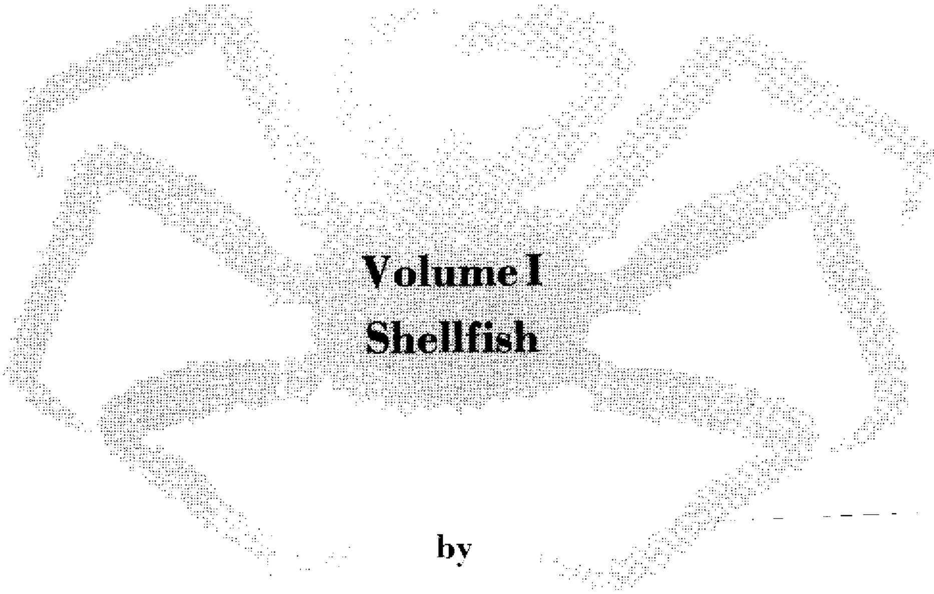
MARKET STRUCTURE

of the

ALASKA SEAFOOD PROCESSING INDUSTRY



Volume I
Shellfish

by

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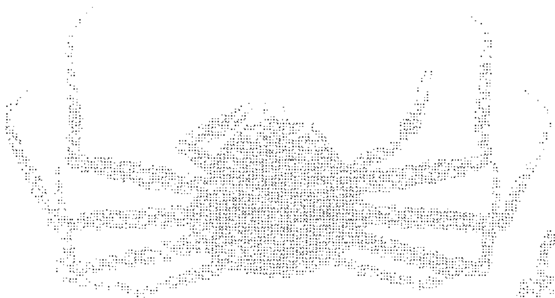

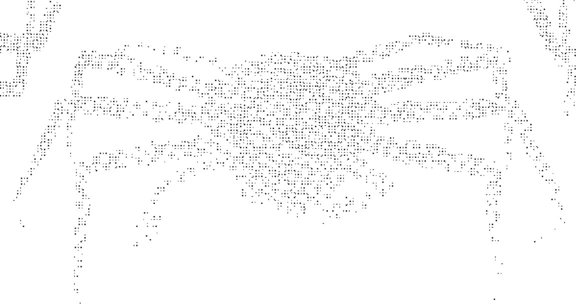

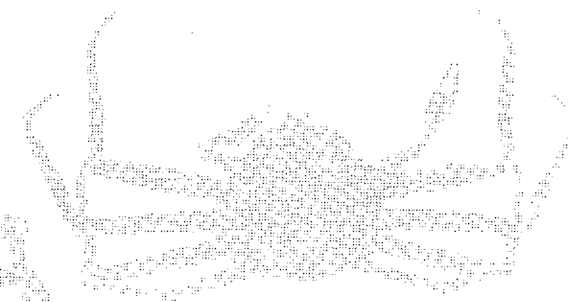

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CONTENTS

CONTENTS
(continued)

CONTENTS
(continued)

CONTENTS
(continued)

FIGURES

TABLES

TABLES
(continued)

TABLES
(continued)

TABLES
(continued)

TABLES
(continued)

TABLES
(continued)

TABLES
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TABLE
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Any errors or omissions remain the responsibility of the authors.

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CHAPTER I

INTRODUCTION

The Fisheries Conservation and Management Act of 1976 formally incorporated economic analysis into the legal and institutional framework for fisheries management. The implementation of this broadened management concept can occur only gradually as economic information needs are defined and as systems for collection, storage, and dissemination are devised. In the meantime, it is important to exploit existing data sources, if by doing so, meaningful economic information and insights are provided to those individuals and agencies responsible for implementing the Act.

This report is directed at this near-term goal by providing as indepth a picture of the Alaska seafood processing sector as available institutional data and industry sources have allowed. The objective underlying this research effort has been to assess the economic structure of Alaska seafood processing as it has evolved since statehood, in the context of changing regulatory, technological, and biological environments. This "in context" approach is dictated by the fact that economic structure is primarily determined by the dynamic forces that constitute an industry's operating environment. Accordingly, this report contains information on the basic industry conditions corresponding to each major processing industry--historical overview, the resource, harvesting and processing methods, and marketing. This information is intended to provide the background for interpreting present structural conditions and structural changes that have occurred since statehood. Many readers will need to use this background material for occasional reference only. For those not knowledgeable about a particular fishery, a complete reading should prove to be beneficial.

Another objective of this work has been to provide management agencies and industry executives with a baseline inventory and description of the primary components of the seafood processing sector. This should provide information for current decision making, and build the framework for annual or periodic updating for all or selective segments of the seafood processing sector. Included in the baseline inventory is the geographic distribution of plants and firms and, within regions, the number and size distribution of plants and firms in total and by major species and process forms. Figure 1 shows how this research was conceptualized and conducted.

Background and Scope of the Study

In 1976, a research effort was initiated under funding by the Alaska Sea Grant Program to develop a comprehensive description of the economic

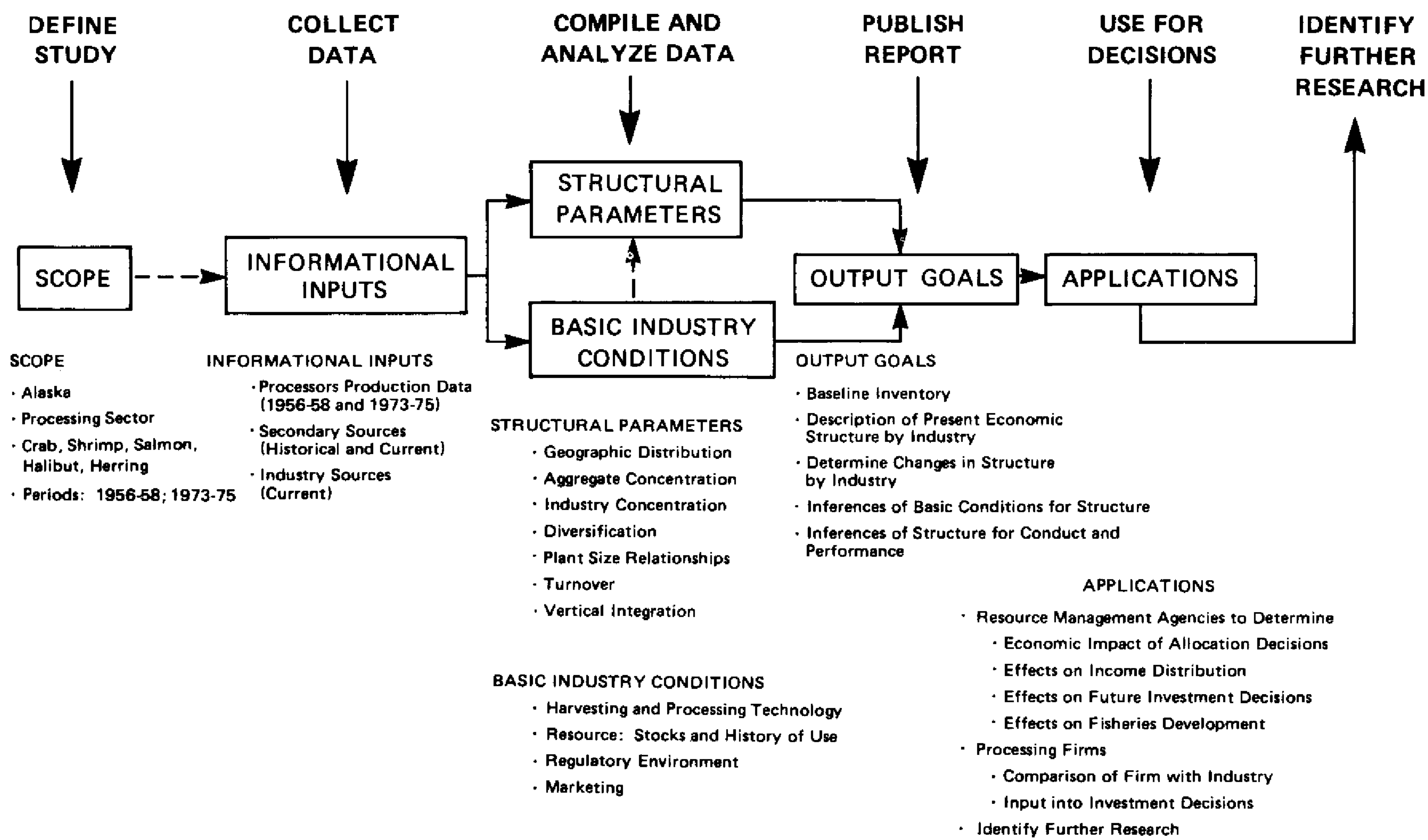

FIGURE 1. CONCEPTUALIZATION OF MARKET STRUCTURE STUDY

structure of the Alaska seafood processing industry. Two factors primarily justified the research, although they by no means exhaust the possible benefits from increased knowledge. The first was the observation that Alaska fisheries resource managers could benefit by an improved understanding of the seafood processing sector. Processing firms make decisions which affect the rate and geographic pattern of utilization of stocks under management. Conversely, processors are affected by the decisions of management agencies. The second justification was that, short of a descriptive study of the type reported herein, there were no ready vehicles for providing the information needed by managers.

The scope of this study is limited in four ways:

First, the study focuses primarily on the processing sector of each fishery; no indepth treatment of the harvesting and marketing levels was attempted.

Second, this focus is on Alaska seafood processing to the exclusion of processing activity in Washington, Oregon, California, British Columbia, and the United States generally. Because these states and regions compete in varying degrees for final-consumption markets, an assessment of economic structure for only one production region must be interpreted cautiously when used as data for evaluations of competitive conditions in these markets. In cases where further processing occurs outside Alaska, as is often the case for frozen crab sections for example, the assessment of final market-competitive conditions based only on primary-production-area data would be even more tenuous. On the other hand, economic structure in Alaska will be indicative of competitive conditions on the buying side of the market, that is, in the acquisition of raw fish for processing.

Third, the time periods compared in this study are: (1) the three-year periods immediately prior to statehood, and (2) the most recent three-year period for which complete data were available. Data were not sufficient to permit coverage of the intervening years.

Fourth, the study describes the economic structure of the processing industry for each of Alaska's major fisheries--salmon, halibut, herring, crab, and shrimp (see Figure 2)--but it does not attempt coverage of the other miscellaneous species.

Data Resources

Most of the data for measuring structure were obtained through the cooperation of the Division of Commercial Fisheries of the Alaska Department of Fish and Game, and the Alaska Regional Office of the National Marine Fisheries Service. These data cover the years 1956 to 1958 and 1973 to 1976. In addition, an industry survey was conducted during the spring and early summer of 1978 to acquire descriptive information not available from institutional sources. On a less formal individual basis, industry executives were approached throughout the period of this study for factual and

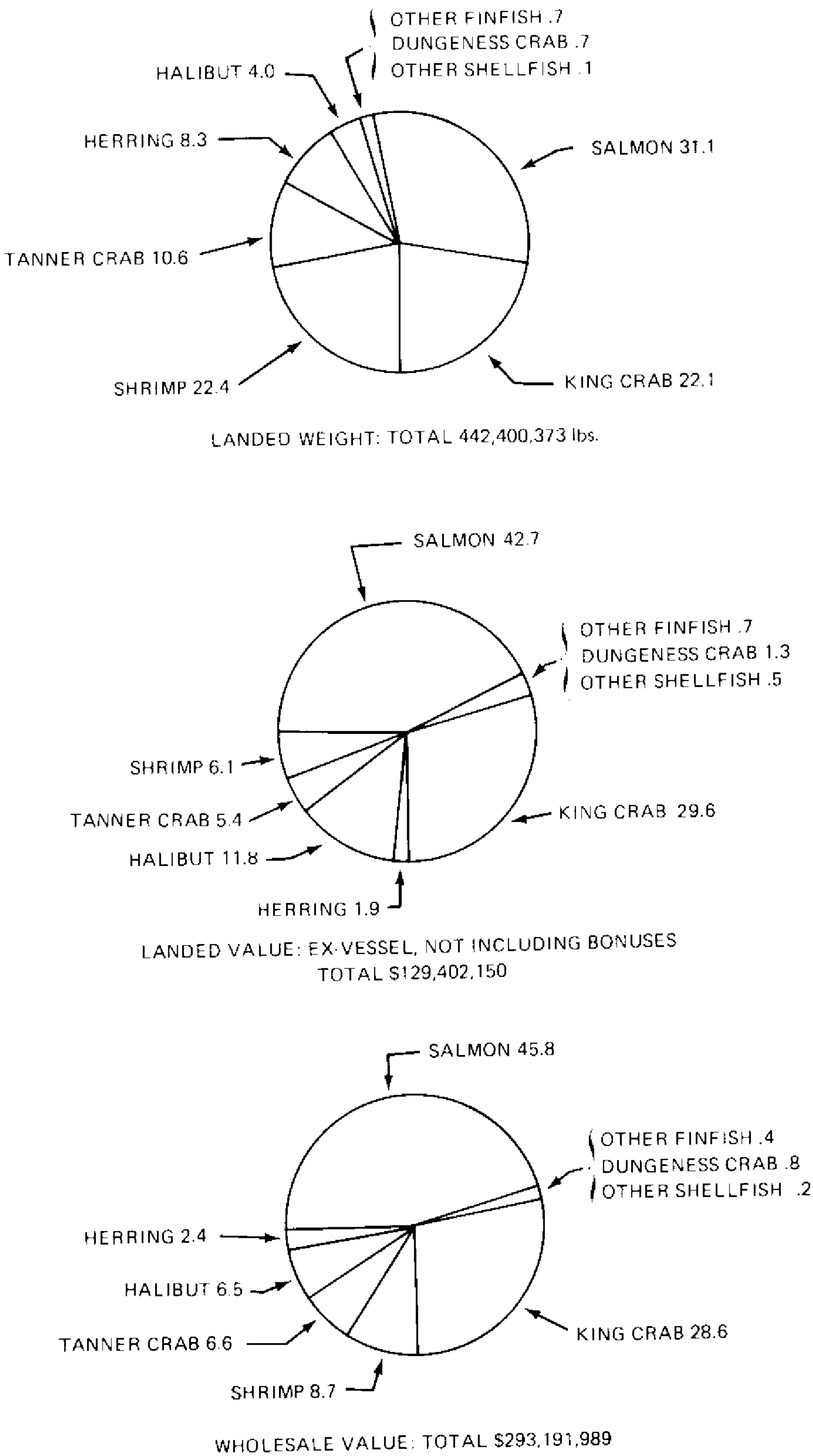

FIGURE 2. LANDED WEIGHT, EX-VESSEL VALUE, AND WHOLESALE VALUE OF ALASKA FISHERIES 1975. ALL VALUES SHOWN IN PERCENT.

interpretive input. Although experience varied widely, most were very generous with their time and knowledge.

While Alaska is not unique in this regard, data on the economic dimensions of its fisheries are sparse and of poor quality. This, of course, is a reflection of the historical orientation of fisheries management toward biological research. The best fisheries data, therefore, are at the harvesting level, where they were used for stock assessment work. Available data progressively decreases as the fish are processed, transported, and marketed. Since this is a study of the processing sector, it was not surprising to find that the quality of the basic data are poor. Many judgements, some arbitrary, were required to make use of the raw production (quantity) data that were available. Value (price) data were found to be so poor that they were not usable in any form in this study. A thorough description of data problems and how they were handled is provided in Appendix I to Volume I.

The basic data used in this study was plant production data of the process form, product form, and species detail requested on the Commercial Operators Annual Report form. Plants not reporting production of any one of the five major species were excluded from the data base. Incomplete reporting, custom production, and changes in plant ownership each caused special problems for this study, as described in Appendix I.

Annual fluctuations in the production of processed fishery products correspond to variations in landings. Some means of normalizing for these variations is required if economic structure is going to be accurately depicted. For example, in a poor salmon season, some plants might not operate at all even though in the previous and subsequent seasons they may have been significant producers. In this case, the size distribution of production over plants in a region would have been drastically different depending on the year of measurement. Table 1 shows the number of plants reporting production, as well as total harvest of finfish and shellfish, in each year covered by this study. Table 2 shows how many companies produced in all three years of each period, two of three years, and only one of three years. As can be seen, there is ample room for distortion with the use of data for a single year. This is especially true at the regional level which can be expected to have experienced greater variation than revealed by statewide totals. To reduce the distorting effect of annual variations, three-year average production figures were used to measure concentration.

Reference to "Period 1" in this study is to the 1956 to 1958 period, and "Period 2", 1973 to 1975. The latest year for which data were available when the study was begun was 1975. Data for 1976, "Period 3," were subsequently evaluated and are included in Appendix IV. The reader is cautioned that these single-year measurements may not be as representative of the distribution of production across plants and companies as the averages for Period 2, 1973 to 1975.

Organization

The results of this study are presented in two volumes. Volume 1, Shellfish, includes king crab, tanner crab, and shrimp. Volume II, Finfish,

TABLE 1

SEAFOOD PROCESSING PLANT COUNT AND HARVESTS BY YEAR
(In Millions of Pounds)

Year	Number of Shore Plants	Number of Floaters	Total Plants	Total Finfish	Total Shellfish
1956	137	22	159	410.4	14.3
1957	139	17	156	349.4	16.0
1958	99	8	107	356.4	20.8
1973	149	29	178	196.1	264.9
1974	149	35	184	187.0	271.7
1975	154	31	185	191.2	246.5
1976	134	37	171	293.5	317.1

Source: Compiled from data provided by Alaska Department of Fish and Game; 1956 and 1957 harvest figures are taken from Fisheries of the United States and Alaska; 1958 harvest figures are from Alaska Fisheries 1958.

TABLE 2

CONTINUITY OF COMPANY OPERATION BY PERIOD

Number of Years in Period for Which Production Reported	Number of Companies	
	Period 1[1]	Period 2[2]
1	65	78
2	54	49
3	55	82

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]1956 to 1958

[2]1973 to 1975

covers halibut, herring, and salmon. Volume I is organized as follows: The remainder of this chapter will provide a brief review of other seafood processing structure studies (more detailed treatment of this material is provided in Appendix II), and a description of the regulatory environment facing the seafood processing sector. The review of other studies is intended to allow the reader to place the results of the present study in broader perspective.

Chapter II describes the structure of the Alaska seafood processing sector and detailed shellfish processing industries. Chapters III, IV, and V present descriptive information on the basic industry conditions (history, the resource, harvesting, and processing methods) of the crab processing industry. Chapters VI through VIII provide the same categories of information for the shrimp processing industry. Chapter IX describes the marketing of Alaska shellfish.

Appendix I provides detailed information on how data problems were treated in the course of this research. Appendix II provides a conceptual overview of economic organization (structure) in general, a review of literature on seafood processing structure in the United States, and a glossary of terms. Appendix III presents the compiled results of the industry survey. Appendix IV includes statistical tables for Period 3 (1976 only) comparable to those shown in the main body of this report for Period 1 (1956 to 1958) and Period 2 (1973 to 1975).

Structural Elements of the U.S. Seafood Processing Industry: A Literature Summary

Relatively few studies have been conducted on structural aspects of the U.S. seafood processing industries. Those that presently exist assess structural components on national and regional bases (Capalbo 1976) or by particular fish and shellfish species (Alvarez, Andrews, and Prochaska 1976; Jensen 1975; Kolhonen 1976; Orth et al. 1977). The scope of the Capalbo study is limited in that it does not evaluate structural elements in all regions and because such elements, when assessed, are aggregated by process form sector. The latter feature renders interpretation of structural parameters more difficult as process form sectors rarely conform to the concept of an industry or market. The specific-species studies, while being free of the above drawbacks, are simply too limited in number or scope; a few species and/or regions are covered by these works but not enough to characterize adequately the economic structure of regional or national markets for these or similar fish products.

In general, the particular species studies are consistent with, and thus tend to support, the study of Capalbo (1976). For this reason, a summary of the Capalbo study is used to describe structural elements of the U.S. processing industry. The other studies are discussed in Appendix II.

A summary of structural elements is presented in Table 3. Most of the structural elements assessed by Capalbo are included in the table; the only regions for which there was coverage for such elements are the New

TABLE 3

SUMMARY OF MARKET STRUCTURE ELEMENTS OF U.S. SEAFOOD PROCESSING INDUSTRY BY NATIONAL AND REGIONAL PROCESS FORM SECTORS

STRUCTURAL ELEMENTS[1]	Fresh Process Form Sectors			Frozen Process Form Sectors			Canned Process Form Sectors		Cured Process Form Sector
	National	New England Region	Middle Atlantic Region	National	New England Region	Middle Atlantic Region	National	Pacific	National
Trend in concentration, 1965-74	increase	increase	increase	increase	increase	increase	increase	increase	increase
8-plant concentration ratio >.70	no	no	no	no	yes	yes	no	yes	no
4-plant concentration ratio >.30	no	yes	yes	no	yes	yes	yes	yes	yes
Inequality of plant size[1]	moderate	moderate	moderate	moderate	great	great	great	great	great
Product extension [2]	moderate	high	moderate	low	moderate	moderate	low	low	low
Vertical integration backward	low	low	low	moderate	moderate	moderate	moderate	moderate-high	---
forward[3]	moderate-high	moderate	moderate	low	low	moderate	low	moderate	moderate
Change in total number of plants, 1965 and 1974	decrease	decrease	decrease	increase	decrease	decrease	decrease	decrease	decrease
Size class[4] of most entry-exit activity; 1965 to 1970	2	2	2	2	2	2	2	2	...
1970 to 1974	2	2	2	2	2	2	2	2	...
Mode plant size (by size class)	...	2	2	...	2	5	...	6	...
Number of plants by size class 1	...	1	-	...	-	-	...	-	...
2	...	118	25	...	31	9	...	27	...
3	...	16	12	...	6	4	...	7	...
4	...	15	8	...	11	2	...	5	...
5	...	13	5	...	27	9	...	30	...
Total	...	163	50	...	75	24	...	69	...

Source: Adapted from Capalbo, 1976.

[1]For further detail see Capalbo, 1976, pp. 78,97.

[2]Descriptions:
low 20%
moderate 20-40 % — % of plants in top 20 that extended production
high 40%

[3]Descriptions:
low 0-9%
moderate 10-25% — % of plants in top 20 that were vertically integrated
moderate-high 26-35%

[4]Size class of plants is by value of annual production:
Class 1 $0 - $99
Class 2 $1,000 - $199,999
Class 3 $200,000 - $499,999
Class 4 $500,000 - $1,000,000
Class 5 $1,000,000 - $10,000,000
Class 6 $10,000,000 +

England and Middle Atlantic regions. It can be seen in the table that concentration increased from 1965 to 1974, at both national and regional levels, in all four process form sectors. The frozen, canned, and cured process form sectors were generally more concentrated than the fresh sector and exhibited greater inequality in plant size. Firms in most sectors did not extend production (diversify) to other process forms, either at the national or regional level. Backward vertical integration appeared to be relatively low in the fresh sector, moderate in the frozen and cured sectors, and moderate to relatively high in the canned sector.[1] Forward integration was generally low to moderate in all sectors but the fresh sector at the national level.

All sectors experienced a decline in plant numbers from 1965 to 1974. Most entry and exit activity was accounted for by plants with annual sales in the $1,000 to $199,999 range. The mode plant size in the fresh sector was relatively small ($1,000 to $199,999) while it was comparatively large ($1,000,000 +) in the frozen and canned sectors.

It should be reiterated that the above description of structural elements is general and not applicable to all species within a process form sector. The information presented is highly aggregated and should be interpreted with care.

Alaska Fishing Industry: Regulatory Environment

Alaska's fishing industry is subject to direct and indirect regulation by many state and federal agencies and departments. In some cases this complex organizational structure leads to overlapping jurisdictions between federal and state government, and contradictory and undefined government policies and objectives.

A review of the federal and state regulatory agencies that affect Alaska fisheries is included. This section will briefly discuss the role of each and point out some of the constraints to the successful management of Alaska fisheries. This review is not intended to be comprehensive, but is intended only to illustrate the general responsibilities of each agency. A summary of these agencies and user groups is shown in Figure 3.

Federal

North Pacific Fishery Management Council (NPFMC). NPFMC is one of the eight regional management councils organized under the Fishery Conservation and Management Act of 1976. The NPFMC has authority over the fisheries of the Arctic Ocean, Bering Sea and the Pacific Ocean from three to 200 miles seaward of Alaska.

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[1]Capalbo did not explicitly consider this structural aspect. The information for this element was derived primarily from other studies (Alvarez et al. 1976; Jensen 1975).

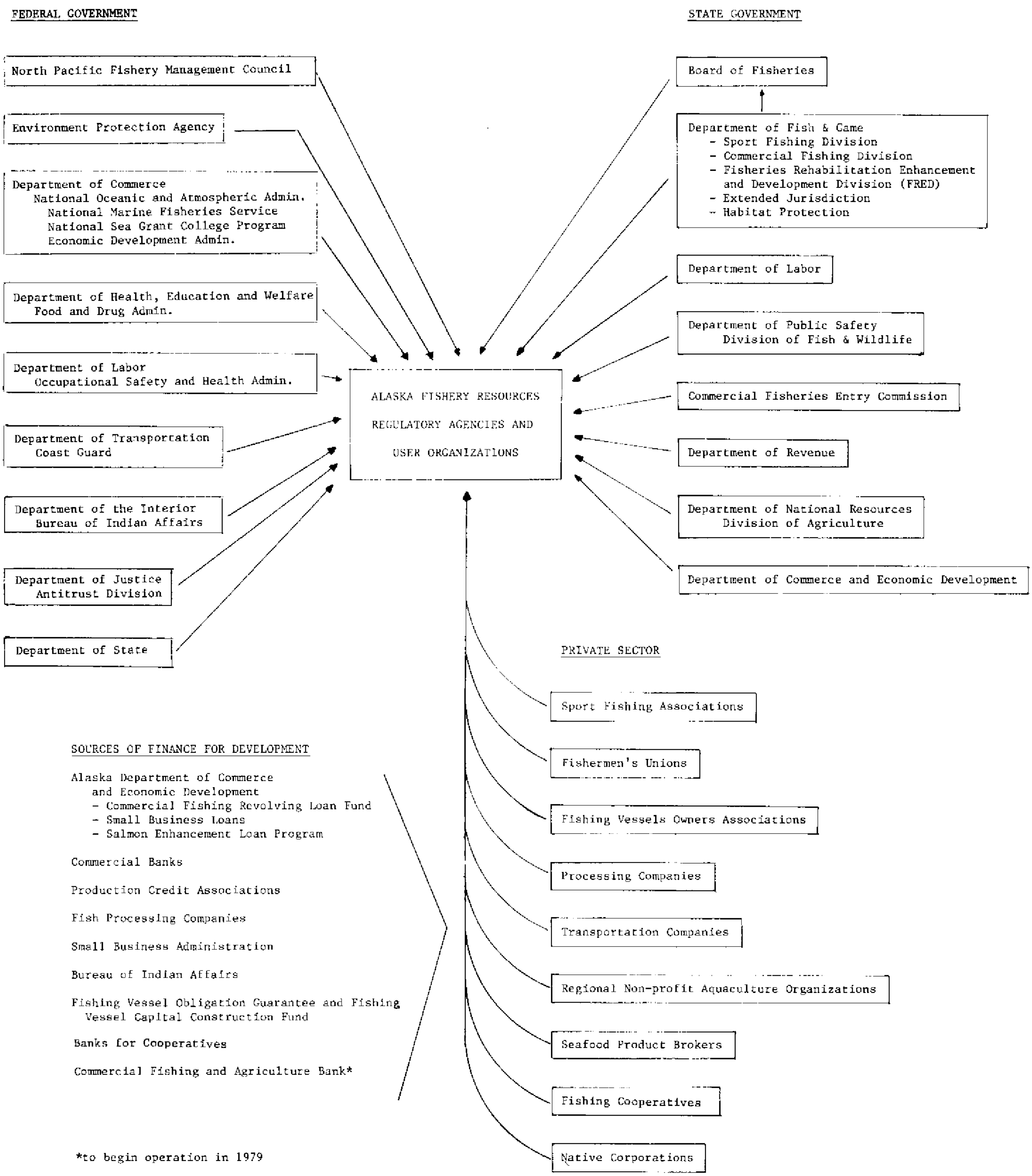

FIGURE 3. AGENCIES AND ORGANIZATIONS AFFECTING ALASKA MARINE RESOURCES DEVELOPMENT

Environmental Protection Agency (EPA). The responsibilities of the EPA are to control and abate pollution by research monitoring, standard setting, and enhancement activities. An example of the regulatory action of the EPA in Alaska is the regulation enacted in 1973 to stop processing wastes in Kodiak from being dumped into the ocean. Faced with the possibility of being shut down, the processing companies found a solution by selling (or paying to have taken away) wastes to Bio-Dry, a reduction processing plant. The EPA is presently in the process of enacting a similar regulation at Dutch Harbor. As the regulation now stands, the plants there had to have screens installed by November 1, 1978, to filter out solid particles from the waste water disposal systems.

Department of Commerce (USDC). The USDC encourages, serves, and promotes the nation's economic development and technical advancement. It offers assistance and information to domestic and international businesses; provides social and economic statistics and analyses for business and government planners; assists in the development and maintenance of the U.S. Merchant Marine, and provides research for and promotes the increased use of science and technology in the development of the economy.

National Oceanic and Atmospheric Administration (NOAA). The purposes of NOAA are to explore, map, and chart the global ocean and its living resources; to manage and conserve those resources; and to describe, monitor, and predict conditions in the atmosphere and ocean. Among its principal functions, NOAA provides special services in support of marine activities. It prepares and issues nautical charts; predicts tides, currents, and the state of the ocean; conducts biological research and surveys the living resources of the sea; analyzes economic aspects of fisheries operations with an eye to improving man's ability to use and conserve those resources; and protects marine mammals.

National Marine Fisheries Service (NMFS). Field organization of NOAA. It provides research and informational services in the areas of resource research, resouce utilization, resource management, and international fisheries.

National Sea Grant College Program. A federal-state-university partnership, which administers and supports research, education, and advisory services in the development of marine resource and technology in American universities.

Economic Development Administration (EDA). The primary function of the EDA is the long-range economic development of areas with severe unemployment. It aids in the development of public facilities and private enterprise to help create new, permanent jobs.

Department of State (USDS). The USDS advises the president in the formation and execution of foreign policy. The department determines and analyzes the facts relating to our overseas interests, makes recommendations on policy and future action, and takes the necessary steps to carry out established policy. It is responsible for negotiation or renegotiation of treaties with other countries which pertain to the fisheries within the fishery conservatation zone.

Department of Health, Education, and Welfare (HEW). This is the department of the federal government most involved with human concerns and the welfare of the individual. Some programs within HEW which have direct effects on Alaskan fisheries are described below.

Food and Drug Administration (FDA). The scope of responsibility of the FDA includes the protecting of the health of the nation against impure and unsafe foods.

Bureau of Biologics. The responsibilities of this bureau include: regulation of biological products shipped in interstate and foreign commerce; inspection of manufacturers' facilities; establishment of written and physical standards; testing of products submitted for release; approval of licenses for manufacturers of biological products; conducting research related to development, manufacture testing, and manufacture of new and old biological products.

Bureau of Foods. This bureau conducts research and develops standards on the composition, quality, nutrition, and safety of foods; conducts research designed to improve detection, prevention, and control of contamination that may be responsible for illness or injury conveyed by foods; reviews industry petitions.[2]

Department of Labor, Occupational Safety and Health Administration (OSHA). The purpose of OSHA is to develop and promulgate occupational safety and health standards; develop and issue regulations; conduct investigations and inspections to determine compliance with safety and health standards; and to issue citations and propose penalties.

Department of Transportation, U.S. Coast Guard (USCG). The USCG is responsible for search and rescue (life and property) on the high seas and in U.S. waters; law enforcement of laws governing navigation, vessel safety, marine environmental protection, and resource conservation (including enforcement of safety standards on foreign vessels subject to U.S. jurisdiction); investigations, surveillance, operations, and boardings to detect violations.

Department of the Interior, Bureau of Indian Affairs (BIA). The BIA encourages and trains Indian and Alaska Native people to manage their own affairs and facilitates full development of their natural resource potentials, consistent with principles of resource conservation.

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[2]In personal correspondence with a compliance officer of the Food and Drug Administration, Department of Health, Education and Welfare, the following information was obtained in response to questions concerning the Alaska fisheries. "Regulations covering specific industries by geographical areas do not exist. Specific regulations concerning sanitary practices and conditions of fishing vessels do not exist. There are no specific regulations with regard to the development of new processing methods or products. The existing statutes and regulations require that all foods shall be free from adulteration and shall be appropriately labeled. We (HEW) have no set quality control standards and do not specify the frequency of quality checks. It is the responsibility of the manufacturer, distributor, and shipper to ensure that foods shipped into interstate commerce are safe and free from adulteration." (A.P. Duzenack 1978, personal communication.)

Department of Justice, Antitrust Division. This organization is responsible for enforcement of federal antitrust laws which involves investigation of possible violations, preparing and trying antitrust cases, prosecuting appeals, etc. It also represents the U.S. in judicial proceedings to review certain orders of the Interstate Commerce Commission, Federal Maritime Commission, etc.

State

Board of Fisheries. This board is responsible for the establishment and changes to commercial or sport fishing regulations; holding public meetings to allow public participation and input on proposed regulation changes.

Department of Fish and Game. This department is responsible for the management of Alaska's fishery resources.

Department of Labor. The workmen's compensation division administers the fishermen's fund which is comprised of 60 percent of the revenue collected from commercial fishing licenses. Medical and convalescent benefits are drawn against the fund through claims filed by fishermen injured or sustaining an illness while fishing.

Department of Public Safety, Division of Fish and Wildlife. The division is responsible for enforcement of harvesting regulations.

Commercial Fisheries Entry Commission. This commission was established in 1973 for the purpose of stabilizing the number of units of gear in the commercial fisheries at levels consistent with good fisheries management and fair dollar returns to the fishermen. Permanent entry permits were issued in 1975 on a point system measuring a fisherman's dependence on fishing; the permits are transferable.

Department of Revenue, Taxation (DRT). DRT is responsible for collecting tax revenue from Alaska fisheries operations. Each processing plant must complete an application for an Alaska fish processor license and pay an annual fee of $25. The state receives "fish tax" revenue from the shellfish industry through processing companies. The schedule of rates at the time of the writing of this report are:

Crab, canned	- 2 percent of raw value
Crab, other processes	- 1 percent of raw value if shore-based processor
	- 4 percent of raw value if floating processor
Shrimp, all processes	- 1 percent of raw value if shore-based processor
	- 4 percent of raw value if floating processor.

Department of Revenue definitions are as follows: "Shore-based fish processor means cold storage and processing plants that are permanently attached to the land or have remained in the same location from January 1 through December 31 of the previous calendar year. Cold storage and fish processing plants which are not permanently attached to the land or did not remain in the same location the previous calendar year are classified as 'floating fish processors.'" Floating processors which moor in the same location every year except for removal for drydock or repairs are apparently eligible for the shore-based rate unless they return to a different location to process according to the following Alaska statutes. "Removal of vessels for repairs. Removal of vessels from the state for drydock repairs does not require reclassification under the higher rate of taxation. State vs. Wakefield Fisheries, Inc., Sup. Ct. Op. No. 779 (File Nos. 1397, 1398), 495 p. 2d 166 (1972). Removal of vessels for periodic repairs and maintenance should not destroy the continuity of the period during which the vessels are deemed to be at fixed locations for one calendar year. State vs. Wakefield Fisheries, Inc., Sup. Ct. Op. No. 779 (File Nos. 1397, 1398), 495 p. 2d 166 (1972). Processor disqualified from 'shore-based' status. Where, in addition to the yearly trips to Seattle for maintenance, the processors also sailed among several Alaskan communities to conduct their processing operations, they were disqualified from 'shore-based' status under this section. State vs. Reefer King Co., Sup. Ct. Op. No. 1344 (File Nos. 2605, 2606, 2607), 559 p. 2d 56 (1976)."[3]

Discussions with persons at the Department of Revenue show that there is no clear definition of the amount of time a processor may remain in drydock outside the state each year and still retain shore-based status.

The state also obtains tax revenues from all people involved in any aspect of the fishing industry in Alaska by state tax on personal income. This is true for year-round or part-year residents.

Department of Natural Resources, Division of Agriculture (DNR, DA). The DNR, DA is the state agency for regulatory control of sanitary conditions of the seafood harvesting and processing industries.

Department of Commerce and Economic Development. This department is responsible for government assistance for fisheries development in Alaska and administers the fisheries revolving loan fund and other loan programs for which fishermen are eligible. Most ad hoc programs for fisheries development are administered by the department.

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[3]Alaska Statutes §43.75.060.

CHAPTER II

ECONOMIC STRUCTURE OF THE ALASKA SEAFOOD PROCESSING SECTOR AND DETAILED SHELLFISH PROCESSING INDUSTRIES

Introduction

The collection and interpretation of economic information requires the use of a systematic and consistent definitional framework. Industrial Organization, a branch of the discipline of Economics, provides a conceptual framework that is applicable to seafood processing and all other industries in the private enterprise economy. The purpose of the framework is to provide a means for sorting and categorizing economic informatin in a manner which is useful for assessing the competitive environment in specific markets.

The economic entities with which economic-structure studies are concerned are plants, firms, industries, and markets. In some instances, the interrelationship between or among entities is straightforward; in other cases, they are obscured by vertical integration, ownership interties, diversification, joint ventures, and custom-production arrangements. All of these complicating factors are common in the Alaska seafood processing sector. Further complicating any description of economic structure is the difficulty of making precise and practical delineations among geographic markets and product markets.

It will suffice here to define an industry as the basic competitive entity which consists of all sellers (firms) who produce a close substitute product and sell to a common group of buyers (Bain 1968).[1] The "close substitute product" constitutes the "relevant product market," and "the common group of buyers" constitutes the "relevant geographic market." An industry, therefore, is all firms who compete in a particular geographic and product market. For example, the relevant product market might be canned king or tanner crab meat, and the relevant geographic market would be nationwide. The canned crab meat (king and tanner) industry would thus be defined as all firms who produce these species of canned crab meat and sell into the nationwide market system.

