew. It is similar to the land tenure and the livestock-crop share rental systems in agriculture.

Most labor productivity increasing opportunities require larger inputs of capital and lower labor requirements which would change the capital-labor ratio that the traditional "lay" is based upon. When opportunities like this arise there is no incentive for vessel owners to make this new kind of investment until the "lay" can be changed to reflect the new capital-labor ratio.

D. Socio-psychological

Many people in the fishing industry are tradition-oriented who view commercial fishing more as a way of life than an occupation. They are slow to adopt new unfamiliar but more productive methods and equipment until they are shown beyond any reasonable doubt that the new methods are better than the old.

About half of the commercial fishermen live in rural communities. If the labor productivity increasing opportunities result in lower labor requirements there may not be an alternative source of employment in or near these rural communities. This would negate some benefits from increased productivity in the fishing industry.

The average age in some of our commercial fisheries is also very high. These older employees have some difficulty in

adopting the new methods and equipment or alternative employment, if they are displaced, then younger employees.

E. Pollution

Pollution is a real problem, especially in some shellfish areas. Practically all of this pollution is caused by people in three areas: 1. Human disease control (from raw sewage), 2. Insecticides and other hydrocarbons that accumulate in fish or cause widespread fish kills, and 3. Heavy metal pollution from industries that kill or accumulate in fish thereby becoming dangerous to man.

F. Resource fluctuations

Fishery resources are very dependent on their enviroment, food supplies, and the size of their preditor populations. This situation causes some of these resources to have violent seasonal and annual fluctuations in abundance and availability. Major fluctuations in production, prices, and gross receipts are the results of these conditions. Commercial fishermen in most of these fisheries face far greater business risks than even farmers and ranchers on the Great Plains. This barrier would still exist if the common property resource and legislative and regulative inefficiences barriers were removed.

III. Opportunities to increase productivity

A. Removal of existing barriers

Unless the barriers to productivity increase are removed, neutralized, or overcome; technological innovations will stay in the experimental stage. They will have little chance to be launched or widely applied on a commercial basis. Most of the barriers cited in the previous section could be removed by educational, persuasive, or legislative means.

B. Technology improvement

To increase productivity by improving labor skills, technology and management will result in greater total production when the same labor force is kept, or in maintaining the same production when a smaller labor force is employed. When agricultural production increased due to technological and management advancement, farm workers were drastically reduced. Fishery production could be increased in like manner by technological and management improvement.

1. Short run opportunities

a. Harvesting--In the short run, fishermen's productivity can be improved by a wider application of modern equipment, such as, electronic aids, radio communications, echo sounders, fish detectors, etc. Bigger

investment is called for in building refrigerated crafts that permit longer voyages and better quality fish, and in installing power-driven blocks on more boats and vessels that permit fewer fishermen to handle more gear than could formerly be done. Without labor-saving devices to increase production and reduce costs, it would be difficult for domestic fisheries to face the competition of fish imports.

b. Processing--The newly introduced eviscerating machine and deboner will help to raise the productivity of the processing sector by reducing labor cost and increasing production, particularly in fillet cutting and fish canneries.

c. Preservation--Irradiation is one of the more effective methods perfected for the preservation of fish products. Freeze drying, super chilling, and pressure are other methods that show promise in the fishing industry. A list of modern devices is shown in the table in the next section that can be adopted to improve the efficiency of different sectors in the production level.

2. Long run opportunities

The long run purpose of advancing fishing productivity is to lower costs or increase the returns to all factors of

production, increase production, and lower prices to consumers. This could be achieved by simultaneously applying many of the following measures.

a. International commissions and agreements to optimally utilize the common property in the sea.

   i. limited entry of fishing units in international waters,

   ii. quota, tax, or other management scheme among nations in international waters, and

   iii. water pollution control by individual countries.

b. Continuous technological improvement

   More and better production and preservation techniques should be introduced for labor-saving and quality improvement in all parts of the total production system from harvesting and handling to processing of fish products.

c. Retraining of fishermen

   Fishing is an occupation requiring skill in using costly and dangerous equipment. As equipment and techniques improve from year to year, fishermen's skill need to be upgraded periodically.

d. Market structure and organization

Many of the processing and marketing firms in the fishing industry are operating on a very small scale. In many isolated parts of the country there is little or no competition between these small fishery marketing or processing firms--not unlike the market conditions that faced dairymen, grain producers, and cattlemen before they developed cooperatives and trucking associations.

