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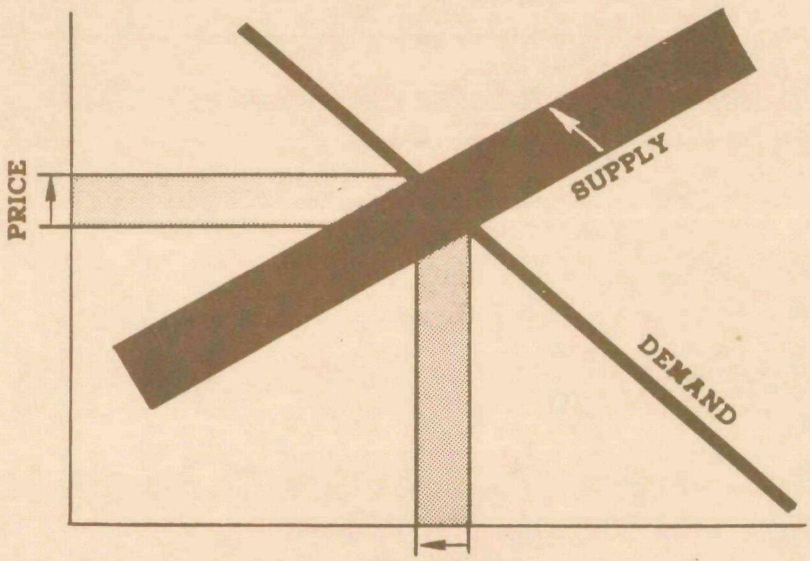
ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES

Seafoods Processing Industry



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ECONOMIC ANALYSIS OF
PROPOSED EFFLUENT GUIDELINES
SEAFOODS PROCESSING INDUSTRY

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Prepared for
Office of Planning and Evaluation
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Washington, D. C. 20460

PREFACE

The attached document is a contractor's study prepared for the Office of Planning and Evaluation of the Environmental Protection Agency ("EPA"). The purpose of the study is to analyze the economic impact which could result from the application of alternative effluent limitation guidelines and standards of performance to be established under sections 304(b) and 306 of the Federal Water Pollution Control Act, as amended.

The study supplements the technical study ("EPA Development Document") supporting the issuance of proposed regulations under sections 304(b) and 306. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports promulgation of certain effluent limitation guidelines and standards of performance based upon an analysis of the feasibility of these guidelines and standards in accordance with the requirements of sections 304(b) and 306 of the Act. Presented in the Development Document are the investment and operating costs associated with various alternative control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Planning and Evaluation of EPA. This report was submitted in fulfillment of Contract No. WA-73X-425, Task Order No. 2 by Development Planning and Research Associates, Inc. Work was completed as of October, 1973.

This report is being released and circulated at approximately the same time as publication in the Federal Register of a notice of proposed rule making under sections 304(b) and 306 of the Act for the subject point source category. The study has not been reviewed by EPA and is not an official EPA publication. The study will be considered along with the information contained in the Development Document and any comments received by EPA on either document before or during proposed rule making proceedings necessary to establish final regulations. Prior to final promulgation of regulations, the accompanying study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the views of the contractor who studied the subject industry. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the subject industry.

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I. INDUSTRY SEGMENTS

This report is limited to consideration of the economic impact of proposed effluent guidelines for the processing of the following species of seafoods: tuna, shrimp, crab and catfish. Both canned and frozen processing is included. The volume of smoked, dried or brined seafood products is not of commercial significance for the species considered in this report. Tuna, shrimp and crab are marine species whereas catfish are produced in farm ponds or are caught "wild" from fresh water rivers.

A. Types of Firms and Plants

In general, the firms and plants included fell under two SIC codes:

SIC 2091 - Canned and Cured Fish and Seafoods (Partial)

Establishments primarily engaged in cooking and canning tuna, shrimp, and crabs.

SIC 2092 - Fresh or Frozen Packaged Fish and Seafoods (Partial)

Establishments primarily engaged in preparing fresh and raw or cooked frozen packaged fish or other seafoods. Includes tuna, shrimp, crab, and catfish.

1. Number and Location of Firms and Plants

Tuna, shrimp and crabs are marine species and as a result, processing plants are primarily located in coastal areas. All tuna plants are located in coastal areas. However, some processors of shrimp and crab operate on the basis of purchases of frozen raw product, either from domestic or imported sources, and as a result, there are processors (particularly freezers of prepared shrimp or crab items) who are located inland.

The number and location of seafood canning and freezing plants, for the species with which this project is concerned, is shown in Tables I-1 and I-2.

a. Canning Plants - Canning plants are generally located at seaports where there are major landings of the species canned. Canning is the principal method of processing for tuna and is important for both shrimp and crab but no catfish are commercially canned.

(1) Tuna canneries are located in California (8), Oregon (5), Washington (4), Hawaii (1), Maryland (1), Puerto Rico (5) and American Samoa (2).

In general, the canning of tuna is carried out in large-scale, specialized plants although some tuna is canned in multi-product fish canneries.

The industry is dominated by five large canners:

Bumble Bee Seafoods Division of Castle and Cook Inc.
Del Monte Corporation
Starkist Foods Inc., a division of the Heinz Company
Van Camp Sea Foods Co., a division of the Ralston Purina Company
Westgate-California Tuna Packers Co., a division of the Westgate-California Corporation

These five firms operate a total of 14 plants and account for over 90 percent of the total pack. All are either divisions of conglomerates, diversified corporations or large diversified food processors.

Two other, medium-sized canners operate:

Whitney-Fidalgo Seafoods Inc. (Seattle) is primarily a salmon canner, but canned tuna ($4 million sales 1972) accounts for 12 percent of its total sales.
IBEC (International Basic Economy Corporation) is a diversified development-investment New York corporation with substantial business interest in Latin America, which operates a tuna plant in Puerto Rico.

The other packers are relatively small or are parts of diversified fish canning or custom canning firms.

(2) Shrimp canners are concentrated in Louisiana (12 plants), Mississippi (10), Alaska (8), and Oregon (4), with Texas having one plant.

Table I-1. Number of shrimp, crab and tuna canning plants by state, and total number of firms, 1972[1]

State	Number of Canning Plants		
	Shrimp	Crab	Tuna
Alaska	8	19	-
Washington	-	2	4
Oregon	4	2	5
California	-	-	8
Hawaii	-	-	1
Texas	1	-	-
Louisiana	12	-	-
Mississippi	10	2	-
South Carolina	-	1	-
North Carolina	-	1	-
Maryland	-	-	1
Maine	-	1	-
Puerto Rico	-	-	5
American Samoa	-	-	2
Total plants	35	28	26
Number of firms	34	23	

[1] There was no record of catfish canning in 1972.

In contrast to tuna canning, the canning of shrimp is carried out in a larger number of small plants such that no group of firms tends to dominate the industry. Shrimp canning is almost entirely carried out by single-plant firms, only one firm out of a total of 34, having two canning plants.

(3) Crab is canned in seven states. Alaska is the most important state in terms of number of plants, accounting for 19 out of the total of 28. Washington, Oregon and Mississippi each have 2 plants canning crab and there is one plant in North Carolina, South Carolina and Maine. However, the canning of crab is of decreasing importance as the bulk of processed crab is in the form of frozen whole crab, crab sections or frozen crab meat. As was the case with shrimp canners, most crab canners operate but a single plant. Out of a total of 23 firms, 5 firms operated 2 plants each. No firm had more than 2 plants.

b. Freezing Plants - Although seafoods freezing plants also tend to be located in coastal areas, these plants are more widely distributed geographically. Lists of seafood freezing plants, equivalent to cannery plant lists, are not available from "official" sources such as the National Marine Fisheries Service. However, DPRA has developed a list of 580 plants that freeze crab, shrimp, catfish and tuna. The list was developed from a variety of current trade association lists and listings from federal and state government sources and has been cross-checked to avoid duplication. It is believed to be essentially complete and representative of conditions which exist in this industry.

It should be noted that the list includes many inland plants which are typically reprocessors or producers of specialty items. The list also includes many blue crab processors that process fresh crab meat in non-hermetically sealed containers. These are included in the blue crab freezing category since it is impossible to differentiate fresh and frozen producers at this time.

Seafood freezers fall into two general classes:

(1) Those which operate primarily with fresh fish.

(2) Those which operate primarily with imported, frozen fishery stocks, particularly important in the case of shrimp processors.

Although the effluent problems of the two types of firms are somewhat different, particularly where the frozen raw material is crab meat, shrimp processors operating on frozen stocks usually receive frozen blocks of headsoff, shell on shrimp and the thawing and shell peeling and deveining operations do generate significant amounts of effluent which must be disposed of.

Table I-2 shows the estimated number of crab, shrimp, catfish and tuna freezing plants and firms, by states, for 1972.

Table I-2. Estimated number of shrimp, crab, catfish and tuna freezing firms and plants by state, 1972

State	Crab	Shrimp	Catfish	Tuna
Alabama	2	5	5	
Alaska	49	22		2
Arizona		1		
Arkansas	1		4	
California	12	21	1	
Delaware		2		
Florida	17	38	1	
Georgia	3	5	1	
Illinois	1	5		
Iowa			1	
Kansas			2	
Kentucky		1	1	
Louisiana	4	16	3	
Maine	2	7		
Maryland	7	2		
Massachusetts	2	5		1
Michigan		1		
Mississippi		4	5	
Missouri			2	
New Jersey	1	2		
New York	7	14		
North Carolina	2	3		
North Dakota		1		
Ohio		2		
Oklahoma			1	
Oregon	7	6		1
Pennsylvania	3	4	1	
South Carolina	1		1	
Tennessee		1	2	
Texas	2	18	6	
Virginia	3	2	2	
Washington	9	8		1
Wisconsin	2	3		
Total - All States 1/	137	199	39	5

1/ The number of crab plants would increase to 360 if those plants that pack their product in nonhermetically sealed containers are included.

The industry primarily consists of single-plant firms. There are multi-plant firms located in at least six states. Alaska has 42 firms operating 61 plants -- one firm operates 6 plants, one 5 plants and the other multi-plant firms operate two plants each. California has four firms operating two plants each, Florida has four firms operating two plants and one firm operating three plants. Multiplant firms in the other three states (Georgia, Maine, Oregon) are limited to one firm which operates two plants.

Crab freezers are concentrated in coastal states and operate primarily with fresh crab. The leading states, in terms of number of plants, are:

Alaska	-	49 plants
Florida	-	17 plants
California	-	12 plants
Washington	-	9 plants
Oregon	-	7 plants
Maryland	-	7 plants
New York	-	7 plants

These seven states account for 79 percent of the total number of crab freezers in the United States. The inclusion of nonhermetically sealed crab meat producers as was done in Table I-2 would substantially increase these numbers.

Shrimp freezers are also located primarily in coastal areas, but operate to a higher degree, with frozen stocks than do crab freezers (Table I-2). The six leading states in number of shrimp freezing plants, are as follows:

Florida	-	38
Alaska	-	22
California	-	21
Texas	-	18
Louisiana	-	16
New York	-	14

These nine states account for 65 percent of the total number of shrimp freezers in the United States.

Catfish freezers account for 99+ percent of the total volume of processing in this industry. There is essentially no production of canned catfish and only a negligible quantity is smoked or otherwise cured. Frozen catfish production considered in this report is confined to processing of pond-reared catfish. Virtually all "wild" catfish are sold as fresh fish. There are some plants which report freezing of ocean catfish, which is a different species, and some firms which prepare frozen fish sticks or other fabricated items based on imported frozen catfish stocks, but these have not been included in this analysis. Pond-reared catfish are produced and processed primarily in the Southern States (Table I-2). Leading states, in terms of numbers of freezers, in 1972 were as follows:

Texas	-	6
Alabama	-.	5
Mississippi	-	5
Arkansas	-	4
Louisiana	-	3

These five states account for 62 percent of the total of 39 catfish processing plants in the United States. Virtually all of the catfish processors are operated in conjunction with production enterprises but also process fish from other producers in the area. All firms but one are single plant organizations.

Table I-3 summarizes much of the above data by presenting plant numbers by type of plant by species by geographical area.

B. Concentration in the Fisheries Industry

No data are available which permit an accurate evaluation of concentration ratios by specific product groups (tuna, shrimp, crab, catfish). However, general industry data are indicative of the overall situation which exists in the canning and freezing of seafoods products. Data from the 1967 Census of Manufactures indicates the following:

	Percent of total value of shipments accounted for by:			
Product line	4 largest companies	8 largest companies	20 largest companies	50 largest companies
Canned and cured seafood	44	59	73	85
Fresh or frozen packaged fish	26	38	56	72

Table I-3. Number of plants by species, geographical area and type of plant

Species	Type of plant: Canner	Type of plant: Freezer	Total
Catfish	0	39	39
Tuna	26	5	31
Shrimp			
Gulf shrimp	23	89	112
West Coast	4	35	39
New England	0	30	30
Alaskan	8	22	30
Crab			
West Coast crab	4	28	32
Alaskan crab	19	49	68
Blue crab	5	283 [1/]	288
Total	89	580	669
Other inland plants [2/]	Canners and Freezers		
Crab	17		17
Shrimp	23		23
Total inland plants			40
Total all plants			709

1/ Includes Rock crabs and producers of nonhermetically sealed products.

2/ Mostly reprocessors and producers of specialty items.

Although these data indicate appreciable concentration in the processing of fisheries products, for the products considered in this report (tuna, shrimp, crab, catfish) the concentration of processing is as follows:

- Tuna processing - the industry is dominated by five large firms (see page I-2) which together account for over 90 percent of the total pack.

- Shrimp processing - the industry is made up of a large number of small processors, some of which are associated with large national seafoods processors, but there is no significant degree of concentration in the industry.

- Crab processing - the situation is similar to that existing in shrimp processing. In fact, some of the firms are the same as those processing shrimp. No significant degree of concentration exists in the industry.

- Catfish processing - the industry is small, processors are scattered and tied to production units. Three major firms, Gold Kist, ConAgra and Southern Catfish Processors, Inc. are large enough to exercise some degree of dominance in this industry.

C. Level of Integration

Integration within the fisheries industry varies by product. Horizontal integration is most common, but examples of vertical integration also exist.

Tuna Processors

Ownership in the tuna industry is dominated by large firms, mainly conglomerates and diversified food processors. Ownership structure of this industry was described on page I-2 of this report.

Horizontal integration exists in that five of the major tuna packers operate multiple plants. In addition, while tuna packing is the primary function of the plants with which this report is concerned, other species of fish and shellfish (salmon, crab, shrimp, etc.) are also processed by many of these tuna packers, either in the same location or in plants at other locations owned by these firms. Two of the major firms (Del Monte and Heinz) are also diversified food processors. Three, Bumble Bee (Castle and Cook), Westgate California Tuna Packers (Westgate California Corporation) and IBEC (Internation Basic Economy Corporation) are parts of conglomerates and one (Van Camp Sea Foods Co.) is a division of a major feed manufacturer (Ralston Purina). Others such as Whitney-Fidalgo or Lazioare diversified (salmon, tuna, crab, shrimp) seafoods processors.

The tuna packers are often vertically integrated backward to a degree in that, in some cases, they either operate tuna fleets directly, through subsidaries or exercise a degree of control over suppliers through delivery contracts or financing arrnagements

Shrimp Processors

There is little integration in the shrimp processing industry. Almost all processors - either canners or freezers are single-plant firms. However, some shrimp processors are divisions of larger seafoods processing companies such as Bumble Bee, California Westgate, etc.

Most shrimp processors also process crab and, in some instances, are firms which process a wide variety of both finfish and shellfish.

Although there is some vertical integration backward, toward fishing operations through the ownership of shrimp boats and through contractual arrangements with private boat operators, such integration is not an important factor in this industry. Some processors carry integration forward in that they not only process and freeze raw and cooked shrimp but also produced breaded frozen shrimp and other prepared shrimp products.

Crab Processors

There is less integration in crab processing than there is in the shrimp industry. Most crab processors are single-plant firms. However, in Alaska and the Pacific Coast States, combinations of crab with shrimp processing are common and some crab processing is carried out by diverisified fish and shellfish processors. In common with shrimp processors, some crab processors are divisions of larger seafood processing firms.

Although most crab processors produce only canned or cooked frozen crab meat, a few firms also produce further processed (crab cakes, deviled crab, etc.) crab products.

Catfish Processors

Vertical integration, backward to catfish production and forward to live hauling, catfish restaurants and pay fishing lakes, is common in the catfish industry. Data were available on 22 firms and showed the following combinations:

	No. Firms
Process only	5
Process plus food fish production	5
Process plus food fish plus live hauling	8
Process plus food fish plus live hauling plus catfish restaurant	1
Process plus food fish, plus live hauling, plus restaurant, plus pay lake	1
Process plus food fish, plus live hauling plus pay lake	1
Process plus catfish restaurant	1

Single plant firms are the rule, only one firm operating two plants.

At one time it was thought that the catfish industry offered opportunities for integration in terms of feed supply, catfish production, processing and marketing similar to that which exists in the broiler industry. As a result, large feed-broiler firms such as Ralston Purina undertook to establish catfish operations. However, primarily as a result of marketing problems, these integrated operations were not successful and only one firm of this type (Gold Kist) remains in the catfish industry.

D. Technological Status of the Industry

Tuna Processing

There has been little change in tuna processing in recent years. New plants, either built or planned, will incorporate the latest developments in canning technology and effluent control, but the remainder of the plants follow conventional canning procedures which have not changed materially in recent years.

The major change affecting the tuna processing industry has been on the supply side. The securing of adequate supplies of tuna for canning is the most pressing problem facing the industry and many processors are integrated backward towards fishing operations through direct or indirect ownership of vessels or through contractual arrangements with private tuna boat operators. Improvements in the size and equipment of tuna fishing vessels have enabled the operators to forage the seas for hundreds and even thousands of miles from the canneries where the fish are to be canned. The fast freezing of tuna immediately after landing the fish on the boat reduces their perishability to a low level and extends the "out" time for a vessel up to several weeks. Such a vessel time "out" from port reduces the number of unsuccessful fishing trips and insures the canneries of a more stable tuna supply through the year.

Some, though not substantial, improvement has occurred in the use of radar to locate new fishing grounds. Further efforts to improve the methods of exploration and location of fish should be of great importance to the tuna industry, particularly as the U.S. offshore fisheries are depleted.

Shrimp Processing

In the shrimp processing industry, the most important and far-reaching technological change has been the invention and adoption of the mechanical shrimp peeler. The PCA Lathrum peeler and the Model A mechanical peelers will peel 700 - 900 pounds of shrimp per hour. Mechanical peeling has resulted in substantial reductions in peeling costs, from 40 cents per pound of shrimp meat to as low as 10 cents per pound. The change to mechanical peeling is taking place at a time when the availability of shrimp peeling labor has dropped substantially, the cost of such labor has risen rapidly and the demand for shrimp has continued to increase. The development of this equipment has been a major factor in enabling the shrimp processing industry to meet the problems posed by scarce and costly labor in the face of increased demand for shrimp.

Crab Processing

Technology in crab processing has not advanced at as rapid rate as is true for shrimp. Mechanical extraction of crab meat from the shell is not as widely adopted as has been the case for shrimp. However, roller picking has become important in Alaska in spite of a somewhat lower meat yield. In other areas, hand picking is still predominant. For both crab and shrimp meat, the most significant technological-marketing change has been the expansion of frozen shellfish sales to both institutional and household users.

Catfish Processing

Industrialized processing of catfish is a relatively new industry and has emerged in its present form only within the past 6 or 7 years. Processing catfish consists of heading, gutting and skinning. Heading is ordinarily done with a bandsaw, gutting and cleaning is done by hand and skinning is either done mechanically or by hand or by a combination of machine and hand dressing. In a survey of 16 catfish processors in the South, completed by the USDA in 1970,[1/] seven plants used machine skinning, seven used hand dressing only and two plants used a combination of machine and hand operations. Sizing of dressed fish is ordinarily done by sight-judgment, but one of the 16 plants had an automatic weighing-sorting machine. In its present status, the catfish processing industry is still at a relatively low-level stage of technology.

1/ Catfish Processing, A Rising Southern Industry, Agricultural Economic Report No. 224, ERS, USDA, 1972.

E. Pack - Canned and Frozen Products

Tuna

Nearly all tuna are canned, only negligible quantities are frozen. Distribution of the 1971 canned pack, by states, is shown in Table I-4 California is the leading state, accounting for 9.7 million cases or 43.8 percent of the total pack. Puerto Rico is the second most important tuna canning state, 7.7 million cases or 34.9 percent of the total. The importance of Puerto Rico has been increasing rapidly in recent years. Maryland, Hawaii and American Samoa together account for 14.9 percent of the total pack, Oregon 5.4 percent and Washington 1.0 percent.

Shrimp

Canned - The Gulf States (Texas, Louisiana and Mississippi) accounted for two-thirds of the pack of canned shrimp (2.1 million cases) in 1971. Louisiana had 12 canneries, Mississippi 10 and Texas 1. Alaska, with 7 canneries packed 966 thousand cases (30.5 percent of the total) and the balance (64,000 cases or 2.0 percent) was canned in 4 Oregon canneries (Table I-5).

Fresh and Frozen - The pack of fresh (chilled) and frozen shrimp is complex not only because of the number of locations and the variety of products, but also due to the fact that plants operate with fresh, frozen and imported frozen raw materials. Table I-6 shows the distribution of the fresh and frozen shrimp pack, by state and type of end product for 1971.

Although it is impossible to calculate the absolute importance of any one state because of unreported small amounts shown, the amounts reported account for 260 out of 280 million pounds total product. On this basis, the principal freezing states are as follows:

Table I-4. Tuna, canned pack, volume by state, 1971

State	Pack, thou. std. cases 1/	Percent of total
California	9,735,943	43.8
Oregon	1,196,123	5.4
Washington	225,994	1.0
Puerto Rico	7,744,296	34.9
Maryland, Hawaii and American Samoa (1)	3,302,617	14.9
Total, United States	22,204,973	100.0

1/ 48, 1/2-pound cans.
(1) Data unavailable by individual state or territory.
Source: Canned Fishery Products, 1971, U. S. Dept. Commerce, UNFS Current Fishery Statistics No. 5901

Table I-5. Shrimp, canned pack, volume by state, 1971

	Pack, thou. std. cases	Percent of total
Alaska (7)	966,100	30.5
Oregon (4)	63,726	2.0
Gulf States	2,136,428	67.5
Texas (1), Louisiana (12), Missippi (10) 1/		
Total, United States	3,166,254	100.0

1/ Data unavailable by individual state.
Numbers in ( ) refer to number of canning plants.

Source: Canned Fishery Products, 1971, U. S. Dept. Commerce, NMFS Current Fishery Statistics No. 5901

Table I-6. Pack of fresh and frozen shrimp, by state, 1971

Region and State	Type of Preparation						
	Raw headless	Cooked whole	Peeled raw	Peeled cooked	Breaded	Specialties	Total excluding small items
	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)
New England							
Me.	(1)	8,583	2,231	1,823	(1)	(1)	12,637
N. H.	(1)	--	--	--	--	--	(1)
Mass.	--	(1)	--	7,451	1,327	3,509	12,287
Mid Atlantic							
N. Y.	--	(1)	--	(1)	(1)	(1)	(1)
N. J.	--	--	--	--	--	(1)	(1)
Pa. & Del.	--	--	--	--	205	(1)	205
Chesapeak							
Md.	--	--	--	--	(1)	(1)	(1)
Va.	--	--	--	--	183	(1)	183
South Atlantic							
N. Car.	432	--	(1)	--	(1)	(1)	432
S. Car.	(1)	--	--	--	--	--	(1)
Ga.	2,827	--	1,186	(1)	14,236	(1)	18,249
Fla. (East Coast)	(1)	--	--	--	13,342	(1)	13,342
Gulf							
Fla. (West Coast)	6,209	--	15,357	(1)	31,531	(1)	53,097
Ala.	8,394	--	(1)	--	--	(1)	8,394
Miss.	5,562	--	(1)	--	(1)	--	5,562
La.	31,612	--	791	2,545	1,701	623	37,272
Tex.	35,083	--	12,676	(2)	23,986	--	72,745

continued.....

Table I-6. Pack of fresh and frozen shrimp, by state, 1971 (continued)

Region or State	Type of Preparation						
	Raw headless	Cooked whole	Peeled raw	Peeled cooked	Breaded	Specialties	Total excluding small items
	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)
Pacific Coast							
Alaska	2,250	1,309	--	3,769	--	--	7,328
Wash.	--	--	--	(1)	--	--	(1)
Ore.	--	--	--	1,706	--	--	1,706
Calif.	(1)	--	351	1,503	9,473	401	11,728
Great Lakes	All production imported in U. S. totals.						
Mississippi R.							
Mo., Okla., Tenn., Tex., & Wis.	--	--	--	--	4,648	193	4,841
Total U. S.	94,139	9,892	34,315	20,741	104,588	16,613	280,288

(1) Included in U. S. totals.
(2) Included with Louisiana.

Source: Processed Fishery Products, Annual Summary, 1971, CFS No. 5903, NMFS, U. S. Dept. of Commerce

State	Percent of total pack
Texas	26.0
Florida	23.7
Louisiana	13.3
Georgia	6.5
Maine	4.5
Massachusetts	4.4
California	4.2
Alabama	3.0
Alaska	2.6
Mississippi	2.0
Other States	9.6
Total	100.0

Thus it is seen that raw headless and breaded together constitute 71 percent of the total pack and when peeled raw and cooked are added, these four products constitute 91 percent of the total.

Crab

Canned - Crab must be delivered to the cannery either live or freshly cooked -- or in some instances frozen whole or as frozen meat. As a result, crab processing is normally restricted to areas near crab fishing grounds. Three distinct areas exist, Alaska, the Dungeness crab areas of California, Oregon and Washington and Blue crab areas along the Atlantic and Gulf States. Data on crab are not as detailed as for shrimp. Of the total canned pack, Blue crab accounts for 52.8 percent, Dungeness crab 13 percent, King crab 24.6 percent and Tanner or Snow crab 9.6 percent. Alaska is the most important crab canning state, accounting for 38 percent of the total pack (Table I-7).

Fresh and Frozen - The crab freezing industry is divided along the same species and geographic lines as was described for canning operations. In addition, there are four major product forms: (1) cooked meat, (2) whole cooked crab, (3) cooked sections and (4) specialty products. All crab is sold cooked.

The principal crab freezing states, 1971, are as follows (Table I-8).

Table I-7. Crab meat, canned pack, volume by state and species, 1971

State	Pack, thou. std. cases	Percent of total
Alaska		
Dungeness	5,291	3.8
King	33,974	24.6
Tanner	13,278	9.6
Total	52,543	38.0
California, Oregon Washington		
Dungeness[1/]	12,737	9.2
Maine, N. Car., S. Car. Mississippi		
Blue[1/]	73,079	52.8
Total, U. S.	138,359	100.0

[1/] Data unavailable by individual state.

Source: Canned Fishery Products, 1971, U. S. Dept. Commerce, UNFS Current Fishery Statistics No. 5901.

Table I-3. Pack of fresh and frozen crab, by species, state and form, 1971

State		Dungeness				King				Tanner & Stone			Blue & Rock	
		Cooked meat	Whole cooked	Sect.	Spec.	Cooked meat	Whole cooled	Sect.	Spec.	Cooked meat	Whole cooked	Sect.	Cooked meat	Spec.
		(000 lb)												
New England -	Me.												107	
	Mass.												(1)	(1)
Mid Atlantic -	N. Y.								(1)					(1)
	N. J.													(1)
	Pa. & Del.													3,791
Chesapeake -	Md.												3,002	1,228
	Va.												3,683	237
S. Atlantic -	N. Car.												2,482	115
	S. Car.												591	
	Ga.												1,005	338
	Fla. E. Coast												1,159	(1)
Gulf -	Fla. W. Coast												1,402	521
	Ala.												322	(1)
	Miss.												498	
	La.												618	437
	Tex.												687	(1)
Pacific -	Alaska	115	1,283	948	--	9,884	24	6,266	--	1,175	11	691		
	Wash.	1,421				361				136				
	Ore.	2,080				1,220								
	Calif.	1,298	100		(1)									
Total U. S.		4,915	1,383	948	Neg.	11,465	24	6,266	Neg.	1,311	11	691	15,592	9,749

(1) Included in U. S. totals.

Source: Processed Fishery Products, Annual Summary, 1971, CFS No. 5093, NMFS, U. S. Department of Commerce

State	Percent of Total
Alaska	39.0
Maryland	8.1
Virginia	7.5
Oregon	6.3
Florida	5.9
North Carolina	5.0
Washington	3.7
Other States	24.5
Total	100.0

These data illustrate two important points concerning the freezing of crab: (1) Alaska dominates the industry, freezing nearly five times as much as any other one state and (2) with the exception of Alaska, crab freezing operations are widely distributed among coastal states no one of which produces more than 10 percent of the total pack.

The pack of frozen crab, by species, in 1971 was as follows:

Species	Percent of Total
Blue (includes Rock)	48.4
King	33.9
Dungeness	13.9
Tanner (includes Stone)	3.8

The freezing of Blue crab is widely distributed along the Eastern and Southern Coasts, but the freezing of King and Tanner crab is largely restricted to Alaska and Dungeness crab processing is distributed from Alaska to California.

By type of product, cooked meat-picked from the shell and body, is the principal product frozen, accounting for nearly two-thirds of the total. Specialty products accounted for 18.6 percent, 15.1 percent was frozen as cooked sections and whole frozen crab represented 2.7 percent of the total.

F. Supply Conditions

Supply, as opposed to a rapidly increasing demand, is, in the minds of the seafoods processing industry, the greatest single problem confronting the industry today. In general, offshore U. S. fisheries for most commercial species, including tuna, shrimp and crab, have declined in productivity and U. S. fishing fleets face increasing competition from foreign fleets in international fishing grounds. The situation is further confused by varying national claims to offshore fishing rights (from 3 to 12 to 200 miles) which has resulted in the impounding of U. S. vessels in such countries as Peru and the recent "Icelandic Cod War" between Iceland and Great Britain. The proposed Law of the Sea Conference in 1974 will address itself to these problems but no immediate solution appears to exist. The catch of some species, such as tuna, is regulated by International Commissions or Agreements, but varying degrees of inspection and enforcement tend to put U. S. fishermen at a disadvantage.

As a result of supply limitations on the domestic catch, the seafoods processing industry has been forced to turn increasingly to imported materials. However, basic processing is still done in U. S. plants. If, as a result of increased effluent control costs, returns to the U. S. processing industry are lowered so much as to become unattractive, it is entirely possible that a greater part of the processing of imported fish and shellfish stocks may be transferred overseas.

Tuna Supplies

The supply of tuna, from both U. S. landings and imports, is shown in Table I-9 and Figure I-1 for the period 1962-1972. A steady growth in both U. S. landings and imports is seen. U. S. landings increased from 340.9 million pounds in 1962 to 524.4 million (a record) in 1972 -- a gain of 54 percent. However, much of this increase came from the growth of the tuna industry in Puerto Rico. Of the total 1962-72 increase of 183 million pounds, 118 million, or 64 percent, was accounted for by the growth of the Puerto Rican industry.

Imports of fresh and frozen fish for processing in the U. S. gained 400 million pounds, more than double the U. S. increase, the imports of canned tuna remaining relatively unchanged. 1972 imports of 764.8 million pounds exceeded the previous record level of 506.6 million pounds by over 50 percent.