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[1]As an alternative to a long digression in the body of this report, Appendix II has been developed to provide a conceptual background for the interpretation of information presented in this report, as well as for assisting the reader who wishes to obtain a general understanding of economic organization. Appendix II also provides an overview of the results of other studies of seafood market structure. This information is intended to allow the reader to place the results of the present study in broader perspective. Finally, Appendix II contains a glossary of technical terms to assist readers as necessary, although an effort has been made to minimize the use of economic jargon.

The relevant market in which the firm competes as a seller is only one of several competitive environments among processors in the acquisition of fish from harvesters. The competitive environment among processors in the acquisition of fish constitutes the most significant source of public interest in seafood processing market structure. Where buyer concentration exists, whether due to geographic isolation of landing ports or other factors, it consistently arouses strong opposition among harvesters, particularly just prior to or during the season when ex-vessel prices are determined.

The statistical information gathered for this study is evaluated at two levels of industry detail. First, data are compiled for the Alaska seafood processing sector as a whole without regard to differences which separate the individual industries of the sector. The structural parameters for this level of detail will be discussed first. Second, production data are organized by individual industries in order that the economic structure of these entities can be determined. The later level of detail is the more theroetically correct for assessing competitive conditions, particularly on the buying side of the market. The individual industry analysis will follow the sectorial analysis.

Structural Parameters of the Alaska Seafood Processing Sector

This section will present measures of market structure which are applicable to the entire Alaska seafood processing sector (as opposed to the individual industries which together comprise the processing sector). The primary characteristic of this information is that it lacks specificity with regard to species and process forms.

Geographic Distribution of Production Facilities

Coastal Alaska has seafood processing establishments from the extreme southeast to the Arctic. As shown in Tables 4 and 5, the present day distribution of production facilities has changed significantly since the prestatehood period. The number of production establishments in Southeast Alaska has declined to less than half, falling from 103 to 47. The number of companies declined from 81 to 44 and the prevalence of multiplant companies fell as well. Yakutat is the only community experiencing growth in both plants and companies and all of the latter are single-plant entities. During Period 1 (1956 to 1958), six establishments failed to report specific location.

Southcentral Alaska, in contrast, has experienced significant growth since statehood in both plants and companies, regionwide and in each community (or landing port). The greatest growth occurred in Cook Inlet, which gained 31 plants and 26 companies. Kodiak gained 15 plants and five companies. The occurrence of multiplant companies has increased significantly, especially in Cook Inlet and Kodiak. Chignik experienced the greatest proportional growth, a fourfold increase in both the number of plants and companies.

TABLE 4

ALASKA SEAFOOD PROCESSING PRODUCTION FACILITIES, REGIONAL SUMMARY BY PERIOD

	Period 2[1]		Change from Period 1[2]		Ratio of Plants to Companies	
	Plants	Companies	Plants	Companies	Period 1	Period 2
Southeastern	47	44	-56	-37	1.27	1.07
Central	144	105	+65	+38	1.18	1.37
Western	54	39	+ 5	- 7	1.07	1.38
Bristol Bay	30	28	- 9	- 8	1.08	1.07
AYK[3]	47	45	+34	+34	1.18	1.04

Source: Compiled from data provided by the Alaska Department of Fish and Game.

[1]1973 to 1975.

[2]1956 to 1958.

[3]Arctic-Yukon-Kuskokwim.

Note: For areas included in each region see Table 5 and also Alaska Department of Fish and Game leaflet area map.

TABLE 5

GEOGRAPHIC DISTRIBUTION OF SEAFOOD PROCESSING PLANTS AND COMPANIES BY PERIOD

	Period 1[1]					Period 2[2]				
Area	Shore Plants	Floating Plants	Total Plants	Total Companies	Plants/ Companies	Shore Plants	Floating Plants	Total Plants	Total Companies	Plants/ Companies
Ketchikan	25	7	32	28		11	2	13	12	
Petersburg/ Wrangell	22	1	23	22		10	2	12	12	
Sitka	22	1	23	19		6		6	6	
Juneau	18		18	17		11	1	12	11	
Yakutat		1	1	1		3	1	4	4	
Unidentified	1	5	6	6						
Total Southeast	88	15	103	81	1.27	41	6	47	44	1.07
Prince William Sound	16	5	21	21		20	13	33	32	
Cook Inlet	20	2	22	21		47	6	53	47	
Kodiak	18	5	23	22		27	11	38	27	
Chignik	2		2	2		7	1	8	8	
S. Peninsula	7	3	10	8		9	3	12	8	
Unidentified		1	1	1						
Total Central	63	16	79	67	1.18	110	34	144	105	1.37
Aleutians	2	2	4	4		7	15	22	14	
N. Peninsula	1	2	3	3		2		2	2	
Bristol Bay	29	10	39	36		24	6	30	28	
Unidentified		3	3	3						
Total Western	32	17	49	46	1.07	33	21	54	39	1.38
Kuskokwim	1		1	1		11	3	14	14	
Yukon	12		12	10		28	2	30	29	
Norton Sound						2		2	2	
Arctic						1		1	1	
Total AYK	13		13	11	1.118	42	5	47	45	1.04

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1] 1956 to 1958.

[2] 1973 to 1975.

Western Alaska experienced a net decline in companies from 46 to 39, but gained a net of five producing establishments. This resulted in an increase in the number of multiplant companies. Within this vast region, the Aleutians gained 18 plants (13 of which are floaters) and ten companies. Bristol Bay, on the other hand, lost nine plants and eight companies.

The Arctic-Yukon-Kuskokwin (AYK) region has enjoyed significant growth since statehood. This region has gained 34 plants and 34 companies, causing multiplant companies to decrease slightly in relative importance. Both the Yukon and Kuskokwim districts are characterized by small plants and companies.

As might be expected, the distribution of production facilities has followed the geographic distribution of harvestable surpluses in important stocks (see Table 6). In particular, Southeastern Alaska (with the exception of Yakutat) and Bristol Bay have lost production facilities, presumably due to the decline in salmon stocks. Central Alaska and the Aleutians have grown rapidly as a result of exploitation of previously underutilized or unutilized shellfish stocks.

Another relevant aspect of geographic distribution refers to the degree to which companies specialize geographically and whether this tendency is changing. As shown in Table 7, geographic specialization is increasing, both in terms of number of companies producing in multiple regions (general areas) and multiple communities (specific areas). The shift in effort to, and the location of surplus shellfish stocks in Central and Western Alaska may explain the increased geographic specialization, as these regions are larger and more remote.

Tables 8 and 9 show the size distribution of plants and companies respectively by region and by period. Surprisingly, Southeast Alaska was the only region gaining plants in the largest size categories though it lost plants overall. Small plants and companies gained in Central and AYK and declined in number in Western Alaska.

Aggregate Concentration

Aggregate concentration refers to the size distribution of all seafood production among companies (or plants), without regard to species or process form categories. The economic implications of high aggregate concentration are uncertain. First, high aggregate concentration in the economy or major sectors thereof does not necessarily imply high concentration in individual industries (for example, canned shrimp, crab sections, etc.). Second, high aggregate concentration tends to be associated with firms that are large in relation to the individual markets in which they operate; that is it tends to be associated with dominant firms (Gort 1962). The latter, in turn, are often associated with "price-leadership" pricing behavior by firms in oligopolistically structured industries. Third, high aggregate concentration is positively associated with large firm size and diversification, both of which can be sources of market power (Gort 1962; Orth 1970; Scherer 1970). Fourth, there is evidence suggesting that large firms tend to be more progressive than smaller firms, making them more dynamic competitors (Scherer 1970).

TABLE 6

HARVEST OF FINFISH AND SHELLFISH BY REGION
(In Pounds)

Year	Southeast Finfish	Southeast Shellfish	Central Finfish	Central Shellfish	Western Finfish	Western Shellfish
1956[1]						
1957[1]						
1958	203,080,267	8,162,231	112,755,451	12,658,688	40,573,110	...
1973	83,912,653	6,564,383	88,120,326	205,035,501	14,411,069	53,330,491
1974	82,349,821	6,597,059	70,922,075	191,149,919	17,324,798	73,932,112
1975	53,736,206	5,700,428	90,082,954	165,271,442	32,030,913	75,532,011
1976	73,188,742	6,291,926	151,257,574	202,041,511	57,712,104	108,716,699

Year	Bristol Bay[3] Finfish	Bristol Bay[3] Shellfish	AYK Finfish	AYK Shellfish	Tota Finfish	Tota Shellfish
1956[1]					410,432,000	14,286,000
1957[1]					349,427,000	16,009,000
1958					356,408,828	20,820,919
1973	11,676,416[2]	...	9,670,068[2]	...	196,114,116	264,930,375
1974	14,540,168[2]	...	16,366,275[2]	...	186,962,969	271,679,090
1975	29,629,462[2]	...	15,321,119[2]	...	191,171,192	246,503,881
1976	48,447,741[2]	...	11,302,373[2]	...	293,460,793	317,050,136

Source: Alaska Department of Fish and Game Statistical Leaflets.

[1]Region breakdown not available.

[2]Figures available for salmon only.

[3]Included in Western.

TABLE 7

COMPANY FREQUENCY DISTRIBUTION
BY NUMBER OF GENERAL REGIONS AND SPECIFIC AREAS
BY PERIOD

Number of General Regions[1]	Number of Companies		
	Period 1[2]	Period 2[3]	Change
1	150	190	40
2	17	14	-3
3	7	5	-2
Number of Specific Areas[4]			
1	140	184	44
2	19	13	-6
3	7	6	-1
4	5	4	-1
5	3	0	-3
6	0	1	1
7	0	1	1

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Regions are Southeastérn, Central, Western, and Arctic-Yukon-Kuskokwim (AYK).

[2]1956 to 1958.

[3]1973 to 1975.

[4]Specific areas are communities or landing ports within regions (see Table 5 for specific area detail).

NOTE: Sample interpretation: 150 companies in Period 1, and 190 in Period 2 operated in only one general area; 17 companies in Period 1, and 14 in Period 2 operated in two general areas, etc.

TABLE 8

PLANT SIZE DISTRIBUTION BY REGION AND PERIOD

	Southeast			Central		
Quantity Produced[1]	Period 1[2]	Period 2[3]	Change	Period 1	Period 2	Change
1 - 50,000	18	12	-6	23	49	26
50,001 - 150,000	16	6	-10	9	26	17
150,001 - 350,000	12	3	-9	8	15	7
350,001 - 750,000	11	7	-4	7	15	8
750,001 - 1,550,000	12	3	-9	8	10	2
1,550,001 - 3,150,000	14	7	-7	15	15	0
3,150,001 - 6,350,000	17	6	-11	8	10	2
6,350,001 - 12,750,000	0	2	2	1	1	0
> 12,750,000	0	1	1	0	0	0

	Western			AYK		
Quantity Produced[1]	Period 1	Period 2	Change	Period 1	Period 2	Change
1 - 50,000	22	13	-9	8	26	18
50,001 - 150,000	6	9	3	3	6	3
150,001 - 350,000	3	3	0	2	2	0
350,001 - 750,000	6	9	3	0	8	8
750,001 - 1,550,000	4	10	6	0	5	5
1,550,001 - 3,150,000	4	9	5	0	0	0
3,150,001 - 6,350,000	4	1	-3	0	0	0
6,350,001 - 12,750,000	0	0	0	0	0	0
> 12,750,000	0	0	0	0	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Pounds of finished product-weight equivalents.

[2]1956 to 1958.

[3]1973 to 1975.

TABLE 9

COMPANY SIZE DISTRIBUTION BY REGION AND PERIOD

Quantity Produced[1]	Southeast Period 1[2]	Southeast Period 2[3]	Southeast Change	Central Period 1	Central Period 2	Central Change
1 - 50,000	13	11	-2	22	47	25
50,001 - 150,000	9	6	-3	8	19	11
150,001 - 350,000	12	3	-9	6	12	6
350,001 - 750,000	9	7	-2	6	3	-3
750,001 - 1,550,000	10	2	-8	4	6	2
1,550,001 - 3,150,000	9	7	-2	11	6	-5
3,150,001 - 6,350,000	15	5	-10	8	7	-1
6,350,001 - 12,750,000	3	2	-1	2	5	3
> 12,750,000	0	1	1	0	0	0

Quantity Produced[1]	Western Period 1	Western Period 2	Western Change	AYK Period 1	AYK Period 2	AYK Change
1 - 50,000	22	11	-11	7	24	17
50,001 - 150,000	6	6	0	2	7	5
150,001 - 350,000	3	2	-1	2	2	0
350,001 - 750,000	6	4	-2	0	6	6
750,001 - 1,550,000	3	4	1	0	6	6
1,550,001 - 3,150,000	2	8	6	0	0	0
3,150,001 - 6,350,000	3	4	1	0	0	0
6,350,001 - 12,750,000	1	0	-1	0	0	0
> 12,750,000	0	0	0	0	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Pounds of finished product-weight equivalents.

[2]1956 to 1958.

[3]1973 to 1975.

The applicability of these generalizations to the Alaska seafood processing sector is not necessarily straight-forward. For this reason, and because a thorough analysis of these issues is beyond the scope of this study, this report will be devoted to a presentation of the factual material gathered. The latter is of interest because it describes the organization of plants and companies within the sector and how organization has changed since statehood.

During Period 1 (1956 to 1958) there were 227 plants and 174 companies reporting some production. Of these companies, 145 operated only one plant, 17 companies operated two plants, six companies had three plants, three had four plants, and one each had five, six, and seven plants. As shown in Table 10, the number of one-plant companies in Period 2 was 179. Period 2 is otherwise quite comparable to Period 1 except that there are two companies having 10 and 11 plants respectively. The mean number of plants in Period 1 was 1.305 and in Period 2 it was 1.349.

Table 11 shows the size distribution of plants and companies for Period 1 and Period 2. In Period 1, 28.6 percent of plants produced less than 50,000 pounds of product (meat weight equivalents) and 50.7 percent produced less than 350,000 pounds. In period 2, 35.5 percent and 57.1 percent of plants produced less than 50,000 and 350,000 pounds respectively. In Period 1, 28.2 percent of plants produced more than 1.5 million pounds and only 18.4 percent of plants produced more than this amount in Period 2. The middle range, from 350,000 pounds to 1.5 million pounds held 21.1 percent of plants in Period 1 and 24.5 percent in Period 2. The average production of plants was approximately 1.2 million pounds in Period 1 and 0.9 million pounds in Period 2.

The distribution of companies by production is similar to that for plants. This is not surprising given that 83 percent of companies in Period 1 and 86 percent in Period 2 were single-plant companies. In Period 1, 32.8 percent of companies produced less than 50,000 pounds and 52.4 percent produced less than 350,000 pounds. In Period 2, these were 41.1 percent and 65.1 percent respectively. There were 25.3 percent of all companies producing more than 1.5 million pounds in Period 1 and 18.2 percent in Period 2. In Period 1, 21.3 percent of the companies produced between 350,000 pounds and 1.5 million pounds and 16.7 percent fell in this range in Period 2. The average production of companies was approximately 1.5 and 1.2 million pounds in Periods 1 and 2, respectively.

In addition to the number and percent of plants and companies in each size category, it is useful to know the cumulative control over production accounted for by plants and companies of different sizes. That is, in addition to knowing the number of companies in a size category, one should also know the percent of total production controlled by those companies. This information is obtained from Tables 12 and 13 and Figures 4 and 5.

Roughly one-half of all plants produced 97 percent of total production in Period 1 and 98 percent in Period 2. In Period 1, 113 of 227 plants produced only three percent of total output, and in Period 2 this fell to two percent for 141 of 282 plants. The level of aggregate company concentration

TABLE 10

NUMBER OF ALASKA SEAFOOD PLANTS OPERATED BY COMPANIES BY PERIOD

Number of Plants	Number of Companies: Period 1[1]	Period 2[2]	Change
1	145	179	+34
2	17	16	-1
3	6	5	-1
4	3	2	-1
5	1	3	+2
6	1	2	+1
7	1	0	-1
8	0	0	0
9	0	0	0
10	0	1	+1
11	0	1	+1
Total	174	209	+35
Mean	1.305	1.349	-

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]1956 to 1958.

[2]1973 to 1975.

TABLE 11

SIZE DISTRIBUTION OF ALASKA SEAFOOD PLANTS AND COMPANIES BY PERIOD

	PLANTS					COMPANIES				
	Period 1[1]		Period 2[2]			Period 1		Period 2		
Production[3]	Number	Cum %	Number	Cum %	Change	Number	Cum %	Number	Cum %	Change
1 - 50,000	65	28.6	100	35.5	+35	57	32.8	86	41.1	+29
50,001 - 150,000	30	39.6	42	50.4	+12	20	44.3	35	57.9	+15
150,001 - 350,000	20	50.7	19	57.1	- 1	16	52.4	15	65.1	- 1
350,001 - 750,000	20	59.5	39	70.9	+19	18	63.8	20	71.6	+ 2
750,001 - 1,550,000	28	71.8	30	81.6	+ 2	19	74.7	15	81.8	- 4
1,550,001 - 3,150,000	34	86.8	31	92.6	- 3	15	83.3	16	89.5	+ 1
3,150,001 - 6,350,000	29	99.6	17	98.6	-12	22	96.0	12	95.2	-10
6,350,001 - 12,550,000	1	100.0	3	96.6	+ 2	3	97.7	7	98.6	+ 4
12,550,001 - 25,550,000	0	100.0	1	100.1	+ 1	4	100.0	2	99.5	- 2
25,550,001 - 51,150,000	0	100.0	0	100.1	0	0	100.0	2	99.5	- 1
Total	227		282		+55	174		209		+35
Average Production	1,161,375		857,663			1,515,127		1,157,230		

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]1956 to 1958.

[2]1973 to 1975.

[3]Pounds of meat-weight equivalents.

TABLE 12

DISTRIBUTION OF PRODUCTION OF ALASKA SEAFOOD PROCESSING PLANTS
BY PERCENT CATEGORY AND PERIOD

Percent of Largest Plants	Percent of Total Production			Number of Plants	
	Period 1[1]	Period 2[2]	Change	Period 1	Period 2
5	23	36	+13	11	14
10	41	54	+13	22	28
15	56	67	+11	34	42
20	67	77	+10	45	56
25	75	83	+8	56	70
30	83	88	+5	68	84
35	88	92	+4	79	98
40	92	94	+2	90	112
45	95	97	+2	102	126
50	97	98	+1	113	141
55	98	99	+1	124	155
60	99	99[3]	0	136	169
65	99[3]	99[3]	0	147	183
70	100[3]	100[3]	0	158	197
75	100[3]	100[3]	0	170	211
80	100[3]	100[3]	0	181	225
85	100[3]	100[3]	0	192	239
90	100[3]	100[3]	0	204	253
95	100[3]	100[3]	0	215	267
100	100	100	0	227	282

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]1956 to 1958.

[2]1973 to 1975.

[3]Rounded.

TABLE 13

DISTRIBUTION OF PRODUCTION OF ALASKA SEAFOOD PROCESSING COMPANIES
BY PERCENT CATEGORY AND PERIOD

Percent of Largest Companies	Percent of Total Production			Number of Companies	
	Period 1[1]	Period 2[2]	Change	Period 1	Period 2
5	38	49	+11	8	10
10	55	68	+13	17	20
15	69	80	+11	26	31
20	78	87	+9	34	41
25	85	92	+7	43	52
30	90	95	+5	52	62
35	93	97	+4	60	73
40	96	98	+2	69	83
45	97	99	+2	78	94
50	98	99[3]	+1	87	104
55	99	99[3]	0	95	114
60	99[3]	100[3]	+1	104	125
65	100[3]	100[3]	0	113	135
70	100[3]	100[3]	0	121	146
75	100[3]	100[3]	0	130	156
80	100[3]	100[3]	0	139	167
85	100[3]	100[3]	0	147	177
90	100[3]	100[3]	0	156	188
95	100[3]	100[3]	0	165	198
100	100	100	0	174	209

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]1956 to 1958.

[2]1973 to 1975.

[3]Rounded.

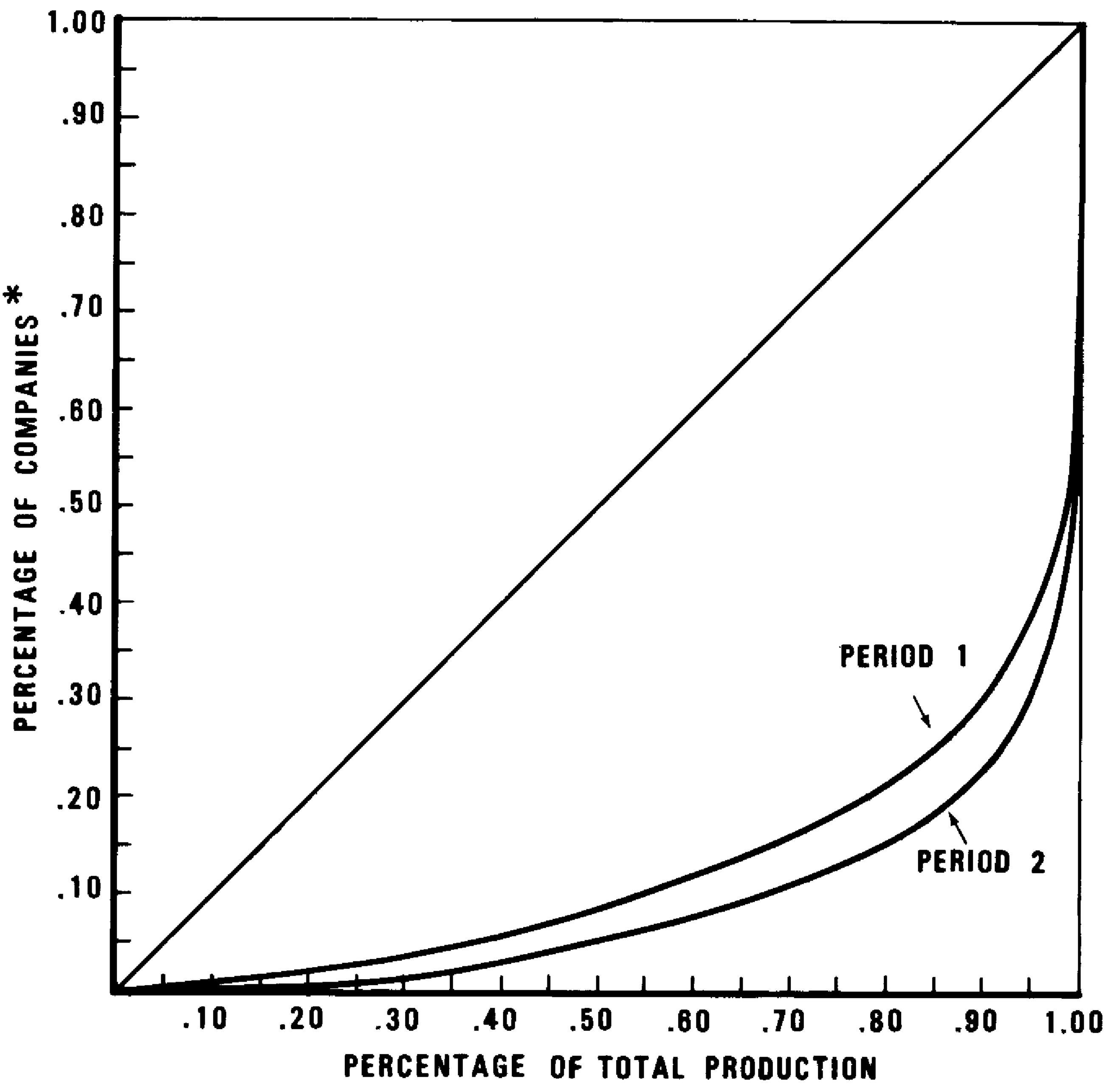

FIGURE 4. LORENZ CURVES FOR ALASKA SEAFOOD PROCESSING PLANTS

*Cumulative from the largest plants

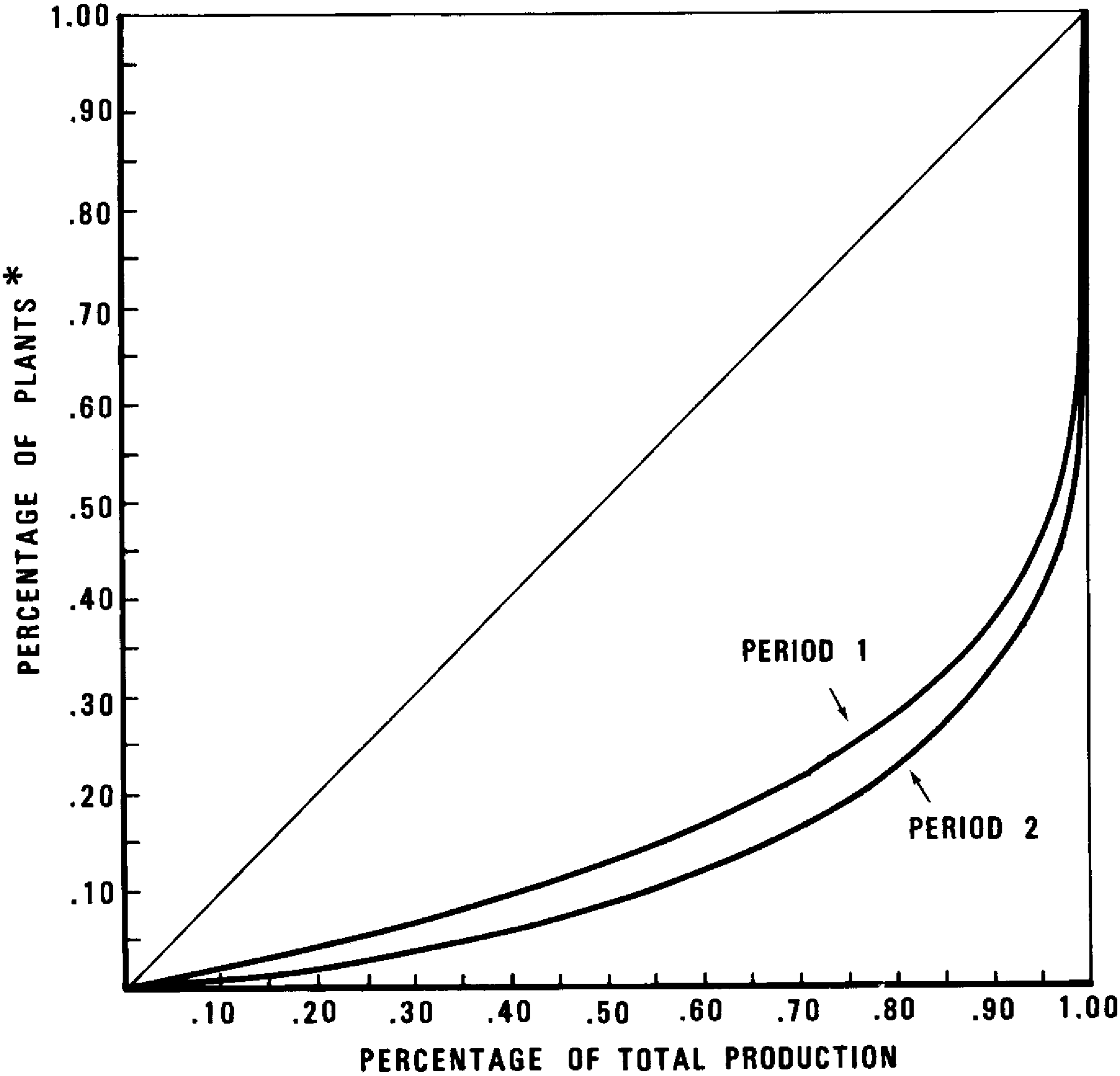

FIGURE 5. LORENZ CURVES FOR ALASKA SEAFOOD PROCESSING COMPANIES

*Cumulative from the largest companies

is even higher due to the significance of multiplant companies. There were 29 such companies in Period 1 and 30 in Period 2. The top half of companies (87 out of 174) had 98 percent of total seafood production in Period 1 and 99 percent (104 out of 209) in Period 2. The largest ten percent (17 and 20 companies, respectively) in Period 1 had 55 percent of total product and 68 percent in Period 2. The top 25 companies controlled two-thirds and three-fourths of total production in Period 1 and Period 2 respectively (Table 14). Thus, not only is overall concentration in the Alaska seafood processing sector high, it has increased significantly since statehood.

Diversification

Another structural characteristic of an industry is the degree to which the plants and companies are diversified. Diversification refers to the production of products by a plant or firm which are sold in more than one industry. In principle, being diversified can be thought of as the state of having multiple product lines. In practice, the distinction among product lines (their differences and similarities) is often difficult to determine objectively. This is partially due to the fact that the degree of difference is often dependent upon the intended application of a product to a particular end use.[2] These complications require decision rules when attempts are made to specify (quantify) the degree of diversification of plants and companies.

For seafood processing plants and companies, the obvious methods for measuring the degree of diversification are to count the number of species processed, the number of processing methods (canning, curing, freezing, fresh), or the number of product forms (whole, fillets and steaks, sections, claws, etc.). None of these, of course, are faultless methods. The most appealing criterion from a technological standpoint is the number of processing methods. However, its use would result in understatement of diversification in that a particular method (for example, freezing) can apply to many species (for example, salmon, crab, shrimp) and product forms (for example, whole, fillets, sections) that are not close substitutes.

Tables 15 through 17 show diversification of Alaska seafood processing plants and companies by each of the three measures employed. They are consistent in showing that diversification of both plants and companies has increased since statehood and that, in general, plants are nearly as diversified as companies. This suggests that, in general, company diversification is achieved via plant diversity rather than the acquisition by multiplant companies of specialized plants producing in different specialized markets. In addition, since among the more diversified plants the number of plants is greater than the number of diversified companies, one can infer that the more diversified plants are owned by multiplant companies. For the single species (or process or product) category, the number of plants also exceeds the number of companies. The inference here is that not only do many single-plant companies specialize, but a number of multiplant companies hold specialized plants as well, and that their plant holdings overall are targeted toward specific species.

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[2]For example, consumers might view canned crab meat from dungeness, tanner, and king crab species as close substitutes for crab salads but they might have a distinct species preference for crab cocktail.

TABLE 14

AGGREGATE CONCENTRATION IN THE ALASKA SEAFOOD PROCESSING SECTOR BY PLANTS AND COMPANIES AND BY PERIOD

	Concentration Ratios[1]					
	Plants			Companies		
The Top	Period 1[2]	Period 2[3]	Change	Period 1	Period 2	Change
10	.21	.29	+.08	.43	.49	+.06
25	.45	.50	+.05	.67	.74	+.07
50	.71	.73	+.02	.89	.91	+.02
100	.95	.92	+.03	.99	.99	0
200	1.00[4]	1.00[4]	0	1.00	1.00[4]	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Each concentration ratio is the production (in meat-weight equivalents) of a given number of top firms over the total production in the Alaska seafood processing sector; when multiplied by 100 it is the percent control of total production by these firms.

[2]1956 to 1958.

[3]1973 to 1975.

[4]Rounded; 174 companies and 227 plants in Period 1, and 209 companies and 282 plants in Period 2.

TABLE 15

DIVERSIFICATION OF ALASKA SEAFOOD PROCESSING PLANTS AND COMPANIES AS MEASURED BY THE NUMBER OF SPECIES HANDLED AND BY PERIOD

Number of Species Handled[1]	Plants			Companies		
	Period 1[2]	Period 2[3]	Change	Period 1	Period 2	Change
1	181	199	+18	131	142	+11
2	31	39	+ 8	30	38	- 2
3	13	22	+ 9	11	16	+ 5
4	0	15	+15	1	14	+13
5	1	7	+ 6	1	9	+ 8
Average	1.270	1.553		1.339	1.660	

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Species are salmon, crab, shrimp, halibut, and herring.

[2]1965 to 1958.

[3]1973 to 1975.

TABLE 16

DIVERSIFICATION OF ALASKA SEAFOOD PROCESSING PLANTS AND COMPANIES AS MEASURED BY THE NUMBER OF PROCESSES AND BY PERIOD

Number of Processes[1]	Plants			Companies		
	Period 1[2]	Period 2[3]	Change	Period 1	Period 2	Change
1	164	151	-13	116	108	-08
2	52	73	+21	45	52	+07
3	9	51	+42	9	39	+30
4	0	7	+07	2	8	+06
5	2	0	-02	2	2	0
Average	1.344	1.695		1.443	1.775	

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Processes are fresh, frozen, canned, smoked in can, smoked, mild cure, salted, and reduction.

[2]1956 to 1958.

[3]1973 to 1975.

TABLE 17

DIVERSIFICATION OF ALASKA SEAFOOD PROCESSING PLANTS AND COMPANIES AS MEASURED BY THE NUMBER OF PRODUCTS AND BY PERIOD

Number of Products[1]	Plants			Companies		
	Period 1[2]	Period 2[3]	Change	Period 1	Period 2	Change
1	170	113	-57	120	87	-33
2	50	98	+48	44	73	+29
3	2	36	+34	5	22	+17
4	4	23	+19	4	11	+ 7
5	0	5	+ 5	0	4	+ 4
6	0	4	+ 4	0	8	+ 8
7	1	2	+ 1	1	1	0
8	0	0	0	0	1	+ 1
9	0	0	0	0	1	+ 1
10	0	0	0	0	1	+ 1
Average	1.317	2.064		1.414	2.129	

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Products are whole/dressed, cheeks/fletches, sections (crab) or tails (shrimp), meats (crab or salmon in can), bait, roe (eggs), bait roe, roe (herring) on kelp, oil, meal, fillets/steaks/strips, crab claws.

[2]1956 to 1958.

[3]1973 to 1975.

The apparent trend toward increasing diversity since statehood can probably be explained by four factors. First, there would appear to be a natural desire by plant owners to increase plant utilization through expansion into areas that are counter-seasonal to their primary product (or species or process). Second, as traditionally-utilized, high-value resources are depleted, there is economic pressure to expand sales by entering other production activities. Third, technological change and changing marketing conditions have encouraged companies to expand into new areas. Fourth, foreign investment has stimulated diversity by providing capital for expansion and assured markets.

Turnover

One way to judge the long-run implications of economic concentration in a sector of the economy (or more narrowly defined individual industry) is to attempt to identify the degree to which companies are entrenched in dominant positions through time. A high degree of turnover of companies within a sector or industry suggests that entrenchment is not an important structural characteristic.

Turnover is defined as the disappearance from a sector or industry altogether or from the top echelon of firms in the sector or industry. Conducting a test for the presence or absence of turnover is a method of assessing whether the competitive environment is dynamic or whether it has settled into a static condition characterized by entrenched positions for the dominant firms.

For this study, company turnover was evaluated both in terms of survivorability and change in market share.[3] The screening of the data for identifying company turnover is complicated by the inability to follow identity in those cases where a company has changed its name between Period 1 and Period 2. To the extent that this has occurred, the turnover measures will overstate actual turnover to an undetermined degree. In those cases where a firm is dissolved or acquired by another company, it disappears as an ownership entity and is properly treated in the turnover analysis.

Of the 152 companies for which production in Period 1 was greater than production in Period 2, 139 had no production in Period 2. Similarly, of the 196 companies having greater production in Period 2 than Period 1, 174 had no production in Period 1. There remain, therefore, 35 companies which produced in both periods. Table 18 shows the change in production from Period 1 to Period 2 for these 35 companies. The majority of companies producing in both periods grew in absolute size, but 13 declined. The size distribution of these 35 companies in both periods is shown in Table 19.

Table 20 shows by rank category the number of companies with zero production in the opposite period. Of the top five companies in Period 1, three were not in existence in Period 2; of those ranked 6 to 15, seven did not

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[3]Market share is defined here as the share of total production of the entire Alaska seafood processing sector.

TABLE 18

DISTRIBUTION OF COMPANIES PRODUCING IN BOTH PERIODS
GROUPED BY THE SIZE OF THE INCREASE OR DECREASE IN PRODUCTION

Change in Production from Period 1[1] to Period 2[2]	Number of Plants	
Increase	22	
Over 100 percent		13
50-100 percent		4
25-50 percent		4
0-25 percent		1
Decrease	13	
0-25 percent		6
25-50 percent		3
50-100 percent		4
Total	35	

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]1956 to 1958.

[2]1973 to 1975.

TABLE 19

SIZE DISTRIBUTION OF COMPANIES PRODUCING
IN BOTH PERIODS

Quantity Produced[1]	Number of Companies		
	Period 1[2]	Period 2[3]	Change
1 - 50,000	8	6	-2
50,001 - 150,000	5	2	-3
150,001 - 350,000	2	2	0
350,001 - 750,000	3	2	-1
750,001 - 1,550,000	3	4	+1
1,550,001 - 3,150,000	6	7	+1
3,150,001 - 6,350,000	5	8	+3
6,350,001 - 12,750,000	1	3	+2
> 12,750,000	2	1	-1

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Pounds of meat weight equivalents.

[2]1956 to 1958.

[3]1973 to 1975.

TABLE 20

OPPOSITE PERIOD PRODUCTION BY MARKET SHARE RANK CATEGORY

Company Rank Period 1[1]	Number of Companies with Zero Production in Period 2[2]	Company Rank Period 2	Number of Companies with Zero Production in Period 1
1-5	3	1-5	4
6-15	7	6-15	4
16-35	16	16-35	9
36-75	29	36-75	33
76-155	68	76-155	73
156-315	16	156-315	51

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]1956 to 1958.

[2]1973 to 1975.

[3]Total number of companies in Period 1 is 174.

[4]Total number of companies in Period 2 is 209.

produce in Period 2. Four of the top five companies in Period 2 did not exist in Period 1; those ranked 6 to 15 in Period 2 contained four which did not produce in Period 1. Cumulatively, the very largest firms in Period 1 (ten of the top 15) did not survive to Period 2 and eight of the top 15 in Period 2 did not exist in Period 1.

To summarize, turnover among Alaska seafood processing firms has been quite high since statehood. Of the 174 companies operating in Period 1 and 209 in Period 2, only 35 operated in both periods under the same company identity. Of the industry leaders in Period 1, a significant number did not operate in Period 2 (three of top five and ten of top 15). Similarly, of those holding dominant positions in Period 2, a majority (four out of five and eight of top 15) did not produce in Period 1.

Due to the inability to consistently trace individual company identities over the 20 years covered by this analysis, the data base was taken at face value with respect to the identity of reporting plants and companies. This loss of detail means that the measures of turnover employed are undoubtedly biased upward. The overall impression of high turnover is probably sound nonetheless, with the exception of a very few firms that have been able to maintain high-ranking positions in both periods. Only three companies were ranked among the top 15 companies in both periods. The next largest ten companies were represented on the list of the top 20 firms in both periods and each of these was within the largest ten in both periods.

Vertical Integration

No direct inferences concerning the extent of vertical integration were possible from the secondary data resources available to this study. Questions concerning vertical integration were included in an industry survey sent to roughly the largest 50 firms in 1976. Of these firms, 19 completed or partially completed the survey form. An additional 11 said they desired to respond but had not done so by August 1, 1978, at which time the survey had to be closed.[4] Survey results, compiled to avoid disclosure of individual-firm information, are presented in Appendix III.