At the same time at the food service and distribution end of the marketing chain, there are many firms starting to offer complete meals and entries with standardization and quality control. These firms are not only in agricultural products but also in seafood products. They need stable supplies with cost control and are on the threshold of contracting or joint-venturing with organizations of seafood producers to meet their mutual objectives as they have started with organizations of agricultural producers.

e. Development of untapped resources

Many of the untapped aquatic resources of today may become the commercial fishery resources of tomorrow.

These untapped resources are the same as marginal land or the frontier in agriculture that comes into production with an increase in demand which increases prices and makes it profitable or with a new technology that reduces cost and thereby making use of the marginal land, frontier, or untapped resources or profitable venture.

King and snow crabs and goose-duck clams were untouched 20 years ago. The growth of these fisheries to commercial status is an example indicative of the evaluation in fish utilization that may be expected to continue. Squid, flying gurnards, spiny dog fish, pomfret and hundreds of others are untapped by American fishermen. Mullet, scads, pompanos, bonito, hake, rex sole, skates and many others are underutilized aquatic resources from both oceans. They are all edible and useful in one form or another. Changing consumer preference and new product development can lead to the harvesting of these untapped and underutilized resources.

f. Aquaculture

Through scientific methods in aquatic husbandry, diseases, predators, nutrition, genetics, and breeding

fish production can be controlled. Temperature, oxygen supply, and purity of water can be regulated. Production and harvesting of fish can be made easier and less costly. Trout and catfish farming is now a commercial venture. Parts of the salmon and oyster production process is now man controlled. There are many other species like shrimp, lobsters, carp, abalone, pompano, flounders, etc. in the United States or the rest of the world that are commercially feasible or right on the threshold of becoming so. In many respects these species are where broilers were 25 years ago.

IV. What is the practical feasibility of opportunities for increasing productivity?

A. Technical problems

Most of the technical problems can be overcome in a period of 3 to 5 years but practically none can be overcome and put into practice in less than a year. Improved vessels, gear, and processing equipment, which would enable increased labor productivity, need almost a year lead time from the investment decision until they begin to become productive.

Most of the basic research in electronics, engineering, economics, genetics, nutrition, chemistry, etc., has been done that could be applied to the fishing industry to increase productivity. What needs to be done, however, is a considerable amount of applied research in nearly all aspects of the commercial fishing industry coupled with a strong program in continuing education so that these improved methods and techniques will be rapidly adopted.

B. Social acceptance

Many of the commercial fishermen are traditional and independent. They have to be shown that new ideas, methods, techniques, procedures, etc., are better than the present ones. Look at the boats and gear in the Chesapeake Bay. Nearly all of the boats are still wooden

and the gear is nearly the same as it was 50 years ago. Only in the shrimp and tuna fisheries have we had wholesale acceptance of improved technology that has revolutionized these fisheries.

The traditional "lay" system of dividing the earnings of the catch between the vessel owner and the crew could also be a problem. Most of the labor productivity increasing methods involve increased investment. Without a change in the lay system in favor of the vessel owner there is not going to be investment in the improved methods because the crew, not the vessel owner, would benefit from the improved methods. The traditional lay system in the late 1950's held up the conversion of the tuna fleet to purse seining for about a year. Vessel owners and crew need to understand the financial consequences of improved techniques and modify the lay system to be consistent with the new financial situation.

C. Political problems

In most engineering, electronic, and similar physical improved techniques there are only limited political implications. In the case of improved navigational systems there would be need to be governmental funding for the establishment and operation of the master systems but there is not any known organized opposition to these systems.

In the case of fishery management schemes that increase labor productivity and lower per unit costs, however, there are major political problems. Each Coastal State is responsible for their own fisheries within 3 miles. Fishery Commissions on the Pacific, Gulf, Atlantic and Great Lakes are directly involved.