The canned pack of tuna in 1972, 616.6 million pounds, was the largest on record, exceeding the 1971 pack, the second highest on record, by 40 percent (Table I-9). Imported raw materials (fresh and frozen tuna)

Table I-9. Supply of tuna, 1962-72

Year	U.S. Landings			Imports		
	Atlantic Gulf, and Pacific Coast States and Hawaii	Puerto Rico	Total	Fresh and frozen including cooked loins and discs 1/	Canned	
					In oil	In brine
	--Thousand pounds--					
1962	312,157	28,790	340,947	364,528	358	56,361
1963	321,619	37,026	358,645	320,910	224	57,270
1964	305,829	48,393	354,222	379,242	201	54,446
1965	318,895	54,576	373,471	378,637	211	50,750
1966	269,172	64,698	333,870	449,840	160	61,400
1967	328,368	97,882	426,250	387,142	186	65,135
1968	293,868	107,660	401,528	422,108	150	67,023
1969	324,884	96,268	421,152	414,453	158	72,958*
1970	*393,494	84,852 2/	478,346	464,583	153	72,109
1971	348,040	128,770 2/	476,810	506,602	1,050	58,792
1972	377,569	146,806* 2/	524,375*	764,784*	384	56,129

* Record. 1/ Round weight. Includes landings in American Samoa of foreign-caught fish. 2/ Includes a small quantity of fish landed in American Samoa by U.S. vessels.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics, 6100.

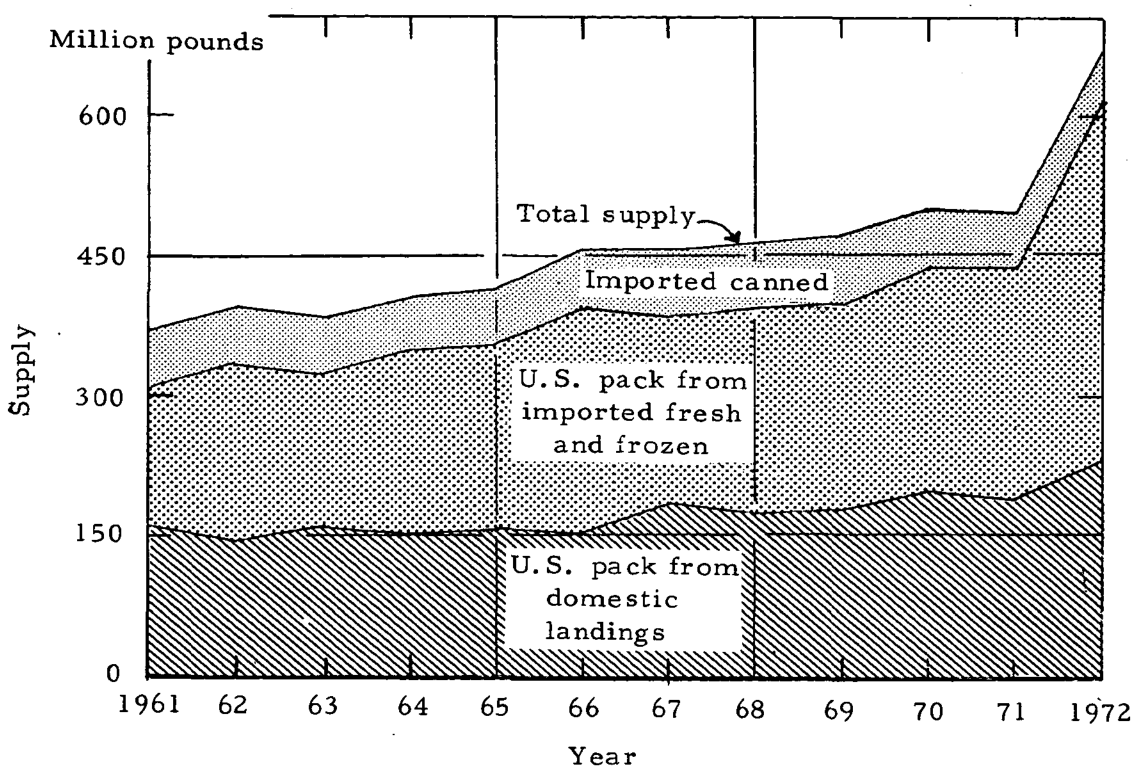

Figure I-1. Supply of tuna, 1961-1972, by source.

Table I-10. Supply of canned tuna, 1962-72

Year	U.S. pack from domestic Landings 1/		U.S. pack from imported fresh and frozen tuna 2/		Total	Imported canned		Total supply
	Thousand pounds	Percent	Thousand pounds	Percent	--Thousand pounds--		Percent	Thousand pounds
1962	147,586	37.6	187,920	47.9	335,506	56,719	14.5	392,225
1963	160,822	41.8	165,890	43.2	326,712	57,494	15.0	384,206
1964	154,208	38.1	195,626	48.4	349,834	54,647	13.5	404,481
1965	161,515	39.5	196,890	48.1	358,405	50,961	12.4	409,366
1966	153,231	33.6	241,037	52.9	394,268	61,560	13.5	455,828
1967	183,236	40.3	205,609	45.3	388,845	65,321	14.4	454,166
1968	176,524	38.1	219.433	47.4	395,957	67,173	14.5	463,130
1969	181,786	38.6	216,651	45.9	398,437	73,116*	15.5	471,553
1970	203,531	39.9	234,109	45.9	437,640	72,262	14.2	509,902
1971	194,967	39.1	243,774	48.9	438,741	59,842	12.0	498,583
1972	230,333*	34.2	386,282*	57.4	616,615*	56,513	8.4	673,128*

*Record. 1/ Includes pack from landings in Puerto Rico and American Samoa by U.S. vessels. 2/ Includes tuna canned in American Samoa from foreign-caught fish.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100.

accounted for 57.4 percent of the total supply of canned tuna and imports of canned tuna added 8.4 percent more, for a total of 66.2 percent (nearly two-thirds) from imported sources. It is interesting to observe that while imports of fresh and frozen tuna for processing in the U. S. have risen dramatically, imports of canned product have been relatively stable, exceeding the quota only one year (1970) since 1960 (Table I-11).

Shrimp Supplies

In response to a growing U. S. demand, the supply of shrimp has increased even greater than was true for tuna, rising from 267.6 million pounds, heads-off basis in 1960 to a record 487.5 million pounds in 1972, a gain of 82 percent. U. S. landings increased 58 percent during the 1960-72 period, but imports gained 113 percent during the same period. In 1972, over 50 percent of the total U. S. shrimp supply came from imports (Table I-12 and Figure I-2).

Imports by Product Form

An increasing amount of the total shrimp imports are coming in peeled, not breaded (Table I-13), this category increasing from 27.4 million pounds in 1964 to 90.1 million in 1972, a gain of 229 percent compared to an increase for shell-on imports from 112.1 million pounds in 1964 to 126.8 million in 1972, a gain of 13 percent. Breaded shrimp imports, although small -- 1.3 million pounds -- were up 160 percent over 1964. Imports of peeled, canned shrimp remained relatively constant at about 3 million pounds. The substantial increase in peeled imports indicates that an increasing amount of total shrimp imports are being processed (peeled) in foreign countries (or on board foreign vessels) probably because of lower labor costs. However, should U. S. shrimp processing costs increase as a result of water pollution controls, this trend toward overseas processing would be further accentuated.

Shrimp Imports by County of Origin

Mexico and Central America represents the major area from which U. S. shrimp imports are drawn. In reality, an even larger proportion of the total shrimp supply comes from Latin American waters as the U. S. shrimp fleet also fishes in these areas. These countries accounted for 51 percent of U. S. shrimp imports in 1972, compared to 56 percent of our imports in 1967. However, in absolute terms, shrimp imports from

Table I-11. Quota and imports of canned tuna not in oil, 1960-72

Year	Quota 1/	Imports	
		Under quota 2/	Over quota 3/
	Thousand pounds		
1960	53,448	50,322	-
1961	57,115	56,210	-
1962	59,059	54,379	-
1963	63,131	56,414	-
1964	60,912	52,931	-
1965	66,059	49,204	-
1966	65,662	57,987	-
1967	69,472	62,275	-
1968	66,985	64,907	-
1969	71,703	71,333	-
1970	70,146	70,146	902
1971	77,296	55,638	-
1972	78,532	54,449	-

1/ Imports have been subject to tariff quotas since April 14, 1956, and are based on 20 percent of the previous year's domestic pack excluding American Samoa.

2/ Dutiable in 1956-67 at 12.5 percent ad valorem; 1968, 11 percent; 1969, 10 percent; 1970, 8.5 percent; 1971, 7 percent; and in 1972, 6 percent.

3/ Dutiable in 1971 at 15 percent ad valorem; and in 1972 at 12.5 percent ad valorem.

Source: Department of the Treasury, Bureau of Customs. (Data in this table will not agree with tuna import data released by the Department of Commerce, Bureau of the Census.)

Table I-12. Supply of shrimp, 1960-1972

Year	U.S. Landings			Imports [1]			Total, heads-off
	Heads-on	Heads-off	Percent of total	Import weight	Heads-off	Percent of total	
	Thousand pounds		Percent	Thousand pounds		Percent	Thousand lbs.
1960	249,452	148,483	55.5	113,418	119,139	44.5	267,622
1961	174,530	103,865	43.6	126,268	134,564	56.4	238,429
1962	191,105	119,154	43.9	141,183	152,504	56.1	271,658
1963	240,478	150,737	47.4	151,530	167,344	52.6	318,081
1964	211,821	133,113	44.0	154,577	169,510	56.0	302.623
1965	243,645	152,346	46.0	162,942	178,955	54.0	331,301
1966	239,046	148,255	43.2	178,549	194,946	56.8	343,201
1967	307,787	189,972	48.5	186,073	202,105	51.5	392,077
1968	299,289	184,065	46.7	189,455	210,063	53.3	394,128
1969	318,537	195,002	47.1	193,741	218,697	52.9	413,699
1970	367,468	224,272	47.7	218,715	245,658	52.3	469,930
1971	*387,932	*236,328	52.5	191,295	213,857	47.5	450,185
1972	384,952	234,432	48.1	*223,226	*253,065	51.9	*487,497

[1] Imports were converted to heads-off weight on the basis of available data on the actual condition of the imports. *Record.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U. S. Dept. of Commerce, Current Fishery Statistics No. 6100.

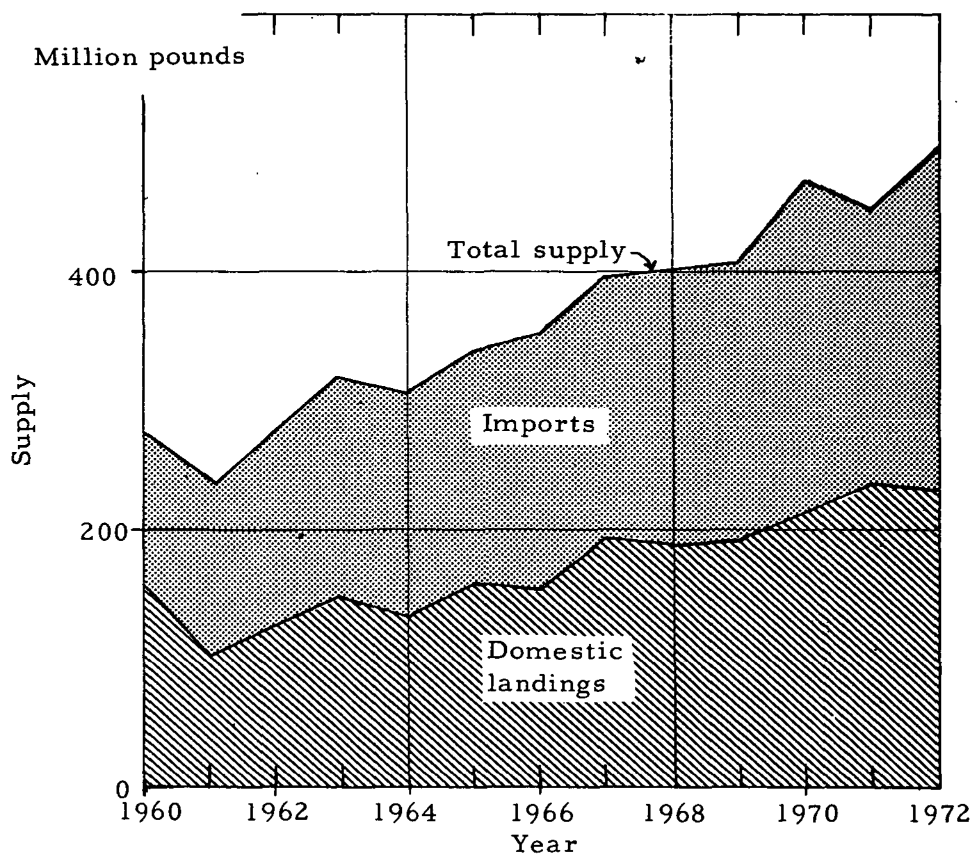

Figure I-2. Supply of shrimp, 1960-1972. (Heads-off weight)

Table I-13. Imports of shrimp, by product types

Year	Shell-on headless	Peeled canned	Not breaded Raw	Not breaded Other	Breaded	Unclassified	Total
			(thousand pounds)				
1964	112,149	3,004	27,385	2,989	508	8,542	154,577
1965	114,177	2,248	31,961	3,290	778	10,488	162,942
1966	129,919	1,547	37,233	2,565	527	6,758	178,549
1967	131,927	2,225	38,959	2,133	830	9,999	186,073
1968	128,042	4,307	47,450	1,809	1,567	6,247	189,455
1969	121,243	3,583	63,792	3,814	1,259	-	193,741
1970	139,978	3,876	69,501	3,946	1,414	-	218,715
1971	123,926	2,742	60,136	3,279	1,212	-	191,295
1972	126,771	1,123	90,143	3,866	1,323	-	223,226

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100.

Mexico and Central America increased from 104 million pounds in 1967 to 114 million in 1972 (Table I-14). Imports from South America rose from 32.5 million pounds in 1967 to 43.9 million in 1972, a gain of 35 percent and now constitute 19.7 percent of total imports. The other major source of imports is Asia and the Mid East (primarily India) where exports to the U. S. rose from 45.9 million pounds in 1967 to 60.0 million in 1972, a gain of 30.6 percent. This area now contributes 26.9 percent of the total U. S. imports. Imports from Australia and Oceania and from Africa, although small, are growing whereas imports from Europe are decreasing in response to increased demand for shrimp in Europe.

Supply of Canned Shrimp - Although the U. S. pack of canned shrimp has increased from 19 million pounds to 24 million pounds in recent years, imports of canned shrimp have decreased from 4.3 million pounds in 1968 to 1.1 million in 1972 and exports (mainly to Canada and the United Kingdom) have risen from 4.5 to 8.5 million pounds with the result that the net supply of canned shrimp available for U. S. consumption has decreased and is lower than it was ten years ago (Table I-15).

Supply of Frozen Shrimp - In contrast to the relatively stable supply of canned shrimp available for U. S. consumption, the supply of frozen shrimp has increased dramatically since 1967, from 103.3 million pounds to 141.4 million in 1972, a gain of 37 percent (Table I-16). However, a substantial part of this volume is "refrozen" shrimp from imported frozen blocks of shrimp which are thawed, peeled, packaged and refrozen by U. S. freezers.

Crab Supplies

U. S. landings of crab have decreased since 1967 and imports of canned crab have remained relatively steady (Table I-17). However, the composition of the crab catch is changing. Blue crab supplies have remained relatively constant, but catch of King and Dungeness crab has decreased. Tanner crab and other species such as Jonah and Red crab have come into commercial use. These changes are shown by the following data:

Table I-14. Imports of shrimp, by country of origin, 1967-1972

Country	Imports - 1,000 lbs.					
	1967	1968	1969	1970	1971	1972
North America						
Mexico	70,460	59,948	56,239	72,018	74,624	80,681
Panama	11,126	10,730	9,927	11,613	9,316	10,105
Nicaragua	5,053	5,627	7,206	6,021	5,639	6,605
El Salvador	6,724	4,639	5,026	6,354	6,707	5,735
Honduras	1,922	2,981	3,925	2,626	3,942	4,811
Other countries	8,686	10,754	9,111	11,937	7,751	6,212
Total	103,971	94,679	91,434	110,569	107,979	114,149
South America						
Venezuela	4,773	5,403	5,851	11,563	10,083	7,995
Ecuador	5,986	6,289	8,901	5,992	5,332	6,935
Guyana	9,452	8,349	8,155	10,165	8,981	6,906
Brazil	2,726	3,018	3,703	4,802	4,406	8,931
Colombia	176	1,619	3,707	2,065	4,841	5,979
French Guiana	6,717	7,820	6,037	5,054	3,808	3,622
Other countries	2,623	3,856	3,993	3,937	2,616	3,515
Total	32,453	36,354	40,347	43,578	40,067	43,883
Europe (Total)	1,675	1,366	1,235	992	1,131	1,225
Asia & Mid-East						
India	18,436	22,133	34,357	33,570	22,770	33,524
Pakistan	7,457	5,475	5,409	7,125	2,924	3,978
Kuwait	-	-	-	-	2,173	2,295
Other countries	20,034	37,756	18,357	17,418	7,185	20,188
Total	45,927	54,414	58,123	58,062	35,052	59,985
Australia & Oceania	671	1,601	1,514	1,608	3,058	1,497
Africa	1,376	1,041	1,088	3,906	4,008	2,487
Grand Total	186,073	189,455	193,741	218,715	191,295	223,226

Table I- 15. Supply of canned shrimp, 1960-72

Year	U.S. pack	Imports	Exports Domestic	Exports Foreign	Total for U.S. consumption
	Thousand pounds				
1960	14,268	(1)	3,482	34	(1)
1961	9,284	(1)	2,503	25	(1)
1962	13,249	(1)	2,212	44	(1)
1963	15,904	4,120 2/	3,199	33	16,792
1964	9,740	3,004	3,692	25	9,027
1965	15,629	2,248	4,510	34	13,333
1966	14,201	1,547	4,479	33	11,236
1967	16,851	2,225	5,255	19	13,802
1968	18,967	4,307*	4,467	20	18,787
1969	20,729	3,583	5,682	39	18,591
1970	25,125*	3,876	6,076	50	22,875*
1971	22,345	2,742	8,334	-	16,753
1972	23,795	1,123	8,450	8	16,460

1/ Data not available. 2/ Partly estimated. * Record.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100.

Table I-16. Freezings of shrimp and crab, 1967-1972

Year	Freezings (000 lbs.)	
	Shrimp	Crab
1967	103,322	6,566
1968	127,031	6,692
1969	128,006	4,340
1970	137,191	5,393
1971	146,691	7,659
1972	141,368	10,018

Table I-17. Supply of fresh crab and canned crab meat, 1967-1972

Year	U.S. Landings	Imports of canned crab
	(000 lb. live wt.)	(000 lb. canned)
1967	315,180	2,160
1968	238,500	4,635
1969	246,000	3,436
1970	268,500	2,765
1971	276,374	3,723
1972	281,077	2,547

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100.

Species	1967 (000 lb)	1972 (000 lb)
Blue	145,027	145,356
Dungeness	42,437	26,917
King	127,716	74,010
Tanner	Neg.	28,994
Other	Neg.	5,800
Total	315,180	281,077

In contrast to shrimp, imports of crab for processing in the United States are negligible. Most crab are landed live and cooked immediately prior to freezing or canning and importing live crabs is not practicable. Imports of canned crab meat have declined in recent years as compared to the early 1960's.

U. S. Pack of Processed Crab - The composition of the U. S. pack of processed crab has changed markedly since 1966. In 1966 there was a record canned crab pack of 11 million pounds, but the canned pack has decreased steadily since that time and was only 2.4 million pounds in 1972 (Table I-18). At the same time, freezings of crab increased from 6.6 million pounds in 1967 to 10.0 million in 1972 (Table I-16).

Catfish Supplies

The catfish processing industry operates primarily on pond-reared catfish produced in the Central South and the Midwest. In 1970 there were 1,642 producers producing catfish on 40,406 acres of ponds in the United States. Major producing states, in 1970, were as follows:

State	Acres
Mississippi	13,827
Arkansas	10,300
Texas	3,916
Alabama	3,439
Louisiana	3,042
Georgia	1,975
Other States	3,907
Total	40,406

Acreage in 1971 is estimated at 43,100.

Size of individual producing units varied from less than one acre to more than a thousand acres.

Table I-18. Supply of canned crab meat, 1960-72

Year	U.S. pack	Percent of total supply	Imports	Percent of total supply	Total supply
	Thousand pounds	Percent	Thousand pounds	Percent	Thousand pounds
1960	4,115	47.7	4,507	52.3	8,622
1961	5,000	54.1	4,237	45.9	9,237
1962	5,621	61.6	3,505	38.4	9,126
1963	7,356	58.1	5,296	41.9	12,652
1964	6,567	59.3	4,508	40.7	11,075
1965	9,139	68.8	4,152	31.2	13,291
1966	11,002*	83.1	2,233	16.9	13,235
1967	9,707	81.8	2,160	18.2	11,867
1968	4,019	46.4	4,635	53.6	8,654
1969	5,027	59.4	3,436	40.6	8,463
1970	5,097	64.8	2,765	35.2	7,862
1971	3,213	46.3	3,723	53.7	6,936
1972	2,406	48.6	2,547	51.4	4,953

* Record. Record imports, 13,507,000 pounds in 1939.
Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100

Collection of data on farm-raised catfish production was begun in 1967. In that year there was an estimated production of 13.7 million pounds of farm-raised catfish, compared to 38.1 million in 1971. Although the industry has grown, it is still experiencing problems concerned with processing and marketing the processed fish.

Data on processing volume were available only for 1970, 1971, and 1972 as follows:

Year	Processed Volume (000 lbs)
1970	3,438
1971	6,741
1972	10,977

Catch of wild catfish varies from 30 to 38 million pounds per year. However, virtually all of these fish are consumed fresh.

Catfish imports (frozen) vary between 3 to 5 million pounds annually. They come mainly from Brazil and are used by fish stick manufacturers and other processors of fabricated fish items.

G. Employment

Employment in the seafoods processing has a pronounced seasonal pattern and within a processing season has intermittent ups and downs depending on the landings of fish and shellfish which determine the supply available to processors.

No published data are available which relate to employment by specific segments of the industry, i.e. tuna, shrimp, crab and catfish. Industry-wide data on employment in the seafoods processing industry are shown in Tables I-19 and I-20. For seafoods products canning plants, 50 percent of the plants employ fewer than 20 people, 90 percent fewer than 100, 98 percent fewer than 250 and only one plant employed over 1,000 people. For plants processing fresh or frozen packaged fish, 52 percent employed fewer than 20 people, 92 percent fewer than 100 and no plant employed over 999.

Contacts made with plants in industry showed the following ranges in employment.

Table I-19. Employment, by size of establishment, canned and cured seafoods, 1967[1/]

Number of employees	Number of plants
1 - 4	84
5 - 9	25
10 - 19	50
20 - 49	81
50 - 99	46
100 - 249	26
250 - 499	4
500 - 999	3
1,000 - 2,499	1

1/ U. S. Department of Commerce, Census of Manufactures, 1967.

Table I-20. Employment, by size of establishment, fresh or frozen packaged fish[1/]

Number of employees	Number of plants
1 - 4	123
5 - 9	54
10 - 19	79
20 - 49	134
50 - 99	65
100 - 249	25
250 - 499	11
500 - 999	6

1/ U. S. Department of Commerce, Census of Manufactures, 1967.

Tuna processors	-	200 - 1,800 employees
Combined shrimp and crab	-	15 - 85, average 48
Shrimp processors	-	10 - 30, average 25
Crab processors	-	15 - 95, average 50
Catfish processors	-	5 - 25, average 14

It becomes virtually impossible to isolate "shrimp or crab" employment from other employment in many plants since these are often multi-product finfish and shellfish processors. Tuna processors tend to be more specialized, although most plants also process other species, and catfish processors normally only process catfish.

Employment is highly seasonal, as related to landings of the particular species. Processing seasons will run from 100 - 200 days. As with any seasonally-produced product employment starts low, builds to a peak and then decreases as the season draws to a close. Variation in employment during the processing season may vary as much as 200 percent, with double-shift operations common during peak periods.

Shrimp and crab operations employ large numbers of women as "peelers" and "pickers". In the Pacific Coast area many of these workers are of Oriental or Mexican extraction and in the Northwest and Alaska, substantial numbers of Indians and Eskimos are used. Thus, these processing operations provide substantial temporary employment opportunities for minority ethnic groups and plant closures would result in severe unemployment in these groups which are not ordinarily mobile.

II. FINANCIAL PROFILES

Basic investment and operating costs for the seafoods industry are not available in published form nor is such information generally available from firms in the industry. The development of investment and operating costs for specific products, e.g. tuna, shrimp or crab, becomes particularly difficult where these products are processed as part of multi-product plant operations. In addition, many of the major processors are parts of conglomerates or diversified food processors so that analysis of financial statements given in annual reports or of data given in such publications as Standard and Poors reveals little about the costs and returns from the seafood processing operations of these corporations.

The situation is further complicated by the fact that the age and construction of seafoods processing plants varies greatly from plant to plant. Although the tuna processing industry is more nearly "standardized" in terms of types of plants than other segments of the industry, virtually no data on investments and operating costs are available. Shrimp and crab processors operate from a variety of facilities. Some are parts of diversified seafoods processing plants, some have "floater" plants based on barges, converted ferries, obsolete "Liberty" ships or other hulls, and some operate out of shore-based plants which vary from ramshackle operations in old waterfront buildings to new, modern, specialized processing plants.

There have been no meaningful studies of the costs of processing seafoods conducted by universities or by the National Marine Fisheries Service. In its evaluation of the market research and service programs of the National Marine Fisheries Service, reported in October, 1972, Development Planning and Research Associates, Inc. recommended that priority be given to costs of processing seafoods and to economies of scale in the processing of seafoods. However, no work has been initiated in this area, nor does it appear that such research will be undertaken in the near future. An opportunity may exist for the establishment of such research by the Sea Grants Institutes -- associated with about 25 universities, but to date most Sea Grant funds have been allocated to biological or physical research.

The pond catfish industry, as an extension of farming operations, has been studied to a limited extent by the U. S. Department of Agriculture and by Land Grant Agricultural Experiment Stations. However, most emphasis has been given to catfish production. In spite of this, more information on investment and processing costs and returns is available for this industry than is true for seafoods processing.

Faced with this situation, DPRA has been forced to develop its own estimates of investment and operating costs based on such data as are available from a variety of unpublished sources and on personal contacts with firms engaged in seafoods processing. Due to the limited amount of time available for Phase I, it has not been possible to contact representatives of all segments of the industry. Personal discussions have been held with representatives of the Pacific Coast seafoods industry from Kodiak, Alaska to San Diego, California. However, no contacts have been made with the Blue crab or shrimp industries of the Eastern and Gulf areas, nor with the tuna processors in Puerto Rico. Contacts with these segments of the industry are planned during Phase II of this project.

As a result, the processing costs and returns developed by DPRA must be considered as preliminary and approximate. However, it is believed that they are representative within a range of ± 10-15 percent of the situation existing for processors of the products studied.

Tuna Processors

The tuna processing industry is primarily composed of firms which are, in turn, parts of conglomerates or large, diversified food canners. As such, the financial profile of the parent company or conglomerate is an important factor dictating the financial status of the tuna processor.

Earnings as a Percent of Sales

Composite industry data for the canned foods industry, which includes such firms as Heinz (Starkist), Van Camp and Del Monte -- all of which are major tuna packers -- shows earnings as a percent of sales varying from 3.1 to 4.3 during the period 1965-1970, with earnings in 1970 of 3.4 percent of sales. Contact with representatives of the tuna industry and review of other financial performance data on this industry, indicate that industry earnings in the seafoods processing industry are, in fact, in the area of 3-4 percent on sales. Analysis of the earnings 1967-1972 of a major, specialized seafoods processor showed average earnings of 3.5 percent on sales.

Plant Description - Tuna Cannery

The representative plant as considered in this analysis is a large-scale plant, specialized in the canning of tuna, but also producing pet food (cat food) from fish by-products and non-fish ingredients.

Processing Methods - Most tuna canned in the United States are caught in distant waters. A modern tuna boat can hold 150 to 300 tons of fish and has a range of approximately 1,000 miles. Because of the extended fishing times, the fish are normally frozen aboard the fishing vessels. The fish usually are unloaded (while frozen) by mechanical hoists and conveyed to the weighing station. After weighing the fish are inspected and thawed.

Tuna are eviscerated by hand in several steps. The body cavities are flushed with fresh water and all adhering viscera carefully removed. The viscera are used for fish meal or pet food and the livers are sometimes recovered for oil and vitamins.

After butchering, the fish are precooked in large, open chambers. The time of cooking varies with the body size, but is usually about three hours. Weight loss during cooking (attributable to oil and moisture loss) averages 22 to 26 percent.

The cooked fish are cooled for approximately 12 hours to firm the flesh. The meat is separated by hand from the head, bones, fins and skin. All dark meat is removed and usually recovered for pet food. The meat to be canned is placed on a conveyor belt and transferred to the "Pak-Shaper" machine.

The tuna slices are arranged lengthwise in the Pak-Shaper. This device molds the loins into a cylinder, fills the cans and trims the meat after filling. The machine can fill from 125 to 150 cans per minute.

Salt and vegetable oils or water are next added to the cans and they are vacuum sealed and retorted by standard procedures. The entire process is diagrammed on Figure II-1.

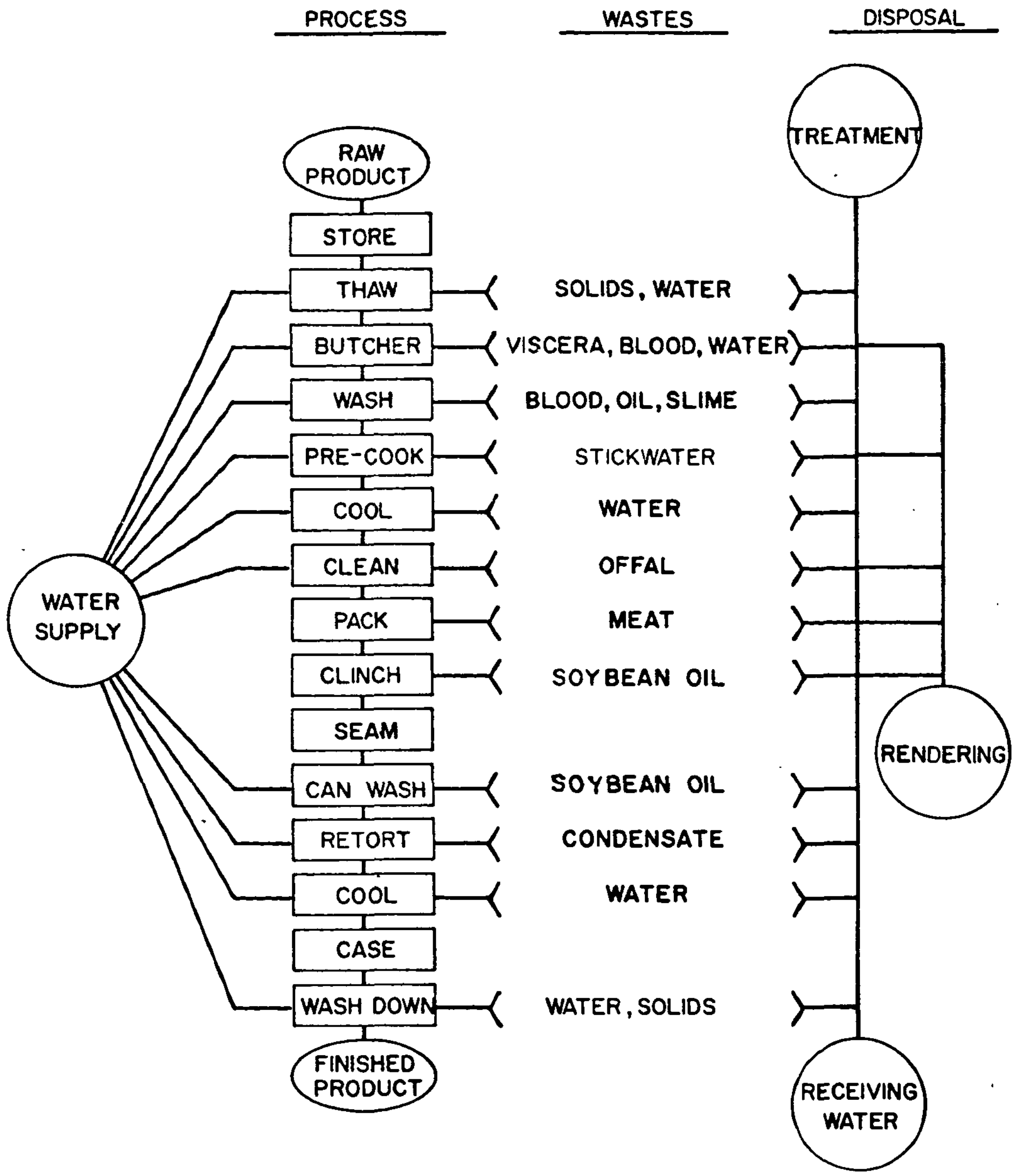

FIGURE II-1. TUNA CANNING

Processing volume - Tuna canneries are normally large-scale, specialized plants. However, in some instances, tuna may be canned in combination with salmon or other fish or shell fish.