Two characteristics of the respondents can be mentioned. First, several of the largest firms cooperated with the survey (including the largest firm). Second, the firms with the most extensive apparent ownership interties with other seafood processors refused to cooperate with the survey.

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[4]It was unfortunate that the survey was mailed to processors at the beginning of their busy season, but this was unavoidable since the researchers experienced extensive delays in efforts to work with industry executives toward a meaningful and mutually acceptable survey format. In addition, a considerable amount of confusion was created when the same research team set out to collect processing capacity and marketing data (for use by the North Pacific Fishery Management Council) coincident with initial negotiations over the survey effort for this study.

Backward Vertical Integration. Backward integration by a company refers to the development of a capability to provide its own sources of supply, either through acquisition or construction. In the seafood processing industry, we are interested in the ownership by processing firms of vessels or the use of other techniques (for example, providing supplies or credit) to assure supplies of raw fish. Of the 19 survey respondents, nine indicated that they did own vessels; Table 21 shows the number of vessels owned by each of these respondents and the species fished by these vessels.

Thirteen respondents felt that, in general, the practice of vessel ownership had increased over the last ten years; only one believed that this practice had decreased. Four respondents felt that decreases had occurred in the salmon fisheries; two felt that it had increased in crab.

The practice of advancing money, gear, or supplies is common and may be a tacit form of backward integration. Sixteen respondents indicated that they did make advances and nine indicated an interest charge. Most respondents believed this practice has not changed over the past decade, while five believed it had decreased; only three felt that it had increased.

For those companies who responded to this survey, vertical integration is an important, but not universal, form of organizational practice. This practice appears to be declining in importance, particularly in the salmon fishery where the imposition of limited entry has created greater economic independence among fishermen. It is uncertain how representative these survey results are of the vertical integration practices of the industry as a whole.

Forward Vertical Integration. This form of integration exists when companies acquire capability in the distribution chain of the goods they produce. Four of the 19 respondents did own an interest in brokerage, wholesale or retail seafood businesses. Only one respondent believed this practice of ownership of distributors has decreased, four that it has increased, five that it had not changed, and six did not respond. The three remaining responses consisted of narrative to the effect that nearly all large processors have in-house brokerage or sales departments (apparently as opposed to holding an interest in a separate company) and that this structural feature is increasingly evident.

Other Company-Specific Information

This section will briefly cover topics which are presented in detail in Appendix III: Industry Survey Form and Responses. These topics are: company financial characteristics, transportation of raw and processed products, domestic sales practices and trends, international business arrangements, and entry and exit decisions of companies.

Company Financial Characteristics (Re: Appendix III; I, 1-5 and II). All respondents indicated a high degree of specialization in the seafood business. Fourteen of the 18 companies who responded to this question had 100 percent of their sales in fish products, three others had between 75 and 100 percent, and one between 50 and 75 percent. This specialization in seafood contrasts with the high level and increasing extent of diversification within the seafood business as shown in an earlier section of this chapter. Five of the

TABLE 21

EXTENT OF VESSEL OWNERSHIP BY "YES" RESPONDENTS

Company Designator	Number of Vessels Owned	Species Fished
1	2	Crab
2	2	Salmon
3	3	Crab
4	3	Salmon
5	5	Crab, Shrimp
6	5	Crab[1]
7	10	Salmon
8	40	Crab, Salmon[2]
9	90	Salmon[3]

Source: Company survey.

[1]Company "6" also owned 15 salmon vessels in Washington.

[2]Company "8" also owned 30 salmon and crab vessels in Washington and 6 shrimp and scallop vessels in remainder of U.S.

[3]Company "9" reduced vessels to approximately 30 in 1977.

respondent companies indicated that they owned plants in other states, but Alaska is the primary production area for 17 of those responding. Of the 17 firms indicating their asset and sales size range, 12 had assets (less merchandise inventory) of greater than $1 million, eight greater than $5 million, and five greater than $10 million; and 16 indicated sales in excess of $1 million, eight had sales in excess of $5 million, and seven had sales of more than $10 million. From this information, it would appear that seafood processors generally have sales-to-asset ratios greater than one. Eight of the 14 companies providing information on their debt-equity structure showed equity-to-assets in excess of 50 percent, and seven of these in excess of 75 percent. Four were highly leveraged at ratios of less than 25 percent, two had ratios between 25 and 80 percent. It is uncertain whether the five nonrespondents were also highly leveraged, as might be assumed. Thirteen of the respondents are private, closely-held corporations, only one is publicly traded, one is a partnership and four are wholly owned subsidiaries of other companies. Five of 19 companies indicated some ownership by other seafood processing companies, and five companies indicated that they owned from 50 to 100 percent in another seafood processor.

Transportation (Re: Appendix III; IV, 1a - 1c). The most common method for transporting raw fish to processors is direct delivery by fishing vessels. This is true for all species except salmon when company-owned or chartered tenders are the most frequently reported method. Tendering is also a close second in herring and is used occasionally for halibut. There was no reported use of tendering in the shellfish fisheries. It is tempting to conclude that aside from depressed stock conditions and the accompanying regulatory constraints (for example, time and area closures) direct delivery is the more efficient method of transporting raw fish. Such judgments cannot be made, of course, independent of technology and product forms desired by the market (for example, frozen versus canned salmon).

For shipment of processed fishery products, the most popular methods vary by process form as would be expected. The shipment of fresh products is accomplished by air freight, although some moves south on private or commercial vessels. Air freight is also used to a minor extent for the transport of frozen products. The most popular method for frozen products is by commercial vessels, although buyer-owned or processor-owned vessels are used to some extent. Canned products are universally shipped by respondents by surface carriers, and all reported the use of commercial carriers rather than private (buyer or processor) vessels. No differences exist, at least among sample respondents, in the transportation of finfish and shellfish products. Given the past and present structure of transportation rates, process form appears to be the sole determinant of transport method. Several respondents reported an increasing shortage of commercial surface capacity in face of expanding needs. Processors also appear to be encountering difficulty in their attempts to charter, lease, or purchase freighting capacity.

Domestic Sales Practices and Trends (Re: Appendix III; V, 1 - 5; VIII, 1a - 1c). Processors, as judged by survey responses, sell most of their products through brokers, some through wholesalers, and very little through retailers. The payment terms used most commonly for canned and fresh/frozen product are normal terms (two percent per ten days, net per 30 days).[5] Consignment is used (somewhat more in fresh/frozen than canned) to a much lesser extent, as is delayed billing. Prepayment appears to be used occasionally, although this was only reported by one respondent for the fresh or frozen process form.

Six of the 19 respondents reported the practice of custom processing for other firms; production advances were reported to not be a part of these transactions. Canned salmon, and to a lesser extent frozen salmon, are the target product and species for this production arrangement.

It appears that the receipt of sales advances by processors from distribution firms is uncommon, but that when it does occur, interest charges are the exception. Sales advances or other incentives are most common with canned salmon, groundfish fillets, and shrimp. This fact supports the presumption that the existence of such incentives would be indicative of a seller's market. Eight of 19 respondents indicated that they used incentive to attract buyers. These include, in descending order of importance, discounts from list price, advertising assistance, and coupons. Thirteen of 19 companies support cooperative product promotion through industry associations. Some companies belong to as many as five associations, although one or two association memberships are more common. For the 15 companies engaging in product promotion, the advertising-to-sales ratio ranged from less than 0.1 percent (three companies) to 2.4 percent (one company). Seven of the 15 indicated less than one percent, two companies reported two percent, while three did not respond.

International Business Arrangements (Re: Appendix III; VI, 1 - 5). Japanese ownership in the Alaska seafood processing industry is reported in another recent research report (Gorham and Orth 1978), and for this reason, questions concerning it were omitted from this survey. No companies reported ownership by companies from countries other than Japan, but one company reported that it had an ownership interest in seafood processing companies in Canada, West Germany, and Japan. Production and sales advances from foreign buyers were reported by five of 17 respondents and four of these indicated that interest is charged thereon. All respondents receiving such advances report that they are a small percentage of total liabilities (less than ten percent). Long-term purchasing contracts were reported by three of 18 respondents. According to the survey, processors do not make advances to foreign buyers.

Entry and Exit (Re: Appendix III; VII, 1a - 1c). Eleven of 19 respondents indicated that they planned to enter other fisheries, all of which are in Alaska, except one which also has expansion plans in Washington. The target species for entry are salmon, groundfish, herring, and mollusks, and the target areas are Bering Sea and Gulf of Alaska. Recent entry has occurred mostly in crab, shrimp, and herring. Salmon, halibut, scallops, and groundfish have had some entrants. Herring has had three companies exit; salmon and groundfish have each had one. The most common methods of entry are the

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[5]If the bill is paid within ten days there is a two percent discount given. At 30 days, the full amount is due.

purchase of existing plant and equipment and the addition of a new product line. The purchase of subsidiaries is another method which has been utilized, though to a lesser extent than the other methods. Exit occurs most frequently by the discontinuance of a product line (as opposed to the sale of a subsidiary or plant).

Structural Parameters of Individual Seafood Markets: Shellfish

Two topics will be addressed in this section. First, individual markets will be examined with respect to the number and size distribution of producers. This structural characteristic is most commonly referred to as market or industry concentration. Second, the site distribution of plants within markets is examined in both periods to determine whether the range of optimum scale can be identified and whether plant-size characteristics have changed over time.

Market Concentration

This section will present summary information on the level and trend in concentration for individual seafood markets (defined by species and process form), and detailed information for shellfish markets. The summary information will be presented first.

Market Concentration Summary. Table 22 shows summary data for all species included in this study and by process form for salmon and crab. These industries, when viewed from their selling or final market side, are for the most part only moderately concentrated. Given that Alaskan producers compete with those from other states except for king crab and tanner crab, this assessment of concentration overstates actual concentration to some degree. Within Alaska, statewide concentration has declined since statehood except for herring and canned salmon.

When these same industries are viewed from the buying or raw-product-acquisition side, however, market concentration ranges from moderate to very high. In halibut, herring, and crab meats, buyer concentration is especially high. Geographically, buyer concentration has increased or remained unchanged in all species in Southeast Alaska. In Central Alaska, buyer concentration has declined or remained unchanged in every market except canned salmon. In both Southeast and Central the level of concentration ranges from moderate to very high. In Western Alaska, buyer concentration fell or remained the same in all markets, although it was at a high to very high level in the 1973 to 1975 period. The Arctic-Yukon-Kuskokwim area, which has only a salmon industry, has experienced high but declining buyer concentration.

Overall, concentration is shown to be inversely related to the size of the market, which for these high-valued species is dependent upon stock status. Growth fisheries tend to have high concentration in their incipiency but the level tends to decline as expansion occurs. On the other hand, contracting fisheries experience increasing concentration as consolidation occurs and as plants are abandoned or shut down. From the harvester's point of view, buyer concentration is a local, rather than regional, phenomenon and is usually very high. On the selling side, concentration appears not to be a significant factor except perhaps for canned salmon.

TABLE 22

SUMMARY OF LEVEL AND TRENDS IN MARKET CONCENTRATION

	Final Product Market		Resource Markets							
			Southeast		Central		Western		AYK	
Species	Current[2]	Change[3]	Current[2]	Change[3]	Current[2]	Change[3]	Current[2]	Change[3]	Current[2]	Change[3]
Finfish										
Halibut	H	↑	H	↑	VH	n.c.				
Herring	H	n.c.	VH	n.c.	H	↓	VH	n.a.		
Salmon	M	n.c.	M	n.c.	M	n.c.	M	↓	M	↓
Canned	M	n.c.	H	↑	H	↑	H	↓	VH	n.c.
Frozen	L	↓	M	n.c.	H	n.c.	H	n.c.	H	↓
Shellfish										
Shrimp	M	↓	VH	n.c.	M	↓	VH	n.a.		
Crab	M	↓	H	n.c.	M	↓	H	↓		
Frozen Shell	M	↓	VH	n.c.	M	↓	VH	n.c.		
Frozen Meat	H	↓	H	n.c.	VH	n.c.	H	↓		
Canned Meat	VH	↓	VH	↑	VH	n.c.				

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]As measured by the following ranges of the four-firm concentration ratio: <.30 = Low (L); .30-.50 = Moderate (M); .50-.75 = High (H); .75-1.00 = Very High (VH); n.c. - No Change; n.a. = No basis for comparison to earlier period due to lack of production.

[2]Current refers to Period 2 (1973 to 1975).

[3]Change is from Period 1 (1956 to 1958) to Period 2 (1973 to 1975).

No adjustment for ownership interties has been made in these data; therefore, conclusions about actual concentration must be tempered accordingly. The effect of not adjusting concentration measures for ownership ties is, of course, to cause understatement of both buyer and seller concentration. Likewise, in discussing buyer (processor) concentration, no explicit consideration has been given to the fact that fishermen's bargaining cooperatives exert countervailing power against processors.

Market Concentration in Detailed Crab Markets. There are 16 potential "relevant markets" in crab if species detail is not considered but geographic detail (at the regional level) and process-form detail are. These market cells are described in Table 23 by the number of firms, number of plants, total production concentration ratios at the two, four, and eight firm levels, and the Herfindal Index for Period 1 and Period 2.[6] The same market cells (by geographic region and process form) are shown in Tables 24 to 26 at the individual species level of detail.

When viewing processors as sellers of final product, geographic area of production within Alaska is not especially relevant to the definition of relevant markets but process form differences may be. For this reason, statewide total market cells in Table 23 for all products, fresh/frozen shell, fresh/frozen meat, and canned meats constitute the most probable relevant markets. For species detail within these, the reader should use Tables 24 to 26. Total market concentration for crab (Table 23, statewide, all products) as measured by the four-firm concentration ratio has declined since statehood from high (.71) to moderate (.44); for fresh/frozen shell products it declined from very high (.88) to moderate (.36); for frozen meats it has declined from very high (.84) to high (.59), and for canned meats it has increased slightly from the high (.71) to very high (.80) category. The number of firms, number of plants and total production has increased in each of these markets except for canned meat, where the number of firms and plants has declined. King crab (Table 24) has experienced a similar pattern of change with firm and plant expansion occurring since statehood and concentration declining. Again, the only exception to this pattern is canned king crab meat. Tanner crab production existed in Period 1 in the Central region only. In Period 2, it existed in all geographic regions. Concentration is high (.54) for all products, moderate (.39) for fresh/frozen shell stock, very high for fresh/frozen meat (.80) and canned meat (.85). Dungeness crab has become a more important product due to the growth of the in-shell category. Statewide concentration has declined for all products from .59 to .37 and for fresh/frozen shell stock from .99 to .43, but it has increased for fresh/frozen and canned meat. In the latter categories the number of firms and plants have declined.

When viewing processors as buyers of raw crab, the regional, total-all-products, cells in Tables 23 through 26 are more pertinent to the definition of relevant markets than are the statewide and detailed-product cells. It could be argued, in fact, that buyer concentration should be examined for

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[6]A four-firm concentration ratio measures the control over total market-cell production by the largest four firms operating in that market. The Herfindal Index is a comprehensive concentration measure in that it includes the relative size of <u>all</u> firms in the industry. It is the sum of the squares of all individual-firm market shares.

TABLE 23

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR TOTAL CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES

Period 1 (1956 to 1958)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	28	32	3,982,100	.592	.713	.824	.292
Southeast	11	12	516,100	.340	.643	.903	.127
Central	16	18	2,766,200	.670	.845	.965	.357
Western	3	3	699,800	.900	1.000	1.000	.557
Fresh/Frozen Shell							
Statewide	15	16	732,900	.778	.882	.981	.446
Southeast	4	4	52,000	.968	1.000	1.000	.790
Central	9	10	637,600	.894	.965	.999	.582
Western	*	*					
Fresh/Frozen Meat							
Statewide	17	20	2,188,600	.771	.837	.935	.547
Southeast	6	6	280,900	.507	.864	1.000	.207
Central	10	12	1,371,100	.864	.929	.999	.660
Western	3	3	536,600	.968	1.000	1.000	.875
Canned Meat							
Statewide	17	18	1,060,700	.456	.707	.896	.149
Southeast	9	10	183,200	.442	.705	.973	.170
Central	6	6	757,600	.638	.990	1.000	.267
Western	*	*					

Period 2 (1973 to 1975)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	60	88	43,304,000	.266	.439	.601	.065
Southeast	15	16	1,417,400	.435	.674	.952	.157
Central	41	59	24,773,500	.349	.480	.658	.087
Western	13	19	17,113,100	.408	.632	.911	.133
Fresh/Frozen Shell							
Statewide	54	81	20,799,500	.205	.355	.561	.052
Southeast	12	12	832,700	.606	.915	.996	.257
Central	39	56	13,880,000	.239	.414	.614	.064
Western	12	18	6,086,800	.473	.751	.969	.164
Fresh/Frozen Meat							
Statewide	33	49	20,510,100	.350	.585	.819	.108
Southeast	6	6	559,300	.569	.889	1.000	.227
Central	21	30	8,924,400	.648	.755	.879	.222
Western	11	15	11,026,300	.415	.679	.964	.146
Canned Meat							
Statewide	9	11	1,994,500	.465	.795	1.000[2]	.179
Southeast	*	*					
Central	7	8	1,969,000	.471	.806	1.000	.184
Western	...	...					

Source: Compiled from data provided by the Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

*Fewer than three firms.

[2]At three significant digits, this ratio rounded to 1.

TABLE 24

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR KING CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES

	Period 1 (1956 to 1958)							Period 2 (1973 to 1975)						
	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products														
Statewide	15	17	3,417,600	.689	.831	.952	.393	48	72	26,948,300	.249	.430	.649	.067
Southeast	...	...						7	7	229,000	.626	.890	1.000	.240
Central	13	15	2,717,800	.682	.860	.893	.370	37	52	10,836,000	.227	.378	.614	.064
Western	3	3	699,800	.900	1.000	1.000	.557	13	19	15,883,300	.375	.605	.906	.125
Fresh/Frozen Shell														
Statewide	9	10	679,400	.839	.926	.999	.515	43	67	12,754,200	.237	.383	.603	.063
Southeast	...	...						4	4	79,700	.829	1.000	1.000	.475
Central	7	8	636,200	.896	.967	1.000	.584	36	50	7,521,100	.242	.412	.663	.068
Western	*	*						12	18	5,153,500	.445	.717	.969	.154
Fresh/Frozen Meat														
Statewide	10	12	1,868,300	.903	.950	.994	.745	32	42	13,320,300	.329	.568	.864	.108
Southeast	...	...						6	6	149,300	.723	.934	1.000	.311
Central	8	10	1,331,700	.890	.956	1.000	.698	19	23	2,441,100	.472	.632	.838	.185
Western	3	3	536,600	.968	1.000	1.000	.875	11	15	10,729,800	.399	.670	.963	.143
Canned Meat														
Statewide	6	6	869,900	.556	.862	1.000	.213	4	4	873,800	.742	1.000	1.000	.398
Southeast	...	...						...	...					
Central	4	4	749,900	.645	1.000	1.000	.273	4	4	873,800	.742	1.000	1.000	.398
Western	*	*						...	...					

Source: Compiled from data provided by the Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

*Fewer than three firms.

TABLE 25

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR TANNER CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES

	Period 1 (1956 to 1958)							Period 2 (1973 to 1975)						
	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products														
Statewide	*	*						44	63	14,850,600	.422	.537	.727	.115
Southeast	...	...						9	9	749,800	.591	.830	.999	.250
Central	*	*						31	45	12,881,700	.476	.608	.801	.143
Western	...	...						6	9	1,219,100	.840	.973	1.000	.366
Fresh/Frozen Shell														
Statewide	*	*						40	57	6,751,700	.232	.390	.605	.061
Southeast	...	...						6	6	507,600	.759	.997	1.000	.357
Central	*	*						30	43	5,321,400	.294	.470	.692	.080
Western	...	...						6	8	922,600	.794	.965	1.000	.351
Fresh/Frozen Meat														
Statewide	...	...						21	32	7,003,700	.691	.804	.940	.264
Southeast	...	...						5	5	242,200	.709	.932	1.000	.308
Central	...	...						13	20	6,465,000	.748	.865	.981	.306
Western	...	...						5	7	296,500	.983	.998	1.000	.598
Canned Meat														
Statewide	...	...						7	8	1,095,300	.532	.849	1.000	.215
Southeast	...	...						...	...					
Central	...	...						7	8	1,095,300	.532	.849	1.000	.215
Western	...	...						...	...					

Source: Compiled from data provided by the Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

*Fewer than three firms.

TABLE 26

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR DUNGENESS CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES

Period 1 (1956 to 1958)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	14	16	564,200	.311	.588	.893	.118
Southeast	11	12	516,100	.340	.643	.903	.127
Central	4	4	48,100	.909	1.000	1.000	.642
Western	...	...					
Fresh/Frozen Shell							
Statewide	6	6	53,100	.948	.990	1.000	.759
Southeast	4	4	52,000	.968	1.000	1.000	.790
Central	*	*					
Western	...	...					
Fresh/Frozen Meat							
Statewide	7	8	320,300	.455	.829	1.000	.194
Southeast	6	6	280,900	.507	.864	1.000	.207
Central	*	*					
Western	...	...					
Canned Meat							
Statewide	11	12	190,800	.424	.677	.934	.157
Southeast	9	10	183,200	.442	.705	.973	.170
Central	*	*					
Western	...	...					

Period 2 (1973 to 1975)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	42	53	1,550,100	.212	.372	.604	.059
Southeast	15	16	438,600	.489	.679	.904	.155
Central	26	35	1,055,900	.302	.505	.771	.094
Western	*	*					
Fresh/Frozen Shell							
Statewide	39	49	1,293,600	.246	.425	.664	.071
Southeast	12	12	245,400	.628	.805	.990	.246
Central	26	35	1,037,600	.307	.513	.785	.096
Western	*	*					
Fresh/Frozen Meat							
Statewide	5	5	186,100	.738	.997	1.000	.387
Southeast	3	3	167,800	.818	1.000	1.000	.465
Central	*	*					
Western	...	...					
Canned Meat							
Statewide	*	*					
Southeast	*	*					
Central	...	...					
Western	...	...					

Source: Compiled from data provided by the Alaska Department of Fish and Game.

[1] Individual items may not add to totals due to rounding.

*Fewer than three firms.

even more detailed geographic breakdowns than provided in Tables 23 through 26. Such a breakdown is provided in Table 27 for all crab without species detail. As a generalization, the narrower the definition of the relevant geographic market, the fewer the competing buyers and the more highly concentrated that market. The narrower definitions shown in Table 27 are made available for only two specific areas, Prince William Sound and Bristol Bay, for illustrative purposes only. The calculation of structure descriptors for detailed market cells is very costly, given their large number, and is frequently not productive in that there are often less than three sellers in a specific market, in which case cell data must be left blank (in such instances, of course, it is apparent that market concentration is very high). Prince William Sound and Bristol Bay were chosen to illustrate narrow relevant markets for the measurement of buyer concentration, primarily because these are two areas within Alaska where such concentration is frequently alleged by harvesters (especially of salmon) to be a problem. As shown in Table 27, crab production in Prince William Sound is highly concentrated at the two- and four-firm levels. There has been some decline, especially at the two-firm level, since statehood.

Market Concentration in Detailed Shrimp Markets. Shrimp products reported by Alaskan processors can be categorized as fresh/frozen in shell, fresh/frozen meat, and canned meat. As shown in Table 28, in Period 1 all of these markets, restricted geographically to Southeast Alaska, were highly concentrated. However, Alaskan producers compete in a much larger geographic market so that this assessment of final market concentration is clearly overstated. By Period 2, concentration among Alaska producers had declined in all product market areas except fresh/frozen in the shell, and it remained very high in canned meat. Substantial increases occurred in the number of firms and plants except in Southeast, which experienced a 50 percent decline and a five-fold drop in total production.

Viewed from the buying side, where the relevant geographic market must usually be narrowly defined, shrimp market concentration is quite high. In Southeast Alaska, for all shrimp products, the four-firm concentration ratio increased from .89 to 1.00; in Central Alaska there were fewer than three firms in Period 1, and 31 firms (32 plants) in Period 2, by which time concentration was only moderate; Western Alaska had no producers of shrimp in Period 1, but had gained five by Period 2, with four-firm concentration ratio of .95. An even finer geographic picture is provided by Table 29. As can be seen, Bristol Bay had no production of shrimp in either period. Prince William Sound went from fewer than three firms to four in Period 2. This sample look at specific area concentration is not especially revealing because the sample areas are not major production areas. Kodiak, Alaska Peninsula, and Cook Inlet are the major production areas for shrimp followed by Southeast Alaska, Dutch Harbor and Prince William Sound. The latter, however, has increased in importance as a shrimp production area since Period 2. The 1976 catch was 465 percent of 1975, and 1977 catch (174,200 pounds) was 129 percent of the 1975 level.

Plant Size Characteristics

To this point, the size distribution of plants has been examined only in terms of total production; that is, without regard to location, species, or

TABLE 27

PRINCE WILLIAM SOUND AND BRISTOL BAY MARKET CONCENTRATION FOR CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES
PERIOD 1 (1956 to 1958)

	Number of Firms	Number of Plants	Total[1] Production	Conc. ratio of 2 largest Firms	Conc. ratio of 4 largest Firms	Conc. ratio of 8 largest Firms	Herfindal Index
Total All Products							
Prince William Sound	4	4	48,100	.908	1.000	1.000	.641
Bristol Bay	--	--					
Fresh/Frozen - Shell							
Prince William Sound	*	*					
Bristol Bay	--	--					
Fresh/Frozen - Meat							
Prince William Sound	3	3	39,400	.999	1.000	1.000	.926
Bristol Bay	--	--					
Canned Meat							
Prince William Sound	*	*					
Bristol Bay	--	--					
			Period 2 (1973 to 1975)				
Total All Products							
Prince William Sound	7	7	2,513,400	.580	.911	1.000	.243
Bristol Bay	--	--					
Fresh/Frozen - Shell							
Prince William Sound	7	7	1,297,300	.562	.913	1.000	.227
Bristol Bay	--	--					
Fresh/Frozen - Meat							
Prince William Sound	3	3	810,200	.987	1.000	1.000	.489
Bristol Bay	--	--					
Canned Meat							
Prince William Sound	3	3	406,000	.819	1.000	1.000	.369
Bristol Bay	--	--					

Source: Compiled from data provided by the Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

*Fewer than three firms.

TABLE 28

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR SHRIMP PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES

Period 1 (1956 to 1958)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	10	11	1,541,800	.622	.882	.947	.264
Southeast	8	8	1,529,900	.627	.889	.954	.268
Central	*	*					
Western	...	...					
Fresh/Frozen Shell							
Statewide	7	8	36,900	.635	.903	.960	.245
Southeast	5	5	25,100	.722	.947	1.000	.314
Central	*	*					
Western	...	...					
Fresh/Frozen Meat							
Statewide	7	7	1,117,500	.645	.887	.944	.284
Southeast	7	7	1,117,500	.645	.887	.944	.284
Central	...	...					
Western	...	...					
Canned Meat							
Statewide	5	5	387,400	.961	.998	1.000	.473
Southeast	5	5	387,400	.961	.998	1.000	.473
Central	...	...					
Western	...	...					

Period 2 (1973 to 1975)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	37	40	22,226,800	.197	.376	.464	.071
Southeast	4	4	348,400	.985	1.000	1.000	.488
Central	31	32	19,833,900	.218	.413	.502	.079
Western	5	5	2,044,500	.712	.954	1.000	.295
Fresh/Frozen Shell							
Statewide	21	22	1,015,100	.900	.948	.963	.754
Southeast	3	3	6,400	.793	1.000	1.000	.365
Central	18	19	1,008,700	.906	.954	.969	.764
Western	...	...					
Fresh/Frozen Meat							
Statewide	22	24	13,918,200	.289	.512	.588	.092
Southeast	*	*					
Central	18	18	11,531,700	.336	.542	.635	.105
Western	5	5	2,044,500	.712	.954	1.000	.295
Canned Meat							
Statewide	6	6	7,293,600	.560	.847	.938	.215
Southeast	...	...					
Central	6	6	7,293,600	.560	.847	.938	.215
Western	...	...					

Source: Compiled from data provided by the Alaska Department of Fish and Game.

[1] Individual items may not add to totals due to rounding.

*Fewer than three firms.

TABLE 29

PRINCE WILLIAM SOUND AND BRISTOL BAY MARKET CONCENTRATION FOR SHRIMP PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES

PERIOD 1 (1956 TO 1958)

	Number of Firms	Number of Plants	Total[1] Production	Conc. ratio of 2 largest Firms	Conc. ratio of 4 largest Firms	Conc. ratio of 8 largest Firms	Herfindal Index
Total All Products							
Prince William Sound	*	*					
Bristol Bay	--	--					
Fresh/Frozen - Shell							
Prince William Sound							
Bristol Bay	--	--					
PERIOD 2 (1973 to 1975)							
Total All Products							
Prince William Sound	4	4	7,300	.909	1.000	1.000	.673
Bristol Bay	--	--					
Fresh/Frozen - Shell							
Prince William Sound	4	4	7,300	.909	1.000	1,000	.673
Bristol Bay	--	--					

Source: Compiled from data provided by the Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

*Fewer than three firms.

process form. This section seeks to determine whether plant size differs by species and process form and whether, within these groups, there has been significant change over the period of this study. The reader will note that because of the high degree of plant diversity, crab and shrimp have not been broken out for separate treatment in this section.

Tables 30 and 31 show the frequency distributions of plants by size categories for each species. Table 30 shows this information by the production of the primary species amounts only, whereas Table 31 contains a distribution based on the total production of a plant where plants are grouped by their primary species. While there appear to be no systematic size tendencies (several species appear to have bimodal distributions), the "Dif" (difference) column may be suggestive of trends in plant size; where significant increases or decreases in the number of plants within a size category suggest underlying biological, technological, or market forces that lead managers to adjust to another size of plant. Large plant sizes are less frequent in Period 2 in salmon and halibut. No clear patterns are evident in the other species except that medium-sized plants are more common. Table 32 shows mean plant size by region and species. Salmon and halibut plants declined in size except in the Arctic-Yukon-Kuskokwim area. Shrimp plant size declined in Southeast. These data suggest that plant sizes, as measured by production data, are primarily a function of biological stock conditions, rather than technology.

The data on process forms shown in Tables 33 and 34 are consistent with this conclusion. No discernible central tendency exists in the size distribution of plant production grouped by process form. Plants whose primary process was canning fell in nearly all size categories, but large plants, those producing between 1.5 and 6.4 million pounds annually (meat weight equivalents) lost the greatest number of plants. This is probably owing to the decline in salmon stocks and the gradual shift to an increase in the proportion of salmon processed in the frozen form. Regional data shown in Table 35 reveal the same pattern.

Summary

It is believed that the descriptive information on seafood processing industry structure contained in this chapter will have many useful applications. The potential for misapplication is also apparent; this could result from the use of structural information out of context of the biological, technological, and regulatory environment surrounding each industry. For this reason, this research report includes detailed treatment of basic industry conditions for each seafood industry studied. This information for shellfish is contained in Chapters II, III, and IV of this report.

Basic industry conditions, especially biological and regulatory, appear to be the primary sources of concentration in the Alaska seafood processing industries. With the exception of significant barriers to entry caused by over-exploited stocks and consequent over-capitalization of harvesting and processing (in salmon and halibut), barriers to entry and exit appear to be low. One would expect, therefore, that concentrations of production would tend to be unstable in expanding fisheries. This, in fact, has been

TABLE 30

SIZE DISTRIBUTION OF PLANTS BY SPECIES CATEGORY AND BY PERIOD
BASED ON PRIMARY SPECIES AMOUNTS

Quantity Produced[1]	Number of Plants														
	Salmon			Halibut			Herring			Crab			Shrimp		
	Period			Period			Period			Period			Period		
	1[2]	2[3]	Dif.	1	2	Dif.	1	2	Dif.	1	2	Dif.	1	2	Dif.
1 - 50,000	56	64	8	1	3	2	2	17	15	13	12	- 1	4	10	6
50,001 - 150,000	25	21	- 4	0	0	0	1	14	13	10	11	1	1	2	1
150,001 - 350,000	18	10	- 8	1	1	0	1	8	7	4	8	4	4	3	- 1
350,001 - 750,000	15	14	- 1	2	0	- 2	0	2	2	2	20	18	1	2	1
750,001 - 1,550,000	15	15	0	6	1	- 5	2	4	2	1	11	10		6	6
1,550,001 - 3,150,000	30	12	-18	4	0	- 4	0	3	3	0	3	3		5	5
3,150,001 - 6,350,000	13	2	-11	1	0	- 1	7	3	- 4	0	1	1	0	0	0
6,350,001 - 12,750,000	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
> 12,750,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Pounds of meat-weight equivalents.

[2]1956 to 1958.

[3]1973 to 1975.

TABLE 31

SIZE DISTRIBUTION OF PLANTS BY SPECIES CATEGORY AND BY PERIOD BASED ON TOTAL AMOUNTS

Quantity Produced[1]	Number of Plants														
	Salmon			Halibut			Herring			Crab			Shrimp		
	Period			Period			Period			Period			Period		
	1[2]	2[3]	Dif.	1	2	Dif.	1	2	Dif.	1	2	Dif.	1	2	Dif.
1 - 50,000	56	64	8	0	3	3	2	16	14	9	9	0	4	8	4
50,001 - 150,000	23	21	- 2	1	0	- 1	1	10	9	8	12	4	1	4	3
150,001 - 350,000	19	9	-10	0	0	0	1	6	5	3	7	4	2	1	- 1
350,001 - 750,000	14	15	1	3	1	- 2	0	3	3	5	16	11	2	4	2
750,001 - 1,550,000	17	14	- 3	3	0	- 3	2	1	- 1	2	9	7	0	4	4
1,550,001 - 3,150,000	28	12	-16	4	1	- 3	0	6	6	1	8	7	0	4	4
3,150,001 - 6,350,000	15	3	-12	4	0	- 4	7	6	- 1	2	5	3	1	3	2
6,350,001 - 12,750,000	0	0	0	0	0	0	1	3	2	0	0	0	0	0	0
> 12,750,000	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Pounds of meat-weight equivalents.

[2]1956 to 1958.

[3]1973 to 1975.

TABLE 32

NUMBER AND AVERAGE SIZE OF PLANTS BY REGION AND SPECIES

	Salmon	Halibut	Herring	Crab	Shrimp
		Number of Plants by Primary Species			
Period 1[3]					
Southeast	61	13	9	9	8
Central	52	2	5	18	2
Western	46	0	0	3	0
AYK	13	0	0	0	0
Period 2[4]					
Southeast	24	1	10	9	3
Central	40	4	36	39	22
Western	27	0	6	18	3
AYK	47	0	0	0	0
Change					
Southeast	-37	-12	1	0	-5
Central	-12	2	31	21	20
Western	-19	0	6	15	3
AYK	34	0	0	0	0
		Average Plant Size by Primary Species[1]			
Period 1[3]					
Southeast	1,144,700	1,398,982	2,088,520	43,775	207,817
Central	954,989	934,915	4,296,677	153,679	12,580
Western	794,501			233,273	
AYK	71,493				
Period 2[4]					
Southeast	830,953	791,255	2,147,503	100,218	39,049
Central	339,643	64,381	266,835	483,477	756,419
Western	609,375		321,542	874,494	419,397
AYK	237,860				
Change					
Southeast	-313,747	-607,727	58,983	56,443	-290,003
Central	-615,346	-870,534	-4,029,842	329,798	743,839
Western	-185,126		321,542	641,221	419,397
AYK	166,367				
		Average Plant Size by Primary Species[2]			
Period 1[3]					
Southeast	2,241,936	2,462,292	2,151,066	60,107	635,036
Central	954,989	1,037,349	4,296,677	977,008	12,580
Western	794,501			233,273	
AYK	71,493				
Period 2[4]					
Southeast	951,933	1,725,110	4,605,811	445,780	41,230
Central	339,801	149,326	915,717	1,019,605	1,296,173
Western	609,375		1,021,755	921,040	419,397
AYK	37,860				
Change					
Southeast	-290,003	-737,182	2,454,745	385,673	-593,806
Central	-615,188	-888,023	-3,380,960	42,597	1,283,593
Western	-185,126		1,021,755	687,767	419,397
AYK	166,367				

Source: Compiled from data provided by Alaska Department of Fish and Game.
[1]Based on primary species amounts only (pounds of meat-weight equivalents).
[2]Based on total amounts produced (pounds of meat-weight equivalents).
[3]1956 to 1958.
[4]1973 to 1975.

TABLE 33

SIZE DISTRIBUTION OF PLANTS BY PROCESS FORM AND BY PERIOD
BASED ON PRIMARY PROCESS AMOUNTS

Quantity Produced[1]	Number of Plants											
	Fresh/Frozen			Canned			Cured			Reduction		
	Period 1[2]	Period 2[3]	Dif.	Period 1	Period 2	Dif.	Period 1	Period 2	Dif.	Period 1	Period 2	Dif.
1 - 50,000	16	40	24	19	13	- 6	35	33	- 2	1	1	0
50,001 - 150,000	14	32	18	10	0	-10	11	0	-11	0	1	1
150,001 - 350,000	13	18	5	9	0	- 9	5	2	- 3	0	0	0
350,001 - 750,000	11	34	23	7	7	0	3	0	- 3	1	1	0
750,001 - 1,550,000	5	19	14	12	7	- 5	0	0	0	1	1	0
1,550,001 - 3,150,000	3	16	13	31	21	-10	0	0	0	0	0	0
3,150,001 - 6,350,000	0	5	5	13	2	-11	0	0	0	7	0	- 7
6,350,001 - 12,750,000	0	1	1	0	0	0	0	0	0	1	0	- 1
> 12,750,000	0	0	0	0	0	0	0	0	0	0	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Pounds of meat-weight equivalents.

[2]1956 to 1958.

[3]1973 to 1975.

TABLE 34

SIZE DISTRIBUTION OF PLANTS BY PROCESS FORM AND BY PERIOD BASED ON TOTAL AMOUNTS PRODUCED

Quantity Produced[1]	Number of Plants											
	Fresh/Frozen			Canned			Cured			Reduction		
	Period 1[2]	Period 2[3]	Dif.	Period 1	Period 2	Dif.	Period 1	Period 2	Dif.	Period 1	Period 2	Dif.
1 - 50,000	16	39	23	17	13	- 4	32	29	- 3	1	0	- 1
50,001 - 150,000	14	33	19	11	0	-11	2	1	- 1	0	1	1
150,001 - 350,000	13	18	5	10	0	-10	2	2	0	0	0	0
350,001 - 750,000	11	31	20	7	6	1	5	2	- 3	1	0	- 1
750,001 - 1,550,000	5	20	15	12	7	- 5	6	1	- 5	1	0	- 1
1,550,001 - 3,150,000	2	15	13	29	19	-10	2	0	- 2	0	0	0
3,150,001 - 6,350,000	1	8	7	15	5	-10	5	0	- 5	7	2	- 5
6,350,001 - 12,750,000	0	1	1	0	0	0	0	0	0	1	1	0
> 12,750,000	0	0	0	0	0	0	0	0	0	0	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Pounds of meat-weight equivalents.