Several international commissions and agreements are involved with managing pelagic and anadromous fishery resources. Establishing or changing fishery management schemes, to increase labor productivity, by any of these political bodies requires a general understanding and acceptance by the majority of the members of these bodies and the leadership of the industries affected. Political bodies will not establish or change these schemes unless they have the backing of the leadership in the industries involved.

A major program in continuing education on fishery management schemes conducted by the NOAA-NMFS Advisory Service would help speed up the adoption of these fishery management schemes.

D. Investment market structure

A major change in the financial market structure facing the fishing industry occurred in June 1972 when the Farm Credit System became eligible to make loans to fishery producers and cooperatives. A material increase in credit and investment and a decrease in interest rates will not occur, however, until the Farm Credit System becomes familiar with the fishing industry, makes a substantial number of loans, and holds a substantial amount of the fishery credit.

Again, a continuing educational program in fishery credit for fishermen, fishery cooperatives and the Farm Credit System would speed up profitable investment in the fishing industry resulting in lower costs and increased productivity.

E. Summary

In the following table are listed many on going or possible productivity increasing activities by harvesting, aquaculture, processing, transportation and distribution, and preservation and also by type of Federal activity or funding. As indicated in the table, there is no need for any basic research, only applied research. Continuing education is needed for practically every activity. Only in a very few activities is Federal legislation or direct action needed. In cases where the direct Federal action is outside of NOAA the Federal agency is indicated, such as the Small Business Administration (SBA) for financing fishermen with limited resources.

No side affects or evaluations are given for any of these activities in this table. When these are taken into account then priorities among these activities can be established.

A picture of the speed of results, however, can be obtained by a look at what needs to be done. The fastest results can be obtained if only direct Federal action is needed. The next fastest results are if only continuing education is needed. The speed in this case would depend on the complexity

of the subject. Applied research and continuing education would take slightly longer because the continuing education could not begin until there were progress reports or preliminary results from the applied research. Legislation would take a minimum of a year.

Productivity increasing cost reducing opportunities in fisheries with type of Federal activity or funding

Sector and activity	Type of Federal activity or funding				
	Research		Continuing education	Legislation	Direct action
	Basic	Applied			
I. Harvesting Sector					
1. Fishery Management		X	X	X	X
2. Navigation					
a. Radar			X		
b. Loran			X		
c. Decca			X	X	X
d. Other		X	X	X	X
3. Fish location					
a. Sonar			X		
b. Other		X	X		
4. Automatic long line baiting equipment					
a. For tuna using existing baits			X		
b. Other species and baits		X	X		
5. Other gear and equipment		X	X		
6. Vessel design		X	X		
7. Import low cost foreign vessels				X	
8. Training					
a. Crew			X		
b. Captains and owners		X	X		
9. Financing					
a. Farm Credit System			X		
b. Fishermen with					
i. Adequate resources			X		
ii. Limited resources			X		

SBA & NMFS

Productivity increasing cost reducing opportunities in fisheries with type of Federal activity or funding

Sector and activity	Type of Federal activity or funding				
	Research		Continuing education	Legislation	Direct action
	Basic	Applied			
10. Reducing price fluctuations					
a. Price supports		X	X	X	
b. Marketing orders					
c. Income payments		X	X	X	
11. MARMAP					
a. Albacore forecasting			X		X
b. Stock catalogue-Woodshole			X		X
c. Other forecasting techniques & species		X	X		X
12. Reduce pollution		X	X		X
13. Low cost foreign vessels			X	X	
14. Vessel safety		X	X	Coast Guard	X
15. Self insuring		X	X		
II. Aquaculture					
1. Genetics		X	X		
2. Nutrition		X	X		
3. Diseases, parasites, etc.		X	X		
4. Gear		X	X		
5. Management		X	X		
6. Marketing		X	X		
III. Processing sector					
1. Filleting machines					
a. New England groundfish			X		
b. Other species		X	X		

Productivity increasing cost reducing opportunities in fisheries with type of Federal activity or funding