Plant capacity for the representative plant used in this analysis is approximately 350 tons of raw product (tuna) per eight-hour shift. Annual pack is approximately 1,600,000 standard cases of tuna (48 half-pound cans).

Pet food production is considered to be completely separate from the tuna processing operations, but an allowance was made for the sale of tuna by-products to the pet food division.

Operating costs and gross margin - Estimated costs of canning tuna are shown in Table II-1. Raw material costs account for 68 percent of total operating costs, labor (11.4%) and cans and cases (9.7%) being the other two major items. Since it is assumed that all tuna canning operations are large-scale or are part of large-scale diversified seafoods processing firms, no economies of scale are postulated. However, it is recognized that with existing plants, the degree of utilization of capacity is an important factor influencing unit costs.

Total costs are $17.60 per case vs. revenue of $18.45, resulting in a gross operating margin of $.85 per case.

Earnings and Cash Flow - Model Tuna Plant

Earnings and cash flow for the model tuna plant are shown in Table II-2. These estimates were developed by DPRA from a variety of sources including published prices for fish and canned product, annual reports of firms in the industry, industry contacts, unpublished research and extablished financial operating ratios. In the absence of actual financial data from the tuna processing industry, they must be considered as preliminary estimates, but it is believed that they approximate conditions existing in the tuna processing industry.

Annual throughput of 1.6 million cases is based on average 1971 pack for major California tuna packers. Given a price of $18.45 per case (including by-product credits) results in sales of $29,160,000 and operating expenses of $28,160,000 (Table II-1), cash earnings of $1,680,000 result. Deducting depreciation and interest paid results in 1972 pre-tax income of $545,850 and after-tax income of $283,842. Investment, working capital and current liabilities were estimated from industry financial ratios. Pre-tax return on investment for 1972 is 6.1 percent, after-tax ROI is 3.2 and return on sales pre-tax is 1.8 percent and after-tax 0.9 percent.

Table II-1. Estimated cost of canning tuna, 1972, dollars per case[1/]

Item	Cost	Percent of total cost
Raw product - fish	12.00	68.1
Direct labor and related costs	2.00	11.4
Cans and cases	1.70	9.7
Condiments (salt and oil)	.45	2.6
Warehouse	.35	2.0
General and administrative	1.10	6.2
Total cost	17.60	100.0
F.O.B. plant revenue	18.45	--
Income (over cost) per case	.85	--

1/ Per case of 48, half pound cans.

Table II-2. Estimated earnings and cash flow for tuna canning plant, 1972

Item	Amount
Annual throughput (cases)	$1,600,000
Sales, at $18.45 /case	29,160,000
Operating expenses at $17.60/case	28,160,000
Cash earnings	1,360,000
Depreciation (5% replacement cost)	223,750
Interest	590,400
Pre-tax income	545,850
After tax income	283,842
Annual cash flow	507,600
Replacement investment	8,950,000
Working capital	10,332,000
Average fixed assets	4,475,000
Working capital	10,332,000
Current liabilities	5,904,000
Average fixed investment	8,903,000
Pre-tax ROI (Percent)	6.1
After-tax ROI (Percent)	3.2
Pre-tax ROS (Percent)	1.8
After-tax ROS (Percent)	0.9

Crab and Shrimp Processors

Crab and shrimp are processed in both canned and frozen form. Since initial preparation, up to the point of actual canning or freezing, is similar, many plants will combine canning and freezing production. The principal difference is that mechanically peeled shrimp are usually canned since texture and color is not as good as where shrimp are hand peeled.

Plant Description - Shrimp and Crab Processing

The representative shrimp plants considered in this analysis process shrimp for both canning and freezing and also can and freeze crab.

Products produced include canned and frozen shrimp and canned and frozen crab. Shrimp products include canned shrimp, frozen raw peeled shrimp, frozen cooked peeled shrimp and raw headless shrimp. The plant does not produce breaded shrimp or prepared shrimp specialties - these being produced by secondary processors. Products are packed in both institutional size and consumer size containers. Crab products include packed cooked meat, cooked sections and whole cooked crab. Cooked crab meat is processed both by canning and freezing. All other products are frozen only. No crab specialty products are produced.

Shrimp processing methods - Shrimp are caught commercially in otter trawls to a distance of approximately 50 miles offshore. The shrimp are separated from the trash fish and stored by various methods. When short storage times will suffice, no preservation methods are used; the shrimp are taken directly to a processing plant or to a wholesale marketing vessel. When longer storage times are necessary, the shrimp are iced in the holds and re-iced every 12 hours. In some cases, notably the Gulf states, the shrimp are beheaded at sea and the heads discarded. Since the heads contain most of the active degradive enzymes, this practice retards spoilage. If the shrimp are beheaded within 30 minutes after being caught, the intestinal vein is readily removed with the head. This increases the value of the product.

The shrimp are unloaded from the vessel into a flotation tank to remove the packing ice, conveyed to a rotary drum to remove surplus water and bits of debris, and then weighed. In some areas (Texas and the South Atlantic states), the shrimp are iced after the initial preparation to optimize peeling conditions.

Next the shrimp are peeled and picked, if the head is still attached, manually or by machine. Machine peeled shrimp are used mostly for canning. The machine-peeled shrimp are paler in color, and have poorer flavor and texture than the hand-picked product. By hand, a picker can peel from 100 to 400 pounds of shrimp per day as compared to a machine's capacity of 4,000 to 12,000 pounds per day. Nearly all Pacific Coast and Alaskan shrimp are machine-peeled, but manual operations are more important for the larger sizes of Gulf shrimp.

After peeling, the meats are inspected and washed. They are then blanched in a salt solution for about 10 minutes and dried by various methods to remove surface water. Again the shrimp are inspected and then canned. The process is outlined on Figures II-2 and II-3.

Crab Processing methods - Crabs are harvested from shallow water in baited traps. Rapid and careful handling is necessary to keep the crabs alive; dead crabs must be discarded because of rapid decomposition.

At most plants, the whole crabs are steam cooked in retorts for 20 to 30 minutes. Pacific Coast Dungeness crab operations first butcher the crabs (remove the backs), and then cook them for 12 minutes or less.

Cooked crabs are marketed in the shell, butchered or whole, or the meats, picked from the shell, are marketed fresh, frozen, or canned. The majority of the Atlantic blue crab meat is marketed fresh or frozen, but the majority of the Pacific Coast crab meat is canned. A large quantity of Dungeness crab is sold in the shell and large quantities of king crab are butchered at sea. Both practices minimize the quantity of butchering wastes to be handled at the processing plant.

The crabs are water cooled after cooking to facilitate handling. The backs are removed if the crabs were not butchered before cooking, and the remaining viscera are washed free. The cooking, cooling and washing waters contain considerable solids and organic pollutants (see Figures II-4 and II-5). The meat is picked from the shells by hand with a small knife. Mechanical methods have only recently been developed to extract the meat from the shells. Mechanical extraction known as "roller picking" involves passing crab legs and parts through a wringer-like set of rollers which bones out the meat.

Crab meat quickly degrades in quality and must be chilled, frozen or canned. Chilled meats can be stored for only a few days; even frozen meats lose texture and flavor qualities rapidly. Canning of crab meat results in additional wastewater flows: retort and can cooling waters. The canning and freezing processes are shown in Figures II-4 and II-5.

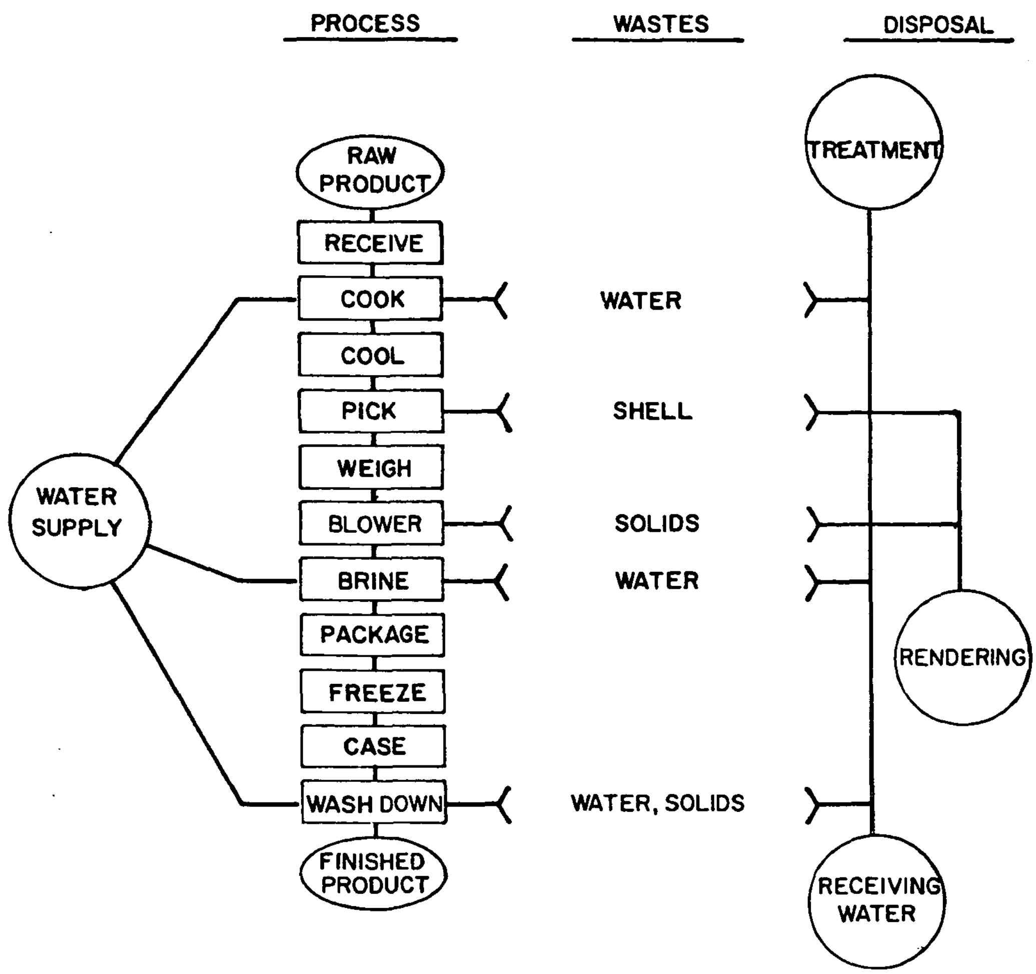

FIGURE II-2. SHRIMP HANDPICKING

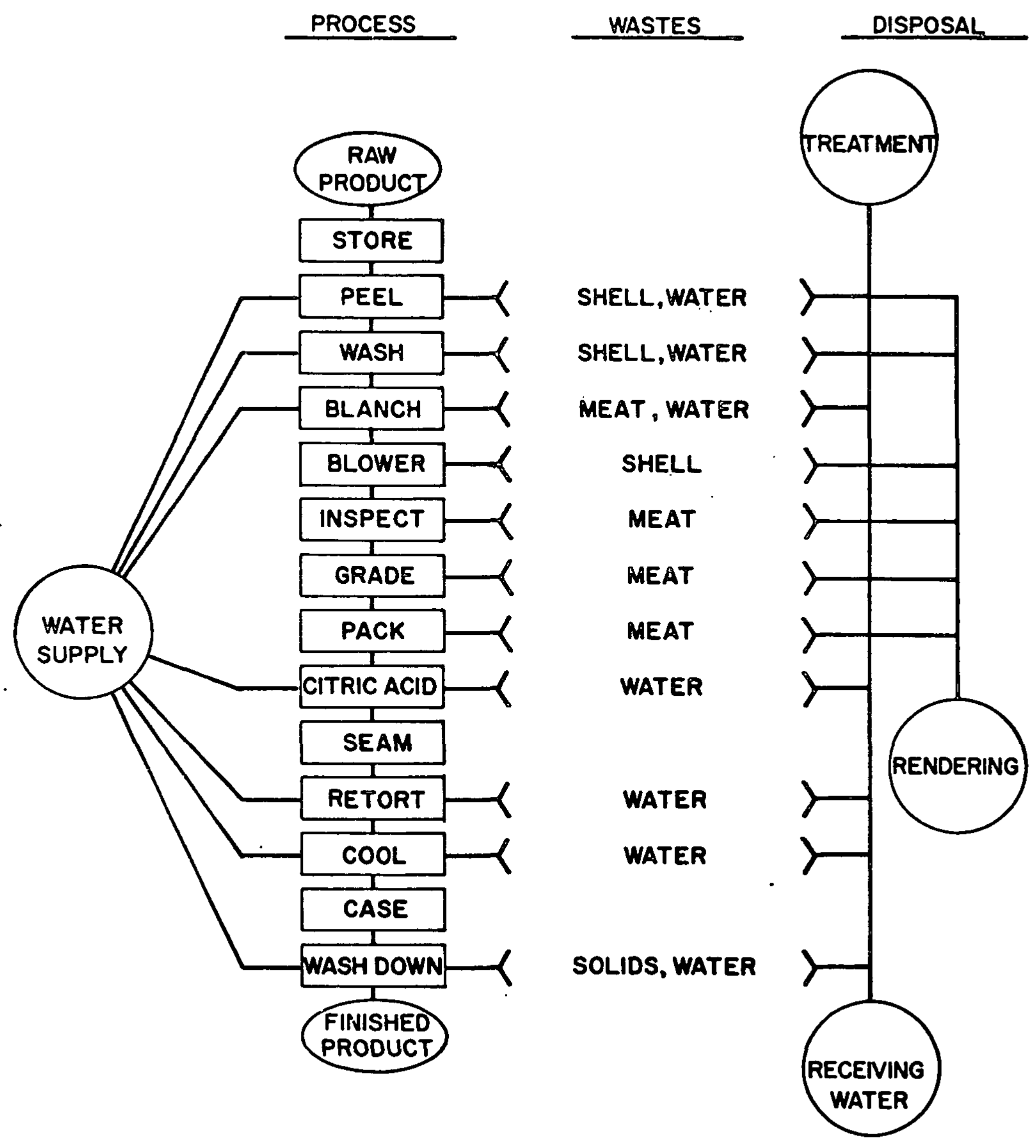

FIGURE II-3. MECHANICAL SHRIMP PEELING

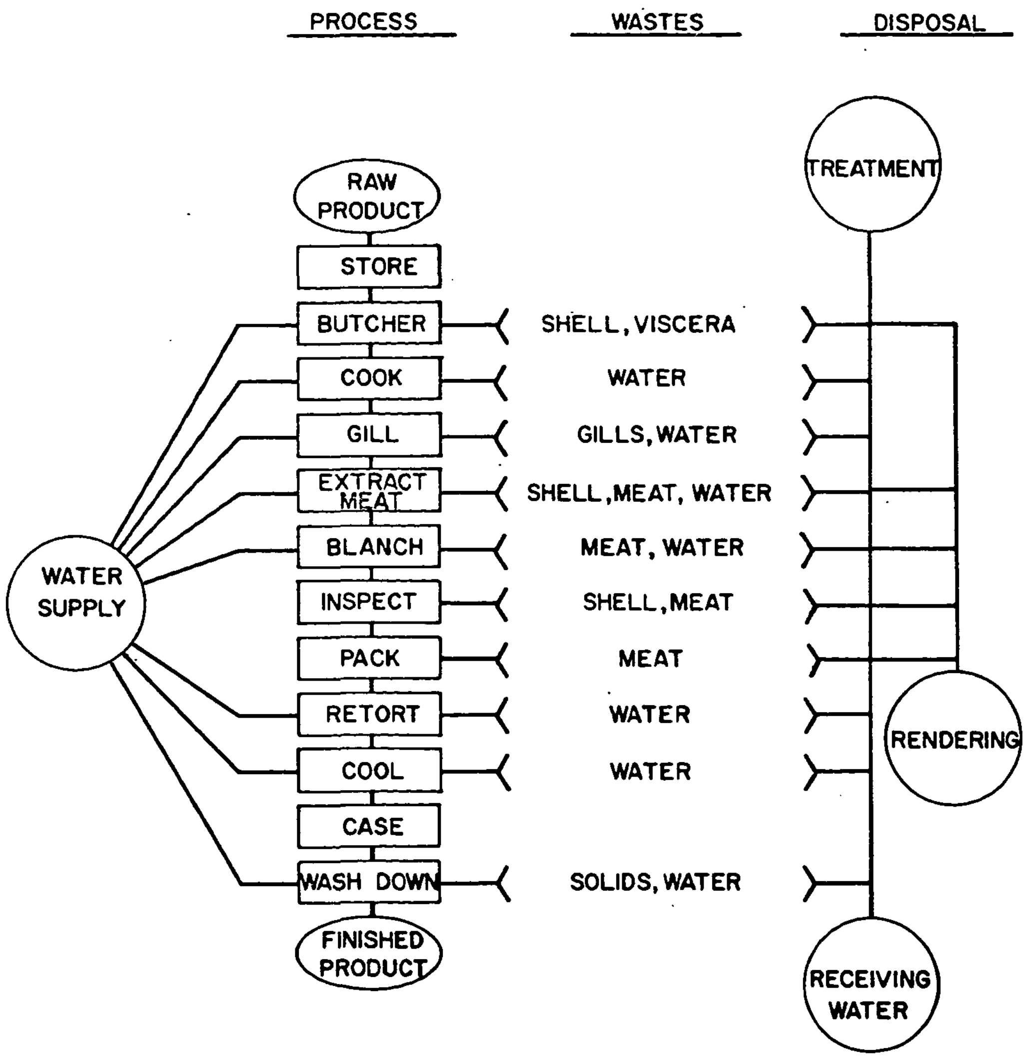

FIGURE II-4. CRAB CANNING

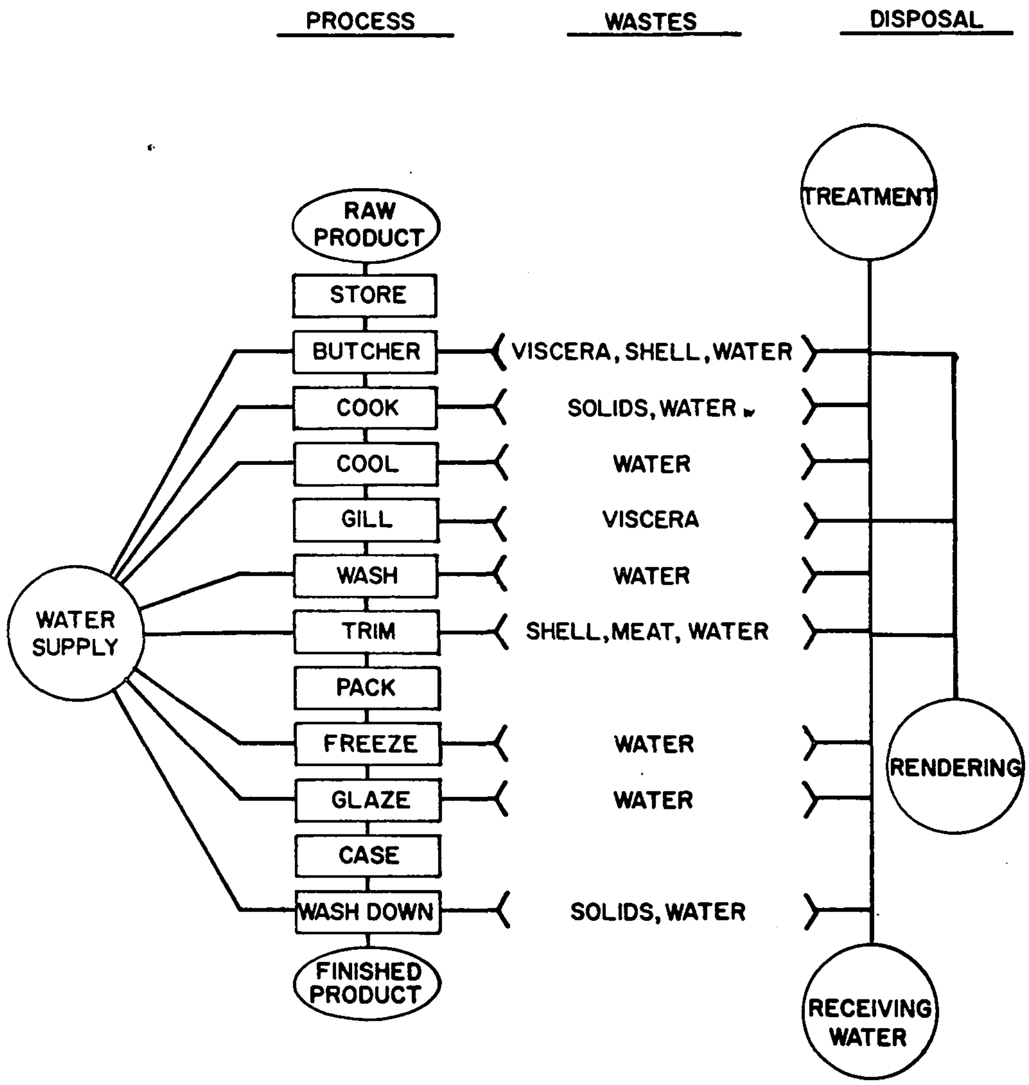

FIGURE II-5. CRAB FREEZING

Earnings and Cash Flows - Model Crab Plants

Costs of production, revenues, earnings and cash flows for model crab processing plants are shown in Tables II-3 through II-7.

The following types and sizes of plants were analyzed:

	Type of plant	Size	Annual throughput (000 lb. liveweight)
1.	Alaskan canned crab meat	Small	2,100
2.		Medium	3,750
3.	Alaskan frozen crab meat	Small	2,100
4.		Medium	3,750
5.	Blue crab canned meat	Small	2,000

Earnings for the types and sizes of plants specified were as follows:

	Type and size of plant				
	Alaskan Crab				Blue Crab
	Canned		Frozen		Canned
	Small	Medium	Small	Medium	Small
Pre-tax income ($000)	$73	$135	$132	$248	$14
After-tax income ($000)	38	70	67	129	7
Pre-tax ROI (%)	14.8	18.1	15.0	18.0	9.1
After-tax ROI (%)	7.7	9.4	7.6	9.3	4.8
Pre-tax ROS (%)	10.1	10.4	8.1	8.5	2.4
After-tax ROS (%)	5.2	5.4	4.1	4.4	1.2
Cash flow ($000)	58	100	101	179	10

Table II-3. Estimated cost of producing Alaskan canned crab meat

Item	Cost per case	Percent of total
Raw material	$22.20 1/	55
Labor	6.95	17
Cans and cases	1.90	5
Other direct costs	3.05	8
Overhead and other	6.50	15
Total cost	$40.60	100
Average revenue	45.00	
Return over cost	4.40	

1/ Assumes 6.7 pounds liveweight per pound of product, $.17 liveweight price per pound and 19.5 pounds per case

Table II-4. Estimated cost of producing Alaskan frozen crab meat

Item	Cost per pound	Percent of total
Raw material	$2.25 [1]	70
Labor	.50	16
Cans and cases	.04	1
Other direct costs	.09	3
Overhead and other	.34	10
Total cost	$3.22	100
Average revenue	3.50	
Return over cost	.28	

1/ Assumes 4.5 pounds live weight per pound of product (75% meat, 25% whole and sections) and $.50 liveweight price per pound

Table II-5. Indicative financial profile of Alaska crab processing plants

Item	Medium		Small	
	Frozen[1]	Canned	Frozen[1]	Canned
Plant size (Tons per day)	12.5	12.5	7.0	7.0
Throughput (1,000 lbs liveweight)	3,750	3,750	2,100	2,100
Sales ($1,000)	2,916	1,292	1,634	724
Operating expenses ($1,000)	2,574	1,108	1,443	620
Cash				
Cash earnings ($1,000)	342	184	191	104
Depreciation ($1,000)	50	30	34	20
Interest ($1,000)	44	19	25	11
Int				
Pre-tax income ($1,000)	248	135	132	73
After-tax income ($1,000)	129	70	67	38
Cash flow ($1,000)	179	100	101	58
Replacement investment ($1,000)	2,000	1,200	1,340	800
Estimated book value ($1,000)	1,000	600	670	400
Net working capital ($1,000)	379	146	212	94
Invested capital ($1,000)	1,379	746	882	494
Pre-tax ROI (Percent)	18.0	18.1	15.0	14.8
After-tax ROI (Percent	9.3	9.4	7.6	7.7
Pre-tax ROS (Percent)	8.5	10.4	8.1	10.1
After-tax ROS (Percent)	4.4	5.4	4.1	5.2

1/ Assumes 75 percent frozen meat and 25 percent frozen whole and sections.

Table II-6. Estimated cost of blue crab canning plant

Item	Cost per pound	Percent of total
Raw material	$1.00	38
Labor	.93	35
Packaging and distribution	.25	9
Overhead and other	.48	18
Total cost	$2.66	100
Revenue	$2.80	
Return over cost	.14	

Table II-7. Estimated earnings and cash flow for model blue crab canning plant

Item	Amount
Annual throughput (live weight)	2,000,000
Sales	560,000
Operating expenses	532,000
Cash Earnings	28,000
Depreciation	3,125
Interest	11,200
Pre-tax Income	13,675
After-tax Income	7,100
Annual cash flow	10,225
Replacement investment	125,000
Average fixed capital	62,500
Working capital 35% Nos	196,000
Current liabilities	112,000
Average fixed investment	146,500
Pre-tax ROI (percent)	9.3
After-tax ROI (percent)	4.8
Pre-tax ROS (percent)	2.4
After-tax ROS (percent)	1.2

Earnings and Cash Flows - Model Shrimp Plants

Costs of production, revenues, earnings and cash flows for model shrimp processing plants are shown in Tables II-8 through II-18.

The following types and sizes of plants were analyzed:

	Type of plant	Size	Annual throughput (000 lb. liveweight)
1.	Alaskan canned shrimp	Small	2,600
2.	Alaskan canned shrimp	Medium	4,550
3.	Alaskan frozen shrimp	Small	2,600
4.	Alaskan frozen shrimp	Medium	4,550
5.	Gulf Coast canned shrimp	Medium	3,000
6.	Gulf Coast frozen shrimp	Medium	3,500
7.	Gulf Coast breaded shrimp	Small	875
8.		Large	5,000

Earnings for the types and sizes of plants specified were as follows:

Type & Size of Plant	Income Pre-tax ($000)	Income After-tax ($000)	ROI Pre-tax (%)	ROI After-tax (%)	ROS Pre-tax (%)	ROS After-tax (%)	Cash Flow -- ($000)
Alaskan, canned, small	$144	$ 75	21.4	11.2	11.9	6.2	$ 26
Alaskan, canned, medium	259	135	25.0	13.0	12.3	6.4	173
Alaskan, frozen, small	111	58	11.5	6.0	13.8	7.2	43
Alaskan, frozen, medium	206	107	14.1	7.4	14.6	7.6	171
Gulf, canned, medium	78	41	7.6	4.0	4.1	2.2	79
Gulf, frozen, medium	32	17	4.4	2.3	3.1	1.6	77
Gulf, breaded, small	9	5	3.8	1.9	3.1	1.6	15
Gulf, breaded, large	150	78	7.6	3.9	5.0	2.8	243

Table II-8. Estimated cost of producing Alaskan canned shrimp

Item	Cost per case	Percent of total
Raw material	$3.10 1/	33
Labor	1.76	19
Cans and cases	1.90	21
Other direct cost	.94	10
Overhead and other	1.63	17
Total cost	$9.33	100
Average revenue	10.35	
Return over cost	1.02	

1/ Assumes 3.3 pounds liveweight per pound of product, liveweight price of $.14 per pound and 6.75 pound product per case.

Table II-9. Estimated cost of producing Alaskan frozen shrimp

Item	Cost per pound	Percent of total
Raw material	$ .75 1/	57
Labor	.16	12
Cans and cases	.04	3
Other direct cost	.19	14
Overhead and other	.18	14
Total cost	$ 1.32	100
Average revenue	1.55	
Return over cost	.23	

1/ Assumes 5.0 pounds liveweight per pound of product and liveweight price of $.15 per pound.

Table II-10. Indicative financial profile of Alaska shrimp processing plants

Item	Medium		Small	
	Frozen	Canned	Frozen	Canned
Plant size (Tons per day)	17.5	17.5	10.0	10.0
Throughput ($1,000 lbs liveweight)	4,550	4,550	2,600	2,600
Sales ($1,000)	1,410	2,112	806	1,207
Operating expenses ($1,000)	1,119	1,783	640	1,019
Cash earnings ($1,000)	291	329	166	188
Depreciation ($1,000)	64	38	43	26
Interest ($1,000)	21	32	12	18
Pre-tax income ($1,000)	206	259	111	144
After-tax income ($1,000)	107	135	58	75
Cash flow ($1,000)	171	173	43	26
Replacement investment ($1,000)	2,540	1,520	1,720	1,030
Estimated book value ($1,000)	1,270	760	860	515
Net working capital ($1,000)	183	275	105	157
Invested capital ($1,000)	1,453	1,035	965	672
Pre-tax ROI (Percent)	14.1	25.0	11.5	21.4
After-tax ROI (Percent)	7.4	13.0	6.0	11.2
Pre-tax ROS (Percent)	14.6	12.3	13.8	11.9
After-tax ROS (Percent)	7.6	6.4	7.2	6.2

Table II-11. Estimated cost of producing canned shrimp, 1972 Gulf Coast

Item	Cost per case[1/]	Percent of total
Raw material	$8.50	65
Labor	1.60	12
Cans and cases	1.35	10
Other expenses and overhead	1.55	13
Total cost	$13.00	100
Revenue	14.15	
Return over cost	1.15	

1/ Per case of 24, 4 1/2 ounce cans.