[2]1956 to 1958.

[3]1973 to 1975.

TABLE 35

NUMBER AND AVERAGE SIZE OF PLANTS BY REGION AND PROCESS FORM

	Fresh/Frozen	Canned	Cured	Reduction
		Number of Plants by Primary Process		
Period 1[3]				
Southeast	25	35	24	5
Central	23	45	3	6
Western	14	16	19	0
AYK	0	5	8	0
Period 2[4]				
Southeast	31	10	0	2
Central	74	23	18	2
Western	33	13	4	0
AYK	27	4	13	0
Change				
Southeast	6	-25	-24	-3
Central	51	-22	15	-4
Western	19	-3	-15	0
AYK	27	-1	5	0
		Average Plant Size by Primary Process[1]		
Period 1[3]				
Southeast	413,758	1,631,568	154,274	3,716,448
Central	226,360	1,347,112	2,785	3,523,049
Western	463,895	1,902,906	11,549	
AYK		130,046	29,634	
Period 2[4]				
Southeast	948,526	833,891		647,782
Central	738,358	1,563,329	14,767	79,512
Western	604,154	1,256,197	17,024	
AYK	288,812	291,491	21,846	
Change				
Southeast	534,768	-797,677	-154,274	-3,068,666
Central	511,998	216,217	11,982	-3,443,537
Western	140,259	-646,709	5,475	
AYK	288,812	161,445	-7,788	
		Average Plant Size by Primary Process[2]		
Period 1[3]				
Southeast	511,815	1,675,110	1,588,922	3,716,448
Central	226,360	1,413,424	2,785	3,525,028
Western	463,895	1,908,307	11,549	
AYK		138,469	29,634	
Period 2[4]				
Southeast	1,054,801	1,000,867		6,536,685
Central	846,344	1,822,359	45,638	1,652,108
Western	604,732	1,325,591	173,390	
AYK	304,848	322,653	85,572	
Change				
Southeast	542,986	-674,243	-1,588,922	2,820,237
Central	619,984	408,935	42,853	-1,872,920
Western	140,837	-582,716	161,841	
AYK	304,848	184,184	55,938	

Source: Compiled from data provided by Alaska Department of Fish and Game.
[1]Based on primary process amounts only (pounds of meat-weight equivalents).
[2]Based on total amounts produced (pounds of meat-weight equivalents).
[3]1956 to 1958.
[4]1973 to 1975.

the pattern in Alaska's growth industries. On the other hand, local buyer concentration will undoubtedly remain high as it is a function of economies of scale, the geographic distribution of fish stocks and the vast coastal distances. Changes in harvesting and/or tendering technology are the only apparent sources of future instability in local buyer concentration. Improved preservation methods on-board vessels (for example, heading and gutting/freezing or freezing in the round) would increase the range of options of landing ports, causing the relevant geographic market to expand and buyer concentration to decline. The successful expansion of harvesters into processing via cooperatives would change the ownership and earning patterns of processing facilities. This would have little actual impact upon local concentration levels, however, unless the underlying biological and marketing forces were expansionary. The main effect of a harvester-owned processing cooperative, if successful, would be to mitigate the tendency of high buyer concentration to depress ex-vessel prices.

CHAPTER III

THE HISTORY OF THE KING AND TANNER CRAB FISHERIES IN ALASKA

Development of the Alaska King Crab Fishery

The Foreign Fishery

Foreign fishing for king crab in waters off Alaska was limited to the Eastern Bering Sea[1] where Japan and the USSR both participated in the king crab fishery and dominated the catch until 1971. In that year, the U.S. landed the major part of the area harvest for the first time.

The Japanese involvement in the king crab fishery was split into two periods by World War II. The fishery was first initiated by Japan in 1930, and this early development was described in a publication by Herbert Shippen (1964). Briefly, from the initial catch of one million pounds with one mothership operating, the fishery reached a peak quickly in 1933 when just over two million crabs were landed by two mothership operations. From 1933 on, the catch declined steadily to a low of only 250,000 pounds in 1939 when the Japanese temporarily abandoned the fishery due to the impending war (Table 36).

During the war years, only very small amounts of king crab from the Eastern Bering Sea were landed, however, in 1947, U.S. trawlers began fishing the area and landed up to half a million crab annually through 1954 (Shippen 1964). With the development of the pot fishery south of the Alaska Peninsula in the late 1950s and the return of the Japanese to the Eastern Bering Sea in 1953, the U.S. fishing effort and catch declined rapidly through 1954 to 1957. After 1958, the U.S. fishing effort in the Eastern Bering Sea was negligible until 1963 when the U.S. started to venture into the area north of Unimak Island with a pot fishery (Table 37).

After their return to the fishery, the Japanese catch of king crab remained fairly steady between the years of 1953 to 1959 at just over one million crab (converted to pounds in Table 37). During 1959, the USSR entered the Eastern Bering Sea king crab fishery in the same area as the Japanese

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[1]With one exception by the Soviet fleet which will be discussed later.

TABLE 36

JAPANESE EASTERN BERING SEA KING CRAB FISHERY
EARLY PERIOD 1930 TO 1939

Year	Motherships	Catch (Millions of Crabs)
1930	1	1.0
1931	...*	...*
1932	1	1.2
1933	2	2.1
1934	2	1.4
1935	1	0.8
1936	1	0.3
1937	1	0.5
1938	1	0.45
1939	1	0.25

Source: Shippen 1964.

*Fishery did not operate during 1931.

TABLE 37

ESTIMATED ANNUAL RED AND BLUE KING CRAB CATCHES IN THE EASTERN BERING SEA BY UNITED STATES, JAPAN, AND USSR, 1953 TO 1977[1]
(In Thousands of Pounds)

Year	U.S.[2]	Japan[3]	USSR[3]	Total
1953	2,000	11,356	0	13,356
1954	2,329	8,086	0	10,415
1955	1,878	8,693	0	10,571
1956	1,896	8,308	0	10,204
1957	588	8,548	0	9,136
1958	7	8,136	0	8,143
1959	0	9,432	2,170	11,602
1960	598	13,838	10,773	25,209
1961	459	21,823	18,581	40,863
1962	74	35,152	18,114	53,340
1963	747	36,142	20,529	57,418
1964	910	40,676	22,400	63,986
1965	1,762	27,826	13,579	43,167
1966	997	29,918	14,080	44,995
1967	3,102	24,090	8,438	35,630
1968	8,687	24,661	3,020	36,368
1969	10,403	12,231	1,882	24,516
1970	8,559	11,234	1,696	21,489
1971	12,995	4,784	1,404	19,183
1972	21,744	4,721	0	26,465
1973	28,190	1,279	0	29,469
1974	49,374	2,618	0	51,992
1975	52,120	0	0	52,120
1976	69,534	0	0	69,534
1977	77,884	0	0	77,884

Source: National Marine Fisheries Service Laboratory, Kodiak. Unpublished data, 1978.

[1]All estimates were made by multiplying reported catch in numbers times an estimate of average weight.

[2]Weight estimates prior to 1966 are derived from International North Pacific Fisheries Commission (INPFC) statistics; average weights since 1966 are as reported by ADF&G.

[3]Average weights computed from average carapace lengths and pack data given in INPFC annual reports.

fishery, north of the Alaska Peninsula.[2] From 1959, both the Japanese and USSR harvests increased rapidly to the peak catches of 5,895,000 crab in 1964 for Japan and 3,019,000 crab for the USSR. It was reported by the Japanese that there was severe competition between Russian and Japanese fishing fleets on the fishing grounds, and that the shift of Japanese fishing effort to the area east of the Pribilof Islands in 1965 to 1966 was to avoid gear losses due to the conflicts between fishing fleets of the two countries.

The U.S. entered into bilateral agreements with both Japan and the USSR which established quotas of 185,000 cases each for 1965 and 1966 (Table 38). These treaties were renegotiated every two years prior to the expiration of the then existing treaty. As can be seen from the quota amounts in Table 38, the amount of allowable foreign catch was decreased every treaty period (two years). As the foreign catch of king crab decreased, the U.S. catch rose steadily and swiftly as the domestic fishery developed. The catch amounts for the foreign and U.S. fishing fleets are shown by country in Figure 6 for the years 1953 to 1977.

In addition to foreign catch quotas, there were other fishing restrictions also negotiated as part of the bilateral treaties. These restrictions, listed in Table 39, were negotiated by the U.S. Secretary of State on behalf of the U.S. government with representatives from the two countries involved, Japan and the USSR.

The first fishing restriction for the foreign fleets which was implemented in November 1964, ended the use of trawl nets to harvest king crab. After this date, the legal fishing gear allowed consisted of tangle nets or pot fishing gear only. In the same treaty, there were additional restrictions placed on the foreign fishing fleets. A small area north of Unimak Island, which was being fished by domestic fishermen, was restricted to pot gear only. This

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[2]In 1963, two Soviet king crab fleets moved from the Eastern Bering Sea into the Western Gulf of Alaska, southeast of Kodiak Island, and fished for one month. The U.S. protested this intrusion, citing the ratifications of the Convention on the Continental Shelf, adopted at Geneva in 1958. These ratifications included "living organisms belonging to sedentary species, ... organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil," (from United Nations Convention on the Law of the Sea, Annex IV; Geneva, 1958) a description which made king crab (and some other shellfish) part of the exclusive sovereign natural resources of the Continental Shelf of the U.S. The Soviet fleet withdrew to the Bering Sea after catching an estimated 2,200 tons. In 1964, the Soviet fleet again appeared in the Gulf of Alaska and again the U.S. protested this fishing. After three weeks, the Soviet fishing fleet was withdrawn to the Bering Sea. The first of the U.S.-USSR bilateral treaties, signed in November, 1964, limited Soviet king crab fishing to the Eastern Bering Sea and effectively prevented further fishing effort in the Gulf of Alaska.

TABLE 38

FOREIGN QUOTAS FOR KING AND TANNER CRAB IN EASTERN BERING SEA

Treaty Period		Japan King Crab	Japan Tanner Crab	USSR King Crab	USSR Tanner Crab
1965-66		185,000 cases[1]	no quota	185,000 cases	no quota
1967-68		163,000 cases	no quota	100,000 cases	no quota
1969-70		85,000 cases	no quota	52,000 cases	40,000 cases
1971-72		37,500 cases	14,600,000 crab[2]	23,000 cases	35,000 cases
1973-74	Area A	270,000 crab	6,000,000 crab	100,000 crab	1,800,000 crab
	Area B	430,000 crab	8,000,000 crab	160,000 crab	2,400,000 crab
	Total	700,000 crab	14,000,000 crab	260,000 crab	4,200,000 crab
1975-76	Area "A"	0 mt	2,500 mt (2,500,000 crab)	0	750 mt (750,000 crab)
	Area "B"	953 mt (300,000 crab)	7,700 mt (11,000,000 crab)	356 mt (112,000 crab)	2,310 mt (3,300,000 crab)
	Total	953 mt (300,000 crab)	10,200 mt (13,500,000 crab)	356 mt (112,000 crab)	3,060 mt (4,050,000 crab)
1977	Area A		2,500 mt		
	Area B		10,000 mt		
	Total	0 mt	12,500 mt[3]	0	0
1978			15,000 mt[4]	0	0

Sources: INPFC, U.S.-USSR and U.S.-Japan Bilateral Treaties, NPFMC Management Plan for Tanner crab.

[1] One case is equivalent to 48 half-pound cans.

[2] Plus allowance of 10 percent.

[3] Composed of 5,100 Chionoecetes bairdi and 7,400 C. opilio.

[4] C. opilio, catch restricted to north of 58° N. latitude and west of 167° W. longitude.

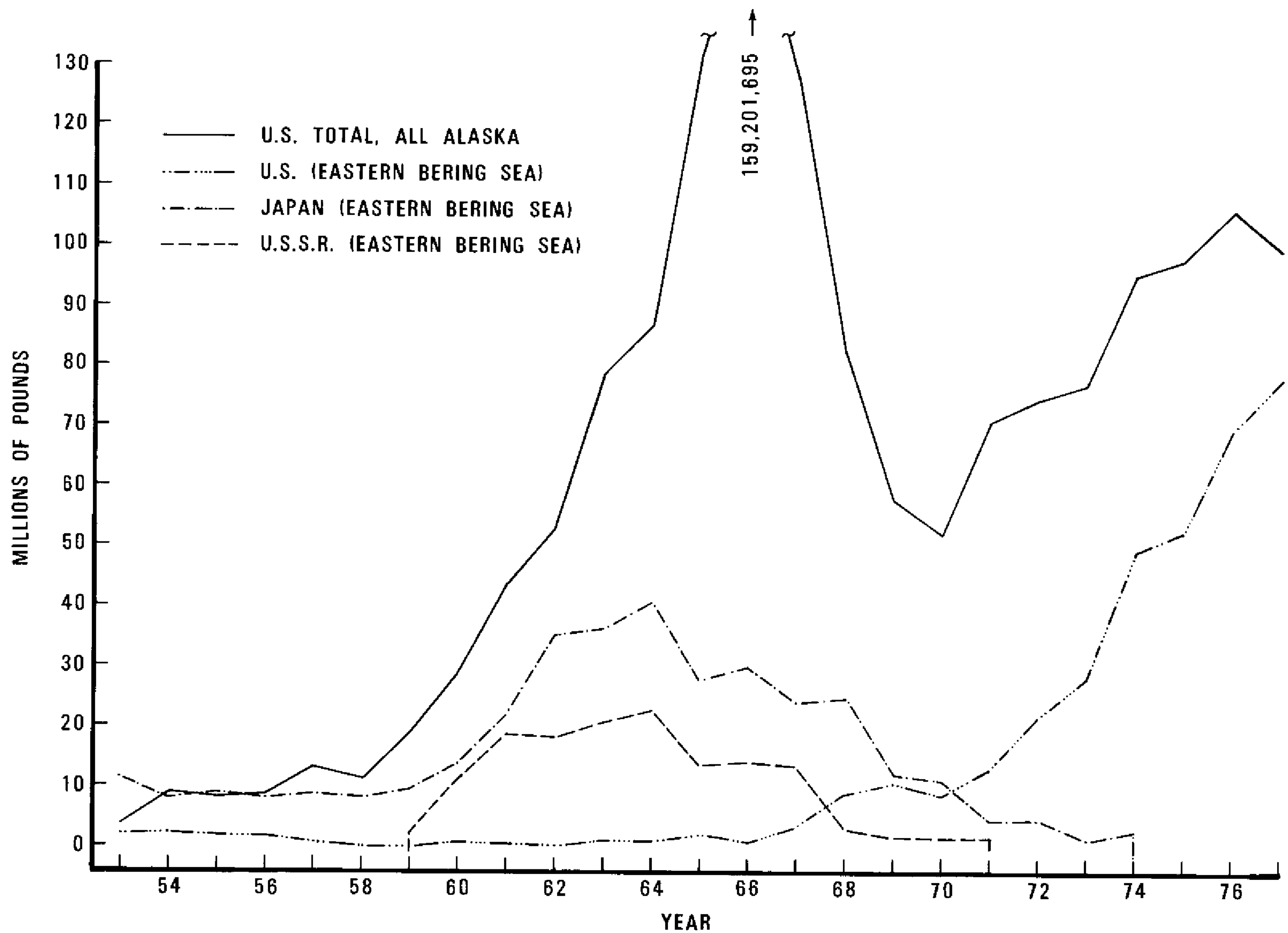

FIGURE 6. KING CRAB CATCH BY FOREIGN AND DOMESTIC FLEETS 1953 TO 1977

TABLE 39

FOREIGN CRAB FISHING RESTRICTIONS FOR JAPAN AND THE USSR

Treaty Period	
Prior to 1964	No restrictions.
1965-66	-tangle nets and pots only -one restricted area north of Unimak Island, pots only -stretched diagonal measure of tangle net shall be no less than 50 cm -females and male king crab with carapace width less than 145 mm must be returned to the ocean
1967-68	-same as above
1969-70	-same as above
1971-72	-minimum size changed to 158 mm
1973-74	-pots only all areas -catch restricted by area
1975-76	-same as above

Source: U.S.-Japan and U.S.-USSR bilateral treaties, 1965 to 1974.

restriction effectively reserved this area for the domestic fishermen as the foreign fleets utilized tangle nets. The size of the tangle net mesh was restricted to be no less than 50 centimeters stretched diagonal measure. A legal minimum size limit of 145 millimeters was instituted, and keeping female king crab of any size was made illegal.

The above changes were included in every treaty negotiated until 1971-72. At that time the minimum size limit for male king crab was changed to 158 millimeters. The final restriction which was imposed was to limit fishing gear to pots only, which was implemented with the 1973-74 treaty. By this time, however, the USSR had dropped out of the fishery and Japan had greatly reduced its catch. Although the Japanese did have an Eastern Bering Sea king crab quota of 953 metric tons for 1975 and 1976, they abandoned the fishery after 1974, apparently because they felt it was not profitable to harvest that amount of crab. There has been no foreign allocation of king crab since 1976.

The U.S. Fishery

The development of the U.S. fleet up through the early 1950s has been described in detail in a well-known book by Browning (1974) and does not require further elaboration. What is important for this study is to examine the pattern of the major developments in the fishery.

The early U.S. trawl fishery in the Bering Sea contributed the majority of the U.S. catch until 1954 (see Table 40), when the landings of king crab from the Kodiak area for the first time surpassed those from the Bering Sea. The Bering Sea fishery continued through 1957, when it all but disappeared for several years. After 1954, however, the Kodiak area took over as the area of major development of the fishery and maintained this lead until approximately 1970 (see Table 41).

The first king crab landings in the Kodiak area were made by purse seiners which fished king crab during the winter using tangle nets or pots, and returning to the salmon fishery during the summer months (Gray, Roys, and Simon 1965). Trawl fishing gear was apparently not used a great deal by this fleet, and it was outlawed from further use by domestic fishermen in 1954. The use of the purse seiners to harvest the crab limited the range of the fishing effort as they were not equipped with live tanks. Because crab are not able to live out of water more than 12 hours, the vessels were forced to deliver their catch daily in order to deliver live crab to the processor as required by law. The annual catch rose steadily through the 1950s in spite of this constraint, and reached over 14 million pounds for the 1959-60 season (Figure 7). During the 1960, 1961, 1962, and 1963 seasons, several purse seiners started to fish king crab year-round and were joined by converted halibut vessels and herring seiners which were equipped with circulating seawater tanks (Gray, Roys, and Simon 1965). These vessels now used only pot gear to fish since the use of tangle nets was outlawed in 1960.

With larger vessels able to fish offshore stocks of crab, the catch climbed rapidly to over 37 million pounds during the 1963-64 season. The fishing vessels were able to deliver all the crab that the processing plants in Kodiak could handle during this period, and occasionally plants were forced to limit the amount that could be unloaded at each delivery (Gray, Roys, and Simon 1965).

TABLE 40

ALASKA CATCH OF KING CRAB BY REGION 1941 TO 1977
(In Pounds)

YEAR	S.E. ALASKA	CENTRAL ALASKA	WESTERN ALASKA	TOTAL
1941	17,472	32,760	...	50,232
1942	4,912	70,352	...	75,264
1943	13,468	31,228	...	44,696
1944	13,648	1,560	...	15,208
1945	...	...	...	...
1946	13,400	9,200	...	22,600
1947	17,550	521	734,597	752,668
1948	...	...	2,133,354	2,133,354
1949	...	...	1,206,945	1,206,945
1950	...	64,882	1,454,367	1,519,249
1951	...	202,281	1,791,631	1,993,912
1952	...	779,611	1,993,222	2,772,833
1953	...	2,614,277	1,998,932	4,613,209
1954	...	6,356,827	2,514,243	8,871,070
1955	...	5,951,120	2,211,800	8,162,920
1956	...	6,899,795	1,896,227	8,796,022
1957	...	12,488,131	588,434	13,076,565
1958	...	11,211,554	...	11,211,554
1959	...	18,839,470	...	18,839,470
1960	3,424	27,878,630	687,962	28,570,016
1961	429,600	38,854,800	4,127,200	43,411,600
1962	1,289,550	44,652,990	6,839,580	52,782,120
1963	1,112,200	50,786,570	26,841,470	78,740,240
1964	820,530	51,638,590	34,261,550	86,720,670
1965	579,300	94,505,762	36,585,650	131,670,712
1966	105,899	117,305,088	41,790,708	159,201,695
1967	599,078	83,010,695	44,106,117	127,715,890
1968	2,199,772	37,559,518	42,278,206	82,037,496
1969	1,895,168	20,274,859	35,559,781	57,729,808
1970	577,802	19,587,102	31,896,126	52,061,030
1971	571,062	20,220,631	49,911,412	70,703,105
1972	952,602	24,722,072	48,751,982	74,426,656
1973	874,180	23,610,989	52,338,934	76,824,103
1974	583,294	32,121,859	62,508,643	95,213,796
1975	436,478	29,667,311	67,525,144	97,628,933
1976	398,463	23,318,393	82,108,140	105,824,996
1977	312,355	16,084,094	83,052,208	99,448,657

Source: U.S. Department of the Interior, Fish and Wildlife Service, Fishery Statistics of the U.S., Statistical Digest Nos. 1-51, (1941 to 1959).

TABLE 41

FOREIGN AND U.S. CATCH OF TANNER CRAB IN EASTERN BERING SEA 1965 TO 1976[1]
(In Millions of Pounds)[2]

	JAPAN			USSR	U.S.	TOTAL CATCH
	Tangle nets	Pots	Total	Tangle nets	Pots	
1965	2.482	...	2.482	1.603[3]	...	4.085
1966	3.591	...	3.591	1.603[3]	...	5.194
1967	20.051	.699	20.750	8.170[3]	...	28.920
1968	24.341	4.531	28.872	8.411[3]	.014	37.297
1969	23.464	18.931	42.394	15.046	.851	58.291
1970	18.506	25.332	43.838	13.795	1.162	58.794
1971	2.051	35.880	37.931	10.132	.147	48.210
1972	.930	36.649	37.579	...[4]	.104	37.683
1973[5]	...	33.603	33.603	...	.321	33.923
1974[6]	...	33.706	33.706	...	6.102	39.808
1975[7]	...	22.239	22.239	...	6.683	28.922
1976[8]	...	23.240	23.240	...	22.341[9]	44.824
1977		27.562[10]	27.562	...	51.876[9]	79.438

Source: International North Pacific Fisheries Commission.

[1] Chionoecetes bairdi and C. opilio.

[2] The number of crab was converted to number of pounds by using a factor of 2.41 pounds/crab, the weight per crab used by NMFS in their Bering Sea stock estimation (1977).

[3] Estimated by applying number of pounds per case in 1969 to case pack figure in indicated year.

[4] No USSR fishery after 1971.

[5] Japanese catch in 1973 was 14.441 million pounds in Area A and 19.162 million pounds in Area B. Areas are those defined in the 1972 bilateral agreement.

[6] Japanese catch in 1974 was 14.458 million pounds in Area A and 19.249 million pounds in Area B. Areas are those defined in the 1972 bilateral agreement.

[7] Japanese catch in 1975 was 5.256 million pounds in Area A and 16.983 million pounds in Area B. Areas are those defined in the 1974 bilateral agreement.

[8] Japanese catch in 1976 was 5.873 million pounds in Area A and 17.366 million pounds in Area B. Areas are those defined in the 1974 bilateral agreement.

[9] U.S. catch through September only; no further effort expected.

[10] The Japanese quota for the Eastern Bering Sea in 1977 was 12,500 mt. It is assumed that the entire quota was harvested.

Note: Statistics for the USSR fishery provided to the United States by the USSR.

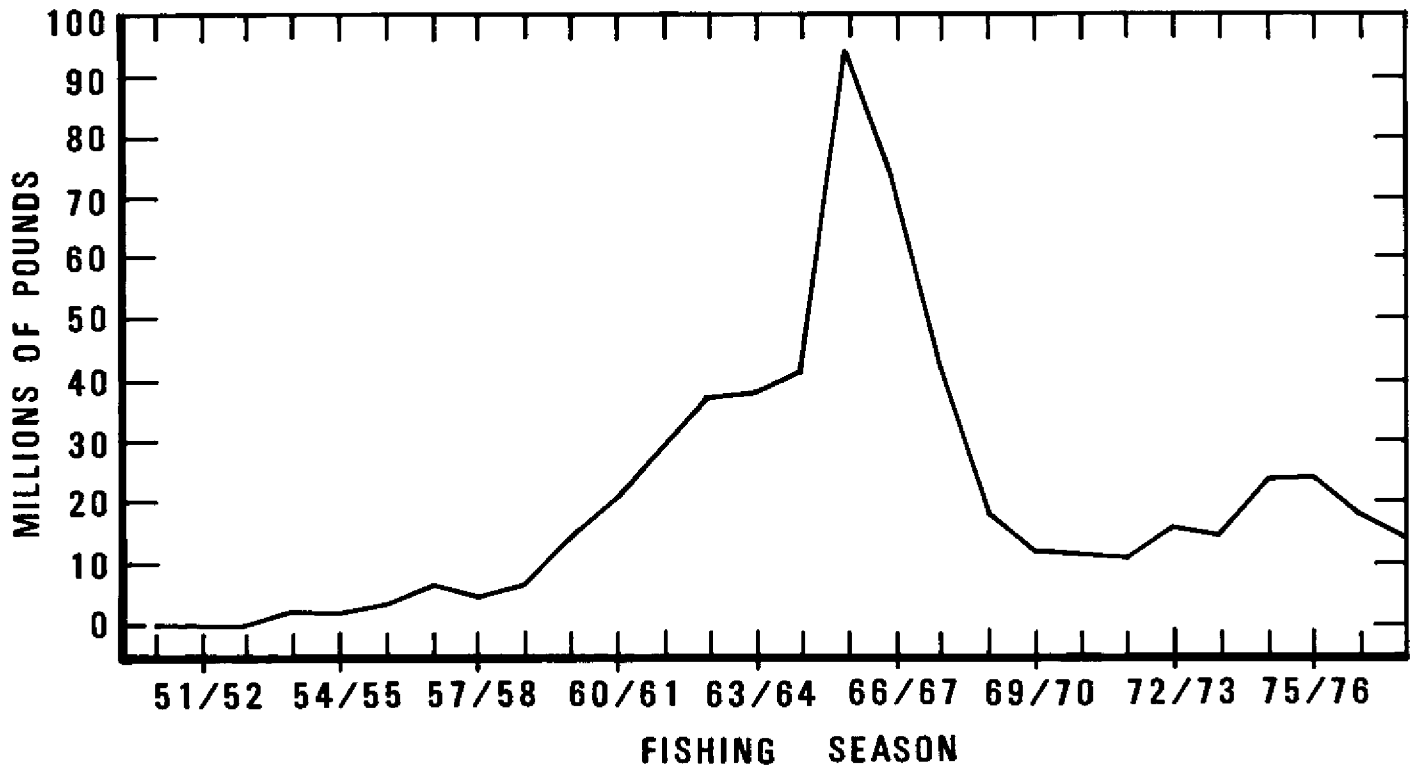

FIGURE 7. KING CRAB CATCH FOR THE KODIAK REGISTRATION AREA BY FISHING SEASON 1950-51 TO 1977-78

The growing king crab industry received a severe blow in March 1964, when most of the king crab fleet and three of the four canneries were destroyed or damaged by the tsunami caused by the earthquake. By April 1965, however, four new crab processing plants had been completed, greatly increasing the processing capacity, and new vessels replaced those lost. The fishing seasons of 1965, 1966, and 1967 proved to be the highest catches of king crab, both for Kodiak and all of Alaska (Figure 6).

After the peak season during 1965-66, the catch of king crab from the Kodiak area declined rapidly. The abundance of large crab apparently decreased due to over exploitation of offshore stocks which had not been fished previously. By 1970, the catch from the Bering Sea had increased to equal the catch from the Kodiak area as more fishing effort was shifted westward. As the foreign catch quotas in the Bering Sea were decreased and phased out in two-year increments, the U.S. catch rose rapidly. From 1971 to the present, the catch from the Bering Sea has risen to over 78 million pounds. During this period, the percentage contribution of the Bering Sea management area to the total state catch has increased dramatically. In 1971, the Bering Sea harvest was 18.5 percent of the state total. By 1977, this had risen to 79.4 percent. The increasing dependence of the state fishery on the Bering Sea resource makes the king crab industry particularly susceptible to extreme fluctuation if the stocks in the Bering Sea area are not able to sustain the present rate of harvest. According to current Maximum Sustainable Yield (MSY) estimates for the Bering Sea, the current catch levels are well within the estimated MSY. Therefore, while this increasing dependence of the fishery on the stocks in one area could become a problem in future, it is apparently acceptable at this time.

Development of the Alaska Tanner Crab Fishery

Foreign Fishery: Japan

The Japanese began experimental fishing for tanner crab in the Eastern Bering Sea in 1953. The amount of production in 1953 was 170 cases, and remained at experimental levels through 1964 when 3,457 cases were processed (Zahn 1970). As a result of the implementation of quotas on the foreign king crab catch in 1965, the Japanese mothership crab fleet began to shift fishing effort to tanner crab. The tanner crab catches in 1965 and 1966 were 1.03 and 1.49 million crab, respectively, which were caught entirely by tangle nets. After 1966, the catch was split between tangle net and pot gear with pot gear taking an increasing percentage of the total catch until 1972, after which tangle nets were restricted from use. From 1967 to 1970, the Japanese catch of tanner crab rose rapidly from 8.6 to 18.2 million crab as the mothership operation continued to shift effort to tanner crab in response to the declining king crab quotas.

A quota for tanner crab catch was included in the U.S.-Japan bilateral agreement for the first time in 1971 (see Table 38). The quota of tanner crab was initially set at 14,600,000 crab, plus an allowable margin of ten percent, for each year of the first tready period, 1971-72. This quota was decreased slightly during the next treaty period (1973-74) to 14 million pounds; however, the area of catch was restricted. The areas and allowable catch are shown in Figure 8. During the final (1975-76) treaty period, the allowable catch was set at 13,500,000 crab, or 10,200 mt, restricted to the areas shown in Figure 9.

After 1976, with the establishment of the Fisheries Conservation and Management Act, the North Pacific Fishery Management Council (NPFMC) took over management and control of foreign fishing within the U.S. fisheries zone off Alaska. The Japanese quota of tanner crab for the Eastern Bering Sea was originally set at 10,200 mt for 1977, with the restriction that only 2,500 mt could be caught in Area A with the same boundaries as Figure 9. This catch was further restricted by species so that the catch could be made up of a maximum of 5,100 mt of *Chionocetes bairdi* and the remaining 7,400 mt of *C. opilio*. After review by the NPFMC, the 10,200 mt total allowable catch was increased to 12,500 mt despite some opposition by Alaskan fishermen and processing companies. The additional allocation of 2.3 mt was entirely made up of *C. opilio*. The 1978 foreign allocation was set at 15,000 mt after much deliberation by the Council. This allocation is limited to *C. opilio* from the area north of 58° north latitude and west of 167° west longitude.

The amount of foreign allowable catch of *C. opilio* from the Bering Sea will continue to be determined by the NPFMC each year as part of the management plan for tanner crab. The allowable catch will probably remain similar to the 1978 amount for at least a couple of years. At present there is not a great deal of interest by the domestic fishery in the *C. opilio* resource in the area the Japanese are presently fishing. It is possible that the situation could change in the future as the domestic industry develops markets for this species. The Japanese allocation of *C. opilio*, therefore, is subject to decrease, assuming that the domestic industry participation in this fishery is increased.

A graph of the Japanese catch of tanner crab in waters off Alaska, compared with the USSR and U.S. catches, is shown in Figure 10.

Foreign Fishery: USSR

In the same manner as the Japanese, the Soviet mothership crab fleet began to shift fishing effort to tanner crab as the quotas were established for king crab. The Soviet catch followed the same pattern as the Japanese catch, though at a lower total catch (Figure 10 and Table 41). The catch for the first two years of harvest, 1965 and 1966, was 665,000 crab during each year. This amount increased to 3.39 million crab in 1967 and 3.49 million crab in 1968. After 1969, tanner crab was included in the U.S.-USSR bilateral treaty (Table 38), with the quota being set at 40,000 cases for the original period, 1969-70. The catch for these two years marked the peak harvest level for the Soviet tanner crab fishery in the Eastern Bering Sea at 6,243,000 and 5,724,000 crab, respectively. The quota was reduced to 35,000 cases for 1971 and 1972.[3] The catch in 1971 was 4,204,000 crab.

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[3]The drained weight of crab meat in a 48 can case of one-half pound cans is 19.5 pounds. At an average recovery factor of 15 percent, this means that each case requires 130 pounds of crab round weight.

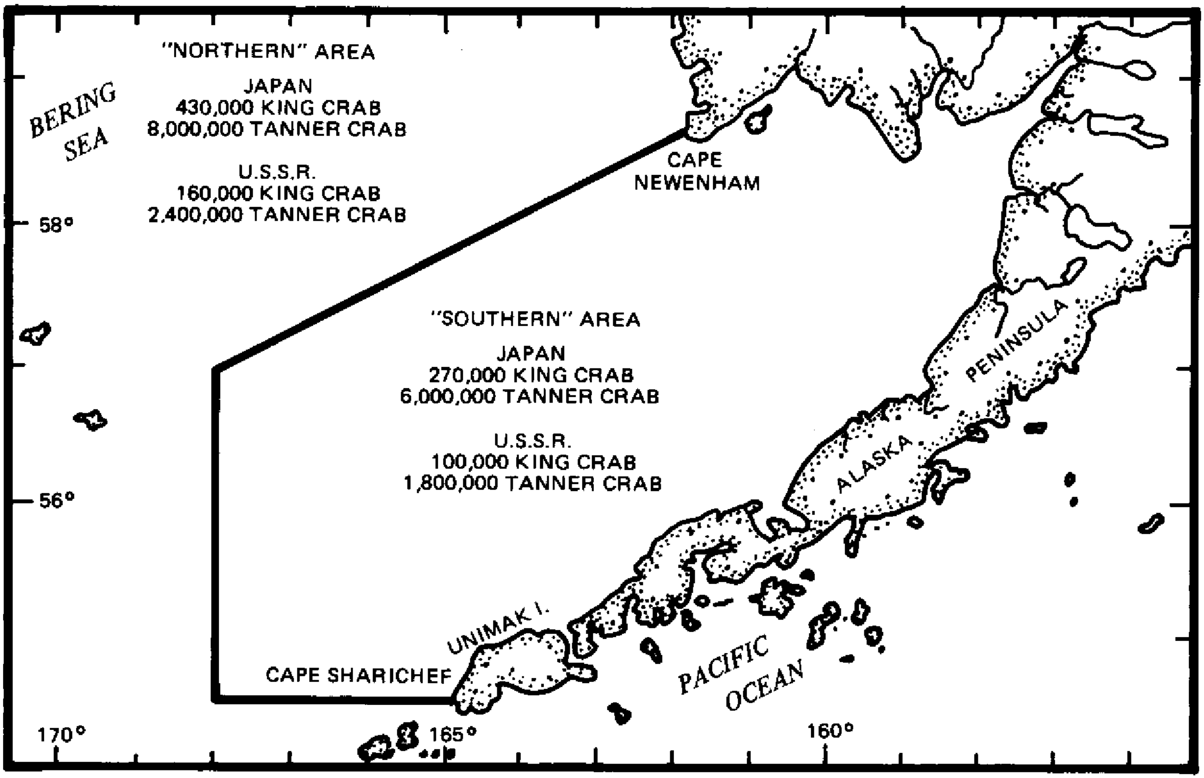


FIGURE 8. AREAS AND CATCH QUOTAS FOR 1973 AND 1974 ESTABLISHED FOR JAPANESE KING AND TANNER CRAB FISHING IN THE EASTERN BERING SEA BY THE U.S.-JAPAN AGREEMENT OF DECEMBER 1972

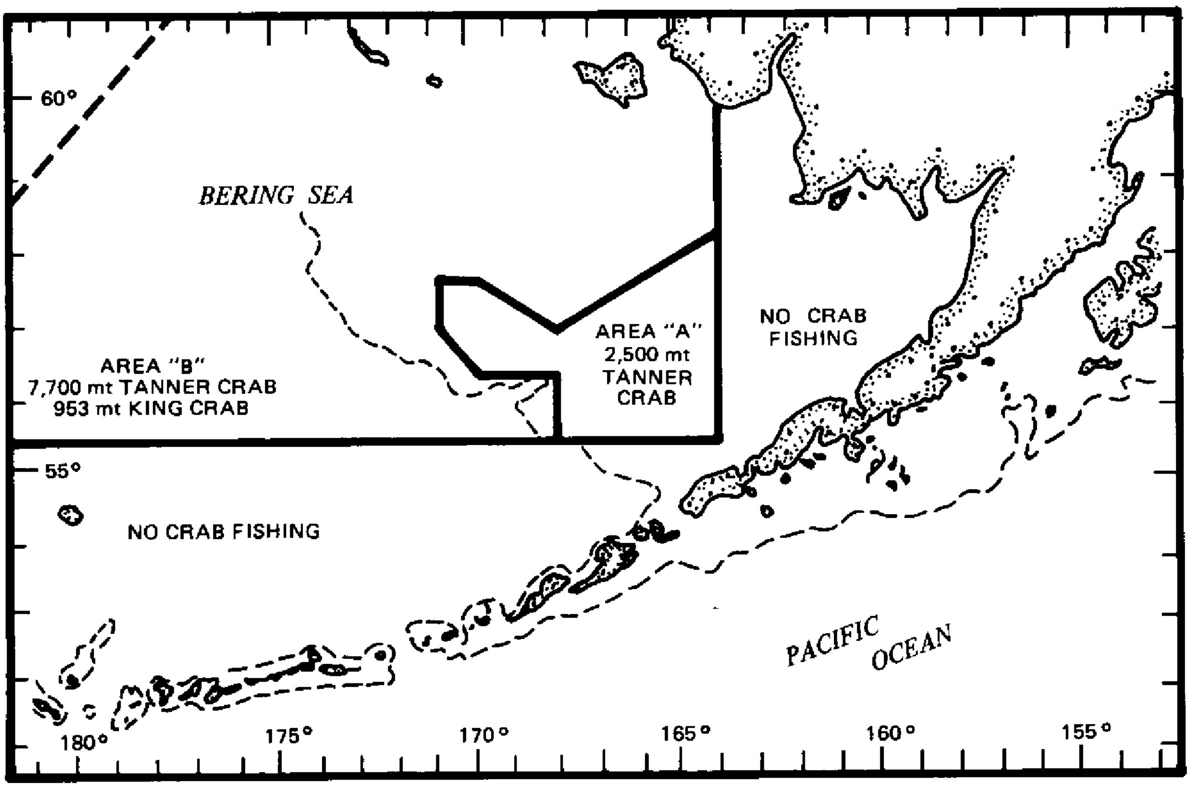


FIGURE 9. JAPANESE EASTERN BERING SEA CRAB QUOTAS AND QUOTA AREAS 1975 AND 1976

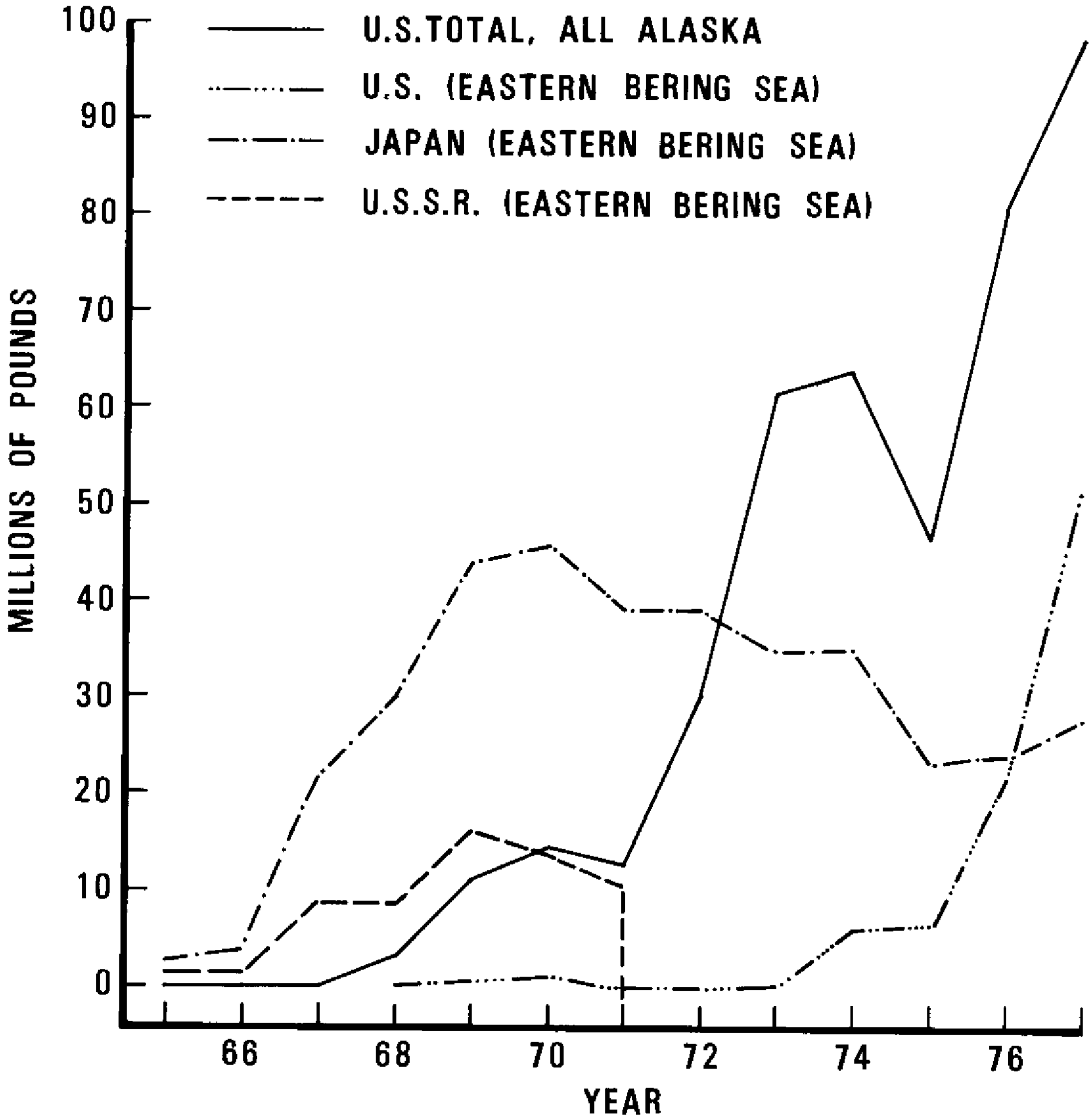


FIGURE 10. TANNER CRAB CATCH BY FOREIGN AND DOMESTIC FLEETS 1965 TO 1977

After 1971, the USSR abandoned the fishery. As was the case for king crab, catch quotas did continue through 1976 as part of the bilateral treaties, but the quotas were not taken.