Sector and activity	Type of Federal activity or funding				
	Research		Continuing education	Legislation	Direct action
	Basic	Applied			
2. Shrimp peelers and graders			X		
3. Deboning machines			X		
4. Crab pickers					
a. King and blue crabs			X		
b. Other crabs		X			
5. Shucking machines					
a. Standard sized oysters			X		
b. Other oysters and clams		X	X		
6. FPC					
a. Lean species			X		
b. Fatty species		X	X		
7. Sardine canning		X	X		
8. Financing					
a. Low income private firms			X		SBA
b. Cooperatives					
i. Adequate resources			X		
ii. Limited resources			X	X	FHA-USDA
IV. Transportation and distribution					
1. Containers					
a. Using existing technology			X		
b. Using improved technology		X	X		
2. Organization structure		X	X		

Productivity increasing cost reducing opportunities in fisheries with type of Federal activity or funding

Sector and activity	Type of Federal activity or funding				
	Research		Continuing education	Legislation	Direct action
	Basic	Applied			
V. Preservation					
1. Irradiation		X	X		
2. Cooling					
a. Super chilling			X		
b. Freeze drying		X	X		
c. Other		X	X		
3. Pressure and other methods		X	X		

V. What technical and financial assistance are available to raise productivity?

A. Organizations

1. Federal Government

At the Federal level, most of the resources available to raise productivity in U.S. fisheries are contained within the National Marine Fisheries Service (NMFS) and Office of Sea Grant of the National Oceanic and Atmospheric Administration (NOAA), Department of Commerce. Within NMFS three offices--Resource Utilization, Resource Research, and Resource Management--have responsibilities bearing the productivity of commercial fisheries.

Under the Office of Resource Utilization the Economic Research Laboratory (ERL) investigates fishery production relationships. It is in this Laboratory that the main capability exists for expanding the effort to study means of improving fishing productivity. The Market Research and Services Division has a similar responsibility in the seafood marketing area. The Fishery Products and Inspection Division, with its regional Fishery Products Technology Centers and Laboratories, has the technical capabilities for innovations resulting in increased productivity in seafood processing. The

Financial Assistance Division is the organization that overcomes some of the inability resulting from not being able to import fishing vessels and for financing fishermen with limited resources.

The Office of Resource Research is responsible for identifying and locating fishery resources--a function that is important in the productivity issue. The Office of Resource Management has responsibilities of encouraging State-Federal cooperation in the use of available fishery resources and, through its extension program, of improving the operating knowledge of fishermen and for helping to develop public fishery policy.

NMFS also has regional facilities by way of its Regional Offices located in all of the coastal regions of the United States. Each has some capability in the areas of economic and biological research.

The fish and game commissioners have regional organizations in the Pacific, Gulf, Atlantic and Great Lakes areas. These organizations can be most helpful in improving fishery management and thereby productivity.

The Coastal Plains Regional Development Commission is also helpful in increasing fishery productivity.

3. Private firms and universities

Private institutions exist, mainly trade associations, which are vitally interested in the yield of the fisheries. These include the National Fisheries Institute, the National Canners' Association, and aquaculture groups, such as the Catfish Farmers of America. They serve an important function in disseminating available information, but are weak in their research capabilities.

A number of consulting firms and universities have considerable expertise in the fisheries area. Among these are A. D. Little, Battelle Memorial Institute, Northrup, Riverside Research, Stanford Research, the University of Washington, Oregon State University, and the University of Rhode Island.

B. Necessary studies

The above Federal, State, private, and academic institutions constitute the potential resources required to work on the problem of raising commercial fishing productivity. In the following table we have identified about ¼ of the NMFS and Sea Grant budget in Fiscal Years 73 and 74 that contribute to seafood productivity increases or about 16 million dollars in FY 73 and 19 in FY 74. This is broken down into applied

Budget Productivity Increases in Seafood

	Fiscal Year 73			74		
	Million dollars					
Total	20			24		
Now in the budget	16			19		
Additional needed	4			6		
Category	Now in budget	Additional needed	Total	Now in budget	Additional needed	Total
Total	16.0	4.0	20.0	19.0	1.0	20.0
Applied research	5.2	2.4	7.2	8.0	3.0	11.0
Continuing education	.8	.6	1.4	1.0	2.0	3.0
Direct action	10.0	1.0	11.0	19.0	7.0	26.0

research, continuing education, and direct action. All of the NMFS financial assistance is in the direct action category. Additional direct action that maybe needed by SBA or the Coast Guard is not included. Continuing education includes both the NMFS extension activities and the Office of Sea Grant advisory service. The additional budget needed each Fiscal Year is also indicated for the same categories. The projects and programs included in each category would follow the listing in the summary table in section IV. Examples and cost range for some of these projects and programs follow. Many of the projects are included in several of our Program Development Plans (PDP). Others were considered but not included because of higher priorities for our limited budget.