Table II-12. Estimated earnings and cash flow for Gulf Coast shrimp canning plant, 1972

Item	Amount
Annual throughput (live basis)	3,000,000
Sales	1,888,000
Operating expenses	1,734,500
Cash earnings	153,500
Depreciation	37,500
Interest	37,800
Pre-tax income	78,200
After-tax income	41,000
Annual cash flow	78,500
Replacement investment	1,500,000
Average fixed assets	750,000
Working capital	660,760
Current liabilities	377,500
Average fixed investment	1,033,260
Pre-tax ROI (percent)	7.6
After-tax ROI (percent)	4.0
Pre-tax ROS (percent)	4.1
After-tax ROS (percent)	2.2

Table II-13. Estimated cost of producing frozen shrimp, 1972, Gulf Coast

Item	Cost per pound	Percent of total
Raw material	$ .91	62
Labor	.15	10
Packaging and sales	.25	17
Overhead	.16	11
Total cost	$1.47	100
Revenue	1.65	
Return over cost	.18	

Table II-14. Estimated earnings and cash flow for shrimp freezing plants, Gulf Coast 1972

Item	Amount
Annual throughput (live weight)	3,500,000
Sales	1,010,625
Operating expenses	900,375
Cash earnings	110,250
Depreciation	60,000
Interest	18,200
Pre-tax income	32,050
After-tax income	16,666
Annual cash flow	76,666
Replacement investment	1,200,000
Working capital	353,700
Average fixed investment	600,000
Current liabilities	232,400
Average fixed investment	721,300
Pre-tax ROI (percent)	4.4
After-tax ROI (percent)	2.3
Pre-tax ROS (percent)	3.1
After-tax ROS (percent)	1.6

Table II-15. Estimated cost of producing breaded shrimp, Gulf Coast, 1972 (large plant)

Item	Cost per pound	Percent of total
Raw material	$2.28	88
Labor	.18	7
Overhead	.10	4
Other	.04	2
Total cost	$2.60	100
Average revenue	2.75	
Return over cost	.15	

Table II-16. Estimated earnings and cash flow for breaded shrimp, 1972, Gulf Coast (large plant)

Item	Amount
Annual throughput (live weight)	5,000,000
Sales	2,750,000
Operating expenses	2,385,500
Cash earnings	364,500
Depreciation	82,500
Interest	49,500
Pre-tax income	150,000
After-tax income	78,000
Annual cash flow	243,000
Replacement investment	3,300,000
Working capital	962,500
Average fixed assets	1,650,000
Current liabilities	632,500
Average fixed investment	1,980,000
Pre-tax ROI (percent)	7.6
After-tax ROI (percent)	3.9
Pre-tax ROS (percent)	5.0
After-tax ROS (percent)	2.8

Table II-17. Estimated cost of producing breaded shrimp, 1972, Gulf Coast (small plant)

Item	Cost per pound	Percent of total
Raw material	$ .90	60
Labor	.21	14
Packaging, peeling and distribution	.25	17
Other	.12	9
Total cost	$ 1.48	100
Revenue	1.62	
Return over cost	.14	

Table II-18. Estimated earnings and cash flow for breaded shrimp, 1972, Gulf Coast (small plant)

Item	Amount
Annual throughput (liveweight)	875,000
Sales	283,500
Operating expenses	259,000
Cash earnings	24,500
Depreciation	10,000
Interest	5,670
Pre-tax income	8,830
After-tax income	4,590
Annual cash flow	14,590
Replacement investment	400,000
Average fixed investment	200,000
Working capital	99,225
Current liabilities	56,700
Average fixed investment	242,500
Pre-tax ROI(percent)	3.8
After-tax ROI (percent)	1.9
Pre-tax ROS (percent)	3.1
After-tax ROS (percent)	1.6

Plant Description - Catfish Processors

Pond-reared catfish are processed in specialized, single-product plants, usually operated in conjunction with pond-catfish production enterprises.

Catfish processing methods - Catfish are harvested by draining the ponds and are shipped alive in tank trucks to processing plants. Live hauling eliminates the need for meat preservation before processing, but generates the problem of disposal of the feces-contaminated holding water.

Figure II-6 depicts the processing method and the wastes resulting. The fish are held in live tanks until processing, which results in more feces-contaminated water.

The fish are first stunned, commonly with electric shock, and then butchered. The butchering process, which includes skinning, beheading, and eviscerating, can be either manual or mechanical. Catfish traditionally have been skinned before marketing.

Butchering machines remove only the outer layer of pigmented skin for esthetic reasons. This process results in solid wastes containing skins, heads and viscera and wastewaters containing blood, slime and flesh.

The processed fillets or steaks are marketed fresh and frozen (breaded or plain).

Earnings and Cash Flow-Model Catfish Processing Plant

The model catfish processing plant is assumed to process 1,600,000 pounds (liveweight basis) of catfish annually. This volume is based on 250 operating days, 8,000 pounds daily capacity and 60 percent of capacity. However, a survey of 16 operating plants in the South in 1970[1/] reported that the 16 plants surveyed only processed an average of 400,000 lbs. per plant, 25 percent of the indicated volume. This low utilization of capacity is a problem which continues to plague the catfish processing industry.

Estimated costs of processing catfish are shown in Table II-19. These costs were developed by the Bureau of Commercial Fisheries and have been adjusted by DPRA to reflect current costs and prices. These costs result in a gross margin of revenue over operating costs of 2.4¢ per pound. However, it should be emphasized again that the low rate of utilization of processing capacity, which characterizes many plants in the industry, will reduce returns below the level indicated.

1/ Catfish Processing, A Rising Southern Industry, ERS, USDA, Agr. Econ. Report 224, 1972.

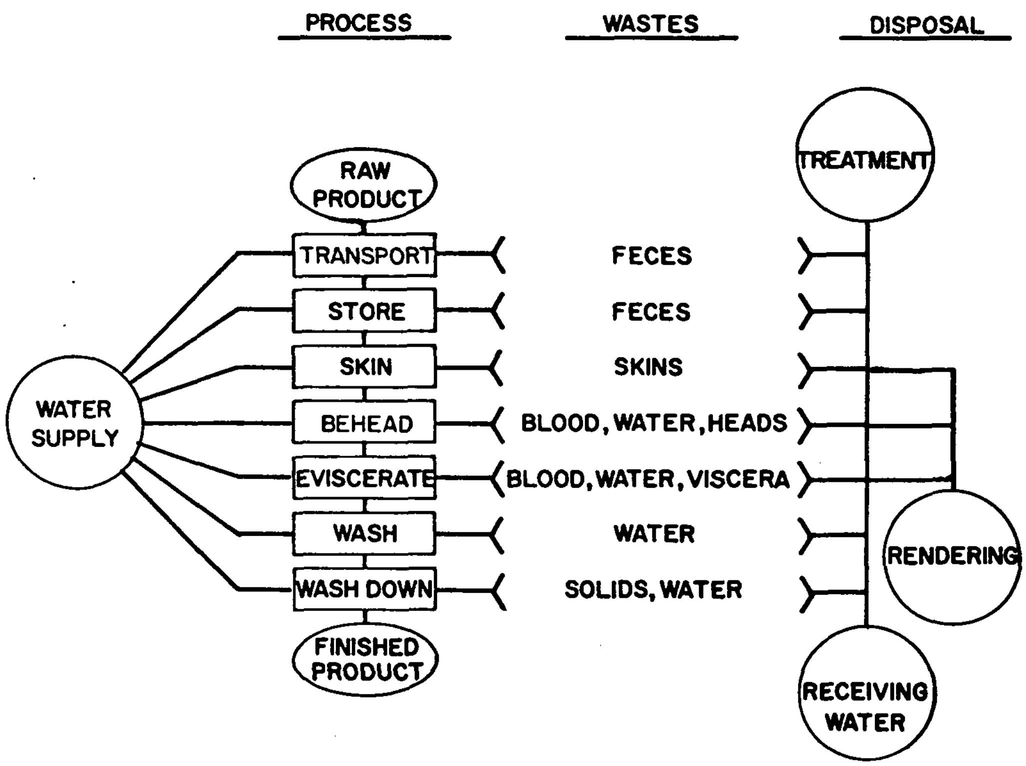

FIGURE II-6. CATFISH PROCESSING

Table II-19. Estimated processing costs for frozen pond-reared catfish

Item	Cost per pound	Percent of total
Raw material (fish at plant)	$ .640	72
Labor	.095	11
Packaging material	.040	5
Building and equipment costs	.063	7
Overhead and sales cost	.055	5
Total cost	$ .893	100
F.O.B. plant revenue	.917	
Return over cost	.024	

Annual throughput of 1,600,000 pounds is based on the survey of Southern processors and a 250-day year with an 80 percent utilization of capacity. It is recognized that 60 percent utilization may be above the current industry average.

At 60 percent utilization, with a price of 91.7 cents per pound for frozen fish, f.o.b. processor, total revenue is $1,100,000. Processing costs are estimated at 89.3 cents a pound. Gross margin is 2.4 cents per pound resulting in cash earnings of $28,000. Deducting depreciation and interest results in a pre-tax income of $1,650 and after-tax income of $858. Pre-tax income return on investment is 1.4 percent after-tax ROI is 0.7 percent and return on sales, pre-tax is 0.2 percent and after-tax 0.1 percent.

Table II-20. Estimated earnings and cash flow for model catfish processing plant

Item	60% Capacity
Annual throughput, pounds frozen fish	1,600,000
Sales at 91.7¢ per pound	1,100,000
Operating expenses at 89.3¢ per pound (Table II-19)	1,072,000
Cash Earnings	28,000
Depreciation	10,750
Interest	15,600
Pre-tax income	1,650
After-tax income	858
Annual cash flow	11,608
Replacement investment	215,000
Working capital	281,000
Average fixed assets	107,500
Working capital	281,000
Current liabilities	216,000
Average fixed investment	117,500
Pre-tax ROI (Percent)	1.4
After-tax ROI (Percent)	0.7
Pre-tax ROS (Percent)	0.2
After-tax ROS (Percent)	0.1

Salvage Value of Assets

The salvage value of seafoods processing plants will vary widely from plant to plant depending on the age of the plant and its equipment, the condition of the plant and its equipment and its location.

In common with most food processing plants, seafoods processing plants undergo periodic renovation, continuous repair and maintenance and equipment items are replaced as they wear out or become obsolete.

Tuna processing plants are specialized canning installations and the buildings and equipment would have little value above scrap. However, in some locations, especially Southern California, site values may be high as opportunities for sale of land for waterfront industrial sites may be good.

Crab and shrimp processing plants vary greatly regarding type of structure and site value. Some "floater" plants are located on barges, converted ferries or obsolete ship hulls and these facilities would have only scrap value. Some shore-based plants would have value for general purpose use and for cold storage warehouse purposes. In some locations along the California, Oregon, Washington coasts and particularly in Florida, site values may be appreciable. In other locations, site values may be nominal. Equipment would generally have only salvage value.

Catfish processing plants, although relatively new, are special purpose plants tied to areas where pond catfish production is important. Generally their locations would have low site values and with the exception of freezing equipment, equipment would have only nominal salvage values. The same would be true of buildings.

Where plants are forced to close because they are presently unprofitable, or because they would become unprofitable if they were forced to assume the added investments and operating costs required for water pollution control, then the salvage value of the buildings would be essentially zero, the equipment might sell from 10 to 50 percent of its original cost and the value of the site could vary widely, depending on location.

In many instances, the value of a seafoods processing plant, particularly where a small firm is involved, would be greater to its present owner than it would be to any potential buyer. In terms of "book value," the physical facilities and equipment may have been fully depreciated, or nearly so, but in terms of their "use value" to their present owners, these plants may represent assets of very tangible values--much greater than their market or their salvage value.

Since no data are available on actual salvage values for seafoods processing plants and since a "market" for plants which would be forced to close, because of added costs of water pollution control, would be virtually nonexistent, the impact analysis will use arbitrary assumptions. All operating capital will be recovered intact, land will be valued at its original cost and buildings and equipment will be valued at a series of percentages of their original value as follows: 25 percent, 10 percent and 0 percent. The combined value of operating capital, land, buildings, and equipment will represent the salvage value to be used.

Constraints on Financing Additional Capital Assets

Constraints on financing additional capital required for water pollution control facilities will vary greatly from firm-to-firm and from location-to-location. In general, it is not anticipated that there will be any serious constraints in securing capital required for pollution control for large and medium size meat seafoods processing plants. However, in individual situations where plants are old and absolete or unprofitable, and where local conditions may require substantial investments for internal pollution abatement systems or for participation in expanding capacity of sewer systems in small communities, meat industry management may hesitate to make the investments required -- even though capital may be available.

In a substantial number of situations, tuna, crab and shrimp processing plants are owned by conglomerates, large diversified food processing firms or by large diversified seafoods processing companies. This ownership pattern was discussed in Chapter I. In these situations, it is anticipated that capital availability would not be a limiting factor. Also, it is known that a substantial proportion of these plants will be able to connect to municipal sewers where, except for connection charges, only nominal capital will be required. This should ease the problem for many small plants.

Capital availability may be a much more serious problem for small plants which continue to operate primarily because owners have depreciated out original investment costs, consider their investment in the plant as "sunk capital" and consider that the plant has a "utility value" if continued in operation which is greater than the "market value" or "salvage value" of the plant should they decide to cease operations. For such plants, the increased investment required for pollution control may be difficult to obtain and even if available may be unattractive to both the borrower and the lender. In these situations, the decision to attempt to obtain additional capital may be based on the desire of the owners to maintain the business for personal employment reasons rather than on the expectation of realizing a return on invested capital.

III. PRICE EFFECTS

A. Supply and Consumption Considerations

Both the total and per capita consumption of all fishery products by U.S. consumers have risen gradually since 1955, when the per capita rate was 10.5 pounds to 12.2 pounds in 1972. This 16.2 percent rise occurred during a period when the domestic catch used for human food declined from 2,579 million pounds in 1955 to 2,579 million pounds in 1971. The fishery industry increased its imports from 1,332 million pounds in 1955 to 3,582 million pounds in order to meet the requirements of U.S. consumers. Canned tuna and shrimp, both raw and processed, accounted for a very substantial part of the rise both in supply and consumption. Since there has been no substantive increase in the world production of fishery products for human food when worldwide consumption was rising, competitive buying intensified among fish processors and distributors in various parts of the world. The competition for available supplies, particularly for such items as shrimp, crab, tuna, halibut, cod and salmon increased as demand increased both in the U.S. and other countries.

Of primary concern to this analysis are the prices and pricing practices in the tuna, shrimp, crab, and catfish industries.

B. Tuna Price Effects

Prices to fishermen for the various tuna species--albacore, skipjack, bluefin, and yellowfin--tend to be based on the international market for tuna, rather than U.S. markets alone. The reason is obvious: tuna are found in many areas of the world and the U.S. tuna fleets fish the seven seas for their prey. As the fish are caught, they are frozen and placed in the bulk-heads for storage until the fishing vessels return to their home ports where the fish are thawed and put through the canning processes.

Tuna (ex-vessel) prices have risen about 56 percent from 1968 through 1972. During this five year period, the supply of canned tuna made available to U.S. consumers rose 45.3 percent, reflecting the failure of tuna production and imports to keep pace with the rising demand. The upward surge of raw tuna prices was carried in the wholesale and retail sectors, which recorded a rise of 39.3 and 31.9 percent, respectively, over the 1968 price, (Figures III-1 and III-2 and Tables III-1 and III-2). The latter percentage increased are on canned tuna which has a unit price considerably above that paid to fishermen for raw fish.

Canned Tuna and Fresh Meat Prices

Nutritionists declare that tuna meat is a high protein food and is often used in place of red meat and poultry. According to the conventional wisdom, this ability to choose from among the various kinds of meats must be considered when one attempts to explain prices and their relationships. With this in mind, we found that the price on all U.S. slaughter cattle rose from $24.63 to $35.77 per cwt or 45.2 percent from 1968 through 1972. For the same period, the average per pound retail price of choice beef in the U.S. rose 31.4 percent, which also fully reflects the higher prices of all slaughter cattle. In other words, the retail prices for canned tuna and choice beef rose about the same percentage 31.9 and 31.4 percent, respectively.

Canned Tuna Prices and Disposable Personal Income

Disposable personal income in the U.S. was at a $591 billion rate in 1968 compared to $795 million in 1972. This 34.5 percent rise in disposable personal income is comparable to the increases in prices discussed in the preceding paragraph.

Canned Tuna Prices and Changes in the Level of Prices

Both wholesale and retail prices for canned tuna have risen substantially in recent years, the price rises being more drastic during 1972, Tables III-1 and III-2. In fact, canned tuna price rises have exceeded the averages for all-commodity and the all-item categories included in the Wholesale Price Index and the Consumer Price Index of the U.S. Bureau of Labor Statistics.

Based on the indexes, we found that the canned tuna wholesale prices rose 17.8 percent more than the Wholesale Price Index for All Commodities from 1968 through the fourth quarter of 1972. The calculations follow:

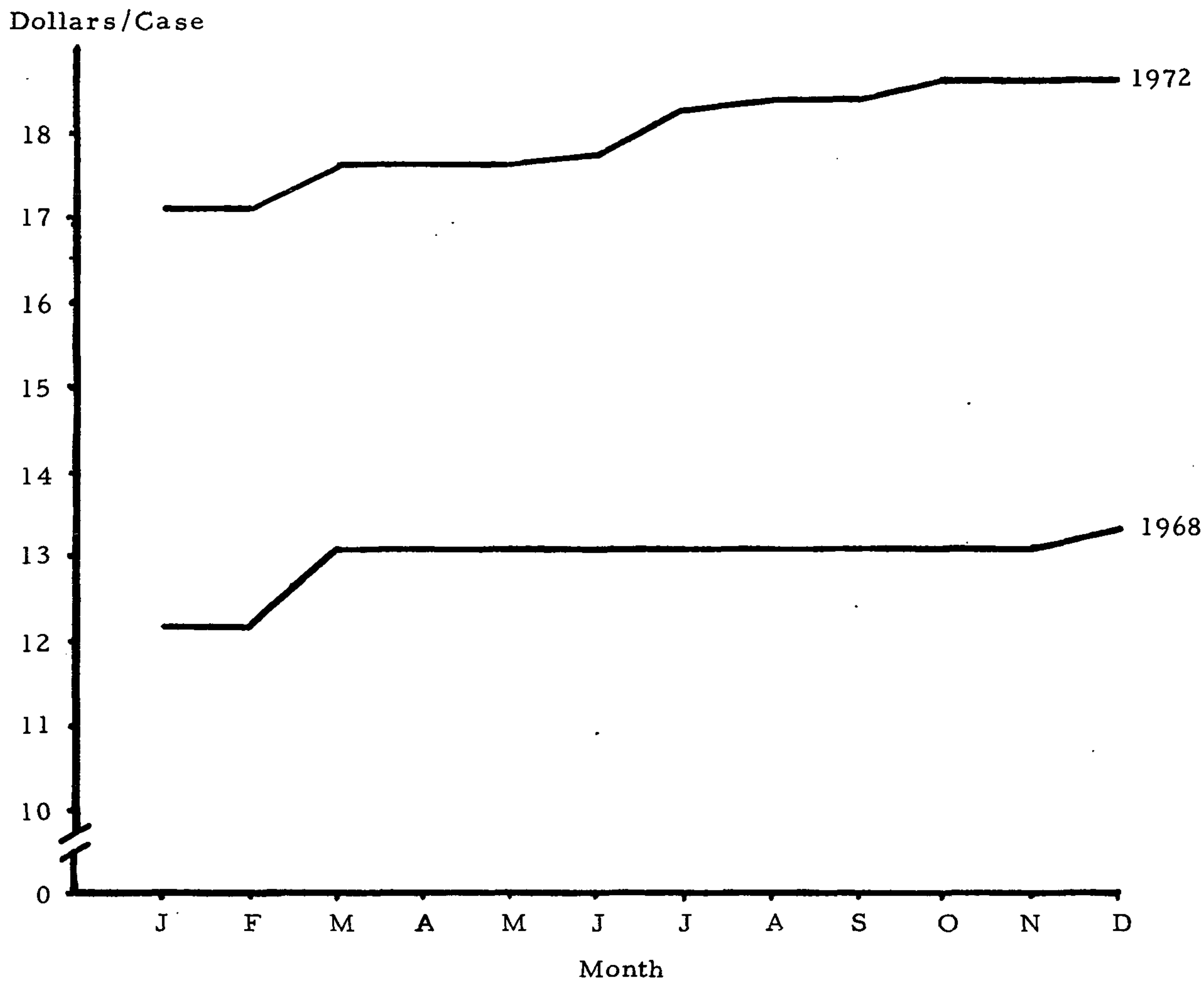

Figure III-1. Canned tuna: Average wholesale prices, Los Angeles, 1968 and 1972.

Table III-1. Canned tuna: average wholesale case prices, 1/ Los Angeles, by months, 1968 through 1972

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
							Month					
	Dollars											
1968	$12.13	$12.13	$13.05	$13.05	$13.05	$13.05	$13.05	$13.05	$13.05	$13.05	$13.05	$13.30
1969	13.30	13.30	13.30	13.30	13.30	13.30	13.30	13.50	13.50	14.18	14.18	14.61
1970	14.61	14.61	14.61	14.85	14.85	14.85	15.60	15.60	15.85	16.35	16.35	16.35
1971	16.35	17.10	17.10	17.10	17.10	17.10	17.10	17.10	17.10	17.10	17.10	17.10
1972	17.10	17.10	17.60	17.60	17.60	17.72	18.23	18.35	18.35	18.60	18.60	18.60

1/ Light meat, chunk, 6 1/2 ounce, 48 cans per case.

Source: US NOAA, Fisheries of the U.S., 1968-1972.

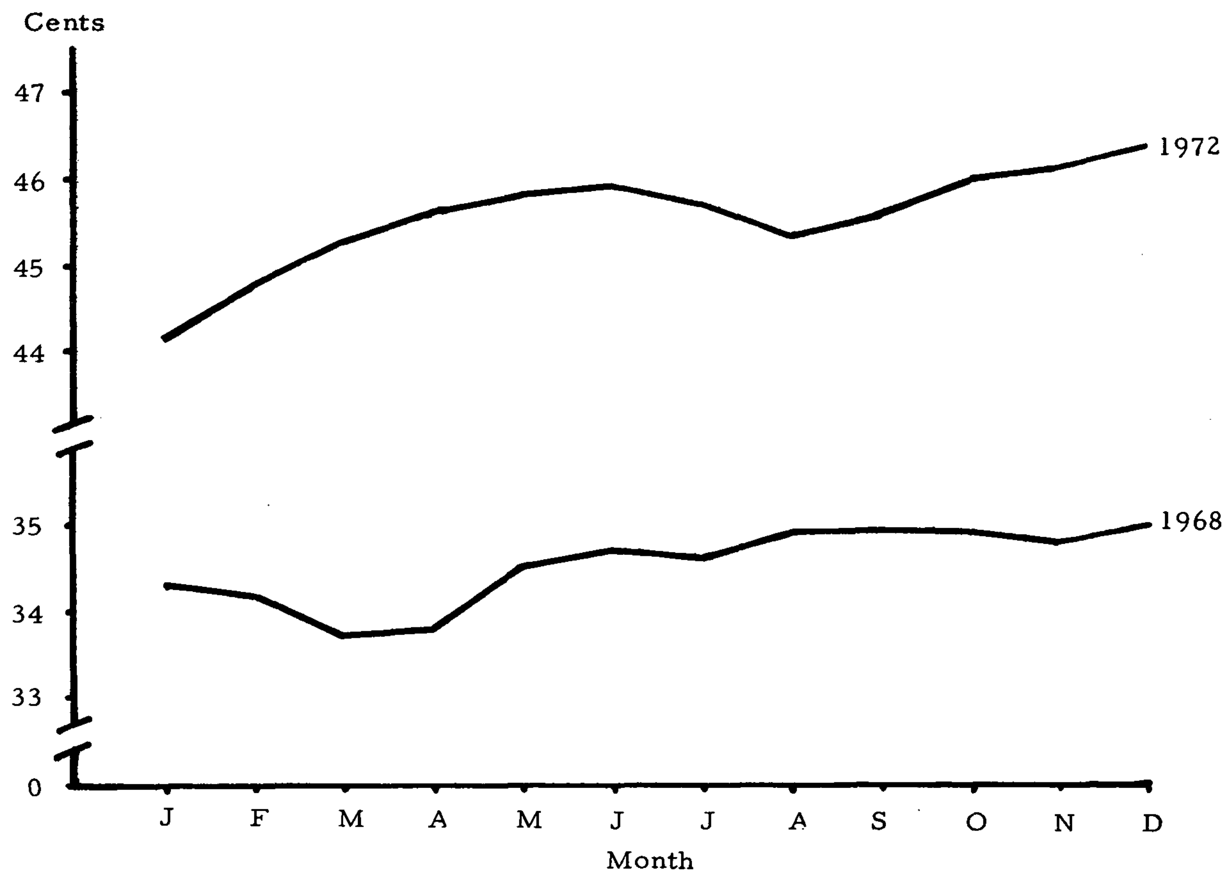

Figure III-2. Canned tuna: Average retail prices per can, 44 cities, 1968 and 1972.

Table III-2. Canned tuna: average retail price per can [1/] in 44 cities, by months, 1968 through 1972

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						Month						
	cents per can											
1968	34.3	34.2	33.7	33.8	34.5	34.7	34.6	34.9	34.9	34.9	34.8	35.0
1969	35.1	35.4	35.1	35.3	35.6	35.5	35.4	35.7	35.8	36.3	36.5	36.9
1970	37.5	37.8	38.3	38.7	39.2	39.4	39.4	40.1	40.7	41.7	42.2	42.7
1971	43.3	43.6	43.9	44.3	44.2	44.4	44.2	44.2	44.3	44.1	43.9	44.1
1972	44.1	44.7	45.2	45.6	45.8	45.9	45.7	45.3	45.6	46.0	46.1	46.4

[1/] 6 1/2 ounce can

Source: U.S. NOAA, Fisheries of the U.S., 1968-1972

Average canned tuna wholesale price per case, 1972	=	$18.00
Average canned tuna wholesale price per case for 1968, inflated by 18.2 percent rise in the WPI ($12.91 x 118.2%)	=	15.27
Price rise not accounted for by change in level of all wholesale prices		$ 2.73 or 17.8 percent

Similarly, we found that the canned tuna retail price increase exceeded the rise in the level of retail prices included in the Consumer Price Index. The calculations follow:

Average canned tuna retail price per case, 1972	=	$45.53
Average canned tuna retail price per case in 1968, inflated by 21.8 percent rise in CPI ($34.53 x 121.8)	=	42.06
Price rise not accounted for by change in the level of all retail prices (CPI)		$ 3.47 or 8.25 percent

Who Will Absorb the Costs of Pollution Control?

On the basis of the forecasts of the U.S. Food and Agriculture Organization, U.S. Department of Agriculture, and U.S. Department of Commerce that protein food (especially meat and fish) will be in continuing short supply for many years, we believe that the pressure of demand on canned tuna supplies will cause prices to hold their present levels and possibly rise faster than the general level of prices.

In view of the strength of consumer demand for canned tuna, we also believe that any additional production costs attributable to pollution controls will be passed on to consumers, provided price ceilings do not prevent such an action. Should the domestic industry be barred from raising prices the real possibility is that canners will absorb the extra costs, because the shortage of tuna fish gives fishermen an exceptionally strong bargaining position in dealing with canners.

There are several reasons that canneries are likely to absorb the additional production costs arising from more rigid pollution controls; however, the following are especially important.

1. Tuna fish canneries in the U.S. are few in number and it is estimated that the six plants in the Terminal Island - San Diego area in California pack 85 to 90 percent of the U.S. output. Furthermore, the four firms that own the six canneries -- Del Monte (2), H.J. Heinz (2), Ralston-Purina and Westgate-California (1)--are basing future production plans on an assumption of a 5 to 7 percent annual increase in consumer demand. Such a volume of production should enable the firms to spread any added pollution control costs with a minimum effect on unit costs.

2. The relatively short supplies of tuna and the strong consumer demand should restrain, if not stop, the upward drift of brand promotional costs, in both total and per unit expenditures. If such restraints occur, unit marketing costs should decrease even with the present volume and decrease further with projected production increases.

3. The tuna canneries in California, Oregon, and Washington are encountering no problems in disposing of fish offal. In fact, such byproduct operations--sales to fish meal manufacturers and subsequent sale to animal and poultry feeders--have a positive effect on net income. The plants major difficulties arise from liquid wastes associated with the butchering and canning operations. Presently, such wastes either are dumped into the waters adjacent to each cannery or into city sewers which are becoming overburdened. Significantly, however, each of the municipal sewer systems is planning or has underway a program to increase its capacity to receive and treat cannery wastes. The cities assumption of the responsibility for this major waste disposal and treatment problem relieves the canneries of any major capital outlay for such purposes. Hence, tuna canners generally will be required to invest in sewer connections and pay a surcharge or fee for waste disposal services.

Under prevailing competitive conditions, wholesalers and retailers would likely shift more to imported canned tuna, if necessary to maintain their selling margins. Since foreign tuna canners are not subject to U.S. EPA environmental pollution controls, they may become increasingly strong competitors for the U.S. canned tuna market. It is highly unlikely that the wholesaler-retailer sector would absorb any of the added costs of pollution controls.

C. Shrimp Price Effects

The U.S. supply of shrimp in 1968 consisted of 79.4 million pounds, heads off, from our domestic fisheries and 209.3 million pounds from imports. Of the 388.7 million pound total, 12.1 million pounds were exported leaving 376.6 million pounds heads off, available for U.S. consumption. Domestic production in 1972 amounted to 234.4 million pounds, heads off, plus 253.0 million pounds of imports. From the available total supply, there was 28.9 million pounds exported leaving 458.5 million pounds for U.S. consumers. This 21.2 percent supply increase from 1968 through 1972 was insufficient to prevent a price rise of 35.2 percent per pound to fishermen for the period studied.

Those most familiar with the domestic shrimp fisheries believe that U.S. production has reached its peak or nearly so and it will level off. If so, our dependence on foreign imports which have accounted for more than half of our supply since 1961, should increase as our population grows. In fact, we are now competing strongly for foreign supplies with shrimp buyers who are trying to satisfy a growing demand in the more affluent nations of Western Europe and Asia. This worldwide competition has manifested itself by raising the prices for U.S. shrimp imports and for domestic supplies which lack any major price restraints imposed by lower priced imports.

Higher prices to fishermen have been fully carried over into the wholesale and retail markets for shrimp, (Figures III-3 and III-4 and Tables III-3 and III-4) with wholesale prices showing a 57.9 percent increase and retail a 39.3 percent increase. As previously stated, disposable personal income rose 34.5 percent during the five years studied.

Shrimp Prices and Prices of other Competing Products

It is not entirely clear what degree of substitution exists among shrimp meat and red meat or shrimp meat and poultry, or shrimp meat and

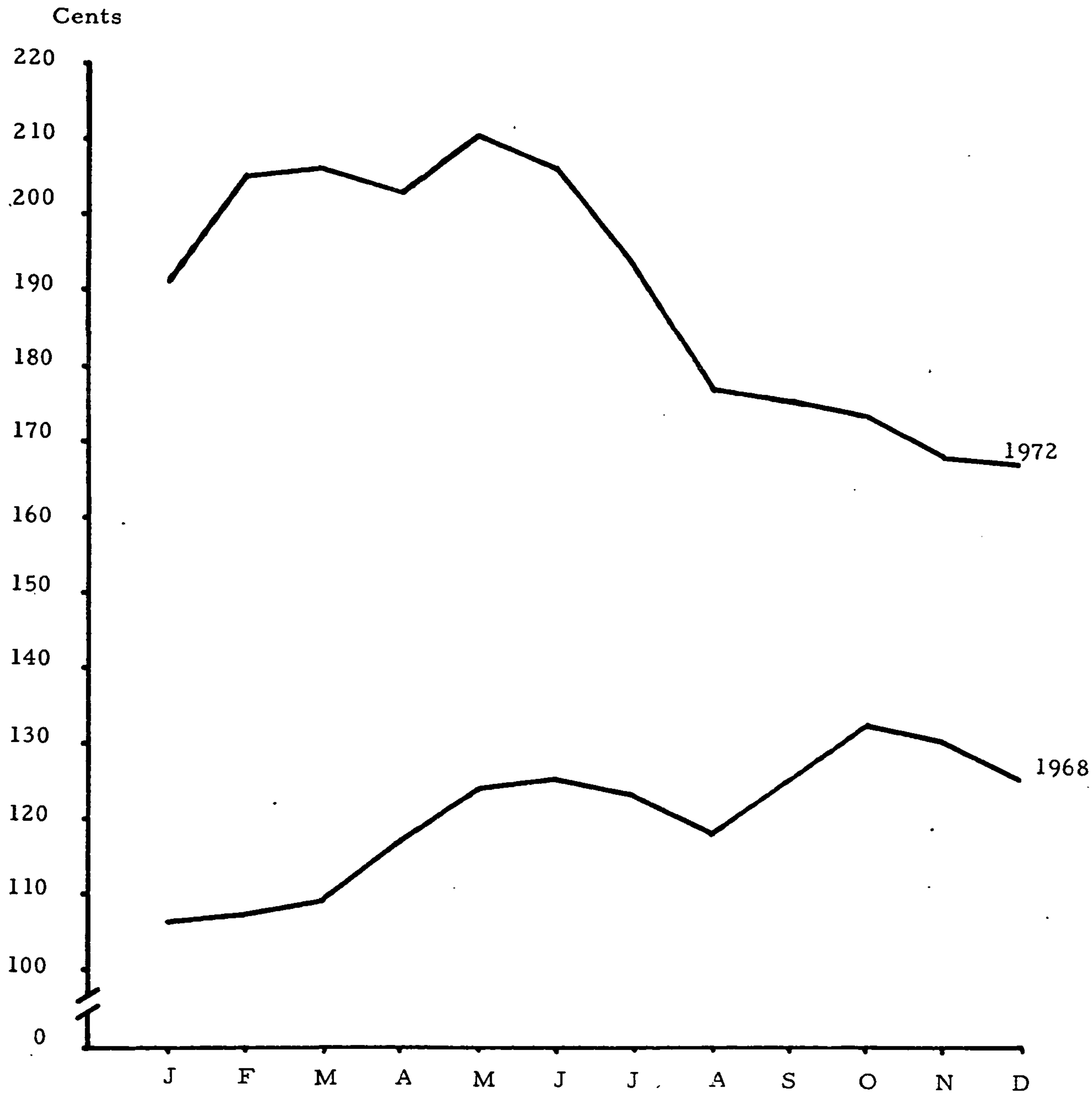

Figure III-3. Shrimp average wholesale prices

Table III-3. Shrimp: average wholesale prices on raw shrimp, [1] Chicago, by months, 1968-1972

Year	Jan.	Feb.	March	April	May	June	Month July	Aug.	Sept.	Oct.	Nov.	Dec.
							Dollars					
1968	$1.06	$1.07	$1.09	$1.17	$1.24	$1.25	$1.23	$1.18	$1.25	$1.32	$1.30	$1.25
1969	1.24	1.24	1.26	1.28	1.31	1.33	1.34	1.34	1.40	1.37	1.31	1.31
1970	1.31	1.33	1.32	1.32	1.33	1.35	1.27	1.27	1.14	1.15	1.16	1.17
1971	1.19	1.28	1.34	1.40	1.52	1.58	1.55	1.62	1.56	1.55	1.73	1.80
1972	1.91	2.05	2.06	2.03	2.10	2.06	1.93	1.77	1.75	1.73	1.68	1.67

1/ Large (26-30 count), brown, 5 pound package

Source: U.S.D.C., NOAA, NMFS, Fisheries of the U.S. 1968-1972.