The U.S. Fishery

The first significant landings of tanner crab by U.S. fishermen was in 1968. Small amounts had been harvested previous to this time; however, in general tanner crab had been considered as undesirable and had been discarded. Some of the deterrents to exploitation of tanner crab resource were:

- lack of domestic markets for tanner crab resulting in low price levels;
- difficulty in processing tanner crab with equipment designed for king crab;
- recovery rates were initially poor.

In spite of the above difficulties, the U.S. industry began to harvest and process tanner crab, initially as a result of declining catches of king crab and as an income supplement during closed king crab seasons. The catch increased slowly through 1971 and then increased rapidly from 1971 to 1974 (Figure 10). There was a significant drop in the catch in 1975 as a result of a strike, when only 46.8 million pounds were landed. The dramatic increase in catch continued in 1976 and 1977 with catches of 80,712,199 and 98,328,860 respectively. For the first time, in 1977, the catch of tanner crab approximately equaled that of king crab. In 1978, with an increased catch expected from the Bering Sea, tanner crab catch could possibly surpass king crab catch in the number of pounds landed.

There has been a gradual shift in harvest of tanner crab from the Kodiak area westward (Table 42). During 1967, the Kodiak area contributed 93.8 percent of the total Alaska catch. By 1977, this had declined to 21.1 percent as fishing effort shifted to the Alaska Peninsula and the Bering Sea. In 1977, the foreign allocation of C. bairdi in the Bering Sea was ended and the entire optimum yield was harvested by U.S. fishermen. With an expected Bering Sea harvest of 65 million pounds in 1978, the westward percentage of total catch will likely increase again in 1978.

TABLE 42

PERCENTAGE OF TOTAL ALASKA CATCH OF TANNER CRAB BY AREA
1967 TO 1977

Year	Westward[1]	Kodiak	Other Areas
1977[2]	66.8	21.1	12.1
1976[2]	51.2	29.1	19.7
1975	34.9	37.4	27.7
1974	28.3	39.9	31.8
1973	11.4	51.1	37.5
1972	13.3	38.9	47.8
1971	19.1	57.5	23.4
1970	24.6	53.2	22.2
1969	15.2	60.9	23.9
1968	4.9	79.0	16.1
1967	3.9	93.8	2.3

Sources: ADF&G Statistical Leaflets 1967 to 1975; ADF&G Monthly Shellfish Reports (preliminary) 1976 to 1977.

[1]Includes catch from Chignik, South Peninsula, Eastern Aleutians, Western Aleutians, and Bering Sea.

[2]From preliminary ADF&G data.

CHAPTER IV

THE CRAB RESOURCE

King Crab

There are four species of king crab which are harvested commercially: red king crab, *Paralithodes camtshatica*; blue king crab, *P. platypus*; brown king crab, *P. brevipes*; and the golden king crab, *Lithodes aquispina*. Most of the catch consists of red king crab, with much smaller quantities of blue king crab being taken in the Northern Bering Sea near the Pribilof Islands, and southwest of St. Matthews Island. The other two species, brown and golden king crab, are not caught in significant quantities.

The area of distribution of the red king crab is on both sides of the North Pacific Ocean. The limits of distribution on the northeastern side are from Vancouver Island in the south to Norton Sound in the north. On the northwestern side, red king crab are found from the southern limit in the Sea of Japan, north into the Sea of Okhotsk and up to the northern limit along the shores of Kamchatka Peninsula at approximately 60^{o} north latitude.

The main areas of abundance of king crab in Alaska are in the area around Kodiak, along the Alaska Peninsula, Dutch Harbor, Adak, and the Bering Sea. Estimates of Maximum Sustainable Yield (MSY) of king crab were obtained from ADF&G for each of the management areas, and are listed in Table 42. The total MSY for the state is estimated to be 145.23 million pounds. It should be noted that these are preliminary estimates of MSY and may be corrected in the final management plan for king crab which will be completed in October 1978. These are the most up-to-date estimates available, however, and should provide an indication of how closely present catch levels approach MSY.

From Table 43, it can be seen that all catches fall within the estimated MSY except the Bering Sea. If these estimates of MSY are correct, then there is a possibility that the king crab stocks in the Bering Sea are presently being overexploited. Since 1974, more than half of the entire Alaska catch has come from the Bering Sea. The contribution of that area to the total catch has increased from 52 percent in 1974 to 79 percent in 1977. As the catch has declined in other areas, much of the slack has been taken up by the Bering Sea, keeping the total state catch relatively constant. The stability of the fishery now rests to an uncomfortably high degree on the status of the Bering Sea stocks. The historical catch by management area is shown in Table 44 for the period from 1960 to 1977. The present landings in all management areas, with the exception of the Bering Sea, are at low levels, down from the historic peak landings in the late 1960s or early 1970s.

World Catch

The world catches of king crab, from 1960 to 1976, are shown in Table 45. The peak world catches were made during the years from 1964 to 1976,

TABLE 43

ESTIMATES OF MAXIMUM SUSTAINABLE YIELD FOR KING CRAB
(In Millions of Pounds)

Area	MYS	1977 Catch	Percent of MSY	Peak Harvest (Year)
Southeastern	.75	.31	41.3	2.2 (1968)
Prince William Sound	1.04	.08	.08	.3 (1972)
Cook Inlet	3.9	2.03	52.0	6.9 (1964)
Kodiak	25.0	13.19	52.8	90.7 (1966)
Alaska Peninsula	8.8	.78	8.9	22.5 (1966)
Dutch Harbor	13.9	4.12	29.6	
Adak	13.0	...	...	25.8 (1971)
W. Aleutians	.84	...	...	
Bering Sea	78.0	78.9	101.2	78.9 (1977)
(By District)				
Unimak I.	56.0[1]			
Pribilofs	10.0[2]			
Norton Sound	2.0[1]			
Northern	10.0[2]			
Total Alaska	145.23			

Source: ADF&G preliminary estimates, May 1978.

[1]Red king crab.

[2]Blue king crab.

TABLE 44

ALASKA CATCH OF KING CRAB BY MANAGEMENT AREA
(In Thousands of Pounds)

Year	South-East	P.W. Sound	Cook Inlet	Kodiak	Chignik	South Peninsula	East Aleutians	West Aleutians (Adak)	Bering Sea	All Alaska
1977	312.4	84.0	2,030.6	13,186.7	205.1	577.7	4,118.0	2.3	78,931.9	99,448.7
1976	398.5	18.0	4,937.4	17,521.9	167.6	673.5	11,460.0	386.3[1]	70,261.8	105,825.0
1975	436.5	53.4	2,886.4	23,924.2	326.3	2,476.9	11,620.9	2,810.4	53,093.8	97,628.9
1974	583.3	85.4	4,601.8	22,987.6	144.7	4,302.5	11,295.2	1,334.9	49,878.5	95,213.9
1973	874.1	207.9	4,349.2	14,397.3	375.8	4,280.7	12,722.7	11,245.4	28,370.7	76,823.8
1972	952.6	296.1	4,607.9	15,479.9	133.3	4,204.9	10,696.2	16,160.9	21,894.9	74,426.7
1971	571.1	144.2	4,157.6	11,820.0	13.3	4,211.8	10,863.0	25,828.1	13,094.1	70,703.2
1970	577.8	94.3	3,888.3	12,069.5	22.8	3,512.2	10,896.3	12,424.8	8,575.0	52,061.0
1969	1,895.3	48.1	2,857.1	12,724.1	310.1	4,335.3	7,179.8	18,040.0	10,340.0	57,729.8
1968	2,189.9	199.6	4,008.6	22,117.6	341.7	10,940.0	14,000.0	19,180.0	8,940.0	81,917.4
1967	599.0	41.8	3,117.5	62,864.4	247.7	17,180.0	27,320.0	13,090.0	4,400.0	128,860.4
1966	105.8	11.0	3,897.6	90,726.2	561.3	22,519.9	31,545.8	8,930.0	997.4	159,295.0
1965	579.3	31.2	2,788.0	76,586.4	769.8	15,038.2[2]	35,877.9			131,670.8
1964	820.5	13.6	6,905.1	29,645.3	720.5	14,994.3[3]	33,621.3			86,720.6
1963	1,112.2		50,786.6[4]				26,841.5[5]			78,740.3
1962	1,289.6		44,653.0[4]				6,839.6[5]			52,782.2
1961	429.6		38,854.8[4]				4,127.2[5]			43,411.6
1960	3.4		27,878.6[4]				688.0[5]			28,570.0

Source: ADF&G Statistical Leaflets 1960 to 1975; 1976 to 1977 preliminary data.

[1]Includes West Aleutians; [2]Includes North Alaska Peninsula; [3]Includes North Alaska Peninsula.

[4]Includes Prince William Sound, Cook Inlet, and Kodiak.

[5]Includes West Aleutians and Bering Sea.

TABLE 45

WORLD CATCHES OF KING CRAB BY COUNTRY[1]
(In Thousands of Metric Tons)

ZONE	1976	1975	1974	1973	1972	1971	1970	1969	1968	1967	1966
Northwest Pacific											
COUNTRY											
Japan	1.2	1.8	5.0	5.8	8.0	8.9	12.8	17.3	23.2	23.2	23.1
Korea	...	.1	.3	.4	.1	.5	.2	1.3	2.5	1.5	.4
USSR	19.6	15.9	17.9	18.7	18.2	19.8	24.2	28.1	31.5	35.5	37.2
Total	20.8	17.8	23.2	24.9	26.3	29.2	37.2	46.7	57.2	60.2	60.7
Northeast Pacific											
Japan	...	...	.4	.4	1.6	1.6	4.8	5.2	7.2	7.1	7.9
USSR	...	...	...	...	...	5.9	7.2	9.0	8.9	6.9	8.8
U.S.	48.0	45.4	44.3	34.5	42.7	32.1	23.6	26.2	37.2	57.9	72.2
Total	48.0	45.4	44.7	34.9	44.3	39.6	35.6	40.4	53.3	71.9	88.9
Total Both Areas	68.8	63.2	67.9	59.8	70.6	68.8	72.9	87.1	110.5	132.1	149.6

For years before 1966, there is no breakdown by area.

	1965	1964	1963	1962	1961	1960
U.S.	59.7	39.3	35.7	23.9	19.7	12.9
Japan	25.9	31.8	31.6	33.6	27.8	25.3
Korea	.3	2.2	2.3	3.5	1.7	...
USSR	44.4	46.2	42.5	41.4	38.7	36.7
Total	130.3	119.5	112.1	102.4	87.9	74.9

Source: FAO Yearbook of Fishery Statistics: Catches and Landings, 1966 to 1976.

[1]See Table 46 for the catches of southern king crab (*Lithodes antarcticus*) which are not included in this table.

with the maximum catch of 149,000 metric tons being landed in 1966. Since then, the catch has declined, both in the Northwest Pacific and the Northeast Pacific. The U.S. percentage of the total world catch has risen steadily from 17.2 percent in 1960 to 69.8 percent in 1976. The steady increase of the U.S. percent of world catch varied slightly during the period from 1965 to 1967. During these years, the record catches from the Kodiak area helped to push the U.S. percentage of world catch upward quickly. The Kodiak harvest dropped drastically after 1967. It was several years before the U.S. percentage of world catch reached the 1965 to 1967 levels and then continued to increase.

The other countries which have participated in the king crab fishery have all declined in percentage of world catch and also in actual catch during the 1960 to 1976 period. The Japanese catch has declined from 59,700 mt, which were landed in 1965 to 1,200 mt landed in 1976. They have not participated in the fishery for king crab in the northwest since 1974, and the catches in the northeast have declined rapidly since 1966, to the 1976 catch of 1,200 mt. The Korean catch of king crab fluctuated between 1960 and 1976. The largest Korean catch of 3,500 mt was made in 1973, and the lowest catch level of 100 mt was landed in 1972 and again in 1976. There were no king crab landings recorded by Korea in 1976. The catch for the USSR has declined steadily since 1964. Starting in 1965, their catch of king crab in the Eastern Bering Sea was limited by quota and their catch in that area decreased steadily until they withdrew in 1971. There is no data available on the stock status of king crab in waters off the USSR to suggest whether the decline in catch there is a result of low abundance of crab or of low fishing effort.

Expansion Potential of the King Crab Fishery

The potential for expansion of the Alaska king crab fishery does not appear to be great at this time because of low levels of abundance in all areas except the Bering Sea. If abundance in some areas of the Bering Sea is greater than presently indicated by MSY estimates, then there may be additional expansion of the fishery.

The stock abundance of king crab in waters off Japan is not known. However, it is not expected that any major increase in catch will occur in this area as it has been fished for a long period of time. And because of the high price of king crab in Japan, it can be presumed that any fishable stocks would have been exploited.

There are no data available on the stock status of king crab in USSR waters in the Sea of Okhotsk and along the Kamchatka Peninsula. If there is potential for increased world catches of red king crab, P. camtshatica, other than from U.S. waters, this area would be the most likely source. While not within the scope of this project, it would be useful for fishery management agencies, such as the NPFMC, to obtain stock estimates from the USSR in order to be able to determine world stocks.

Another increase in world production of king crab could possibly come from Argentina or Chile. In Food and Agriculture Organization (FAO) publications, both countries show landings of southern king crab, *Lithodes antarcticus* (Table 46). This is not the same genus as red and blue king crab caught off Alaska; however, it is the same genus as golden king crab, *L. aquispina* caught in waters off Alaska. The southern king crab from Argentina and Chile are exported as king crab on world markets. Much of the crab produced is exported to Europe, Japan and the U.S. At present, the amounts caught are small and the possibility for expansion of the fishery in both of these countries is uncertain. More survey work is necessary to determine harvestable stocks. It was indicated by fisheries agencies in both countries that lack of modern fishing boats and processing facilities hampered production. The "outside" waters are not fished presently because the ocean conditions are too severe for the present fleet.

Tanner Crab

There are six species in the genus *Chionoecetes* which in Alaska are commonly known by the name tanner crab. Of the six species, three are found in waters off Alaska; *C. opilio*, *C. bairdi*, and *C. angulatus*. The species which are not present in Alaska are *C. opilio elongatus*, *C. tanneri*, and *C. Japonicus*. The areas of distribution for each species is shown in Table 47.

The most commercially important species is *C. bairdi* followed by *C. opilio*. The U.S. tanner crab fishery concentrates mainly on the larger *bairdi* with only incidental amounts of *opilio* being caught. *C. opilio* is being harvested by Japan and the USSR in the Bering Sea and by Canada in the Atlantic off the coast of Labrador. Japan also harvests *C. opilio elongatus* in the Sea of Japan. At present, the other species are not fished commercially. There have been investigations of the feasibility of harvesting *C. tanneri* off the coast of Oregon, but the relatively low population densities have prevented the establishement of a fishery for this species.

Catch and Abundance in Alaska

The largest concentrations of tanner crab are located in the Bering Sea, South Peninsula (including Chignik), and Kodiak areas. A comparison of the Maximum Sustainable Yield, Optimum Yield, Allowable Biological Catch and 1977 catch by management area is shown in Table 48.

From Table 48, it can be seen that the Chignik/South Peninsula and the Bering Sea areas offer the greatest opportunity for increased catch according to the MSY estimates. In 1977, the Bering Sea area in which the 1977 catch level was only 58.4 percent of MSY, produced more than half of the entire catch of tanner crab.

The catch of tanner crab by management area is shown in Table 49, from the first significant landings in 1967 to 1977. Over the past several years, the landings in the Southeast, Cook Inlet, and South Peninsula have remained relatively constant. The catch from the Prince William Sound and Kodiak areas have decreased substantially. The Chignik area landings have fluctuated widely but have generally increased and as already mentioned, the Bering Sea has dramatically increased in tanner crab catch in the past several years.

TABLE 46

CATCH OF SOUTHERN KING CRAB (*Lithodes antarcticus*)
(In Thousands of Metric Tons)

	1975	74	73	72	71	70	69	68	67	66	65
Argentina	.4	.4	.2	.3	.3	.2	.2	.3	.3	.1	.1
Chile	.5	.5	.4	.4	.4	.4	.4	.5	.5	.4	.3

TABLE 47

CHIONOECETES SPP., DEPTH LOCATION AND DISTRIBUTION

Species	Depth (In Meters)	Geographic Distribution
C. opilio (O. Fabricius)	13-454	Bering Sea, Arctic Ocean, North Atlantic Ocean from west coast Greenland to Casco Bay, Maine
C. elongatus, Rathbun	To 2,222	Sea of Japan, Okhotsk Sea
C. bairdi, Rathbun	Shoalwater to 474	Bering Sea to California
C. tanneri, Rathbun	53-1,942	Washington to lower California
C. angulatus, Rathbun	90-2,972	Bering Sea to Oregon
C. japonicus, Rathbun	411-2,103	Sea of Japan

Source: NPFMC (1977) *Fishery Management Plan for Tanner Crab off Alaska*.

TABLE 48

ESTIMATES OF MAXIMUM SUSTAINABLE YIELD (MSY), OPTIMUM YIELD (OY), AND ALLOWABLE BIOLOGICAL CATCH (ABC) FOR TANNER CRAB
(In Millions of Pounds)

Area	MSY	ABC	OY	1977 Catch	% of MSY	Peak Catch (Year)
Southeastern/ Yakutat	.5	5.5	5.5	3.4	61.8	3.8 (1976)
Prince William Sound	.2	3-7.0	3-7.0	2.9	40.3	12.3 (1973)
Cook Inlet	5.3	5.3	5.3	5.6	150.7	8.5 (1973)
Kodiak	21.5	15-25.0	15-25.0	20.7	96.3	31.5 (1973)
S. Peninsula[1]	20.0	20-30.0	20-30.0	12.5	62.5	18.4 (1976)
Aleutians[2]	2.0	2.0	2.0	1.3	65.0	1.3 (1977)
Bering Sea						
C. bairdi	88.8	88.8	73-89.0	51.9	58.4	51.9 (1977)
C. opilio	450.0	450.0		2.0[3]	...	...

Source: NPFMC (1977) Fishery Management Plan for Tanner Crab off Alaska.

[1]Includes Chignik.

[2]Includes Aleutian Is. East--Unalaska, Aleutian Is. West--Adak, and W. Aleutians.

[3]Estimated from incidental catch rates, catch amount included in total for C. bairdi.

TABLE 49

CATCH OF TANNER CRAB BY AREA
(In Thousands of Pounds)

Year	Southeast	Prince William Sound	Cook Inlet	Kodiak	Chignik	South Peninsula	Aleutians East Aleutians	Aleutians West (Adak)	Bering Sea	All Alaska
1977	3,373.4	2,894.8	5,655.4	20,720.1	5,616.4	6,891.0	1,301.7		51,876.2	98,329.0
1976	3,885.5	6,000.4	6,031.5	23,446.2	11,169.6	7,240.9	534.3	62.2	22,341.5	80,712.1
1975	3,032.2	5,016.7	4,952.4	17,506.3	3,756.6	5,483.9	77.2	3.3	7,028.4	46,857.0
1974	3,087.5	9,597.8	7,660.9	25,474.5	4,087.6	8,384.2	498.8	70.5	5,044.2	63,906.0
1973	1,893.0	12,296.8	8,509.1	31,519.9	918.1	5,652.8	59.0	168.5	301.8	61,319.0
1972	790.1	8,550.7	4,807.8	11,906.6	26.5	3,938.1	3.9		111.7	30,135.4
1971	251.1	642.3	2,116.8	7,410.8	152.3	2,140.8			166.0	12,880.1
1970	583.2	1,292.4	1,328.7	7,708.1	2.8	2,093.6			1,464.4	14,473.2
1969	267.4	936.5	1,479.7	6,822.7	38.1	606.3	21.0	2.2	1,033.2	11,207.1
1968	109.3	245.2	165.1	2,561.0	21.5	110.6	12.8		8.1	3,243.6
1967	2.7			111.1	1.6	3.0				118.4

Source: ADF&G Statistical Leaflets 1960 to 1965; 1976 and 1977 preliminary data.

World Catch

The total world catch of tanner crab, for both C. bairdi and C. opilio is shown in Table 50. The catch is divided into the three major areas of catch, in the Northwest Pacific, Northeast Pacific, and Northwest Atlantic. The catch from the Northwest Pacific made by Japan and the USSR has declined since 1968. Some of the decrease of the Japanese fishery was made up by the catches in the Northeast Pacific; however, these have been reduced by quotas since that time. The major increase in percentage of world production has been made by the U.S. As the Japanese tanner crab fishery was reduced in the Bering Sea, the domestic catch developed quickly. In 1976, the U.S. produced 50.3 percent of the total world supply. The catch of C. opilio made by Canada has remained fairly steady. It is unlikely that Canadian production will experience a major increase in the near future because processing is done entirely by hand, which is an effective limit to increasing supply.

Data on stock abundance for tanner crab for countries other than the U.S. are not available. It is assumed that catch rates are an indication of abundance in lieu of stock abundance data.

Expansion Potential of the Tanner Crab Fishery

The greatest potential increase for expansion of the tanner crab fishery in Alaska is in the Bering Sea. The stocks of C. bairdi from that area are estimated to be capable of withstanding the current or increased level of harvesting for several years. However, crab from the small year classes in the mid 1960s will be entering the fishery in the early 1980s (Somerton and Low 1977). A smaller number of crab available for harvest can be expected during this period. The fishery can be expected to shift effort to the smaller species, C. opilio, to continue production levels. Up through 1977, there had not been significant interest shown by domestic fishermen and processors in C. opilio. In early 1978, however, at least one processing company in Dutch Harbor requested deliveries of C. opilio from fishermen and processed one million pounds before the end of the season. If the marketing of this product is successful, the domestic fishing effort for C. opilio could increase rapidly during the next several years.

Dungeness Crab

The dungeness crab was not one of the species included in this study because of the low landings over the past several years. Most of the crab processing companies in the state expressed little interest in processing dungeness crab because of low market prices. In May 1978, however, one of the processing companies in Kodiak started taking deliveries of dungeness, paying 60 cents per pound, and expects to process approximately one million pounds during the year. If market conditions improve for dungeness crab, production again may become more significant in the future.

TABLE 50

WORLD CATCHES OF TANNER CRAB BY COUNTRY
(In Thousands of Metric Tons)

COUNTRY	1976	1975	1974	1973	1972	1971	1970	1969	1968	1967	1966	1965	1964
Northwest Pacific													
Japan	13.9	16.1	24.7	20.8	27.7	28.2	36.0	34.7	38.6	31.9	19.5	16.4	20.4
USSR	3.4	3.2	3.9	3.3	...	...	...	...	...	...	...	...	...
Total	17.3	19.3	28.6	24.1	27.7	28.2	36.0	34.7	38.6	31.9	19.5	16.4	20.4
Northeast Pacific													
Japan	8.1	8.1	5.4	12.6	14.0	14.2	17.3	17.6	23.1	...	...	...	...
U.S.	36.6	20.9	29.1	27.8	20.9	5.8	6.6	5.1	1.5	.1	...	...	...
Total	44.7	29.0	34.5	40.4	34.9	20.0	23.9	22.7	24.6	.1	...	...	...
Northwest Atlantic													
Canada[1]	10.7	7.0	10.4	9.9	7.0	6.8	7.7	8.6	5.2	...	...	...	...
Total for All Areas	72.7	55.3	73.5	74.4	69.6	55.0	67.6	66.0	68.4	32.0	19.5	16.4	20.4

Source: FAO (1964 to 1976).

[1]*C. opilio* only.

CHAPTER V

FISHING GEAR AND PROCESSING METHODS FOR KING AND TANNER CRAB

Crab Fishing Gear

Vessels

The same fishing vessels are used for both king and tanner crab in most areas. While there are many smaller vessels which fish more protected inside waters, the weather conditions during the crab seasons in the outside areas of Kodiak and westward make the use of larger vessels more favorable. The vessels used for crab fishing during the development of the fishery were converted gillnetters, herring seiners, or halibut boats. In many cases these were not satisfactory because of the unique requirements of the crab fishery. The crab fleet has developed through the short history of the fishery to the present status, where a large part of the fleet is made up of new steel-hulled vessels in the 80- to 120-foot range, which have been specially designed for the fishery. The Bering Sea crab fleet has been described as the most modern fleet of fishing vessels in the United States, except for the San Diego and San Pedro tuna fleets. There are new vessels, which cost in the range of 1 to 1.5 million dollars, joining the fleet as rapidly as boat yards around the country can turn them out.

Some of the basic requirements for the design of these vessels include:

- The ability to maintain stability and maneuverability with heavy loads of seawater in the circulating live tanks.
- A stable working platform for hauling the pots is required, because much of the present fishery is in outside water during times of the year when heavy seas are normally experienced. Vessels over 80 feet in length are generally preferred for this reason.
- A large deck area is required to carry the crab pots as they are moved from storage to the fishing grounds or from one fishing area to another. With some vessels fishing upwards of 300 pots, this capacity becomes essential for operation.
- A pilothouse which has good visibility of the deck area so the skipper can observe the deck men handling pots and maneuver the vessel alongside the buoys.
- The ability to diversify into other fisheries if necessary. An example of this capability for diversification is shown by many of the new vessels entering the fishery. They can fish king and tanner crab, tender for salmon, and convert to groundfish gear when that fishery becomes attractive in the future.

The numbers of vessels by management area are shown in Tables 51 and 52 for king and tanner crab. The vessel numbers are not additive to determine total fleet size because many vessels fish more than one area and both fisheries.

TABLE 51

REGISTERED TANNER CRAB VESSELS FOR KODIAK AND WESTWARD MANAGEMENT AREAS 1977-78 SEASON

Keel Length (In Feet)	Number of Vessels	Percentage of Total
<20	1	0.4
20-29	7	2.6
30-39	51	19.0
40-49	51	19.0
50-59	9	3.4
60-69	22	8.2
70-79	38	14.2
80-89	36	13.4
90-99	30	11.2
100-109	7	2.6
110-119	8	3.0
120-129	3	1.1
>130	5	1.9
TOTAL	268	100.0

Source: ADF&G Vessel Register 1977-78 Season.

TABLE 52

REGISTERED KING CRAB VESSELS FOR KODIAK AND WESTWARD MANAGEMENT AREAS 1977-78 SEASON

Keel Length (In Feet)	Kodiak		Sand Point		Dutch Harbor		Bering Sea		Multiple Registrations for Bering Sea[1] and		
	Number	Percentage of Total	Number	Percentage of Total	Number	Percentage of Total	Number	Percentage of Total	Kodiak	Sand Point	Dutch Harbor
<20	10	3.5	0	0	2	1.5	0	0			
20-29	27	9.6	0	0	4	3.0	1	.8	1		
30-39	93	33.1	8	20.0	2	1.5	3	2.4	1	1	1
40-49	43	15.3	15	37.5	7	5.2	7	5.6	1	4	2
50-59	6	2.1	5	12.5	1	.7	4	3.2		3	1
60-69	24	8.5	4	10.0	4	3.0	8	6.3	4	1	3
70-79	32	11.4	3	7.5	24	17.8	21	16.7	8	2	12
80-89	23	8.2	0	0	34	25.2	28	22.2	7		21
90-99	9	3.2	0	0	27	20.0	18	14.3	3		15
100-119	4	1.4	1	2.5	10	7.4	10	7.9	3	1	6
110-119	6	2.1	1	2.5	8	5.9	11	8.7	4	1	5
120-129	1	.4	3	7.5	3	2.2	7	5.6	1	3	3
>130	3	1.1	0	0	6	4.4	8	6.3	3		5
TOTAL	281	100.0	40	100.0	135[2]	100.0	126	100.0			

Source: Alaska Department of Fish and Game Vessel Registration 1977-78.

[1]The Bering Sea is a non-exclusive registration area: that is, a vessel registering intent to fish in another management area can also register to fish the Bering Sea, with the exception of area H (Cook Inlet).

[2]Includes three vessels for which the length was not given.

As shown in Table 53, the number of vessels making landings of king crab has increased in the areas of Cook Inlet, Kodiak, Dutch Harbor, and the Bering Sea during 1969 to 1976. The number of vessels fishing king crab in Southeast, Prince William Sound, Alaska Peninsula, and the Western Aleutians decreased over the same period. For tanner crab, the areas with the largest increases in number of vessels fishing were Prince William Sound, Cook Inlet, Alaska Peninsula, and the Bering Sea.

The length distribution for the currently registered king and tanner crab fleets is shown in Tables 51 and 52 for Kodiak and westward areas. This listing is made by ADF&G regional office in Kodiak and is not available for the other management areas in the state.

Data presented in Table 51 indicate that 41 percent of the vessels registered to fish tanner crab are less than 50 feet. Many of these vessels probably fish for salmon also as they are under the Alaska limit for seine vessels. Almost half (47 percent) of the vessels are from 60 to 99 feet, with the remaining 12 percent over 100 feet.

King crab vessels registered are listed by the three exclusive registration areas: Kodiak, Sand Point, and Dutch Harbor. The Bering Sea is a multiple registration area which allows vessels to register to fish there in addition to registering in one exclusive area. The exclusive registration areas for those vessels registered in the Bering Sea are shown in the last three columns of Table 52. The predominant registration combination is Dutch Harbor and the Bering Sea.

Gear on the Vessel

The hydraulic pot lifter is one of the most important pieces of crab gear. Its development has made the recovery of pots in heavy seas easier, and with less gear loss from lines that snapped from the strain of the pitching of the vessel as the pot is lifted. The hydraulic lifter presently in use is hung from a starboard davit and automatically compensates for added stress by paying out line as necessary, thereby maintaining a constant pressure on the line.

Sophisticated electronic gear is necessary to be able to locate the pot string, especially when visibility is poor. The use of Loran A or C is supposed to be able to guide the skipper to within 1,000 and 100 yards, respectively, of the pot string if calibrated correctly. This was confirmed in discussion with fishermen from Kodiak who said that by using Loran C they were guided consistently to within 100 yards of the pot string.

Pots

Several kinds of pots are used for king and tanner crab fishing. The most common type are square, measuring 7 ft x 7 ft x 2 1/2 ft or 6 ft x 2 1/2 ft. These pots are constructed of welded steel round bar and most commonly use nylon webbing, which is laced to an interior frame to prevent abrasion from rubbing on the sea bottom or while on the boat. They are strong enough to withstand stacking and hauling catches, which could weigh up to 2,000 pounds. These pots last approximately from three to five years, and the present cost has been estimated from $400 to $700 each when rigged ready-to-fish. Other types of pots used include other sizes of square pots from

TABLE 53

NUMBER OF VESSELS MAKING LANDINGS BY MANAGEMENT AREA 1969 TO 1976

Area	1969	1970	1971	1972	1973	1974	1975	1976
King Crab								
Southeastern	35	31	19	19	31	32	28	25
Prince William Sound	19	12	20	25	22	21	10	13
Cook Inlet	46	53	54	53	66	81	67	80
Kodiak	142	115	87	88	131	161	170	194
Alaska Pen.	63	45	31	33	39	37	40	28
Dutch Harbor	58	57	38	68	59	87	81	74
Bering Sea	69	57	56	74	68	105	104	142
W. Aleutians	75	59	62	50	62	39	42	20
Tanner Crab								
Southeastern	40	27	17	30	50	54	39	30
Prince William Sound	19	13	20	47	51	54	33	38
Cook Inlet	31	27	44	54	108	90	51	72
Kodiak	116	81	54	64	126	125	106	107
Alaska Pen.	34	33	18	30	40	65	47	70
Dutch Harbor	10	4	1	2	4	7	2	9
Bering Sea	42	27	9	13	22	26	27	66
W. Aleutians	1	0	0	0	13	6	1	2

Source: Commercial Fisheries Entry Commission, Alaska Shellfish Bio-Economic Data Base, 1977.

5 ft x 5 ft to 8 ft x 8ft, pyramid style pots, Japanese longline conical pots, and round pots. The three latter types of pots receive very little use. They have top openings which are reportedly less efficient than the side openings of the square pots. The Japanese longline pots have been tried in the Kodiak area but they were not very successful. The strong tidal currents shifted the entire strings along the bottom and they frequently became tangled with other gear.

In order to modify the square pots when converting from king crab to tanner crab, the tunnel entrance is partially closed, making a smaller opening.

Circulating Seawater Tanks

The circulating seawater tanks are part of the structure of the vessel itself and are necessary in order to keep landed crab alive until delivery to the processing plants. The critical determinants for crab survival are:

1. water replacement within the tank (pumping rate) which keeps the dissolved oxygen level at a tolerable level,
2. salinity,
3. temperature,
4. extent of crowding,
5. length of time held,
6. weather encountered which determines the amount of agitation within tanks.

Tanner crab are considerably more subject to dead loss than king crab because the shells are relatively thinner and weaker. When stacked in the circulating seawater tanks the weight of the crab piled above compresses the shell, restricting the movement of water across the gills for those crab in the bottom layers. This can result in asphyxiation if conditions are severe or prolonged. The problem is accentuated if weather conditions are unfavorable. The lower layer of crab in the tank can have their shells actually worn away from rubbing along the tank if the vessel is rolling heavily. Tanner crab are also extremely sensitive to increases in water temperature. Increased dead losses can be expected at water temperatures above 5° to 6° C (Hartsock 1975). The salinity of the ocean water which is circulating through the tank is as critical a factor as temperature. The adverse effects on the crab from these different factors are compounded if they occur simultaneously.

Buoys

The buoys used to locate the crab pots are usually Norwegian inflatable polyform buoys. Especially when fishing offshore, two buoys are used in order to provide enough buoyance to remain on the surface in strong tidal currents. A third "sea lion" buoy is often used which is made of styrofoam. In case the polyform buoys are punctured by a sea lion, the pot line can still be located by this third buoy.

Bait

For king and tanner crab, frozen herring are usually preferred although groundfish are also used. The bait is placed in perforated plastic jars and hung in the pot, usually in pairs. The quality of the bait is important to its effectiveness. The freshest bait will catch the most crab.

Fishing the Gear

The crab pots are fished individually in a string, usually set in a straight line to make it easier to locate the pots when they are pulled. The distance that the pots are set apart along the string will vary, depending upon the fishing area. If the skipper is prospecting a new area where the locations of crab concentrations are not known, then the string will be widely spaced in order to cover more area. Once the areas of concentration are located, the pots are spaced very close to one another to take advantage of the abundance of crab in that area.

Each pot is individually set after being baited and placed on the hydraulic pot launcher. The pot line is adjusted according to the depth of water, plus 25 percent to 50 percent if there are strong tidal currents. The pot is launched over the side and the vessel moves on to make another set. The interval between times the pots are lifted and emptied will vary considerably depending upon fishing conditions at the time, which would include weather, concentrations of crab, proximity to buyer, the size of the vessel, and the number of pots fished.

When approaching the string of pots, the skipper will come up to the buoys on the leeward side if possible without extra maneuvering. Otherwise the approach is made in the direction of travel. The bow of the vessel is pointed slightly into the wind to keep the deck men from being engulfed in spray from waves coming against the side of the vessel. The line from the pot to the buoys is caught by a grappling hook and run through the blocks on the pot lifter which rapidly raises the pot until the brindle reaches the blocks. As the pot is lifted, the line is coiled on deck to be ready to reset the pot. A line from the picking boom is hooked onto the frame of the pot and it is lifted aboard and emptied, rebaited and launched over the side again. The vessel then moves to the next pot in the string. The number of pots a vessel can lift in one day will again depend on a number of factors, with weather perhaps being most important; however, an estimate for the average number of pots which can be lifted in one day is 70 to 80 pots for Kodiak vessels and 100 to 150 pots for vessels in the Bering Sea, working around the clock.