1. A study of the determinants of vessel and boat captain's productivity. Cost Range: $20,000 - $30,000.
2. A study of alternative Federal-State management schemes designed to yield the maximum sustainable output. Cost Range: $150,000 - $200,000.
3. A study of the means of encouraging the adoption of improved navigational equipment. Cost Range: $5,000 - $15,000.

4. A study of the cost of present Federal and State regulations affecting commercial fishing activities. Cost Range: $75,000 - $125,000.
5. A study of the feasibility of a Federal loan program for the conversion of gear. Cost Range: $20,000 - $30,000.
6. A study of risk reduction methods in harvesting and processing in order to encourage expanded investment. Cost Range: $30,000 - $50,000.
7. A study of productivity determinants in aquaculture. Cost Range: $10,000 - $15,000.
8. A study of new technology adoption rates in the fish harvesting sector. Cost Range: $20,000 - $30,000.
9. A study of possible waste utilization and treatment on processing sector costs and productivity. Cost Range: $20,000 - $30,000.
10. A study of the impact of proposed wholesome fish and fishery products legislation on processing sector costs and productivity. Cost Range: $20,000 - $30,000.

Table 1.--Wholesale Price Indices (1947-1971)

Year	Farm Products	Processed Foods & Feeds	Prices Rec'd by Farmers	Unprocessed Fin Fish	Fresh Processed Fish
	- - - - - - - - - - - - - - - -		1967=100	- - - - - - - - - - - - - -	
1947	109.4	82.9	109	53.7	57.3
1948	117.5	88.7	113	58.2	56.5
1949	101.6	80.6	98	55.6	52.4
1950	106.7	83.4	102	63.2	53.5
1951	124.2	92.7	119	64.0	57.1
1952	117.2	91.6	113	65.6	59.1
1953	106.2	87.4	100	60.5	66.6
1954	104.7	88.9	97	65.7	59.0
1955	98.2	85.0	91	61.0	60.7
1956	96.9	84.9	91	67.4	71.2
1957	99.5	87.4	92	69.6	77.2
1958	103.9	91.8	98	82.4	80.0
1959	97.5	89.4	95	86.7	75.1
1960	97.2	89.5	94	87.8	77.5
1961	96.3	91.0	94	86.2	84.1
1962	98.0	91.9	96	96.7	94.1
1963	96.0	92.5	96	94.0	92.7
1964	94.6	92.3	93	90.5	86.2
1965	98.7	95.5	98	96.2	88.9
1966	105.9	101.2	105	101.0	101.7
1967	100.0	100.0	100	100.0	100.0
1968	102.5	102.2	103	108.8	111.2
1969	109.1	107.3	108	134.1	124.3
1970	111.0	112.0	110	150.4	123.9
1971	112.9	114.3	112	148.3	141.0

Sources: 1. Economic report of the President: Jan. 1972.
2. Bureau of Labor Statistics.

Table 2.--Compound annual rate of growth in output per fisherman

Fishery	Growth Rate	Period for which data are available
	Percent	
Finfish		
1. North Atlantic Groundfish	+1.7*	1950-66
2. North Pacific Groundfish	+4.1*	1950-66 1/
3. Pacific Halibut	-0.3	1927-66 2/
4. Pacific Albacore Tuna	+2.1	1956-66
5. Pacific Yellowfin - Skipjack Tuna	+2.0*	1935-67 3/
6. Alaskan Salmon	-4.5*	1927-66
7. Atlantic Menhaden	+2.6*	1950-67
8. Gulf of Mexico Menhaden	+6.8*	1950-67
Shellfish		
9. Inshore Northern Lobster	-0.4	1950-66
10. Offshore Northern Lobster	-11.6	1961-66
11. Alaskan King Crab	+18.4*	1960-67
12. Gulf of Mexico Blue Crab Pot Fishery	+11.2*	1950-67
13. Atlantic Blue Crab Pot Fishery	+2.1*	1950-67
14. North-Middle Atlantic and Chesapeake Bay Dredge Clam Fishery	+7.9*	1950-66
15. Pacific (Excluding Alaska) Dungeness Crab	+1.5*	1932-67 4/
16. Gulf Shrimp	-1.7*	1950-66
17. Atlantic Shrimp	-1.7	1950-66
18. Atlantic (Subarea 5Z) Sea Scallop	+2.4*	1950-66
19. Atlantic and Gulf Oyster Fishery	-3.1*	1950-66