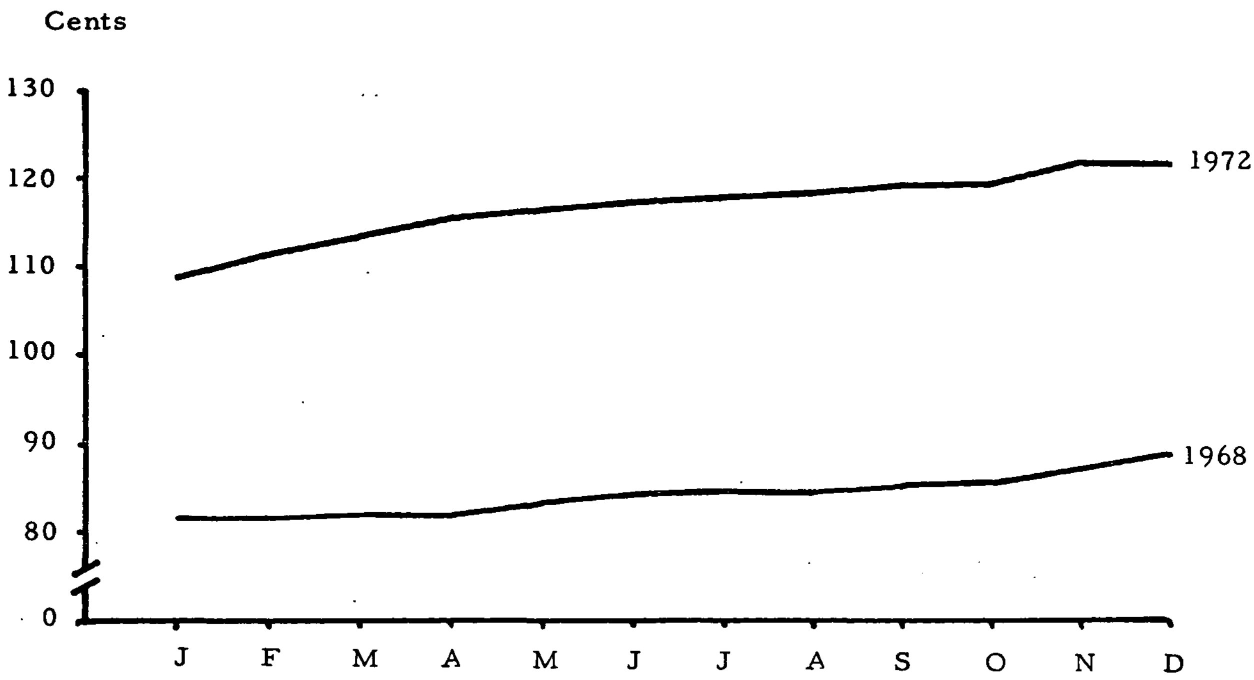

Figure III-4. Shrimp average retail prices.

Table III-4. Shrimp: Average retail prices raw shrimp 1/, 41 cities, by month 1968-1972

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
							Month					
	-----	-----	-----	-----	-----	-----	cents	-----	-----	-----	-----	-----
1968	82.0	81.8	82.1	82.3	83.1	84.0	84.7	84.7	85.3	85.6	87.2	88.9
1969	90.2	91.7	92.3	92.9	94.3	95.1	95.8	96.8	97.3	98.4	98.8	99.8
1970	101.3	101.7	102.2	102.0	102.3	102.7	102.3	101.8	102.0	101.6	101.2	100.4
1971	99.9	100.9	101.3	101.8	103.0	103.9	105.4	106.1	106.8	107.1	107.8	103.1
1972	109.0	111.5	113.5	115.7	116.8	117.7	118.2	118.6	119.7	119.5	121.9	121.8

1/ Frozen, 10 ounce consumer package

Source: USDC, NOAA, NMFS, Fisheries of the U.S., 1968-1972 canned tuna, or shrimp meat and crab or other fishery products. However, we are assuming some substitutability in all cases and marked substitutability for shrimp, crab and tuna meats. It may be worthwhile, therefore, to compare shrimp and tuna price changes at the three levels of marketing These follow:

Price to:	Percent increase 1968-1972 Shrimp	Tuna
Fishermen	35.2	51.3
Wholesalers	57.9	39.3
Retailers	39.3	31.9

One cannot avoid noting the closeness of the change in retail shrimp prices (39.3 percent) to the change in disposable pesonal income.

Shrimp Prices and Changes in the General Level of Prices

The relationship of changes of shrimp prices to the changes in the levels of all wholesale commodity prices and of consumer prices, as shown in the two Bureau of Labor Statistics indexes, gives one a measure of change. For example, the wholesale price comparison follows:

Average wholesale price per unit of shrimp in 1972	=	$1.895
Average wholesale price per unit of shrimp in 1968 inflated by the 18.2 percent rise in the WPI ($1.20 x 118.2)	=	1.418
Price rise not accounted for by the change in the level of all wholesale prices	=	$ .447 or 33.6 percent

We also found that the 1972 average increase in the retail price of shrimp was in excess of other retail prices included in the Consumer Price Index. The calculations follow:

Average retail price per unit of shrimp in 1972	=	$1.169
Average retail price per unit of shrimp in 1968 inflated by the 21.8 percent rise in the CPI ($.843 x 121.8)	=	1.027
Price rise not accounted for by the change in the level of retail prices	=	$ .142 or 13.8 percent

Who Will Absorb the Costs of Pollution Control?

Reference has been made to the prevailing and possible future strong demand for meat, poultry, and fishery products. In addition to the strong U.S. demand for shrimp, in all forms, Western Europe and Japan presently are bidding competitively for available shrimp supplies. In view of the demand situation and the likelihood that production will not increase sufficiently to satisfy the growing consumer demand at prices lower than those now prevailing, it is reasonable to expect further shrimp retail price increases at all levels of production and marketing. Moreover, the demand situation is so favorable to the shrimp industry that it should be able to pass any cost increases on to consumers in the form of higher prices.

In the event that consumer price resistance should occur, the processing sector--fresh, freezing, and canning--would most likely have to absorb any cost increases. Under such conditions, the impact on shrimp processing plants and firms would vary greatly. Even the largest shrimp processing operation is relatively small, volumewise. For example, a plant receiving 5 million pounds of live shrimp would probably have about 1.25 million pounds of processed product which could be sold at $1.25 million. At present 1972 prices (about $1 per pound wholesale) the probable net return on investment would not exceed 12 percent or $150,000. Under the foregoing conditions, a processor might well afford an additional pollution control cost of $10,000 annually. However, a plant receiving .5 million pounds of live shrimp might sell its output of .125 million pounds of shrimp meat for $125,000 from which it would receive a net return of 10 percent or $12,500. Should this operator be faced with $5,000 annually in added pollution control costs, he might choose to sell his plant to a larger operator who would expand the output or he might abandon his plant if alternative opportunities were more profitable. In essence, the smaller plants and firms likely would be affected very adversely by any rigid pollution standards that would require both more capital and more operating costs.

Based on DPRA's survey of shrimp processing plants in California, Oregon, Washington and Alaska, one must conclude that there would have to be a complete restructuring of the shrimp processing industry unless some form of cooperative action among processors for waste disposal and pollution control is developed.

DPRA also believes that the wholesale and retail secotrs of the industry are unlikely bearers of any further production cost increases. This sector would turn to foreign suppliers.

Qualification of Assessment

DPRA is fully aware of the technological changes taking place in both the production and marketing of shrimp. It is possible, therefore, that new shrimp fisheries may be found and propagation may become feasible as a means of maintaining and expanding existing shrimp fisheries. If so, the pressure of demand on existing production could be relaxed.

This condition could lower prices at all levels. If such a supply improvement were to occur, DPRA believes that the fishermen and processors would have to share the added burden of pollution control costs in the form of lower prices.

D. Crab Price Effects

The data on U.S. Landings, imports, and utilization of the various species of crab--Blue, Dungeness, King and Snow-- are sketchy. However, the available data, when supported by other information about the production and pricing practices of the different sectors of the fisheries industry, provide some insight into the problems of supply, demand, and prices.

The supply of crab available for sale to U.S. consumers for the 1967-1972 period is shown in Figure III-5 and Table III-5. The supply from U.S. landings ranged from about 242 to 315 million pounds liveweight, annually, plus small amounts of imported canned crab. If we assume that a live crab yields about 18 percent of edible meat, the crab meat supply, including imports, ranged from about 43 to 57 million pounds, annually. It is apparent that there were much greater fluctuations in the landing by species between 1968 and 1972 than there was in total landings of all species which rose each year after 1968. Another observation is the erratic performance of the Dungeness and King species--probably the most desirable and higher priced species--and the fast rise in the production of Snow crab, a lesser-known and less-favored specie.

DPRA estimates the 1968 average exvessel price per pound on all landed species at 18.41 cents and the 1972 average at 20.85 cents. However, a look at the averages shows the relatively higher exvessel prices for Dungeness and King crab, (Figure III-6 and Table III-6). Both tradespeople and consumers differentiate between the different species. For example, Blue crab are a product of Atlantic and Gulf waters. They are sold mainly as whole, fresh

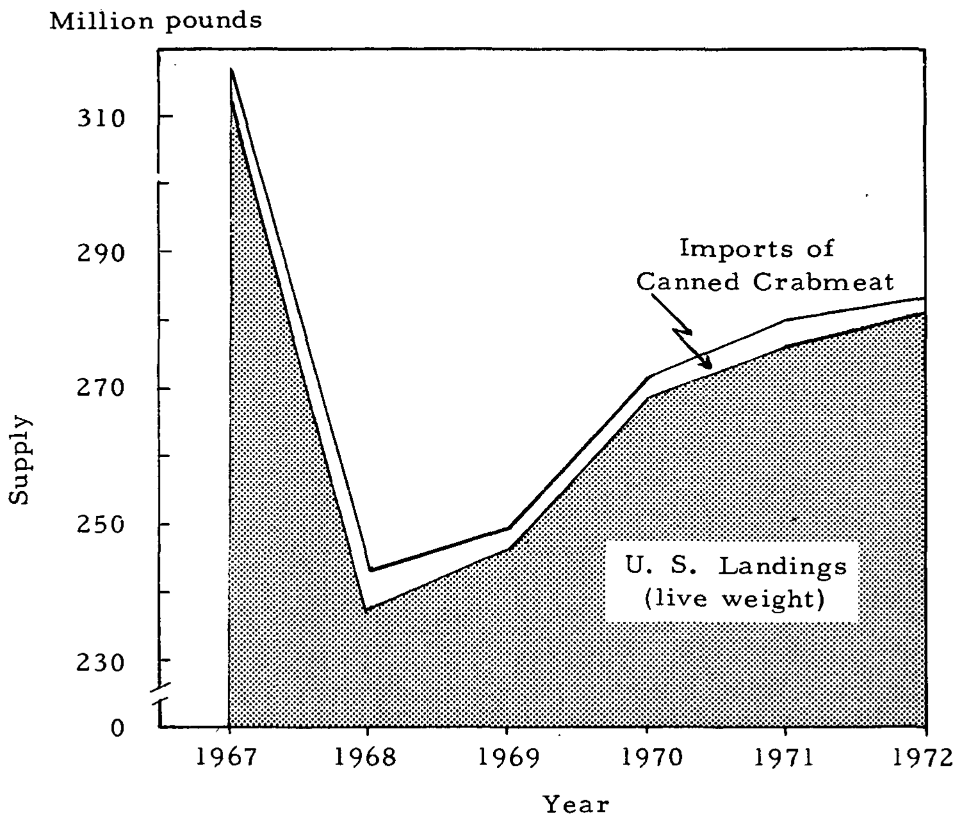

Figure III-5. Supply of crab (live wt.) and imported crab meat, 1967-1972.

Table III-5. U.S. Crab landings and imports by years

Year	Species					
	Blue	Dungeness	King	Snow	All Imports	Total
			---million pounds---			
1967	145.0	42.4	127.7	N.A.	2.16	317.26
1968	109.5	44.0	85.0	3.2	4.64	246.34
1969	129.9	49.1	55.8	10.2	3.44	248.44
1970	142.4	58.7	51.9	14.5	2.77	270.27
1971	145.1	42.7	70.4	18.2	3.72	280.12
1972	145.4	26.9	74.0	34.8	2.55	283.65
Total	817.3	263.8	464.8	80.9	19.28	

Source: USDC, NOAA, MMFS, Fisheries of the US, Annuals 1967-1972.

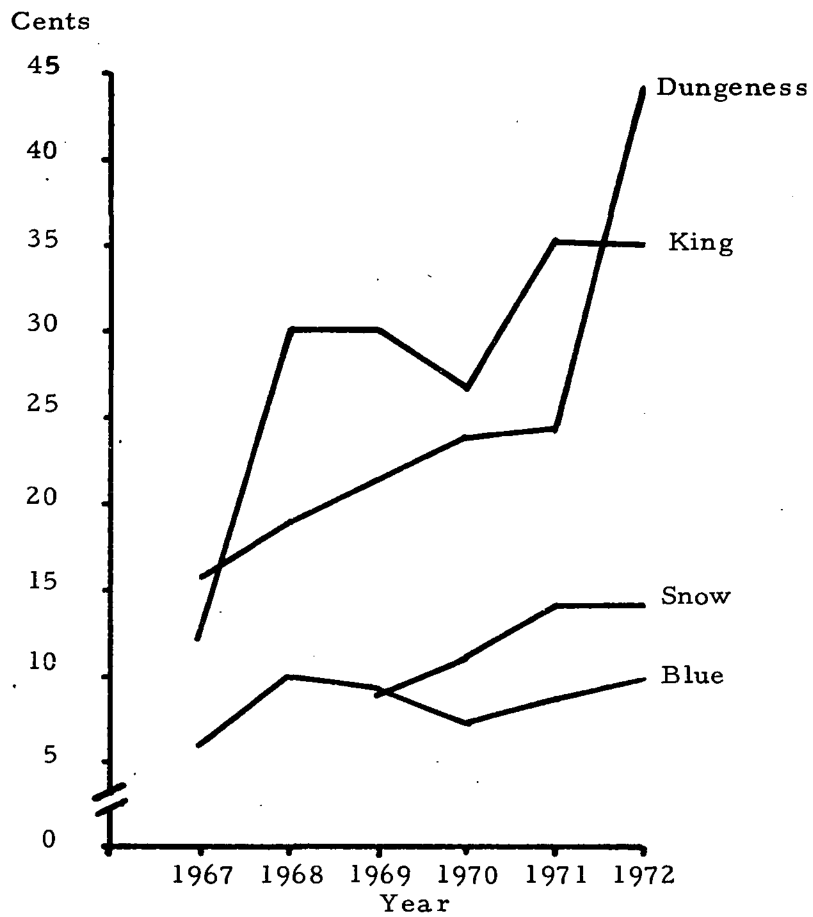

Figure III-6. Average Exvessel prices for U.S. Crab, by species, by years, 1967-1972

Table III-6. Average exvessel prices for crab, 1967 through 1972

Year	Species			
	Blue	Dungeness	King	Snow
	------cents per pound------			
1967	5.93	15.67	11.70	N.A.
1968	9.86	18.60	30.00	N.A.
1969	9.39	21.38	29.92	8.93
1970	7.02	23.67	26.58	10.97
1971	8.59	24.48	35.08	14.00
1972	9.76	44.10	34.99	14.00

NA = Not available

Source: USDA, NOAA, NMFS, Fisheries of the U.S. Annuals 1967-1972.

crab or fresh meat, crab meat cakes, etc. in the states adjacent to the production area. Dungeness crab are harvested from the Pacific Ocean, mainly between San Francisco and Vancouver, B.C. Again the sales are primarily to consumers in the Pacific Coast states as whole fresh crab or fresh or frozen meat. The sales area for frozen Dungeness meat recently has widened to include all of the U.S. and some foreign countries, as is true for the small amount that is sold as canned meat. King crab is a product of Alaskan waters and is now sold mainly as frozen meat, in both U.S. and foreign markets. Snow crab also is of Alaskan origin. It is a relatively new product commercially and is marketed largely as frozen meat. Its market is limited (Figure III-7 and Table III-7).

A further description of the markets for crab meat is essential to an understanding of pricing practices and the characteristics of demand. DPRA estimates that fully 90 percent of all crab meat is sold to consumers in restaurants, either commercial or institutional. Moreover, the heaviest volume is done by specialized seafood restaurants. This means that about 10 percent of all crab or crab meat sales are made directly to consumers for home use. Such a market structure makes the principal buyers more sensitive to supply conditions. For example, an oversupply (heavy inventory) of frozen crab meat usually is eased by "specialing" the item on restaurant menues and by making moderate to drastic price cuts to restaurant buyers. When crab meat is in short supply and relatively high priced, restaurant use substitutes except in specialty seafood restaurants that cater to a less price conscious clientel. The essence of our analysis is that the growth of the market for crab meat probably will relate largely to the increases or decreases in the away-from-home eating habits of U.S. consumers.

In view of the characteristics of the markets for the various species of crab and an assumption that the annual crab harvest can decrease but not increase substantially from year to year, DPRA believes that production uncertainty is a critical factor affecting the well-being of crab fishermen and processors. For example, the abrupt decline in the harvest of King crab after 1967 ruined several small processors who could not get crab, even though those who got crab prospered from a 63 percent price rise. This high risk factor arising from uncertainty about the annual harvest is a pervasive force throughout the crab processing sector. Moreover, the reluctance of plant owners and managers to invest further in pollution control is associated with their knowledge of both risk and uncertainty of supply.

Since the only supply and price data available to us relates to crab landings and prices to fishermen, they were used to learning the statistical relationships between the supply and exvessel price for each species. No statistically

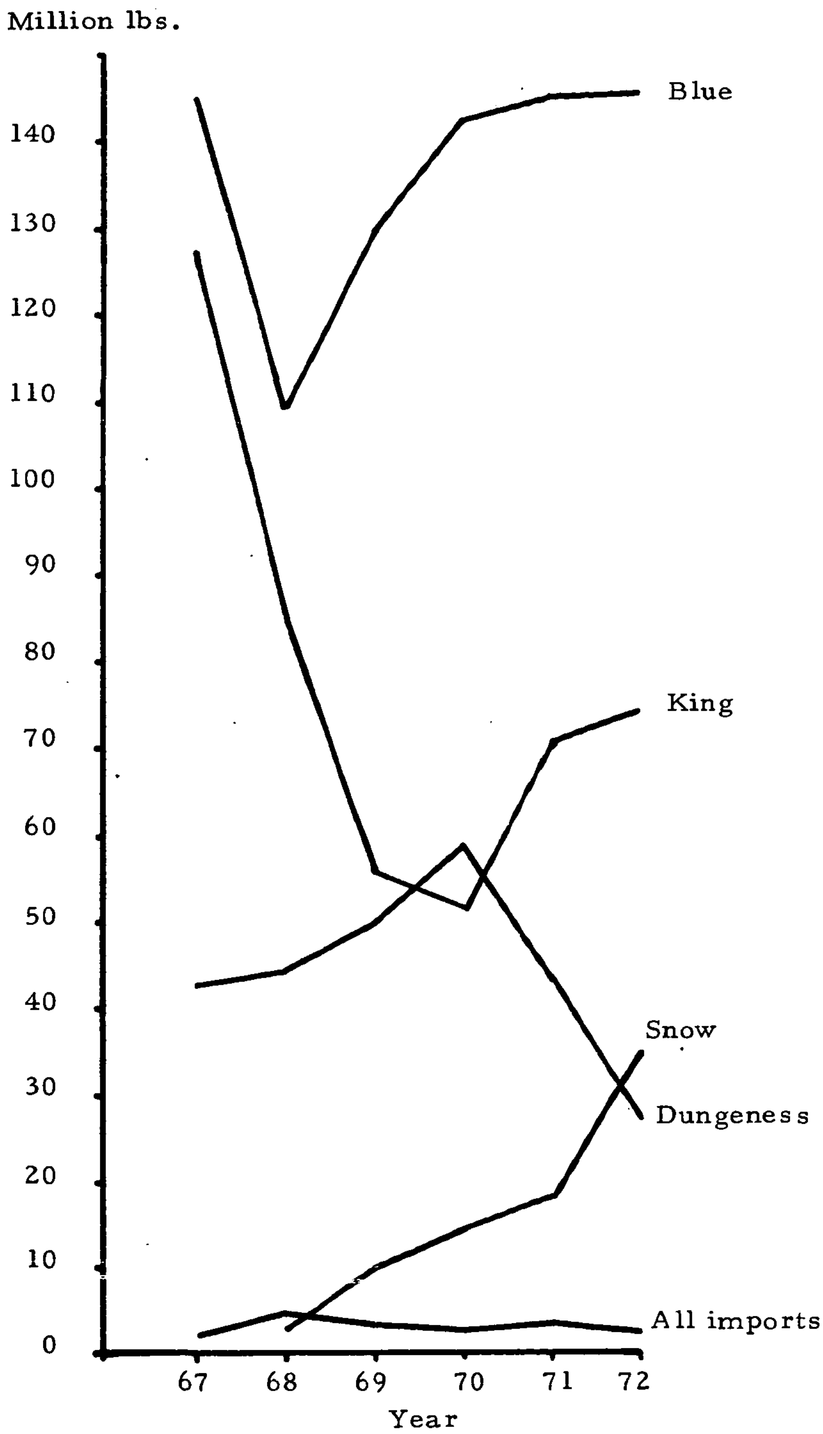

Figure III-7. U.S. Crab landings and imports, by years 1968-1972

Table III-7. Supplies and utilization of West Coast crabs, 1957-59 average, 1960-71

Year	Supplies							Utilization						
	Beginning stocks 1/	Landings: King	Landings: Dungeness	Landings: Snow	Landings: Total	Imports 2/	Total	Ending stocks	Canned: King	Canned: Dungeness	Canned: Snow	Canned: Total	Exports 3/	Fresh & frozen consumption
	Million pounds													
1957-59 average	2.0	14.4	40.6	-	55.0	0.7	57.7	1.6	5.0	5.2	-	10.2	-	45.9
1960	1.0	28.6	36.2	-	64.8	2.5	68.3	1.6	10.4	4.8	-	15.2	-	51.5
1961	1.6	43.4	32.7	4/	76.1	2.2	79.9	2.1	15.9	6.0	-	21.9	-	55.9
1962	2.1	52.8	23.4	4/	76.2	2.3	80.6	2.2	19.5	4.6	-	24.1	-	54.3
1963	2.2	78.7	24.9	-	103.6	2.2	108.0	5.0	26.6	5.6	-	32.2	-	70.8
1964	5.0	86.7	23.0	4/	109.7	1.7	116.4	8.3	24.5	4.3	-	28.8	-	79.3
1965	8.3	131.7	28.9	-	160.6	1.5	170.4	6.8	34.0	6.8	-	40.8	-	120.8
1966	6.8	159.2	39.7	4/	198.9	.7	208.4	5.2	46.4	5.9	-	52.3	-	150.9
1967	5.2	127.7	42.4	0.1	170.2	1.3	176.7	2.9	41.6	4.9	4/	46.5	-	127.3
1968	2.9	85.0	44.0	3.2	132.2	8.6	143.7	8.3	9.9	3.6	0.1	13.6	2.2	119.6
1969	8.3	57.8	49.1	11.2	118.1	12.1	138.5	7.0	7.4	5.4	1.4	14.2	1.0	116.3
1970	7.0	51.9	58.7	15.5	126.1	12.4	145.5	7.0	5.8	5.0	4.4	15.2	2.1	121.2
1971 5/	7.0	70.0	42.6	12.7	125.3	17.6	149.9	7.4	6/6.0	1.1	6/1.0	8.1	2.3	132.1

1/ Frozen only.
2/ Fresh and frozen only.
3/ King crab only.
4/ Less than 50,000 pounds.
5/ Preliminary.
6/ Estimated.

Source: USDC, NOAA, NMFS, Shellfish Situation and Outlook, Annual Review, 1971 significant relationship was found for any of the species. The r^2 for each was Blue .23, Dungeness .45, and King .55. In view of the foregoing results, the relationship of the total value of landings (exvessel) and the volume of landing was undertaken. The result here was an r^2 of .19. The 1972 landings of all species of crabs was 281.1 million pounds compared to 238.5 million pounds in 1968. Despite this increase of 17.85 percent in supply, the exvessel value of the landings rose from $20.23 million in 1968 to $51.66 million in 1972 or 155.4 percent. DPRA calculations indicate that only 22.8 percent of the exvessel price change can be attributed to changes in the general price level. This further strengthens DPRA's belief that the demand for crab meat is tied closely to the away-from-home eating business.

Who Will Absorb the Costs of Pollution Control?

DPRA believes that the present level of disposable consumer income is sufficient to maintain the level of demand for crab meat in all forms despite the fact that present prices are at a record high. It also appears that there is little possibility of any sustained increase in supplies of crab meat, other than from Snow crab, which has not been fully accepted by the public as a substitute for Blue, Dungeness, or King.

In view of the strong leverage of sellers, DPRA believes that pollution control costs will be passed on to consumers, especially if disposable incomes remain high and the trend toward eating away from home continues to rise. This latter condition is especially important, because it is reasonably easy to pass along to consumers increases in raw materials costs when the main part of the consumer price is for preparation and other services. DPRA does not have an adequate statistical base on which to judge the impact on fishermen and processors in different geographical areas and for different processing plants. Deductively, however, its cursory study of the crab industry leads to these tentative conclusions:

1. Small crab processors should have considerable difficulty finding investment capital to pay for major plant improvements or for any significant operating cost increases. Such plants may decrease in number rather materially. It is doubtful, however, that this closing of smaller plants would create any severe unemployment problem. In the first place, most of the plant workers are pickers who should find employment in the expanded operations of larger plants that continue to operate. Second, the landings of crab should be handled more efficiently in larger plants provided there is some concentration of processing operations.

2. Crab fishermen should not be affected in most instances. However, there are a few areas where the closing of small plants located near a crab fishing area will increase the time and cost to fishermen of getting their catch to the processor. In warmer climates, this transportation time factor may limit the "time at sea" for small boats and stimulate the purchase of larger vessels with adequate refrigeration. This latter condition, which is going on now for other reasons than pollution control, should further affect the number of fishermen needed for the crab harvest.

3. Except in Alaska, crab processing is one of three parts of processing plant's activity. Most plants in California, Oregon, and Washington are multi-product plants, i.e., crab, shrimp, and fish of whatever species are found in local fisheries, and this factor would also operate to dampen the effects on crab prices of pollution-associated cost increases.

E. Catfish Price Effects

In contrast to tuna, crab and shrimp, the market for catfish is small and pricing systems are not organized. Three types of catfish are marketed: pond-reared, wild, and imported, for which price differentials exist. The market is not highly structured and marketing of processed, pan-ready catfish remains the primary problem of the industry.

Price Differentials by Catfish Types

Pond-reared catfish normally bring premium prices when compared to "wild" or imported fish. On a "pan-ready" basis, wholesale prices in 1970 were as follows:

Pond-reared catfish	-	$.72 - .75 lb.
Wild catfish	-	.58 - .63
Imported (frozen)	-	.60 - .70

The greater uniformity and better preparation of pond catfish results in a superior product which commands a premium price.

Market Channel Price Margins

Price margins f.o.b. producer-wholesaler-retail, in 1969 averaged approximately 20 percent from producer to wholesaler and 45 percent from wholesale to retail.

The prices, pan-ready basis, quoted were as follows:

Type	F.o.b. processor producer or importer	Wholesaler	Retail
Pond-raised	82-99¢	82-99¢	119-139¢
Wild	60-65¢	71-75¢	99-109¢
Imported	50-60¢	60-65¢	89-99¢

There is no quoted market price published for farm-reared catfish. However, the Chicago market price on wild, fresh catfish is reported. Prices 1961-1971 were as follows:

Year	Wild, fresh catfish, Pan-ready, ¢/lb.	Farm-reared catfish, pan-ready average wholesale price/¢ lb.
1961	42.5¢	
1962	43.3	
1963	41.6	
1964	43.0	
1965	50.2	
1966	59.2	
1967	60.8	
1968	62.5	
1969	62.5	
1970	60.5	
1971	59.0	79.0¢
1972		81.0
1973 (1st 6 mos)		94.0

Absorption of Increased Processing Costs

The present (1973) market for farm-reared catfish is strong and the supply of fish is inadequate to meet the demand. However, the market tends to be localized, the Mid-South, and to some degree the Midwest, being the areas where demand is strongest. Catfish is not accepted by consumers to the degree true for tuna and shellfish. Further, a substantial part of the demand is from low-income groups and Blacks. However, in view of the strong demand there should be opportunities to pass on to consumers increased processing costs associated with pollution control.

F. Market Pricing Practices

Tuna Pricing

The prices paid to fishermen for the various species are based on world prices for canned tuna. While fishermen in the locality of a cannery usually have a contract stating the minimum prices for the species, actual operating conditions determine what canners pay for a given catch from a local fisherman. Recently, the demand from canneries has been strong and competitive bidding above contract levels has been commonplace.

Tuna canners usually are especially cost conscious, particularly when raw material prices (tuna) are rising and foreign competition is strong as they have been for the past 18 months. However, increases in consumer demand and the prices of all red meat and all species of edible fish and shellfish have enabled canners to raise the prices of their canned product, thereby easing some of their traditional concern about raw material (tuna) prices. Consequently, prices to fishermen have risen on that part of their supply bought from independent fishermen. Because tuna canneries are generally large volume operations, prices also must be reckoned in terms of their impact on profits at different levels of cannery output.