Harvesting Capacity

Harvesting capacity estimates have been estimated by management area for king and tanner crab in Tables 54 and 55. Most of the data used to compute these estimates came from the Commercial Fisheries Entry Commission (Queirolo et al. 1978).

The daily and annual harvest capacity estimates were determined by the following method. The number of vessels fishing was determined from the number of vessels making landings in each management area in 1976. These

TABLE 54

KING CRAB HARVESTING CAPACITY BY AREA 1976

Area	Number of Vessels Fishing[1]	Estimated Mean Live Tanking Capacity (In Pounds)[2]	Calculated Harvesting Capacity per Landing (1,000 Pounds)	Average Number of Landings per Year for Each Vessel[3]	Estimated Harvesting Capacity per Year (1,000 Pounds)	Actual Landings (1,000 Pounds)	Guideline Harvest Levels, 1976 (1,000 Pounds)[4]
Southeast	25	31,666.7	791.7	4.20	3,325.0	398.2	1,200
Prince William Sound	12	11,900.0	142.8	6.15	878.2	17.2	500
Cook Inlet	79	30,637.5	2,420.4	13.21	31,972.9	4,954.4	5,000
Kodiak	194	48,391.4	9,387.9	5.72	53,698.9	17,521.8	14,000-24,000
Alaska Pen.	28	27,777.8	777.8	4.07	3,165.6	881.5	2,700- 5,300
Dutch Harbor	74	123,888.9	9,167.8	3.97	36,396.1	11,470.7	14,500
Bering Sea	142	117,647.1	16,705.9	7.70	128,635.3	70,410.8	40,000-60,000
Western Aleutians	11	135,000.0	1,485.0	1.00	1,485.0	386.4	...
Adak	...	...	...	...	...	...	1,500

[1] Alaska Shellfish Bio-Economic Data Base, Commercial Fisheries Entry Commission (CFEC). These are the actual numbers of vessels making landings in various management areas and are not additive. That is, vessels making landings in more than one area will be listed for each area fished.

[2] Survey by CFEC (see [1] above).

[3] CFEC computer file: R01-03V-4421, November 12, 1977.

[4] ADF&G Shellfish Commercial Fishing Regulations, 1976.

TABLE 55

TANNER CRAB HARVESTING CAPACITY BY AREA 1976

Area	Number of Vessels Fishing[1]	Estimated Mean Live Tanking Capacity (In Pounds)[2]	Calculated Harvesting Capacity per Landing (1,000 Pounds)	Average Number of Landings per Year for Each Vessel[3]	Estimated Harvesting Capacity per Year (1,000 Pounds)	Actual Landings (1,000 Pounds)	Guideline Harvest Levels, 1976 (1,000 Pounds)[4]
Southeast	30	38,062.5	1,141.9	9.09	10,379.9	4,069.6	4,750
Prince William Sound	38	25,794.1	980.2	12.68	12,428.9	6,000.4	15,500
Cook Inlet	72	42,042.1	3,027.0	11.83	35,809.8	5,935.3	15,000-25,000
Kodiak	107	59,991.9	6,149.1	8.98	57,643.8	25,128.9	0
Alaska Pen.	70	86,800.0	6,076.0	7.03	42,714.3	16,752.0	0
Dutch Harbor	9	155,000.0	1,395.0	1.78	2,483.1	551.3	0
Bering Sea	66	161,285.7	10,644.8	4.7	50,030.8	22,324.5	0
Western Aleutians	2	...	...	...	...	...	...

[1] Alaska Shellfish Bio-Economic Data Base, Commercial Fisheries Entry Commission (CFEC). These are the actual numbers of vessels making landings in various management areas and are not additive. That is, vessels making landings in more than one area will be listed for each area fished.

[2] Survey by CFEC (see [1] above).

[3] CFEC computer file: R01-03V-4421, November 12, 1977.

[4] ADF&G Shellfish Commercial Fishing Regulations, 1976.

numbers are not additive to determine the total fishing fleet size in Alaska because some vessels deliver to more than one area. The estimated mean live tanking capacity estimates come from a survey done by CFEC during the summer of 1977, and is an average of the vessels included in that survey. These estimated mean tank capacities are given in pounds of crab. The calculated daily harvest capacity by area was simply the product of the number of vessels fishing and the estimated mean live tanking capacity.

Daily harvest capacity estimates for each area were multiplied by the average number of landings made during the year by each vessel fishing in that management area to give the estimate of annual harvesting capacity. The estimate for the average number of days on which landings were made for each vessel were made from the computer files at CFEC which have stored the actual number of landings by area.

As seen from the tables, the calculated harvesting capacity is considerably larger than the actual landings for 1976. There are several suggested reasons for these differences. The estimates generated represent what would be the maximum possible amount of catch that could be kept alive and transported to the processor under ideal conditions. Under actual fishing situations, these conditions rarely occur. There are a multitude of variables upon which the amount of catch per trip will depend. These variables include rate of catch, condition of crab, water temperatures, weather conditions, and processor rotation schedules. It is significant to note that the areas for which the actual landings are the highest percentage of estimated harvesting capacity are those areas which produce most of the crab caught. For areas such as Southeast Alaska, which do not have large concentrations of crab available to harvest, the maximum capacity will not usually be utilized due to low levels of catch. This example helps to reinforce the reservations on harvest capacity estimates reflecting real conditions as stated above.

Processing

Most of the early U.S. king crab production ended up as frozen product, partially because of difficulty experienced in canning. The Japanese had been successfully canning king crab for many years before the U.S. started processing, but they were reluctant to divulge many of their processing methods. Consequently, domestic processors had to learn on their own. One of the major obstacles which had to be overcome was the development of machinery capable of extracting the meat from the legs, shoulders, and claws. Once this problem was resolved for king crab, the machinery had to be adjusted to handle the smaller tanner crab when they started to be processed in the late 1960s. Another problem faced was the blueing of the meat in the can. This was corrected through adjustments in the cooking process. Minor adjustments are still being made in processing methods; however, the basic steps are similar at all plants. The present processing methods being used are outlined in this section.

Processing Methods

There are similar basic methods used in processing king and tanner crab; however, the exact processing sequence and methods vary somewhat at each plant. The following description attempts to outline an average processing method.

Live crab are unloaded by hand from the holds of the fishing vessels. Those crab which have expired are set aside in piles to be discarded or used for reduction. If the crab are not going to be processed immediately, they are put into circulating seawater holding tanks which keep them alive. If the crab are going to be processed immediately, they are loaded into plastic totes or crab bags and taken into the processing area. Some plants ice the crab in the bins if there is some delay anticipated in order to slow the metabolism, thus keeping them alive longer.

The first processing station for the crab after they come out of the vessel or from the live tank is the butcher, where the crab are killed by grasping the legs on both sides of the body and pushing hard against a dull-bladed fixed knife. This removes the carapace and vicera. The crab are gilled by grinding against a rotating drum. After the crab are gilled, they can go either to the meat line to be processed into canned or frozen crabmeat, or to the section line to be processed into crab sections.

The decision on which product form the crab will be processed into is based upon:

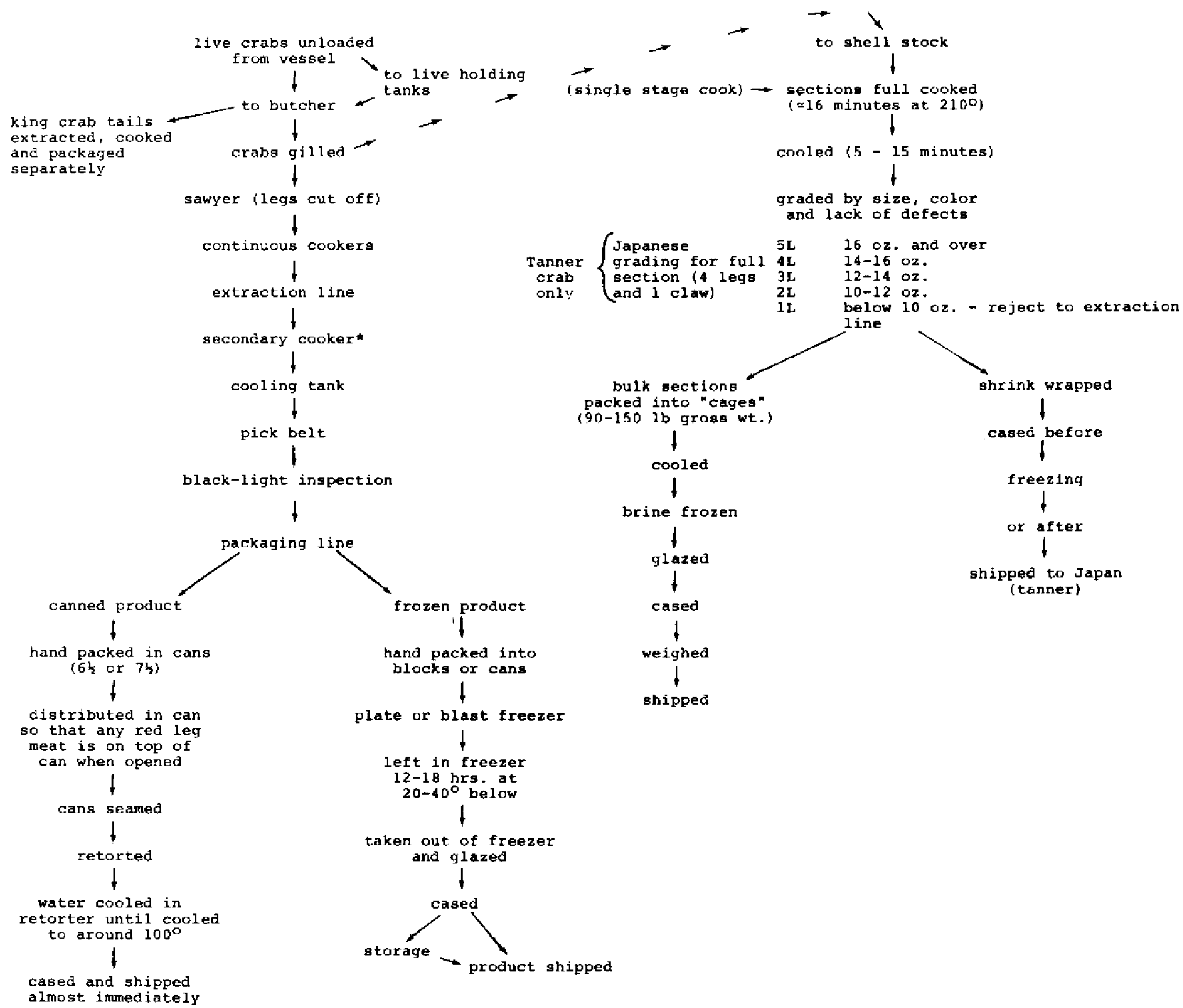
1. the processing equipment available,
2. size and quality of the crab,
3. current market conditions for different product forms,
4. the cost of production of the different product forms.

For purposes of clarity, the meats and section processes are discussed separately below; however, at some processing plants, which have the facilities to do so, these are both run concurrently. There is a flow diagram of the processes given in Figure 11.

Processing of Crab Meats

From butchering to the second cook, the process is the same whether crab meat is destined to be canned or frozen. Usually crab meat processing uses a two-stage cook, partly to help combat the problem of blueing in canned crab. In plants which do not have a canning line, the processing method for frozen meats uses only a single-stage cook.

Following through the flow diagram, from the first processing station the crab goes into a continuous cooker where the leg and body meat is cooked. As soon as possible after the crab comes out of the cooker, the legs and bodies are squeezed in rubber rollers to extract the meat. The shells from the legs go through the rollers and the meats which are squeezed out from the shell are moved into a running water trough where shell bits are dropped out. The shoulder and claw meats are removed from the shell by jets of water and go through a similar water trough to settle impurities.



*in a plant where canning is not done, processing method for frozen meats utilizes a single stage cook.

FIGURE 11. STEPS IN PROCESSING KING AND TANNER CRAB

The crab now goes through the second cook, after which the extracted meat is cooled in the cooling tank or tube. Either before or after the second cook, the meat goes through a pick belt where bits of shell and other extraneous materials are removed. Several plants also use a black light as a final inspection in order to be able to see and remove small bits of shell. Up to this point, the process is the same for meats destined to be canned or packed into frozen packages.

If the product form is to be frozen meats, the meat is now hand packed into blocks. These blocks are built in three layers with red meats on the bottom layer, shoulder, claw, and leg tip white meat in the middle layer, and merus (leg meat) for the top layer. The crab meat is packed into a wax-lined cardboard carton which has been placed inside an aluminum freezing pan. The blocks are formed into lengths that vary in size. One size that is common is the 15-pound block called a "long john." The blocks are frozen in a plate or blast freezer. After freezing, they are cased and then shipped immediately or stored for shipping when transportation becomes available.

The meats for canning are packed by hand into the cans. A layer of parchment is put into the bottom of the can to prevent the red pigmentation from leaking onto the plating of the can. Leg portions are cut and fitted for the first layer, and then the can is topped with body meat and incidental red meat. The cans are labeled upside down so that the bottom of the can as packed becomes the top, and when opened by the consumer, the red meat shows first. After filling, the cans are seamed, retorted, and then cooled in water until they are around 100^{o} F. At this time they are cased and are ready to ship. King crab tails are not processed along with the other meats but are extracted, cooked, packaged, and frozen separately.

Processing of Crab Sections (Shell Stock)

After the butcher station, crab destined for sections or brine section pack go to the cooker. Again this is a continuous cooker and generally crab section processing uses a single stage cook. The sections are cooled after cooking to avoid salt absorption, and then are packed into wire cages for freezing or they can be individually wrapped (cryovac shrink wrapping). Tanner crab sections (four legs and one claw) for export to Japan are graded by size according to the following classifications:

5L = 16 oz & over	Premium quality
4L = 14 oz - 16 oz	Premium quality
3L = 12 oz - 14 oz	Premium quality
2L = 10 oz - 12 oz	
Under 10 oz - reject	

The individual sections are frozen (blast frozen generally) and cased. They are then ready for shipment.

Bulk sections are packed into wire "cages" (90 to 150 pound gross weight). They are frozen in a continuous brine immersion freezer, then cased and shipped. Sections processed in this manner are destined to be marketed as sections or can be reprocessed further at plants in Washington or California.

King crab sections for export to Japan do not have the same grades as tanner crab. They are frozen in bulk and shipped to Japan in that form. Upon arrival in Japan, they are reprocessed into a canned product.

New Developments in Crab Processing Methods

A new processing method which has recently developed for tanner crab sections is to freeze them in a raw (green) form without any cooking. At present, sections processed in this manner are destined only for the section market in Japan. To process, the green sections are dipped in a solution containing chemicals supplied to the processor by Japanese companies. The purpose of the solution bath is to prevent blueing of the frozen section.

There have been significant quantities of tanner crab processed by this method this year (1978), and sold to the Japanese section market. The advantage to the processor is to reduce processing method steps necessary and, therefore, reduce processing costs per unit of finished product. At present, the chemicals in the bath used to prevent blueing in the sections have not been approved by the FDA for use in this country; however, persons in the industry indicated that this is because of the amount of time necessary for the FDA to approve new chemical processes. When it is presented for approval for use for product for domestic market, it was felt that this process will be approved by the FDA. The process of approval takes several years however, therefore, sections processed raw will not be immediately available to the domestic market.

The locations of the shellfish processing plants in Alaska are shown in Figure 12 on the following page. Most of the processing plants are concentrated in two areas: Dutch Harbor/Unalaska/Akutan and the Kodiak area.

Most processing plants process both king and tanner crab. Since the fishing seasons are at different times of the year for these species, conflicts for processing facilities of the plants do not occur. There is some overlap of shrimp processing during the times crab are being processed, but the equipment used for shrimp is generally different. Unless labor or common processing facilities such as freezing space is a constraint, processing two species at one time will not reduce crab processing capacity. The amount of catch by month for king crab, tanner crab, and shrimp is shown in Figure 13 for the 1977 catch. From this, the time distribution during which the product will have to be processed can be seen.

Processing Capacity and Capacity Utilization

In some areas of the state such as Dutch Harbor, the new processing plants being built and the additions to existing facilities are increasing processing capacity rapidly. These processing capacity estimates were determined by data which were current at the time of this study. The point to be made is that the crab processing industry is dynamic, therefore, it is necessary to update processing capacity figures as increases (or decreases) occur.

The processing capacity for king and tanner crab was calculated from data collected by surveying individual processing companies in spring and

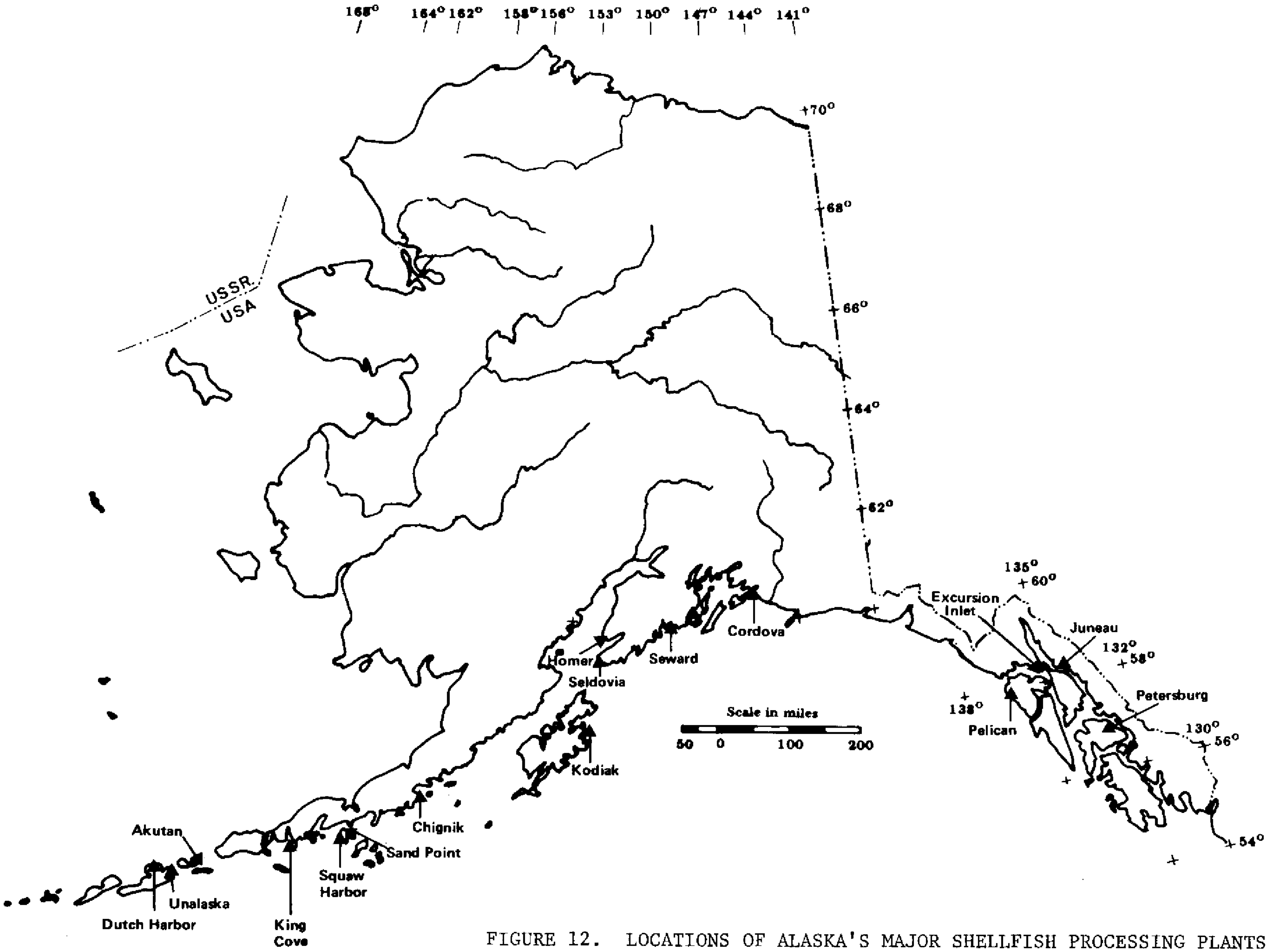


FIGURE 12. LOCATIONS OF ALASKA'S MAJOR SHELLFISH PROCESSING PLANTS

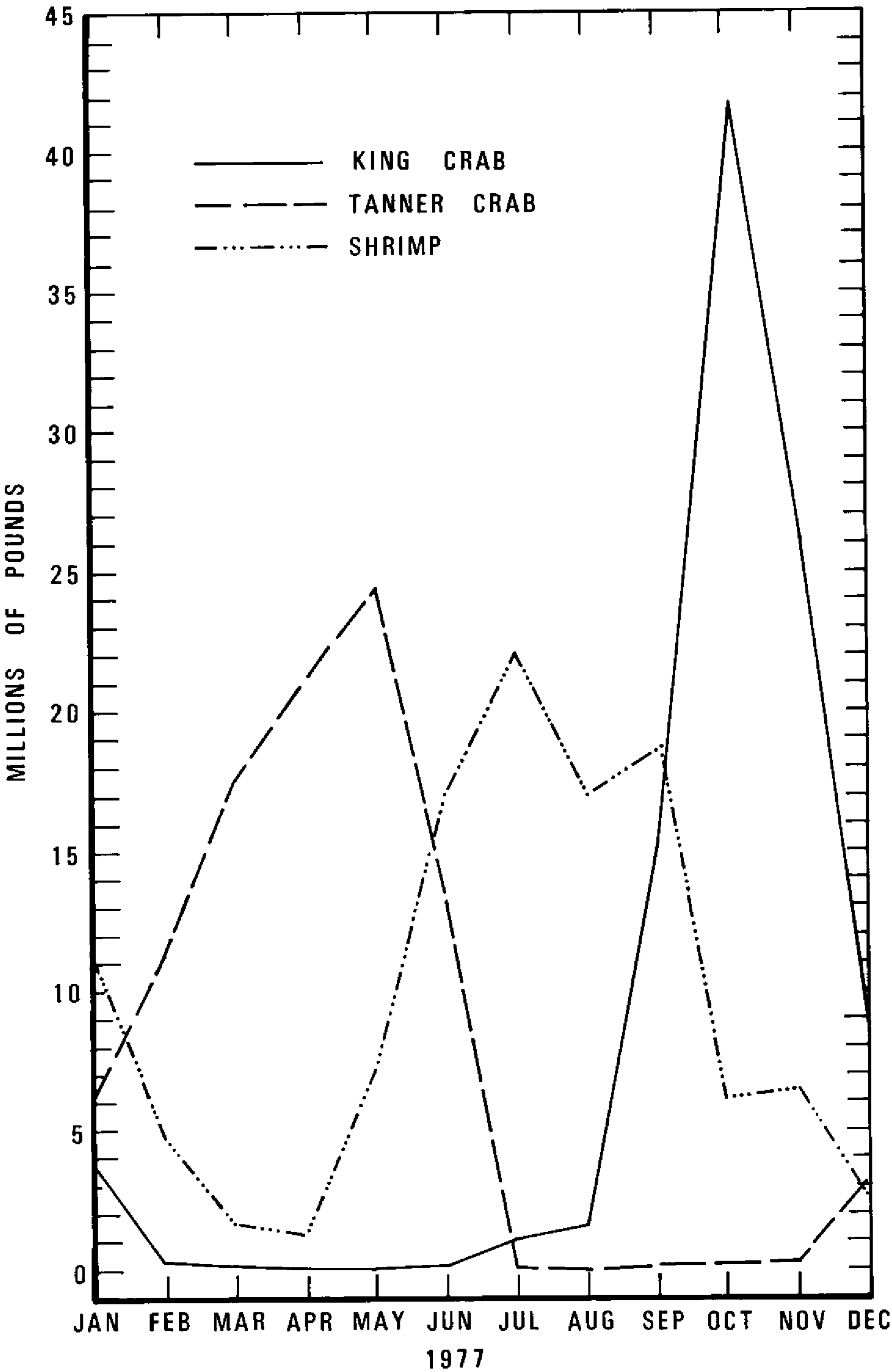


FIGURE 13. RELATION BETWEEN ALASKAN MONTHLY TANNER CRAB, KING CRAB, AND SHRIMP CATCHES, ALL AREAS, 1977

summer 1977, updated for the addition of new processing facilities in early 1978. The processing capacity estimates are divided into management areas. A listing of these areas, and their respective percentage contribution to the 1977 catch are listed in Table 56.

The processing capacity estimates for these areas are shown on the next page in Table 57 and are then discussed by area. In all cases, the maximum capacity estimates were determined from information provided by the plant managers or other company personnel. It should be noted that the capacities are for king crab <u>or</u> tanner crab. Both species are not processed at the same time. The conditions under which the maximum harvesting capacity was determined were:

1. The maximum number of pounds of raw (round weight) crab which could be processed during a 24-hour period using existing capital equipment and facilities.
2. Production downtime for cleaning and maintenance was to be taken into consideration.
3. Limits on the supply of available labor were taken into account; however, if a plant was operating a double shift or had the capability of operating a double shift, then this capability was included in the capacity estimate.
4. The estimates are generally for production of crab sections. Many plants have the capacity to can or freeze crab meats, and if meats are processed instead of sections, the capacity is less than for section production. The determination of which product will be produced will be determined by each plant in reaction to market conditions existing at the time.

The calculated capacity utilization rates from current area catch amounts and the maximum capacity estimates provide an indication of how much of the plant processing capacity in each area is used on the average. It should be recognized that the raw product does not come to the processing plants in a constant rate of supply during the fishing season. Catches are determined by exogenous factors such as weather, concentrations of stocks fished, and distance of the catch areas from processing plants. These factors, plus the fact that shellfish are difficult to hold before processing without substantial loss of quality, tend to make production amounts vary extensively during the season. In order to be able to handle the necessary peaks of product deliveries to the plants, some unutilized capacity is inevitable during more slack periods.

<u>Southeastern Alaska</u>

There are six plants in the Southeastern area processing king and tanner crab products. These are:

Alaska Glacier Seafood Company
Excursion Inlet Packing Company
Icicle Seafoods, Inc.
Juneau Cold Storage
Pelican Cold Storage Company
St. Elias Ocean Products, Inc.

TABLE 56

KING AND TANNER CRAB CATCH BY AREA 1977
(In Percent of Total Catch)

Area	King Crab	Tanner Crab
Southeastern	.3%	3.4%
Prince William Sound	.1	2.9
Cook Inlet	2.0	5.8
Kodiak	13.3	21.1
Westward*	84.3	66.8

Source: Alaska Department of Fish and Game, Monthly Shellfish Report.

*Includes processing plants at Chignik, Southern Peninsula, Akutan, Dutch Harbor, and Unalaska.

TABLE 57

KING AND TANNER CRAB MAXIMUM DAILY PROCESSING CAPACITIES BY AREA
(In Thousands of Pounds Round Weight)

Area	King Crab	Tanner Crab
Southeastern	699	625
Prince William Sound		265
Cook Inlet	210	200
Kodiak	1,432	1,134
Westward*	2,631	2,039

Source: Alaska Department of Fish and Game, Monthly Shellfish Report.

*Includes processing plants at Chignik, Southern Peninsula, Akutan, Dutch Harbor , and Unalaska.

The total maximum harvesting capacity for these plants is listed below:

King crab	699,000 pounds per day
Tanner crab	625,000 pounds per day

In 1977 the catch of king and tanner crab in the Southeastern area was 312,355 pounds and 3,373,392 pounds respectively. Obviously, king crab is not a major production species for these plants. Three of the six plants which did process king crab operated from four to 35 days with an average operating period of 21 days. The amount of crab available for processing is the main limiting factor for these plants. Tanner crab is a more significant product for the plants in Southeast. The number of days of operation ranged from 19 to 145 in 1976 with an average annual operation of 72 days. It was stated by several plant managers that, if the raw product were available, they could operate 225 days over a nine-month season without any problem; however, it is not likely that this amount of crab will become available.

With the present processing capacity and 1977 harvest levels, the capacity utilization rates for these plants has been calculated over a possible range of annual days of operation and are shown in Table 58.

From Table 58, it can be seen that there is considerable excess processing capacity for king and tanner crab in the Southeast area. It should be recognized that due to the abundance available for production, tanner crab, and especially king crab, are not full-time fisheries in this area.

Prince William Sound

There are three plants in the Prince William Sound (PWS) area processing king and tanner crab. Processing of king crab is not significant due to the low abundance of harvestable size king crab.

The processing plants which have capability to process crab are:

Morpac, Inc.
North Pacific Processors
Seward Fisheries

Only two of these plants process king crab, however, so the processing capacity estimate for king crab cannot be released, as this would allow identification of an individual firm's contribution. The total harvesting capacity estimate for tanner crab is 265,000 pounds of raw crab per day. This capacity received very little use in 1977.

Cook Inlet

There are three crab processing plants in Cook Inlet:

Pacific Pearl Seafoods	Seldovia
Seward Fisheries	Homer
Whitney-Fidalgo Seafoods, Inc.	Homer

TABLE 58

CAPACITY UTILIZATION, KING AND TANNER CRAB FOR SOUTHEAST ALASKA

		Annual days of operation		
		150	100	50
Pounds/day processed[1]	King	2,082	3,124	6,247
	Tanner	22,489	33,734	67,468
Capability utilization[2] (percent)	King	.3	.4	.9
	Tanner	3.6	5.4	10.8

[1]Calculated using 1977 Southeast area catches of 312,355 pounds of king crab.

[2]Calculated using maximum processing capability of 699,000 pounds per day of king crab and 625,000 pounds per day of tanner crab.

These plants have a total maximum processing capacity of:

King crab	210,000 pounds per day
Tanner crab	200,000 pounds per day.

The annual days of operation in 1976 averaged 47.5 days for king crab and 80 days for tanner crab. With the present processing capacity and the 1977 harvest levels, the capacity utilization rates for these plants have been calculated over a possible of annual days of operation and are shown in Table 59.

With a 50-day operating season, which is approximately the length of operation in 1976, the king crab capacity utilization is less than 20 percent. With the 1976 tanner crab average operating season, the capacity utilization would be 35 percent. Increasing the days of operation would reduce the daily capacity utilization rate. If the operating season were shortened, this would increase the daily capacity utilization rate; however, it appears that this would present no problem as there is excess processing capacity.

Kodiak

The processing companies surveyed in Kodiak are listed below by company and by plant where more than one plant is owned by the same company.

Alaska Pacific Seafoods, Inc.
Alaska Packers Association, Inc.
B & B Fisheries, Inc.
East Point Seafood Company
Kodiak King Crab, Inc.
New England Fish Company
North Pacific Processors, Inc.
Pacific Pearl Seafoods - main plant
 - Roxanne Division
Pan Alaska Fisheries - Magellan Barge
 - Skookum Chief
Swiftsure Alaska, Inc.
Ursin Seafoods, Inc.
Whitney-Fidalgo Seafoods, Inc.

Other plants in Kodiak which were not included in the capacity estimates because they could not be contacted were: Northern Lights Native Group plant at Port Lyons, the C & C plant at Ouzinkie, and EAC Americo at Middle Bay.

The capacity estimates include data from 13 (all but one of the above plants) which were obtained by individual survey during May 1977. At that time, the major target for the survey was tanner crab data, therefore, capacity estimates for king crab production were not obtained for all plants surveyed. Rather than going through the procedure of resurveying the remaining eight plants for which king crab capacity data was not collected, a ratio of king crab to tanner crab processing capacity for Westward was determined from the capacity estimates for that area. The tanner crab processing

TABLE 59

CAPACITY UTILIZATION, KING AND TANNER CRAB FOR COOK INLET

		Annual days of operation		
		150	100	50
Pounds/day processed[1]	King	13,537	20,306	40,612
	Tanner	37,702	56,554	113,108
Capacity utilization[2] (percent)	King	6.4	9.4	19.3
	Tanner	18.8	28.3	56.6

[1]Calculated using 1977 Cook Inlet area catch of 2,030,603 pounds king crab and 5,655,390 tanner crab.

[2]Calculated using maximum processing capability for king crab 210,000 pounds per day; for tanner crab 200,000 pounds per day.

capacity for the missing eight plants was multiplied by this ratio (which was 1.3), to determine king crab processing capacity. That is, an individual plant in Kodiak is able to process an average of 1.3 times as much raw king crab as tanner crab during a given period. This is due to the larger size of the king crab with respect to the tanner crab. The crab have to be handled individually, therefore, a larger per unit weight results in an increased overall capacity. It is recognized that this ratio will change from plant to plant; however, on the average, this method should yield reasonably accurate estimates for king crab processing capacity.

The maximum processing capacity estimates for the Kodiak area are listed below. These figures include estimates from all but one of the 14 listed processing plants.

King crab	1,431,600 pounds per day
Tanner crab	1,133,700 pounds per day

The number of days of operation can vary from 60 to 120 days operating per year. During the 1977-78 season, the king crab quota was caught during 122 days. The 7-inch season was open from September 15 to November 30, and the 8-inch season was open from November 30 to January 15. The tanner crab quota was caught in 96 days, from January 1 to April 6. Significant amounts of crab from other areas such as the South Peninsula and the Bering Sea can be delivered after the Kodiak season closing date; however, most of the crab processing in Kodiak will be done during this period. The capacity utilization rates for the 1977 Kodiak catch over a range of possible operating days is shown in Table 60. From this table, it can be seen that, with current catch levels and length of operating season, there is considerable crab processing overcapacity in Kodiak, especially for king crab.

Westward

The Westward area consists of catches from Chignik, South Peninsula, Aleutian Islands East (Unalaska), Aleutian Islands West (Adak), and the Bering Sea. There are 25 plants in this area listed below by company and processing locations or vessels.

Alaska Packers Association Association, Inc.
  Chignik Plant
Alaska Shell, Inc.
  M/V Alaska Shell
  M/V Northern Shell
All Alaskan Seafood, Inc.
  M/V All Alaska
Deep Sea, Inc.
  M/V Deep Sea
Dutch Harbor Seafoods, Inc.
  M/V Galaxy
New England Fish Company
  M/V Theresa Lee
Pacific Pearl Seafoods
  M/V Akutan
  Captain's Bay Point
  Sand Point Plant
  Dutch Harbor Plant

TABLE 60

CAPACITY UTILIZATION, KING AND TANNER CRAB FOR KODIAK

		Annual days of operation		
		150	100	50
Pounds per day processed[1]	King	92,811	139,216	276,432
	Tanner	220,169	330,254	660,508
Capacity utilization[2] (percent)	King	6.5	9.7	19.4
	Tanner	19.4	29.1	58.4

[1]Calculated using 1977/78 Kodiak area catches of 13,921,611 pounds of king crab and 33,025,396 pounds of tanner crab.

[2]Calculated using maximum processing capacity of 1,604,650 pounds per day king crab and 1,133,700 pounds per day tanner crab.

Pan Alaska Fisheries
M/V Royal Alaskan
M/V Royal Sea
Unalaska Plant
Pelican Cold Storage Company
M/V Priscilla Ann
Peter Pan Seafoods, Inc.
King Cove
Queen Fisheries, Inc.
M/V East Point
Sea Alaska Products
M/V Sea Alaska
M/V Sea Producer
Trident Seafoods Corporation
M/V Billican
Universal Seafoods, Ltd.
M/V Unisea
Vita Food Products, Ltd.
M/V Vita
M/V Viceroy
Whitney-Fidalgo Seafoods, Inc.
M/V Mokahana
M/V Whitney

This area contributes the major part of the Alaska catch for both king and tanner crab (84.3 percent and 66.8 percent of state catch in 1977, respectively), and correspondingly has the largest processing capacity. There are several new processing plants which have added to the capacity of this area and many of the other plants have expanded their facilities. The estimates of individual plant capacity for king and tanner crab were updated in January 1978 to include these additions. The following total capacity include all but one of the 25 plants listed.

King crab	2,631,000 pounds per day
Tanner crab	2,033,545 pounds per day

The number of days of operation for these plants varied from 71 to 170 days for tanner crab. The king crab operating season is shorter than the operating season for tanner crab because the king crab quotas are caught during a shorter period of time due to the intense fishing pressure.

The capacity utilization for the 1977-78 Westward area catch level over a range of possible operating days is shown in Table 61.

TABLE 61

CAPACITY UTILIZATION, KING AND TANNER CRAB FOR WESTWARD AREA

		Annual days of operation		
		150	100	50
Pounds per day processed[1]	King	558,900	838,350	1,676,700
	Tanner	437,902	656,852	1,313,705
Capacity utilization[2] (percent)	King	21.2	31.9	63.7
	Tanner	21,5	32.3	64.6

[1]Calculated using the 1977 Westward area catch of 83,834,933 pounds of king crab and 65,685,247 pounds of tanner crab.

[2]Calculated using the Westward area maximum processing capacity of 2,631,000 pounds per day for king crab and 2,033,545 pounds per day for tanner crab.

CHAPTER VI

THE HISTORY OF THE SHRIMP FISHERY IN ALASKA

Foreign Shrimp Fishing in Waters Off Alaska

Shrimp were first harvested in the Eastern Bering Sea and the Gulf of Alaska by Japanese and USSR fishing fleets. The histories of these fisheries are described for each country below.

Japanese Shrimp Fishery

Bering Sea. The Japanese began the first foreign shrimp fishery in Alaskan waters in 1961 north of the Pribilof Islands in the Bering Sea (Chitwood 1966). During the initial year of fishing effort, 16 trawlers delivering to one factory ship landed over 31 million pounds of shrimp.[1]

As shown in Table 62, the peak Japanese harvest of shrimp from the Eastern Bering Sea was in 1963 when over 60 million pounds were landed. After this year, the catch and effort declined through 1968, when less than one million pounds were landed. After 1968, the abundance of shrimp was apparently not at a sufficiently high level to economically continue to harvest them. The decline in abundance was apparently due to overfishing and perhaps other factors. After 1968, there was no directed Japanese fishery for shrimp in the Eastern Bering Sea, however, catches were made incidentally to other trawl fisheries. Statistics on the amount of incidental shrimp catches are not available. NMFS surveillance and law enforcement personnel observed three Japanese vessels fishing shrimp northwest of the Pribilof Islands during July and August of 1976. One vessel was boarded and its captain reported that catch rates were in excess of ten metric tons per day.[2]

By agreement after the implementation of the 200-mile limit, the Japanese through 1977 and 1978 must return to the ocean all the incidental shrimp catch from the Eastern Bering Sea. In 1979 the North Pacific Fishery Management Council will determine if foreign fishing is going to be allowed in this area and what the quotas will be.[3]

There is apparently still Japanese interest in fishing the Eastern Bering Sea near the Pribilof Islands. In August 1977, NMFS was approached by representatives from the Japan Fishery Agency with a proposal to allow a 600 metric ton shrimp catch for exploratory purposes. This proposal was declined by the NPFMC.