* trend was statistically significant at the 5 percent level.

1/ Excludes 1952-54 and 1957.
2/ Excludes 1933.
3/ Excludes 1955.
4/ Excludes 1946, 1948, 1949, 1952-54, and 1957.

Table 3.-- Production, Man-Year and Labor Productivity Indices for all U.S. Fisheries, 1950-66

	Production Index 1/ (1)	Man-Year Index 2/ (2)	Labor-Productivity Index (1)÷(2)
	Base: 1957-59=100		
1950	133.21	199.93	66.62
1951	99.83	137.39	72.66
1952	86.08	113.32	75.97
1953	84.17	111.04	75.80
1954	89.73	107.34	83.59
1955	93.47	109.68	85.22
1956	101.05	111.77	90.41
1957	100.37	109.53	91.63
1958	104.03	98.92	105.17
1959	95.60	91.30	104.72
1960	86.15	82.43	104.51
1961	85.93	82.00	104.80
1962	90.79	82.08	110.61
1963	92.14	83.39	110.50
1964	85.54	78.67	108.72
1965	89.59	85.30	105.04
1966	88.33	89.80	98.37
Compound Annual Rate of Growth	-1.0%*	-4.0%*	+3.0%*

1/ Production Index = $\frac{\sum_{i=1}^{N} L_0 Q_i}{\sum_{i=1}^{N} L_0 Q_0}$

2/ Man-Year Index = $\frac{\sum_{i=1}^{N} L_i Q_i}{\sum_{i=1}^{N} L_0 Q_0}$

where L_i and L_0 denote man-years expended in current and a base period (1957-59=100) while Q_i and Q_0 denote production in current and a base period (1957-59=100) respectively.

* = Statistically significant at the 5 percent level.

Table 4. Index of labor productivity by selected sectors, 1950-71.

Year	Total private 1/	Farm 1/	Nonfarm industries 1/	Fishing 2/
	- - - - - - - - - - 1967 = 100 - - - - - - - - - - - - - - -			
1947	51.3	29.2	57.1	
1948	53.6	34.0	58.8	
1949	55.3	33.1	61.1	
1950	59.7	37.7	65.0	98.3
1951	61.5	37.9	66.3	92.4
1952	62.7	41.2	66.9	94.7
1953	65.3	46.7	68.9	95.0
1954	66.9	49.1	70.5	106.7
1955	69.9	49.5	73.6	107.9
1956	70.0	51.6	73.2	120.5
1957	72.0	54.7	74.8	112.2
1958	74.3	60.4	76.7	119.3
1959	76.9	61.5	79.3	128.6
1960	78.2	64.9	80.3	122.8
1961	80.9	70.0	82.7	129.7
1962	84.7	71.7	86.4	137.4
1963	87.7	78.1	89.1	122.3
1964	91.1	79.5	92.4	115.1
1965	94.2	86.9	95.1	120.4
1966	98.0	90.5	98.4	104.3
1967	100.0	100.0	100.0	100.0
1968	102.9	100.2	102.9	105.2
1969	103.4	110.7	102.7	106.5
1970	104.3	115.6	103.5	N.A.
1971	108.1	125.6	107.0	3/ 109.7

1/ Source: Department of Labor, Bureau of Labor Statistics. Indexes of output per man-hour.

2/ Unadjusted labor productivity per man-year for all U.S. fisheries using total production and total employment. This index is not comparable with columns 1, 2 and 3.

3/ Index using total of full-time and part-time fishermen not comparable with previous years.