Fabricators, who use tuna meat in the preparation of frozen dinners, etc., generally have not enjoyed the benefits of strengthened demand for fish and shellfish. Such fabricators are being restrained by competitors who are seeking to expand their sales to retail food stores and institutional users of frozen dinners. Price cutting to gain market entry has been and is a common practice.

DPRA learned from its 1972 study of the fishery industry, conducted for the National Marine Fisheries Service, that the markup on canned tuna in retail food stores generally ranges from 25 to 32 percent, with a good turnover. However, the markup on such items as frozen tuna pies, etc., may be about the same as canned tuna, with a relatively slow turnover. "Specialing" of most frozen food items further reduces margins of retailers, which is subsequently reflected in prices paid to fabricators.

Crab and Shrimp Pricing

"Brokers" in the shellfish trade generally are merchant-brokers or wholesalers. They either own or have part ownership of the products they sell. These fish and shellfish "brokers" and general food brokers are important functionaries in marketing crab and shrimp, even though there are a few multi-product fishery firms that operate their own sales department. Because fresh and frozen crab and shrimp meat is highly perishable compared to red meat, cooperation among brokers is quite common and necessary. Excessive inventories must be moved quickly. As one prominent broker told DPRA, "we discover prices, we don't make them." In essence, high unit value items such as fresh and frozen crab and shrimp respond quickly to supply-consumption imbalances, either up or down. Hence, DPRA, at this point in its inquiry in the crab and shrimp markets, and without any knowledge of price elasticity, accepts the thesis the nature of demand is such that sellers are especially vulnerable when they have excessive inventories of fresh and frozen shellfish, because their own regular customers may not respond sufficiently to downward price changes. It is under these conditions that brokers seek the help of other brokers to broaden their market. A further consideration is that supply maladjustments often occur between one broker and his regular trade at a time when other brokers may be unable to satisfy the demands of their regular customers.

According to the information obtained by DPRA, canned crab and shrimp also is sold mainly by brokers, especially those who handle a full line of canned food. Recognizing that both canned crab and shrimp are specialty products, general food brokers have a geographical coverage of food markets that enables them to sell such low turnover items as crab and shrimp. Again, DPRA cannot accurately assess supply-demand responses without a very intensive price analysis.

G. Sales Promotion

The promotion of canned tuna under various proprietary brands is extensive, well-financed, and it reaches all sectors of the consuming public, either through newspapers and magazines and/or television and radio. As a result of such promotional activities, "Star Kist," and "Chicken-of-the-Sea," etc., are almost as commonplace as using "Frigidaire" when referring to all electric refrigerators. Furthermore, consumer knowledge about ways to prepare tuna is thought to be unusually good. Some industry people claim that "tuna fish sandwiches and casseroles, unlike hamburgers and hot dogs, have no national boundary."

Except for broker brand promotion of frozen and canned crab and tuna in trade publications directed at wholesalers and retailers, advertising of crab and shrimp is relatively small. None of the firms contacted by DPRA in its 1972 study of the fisheries industry had any separate sales promotion budget for the items discussed.

IV. ECONOMIC IMPACT ANALYSIS METHODOLOGY

The following economic impact analysis utilizes the basic industry information developed in Chapters I-III plus the pollution abatement technology and costs provided by Environmental Protection Agency. The impacts examined include:

- Price effects
- Financial effects
- Production effects
- Employment effects
- Community effects
- Other effects

Due to the crucial nature of potential plant shutdowns (financial and production effects) to the other impacts, a disproportionate amount of time will be devoted to the financial and plant closure analysis.

In general, the approach taken in the impact analysis is the same as that normally done for any feasibility capital budgeting study of new investments. In the simplest of terms, it is the problem of deciding whether a commitment of time or money to a project is worthwhile in terms of the expected benefits derived. This decision process is complicated by the fact that benefits will accrue over a period of time and that in practice the analyst is not sufficiently clairvoyant nor physically able to reflect all of the required information, which by definition must deal with projections of the future, in the cost and benefit analysis. In the face of imperfect and incomplete information and time constraints, the industry segments were reduced to money relationships insofar as possible and the key non-quantifiable factors were incorporated into the analytical thought process to modify the quantified data. The latter process is particularly important in view of the use of model plants in the financial analysis. In practice, actual plants will deviate from the model and these variances will be considered in interpreting financial results based on model plants.

A. Fundamental Methodology

Much of the underlying analysis regarding prices, financial and production effects is common to each kind of impact. Consequently, this case methodology is described here as a unit with the specific impact interpretations being discussed under the appropriate heading following this section.

The core analysis for this inquiry was based upon synthesizing physical and financial characteristics of the various industry segments through model or representative plants. The estimated cash flows for these model plants are summarized in Chapter II. The primary factors involved in assessing the financial and production impact of pollution control are profitability changes, which are a function of the cost of pollution control and the ability to pass along these costs in higher prices. Admittedly, in reality, closure decisions are seldom made on a set of well defined common economic rules, but also include a wide range of personal values, external forces such as the ability to obtain financing or considering the production unit as an integrated part of a larger cost center where total center must be considered.

Such circumstances include but are not limited to the following factors:

1. There is a lack of knowledge on the part of the owner-operator concerning the actual financial condition of the operation due to faulty or inadequate accounting systems or procedures. This is especially likely to occur among small, independent operators who do not have effective cost accounting systems.

2. Plant and equipment are old and fully depreciated and the owner has no intention of replacing or modernizing them. He can continue in production as long as he can cover labor and materials costs and/or until the equipment deteriorates to an irrepairable and inoperative condition.

3. Opportunities for changes in the ownership structure of the plants (or firms) exist through acquisition by conglomerates, large diversified firms, or through other acquisition circumstances which would permit re-evaluation of assets or in situations where new ownership may be willing to accept temporary low returns with the expectation that operations can be returned to profitable levels.

4. Personal values and goals associated with business ownership that override or ameliorate rational economic rules is this complex of factors commonly referred to as a value of psychic income.

5. The plant is a part of a larger integrated entity and it either uses raw materials being produced profitably in another of the firm's operating units wherein an assured market is critical or, alternatively, it supplies raw materials to another of the firm's operations wherein the source of supply is critical. When the profitability of the second operation offsets the losses in the first plant, the unprofitable operation may continue indefinitely because the total enterprise is profitable.

6. The owner-operator expects that losses are temporary and that adverse conditions will dissipate in the future. His ability to absorb short-term losses depends upon his access to funds, through credit or personal resources not presently utilized in this particular operation.

7. There are very low (approaching zero) opportunity costs for the fixed assets and for the owner-operator's managerial skills and/or labor. As long as the operator can meet labor and materials costs, he will continue to operate. He may even operate with gross revenues below variable costs until he has exhausted his working capital and credit.

8. The value of the land on which the plant is located is appreciating at a rate sufficient to offset short-term losses, funds are available to meet operating needs and opportunity costs of the owner-operator's managerial skills are low.

The above factors, which may be at variance with common economic decision rules, are generally associated with proprietorships and closely held enterprises rather than publicly held corporations.

While the above factors are present in and relevant to business decisions, it is argued that common economic rules are sufficiently universal. To provide an useful and reliable insight into potential business responses to new investment decisions, as represented by required investment in pollution control facilities thus, economic analysis will be used as the core analytical procedure. Given the pricing conditions, the impact on profitability (and possible closure) can be determined by simply computing the ROI (or any other profitability measure) under conditions of the new price and incremental investment in pollution control. The primary consequence of profitability changes is the impact on the plant regarding plant shutdown rather than making the required investment in meeting pollution control requirements.

In the most fundamental case, a plant will be closed when variable expenses (Vc) are greater than revenues (R) since by closing the plant, losses can be avoided. However, in practice plants continue to operate where apparently Vc > R. Reasons for this include:

- lack of cost accounting detail to determine when Vc > R.
- opportunity cost of labor or some other resource is less than market values. This would be particularly prevalent in proprietorships where the owner considers his labor as fixed.
- other personal and external financial factors.
- expectations that revenues will shortly increase to cover variable expenses.

A more probable situation is the case where Vc < R but revenues are less than variable costs plus cash overhead expenses (TCc) which are fixed in the short run. In this situation a plant would likely continue to operate as contributions are being made toward covering a portion of these fixed cash overhead expenses. The firm cannot operate indefinitely under this condition, but the length of this period is uncertain. Basic to this strategy of continuing operations is the firm's expectation that revenues will increase to cover cash outlay. Factors involved in closure decisions include:

- extent of capital resources. If the owner has other business interests or debt sources that will supply capital input, the plant will continue.
- lack of cost accounting detail or procedures to know that TCc>R, particularly in multiplant or business situation.
- labor or other resources may be considered fixed and the opportunity cost for these items is less than market value.

Identification of plants where TCc > R, but Vc < R leads to an estimate of plants that should be closed over some period of time if revenues do not increase. However, the timing of such closures is difficult to predict.

The next level of analysis, where TCc < R, involves estimating the earnings before and after investment in pollution abatement. So long as TCc <R it seems likely that investment in pollution control will be made and plant operations continued so long as the capitalized value

of earnings (CV), at the firms (industry) cost of capital, is greater than the scrap or salvage value (S) of the sunk plant investment. If $S > CV$, the firm could realize S in cash and reinvest and be financially better off. This presumes reinvesting at least at the firms (industry) cost of capital.

Computation of CV involves discounting the future earnings flow to present worth through the general discounting function:

$$V = \sum_{n=1}^{t} A_n (I+i)^{-n}$$

where

V	=	present value
A_n	=	a future value in n^{th} year
i	=	discount rate as target ROI rate
n	=	number of conversion products, i.e., I year, 2 years, etc.

It should be noted that a more common measure of rate of return is the book rate, which measures the after-tax profits as a ratio of invested capital, is net worth or sales. These ratios should not be viewed as a different estimate of profitability as opposed to DCF measures (discounted cash flow) but rather an entirely different profitability concept. The reader is cautioned not to directly compare the DCF rates with book rates. Although both measures will be reported in the analyses, the book rate is reported for informational purposes only.

The two primary types of DCF measures of profitability are used. One is called the internal rate of return or yield and is the computed discount rate (yield) which produces a zero present value of the cash flow. The yield is the highest rate of interest the investor could pay if all funds were borrowed and the loan was returned from cash proceeds of the investment. The second DCF measure is the net present value concept. Rather than solve for the yield, a discount rate equivalent to the firms cost of capital is used. Independent investments with net present values of above zero are accepted; those below zero are rejected. The concept of comparing capitalized earnings with the sunk investment value is a variation of the net present value method.

The data input requirements for book and DCF measures are derived, to a large extent, from the same basic information although the final inputs are handled differently for each.

1. Benefits

For purposes of this analysis, benefits for the book analysis have been called after-tax income and for the DCF analysis after-tax cash proceeds. The computation of each is shown below:

After tax income = (1 - T) x (R - E - I - D)

After tax cash proceeds = (1 - T)x(R - E - D) + D

where

T = tax rate

R = revenues

E = expenses other than depreciation and interest

I = = interest expense

D = depreciation charges

Interest in the cash proceeds computation is omitted since it is reflected in the discount rate, which is the after-tax cost of capital, and will be described below. Depreciation is included in the DCF measure only in terms of its tax effect and is then added back so that a cash flow over time is obtained.

A tax rate of 48 percent was used throughout the analysis. Accelerated depreciation methods, investment credits, carry forward and carry back provisions were not used due to their complexity and special limitations. It is recognized that in some instances the effective tax rate may be lower in a single plant situation, but with the dominance of multiplant firms, the firm's tax rate will be close to the 48 percent rate.

Revenue, expenses, interest and depreciation charges used were those discussed in Chapter II and Chapter V for pollution control facilities. These items were assumed to constant over the period of analysis.

2. Investment

Investment is normally thought of as outlays for fixed assets and working capital. However, in evaluating closure of an on-going plant where the basic investment is sunk, the value of that investment must be made in terms of its liquidation or salvage value, that is its opportunity cost or shadow price. 1/ For purposes of this analysis, sunk investment was taken as the sum of equipment salvage value plus land at current market value plus the value of the net working capital (current assets less current liabilities) tied up by the plant (see Chapter II for values). This same amount was taken as a negative investment in the terminal year. Replacement investment for plant maintenance was taken as equal to annual depreciation, which corresponds to operating policies of some managements and serves as a good proxy for replacement in an on going business.

Investment in pollution control facilities was taken as the estimates provided by EPA and shown in Chapter V. Only incremental values were used, to reflect in-place facilities.

The above discussion refers primarily to the DCF analysis. Investment used in estimating book rates was taken as invested capital - book value of assets plus net working capital. In the case of new investment, its book rate was estimated as 50 percent of the original value.

3. Cost of Capital - After Tax

Return on invested capital is a fundamental notion in U.S. business. It provides both a measure of actual performance of a firm as well expected performance. In this latter case, it is also called the cost of capital. The cost of capital is defined as the weighted average of the cost of each type of capital employed by the firm, in general terms equities and interest bearing liabilities. There is no methodology that yields the precise cost of capital, but it can be approximated within reasonable bounds.

The cost of equities was estimated by two methods -- the dividend yield method and the earnings stock price (E/P ratio) method. Both are simplifications of the more complex DCF methodology. The dividend method is:

1/ This should not be confused with a simple buy sell situation which merely involves a transfer of ownership from one firm to another. In this instance, the opportunity cost (shadow price) of the investment may take on a different value.

$$k = \frac{D}{P} + g$$

where

k = cost of capital
D = dividend yield
P = stock price
g = growth

and the E/P method is simply

$$k = E/P$$

where

E = earnings
P = stock price

and is a further simplication of the first. The latter assumes future earnings as a level, perpetual stream.

The after tax cost of debt capital was estimated by using estimated 7.5 percent cost of debt and multiplying by .52 -- assuming a 48 percent tax rate. These values were weighted by the respective equity to total asset and total liabilities [1/] to total asset ratios.

The average cost of capital for the seafoods processing industry was estimated as follows:

Dividend Yield Plus Growth

Capital	Weight	Cost	Growth	Cost
Equity	.56	.032	.04	.058
Debt	.44	.039	--	.015
Average cost of capital				.073

E/P

Capital	Weight	Cost	Growth	Cost
Equity	.56	.060	--	.034
Debt	.44	.039	--	.017
Average cost of capital				.051

As shown in the above computations, the estimated after-tax cost is 5.6 to 6.7 percent. The subsequent analysis was based on 6.0 percent. The four percent growth factor is roughly equal to inflation expectations.

1/ It is recognized that liabilities contain non-interest bearing liabilities, but its weight is believed to be an adequate proxy for the weight of debt.

As shown in the above computations, the estimated after-tax cost is 5.1 to 7.3 percent. The subsequent analysis was based on 6.0 percent. The four percent growth factor is roughly equal to inflation expectations.

It was assumed that, for the seafoods processing industry, a pre-tax cost of capital of 11.5 percent was used for evaluating new projects.

4. Construction of the Cash Flow

A thirty-two period cash flow was used in this analysis and was constructed as follows:

1. Sunk investment (salvage market value of fixed assets plus net working capital) taken in year t_0.
2. After tax cash proceeds taken for years t_1 to t_{30}.
3. Annual replacement investment, equal to annual current depreciation taken for years t_1 to t_{30}.
4. Terminal value equal to sunk investment taken in year t_{31}.
5. Incremental pollution control investment taken in year t_0 for 1977 standards and year t_6 for 1983 standards.
6. Incremental pollution expenses taken for years t_1 to t_{30} for 1977 standards and years t_7 to t_{30} for 1983 standards.
7. Replacement investment taken on BPT incremental investment in years 10 and 20 and on BAT incremental investment in year 26 based on useful lives of 10 and 20 years, respectively.
8. Terminal value of pollution facilities equal to original cost of land taken in year t_{31}.

B. Price Effects

At the outset, it must be recognized that price effects and production effects are intertwined with one effect having an impact upon the other. In fact, the very basis of price analysis is the premise that prices and supplies (production) are functionally related variables which are simultaneously resolved.

Solution of this requires knowledge of demand growth, price elasticities, supply elasticities, the degree to which regional markets exist, the degree of dominance experienced by large firms in the industry, market concentration exhibited by both the industry's suppliers of inputs and purchasers of outputs, organization and coordination within the industry, relationship of domestic output with the world market, existence and nature of complementary goods, cyclical trends in the industry, current utilization of capacity and, exogenous influences upon price determination (e.g., governmental regulation).

In view of the complexity and diversity of factors involved in determination of the market price, a purely quantitative approach to the problem of price effects is not feasible. Hence, the simultaneous considerations suggested above will be made. The judgment factor will be heavily employed in determining the supply response to a price change and alternative price changes to be employed.

As a guide to the analysis of price effects, the estimated price required to leave the model plant segment as well off will be computed. The required price increase at the firm level will be evaluated in light of the relationship of the model plant to the industry and the understanding of the competitive position of the industry. The required price increase can be readily computed using the DCF analysis described above, but dealing only with the incremental pollution investment and cash proceeds.

Application of the above DCF procedure to these costs will yield the present value of pollution control costs (i.e., investment plus operating cost less tax savings). If this is known, the price increase required to pay for pollution control can readily be calculated by the formula

$$X = \frac{(PVP)(100)}{(1-T)(PVR)}$$

where:

X = required percentage increase in price

PVP = present value of pollution control costs

PVR = present value of gross revenue starting in the year pollution control is imposed

Note that this formula implies that incremental profits resulting from the price increase will be taxed at a rate of 48 percent.

C. Financial Effects

In Chapter II, the financial characteristics of model plants were presented. These data will serve as the base point for the analysis of financial effects of pollution control. The primary focus of analysis will be upon profitability in the industry and the ability of the firms to secure external capital. Hence, it is obvious that this portion of the analysis cannot be divorced from production effects since profit levels and the ability to finance pollution abatement facilities will have a direct influence on supply responses -- utilization of capacity and plant closures.

The measures of profitability utilized will include after-tax book rate of return on invested capital and cash flow (after-tax profit plus depreciation) will be measured. After-tax profit as a percent of sales will also be reported to assist in comparing financial data with standard industrial measures.

In addition to these factors, two additional measures of economic profitability will also be examined: (1) capitalized value of earnings and (2) present values estimated by the procedures described in Section A above. Both of these measures will be calculated on pre- and post-pollution control bases.

Given these financial measurements, the ability of the industry to finance the required pollution control expenditures will be reexamined in light of the financial results and the information shown in Chapter II. This ability will vary from one industry subsector to another due to differential financial structures, profitability and abatement requirements. Hence, capital availability and cost will probably have to be examined on a model plant by model plant basis.

D. Production Effects

Potential production effects include reductions of capacity utilization rates, plant closures and stagnation of industry growth. It is anticipated that reductions in capacity utilization will be estimated via qualitative techniques given the analysts' knowledge of the industry. The same is true for assessing the extent to which plant closures may be offset by increases in capacity utilization on the part of plants remaining in operation. Data limitations and time constraints are expected to require that the impact of pollution control standards upon future growth of the industry also be estimated via qualitative methods.

The remaining effect, plant closures, is very difficult to measure realistically as discussed above in Section A. As a starting point in the plant closure analysis, a shutdown model will be employed to indicate which model plants should be closed, the marginal operations and the sound operations. These conclusions will be based upon the decision rule that a plant will be closed when the net present value of the cash flow is less than zero.

It is recognized that the use of model plants to represent an industry is imperfect and that not all of the relevant factors can be included in the models. In other words, for any given model plant one would expect to find some actual plants with profits lower and some higher than shown for the model plant. In a statistical sense, one can describe this phenomenon via distribution functions. By examining various publications and through numerous discussions with knowledgeable individuals in the seafoods industry throughout the continental U. S. and Alaska, typical profit levels and variations were estimated for each industry segment covered in this report. A financial model was constructed for each segment which best reflects median conditions indicated by the data attainable within the constraints of the study. Where possible, models for alternative plant sizes within a segment were also constructed. In other cases a formal model was used for only one size grouping and the results were modified qualitatively to reflect impacts on other size groupings. It is recognized that the models may not exactly represent median conditions in the industry segments studied. In that light, the models should be viewed as surrogates based on the best data available at this point.

The analysis was done under a without pollution control condition and a with pollution control condition. The former (and including historical trends) was used to establish a baseline against which total closures after pollution control were compared, to arrive at an estimate of closures due to pollution control.

Given the production effects of estimated production curtailments, plant closings and changes in industry growth, a major consideration arises in the implications of these factors upon employment in the industry. The employment effects stemming from each of these production impacts will be estimated. To the extent possible, the major employee classifications involved will be examined as will the potential for re-employment.

F. Community Effects

The direct impacts of job losses upon a community are immediately apparent. However, in many cases, plant closures and cutbacks have a far greater impact than just the employment loss. Multiplier effects may result in even more unemployment. Badly needed taxes for vital community services may dwindle. Community pride and spirit may be dampened. However, in some cases, the negative community aspects of production effects may be very short-term in nature with the total impact barely visible from the viewpoint of the overall community. In a few cases, the closure of a plant may actually be viewed as a positive net community effect (e.g., a small plant with a high effluent load in an area with a labor shortage).

These impact factors will be qualitatively analyzed as appropriate.

G. Other Effects

Other impacts such as direct balance of payments effects will also be included in the analysis. This too will involve qualitative analyses.

V. EFFLUENT CONTROL COSTS

Water pollution control costs used in this analysis were furnished by the Effluent Guidelines Division of the Environmental Protection Agency. These basic data were adapted to the types and sizes of plants specified in this analysis.

Three effluent control levels were considered:

BPT	-	Best Pollution Control Technology Currently Available, to be achieved by July 1, 1977
BAT	-	Best Available Pollution Control Technology Economically Achievable, to be achieved by July 1, 1983
NSPS	-	New Source Performance Standards, apply to any source for which construction starts after the publication of the proposed regulations for the Standards

Description of Effluent Control Levels and Costs

The specifications and descriptions of the effluent control guidelines and control technologies were developed for the Effluent Guidelines Division, EPA by Environmental Associates in their draft report. [1/] The proposed technologies, capital and operating costs, furnished by EPA for use in this analysis are shown in Table V-1. It is understood that these are tentative recommendations, made in the draft report and are subject to change based on comments received and further review by EPA.

1/ Development Document for Effluent Limitation Guidelines and Standards of Performance -- Canned and Preserved Fish and Seafoods Processing Industry, Draft Report, Environmental Associates, Inc., July, 1973.

Table V-1. Effluent control costs, seafood processing plants, 1972 [1]

Product category	Treatment level [2]	Proposed effluent treatment technology	Capital cost [4] Size of plant -- operating capacity			Daily operating & maintenance cost Size of plant -- operating capacity			Land required at full capacity (acres)
			Half	Full	Twice	Half	Full	Twice	
Catfish	BPT	Pond 1, screen and aerated lagoon plus oxidation pond	$64,560	$97,916	$148,488	$21	$31	$47	5.3
	BAT[3]	Pond 1, screen and aerated lagoon plus extended aeration & clarification	66,712	100,068	151,716	11	16	25	0.4
	NSPS	BPT plus spray irrigation	65,313	99,000	150,640	22	33	50	16.6
Conventional blue crab	BPT	Screen plus aerated lagoon	4,260	6,456	9,813	4	6	9	0.4
	BAT	BPT plus flow equalization, extended aeration and clarification	20,551	31,204	47,430	9	13	21	0.3
	NSPS	Same as BPT	4,260	6,456	9,813	4	6	9	0.4
Mechanized blue crab	BPT	Screen plus aerated lagoon	7,101	10,760	16,355	4	6	9	0.7
	BAT	BPT plus flow equalization, extended aeration and clarification	82,852	125,892	190,452	11	16	25	0.4
	NSPS	Same as BPT	7,101	10,760	16,355	4	6	9	0.7
Alaskan crab meat	BPT	Screen and barge	236,397	358,308	543,380	205	311	472	0.2
	BAT	BPT plus floatation	1,010,146	1,531,143	2,324,160	308	467	703	0.5
	NSPS	BPT plus in-plant operating improvements	269,032	401,346	600,192	205	311	472	0.2

(continued)

Table V-1. (continued)

Product category	Treatment level 2/	Proposed effluent treatment technology	Capital cost 4/ Size of plant -- operating capacity: Half	Full	Twice	Daily operating & maintenance cost Size of plant -- operating capacity: Half	Full	Twice	Land required at full capacity (acres)
Alaskan crab, whole and sections	BPT	Screen and barge	$159,248	$242,100	$366,916	$133	$210	$318	0.2
	BAT	BPT plus floatation	682,184	1,034,036	1,567,732	208	315	477	1.0
	NSPS	Screen, reduction	318,496	482,098	730,604	220	334	506	0.2
Dungeness & Tanner crab (Calif., Ore., Wash.)	BPT	Screen, floatation	75,320	115,132	174,312	22	35	53	1.0
	BAT	BPT plus aerated lagoon	143,108	217,352	329,256	29	44	67	3.0
	NSPS	Same as BPT, plus in-plant operating improvements	104,372	158,172	239,948	22	35	53	1.0
Southern shrimp	PBT	Screen, floatation	136,652	207,668	314,192	18	28	42	1.0
	BAT	BPT plus aerated lagoon	177,540	269,000	407,304	28	42	64	13.0
	NSPS	Same as BPT, plus in-plant operating improvements	144,184	218,428	331,408	18	28	42	1.0
Breaded shrimp	BPT	Screen, foatation	177,540	267,000	407,304	53	80	124	1.0
	BAT	BPT plus aerated lagoon	257,164	390,588	591,800	66	100	151	12.0
	NSPS	Same as BPT, plus in-plant operating improvements	220,580	333,560	505,720	53	80	124	1.0
Alaskan shrimp	BPT	Screen, barge	403,500	611,168	926,436	297	451	684	0.2
	BAT	BPT plus floatation	2,046,552	3,102,108	4,702,120	515	781	1,183	0.7
	NSPS	Screen, reduction	794,088	1,204,044	1,824,896	589	893	1,353	0.2

(continued)

Table V-1. (continued)

Product category	Treatment level 2/	Proposed effluent treatment technology	Capital cost 4/ Size of plant -- operating capacity			Daily operating & maintenance cost Size of plant -- operating capacity			Land required at full capacity (acres)
			Half	Full	Twice	Half	Full	Twice	
Northern pink shrimp (Calif., Ore., Wash.)	BPT	Screen, floatation	$96,340	$147,412	222,732	13	19	30	1.0
	BAT	BPT plus aerated lagoon	128,044	193,680	293,748	19	30	45	8.3
	NSPS	Same as BPT, plus in-plant operating improvements	104,372	158,172	239,948	13	19	30	1.0
Tuna	BPT	Screen, floatation	299,128	454,072	688,640	108	165	250	0.5
	BAT	BPT plus high rate trickling filter and activated sludge	1,052,000	1,595,000	2,417,000	333	505	765	8.3
	NSPS	Same as BPT, plus in-plant operating improvements	342,168	518,632	786,556	108	165	250	0.5

1/ Source: Effluent Guidelines Division, Environmental Protection Agency, from materials developed by Environmental Associates, Inc. 1971 costs adjusted to 1972 levels by DPRA by applying appropriate cost adjustment factors.

2/ BPT = Best Practicable Technology (1977)
BAT = Best Available Technology (1983)
NSPS = New Source Pollution Standard

3/ Cost of BAT starting from no control. However, incremental cost of reaching BAT from BPT would be $18,292 for full utilization, $12,761 for half utilization and $26,900 for twice utilization.

4/ Does not include land acquisition costs (see Ch. VI).

The technical document describing the recommended technology for achieving the BPT, BAT and NSPS guidelines was prepared for EPA by Environmental Associates, Inc. of Corvallis, Oregon and is titled "Development Document for Effluent Limitation Guidelines and Standards of Performance--Canned and Preserved Fish and Seafoods Processing Industry," Draft Report, July, 1973. To avoid duplication and possible confusion, no detailed, technical descriptions of BPT, BAT and NSPS guidelines are given in this report. The interested reader is referred to the above-mentioned document for technology descriptions.

All effluent control technologies, costs and related plant characteristics to which these costs apply were specified by EPA Effluent Guidelines Division, based on the technical report of Environmental Associates, Inc. Since the system costs were in terms of 1971 cost levels, it was necessary to up-date these to 1972 by the use of appropriate cost inflators, i. e., Index of Sewage Treatment Plant Construction Costs for Investment and the Implicit Price Inflator for GNP for operating costs.

The updated investment and operating costs for the specified product categories and treatment levels are shown in Table V-1. The daily capacities for the plants specified in the EPA treatment costs are shown in Table V-2. The plant sizes shown are all for large, commercial processors and the effluent treatment costs are "single point" estimates in that they apply specifically to the plants shown. Limited data for other sizes of plants were available from EPA and it was necessary to extrapolate from these data to get estimates of treatment costs for other sizes of plants specified in the analysis.

<u>Current Status of Effluent Control in the Industry</u>

The availability and usage of municipal wastewater treatment systems will be an important factor influencing potential closures of seafoods processing plants. There are no published sources of information concerning the extent to which seafoods processors utilize municipal sewage systems. For the purposes of this study, estimates were made on the basis of industry contacts and discussions with men in industry and government who are knowledgeable concerning conditions in their industry. These estimates are shown in Table V-3. For those plants, located on the seacoast, which do not have sewer connections, fishery processing wastes are usually returned to the ocean through outlet pipes where tidal action sweeps the waste into the ocean. In some instances, solids are ground before being discharged. In other instances screens are used to remove solids which are then disposed of in land fills or, in a few cases, are processed into animal feeds, pet foods or fertilizer.

Table V-2. Plant capacities, two-shift operation, on which effluent control costs were based 1/

Product and Category	Capacity, tons per day raw product 2/
Catfish	15.0
Conventional blue crab	6.0
Mechanized blue crab	11.7
Alaskan crab 3/	25.0
Dungeness crab (Calif., Ore., Wash.)	14.0
Southern shrimp	40.0
Breaded shrimp	14.0
Alaskan shrimp	35.0
Northern pink shrimp (Calif., Ore., Wash., New England)	20.0
Tuna	375.0

1/ Development Document for Effluent Limitation Guidelines and Standards of Performance -- Canned and Preserved Fish and Seafoods Processing Industry, Draft Report, Environmental Associates, Inc., July 1973.

2/ Capacity is for full-sized plant.

3/ Alaskan crab has two segments, (1) meat and (2) whole and sections, both the same size.

Table V-3. Estimated percentage of seafoods processing plants discharging into municipal wastewater treatment systems, by product category, 1973

Product category	Estimated percentage plants discharging into municipal systems
Catfish	50
Conventional blue crab	50
Mechanized blue crab	50
Alaskan crab meat [1/]	5
Dungeness and tanner crab (Calif., Ore., Wash.)	10
Southern shrimp	50
Breaded shrimp	50
Alaskan shrimp	5
Northern pink shrimp (Calif., Ore., Wash., New England)	10
Tuna	20

1/ Alaskan crab has two segments, (1) meat and (2) whole and sections, both the same size.

In some locations in the Pacific Northwest, where sewers are available, cook waters are sewered but all other liquid wastes and cleanup water is dumped into the ocean or rivers.

VI. IMPACT ANALYSIS

The imposition of effluent controls on seafood and fish processing industry will have both direct and indirect impacts on the industry, on consumers, on its suppliers and on communities in which plants are located. An analysis was made, for specified effluent control levels, in both quantitative and qualitative terms, of the impacts which are expected.

The following types of impacts have been analyzed:

A. Price Effects
B. Financial Effects
C. Production Effects
D. Employment Effects
F. Community Effects
G. Balance-of-Trade

A. Price Effects

As will be seen in the following section of this report, the role of price effects in this analysis is critical. The industry is one with a relatively low value added and low profit margin in relation to sales. A small change in the wholesale price with raw product prices staying constant results in significant changes in industry profits. The converse of this argument is likewise true. Hence, if an increase in processor margins can be expected as a result of mandatory effluent treatment practices, the adverse economic impacts of those controls on the industry will, in some cases, be ameliorated. Given the diversity of industry segments covered in this study, it is best to examine prices on a segment by segment basis.