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[1]Catch figures are taken from Table 63 which do not agree with the catch listed by Chitwood. Since the data source is the same for both tables (INPFC), it is assumed that the latter table contains revised catch figures and these have been used.

[2]NPFMC, Preliminary Fishery Management Plan for Shrimp, December 1976, p. 47.

[3]M.I. Hutton 1978, personal communication.

TABLE 62

JAPANESE CENTRAL BERING SEA SHRIMP FISHERY STATISTICS

Year	Factory ships	Trawlers	Shrimp	Period of fishing Began	Period of fishing Ended
	Number	Number	Tons		
1961	1	16	11,250	February	December
1962	3	38	23,100	February	December
1963	2	31	34,775	February	December
1964	2	23	22,550	February	December
1965	2	27	7,630	March	September
1966	1	13	3,230	May	August

Source: P. E. Chitwood, Japanese, Soviet and South Korean Fisheries Off Alaska, Washington, D. C., U.S. Fish and Wildlife Service, 1966.

TABLE 63

FOREIGN CATCHES OF SHRIMP FROM
THE GULF OF ALASKA AND THE BERING SEA 1961 TO 1973
(In Thousands of Pounds)

	JAPAN			USSR
Year	Bering Sea	Gulf of Alaska	Total	Gulf of Alaska
1961	31,128.0	0.0	31,128.0	0.0
1962	40,543.3	0.0	49,543.3	0.0
1963	59,815.0	1,442.0	61,257.0	0.0
1964	45,262.0	5,225.8	50,487.8	8,890.6
1965	19,490.0	185.2	19,675.2	15,401.9
1966	6,679.7	1,045.2	7,624.9	23,104.0
1967	7,280.9	560.0	7,840.0	25,103.9
1968	994.4	2,904.0	3,898.4	6,301.9
1969	0.0	0.0	0.0	11,701.9
1970	0.0	0.0	0.0	9,300.7
1971	0.0	0.0	0.0	10,400.9
1972	0.0	0.0	0.0	5,100.2
1973	0.0	0.0	0.0	4,410.0

Source: National Marine Fisheries Service, Preliminary Fishery Management Plan, Shrimp of the Eastern Bering Sea and Gulf of Alaska (Juneau: December 1976), pp. 17 and 18. (Original sources cited as INPFC 1971 and 1972 Statistical Yearbook and U.S.-USSR data exchanges).

Gulf of Alaska. The Japanese shrimp catch from the Gulf of Alaska for the years 1963 to 1968 is shown in Table 63. The fishing took place near the Shumagin Islands and offshore from Twoheaded Island.[4]

Processing of the Japanese shrimp catch was by factory ship operation. Catch from the trawlers was transferred in baskets to the factory ship and shoveled to conveyors which carry the shrimp to the peelers on deck. The peeled shrimp then go below deck to be cooked and canned or frozen (Chitwood 1966).

Soviet Shrimp Fishery

The first known Soviet shrimp fishery in Alaskan waters was during a one month period during the spring of 1963, when six large freezer/trawlers fished just north of the Pribilof Islands. Previous to this, the Soviet shrimp fishery was restricted by lack of suitable vessels to inshore waters near their own coast. During 1962-63, a medium-sized freezer/trawler was developed which facilitated the exploitation of more distant fishing areas. In 1964, two of the new vessels fished the same area in the Eastern Bering Sea from February until mid June. Another two vessels fished off the southwest coast of Kodiak near the Trinity Islands from late October until early December.

After 1964, Soviet shrimp fishing effort was shifted entirely to the Shumagin Islands area. In 1965, the ex-vessel fleet which started fishing in February increased to ten by the end of the year with the effort divided between southwest Kodiak Island and the Shumagin Islands. During 1966, the Soviet fishing effort was concentrated mostly in the Shumagin Islands area and by the end of the year, 18 freezer/trawlers were operating there. Also during 1966, the freezer/trawler fleet was joined by a cannery factor ship which allowed complete processing of shrimp on the fishing grounds. Prior to the arrival of the factory canning ship, the shrimp catch was frozen in the round by the freezer/trawlers and processed when it was delivered to shore facilities in Soviet ports (Chitwood 1966).

In October 1966, the approval of Public Law 89-658 established a fisheries zone contiguous to the territorial sea of the United States. This nine-mile contiguous zone carried the same rights as the U.S. territorial sea and so the exclusive fishery zone was effectively extended from three to 12 miles. A significant part of the previous Soviet shrimp fishery took place within this zone so the act had the effect of restricting Soviet participation in the shrimp fishery off Alaska.

The amount of Soviet shrimp catch in the Gulf of Alaska increased from less than nine million pounds in 1964 to the peak year of 1967 when over 25 million pounds were harvested. It subsequently declined to less than four and one-half million pounds by 1973 (Table 63).

In March 1967, there were two prosecuted Soviet shrimp fishery violations; one violation of the territorial waters and one violation of the contiguous fishery zone. These violations resulted in fines to the master of $5,000 and

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[4]NPFMC, Preliminary Fishery Management Plan for Shrimp, 1976.

$10,000 respectively. There were two other contiguous fisheries zone violations which were prosecuted in 1971 and 1974. These violations resulted in fines and civil suits totaling $50,000 and $250,000, respectively. There has not been any Soviet shrimp fishing off Alaska since 1974.

The relationships between the foreign and U.S. shrimp fisheries can be seen from Figure 14.

U.S. Shrimp Fishery in Alaska

The first shrimp processing plant in Alaska was started in 1915 in Thomas Bay, north of Petersburg. The catch was initially made entirely by beam trawl and grew from 164,000 pounds in 1916 to 2.2 million pounds in 1921 when there were four shrimp processors in the Petersburg-Wrangell area processing the catch. The shrimp catch for the Southeast area fluctuated between 1.7 and 5.5 million pounds between 1921 and 1956. During this period, the landed shrimp were cooked, picked by hand, and packed into cans which were sealed and kept refrigerated or frozen until they reached the market. Expansion of the shrimp fishery was limited by the amount of hand labor necessary to pick the shrimp.

In 1957, the mechanical shrimp peeler was introduced in Wrangell. This enabled the processing of the peak catch for the Southeastern area of 7.6 million pounds in 1958. After that year, the shrimp catch for the Southeastern area declined and has averaged less than one million pounds since 1970.

The introduction of the mechanical peeler precipitated the development of the shrimp fishery in the Kodiak area. In 1958 one processing company installed three peeling machines (Jackson 1968), and from this start, Kodiak quickly became the dominant area of the shrimp fishery in Alaska. The catch of shrimp increased rapidly in Kodiak, reaching a peak catch of 82.2 million pounds in 1971, after which the catch was restricted by quota. Each year from 1965 until 1972, the Kodiak area produced more than 80 percent of the Alaska production of shrimp as shown in Figure 15 and Table 64.

As the shrimp catch in Kodiak declined after 1971, fishing effort increased in the Chignik-South Peninsula area. The catch for this area has increased from 5.5 million pounds in 1968 to 74.2 million pounds in 1977, and for the past two years has surpassed the Kodiak catch (see Figure 15 and Table 64). The South Peninsula is now the dominant shrimp producing area in the state and has the largest concentration of fishing effort. The processing capacity from this area is growing rapidly in order to handle the increased catches.

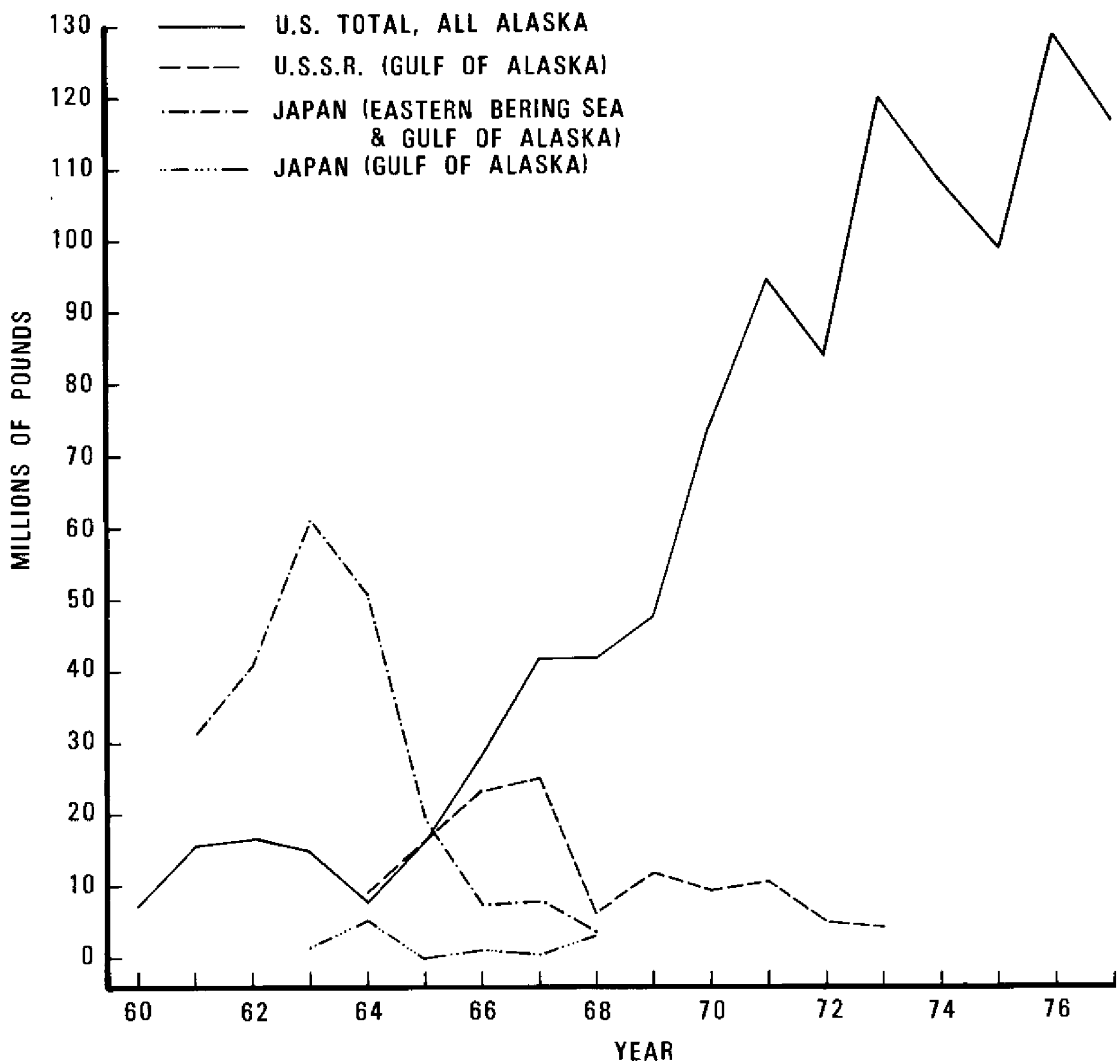

FIGURE 14. SHRIMP CATCH BY FOREIGN AND DOMESTIC FLEETS 1960 TO 1977

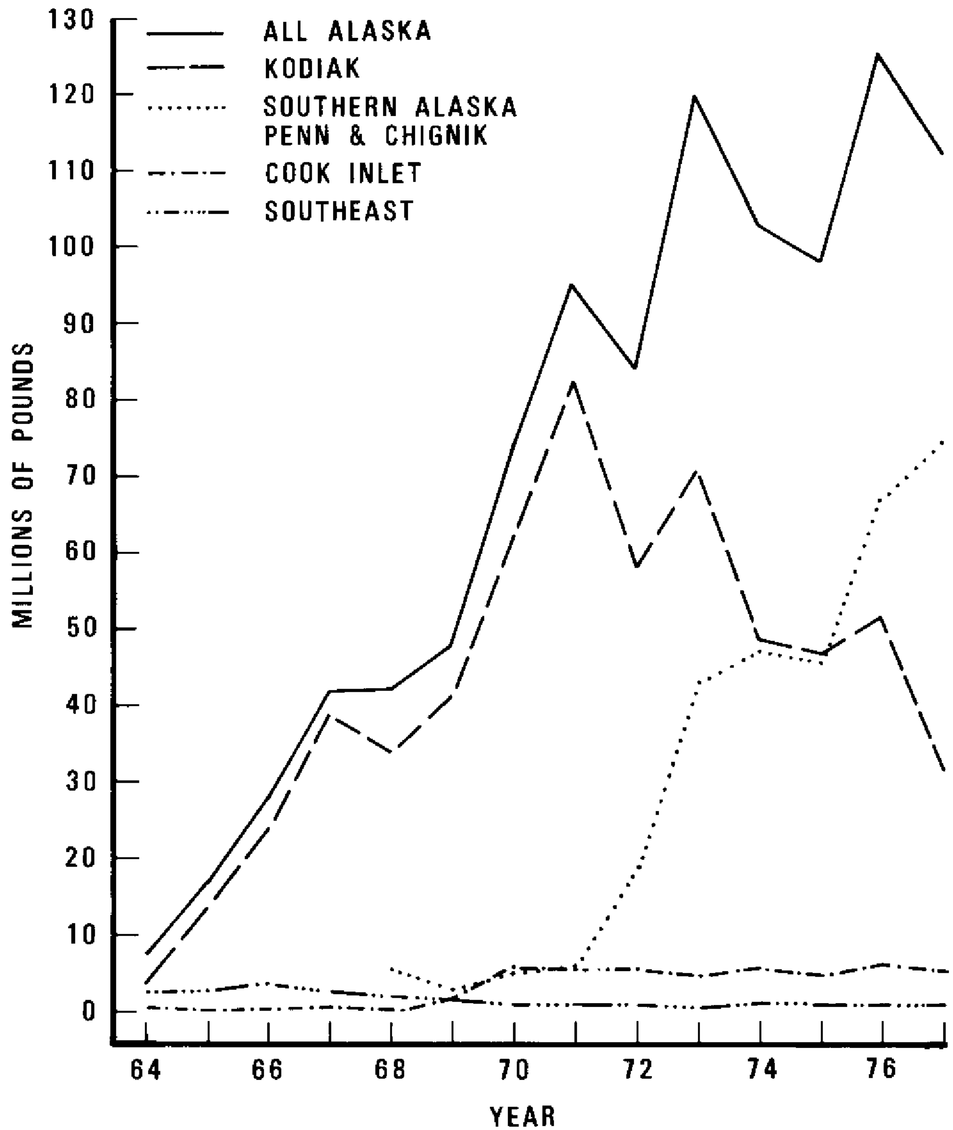

FIGURE 15. SHRIMP CATCH OF DOMESTIC FLEETS BY AREA 1964 TO 1977

TABLE 64

ALASKA SHRIMP CATCH BY MANAGEMENT AREA 1964 TO 1977
(In Pounds)

Year	All Alaska	Kodiak	S. Alaska Pen. & Chignik	Cook Inlet	Southeastern
1964	7,724,630	4,330,120		601,410	2,793,100
1965	16,819,450	13,810,170		64,500	2,944,780
1966	28,192,376	24,097,700		309,676	3,785,000
1967	41,812,600	38,267,900		741,400	2,803,300
1968	42,019,600	34,361,600	5,527,600	26,700	2,103,700
1969	47,848,000	41,243,500	3,076,900	1,847,200	1,680,400
1970	74,246,400	62,181,200	5,289,700	5,817,600	957,900
1971	94,884,600	82,153,700	6,319,900	5,451,300	959,700
1972	83,726,800	58,352,300	18,905,900	5,548,600	920,000
1973	119,499,800	70,511,500	43,380,200	4,897,100	711,000
1974	102,978,200	48,771,100	47,258,800	5,748,900	1,199,400
1975	98,061,600	46,759,100	45,527,300	4,753,100	1,023,100
1976	125,168,886	51,400,472	66,588,266	6,201,528	978,620
1977	112,141,250	31,801,573	74,252,115	5,136,876	950,686

Source: ADF&G Statistical Leaflets, 1964 to 1975.
ADF&G Monthly Shellfish Reports, 1976 to 1977.

CHAPTER VII

THE SHRIMP RESOURCE

There are nine species of pandalid shrimp found in waters off Alaska, five of which are caught commercially. These species are: pinks (Pandalus borealis), humpies (P. goniurus), sidestripes (P. dispar), coonstripes (P. hypsinotus), and the spot shrimp (P. platyceros). The most important in the commercial harvest in Alaska is the pink shrimp. It comprises the major part of the catch in all areas, ranging from at least 85 to 98 percent of the total catch. The second most abundant shrimp in the commercial catch is the humpy. The sidestripe, coonstripe, and spot shrimp are caught in less significant amounts. The characteristics of these five species are shown in Table 65.

The major production areas in the state are Kachemak Bay in Cook Inlet, the bays along the east side of Kodiak Island and along the Alaska Peninsula from Sutwik to Sanak Islands. Data on shrimp stock estimates are limited, and in lieu of other data, the ADF&G shrimp harvest guidelines are used as an indication of abundance. These estimates are shown in Table 66 for the 1977-78 season and the 1978-79 season.

The shrimp catch by area is shown in Table 67 for the years 1960 to 1977. From this data, the major trend of the fishery shows a gradual shift in the area of catch from the Kodiak area to the Chignik-Alaska Peninsula areas since 1971. The shrimp stocks in the Kodiak area have experienced drastic declines since 1976 and are expected to produce greatly reduced catches during the 1978-79 season.

In addition to the problem of these light shrimp catches, fishermen have been getting high percentages of trash fish in their trawls. In past years this incidental catch was less than ten percent but during 1977-78, the percentage increased to 40 or 60 percent or higher. In some cases this made it necessary to dump the trawl catches overboard. The reasons for the decline in stocks are not known. Overfishing of stocks may be a contributing factor but the effect of fishing has not been determined. Environmental factors which may be contributing to these low levels of abundance in traditional fishing areas include: water temperatures four to five degrees centigrade warmer than average, which may be causing vertical or seaward migration of stocks, and/or predation by large stocks of groundfish moving into areas of shrimp concentrations. The adverse effects of environmental factors possibly contributing to the decline of stocks are compounded by high catches. However, ADF&G maintains that fishing effort is not the sole contributing factor because stocks have also declined in unfished areas. The decline of the shrimp stocks is an item of major concern to fishermen and processors in Kodiak and biologists are conducting research to determine what is happening.

The 1977 catch from the Chignik area, 27.8 million pounds, was near the record high for that area, and the Alaska Peninsula set a new record catch of 46.4 million pounds in 1977, eight million pounds more than in 1976. Much

TABLE 65

GENERAL CHARACTERISTICS OF THE FIVE IMPORTANT SPECIES OF ALASKA SHRIMP

Species of Shrimp	Approximate Maximum Size (Inches)	Shrimp per Pound (Number)	Geographic Range in Alaska	Type of Gear	Type of Bottom	Usual Depth of Capture (Fathoms)	Greatest Depth of Capture (Fathoms)
Pink	6.5	60-160	Pribilof Islands-Southeastern	Trawl	Smooth mud	20-100	350
Sidestrip	8.5	20-100	Central Bering Sea - Southeastern	Trawl	Smooth mud	>20	350
Humpy	4.75	80-180	Bering Strait-Southeast	Trawl	Smooth mud, sand, organic debris	10-100	100
Coonstripe	8		Norton Sound - Southeastern	Trawl Pot	Smooth mud, sand rocky,	25-50	100
Spot	11	6-25	Unalaska-Southeastern	Pot	Rough, rocky	>30	266

Source: Barr 1970.

TABLE 66

GUIDELINE HARVEST QUOTAS FOR SHRIMP BY AREA
(In Millions of Pounds)

Area	1977-78 Guideline	1978-79 Guideline
Southeastern	.76	
Prince William Sound	no quota	
Cook Inlet	5.60	
Kodiak	40.4-62.50	13.0-47.0
Chignik	14.0-32.00	11.0-29.0
S. Peninsula	27.0-62.00	17.5-66.0
Aleutians	2.5- 5.50	2.5- 5.5

Source: ADF&G Shellfish Commercial Fishing Regulations, 1977-78 and 1978-79.

TABLE 67

CATCH OF SHRIMP BY MANAGEMENT AREA
(In Thousands of Pounds)

Year	South-east	Prince William Sound	Cook Inlet	Kodiak	Chignik	S. Peninsula	E. Aleutians	All Alaska
1977	950.7	174.2	5,136.9	31,801.6	27,797.7	46,454.4	4,599.8	116,915.3
1976	978.6	135.3	6,201.5	51,400.5	29,042.2	37,546.1	3,670.6	128,974.8
1975	1,023.1	29.0	4,752.1	46,759.1	25,916.9	19,610.4	893.6	98,984.2
1974	1,199.4	13.8	5,748.9	48,771.1	21,762.7	25,496.1	5,749.4	108,741.4
1973	711.0	7.4	4,897.1	70,511.5	24,889.7	18,490.5	456.2	119.963.4
1972	920.0	8.6	5,548.6	58,352.3	4,110.3	14,795.6	94.6	83,830.0
1971	959.7	6.5	5,451.3	82,153.7	1,091.7	5,228.2	...	94,891.1
1970	957.9	9.9	5,817.6	62,181.2	890.7	4,399.0	...	74,256.3
1969	1,680.4	2.6	1,847.2	41,243.5	419.9	2,657.0	...	47,850.6
1968	2,103.7	3.4	26.7	34,361.6	1,153.7	4,373.9	...	42,023.0
1967	2,803.3	...	741.4	38,267.9	...	...	...	41,812.6
1966	3,785.0	.9	309.7	24,097.1	...	...	...	28,192.7
1965	2,944.8	2.2	64.5	13,810.2	...	...	...	16,821.7
1964	2,793.1	2.1	601.4	4,330.1	...	...	...	7,726.7
1963	3,110.3		12,016.6*		...	...	...	15,126.9
1962	3,884.0		13,059.1*		...	...	...	16,943.1
1961	4,212.3		11,768.2*		...	...	...	15,980.5
1960	3,343.4		4,092.8*		...	...	...	7,436.2

Source: ADF&G Statistical Leaflets 1960 to 1975; 1976 to 1977 preliminary data

*Includes catches in Prince William Sound, Cook Inlet, and Kodiak.

of the increase in the Southern Peninsula came from increased catches from Pavlov Bay. NMFS trawl surveys indicated high abundance indices for Pavlov, Morzhovoi, and Kujulik Bays. The trawl surveys and the performance of the commercial fishery in Bever Bay, Unga Straits, West Nagai, and Kennoys Island areas indicate severely depressed stocks. As this area is producing an increasing percentage of the Alaska catch, stability of the fishery at present levels statewide will depend upon the westward area's ability to support increased catch levels. The levels of abundance in the next several years will prove if these areas can support these increased harvests. According to current estimates by ADF&G biologists, the catch level for the Alaska Peninsula will probably be reduced, which will result in a lower total state harvest.

The shrimp fishery in the other management areas are expected to remain relatively stable in 1978-79.

Pacific Coast Pandalid Shrimp Fishery

Alaska's contribution to the total Pacific Coast landings of pandalid shrimp was reduced in 1977 to 58.8 percent of the total, from 73.5 percent in 1976. This was caused by record landings in Washington, Oregon, and California and a drop in the Alaska catch (see Table 68). Shrimp landings from Alaska are not compared with total shrimp landings in the U.S. because the fisheries are not comparable. The Gulf of Mexico and Atlantic fisheries concentrate on larger Penaeid shrimp which are a low volume, high value per unit fishery, whereas the Pacific pandalid fishery is a high volume, low value per unit fishery. Physical characteristics, product forms, and market characteristics are sufficiently different to defy comparison.

World Supply

To compare the Alaska catch of pandalid shrimp with the total world catch, data is needed on the pandalid catch by country. These data are available in part from the FAO publication *Yearbook of Fishery Statistics: Catches and Landings*, Table B-45. However, there were several problems encountered in using these data. The species classification of pandalid shrimp appear to be confused in this publication. For example, there is no listing for U.S. catch of *P. borealis*. There is a listing of U.S. catches of *Pandalus spp.*--Pacific Ocean shrimp--for the Pacific Northwest which were assumed to include the Alaska catches of *P. borealis*. Other assumptions necessary to compile the world supply table are listed below.

- The catch figures for Canada, Faeroe Islands, Japan, and the U.S. were taken from the "Shrimp and Prawns" category prior to 1970. This was done because the review catch amounts listed under "pink shrimp" in 1970 to 1972 matched the catch figures listed earlier under the "Shrimp and Prawns" classification.

- Earlier yearbooks listed Portugal having made catches of common shrimp in the Northeast Atlantic which included some deepwater prawns (*Pandalus*). The amounts of the *Pandalus* landings were not differentiated however, and therefore, catches from Portugal were excluded.

TABLE 68

ANNUAL PANDALID SHRIMP LANDINGS 1965 TO 1977 BY REGION
(In Pounds)

Year	Alaska	British Columbia	Washington	Oregon	California	Total
1961	15,980,550	1,206,000	1,436,599	1,455,900	2,006,274	22,085,323
1962	16,943,120	1,663,000	1,367,441	2,750,400	1,786,289	24,510,250
1963	15,126,950	1,788,000	956,105	3,114,700	2,095,278	23,081,033
1964	7,726,750	1,052,000	314,130	5,477,400	980,608	15,550,888
1965	16,818,941	1,755,000	23,468	1,748,000	1,425,875	21,771,284
1966	28,192,621	1,682,000	282,947	4,751,300	1,213,959	36,122,827
1967	41,812,552	1,696,000	1,028,744	10,373,956	1,404,821	56,316,073
1968	42,023,084	1,568,000	1,163,864	10,976,258	2,223,205	57,954,411
1969	47,850,560	2,118,700	1,425,286	10,477,945	2,951,800	64,824,291
1970	74,256,326	1,537,800	925,000	13,735,000	4,044,640	94,498,766
1971	94,891,304	735,000	678,000	9,291,000	3,074,000	108,669,304
1972	83,830,064	794,000	1,562,000	20,900,000	2,500,000	109,606,064
1973	119,963,729	1,729,000	5,271,000	24,500,000	1,239,000	152,702,729
1974	108,741,434	2,644,000	9,300,000	19,968,000	2,360,000	143,013,434
1975	98,535,031	1,729,000	10,200,000	23,700,000	4,997,000	139,161,031
1976	129,011,047	8,470,000	9,224,898	25,300,000	3,470,000	175,475,945
1977[1]	116,871,605	6,200,000	11,400,000	48,580,022	15,663,451	198,715,078

Source: Pacific Marine Fisheries Commission, Annual Report, 1976.

[1]Preliminary.

- The yearbooks listed catches by Canada in the Northeast Pacific for the years 1970 to 1972, but since the later yearbooks dropped these figures, it was assumed that this was a correction and these landings were excluded. This would appear to be an omission in the FAO statistics because Canada does have significant landings of Pandalus shrimp in waters off British Columbia.

- The catch figures for Scotland during 1965 to 1969 were taken from the "Common Shrimp" classification. The "Common Shrimp" catches for Scotland in 1970 to 1972 matched the review catches of "Pink Shrimp" for 1970 to 1972 in later yearbooks, and it was assumed that this was a correction of an earlier misclassification.

Table 69 should provide an indication of the United States' relative importance in world Pandalus shrimp catches, the above reservations notwithstanding. The U.S. percentage of world catches varies from 22.0 percent in 1964 to 44.9 percent in 1976, with the highest percentage of world catch, 69.4 caught by the U.S. in 1972. As the U.S. had a record catch of pandalid shrimp in 1977, the relative importance in providing the world supply has probably increased from the 1976 figure.

TABLE 69

WORLD LANDINGS OF PANDALUS SHRIMP BY AREA
(In Thousands of Metric Tons)

ZONE	1976	1975	1974	1973	1972	1971	1970	1969	1968	1967	1966	1965	1964
Northwest Pacific													
Country													
Japan	2.2	2.0	...	.1	...	6.7	6.0	9.5	12.2	...	...	...	...
Korea Rep.	...	...	.4	...	...	.1	...	...	...	...	...	...	...
Total	2.2	2.0	.4	.1	...	6.8	6.0	9.5	12.2	...	...	...	...
Northeast Pacific													
Canada	...	...	...	...	...	...	...	.1	.7	.8	.8	.8	.5
Japan	.4	...	...	...	...	...	...	...	1.3	4.6	3.4	9.8	...
U.S.A.	74.8	62.0	63.0	68.4	49.2	48.0	40.9	27.8	25.0	24.5	15.3	8.8	6.4
Total	75.2	62.0	63.0	68.4	49.2	48.0	40.9	27.9	27.0	29.9	19.5	19.4	6.9
Eastern Central Pacific													
U.S.A.	...	.6	.2	.6	.1	.9	1.2	.6	.6	.2	.3	.3	...
Northeast Atlantic													
Denmark	2.7	2.1	.8	.9	3.2	4.4	4.2	5.4	5.2	4.8	4.7	5.1	3.6
Germany Fed.	...	...	...	...	...	...	...	...	...	...	.1	...	...
Iceland	6.8	4.9	6.5	7.3	5.3	6.3	4.5	3.3	2.5	1.5	1.8	.9	.5
Norway	13.3	10.2	10.0	9.3	9.1	7.8	7.6	6.4	7.2	8.4	7.4	10.5	11.0
Spain	4.3	4.3	...	...	...	...	...	...	...	...	...	...	...
Sweden	2.5	2.0	2.0	2.1	2.5	2.9	2.7	2.2	2.3	2.0	1.8	3.9	4.5
UK England-Wales	.2	...	...	.1	...	...	...	...	...	...	...	...	...
UK Scotland	2.0	.5	.4	.2	.2	.5	.1	...	...	.1	.1	.1	.1
Total	31.8	24.0	19.7	19.9	20.3	21.9	19.1	17.3	17.2	16.8	15.9	20.5	19.7
Northwest Atlantic													
Canada	5.0	4.7	3.5	2.2	1.4	1.8	2.0	1.1	1.0	1.2	...	...	...
Denmark	2.7	1.1	.3	.2	.1	...	...	...	...	...	...	...	...
Faeroe Island	11.2	5.3	2.0	1.4	.8	.5	.1	...	...	...	...	...	...
Greenland	9.8	9.9	10.2	8.1	7.4	8.9	8.4	6.7	5.6	5.6	5.4	5.1	3.8
Japan	...	...	...	...	...	...	...	...	...	...	...	...	.1
Norway	12.0	8.7	5.9	2.9	1.4	...	...	...	...	...	...	...	...
Spain	12.0	6.9	...	...	...	...	...	...	...	...	...	...	...
U.S.A.	1.6	5.3	8.6	9.8	11.4	11.9	11.2	13.6	7.0	3.5	2.1	1.0	.4
USSR	6.5	6.0	3.2	...	...	...	...	...	...	...	...	...	...
Total	60.8	47.9	33.7	24.6	22.5	23.1	21.7	21.4	13.6	10.3	7.5	6.1	4.3
Total for all areas	170.0	136.5	117.0	113.6	92.1	100.7	88.9	76.7	70.6	57.2	43.2	46.3	30.9
U.S. percent of total	44.9	49.7	61.4	69.4	65.9	60.4	60.0	54.8	46.2	49.3	41.0	21.8	22.0

Source: F.A.O., Yearbook of Fishery Statistics: Catches and Landings, 1964 to 1976.

CHAPTER VIII

FISHING GEAR AND PROCESSING METHODS FOR SHRIMP

Shrimp Fishing Gear

The vessels and gear used to harvest shrimp throughout Alaska vary from area to area due to differences in species distribution, abundance, and the weather and type of bottom conditions encountered.

Vessels

Southeastern. In 1976 there were 18 vessels fishing for shrimp in the Southeast area--14 beam-trawlers and four vessels fishing pots. For most of the fishermen, shrimp fishing is an off-season employment from the salmon (gillnet and seine) and halibut fisheries. The number of vessels participating since 1969 has remained fairly constant (Table 70).

Cook Inlet. There were 42 vessels recording landings in Cook Inlet during 1976. Of these, 34 were fishing with pot gear and eight were trawlers. The majority of the shrimp are landed by the trawlers, although only four of them are active in the fishery. The total number of vessels fishing increased from 16 in 1969 to 68 in 1973, and has declined since then (Table 70).

Kodiak and Westward. All vessels fishing from Kodiak west are registered in Area J (Table 71). The vessels registered for the current season are listed in this table by length and gear type. It should be noted that these are registered vessels and they have not necessarily all participated in the fishery.

Of the total 90 vessels registered in Area J, six use pot gear, ten use a beam-trawl, 27 use a single otter trawl, and 47 use double otter-trawl gear. The largest component of the fleet and the largest vessels are the double otter-trawlers. They are all from 60 to 100 feet in length and many are modern, steel hulled with a stern ramp for hauling the trawls.

The numbers of vessels actually fishing for shrimp each year are shown in Table 70. They are shown by management area for the years 1969 to 1976.

From Table 70, it can be seen that the largest increase in numbers of fishing vessels has occurred in the Alaska Peninsula. The numbers have increased steadily from three to 71. The Southeast participation has remained fairly constant at around the present 18 vessels. The Prince William Sound, Cook Inlet, and Kodiak numbers of vessels increased and subsequently decreased to the 1976 level of two, 42, and 80, respectively. The vessels fishing in Dutch Harbor increased from two in 1972 to eight in 1976.

Types of Gear

Pots. A small percentage (.002 percent in 1975) of the annual shrimp catch is made by pot. They are used to fish selectively for the larger

TABLE 70

FISHING VESSELS BY MANAGEMENT AREA 1969 TO 1976

Area	Number of Vessels Fishing[1]							
	1969	1970	1971	1972	1973	1974	1975	1976
Southeast	16	16	14	17	9	18	15	18
Prince William Sound	3	7	7	6	5	5	4	2
Cook Inlet	16	11	19	33	68	53	31	42
Kodiak	25	34	48	71	92	91	88	80
Alaska Pen.	3	4	5	23	35	48	57	71
Dutch Harbor	0	0	0	2	1	7	4	8

Source: Alaska Commercial Fisheries Entry Commission, Alaska Bio-Economic Data Base.

[1]The numbers of vessels in each area are not additive to calculate the total fleet because some vessels land in more than one area.

TABLE 71

REGISTERED SHRIMP VESSELS BY FISHING GEAR 1977-78 SEASON AREA J (KODIAK AND WESTWARD)

Keel Length (Feet)	Pot	Beam Trawl	Single Otter	Double Otter	Total Vessels	Length Catagory (% of Total)
<20					0	
20-29	2				2	2.2
30-39	3	6	1		10	11.1
40-49		4	6		10	11.1
50-59			2		2	2.2
60-69			9	12	21	23.3
70-79	1		4	24	29	32.2
80-89			4	9	13	14.4
90-99				2	2	2.2
100-109						
110-120						
>120			1		1	1.1
Total Vessels	6	10	27	47	90	100.0

Source: ADF&G Vessel Registration, 1977-78.

shrimp, spots and coonstripes, in steep rocky bottom areas where trawls cannot be used. The pots are fished individually in a manner similar to fishing crab pots although on a much smaller size scale.

Beam Trawls. The beam trawl is used to harvest shrimp in Southeast Alaska and in the Kodiak area. The advantages of the use of a beam trawl over an otter trawl are:

- It can be operated easily by one man.
- The size and horsepower of a boat are not important; the net is easy to tow.
- The gear is relatively inexpensive.
- It enables participation in the shrimp fishery in the off season for any vessel which has a net reel, for example, salmon gillnetters and seiners.
- It can be used to fish areas where lack of maneuvering space and poor sea bottom conditions make the use of otter trawls difficult.

The beam trawls used in the Southeast area are of the conventional sled type. A 40-foot spruce beam keeps the mouth of the net open and it slides over the sea bed on a steel shoe which also supports the beam. The beam trawls used in the Kodiak area are of the floating staff type. These trawls use a detachable wood or aluminum staff and do not use a sled but rather are held off the bottom by a balance of the weighted ends of the mud rope and the floats on the headrope.

Otter Trawls. Otter trawls account for almost all of the shrimp landed in Alaska. The two types are the single otter trawl and double-rigged otter trawl, the latter making up over half the entire fleet for Kodiak and Westward. These trawls are towed along the ocean bottom at 1 1/2 to 2 knots and trap shrimp in the cod end.

Single Otter Trawls. The single otter trawlers are stern trawlers and use a drum to wind the net aboard. The shape of the trawl is shown in Figure 16.

The otter doors are set at an angle facing outward and provide the outward force to spread the opening of the trawl as they are pulled along the ocean bottom. The ground rope is weighted to keep the bottom of the net down and the head rope is buoyed up by floats. A tickler chain, six to eight feet shorter than the ground rope, drags along the bottom to stir up shrimp and they are trapped by the net and pass back into the cod end. The net is attached to the vessel by the towing (dandy lines) warps which go from the otter doors through the gallows and then through leads to the winch.