The extent to which price increases can be passed on depends on many factors. These factors include essentially all demand and supply considerations, some of which are listed below:

1. the number of firms in the industry
2. the number of plants with low cost waste treatment options such as municipal sewer availability
3. the relationship of domestic production relative to imports
4. possible substitution effects
5. the competitive structure of the industry.

Given the diversity of industry segments covered in this study, it is best to examine prices on a segment by segment basis. Even when approached on this basis, time, data availability and budget constraints are substantial. The procedure that has been adopted is therefore to calculate the price increases required to completely ameliorate adverse production impacts, estimate the closures in the absence of any price increase and then to reduce the calculated price effects and estimated closures to the level that is actually expected. The expected price changes and the projected closures therefore reflect the influence of many factors such as the above list of five items as well as the judgment of qualified persons.

1. Catfish

The catfish processing industry is, for all practical purposes, still in its infancy. The 1960's saw a rapid proliferation of catfish rearing and processing enterprises as rumors of large profits spread. A wide cross-sections of firms, both large and small, rushed in. Processor capacity surged ahead of supplies and profit margins dropped accordingly. Both supplies and demand are expanding but, a full recovery from the over-capacity problem in processing will not be forthcoming for quite some time.

Utilization of processing capacity is currently estimated at 40-60 percent.[1/] Industry sources report few, if any, firms have experienced profits during the past two years. Price freezes imposed by the Federal government have further compounded the problem. Most firms are staying in operation in hopes of a larger supply of fish and an increasing demand. Low plant salvage values have also probably influenced many of the firms to try to maintain operations in hopes of a more profitable future.

Effluent treatment investment and operating costs are expected to have a large impact on this depressed industry segment. We feel 25-40 percent of the industry capacity could be closed without substantially increasing processor margins (except for a few isolated cases). Considering that small and medium plants would be most likely to close in face of the proposed standards, over 50 percent of the plants could probably be closed without significantly raising processor margins. Therefore, due to excessive idle capacity in this industry segment, we are not projecting a price increase to result from mandatory pollution abatement standards.

1/ "Catfish Processing -- A Rising Southern Industry," ERS, USDA, Agricultural Economic Report No. 224, April, 1972.

2. Blue Crab

The blue crab industry is relatively old, well established, and has been processing a rather stable volume in recent years. The bulk of the industry's output is sold fresh, cold packed in nonhermetically sealed containers or in frozen form. A few plants produce hermetically sealed cans. Given the nature of the industry and knowledge gained through industry representatives, we feel excess capacity exists in the industry -- perhaps more than 20 percent. Since it is projected in the following section, production imports, that the proposed effluent guidelines will close less than 10 percent of the industry capacity which is less than the estimated idle capacity, no price effects impacts are projected for the blue crab industry.

3. Southern Shrimp

The southern shrimp industry segment applies to those plants in the South Atlantic and Gulf areas which do not bread their final product. Since only a small percentage of all shrimp are processed fresh, most of the output appears as canned or frozen. Many of the plants producing frozen shrimp (unbreaded) also produce breaded shrimp. Therefore, it is difficult to analyze southern shrimp separately from breaded shrimp. In placing freezer-breader plants in the two categories, we defined a plant with over 50 percent of final product breaded as in the breaded shrimp segment and a plant with less than 50 percent of final product breaded as in the southern shrimp segment. However, the data available are less than adequate for such a classification scheme and, therefore, should be viewed as indicative of existing plant types rather than a tabulated estimate based upon detailed data.

If no price effects were induced by effluent guidelines, the production impacts on the southern shrimp industry segment would be substantial. The role of price effects serving to ameliorate those impacts will be highly influenced by two critical factors (1) the relationship between municipal sewage charges and private industrial treatment costs for shrimp processors and (2) the quantity and price of imported shrimp.

We feel a wholesale price increase of about 1.6 percent would be required to pay for private effluent treatment costs under BPT guidelines in a large southern shrimp plant. BAT treatment would cost another 1 percent or more -- depending on land costs. Although municipal waste treatment would be expensive for these plants, we feel it definitely would cost less than BAT private treatment and should be less than BPT costs. Hence, direct dischargers under BAT controls would be at a distinct economic disadvantage when compared to sewered plants. Any disparity under BPT controls would be less than under BAT conditions. Since we estimate 50 percent of the industry segment is sewered, long run price adjustments induced by BAT guidelines would be unlikely.

Since shrimp imports exceed domestic production, significant price changes on the domestic market could alter the industry's structure. Processing cost increases would encourage final processing of imported shrimp prior to importation. Price increases would enable importers to buy more shrimp in the international market.

Recognizing that the southern shrimp harvest varies substantially from year to year (e.g. 1973 should be much lower than the past two years), projecting price effects is very difficult. Still, there is a strong demand for the large southern shrimp and demands on the international market is growing. When all factors are considered; i.e., imports, municipal sewer availability, recent demand trends and land availability, the calculated price increase of 1.6 percent for BPT and 1 percent or more for BAT would be substantially reduced. While it is impossible to pinpoint the exact price effect it is estimated that it will be sufficiently large to reduce plant closures under the no price change assumption by a factor of one-fourth.

4. Tuna

In many respects, the tuna segment is different from other industry segments studied in this report. Tuna canning has a much higher market concentration than does shellfish and catfish. There is a tariff quota on canned tuna with the quota equalling 20 percent of the previous year's domestic pack excluding American Samoa. The duty rate has been declining since 1967. Imports over the quota were dutiable at 12.5 percent ad valorem in 1972. During the past ten years, only 1970 saw imports above the quota.

Even though there is a quota on canned tuna, about one-half of the industry's raw material is imported. The record pack of 616.6 million in 1972 consisted of 57.4 percent imported fresh and frozen tuna and 8.4 percent canned tuna for a total of 66.2 percent imported. Imported raw product varies in form from raw fish to frozen loins.

The cost of effluent treatment as a percent of sales (both computed as net present values of future cash flows) is fairly small for large tuna canning plants -- 0.2 for BPT, 0.5 for BAT and 0.8 for BAT-A. Net profit on sales for the same plant would be about 0.9 percent under median conditions. Even though these costs are fairly small when compared to value of product, the added costs might be enough to encourage pre processing at the fishing fleet level and/or form and volume of imports.

Given the import tariff quota, a price change would seem to be a reasonable expectation. However, we do not believe price changes would be sufficient to pay the entire cost of treatment for large plants. Given the substantial economies of scale in tuna canning and waste water treatment, the price increase would pay for an even smaller portion of the medium and small plants' waste water treatment costs. Changes in wholesale canned tuna prices resulting from effluent guidelines are expected to be roughly 0.1, 0.2 and 0.3 percent for BPT, BPT + BAT and BPT + BAT-A, respectively. Price changes of this magnitude will reduce plant closures by by approximately 25 percent from those calculated assuming no price changes. The price change would be borne by the consumers due to the international competition at the ex-vessel level.

5. Northern Pink Shrimp

Processors in this industry segment are primarily located in the Pacific Northwest and New England. In the Northwest, shrimp processing may take place in a shrimp only plant or may be in conjunction with other seafood processing (e.g., crab or salmon). In New England, there are a few plants which specialize in shrimp but, most process finfish (e.g., whiting). In cases where shrimp is processed in conjunction with finfish, we have assumed the other products would have profit margins and effluent treatment costs similar to shrimp and that one treatment system would serve the combined effluent streams from processing all of the plants products.

Using the same logic as described for Southern shrimp, above, we estimate a price increase of 1.6 percent and 1 percent would be required to ameliorate the impacts of BPT and BAT standards respectively. The expected price change is substantially less, perhaps in the neighborhood of 50 percent of the above and is expected to be sufficient to cover land costs and reduce plant closures (in the absence of the expected price increases) by one-fourth.

6. Alaskan Shrimp

As in Washington and Oregon, shrimp processing is usually found in shrimp only or combined shrimp - crab plants and, in some cases finfish plants. The finished product domestically competes with northern pink shrimp and the smaller sizes of southern shrimp. Again, imports also play an important role in price analysis. Hence, we conclude the f.o.b. plant price change will closely approximate that for northern pink shrimp. However, it is very critical to note that proposed effluent treatment costs per dollar of sales are much higher for Alaskan shrimp than for continental shrimp. As a result, price changes will probably decrease closures from those projected under the no price change assumption by only roughly 10 percent.

7. Alaskan Crab

Although effluent treatment cost data were provided for two levels of Alaskan crab processing (i.e., meat only and whole and sections), we have analyzed the price effects impact on the basis of an average for the entire industry segment. We feel this position is justifiable given prevailing crab processing methods in Alaska. The majority of plants prefer to pack meat only unless processing volume exceeds picking capacity or temporary market conditions favor whole and sections. However, it is recognized that some plants specialize in whole and sections while still others buy frozen sections as their raw product and sell the meat.

In examining this industry segment, the only close substitutes found were dungeness and tanner crab from the continental West Coast and imports from Canada. Given the stability and location of the blue crab market, it is doubtful that this industry segment could influence the Alaskan market appreciably. The combined volume of West Coast dungeness and tanner and Canadian import potential is small enough in relation to the Alaskan volume that they could not dictate price. However, the lower effluent treatment costs on the West Coast will have a dampening affect on upward price movements. Also, if prices of Alaskan crab should rise drastically, we would likely see some cross product substitution from crab to shrimp.

The proposed effluent treatment costs for Alaskan crab are quite high and projected plant closures assuming no price changes are quite high (see Table VI-2 in Section C). Price increases required to cover all additional costs of pollution abatement standards are approximately 2 and 5 percent for BPT and BPT + BAT, respectively. Expected price increases are in the neighborhood of 1.5 and 3 percent for BPT and BPT + BAT, respectively. This increase is expected to be of sufficient magnitude to cover land costs and reduce closures by 50 percent from the level projected in Table VI-2.

As a note of interest, if BAT technology was to include aerated lagoons, the land requirements would increase by a factor of four-five. The cost of land in that case would probably place costs and plant closures beyond reach for a large portion of the Alaskan crab plants. Also, it should be noted that the BAT technology we have analyzed requires an estimated one acre of land for a 25 TPD plant. If one acre of land cannot be obtained reasonably (e.g., less than $100,000) when extraordinary land preparation costs are included and placing the equipment on piling is not feasible, the closure impacts could be more severe than projected. We would suggest that more effort needs to be devoted to the land availability and alternative problems for Alaskan plants prior to terming this analysis as truly reflective of Alaskan conditions.

8. Dungeness and Tanner Crab -- Continental

As noted in the Alaskan discussion, above, this segment's market is highly influenced by Alaskan operations. Also, several of the West Coast plants serve as final product preparation points for crab originally processed in Alaska (e.g., large blocks of frozen meat are sawed into consumer package size, packaged and labeled). Given the comparative per unit product effluent treatment costs between West Coast and Alaska, it is believed that the West Coast segment will not be impacted nearly as severely as the Alaskan segment. We would predict price changes to be roughly equivalent to those for the Alaskan crab segment.

9. Price Impacts Summary

As was indicated above, the price changes required to offset the impacts of pollution abatement standards can be assessed ceteris paribus. The required price changes range from less than one percent for BPT for Blue crabs to approximately two percent for Alaskan crab. BAT standards would add only an additional fraction of a percent for Blue crabs to approximately three percent for Alaskan crabs. All other industry segments would be included in this range, most being approximately 1.5 percent for BPT and one percent for BAT.

The expected price changes are however much more difficult to assess since the influence of many other factors must be considered. In general, however, the expected price changes fall into three groups, zero expected price changes for catfish and Blue crabs, less than one percent for Southern shrimp, tuna, Northern pink and Alaskan shrimp for BPT and BAT and greater than 1 percent for BPT Alaskan crab and approximately 3 percent for BAT Alaskan crab.

10. Price Controls

For the purposes of the above analysis, it was assumed that a free market would prevail. It should be realized that if price controls are in effect when firms are faced with mandatory effluent treatment costs and the price controls are not responsive to the added costs of production resulting from such effluent treatment, the above analysis would be in error and plant closure effects would be much more severe than the estimates presented below.

B. Financial Effects

Financial profiles for the relevant portions of the seafood processing industry have been presented in Chapter II of this report. Basic industry information and data assimilated during the completion of this segment of the study has revealed that there is a great disparity in profit rates, production practices, prevailing technology and expected future profitability within and between all industry segments.

Attempts to acquire specific plant financial data has also indicated that many plants and entire industry segments are operated on a day to day basis influenced primarily by the availability of raw product. Detailed raw product costs, production and financial data are in many cases considered incidental to raw product availability. The variation in raw product availability and the failure of many plants to accurately account for specific production costs and financial data has, in some cases, thwarted attempts to quantify numerous inter and intra industry relationships. The lack of accurate and applicable financial and production data has necessitated a higher degree of generalization than would be normally desirable. For example, in most cases the data constraint permitted the construction of only one model plant for an entire industry segment. The impacts of pollution abatement standards for other plants within these segments were developed by extrapolating the model plant impacts using fundamental industry relationships as reported by knowledgeable industry representatives and published reports.

The following subsection briefly summarizes the profitability of the industry segments considered. (Also see Table VI-1 in Section C).

1. Profitability

Catfish - The 1972 data for the model catfish processing plant show that catfish processors are currently realizing very low returns on invested capital. The model catfish processing plant operating at 60 percent capacity is realizing an after tax return on investment of less than one percent. This low rate of return is the result of rising production and raw material costs and a general over supply of processing capacity in this a new and developing industry. Current processing capacity greatly exceeds both the demand for final product and the supply of raw product. Recent plant closures, industry contacts and published reports concerning the profitability of catfish processing tends to confirm the general situation portrayed in the model plant analysis. It is the opinion of DPRA that if the model plant were to be adjusted to reflect the 1973 situation, it would show an even lower or perhaps negative rate of return on investment and sales. Only the passage of time and the accompanying reduction in the number of processing plants, increased supply of raw product and/or a dramatic upward shift in demand for the final product will improve the financial prospects of catfish processors.

Conventional and mechanized blue crabs - The model plant developed in Chapter II depicts the financial situation for a large East Coast crab plant processing two million pounds of live weight crabs. The after tax return on investment for this plant is 4.8 percent. While this is a satisfactory or adequate rate of return for large plants, it does not or can not be generalized for the industry as a whole. Medium and to a greater extent small plants tend to be quite old and much less profitable. Industry sources indicate that many older plants are less efficient and are essentially only meeting expenses or selling the labor of the proprietor.

The shortage of experienced crab pickers has also had an adverse effect on on many small conventional Blue crab processing plants. There are reported cases of low plant utilization due primarily to the inability to acquire experienced pickers. For these reasons the modern and partially mechanized plants, are experiencing a competitive advantage over the small, older plants.

Alaskan Seafood Processors - The Alaskan seafood processors included in the scope of this report includes frozen and canned Alaskan crabs and shrimp. The profitability of the Alaskan processor is severely dampened by high processing and transportation costs. This is partially offset by the fact that the Alaskan plants are typically quite large and process a diversified product line to take advantage of beneficial economies to scale. High processing costs are also frequently offset by shipping the intermediate product to plants located on the West Coast or in inland states for final processing and distribution.

In general, the target pre-tax return on sales is reported to be 10 percent with the realized rate approximating that achieved by other West Coast seafood processors.

West Coast Seafood Processors - While many specific line items of West Coast seafood processors are considerably different from Alaskan processors, the final line, i.e., return on investment, is quite similar to the Alaskan segment of the industry. The differential previously favoring Alaskan processors has diminished in recent years resulting in very comparable or nearly equal returns. At the present time the data indicates that the return for West Coast and Alaskan shrimp and crabs exceeds that realized by East Coast and Gulf processors.

Gulf Seafood Processors - Gulf seafood processors included in the scope of this study include canned and frozen shrimp and canned and frozen crabs. The processing plants within this segment range from the very small single product-process to the very large diversified and integrated processing plants. The profitability varies accordingly. For example, the large shrimp breading plant portrays a 2.8 percent after tax return on sales while the small shrimp breader is shown to have a 1.6 percent after tax return on sales. In general, however, this segment is similar to others in that the large plants can be characterized as the more profitable. In addition, the shrimp freezing and breading, and crab freezing segments possess a slight profit advantage over the respective canning segments.

It should be noted, however, that there are occasionally brief periods of time when the larger plants find themselves in a relatively unfavorable position. For example, in years such as 1973 when there is a drastic reduction in the domestic shrimp landings, the small plants can utilize a greater percentage of their capacity due to their ability to start production lines with a very limited volume of raw product. The larger plants requiring a greater volume of raw product find it undesirable to initiate production processes with limited raw material supplies. This is, however, an atypical situation.

New England Shrimp Processors - A review of the data indicates that the New England shrimp processors are quite similar to the West Coast shrimp processors in many respects. The New England shrimp that is processed is the small northern variety as is the West Coast shrimp. Industry representatives indicate that the profit levels are also quite comparable to the West Coast profit levels. It is, however, worthwhile to note that a sizeable proportion of the New England shrimp is processed in conjunction with finfish. In many of these plants, shrimp represents a production sideline during slack winter months and does not represent the plant's primary product. This increases the difficulty of assessing the profitability as well as the potential impacts of pollution abatement standards.

Tuna Processing Plants - The tuna processing industry consists of 31 plants, most of which fall into two categories, i.e., small or very large processing plants with very few medium sized plants. There are conflicting reports concerning the profitability of these plants. Some reports indicate that the industry in general as well as many specific plants are very profitable. As of the present time, however, we have not been able to substantiate these reports and, in fact, the reverse has been true. Industry sources report isolated cases of plants that incurred losses as great as half a million dollars in 1972. Other reports indicate that one plant in the Northwest recently closed because of an unfavorable profit position. Other reports indicate that still another plant located in Southern California is scheduled also to discontinue production in the near future.

The model plant portrayed in Chapter II is based on data supplied by industry sources and financial reports of tuna processing companies and shows an after tax return on investment of 3.2 percent which is believed to adequately represent much of the industry. In addition to the plants included in the above segments, there are many plants located in inland states that process shrimp, crabs and tuna. No attempt has been made to include these plants in the analysis in that almost all of these plants receive partially processed raw product and produce specialty items and are therefore in many respects fundamentally different from the majority of the plants included in the above segments.

A succinct summary of cash flow and net present value data for selected industry segments with and without pollution controls is presented in Table VI-1.

C. Production Effects

Of real and fundamental interest are the production impacts which the inauguration of BPT and BAT effluent controls may bring about. Of particular interest are potential plant closures. As discussed in Chapter IV, the methodology used was the economic shutdown model or model plant analysis. The financial burden of pollution abatement standards were applied to the model plants to ascertain the financial impacts. Inference regarding closures for each segment was drawn, based on the relationship to models as well as factors not reflected in model plant data. In order to obtain tractable models, the seafood industry was characterized by specific product segments. It is recognized that many multi-product complexes do exist and that the economics of these complexes may not be fully reflected in the building block models employed in this analysis. However, it is DPRA's opinion that the building block economics do not greatly differ from those found in complex situations and that use of this procedure will produce usable and reasonable conclusions.

It is also expedient to mention that the lack of published data and the great variability within and between industry segments has, in some cases, necessitated extending projected impacts on the basis of the results derived from a single model plant.

Table VI-1. Estimated cash flow and net present value for model plants with and without effluent controls -- without price adjustments and without considering land requirements

Model Plant	Capacity	Present		BPT		BAT	
		Cash flow	Net present value	Cash flow	Net present value	Cash flow	Net present value
	(TPD)	---	---	---	$1,000 ---	---	---
Catfish	4	9	89	6	-62	6	-65
Gulf Shrimp Canner	14	60	432	59	210	61	297
Gulf Shrimp Breader	2	15	128	16	-67	17	0
	10	103	797	105	512	108	547
Gulf Shrimp Freezer	7	27	145	30	24	31	69
East Coast Blue Crab	5	13	95	13	84	13	61
Alaskan Crab							
Canned	12.5	80	1,101	75	342	80	-298
Freezer	12.5	152	1,564	148	1,102	160	556
Alaskan Shrimp							
Canned	17.5	151	1,687	150	918	125	-370
Freezer	17.5	118	1,203	117	434	142	-854
West Coast Shrimp							
Frozen	10	64	612	68	486	69	467
Canned	10	84	916	88	790	89	771
West Coast Crab							
Canned	7.0	44	442	46	330	47	211
Frozen	7.0	82	809	84	697	85	643

1. Potential Plant Closures

The underlying model plant financial parameters relating to the closure analysis are shown in Table VI-1 above. Two kinds of data are reported -- cash flows and net present values based on investment and after tax cash proceeds. The cash flows indicate the cash position of the plants. Clearly, if it is negative over time the plant can not continue operations. Also, if it is only slightly positive, replacement investment might not be able to be met, meaning eventual plant closure.

Net present values, computed at 6.0 percent after tax cost of capital, present a better long run analysis of future financial performance, since they include returns over time and replacement investment as well as a measure of the efficiency of capital use. In interpreting net present values (NPV) in Table VI- 1, values less than zero indicate that the firm would be financially better off by liquidating the sunk investment and reinvesting where that money could yield the firms target return on capital.

None of the model plants fit actual plants exactly, so these results must be interpreted in light of what is known about actual plants. Unfortunately there is also conflicting data concerning the amount of pollution equipment in place. While it is commonly recognized that the seafood industry does not, in general, have a great deal of pollution equipment in place, there are many areas where screening and dehydration of solids is practiced. At EPA direction, however, the across the board assumption was that none was in place.

The statistical procedure used to estimate the percent closures given net present value is described in the methodology section of this report. In general, however, the assumption is that the actual net present values prevailing in the industry would be distributed about the estimated model plant net present value. Actual industry samples could be expected to uncover both higher and lower net present values. Estimating the percentage of the plants within the industry that possess negative net present value after the imposition of pollution abatement standards will produce the expected closures attributable to pollution abatement standards. Where observations were available for only one plant size within a given segment, closures for other size categories were developed by extrapolating the derived results and applied to other industry size segments. The extrapolation procedures were based on both reported industry data and temperted with a priori industry information.

The application of the above quantitative and qualitative methods resulted in the estimated plant closure percentages listed in Table VI-2. Table VI-2 depicts the percent of direct discharges by size classifications that are expected to close. These estimates do not reflect expected price changes or the cost of land required for pollution abatement equipment and lagoons. These factors are considered at a later point in the analysis.

The estimated baseline closures between the present and 1977 and between 1977 and 1983 are presented in Table VI-3. For most industry segments baseline closures are expected to be nominal with a few small, marginal plants leaving the industry between now and 1977 and between 1977 and 1983. This, however, is not true for the catfish segment where high baseline closures are projected. If Gulf shrimp yields are reduced by the same magnitude during the next production season as they were in the 1973 season, the same may be true for the Gulf shrimp industry. This, however, is conjecture at this point and the baseline closures do not reflect this situation.

Price increase, land costs and other qualitative aspects were then considered to determine the expected number of plant closures. These closure estimates were developed by considering only those plants that are direct discharges.

The estimated number of plant closures which appear in Table VI-4 were developed by appropriately adjusting the closure percentages to reflect municipal sewer availability, expected price changes, baseline closures, land values and requirements and other quantitative and qualitative data. All of these factors require a certain amount of judgment and intuition and without a doubt increases the likelihood for disagreement or controversy. The factors that affect expected closures are many and diverse. For example, contacts with industry indicated that land prices (only one of the factors that affects closures) may vary from $500 to $100,000 an acre. Inquiries into land prices in the Gulf indicated that plants located in rural areas may be able to acquire land at $500 or less per acre. Plants located in urban areas could be expected to pay $10,000 or more per acre. On the other hand, land availability on Terminal Island and other west coast cities indicate that lease or acquisition and land preparation costs could be $100,000 per acre or higher. Other relevant factors have a similar degree of variability.

It is believed, however, that the final plant closures are an accurate projection of the likely impacts resulting from mandatory pollution abatement standards for the selected segments of the seafood processing industry. Further refinement of the closure estimates would require and is indeed possible only with an on-site evaluation of all of the above factors.

Table VI-2. Estimated percent plant closures without price increases and without land costs and net of base closures*

Industry Segment/ Plant Size	Percent of direct discharges estimated to close					
	BPT only Plant size			BPT and BAT Plant size		
	Small	Medium	Large	Small	Medium	Large
Gulf shrimp canners	30	20	13	38	26	17
Gulf shrimp breaders	81	54	36	88	59	39
Gulf shrimp freezers	32	21	14	50	33	22
Blue crab	5	3	2	20	14	9
Catfish	46	64	63	46	64	64
Tuna	13	10	6	40	39	25
Alaskan frozen crab	9	6	3	33	22	14
Alaskan canned crab	29	19	12	97	74	49
West Coast frozen crab	3	2	1	6	4	2
West Coast canned crab	7	5	3	23	15	9
Alaskan frozen shrimp	33	22	14	97	90	59
Alaskan canned shrimp	18	12	7	97	65	43
West Coast canned northern pink shrimp	30	20	14	39	26	18
West Coast frozen northern pink shrimp	17	11	6	20	13	9

*/ Estimates indicate incremental closures above a baseline estimate (assuming currently prevailing effluent treatment practices). The percent of closures are percent of direct discharges by size classification. Percent on municipal sewers and total plant numbers by industry segment has been presented in Tables VII-7 and I-3, respectively.

Table VI-3. Estimated baseline closures by industry segment

	Current to 1977	1977 through 1983
Catfish	15	0*
Tuna	1	2
Shrimp Gulf West Coast New England Alaskan	5	5
Crab West Coast Alaskan crab Blue crab	9	10

* Baseline closures of 15 plus closures attributed to BPT standards eliminate 70 percent of the industry. No baseline closures have been estimated from the remaining 30 percent of the industry beyond 1977.

Table VI-4. Estimated number of plant closures by industry segment after considering baseline closures, land availability, price adjustments and municipal sewer availability

Industry segment	Estimated number of plant closures BPT	BPT + BAT
Tuna	2	10
Catfish	12	12
Northern pink shrimp (Calif., Ore., N.Eng.) canners & freezers combined	9	15
Southern shrimp		
Canners	3	6
Breaders & freezers	7	18
California shrimp breaders	1	3
Alaskan shrimp canners & freezers	5	20
Blue crab	7	23
Dungeness & Tanner Crab (Calif., Ore., Wash) Canners & freezers combined	2	3
Alaskan crab meat canners & freezers combined	5	15
Total	53	125

2. Production Curtailment

Data concerning current utilization of capacity by industry segment is not generally available except for catfish. To further complicate matters, a measurement of capacity utilization at a given point in time may not be reflective of typical conditions (e.g., capacity utilization in southern shrimp plants has been very low this year after two near peak years). However, there are indications that some over-capacity exists in nearly all industry segments. In segments where market concentration is higher (e.g., tuna), utilization of capacity probably runs somewhat higher.

Without detailed knowledge of capacity utilization by segment, the price analysis presented earlier was necessarily based upon subjective judgment formed through general knowledge of the industry segments and observations of impacts of past events. As a result, precise estimates of production curtailment were not made. With the exception of Alaskan crab and shrimp plants, we would not predict substantial reductions in domestic production as a result of the proposed effluent guidelines. This conclusion is based upon the premise that with the projected price increases and anticipated charges for municipal treatment of industrial effluents, some new (probably large) plants would be constructed. The increase in capacity utilization by old plants which do not close, added production of new plants and, in some cases, increases in imports should make any changes in total product consumption fairly small except for Alaskan crab where consumption might drop 5-10 percent under BAT guidelines.

Even though it is perhaps difficult and further opens the door for controversy it is desirable to present the plant closures by size of plant. This information is presented in Table VI-5.

3. New Source Performance Standards

New facilities on line after approximately January 1, 1974 must meet the NSPS guidelines for direct discharge into navigable waters. The general impact of NSPS guidelines will be to slow down new plant construction rates.

Table VI-5. Number of plant closures by size classification

Industry Segment/Standard	Size Classification		
	Small	Medium	Large
Tuna	(<400,000 cases annually)	(400,000 to 1,599,000 annually)	(1,600,000 cases and up annually)
BPT	2	0	0
BAT	3	2	3
Catfish	(<3,000 lb. live weight annually)	(3,000 to 11,999 lbs liveweight annually)	(>12,000 lb liveweight annually)
BPT	3	5	4
BAT	0	0	0
Shrimp (Northern Pink shrimp, Southern shrimp and Alaskan shrimp)	(<1,000,000 lb or 50,000 cases annually)	(1-5 million lbs or 50 to 100,000 cases annually)	(>5 million lbs or 100,000 cases annually)
BPT	18	5	2
BAT	22	9	6
Crab (Blue, Dungeness and Tanners and Alaskan)	(Less than 1 million lbs live-weight annually)	(1 M to 3 M live-weight lbs annually)	(Greater than 3 M lbs liveweight annually)
BPT	8	3	3
BAT	17	5	5

In terms of the continental U. S., these guidelines are generally not too expensive when compared to the investment cost of a new plant -- especially after 1977 when BPT guidelines put upward pressure on processor margins. However, NSPS guidelines plus anticipation of BAT guidelines in 1983 will contribute to the relative advantage of plant sites where municipal sewage treatment is available. There is some evidence that this trend is already emerging (e.g., a tuna plant on Terminal Island is being closed and replaced by one in San Diego which will be sewered). In summary, in the Continental U.S., where good sewered sites and reasonable NSPS guidelines are involved, these guidelines are not expected to induce large economic impacts.

In Alaska however, we believe NSPS guidelines will severely limit new plant construction. In most areas municipal treatment of seafood processing wastes is not available. New plants would probably have to provide private effluent treatment facilities. Prior to 1977, price effects would not be available to help pay the added cost of treatment. Treatment costs also appear to be much higher than the cost of equivalent technology in the 48 states. After publication of the NSPS guidelines, it is unlikely that any new plants would be planned in Alaska prior to 1977.

It is possible that new Alaskan plant construction in these industry segments could be halted until closures induced by BAT guidelines materialize.

D. Employment Effects

1. Distribution of Employment by Plant Size

There is substantial concentration of employment in large firms in the seafoods processing industry. Published data are not available on each industry and product category considered in this study, but industry-wide data from the Census of Manufactures provides an indication of the situation which exists.

In the fresh and frozen packaged fish industry, in 1967, 79 percent of the plants employed less than 50 people and accounted for 29 percent of total employment. At the other end of the scale, 3 percent of the plants employed over 250 people, but had 34 percent of the total number of employees. Details, by plant size are shown in Table VI-6.

Table VI-6. Employment in the fresh and frozen packaged fish industry, by size group, 1967[1]

Number of employees per plant	Number of establishments	Number of employees	Average per firm
Less than 10	178	600	3.4
10 - 49	213	5,600	26.3
50 - 99	65	4,500	69.2
100 - 249	25	3,500	140.0
250 - 499	11	3,500	318.0
500 and over	6	3,800	633.0
Total	497	21,400	43.1

1/ Source: Census of Manufactures, U. S. Department of Commerce.

Table VI-7. Employment in the canned and cured seafood products industry, by size group, 1967 [1]

Number of employees per plant	Number of establishments	Number of employees	Average per firm
Less than 10	109	400	3.7
10 - 49	131	3,300	25.2
50 - 99	46	3,300	71.7
100 - 249	26	3,700	142.0
250 - 499	4	1,500	375.0
500 and over	4	3,600	900.0
Total	320	15,800	49.4

1/ Source: Census of Manufactures, U. S. Department of Commerce.

In the canned, cured and preserved seafoods industry, in 1967, 75 percent of the plants employed less than 50 people and accounted for 23 percent of total employment. In the large plant category, 3 percent of the total number of plants employed over 250 people, but had 33 percent of the total number of employees. Details, by plant size, are shown in Table VI-7.

Approximately 91 percent of the total employees in the fresh and frozen fish industry and 89 percent in the canned seafoods industry are production employees.

2. Annual Earnings

Estimated average earnings, for all employees, in fresh and frozen fish plants, in 1973, averaged $5,050 in the 48 states and $7,550 in Alaska. In the canned seafoods industry earnings averaged $6,122 and $9,152 for the two areas. Distribution of earnings, by plant size, is shown in Table VI-8 and VI-9 for 1973.

3. Unemployment and Employee Earnings Losses Associated with Plant Closures

The closure of seafood processing plants as a result of their inability to bear the cost of effluent control systems would result in substantial unemployment and loss of earnings throughout all segments of the industry.

In aggregate, at the BPT control level, for tuna, crab, shrimp and catfish, plant closures could result in the loss of 3,100 jobs and a reduction in employee earnings of as much as $19,500,000. At the BAT control level, job losses could go as high as $9,400 and employee earnings would be reduced as much as $67,000,000. Details of these estimates of unemployment and loss of earnings are shown in Tables VI-10 and VI-11.

4. Possibility of Reemployment in New Plants Being Built

There would be little probability that new plants would be built in the same area to replace small or obsolete plants which were forced to close because of their inability to add necessary equipment to comply with water pollution control requirements. This is especially true for the Alaskan segments. It does however hold to varying degrees for the other segments as well. Small seafood processing plants face substantial disadvantages

Table VI-8. Estimated annual earnings per employee, fresh and frozen fish industry, 48 States and Alaska, by size group, 1973 1/

Number of employees	Average earnings 2/ 48 States	Alaska
Less than 10	$5,132	$7,672
10 - 49	5,099	7,623
50 - 99	4,760	7,116
100 - 249	4,560	6,817
250 - 499	5,440	8,132
500 and over	5,268	7,876
Average	5,050	7,550

1/ 1967 earnings inflated by changes in wage rates in food manufacturing industry, 1967-1973.

2/ Includes earnings of both production workers and management employees.

Table VI-9. Estimated annual earnings per employee, canned and cured seafoods, 48 States and Alaska, by size group, 1973 1/

Number of employees	Average earnings 2/ 48 States	Alaska
Less than 10	$6,300	$ 9,418
10 - 49	6,405	9,575
50 - 99	6,448	9,640
100 - 249	5,148	7,750
250 - 499	4,946	7,394
500 and over	7,078	10,582
Average	6,122	9,152

1/ 1967 earnings inflated by changes in wage rates in food manufacturing industry, 1967-1973.

2/ Includes earnings of both production workers and management employees.

Table VI-10. Estimated unemployment and employee earnings losses resulting from imposition of BPT (1977) level effluent controls on the seafoods processing industry

Type and size of plant	Estimated number of closings	Estimated employees per plant	Estimated unemployment	Estimated ann. avg. earnings	Estimated ann. earnings lost
Tuna	2	447	894	$7,170	$6,401,000
Catfish 1/	12	14	168	5,100	857,000
Northern pink shrimp (Calif. Ore. Wash, N. Eng.) canners & freezers combined	9	40	360	6,000	2,160,000
Southern shrimp					
Canners	3	70	210	6,000	1,260,000
Breaders & freezers	7	80	560	5,000	2,800,000
Other shrimp breaders	5	40	200	5,000	1,000,000
Alaskan shrimp canners and freezers	5	60	300	8,250	2,475,000
Blue crab	7	40	280	5,000	1,400,000
Dungeness & Tanner crab (Calif., Ore. Wash.) Canners & freezers combined	2	25	50	6,000	300,000
Alaskan crab meat canners & freezers combined	5	40	200	8,250	1,650,000
Total	53	--	3,062	--	$20,303,000

1/ These closures are above those plants which are expected to close before imposition of BPT controls in 1977, closures not associated with pollution control factors.

Table VI-11. Estimated unemployment and employee earnings losses resulting from imposition of BPT+BAT effluent controls on the seafoods processing industry

Type and size of plant	Estimated number of closings	Estimated employees per plant	Estimated unemployment	Estimated ann. avg. earnings	Estimated ann. earnings lost
Tuna [1/]	10	447	4,470	$7,170	$32,050,000
Catfish [2/]	12	14	168	5,100	857,000
Northern pink shrimp (Calif., Ore. N. Eng.) canners & freezers combined	15	40	600	6,000	3,600,000
Southern shrimp					
Canners	6	70	490	6,000	2,940,000
Breaders & freezers	18	80	1,440	5,000	7,200,000
Other shrimp breaders	3	40	120	5,000	600,000
Alaskan shrimp canners & freezers	20	60	1,200	8,250	9,900,000
Blue crab	23	40	920	5,000	4,600,000
Dungeness & Tanner Crab (Calif., Ore., Wash) Canners & freezers combined	3	25	75	6,000	450,000
Alaskan crab meat canners & freezers combined	15	40	600	8,250	4,950,000
Total	124	--	9,373	--	$66,727,000

1/ Estimated plant closures were made on the basis of treatment strategy BAT + BPT -- II_A for tuna processors. Closures on the basis of treatment strategy BAT + BPT -- II are estimated to be a total of 6.

2/ These closures are the same as shown for BPT since BPT guidelines would close all remaining direct discharge plants in 1977.

due to economies of scale in processing and water pollution control operations. As a result, it is doubtful that these small plants would be replaced since medium or large plants which might survive could absorb the added volume represented by these small plants. Obsolete plants are most likely to persist in areas where the fishing and seafood processing industries are declining and as a result there would be little inducement to replace plants in these areas.

5. Absorption of Laid-off Employees by Other Plants

Little opportunity would exist for absorption of laid-off employees by other plants in the same area. Although the seafoods industry is geographically dispersed, total employment in the industry has been declining during the past ten years as larger, more-highly-automated plants have been built which require fewer employees per thousand pounds of seafood processed. In addition, many plants operate only on a single-shift basis at less than 100 percent of capacity. The volume represented by these plants could be absorbed by remaining plants without taking on additional employees.

There is the possibility that some plants could increase imports of partially processed raw materials, reorganize their production lines and concentrate on final processing only. To the extent that this occurs, some employees would be retained and the adverse unemployment impacts partially ameliorated. In general, however, this is expected to have a minor influence on unemployment impacts.

6. Secondary Unemployment Effects

The closure of seafood processing plants could result in some unemployment among fishermen who depended on these plants to provide a market for the fish and shellfish which they caught. The implication of the impact of plant closures on fishermen are discussed in more detail in the section dealing with community impacts.

Several other considerations or qualifications should be introduced at this juncture. These facors are briefly mentioned below.

Cooperative treatment or barging efforts by contiguous plants could result in a substantial reduction in waste treatment costs. Improved by-product recovery could also, and in some cases, substantially lower the net effluent treatment costs. In addition, provisions have been made (Section 301-C) which would allow the administration to modify BAT effluent guidelines on a case by case basis. All of these factors, jointly or separately, could result in a substantial reduction in plant closures, unemployment impacts and community impacts. The uncertainty and nebulous nature of these considerations prohibits a detailed analysis at this point in time. The important point to be gleaned from the above factors is that to the extent that each or all occur, the estimated impacts will have to be modified accordingly.

E. Community Effects

The seafoods processing industry is concentrated in coastal communities from Alaska to Florida to Maine. The pond catfish processing industry is concentrated in the Mid-South.

Seafood processing plants are located primarily in small towns and large cities. There are large numbers of small towns scattered up and down the coasts where fishing and seafood processing is the major industry. This is particularly true in Alaska. However, many major freezers and canners are located in major cities such as Seattle, San Francisco, Los Angeles, San Diego, New Orleans, Tampa, Miami, etc.

Distribution of processors by size of community is shown in Table VI-12.

Table VI-12. Distribution of seafood processors by size of city in which located

Size of City	Percentage of total processors		
	Seafood canners [1/]	Seafood freezers [1/]	Pond catfish processors
(population)	(%)	(%)	(%)
Less than 1,000	27	7	13
1,000 - 4,999	22	22	59
5,000 - 9,999	6	6	13
10,000 - 24,999	7	6	9
25,000 and over	38	59	6
Total	100	100	100

1/ Includes tuna, shrimp and crab processors.

Although the closing of a major canner or freezer reprsents a substantial economic loss to any community, the impact in a major city such as Los Angeles, San Diego or Tampa, would not be as disastrous as would the closing of a much smaller plant in a location such as Kodiak, Alaska (population under 3,000) where processing of fishery products is the primary local industry. There are 13 shellfish processors in Kodiak and unless they can individually or collectively solve their effluent control problems at a cost which will permit them to stay in business, plant closures could wipe out the economic base of Kodiak. Although the situation in Kodiak is dramatic because of the concentration of seafood processing at this location and the lack of alternative employment opportunities, the impact of plant closures would be equally severe in large numbers of isolated communities where the landing and processing of fish and shellfish represents a major segment of the local economy.

As shown in Table VI-12, 49 percent of the seafood canners and 29 percent of the freezers are located in towns of less than 5,000 population. The impact on these small communities would be severe. Small to medium canners and freezers employ 40-80 workers. In spite of the fact that the processing of seafood is seasonal, the closure of a plant employing 60 workers could mean the loss of $360,000 in plant payroll plus $30,000 in management salaries. This could equal 6-8 percent of the total community income. If loss of income to fishermen is added, the impact becomes greater.

The catfish processing industry is already in difficulty. Most processors are operating at less than 50 percent of capacity. However, at present the demand for frozen catfish fillets is strong and the low utilization rate is primarily the result of limitations in the supply of fish for processing. However, if as a result of required investments in effluent control systems, these processors cease operations, the impact would be greatest on low income families in the Mid-South where the seasonal labor required by catfish processing provides a welcome supplement to family incomes. Since much of this income is spent in the local community, it would have a direct effect on the level of business activity in affected areas.

Impacts on Suppliers

Closure of seafoods processing plants will have a direct impact on the suppliers of raw fish (fishermen and pond catfish producers). Because of the perishable nature of fish and shellfish and because of the high wastage in processing operations, the seafoods processing industry is supply oriented. This is particularly true of the shellfish and pond catfish industries. If plants close, fishermen and catfish producers will, in many instances, encounter severe problems in finding alternative outlets for their production.

Pond catfish are hauled live in tank trucks to processing plants. Plants are located in areas where there is a concentration of production. If catfish producers are forced to haul their fish greater distances because of nearby plant closures, the increased cost of hauling would result in substantial reductions in grower incomes. The industry is already faced with a shortage of fish for processing and if catfish farmers reduced production in response to lower returns, this problem would become increasingly severe.

A similar situation would exist in the crab fishing industry. Crab are normally landed live and are cooked and cleaned immediately after landing. Although it would be possible to cook and clean crab where landed and then ship chilled carcasses to processing plants for meat extraction and canning or freezing, the transportation costs involved in shipping iced crab, which would be 60-70 percent waste, would add substantially to product cost and would probably be reflected in lower ex-vessel prices. While it would be possible to land crab at other ports, where processing plants would exist, the additional time at sea would reduce production per boat and lower returns to crab fishermen.

Although the market problem would not be as severe for shrimp, fishermen would still be faced with the problem of delivering chilled, heads-off shrimp greater distances to the remaining processors. This would add transportation costs, whether by truck or by boat, would increase product costs and reduce returns to fishermen. As an alternative, shrimp processors might increase their imports of frozen shrimp and rely less on domestic landings. However, increasing world demand for shrimp, particularly in Japan, has resulted in greater competition for shrimp supplies throughout the world.

The closure of tuna processing plants in any given location would have a lesser impact on fishermen than was true for the other products considered in this study. Tuna are normally caught in distant waters. The tuna fleet is at sea for extended periods and delivery of the tuna catch to alternative locations does not constitute as serious a problem as it does to shrimp or crab fishermen.

While it is impossible to investigate community impacts for all possible plant closures, it is possible to present a few generalizations beyond what has been discussed above. Rather than attempting to pinpoint the location of all expected closures, we have briefly investigated the location characteristic by industry segment to provide additional insight into probable community impacts.

The location characteristics of a random sample of plants in the Blue Crab, Gulf Coast and west coast segments produced the location characteristic distribution presented in Table VI-13.

Table VI-13. Plant location and size of local population

Industry Segment	Percent of Plants by City Size: 250 or less	250 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 49,999	50,000 to 99,999	100,000 and over	Total (%)
Blue Crab	40	40	15	5				100
Gulf Coast Processors		20	10			30	40	100
West Coast		20					80	100

Eighty percent of the plants in the blue crab sample were found to be located in communities with less than 1,000 persons. On the other hand, 80 percent of the plants in the west coast sample were located in communities of 100,000 or larger. The Gulf Coast segment revealed that 70 percent of the plants were located in communities with a population base of 50,000 or greater while the remainder were located in communities with less than 5,000 persons.

This information (along with other information presented above) permits a few other observations and summary statements concerning the relative impacts by segment. They are as follows:

1. The community impacts are expected to be rather substantial in the Alaskan segment which has a relatively large number of closures in small communities.

2. The west coast plants in general are located in larger communities where the projected impacts for the most part could be easily absorbed.

3. The Gulf Coast segment, while impacted less than the blue crab segment are located in larger cities where the economic readjustment would be enhanced by a broader economic base.

4. The blue crab segment which can be characterized as having a large number of plants in small communities is expected to experience a relatively minor impact. There will, however, in all likelihood be some clustering of plant closures in very small communities.

5. While the expected plant closures in the catfish segment are relatively large, the geographical dispersion of these plants is great. This will tend to ameliorate to a substantial degree the expected community impacts.

F. Impact on Foreign Trade

The impact of substantial plant closures associated with the imposition of effluent guidelines on the fisheries processing industry could result in driving additional processing overseas. This would be particularly true for tuna, crab and shrimp. The farm-raised catfish industry is not as greatly affected by imports since these fish are sold mainly as fresh or frozen fillets whereas imports of catfish go primarily into fabricated fish sticks and other similar items.

Tuna

The total supply of canned tuna in the United States has increased from 392 million pounds in 1962 to 673 million in 1972, a gain of 72 percent. Approximately 91.6 percent of the total supply was packed in the United States. However, of this total, 63 percent was represented by imports of fresh or frozen tuna purchased from foreign fishermen by U.S. canners. Imports of canned tuna are relatively unimportant and normally account for 4 to 5 percent of the total supply. Canned imports are subject to tariff quotas equivalent to no more than 20 percent of the previous year's domestic pack. Canned imports have varied between 50 and 73 million pounds and in 1972 were 56,513,000 pounds, equal to 8.4 percent of the total U.S. supply. In only one year, 1970, have imports above quota come in (902,000 pounds). The tariff quota system does not limit total imports but provides for a differential duty, quota imports being levied 6 percent ad valorem in 1972 as opposed to 12.5 percent duty on above-quota imports. Japan is the principal supplier of canned tuna imported into the United States. The low level of imports in 1972 was the result of two major factors, FDA detention of large quantities of Japanese product because of problems associated with decomposition and Japanese currency revaluation. With the prospect of a continued strong demand for canned tuna by the American consumer, and if U.S. pack is reduced as the result of plant closures associated with the imposition of effluent guidelines, it is anticipated the U.S. canned tuna prices will rise still further and that these higher prices will attract increased imports of canned tuna in spite of higher duties for shipments above tariff quota levels. In addition, it is possible that a higher proportion of tuna imported for canning in the United States, may come in the form of loins (frozen or cooked) as partial processing on board ships or overseas could increase. Another possibility would be the establishment of overseas canning operations by major U. S. tuna packers.

Shrimp

Consumption of shrimp in the United States has nearly doubled since 1960. Prices reached record levels in 1972, but demand continued strong. Of the total 1972 supply of 487.5 million pounds (heads-off), 253.1 million, or 52 percent came from imports. Composition of imports, 1964 and 1972, was as follows:

Form imported	Percent of total imports	
	1964	1972
Shell-on headless	72.7	56.8
Peeled, not breaded	19.6	42.1
Peeled, breaded	0.3	0.6
Peeled, canned	1.9	0.5
Not classified	5.5	-
Total	100.0	100.0

These data show a definite swing toward the importation of a higher proportion of processed or partially processed shrimp. In particular, the relative quantity of peeled shrimp imported has more than doubled since 1964. Most of these shrimp enter as heads-off, peeled frozen shrimp in blocks and are thawed, de-veined if necessary, individually quick frozen and packaged in consumer or institutional packages. These shrimp may be frozen raw, cooked or breaded. Although the volume of breaded shrimp imported more than doubled 1964-1972 (from 0.5 million pounds to 1.3 million pounds), the total volume is still only 0.5 percent of total imports. Imports of peeled canned shrimp have remained fairly stable at around 2.5 to 3.5 million pounds. Consumption of canned shrimp in the United States is small, Alaska has potential to expand canning operations, and little change in imports of canned shrimp is expected.

Mexico is the most important source of shrimp imported into the United States, supplying 80.7 million pounds (36 percent of total imports) in 1972. Central American countries shipped 33.5 million pounds to the U.S., South America -- 43.9 million, and India -- 33.5 million. A potentially important shrimp fishery may exist off the coast of West Africa, but this source has not been highly developed. However, recent exploratory efforts by the Japanese indicate that West African waters may produce large quantities of shrimp in the future.

Closure of U.S. shrimp processors as the result of the imposition of effluent limitations would accelerate the existing trend towards increased processing (peeling and de-veining) of shrimp either on board ships or in land-based processing plants located outside the United States. Shrimp landed by U.S. vessels would continue to be processed by those U.S. firms which would remain in operation.

Given the expected maintenance of a strong demand for shrimp in the United States and normal yields from U.S. shrimp fisheries, the principal impact of closure of substantial numbers of U.S. shrimp processors would be to encourage more processing overseas. The total volume of shrimp imports would not change materially from that which would have existed otherwise, but the trend toward the importation of an increasing proportion of peeled and de-veined shrimp could be substantially accelerated.

Crab

In contrast to tuna and shrimp, imports of crab for processing in the United States have been relatively small. Most crabs are landed live and cooked immediately prior to processing. Imports of Blue crabs to the East Coast are negligible. However, imports of West Coast crabs (King, Snow and Dungeness) have increased rapidly since 1967. In 1967 imports were only 1.3 million pounds. Imports jumped to 8.6 million pounds in 1968 and in 1971 were 17.6 million pounds. Most of the imported crabmeat comes from the Canadian Northwest. Imports of canned crabmeat (mainly from Japan) have decreased during the past ten years, from a high of 5.3 million pounds in 1963 and were 2.5 million pounds in 1972, which was, however, equal to 51 percent of the total U.S. supply of canned crabmeat. The U.S. pack of canned crabmeat has also declined, from 11 million pounds in 1966 to 2.4 million in 1972.

It is doubtful that closure of U.S. crab canners would result in substantial increases in canned crab imports. The demand for canned crab is small and has been decreasing. However, should crab freezers in Alaska, Washington, Oregon and California be forced out by effluent guideline requirements, it is probable that, in the absence of equivalent effluent controls by Canada, expansion of crab processing on the West Coast of Canada could occur with the bulk of the crabmeat destined for export to the United States.

The supply of crab has not increased during the past six years. Since 1968, combined U.S. landings (live weight) have varied between 238.5 and 281.1 million pounds. Crab does not share the popular demand for either shrimp or tuna and crab imports will be tied to the total level of consumer demand for crab.

Catfish

The closure of catfish processing plants would have very little impact on foreign trade in farm-raised catfish. Catfish imports (mainly from the Amazon River area of Brazil) do not serve the same market as farm-raised catfish fillets. Therefore, it is believed that curtailment of catfish processing would have virtually no effect on catfish imports to the U.S.

VII. LIMITS OF THE ANALYSIS

A. General Accuracy

The seafoods processing industry is complex in terms of the number, ownership, location and type and size of plants. Variations in the seasonal pattern of operations, extreme variation in climatic conditions (Kodiak, Alaska to Key West, Florida) and substantial differences in raw product characteristics all contribute to the complexity of this industry.

Detailed information on size distribution by types of plants is not available, nor is information concerning processing costs and returns. Very little research has been conducted, by any source, on the economics of seafoods processing. As a result, the financial aspects of the analysis, were, of necessity, based on synthesized costs and returns for "representative" types and sizes of model plants. These costs and returns were developed from a variety of unpublished and published sources and from contacts made with firms in the industry. They are, as a result, indicative only and not representative of any one plant or firm, but are believed to be useful for the purposes of this analysis.

Published information from the Internal Revenue Service, such references as Standard and Poors, Dun and Bradstreet, and other sources of data on financial ratios and financial performance were used as checks on the reasonableness of results obtained in the financial analysis of representative plants.

Throughout the study, an effort was made to evaluate the data available and to update these materials wherever possible. Checks were made with informed sources in both industry and government to help insure that data were as reliable and representative as possible. In some instances, e.g., catfish data, visits were made to offices of agencies responsible for development of these statistics and access was permitted to unpublished data which was necessary for background purposes or to provide data for recent periods.

Although processing cost data, information on investments and other "representative plant" cost and returns information must be considered approximate, general information on these items was obtained from a substantial number of processors and when classified and cross-checked, showed reasonable degrees of consistency.

Water pollution control costs were furnished by EPA, Effluent Guidelines Division. These costs were developed for a variety of industry categories and subcategories and effluent treatment systems. It was necessary to adapt these effluent control costs to the types and sizes of model plants used in this analysis. In addition, because there was presented a range of waste treatment techniques, and associated costs, purported to be adequate for meeting specified effluent limits under varying conditions, it was necessary to arbitrarily select one waste treatment technology for each industry segment and treatment level. This selection was made with the assistance of EPA. Given this designated treatment technology, it was necessary to adapt the effluent treatment costs to the types and sizes of model plants used in the analysis. In addition, it was necessary to make specific assumptions regarding the current status of effluent treatment and disposal in the seafoods processing industry. These assumptions are dexcribed in detail in the "Critical Assumptions" section of this report. The validity of these assumptions and of the effluent control costs which result introduce an additional element of uncertainty and possible inaccuracy.

However, given the accuracy of the pollution control costs as being acceptable, it is believed that the analysis represents a usefully accurate evaluation of the economic impact of the proposed effluent guidelines on the seafoods processing industry.

B. Range of Error

Different data series and different sections of the analysis will have different possible ranges of error. Estimated error ranges as an average for the industry are as follows:

		Error Range %
1.	Information regarding the organization and structure of the industry, number, location and size of plants, and other information descriptive of industry segments	± 10
2.	Price information for products and raw materials	± 10

	Error Range %
3. Cost information for plant investments and operating costs	± 15
4. Financial information concerning the seafoods processing industry	± 15
5. Salvage values of plants and equipment	± 20
6. Water pollution control costs	Unknown
7. Present status of effluent control in the industry	± 20

C. Critical Assumptions

The complex of types and sizes of seafoods processing plants, processes involved and effluent control levels and systems proposed to meet these levels, all required the making of a series of assumptions required to keep the analysis within manageable limits and to specify "representative" situations which would permit further development of industry-wide impacts. These assumptions fall into seven general areas:

1. Assumptions regarding industry structure
2. Assumptions concerning raw material and product prices
3. Assumptions concerning "representative" model plants
4. Assumptions concerning water pollution control costs
5. Assumptions concerning current status of effluent disposal systems in use by the industry
6. Assumptions concerning the salvage value of plants and equipment
7. Assumptions concerning "shutdown" decisions.

1. Industry Structure - The seafoods processing industry is complex and geographically scattered. Although this project was concerned only with tuna, shrimp, crab and farm-raised catfish, many of the firms and plants in the industry can and/or freeze a much wider variety of fish and shellfish. Many of these plants are parts of diversified seafoods processing forms or of general food processing companies. Restricting the analysis to the four species mentioned above introduces an element of artificiality insofar as a description of industry structure is concerned. Although the National Marine Fisheries Service maintains lists of seafoods canning plants, no comparable information exists for the freezing industry. As a result, it was necessary to develop much of the industry structure information from primary sources.

Substantial differences develop when "official" or published lists or directories of seafood processing firms are compared with reports from firms and individuals located in the areas of concern. For example, review of materials from the National Marine Fisheries Service (canners only) and directories of frozen food processors indicated that there were only 7 Blue Crab processors in Maryland. However, conversations with processors in the area indicated that thre may be as many as 36 firms processing Blue Crab in Maryland. It is recognized that many of these "processors" may be very small operators who clean or pick crab and sell chilled crab to local markets or restaurants in non-hermetically sealed containers. The same situation undoubtedly exists along the Gulf Coast and on the West Coast. Listings for Alaska, of commercial fisheries processors, obtained from the State of Alaska, Department of Fish and Game, are believed to be reasonably complete. Since the projected number of plant closures is related to the number of plants in operation, a concerted effort was made to make the estimates of plant numbers as complete as possible. Although some small operators have undoubtedly been overlooked, it is believed that the processor numbers shown represent a high proportion of commercial processing capacity.

2. Raw Material and Product Prices - There is no single source which publishes satisfactory prices for raw fish and shellfish and processed seafood products. Major reliance was placed on contacts with firms in the seafoods processing industry, but prices for both raw and processed products were checked with both published and unpublished price information from the National Marine Fisheries Service. Prices of both fish and processed seafoods products have increased sharply during the past year, along with the prices of all other protein foods. A particular effort was made to insure that raw material and processed product prices were on a comparable basis for the types of products and for the time periods considered.

3. "Representative" Model Plants - No single plant is "representative" of the complex of types and sizes of plants which constitute the various segments of the seafoods processing industry. Although specific types of plants (e.g. tuna canners, shrimp breaders, etc.) will have certain items of equipment in common, the plants will vary greatly regarding size, construction, equipment combinations and layout and sites. For example, shrimp processors are found at coastal areas and at inland locations such as Phoenix, Arizona. Plants are located on piers built out into the bay, on converted ship hulls and at shore-based sites. A distinction often made relates to "shore-based" U.S. "ship-based" plants. They vary in size from small, simple operations to large, mechanized processing plants.

The technical information on effluent control systems and costs, supplied by EPA, was based on specified types and sizes of plants. As a result, it was necessary to pattern the impact analysis around those types of plants included in the technical study of effluent control systems.

The "model" plants used in this analysis are described in Chapter VI. The types of plants used were as follows:

1. Tuna	Plant processing 1,600,000 cases of canned tuna per year, operating season 250 days, single shift basis
2. Southern shrimp	a. Canner processing 14 tons per day of raw product, 110 day season, single shift basis
	b. Freezer processing 7 tons per day of raw product, 260 day season, single shift basis
3. Shrimp breader	a. Small plant, processing 2 tons per day raw product, 260 day operating year, single shift basis
	b. Large plant, processing 10 tons per day raw product, 260 day operating year, single shift basis
4. Alaskan shrimp	Combination canning and freezing plant processing 17.5 tons per day raw product, 130 day season, single shift basis
5. Northern pink shrimp (Calif., Ore., Wash., New England)	Combination canning and freezing plant processing 10 tons per day raw product, 130 day season, single shift basis
6. Alaskan crab meat	a. Canner processing 12.5 tons per day raw product, 150 day season, single shift basis
	b. Freezer processing 12.5 tons per day raw product, 150 day season, single shift basis, 75 percent meat, 25 percent whole and sections

7. Dungeness and Tanner Crab (Calif., Ore., Wash.)	Single product canning plant and single product freezing plant processing 7 tons per day, 150 day season, single shift basis
8. Blue crab	Combination conventional and mechanized plant processing 5 tons per day raw product into canned and fresh chilled product, 200 day season, single shift basis
9. Catfish	Processes fresh and frozen catfish fillets, 4 tons per day raw product, operates at 60 percent of capacity, 250 day season, single shift basis

It is recognized that this classification of plants does not approach the variety of types and sizes of plants which comprise these segments of the seafoods processing industry. In reality, each plant is individually engineered and equipped to meet the requirements of a particular site and location. In addition, the product mix will vary from plant to plant and from time to time within a given plant. However, it is believed that the types of plants used in the analysis serve to illustrate the nature and the severity of the economic impact which would result from the imposition of proposed effluent limitation guidelines on the tuna, shrimp, crab and farm-catfish processing industries.

4. Conversion Factors - Conversion factors for converting from raw product to processed product, e.g. raw crab to crab meat, tuna to canned tuna, etc. are critical in that a small change in the conversion factor results in a substantial change in the yield of processed product and affects plant returns accordingly. Conversion factors used were obtained from both industry and published sources and are believed to be representative for the types of raw and processed products with which this project is concerned.

5. Effluent Control Costs - Effluent control systems and costs for systems specified were supplied by the Effluent Guidelines Division of EPA. Critical limitations regarding the applicability of these effluent control systems include the following:

a. The physical availability and the cost of land where lagoons are proposed as a part of the effluent treatment system.

b. The validity of extrapolating costs to obtain estimates for treatment systems for plants of various sizes required beyond the limits of cost data provided by EPA.

c. The application of treatment costs based on 2-shift operations (as supplied by EPA) to plant situations involving single shift days. The calculations used considered treatment costs as related to total tons processed per day regardless of the number of shifts. For some types of non-biologic treatment systems, this could result in an understatement of treatment costs as capacities of certain items of equipment, e.g. screens, might not be adequate to handle the volume specified on a one-shift basis.

d. The effluent treatment systems costs assumed that the plants had none of the required equipment currently in place. However, it is known that some plants do have screening devices, grinders, etc. which are being used to process effluent prior to its discharge from the plant and in some cases to recover solid materials for utilization as by-products or for disposal as solid wastes in landfills, etc. To the extent that such equipment is in place in existing plants, the incremental cost of achieving BPT or BAT controls would be reduced.

6. Current Status of Municipal Treatment in the Industry - Only limited information is available concerning the number, location and types of seafoods processing plants discharging into municipal sewage systems. As a result, it was necessary to develop estimates of the number of plants served by municipal sewer systems. These estimates were made by personal visits to plants and by telephone contacts with processors and others knowledgeable concerning effluent control practices at specific locations. The estimates are shown in Table V-3. Although these estimates are not based on a complete survey of all of the plants in each area and product category, it is believed that contacts made in each area were adequate to provide a useful estimate of the importance of municipal waste treatment system connections to the seafood processing industry in 1973. In some situations, e.g., Astoria, Oregon and Terminal Island, California, expanded and/or improved sewage treatment facilities are either planned or actually under construction. These new facilities will relieve the situation in those locations as they are completed and come on stream.

7. Salvage Values - Salvage values of buildings, equipment and land will vary greatly from one location to another and with the type and conditions of structures and equipment.

In order to avoid problems which would be inherent in attempting to establish differential salvage values, a set of "standard" assumptions concerning salvage values was developed:

a. Land was salvaged at its estimated 1972 value.

b. Buildings and equipment were salvaged at a net amount equivalent to 10 percent of their 1972 replacement value.

c. Net operating capital was recovered intact.

8. "Shutdown" Decisions - The general purpose of the "shutdown" model is to examine the profitability of the model plants before and after the imposition of effluent limitation guidelines, to determine the probability of forced closures which would result and to calculate the price changes required to cover the added effluent control costs. The model requires assumptions relative to numerous factors and are described in detail in previous sections of this report. Assumptions used, while arbitrary, were made on the basis of the best information which could be developed regarding conditions prevailing in the seafoods processing industry.

BIBLIOGRAPHIC DATA SHEET	1. Report No. EPA-230/1-73-025	2.	3. Recipient's Accession No.
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15. Supplementary Notes

16. Abstracts

The economic impacts of proposed effluent guidelines on the seafoods processing industry are assessed. The analysis is confined to tuna, shrimp, crab and farm-reared catfish processing plants and includes classification and description of types of firms and plants, financial profiles, investment and operating costs and profits for selected types of model plants, evaluation of pricing relationships and analytical procedures. The financial impact of proposed effluent treatment technology was assessed in terms of prices, industry returns, volume of production, community impacts and international trade.

It is estimated that BPT standards will close 53 seafood processing plants. This includes 12 catfish, 2 tuna, 25 shrimp and 14 crab processing plants. It has further been estimated that BAT standards will close 8 tuna, 37 shrimp and 27 crab processing plants.

17. Key Words and Document Analysis. 17a. Descriptors

Water pollution, economic analysis, seafoods, tuna, shrimp, crab, catfish, pollution, industrial wastes, economic demand, supply, prices, feasibility analysis, discounted cash flow

17b. Identifiers/Open-Ended Terms

02 Agriculture, B-Agriculture Economics
05 Behavioral and Social Sciences, C-Economics

17c. COSATI Field/Group

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