To haul the net, the warps are wound in by the winch until the doors reach the gallows where they are left hanging. The transfer cables are unhooked from the warp line, leaving the mouth and part of the body of the

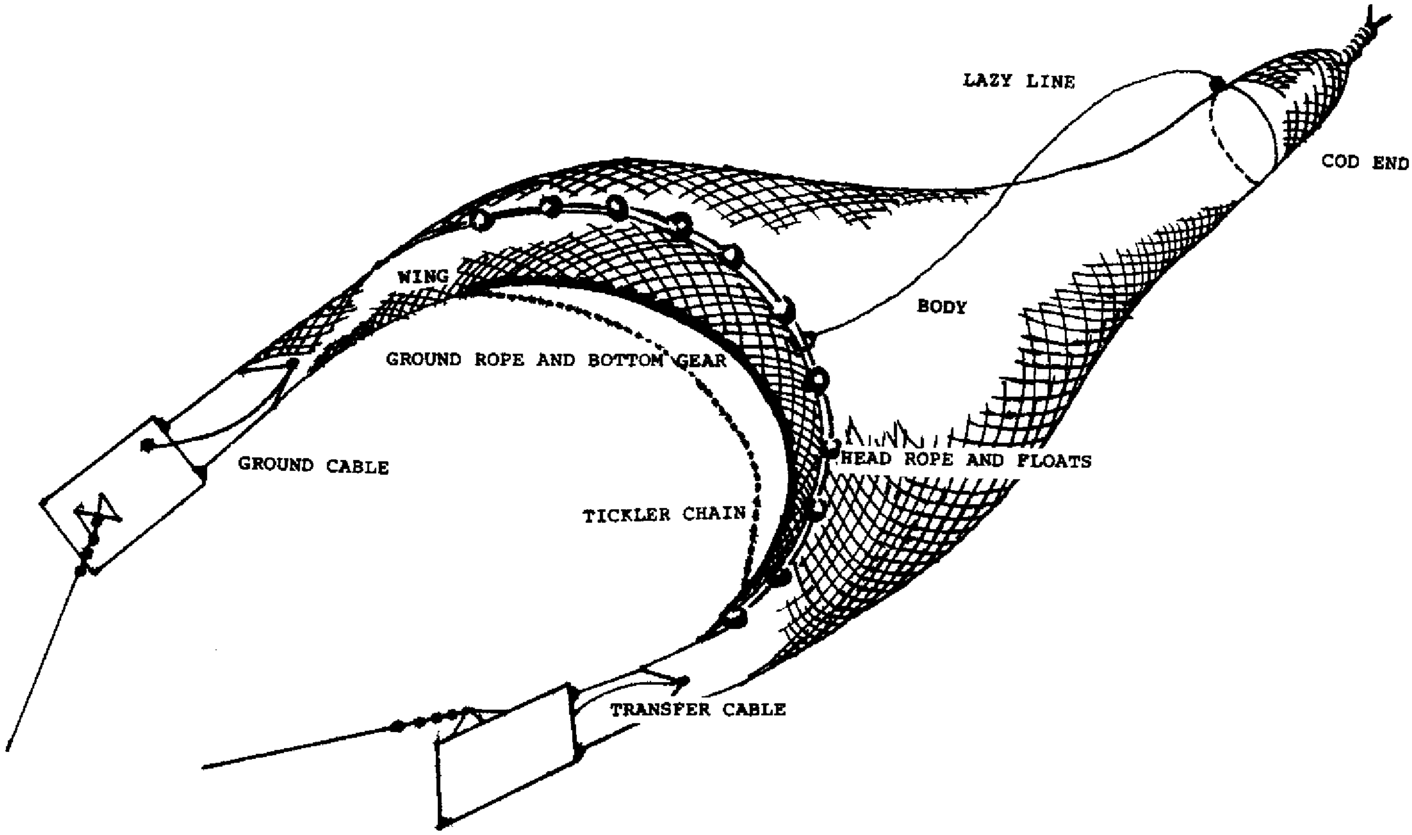

FIGURE 16. TYPICAL RIGGING FOR SHRIMP OTTER TRAWL

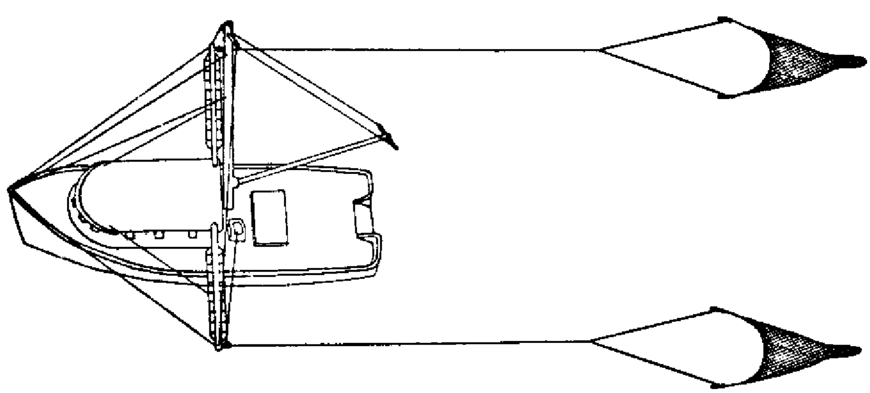

FIGURE 17. DOUBLE-RIGGED SHRIMP TRAWLER

Reprinted from Alaska Fish Tales and Game Trails, Alaska Department of Fish and Game, July-August 1977 net. The body of the net is then attached to the overhead boom by a ring strap and the net is lifted to fill the cod end. The vessel is turned to bring the cod end alongside so it can be hauled aboard and emptied. If necessary, the catch is split and brought aboard in several loads.

Double Otter Trawl. The double-rigged stern ramp trawlers presently being used in Alaska have evolved from shrimp vessels used in the Gulf of Mexico. The semi-balloon trawls have tended toward high opening nets rather than the narrow opening Gulf style net. The dimensions of an average net opening presently being used in Kodiak for double trawling are 50 ft (headrope) by 14 ft (height) by 60 ft (ground rope).[1] The advantage in using the double trawls over a single trawl is that it allows more area to be fished. With the same amount of towing resistance as one large trawl, two smaller trawls can be pulled which have greater horizontal spread at the opening.

Light trawl doors are used in double trawling which are connected directly to the wings of the side of the net, and a wire brindle runs from the towing warp to the doors. The nets are towed from the ends of two outrigger booms out each side of the vessel (Figure 17).

In being hauled, the nets are pulled in simultaneously by two mid-ship winches until the doors reach the towing block at the end of the outrigger. A lazy line around the cod end is hooked and hauled up the stern ramp. The cod end is then lifted and emptied, splitting the catch several times if required. To set, the cod end is returned overboard and the winch brakes are released, letting the towing warp run out to the length desired. Both trawls can be hauled and set again, catching up to 20,000 pounds each side in about 20 minutes.

On-Board Handling

Shrimp usually receive little on-board processing except hosing off the mud if necessary and storing them in ice, in bins in the hold. A few vessels are using refrigerated brine to keep shrimp but these systems are not in widespread use because of the high cost of conversion.

Some on-board handling is done for larger shrimp which are frozen on-board, either whole or tails. This type of on-board processing is usually done in Southeast Alaska or Cook Inlet, although one vessel in Kodiak has been processing the catch on-board. It is fished selectively for sidestripes in deep (100 fathom) sandy bottom areas, and for coonstripes in rocky bottom areas. The raw catch is frozen whole in 15-pound blocks and then packed for export to the Japanese specialty market. These shrimp which have been frozen within four hours after being caught result in a high quality product.

Electronic Gear

Increased use of sophisticated electronic gear has raised the efficiency of the shrimp fleet by allowing the fishing of more productive contour edges

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[1] Oral Burch 1977, personal communication.

in the bays. There is widespread use of conventional depth recorders which provide an indication of water depth and type of bottom under the boat. There are also many vessels which have side scanning sonar which tilts to the side making it possible to fish close to rocky areas without damaging the gear.

Another new electronic instrument being used is the net recorder. It rides on the headrope and provides sounding up, down, and forward from the trawl. Its main application is for bottomfish trawling, but it may also find use in fishing for shrimp.

New Technology

There are several types of gear being developed which are at the experimental stage or are not yet in widespread commercial use. Some of these are:

- The use of refrigerated brine to keep shrimp in the vessel hold. This has the advantage of keeping shrimp at a reasonable quality a day or so longer than icing. Also, when there is a long run to the fishing grounds, there is no loss of refrigerating capability on the trip out as there is with ice.

- Separator trawls are being developed which will separate out trash fish from shrimp allowing fish to escape through the top of the trawl. This type of trawl has not been used in Alaska because until 1977 incidental fish catches have been at low levels and the separator trawl has not been proved to be as effective as existing trawls.

- Electric shrimp trawls have been tested which electrically stimulate shrimp in their burrows in the mud bottom. These would allow the catch of shrimp unavailable to traditional trawls. This system is still in the experimental stage, however it is probably most applicable to fishing for Panaeid shrimp in the Gulf of Mexico.

Harvesting Capacity

Estimates for the harvesting capacity of the shrimp fleet have been calculated by area in a manner similar to the estimates for crab harvesting capacity. These estimates are summarized in Table 73 and are discussed by area below.

Southeastern. In 1976, there were four vessels with pot gear and 14 vessels with trawl gear (beam trawl) fishing in the Southeastern management area. The harvesting capacity of this fleet, calculated from the survey data from Commercial Fisheries Entry Commission (CFEC), appears to be overstated for several reasons. It was emphasized, in discussions with the ADF&G shellfish biologist in Petersburg, that the holds of the fleet were not presently being utilized. The majority of the fleet stores the catch on deck in 200-pound boxes. It was estimated that peak catches are about 30 boxes or approximately 6,000 pounds. The use of the vessel holds is not necessary, both because of generally low catch levels and also, during the peak catch

TABLE 72

SHRIMP HARVESTING CAPACITY ESTIMATE FOR THE SOUTHEASTERN ALASKA AREA
1976-77 SEASON

	Number of Vessels	Estimated Hold Capacity (In Pounds)	Calculated Harvesting Capacity per Landing (In Pounds)	Average Number of Landings per Year for Each Vessel	Estimated Harvesting Capacity (In Pounds)
Trawl:	14	20,000	280,000	33.43	9,360,400/year
Pot:	7	15,000 (minimum)	105,000	3,7	388,500/year

Source: Tim Koeneman 1978: personal communication.

periods, processors place vessels on landing quotas due to limited processing capability. A problem also mentioned concerning estimation of harvesting capacity of the pot fleet was that the fleet size and fishing effort were inconsistent, making estimation difficult.

As an alternative to the harvesting capacity calculated from the CEFC data, ADF&G in Petersburg provided their estimate for the 1976-77 season, making the assumptions shown in Table 72.

The estimates shown in Table 72 may be more reflective of harvesting capability in the Southeastern area than the ones calculated in Table 73 because they use more current data provided by a person closely involved with the fishery. In any case, it would appear that harvesting capacity is not a constraint to production in this area.

Prince William Sound. No harvesting capacity estimates were calculated for the Prince William Sound area because the area historically has not contributed significant amounts of shrimp catch and there is no resident shrimp fleet. In 1977, the Prince William Sound area set a new catch record of 168,000 pounds, due mostly to exploratory effort by Kodiak-based vessels.

Cook Inlet. As was the case for the Southeastern area, the estimates of harvesting capacity for the Cook Inlet area appear to be overstated. From the CEAC data, 34 vessels fished shrimp with pot gear and eight vessels fished with trawl gear. In order to revise the estimate of capacity found in Table 73, the ADF&G biologist in Homer was contacted for further information. The following information was obtained concerning the trawl fishery. Of the eight vessels registered which made landings, four vessels were active participants in the fishery. These four vessels have an average hold capacity of 67,500 pounds, giving a harvesting capacity per landing of 270,000 pounds. During the season, these vessels average approximately 115 deliveries, resulting in an annual harvesting capacity of 31 million pounds (see Table 73, footnote 5).

Some clarification with regard to this annual harvesting capacity is needed. The vessels are restricted to landings of around 15,000 pounds of shrimp per day due to the processing constraint in the area. This is why the average number of deliveries per vessel is as high as it is. If the vessels delivered as much as they could, the area quota could be filled in about three weeks. In Cook Inlet, obviously harvesting capacity is not a constraint to production.

Kodiak, Alaska Peninsula, and Dutch Harbor. In these three areas, the harvesting capacity estimates generated seemed to be more reasonable than for Southeastern and Cook Inlet. Many of the vessels making landings in all three areas are from the same fleet out of Kodiak. The number of vessels fishing in each area and the number of landings made per year in each year provide an indication of the amount of harvesting capacity that was available in each area in 1976. The actual 1976 catches for these areas represent 44 percent, 57 percent, and 32 percent of the total capacity, respectively. Since the capacity estimates are calculated from the actual number of trips made, this indicates that total hold capacity is not at present being utilized. From personal discussions with shrimp fishermen during the 1977-78 shrimp season, the unutilized capacity has probably increased due to low catch levels.

TABLE 73

SHRIMP HARVESTING CAPACITY BY AREA 1976

Area	Number of Vessels Fishing[1]	Estimated Mean Live Tanking Capacity (In Pounds)[2]	Calculated Harvesting Capacity per Landing (1,000 Pounds)	Average Number of Landings per Year for Each Vessel[3]	Estimated Harvesting Capacity per Year (1,000 Pounds)	Actual Landings (1,000 Pounds)	Guideline Harvest Levels, 1976 (1,000 Pounds)[4]
Southeast - Pot	4		...	5.75	...	} 907.1	} no quota
Trawl	14	64,400.0	901.6	25.67	23,144.0		
Cook Inlet - Pot	34		...	26.29	...	} 6,207.7	600
Trawl[5]	8	28,516.7	228.1	57.29	13,069.8		5,000
Kodiak	72	139,880.0	10,071.4	11.63	117.129.9	51,850.5	55,000
Alaska Pen.	69	150,192.3	10,363.3	11.22	116,275.9	66,139.3	0
Dutch Harbor	8	171,333.3	1,370.7	8.25	11,308.0	3,670.6	0

[1] Alaska Shellfish Bio-Economic Data Base, Commercial Fisheries Entry Commission (CFEC). These are the actual numbers of vessels making landings in various management areas and are not additive. That is, vessels making landings in more than one area will be listed for each area fished.

[2] Survey by CFEC (see [1] above).

[3] CFEC computer file: R01-03V-4421, November 12, 1977.

[4] Alaska Department of Fish and Game Shellfish Commercial Fishing Regulations, 1976.

[5] Revised estimate for Cook Inlet was provided by Tom Schroder, ADF&G biologist in Homer, correcting the CFEC data to: four trawl vessels fishing, 67,500 pounds mean hold capacity per vessel, 270,000 pounds per landing, 115 landings per year, giving an estimated total harvesting capacity of 31,050,000 per year.

Processing Methods for Shrimp

The introduction of the mechanical peeler, which was brought to Alaska in 1957, was perhaps the most important breakthrough in the development of the shrimp fishery. Previous to this, all shrimp had to be peeled by hand, making the processing costs prohibitive to large-scale operation. Since the majority of the catch in Alaska is small pink shrimp (60 to 160 to the pound), the hand labor required per shrimp did not yield a great deal of product for that effort. The expansion of the fishery beyond the amount produced in the small, high quality pack in Southeastern Alaska was limited because of this. Once the methods for economical machine processing of shrimp were available, the fishery was able to develop rapidly.

There were initial problems with quality of product when machine picked shrimp were first being produced. In order to work efficiently, the shrimp had to be "conditioned" before being peeled. This resulted in shrimp being held until they were no longer fresh and the color and flavor of the product suffered. This problem was solved by the development of peelers which did not need ripened shrimp to work efficiently.

As was done for king and tanner crab processing, a flow chart describing the present processing methods for shrimp was developed (Figure 18). Again, because each plant will vary some parts of its processing methods, this will not describe exactly the processing method used in each plant. It does, however, provide the basic processing steps for the various product forms which are: frozen raw-whole, frozen raw-peeled, frozen blocks/cans, individual quick frozen (IQF), and canned.

The steps in processing are shown in Figure 18 for the different product forms, from the time the shrimp are unloaded from the vessel hold to when the final product is ready to ship. One of the major differences in processing methods is determined by whether the peeler used is a model A or PCA. The model A peels the raw shrimp and the PCA peels cooked shrimp. This difference could become important if the use of refrigerated seawater becomes more widespread than it is at present because shrimp held this way have to be peeled raw. This is because the shells of shrimp held in brine for several days have already started to break down, and if they are cooked before peeling, the recovery is lower than if peeled raw. The first several steps in the processing method are common for all product forms, however, and these are described below.

The shrimp are taken from the vessel hold and placed in plastic totes, iced and topped to await processing. The pH of the shrimp in the totes is checked as a quality control measure to reject poor quality shrimp. Next, the shrimp are run by conveyor to the fish pick where fish and any other extraneous materials are removed. After this, the shrimp can be run through a grader which separates the shrimp by size, although this operation is frequently skipped. From this point on, the processing methods vary by product form and are treated individually.

Frozen Raw-Whole

This process, when used, is mainly for larger shrimp such as sidestripes, which are put up in a low count-per-pound pack or frozen in blocks. The

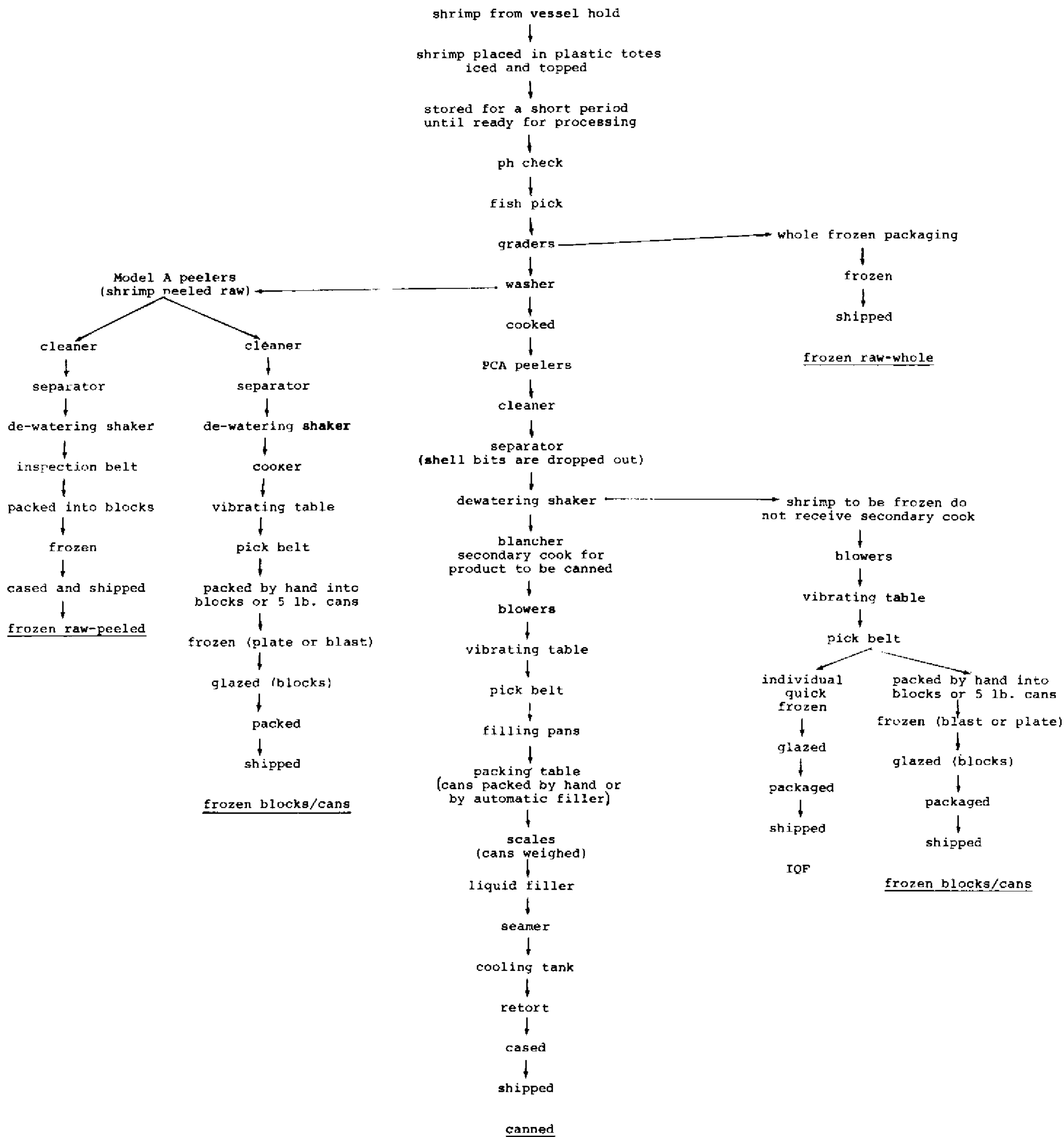

FIGURE 18. FLOW CHART FOR SHRIMP PROCESSING

blocks of shrimp are formed in a manner similar to crab meat blocks. They are hand packed into waxed cardboard cartons which are in an aluminum freezing tray. The shrimp are then frozen in blast or plate freezers, removed from the freezing pan, and cased.

Frozen Raw-Peeled

After the fish pick, the shrimp go through a washer and then are peeled by model A peelers. They then go through a cleaner and after that to a separator where small bits of shell are dropped out. The excess moisture is removed by a de-watering shaker, the shrimp are inspected for any shell pieces and then are packed into blocks by hand. They are then frozen and glazed and packed, ready to be shipped.

Frozen Cooked-Blocks/Canned

The shrimp are cooked before or after peeling depending upon which type of peeler is used. Otherwise, the process is the same for both methods. The shrimp go from the washer and then are cooked and peeled (PCA). After this, the shrimp go through a cleaner, separator, and de-watering shaker. As these shrimp are going into a frozen product form, they do not receive a secondary cook, but go next through blowers which blow away shell particles. The shrimp then pass over a vibrating table where broken shrimp are separated from the whole ones and then over a pick belt for final inspection. The shrimp are packed by hand into blocks or five-pound cans, frozen by blast or plate freezer, glazed (blocks), packaged and are ready for shipping.

Individually Quick Frozen

Shrimp which are to be individually quick frozen (IQF) go through the same process as the frozen cooked-blocks/canned process described above up to the pick belt. They are then quick frozen individually, glazed, packaged, and are ready to ship.

Canned

The shrimp go through the same process as for frozen product up to the de-watering shaker. The next step is to the blancher where the shrimp peeled by model A receive their first cook and those peeled by PCA receive their second cook. The shrimp then go to first and second stage blowers, through the vibrating table and are inspected for shell bits at the pick belt. They are graded into whole or broken and put into pans from which the cans are filled by hand. These gradings will go on the label of the shrimp to indicate the relative size and quality of the shrimp. An example of the grades used are "tiny, broken, and small." There are a couple of plants which use an automatic filler for the cans, although most are filled by hand. The cans are weighed, liquid filled, seamed, and then go to the retort. The times and temperatures for retorting will vary slightly by plant but will be around $240^{\circ}F$ for 24 minutes (whole shrimp) and 27 to 28 minutes (broken). The cans come out of the retort and are dumped into a water tank which cools the cans and also acts as a cushion to prevent the cans from denting. They are then cased and are ready to ship.

The recovery rates from live weight to product weight for shrimp will vary considerably depending on a number of factors such as the uniformity of the size of shrimp, condition of the shrimp when peeled, and the competence of the operator of the peelers. An estimate of average recovery would be from 16 to 18 percent. However, recovery can vary from less than ten percent to a maximum of approximately 22 percent.

Shrimp Processing Capacity/Capacity Utilization

The processing capacity for shrimp in Alaska was calculated from data collected by ADF&G. For purposes of comparison, the processing capacity has been divided up into areas of production according to the management areas delineated by ADF&G. These areas, along with their respective percentage of the total 1977 Alaska shrimp catch are listed in Table 74.

Southeastern

There are only two plants processing shrimp in the Southeastern area. Because of this, the data on processing capacity cannot be listed as this would identify an individual firm's contribution. This data was collected, however, and comparing the maximum capacity with the average production for both of these plants, yields a capacity utilization rate of 41.5 percent. This figure indicates that there is excess capacity available. As the catch of shrimp in the Southeastern has remained fairly steady at around one million pounds since 1970, the full capacity of the plants will probably not be utilized fully in the near future.

There are also several fishermen who process onboard and sell their shrimp off the docks. These are generally spot, coonstripe, and sidestripe shrimp which are caught by pots and sold fresh or fresh frozen. The larger spot shrimp are usually sold as tails only, and the sidestripe and coonstripe are sold both as whole and tails. The amount of production per vessel was estimated to be 300 to 800 pounds per day.

Cook Inlet

As was the case for the Southeastern area, the processing capacity data for Cook Inlet cannot be released as there is only a single plant in operation. Harvesting capacity is somewhat of a constraint; however, the processing company and the three boats fishing shrimp have worked out a system which seems to work well. The amount of shrimp each vessel can deliver to the plant each day is limited to a third of the daily processing capacity. Throughout the fishing season, which runs approximately from July to January, each boat will make about 130 deliveries until the quota is harvested. When possible, the plant operates at 75 to 80 percent of maximum capacity to ensure a top quality product.

There is also a pot fishery for larger shrimp which are processed onboard or by several small processing operations producing frozen whole shrimp or frozen tails.

TABLE 74

SHRIMP CATCH BY AREA 1977
(In Percent of Total Catch)

Southeastern Alaska	0.8%
Cook Inlet	4.4%
Kodiak	27.2%
Chignik	23.8%
South Peninsula	39.7%
Dutch Harbor	3.9%

Kodiak

For the 1977-78 season, there are eight companies in Kodiak processing shrimp. These companies are:

Alaska Packers Assiciation, Inc.
Alaska Pacific Seafoods
B & B Fisheries, Inc.
East Point Seafood Company
Kodiak King Crab, Inc.
New England Fish Company
Pacific Pearl Seafoods
Pan Alaska Fisheries

The processing capacity of these plants is shown in Table 75.

The eight plants have a total of 80 shrimp peelers and a maximum 24 hr/day operating capacity of 1,210,000 pounds per day (round weight). With the number of shifts per day and hours per shift actually run during average operation, the capacity is 730,000 pounds per day (round weight). These processing capacity estimates were collected by ADF&G in Kodiak by contacting each plant superintendent, and are current as of December 1, 1977.

The number of days which the plants operate in a year is one of the main determinants of capacity utilization. In discussions with the managers at two of the plants in Kodiak, they stated that their plants could process shrimp 250 days per year without conflicting with other production of the plant, for example, crab, and salmon. This length of operation may not be possible for all plants in Kodiak, but it does provide an estimate of a possible maximum. Table 76 divides the 1977 Kodiak area shrimp catch of 31,801,573 pounds by a range of annual operating days to determine the number of pounds per day which the processing plants in Kodiak would have to process each day, for annual operating estimates of 250 days per year to 50 days per year. From the maximum capacity estimate of 1,210,000 pounds per day, the capacity utilization at each level is calculated.

It is clear from Table 76 that there is excessive shrimp processing in Kodiak. In fact, the entire 1977 catch could have been processed in 26.3 days. This comes as no surprise as the amount of shrimp caught in the Kodiak area has decreased sharply in the past several years, while total processing capacity has increased. Using only the Kodiak area catch to determine capacity utilization however, will cause underestimation of the utilization rate because Kodiak also processes shrimp caught in other areas such as Cook Inlet, Chignik, and the South Peninsula. During 1976, the eight plants in Kodiak (with the exception of one which was under construction) processed 65.5 million pounds of shrimp. This was 14.1 million pounds more than the Kodiak catch if 51.4 million pounds, the difference coming from other areas. During 1977, there were shrimp coming into Kodiak for processing from as far away as Pavlov Bay, a 48-hour run for the fishing boats.

Considering that the 1978 Kodiak shrimp catch is expected to be very low, about 15 to 20 million pounds, and also that the processing plants in the South Peninsula are increasing capacity to handle more of that area's shrimp catch, the use of the figure 31.8 million pounds (1977 Kodiak area catch) may

TABLE 75

TOTAL ALASKA SHRIMP PROCESSING CAPACITY 1977 TO 1978

	No. of Plants	No. of Peelers	Daily Processing Capacity Estimates (In Thousand Pounds) 24 hrs/day Average Operation	Maximum Production
Southeastern	2	*	*	*
Cook Inlet	1	*	*	*
Kodiak	8	80	730	1,210
Chignik/South Peninsula/ Dutch Harbor	5	46	360	545
Total	16	126	1,090	1,755

Source: ADF&G; figures are as of December 1, 1977.

*Less than three companies. Data not included to maintain confidentiality.

TABLE 76

1977 CAPACITY UTILIZATION OF KODIAK SHRIMP PROCESSING PLANTS

Annual days of operation	250	200	150	100	50
Pounds/day processed[1]	127,206	159,008	212,010	318,016	636,031
Capacity utilization[2] (percent)	10.5	13.1	17.5	26.3	52.6
Capacity utilization[3] (percent)	17.4	21.8	29.0	43.6	87.1

[1]Calculated using 1977 Kodiak area catch of 31,801,573 pounds.

[2]Calculated using maximum capacity of 1,210,000 pounds per day.

[3]Calculated using average operation capacity of 730,000 pounds per day.

not be unreasonable. If there is not some kind of encouragement in the shrimp catches around Kodiak in the next couple of years, some capital equipment could be shifted westward where additional processing capacity is needed.

Chignik/South Peninsula/Dutch Harbor

There are five plants processing shrimp in the Chignik/South Peninsula/Dutch Harbor areas. These are:

Alaska Packers Association, Inc.	Anchorage Bay
Peter Pan Seafoods, Inc.	Squaw Harbor
Pacific Pearl Seafoods	Sand Point
Whitney-Fidalgo Seafoods, Inc.	Dutch Harbor
Vita Food Products, Inc.	Dutch Harbor

From Table 75 the maximum processing capacity for these plants is 545,000 pounds per day round weight. The calculations of capacity utilization over a range of operating days is shown in Table 77.

Processing the 1977 catch of 78.8 million pounds would have taken 144.7 days; however, there were approximately 14 million pounds of this total which were processed in Kodiak in 1977. This was probably because 54.7 million pounds of the total catch was during June, July, and August. Even if all five plants had operated at maximum capacity every day for these three months, they could not have been able to handle this concentrated production. The capacity utilization rates calculated using average operating capacities for these plants, go over 100 percent of capacity for season lengths of 150 and 200 days. This is another indication that plants in the Westward area need to operate as closely as possible to the maximum capacity in order to handle as much of the catch as possible. Operating the plant at the flat-out maximum may or may not be the most cost efficient level of production for the individual plants.

At the time of this survey (December 1977), one plant was installing four additional peelers and another was planning to add four peelers. These additions will enable the Westward processing plants to handle a greater percentage of the area catch in 1978.

TABLE 77

1977 CAPACITY UTILIZATION FOR CHIGNIK/SOUTH PENINSULA/DUTCH HARBOR

Annual days of operation	250	200	150
Pounds/day processed[1]	315,407	294,259	525,680
Capacity utilization[2] (percent)	57.9	72.3	96.4
Capacity utilization[3] (percent)	87.6	109.5	146.0

[1]Calculated using 1977 catch of 78,851,973.

[2]Calculated using maximum capacity of 545,000 pounds/day.

[3]Calculated using average operation capacity of 360,000 pounds/day.

CHAPTER IX

MARKETING OF ALASKA SHELLFISH

Marketing of King Crab

King crab is the most widely recognized of the three Alaskan crab species commercially harvested, and also commands the highest price of the three. At the time the U.S. entered the fishery, the Japanese had already been fishing king crab for a long period of time and king crab products had a strong consumer demand in that country as a result of this long exposure. The growth of the domestic markets for king crab came largely as a result of the marketing efforts of the early pioneers in the industry such as Lowell Wakefield. This early marketing work introduced king crab to consumers in the U.S. and also established European markets for U.S. exported products.

King crab is processed and marketed in several different product forms: whole fresh and frozen, frozen sections (four legs and one claw), frozen meats which have been extracted from the shell, canned meats, and the separate claws. These product forms require varying amounts of processing and, therefore, vary in the cost of production.

Whole crab, either fresh or frozen, is generally restricted to small local markets within Alaska. This is because most king crab is shipped out of state, and shipping whole crab would add an additional 45 percent or so to the shipping weight, creating unnecessary additions to the shipping costs.

The predominant king crab product form processed is sections. Production of sections is less labor intensive than shelled meats, which is an important consideration because of the high cost of labor in Alaska. For many processing plants in the Westward region, the physical space constraints of the processing area and lack of housing available for plant workers make the production of bulk sections more cost efficient than meat production. Almost all of the king crab processed in Alaska is routed through the Seattle area and either shipped from there as bulk sections or reprocessed into meats or into smaller packages for distribution to markets. The sections reach the reprocessing plants in brine frozen bulk packages from 75 to 150 pounds gross weight. An example of the smaller package size into which these bulk section crates are repackaged is the 20-pound carton. The legs and claws are glazed, placed in the poly-lined cardboard carton in a natural proportion of one claw to four legs.

Production of frozen crab meats is the second most important product form. Extracted meats are generally frozen in 15-pound blocks as described in the processing section. When the blocks reach the reprocessing plant they are cut into five-pound blocks, glazed, placed in a polyethylene cardboard carton and put into a shipping carton. The shipping carton holds six five-pound blocks (total weight 30 pounds). Some companies also put out smaller packages of meats destined for the retail trade in eight-ounce, six-ounce, and three-ounce cubes. These small package sizes are necessary to sell the product at a price low enough so people will buy it; however, many supermarket chains have discontinued carrying frozen king crab meats because there is such a high incidence of pilferage.

Canned king crab meats are becoming less popular than they once were. In discussions with marketing people at several processing companies, the main suggested cause of the decrease in the amount of king crab canned was that the high cost of raw crab plus increasing costs of canning raise the cost of a can of meats to the point where it is prohibitive to the retail consumer. One processing company contacted did can a small amount of king crab in 1977 and had not been able to sell it. To their knowledge, they were the only company which canned king crab that year. For a description of the shipping methods for canned product, see the shrimp section on distribution of canned shrimp.

King crab claws are sometimes packaged by themselves. They go to the institutional market or to the retail market as a specialty item.

The product forms processed for 1956 through 1958, and for 1973 through 1976, are shown in Table 78. It should be noted that these are the product forms of crab as they are processed in Alaska and not the product forms which reached the final consumer. The amount of sections which are further reprocessed into meats are certainly significant; however, the quantitative amounts are not known.

Marketing of Tanner Crab

Tanner crab is marketed under the trade name of snow crab and will be occasionally referred to by this name in this section. It was originally marketed under the name "queen crab" in order to imply similarity to king crab. The Food and Drug Administration rejected this name as being misleading, and the name snow crab has become predominant.

The product forms for tanner crab are mainly frozen sections (four legs and one claw--also called shell stock or clusters by the industry) and canned or frozen extracted meats from the sections. For export to the Japanese market, the sections are graded by size, with the larger sections commanding the highest price (see discussion of specific grades in the processing section).

The product form for tanner crab processed in Alaska is partly dependent upon current market demand for a specific product form but also more importantly, the cost of production of the different forms. Extraction of the meat from sections, to be either frozen or canned, is relatively more labor intensive than the labor required to produce crab sections. With the high cost of labor in Alaska, it is less costly for processing companies to ship frozen sections from Alaska south for further reprocessing in Washington or California than to do complete processing in state.

TABLE 78

SHELLFISH PRODUCT WEIGHTS BY YEAR
(In Pounds)

King Crab	1956	1957	1958	1973	1974	1975	1976
F/F Whole[1]	196,526	8,300	1,926	576,557	23,239	305,922	56,849
F/F Sections	266,435	1,682,880	800,000	17,211,508	13,554,893	34,207,323	33,981,945
F/F Meat	515,578	1,262,067	1,120,000	8,960,803	11,371,640	6,955,411	8,444,834
Canned Meat	723,530	866,281	360,701	818,009	800,493	1,002,787	668,965
F/F Claws	30,798			136,327	184,798	262,121	10,126
Tanner Crab							
F/F Whole			2,260	7,093	25,806		40
F/F Sections				15,557,685	16,524,455	17,851,926	26,223,656
F/F Meat				6,639,422	3,142,978	1,181,626	3,228,633
Canned Meat				915,293	998,259	878,696	1,239,469
F/F Claws				172,143	121,836	486,711	590,999
Shrimp							
F/F Whole	103,600	59,891	23,437	5,340,887	505,558	267,034	4,383,813
F/F Tails				13,302	23,079	15,036	21,507
F/F Meat	436,669	396,080	889,170	6,096,435	1,585,321	1,277,559	1,118,264
Canned Meat		159,198	228,184	7,950,661	4,369,480	3,785,826	3,699,864

Source: ADF&G Processors Annual Reports, edited and corrected by Alaska Sea Grant Program.

[1]F/F = fresh frozen.

Some of the reprocessing plant locations in the Seattle area include Bellingham, Everett, Rainier, Redmond, and Monroe. Many of the larger processing plants have their own reprocessing facilities at these locations. Companies which do not have these facilities available themselves are able to have reprocessing done on a custom packing basis. There are several custom reprocessing plants in Seattle which use machine processing methods. Tanner crab sections are also shipped frozen by truck to locations in California where the meats are shaken out by hand. The hand labor results in a higher recovery factor than does machine processing. The abundant supply and relatively less expensive labor in California make hand processing feasible.

The product forms and amounts processed are shown on a statewide basis in Table 78 for the years 1956 to 1958 and 1973 to 1976. Due to the large amount of out-of-state reprocessing, this table is not indicative of the product breakdown which reaches the market. It can be seen from this table that the predominant form for tanner crab processed in Alaska is in sections. The majority of these are packed in large, 90 to 150 pound bulk packs which have been brine frozen. A significant portion of these bulk sections is exported to Japan, generally shipped via Seattle. Product destined for the domestic market is repackaged or reprocessed, as mentioned above, into smaller packages. For example, one common package size is 20 pounds. Sections are packed into a polyethylene-lined cardboard carton. The legs and claws may have become separated during processing and shipping, however, a "natural proportion" of one claw to four legs is maintained in this pack. There is also a smaller amount of sections which are individually shrink-wrapped (cryovac wrapping) for the specialty market in Japan.

Extracted meats are processed into blocks of frozen meats or are canned. Due to the high costs of canning the product, this form is used to a lesser extent by processing companies in Alaska. Blocks of crab meat are usually frozen in a 50-pound block known as a "long john," or similarly sized block. When these blocks reach the reprocessing plants, they are cut into five-pound portions and packed into a polyethylene-lined cardboard carton. Six of these five-pound portions go into a shipping carton for distribution to markets.

Geographic Distribution

Data for the distribution of crab are known only to the extent of the locations of some of the major centers of distribution. One of the difficulties in obtaining quantitative estimates of the amount of product going to the different areas of the country is that these data are not available on an industry-wide basis. The sales and marketing organization within one company will know where the product that their company sells is distributed. They will also have a reasonable understanding of where product from some of the other processing companies is marketed, but the total quantities going to different distribution centers will not be known.

In order to determine accurately the quantity of geographic distribution for crab products, it would be necessary to complete an industry-wide survey of the processing companies. This was originally planned as part of this study; however, due to lack of enthusiasm from the processing industry in being subjected to another questionnaire, this part of the study was dropped.

The main centers of distribution which were mentioned by several processing companies are shown in Figure 19.

Market Channels for King and Tanner Crab

The market channels for king and tanner crab are basically the same. From the processing companies in Alaska, the product will go to the domestic market or for export. These are discussed separately below and also shown in the flow charts in Figures 20 and 21.

Product for Export

Product for export is shipped from the processing plant to the importing company, either directly or via Seattle. In general, export sales do not go through a broker. They are handled by company sales personnel who deal directly with the importer. For example, a processing company in Alaska will sell tanner crab sections directly to a trading company in Japan (the largest export market for both king and tanner crab). The product is shipped F.O.B. Alaska and may go directly to Japan, or more commonly go through Seattle as a transshipment point.

From discussions with sales personnel at various processing companies, it was estimated that approximately 50 percent of the tanner crab produced is exported to Japan. It was emphasized that their exports were almost entirely sections. Most of the sections are exported in bulk, brine frozen crates, and a small percentage are exported as single shrink-wrapped sections.

A study of the market channels for tanner crab in Japan was not included within the scope of this project. This subject is covered in Alaska Sea Grant Report No. 78-12 (Gorham and Orth 1978) which should be referred to by those desiring additional information on that area.

From information obtained from processing companies which ship king crab to Japan, the demand there is for bulk sections which are further reprocessed into canned or frozen meats.

Product for the Domestic Market

Frozen King and Tanner Crab. From Alaskan processing companies, frozen king and tanner crab products are put into cold storage facilities near the Seattle area. The project generally is reprocessed and/or repackaged at these locations. Distribution to the northwestern area is made directly from these cold storage facilities. Sales are made through brokers or by processing company sales personnel. Brokers act as independent sales agents representing the processing company, receiving a commission (usually 2 1/2 percent) on all sales made. They have authority from the processing company to release product from storage to be shipped to the buyers.

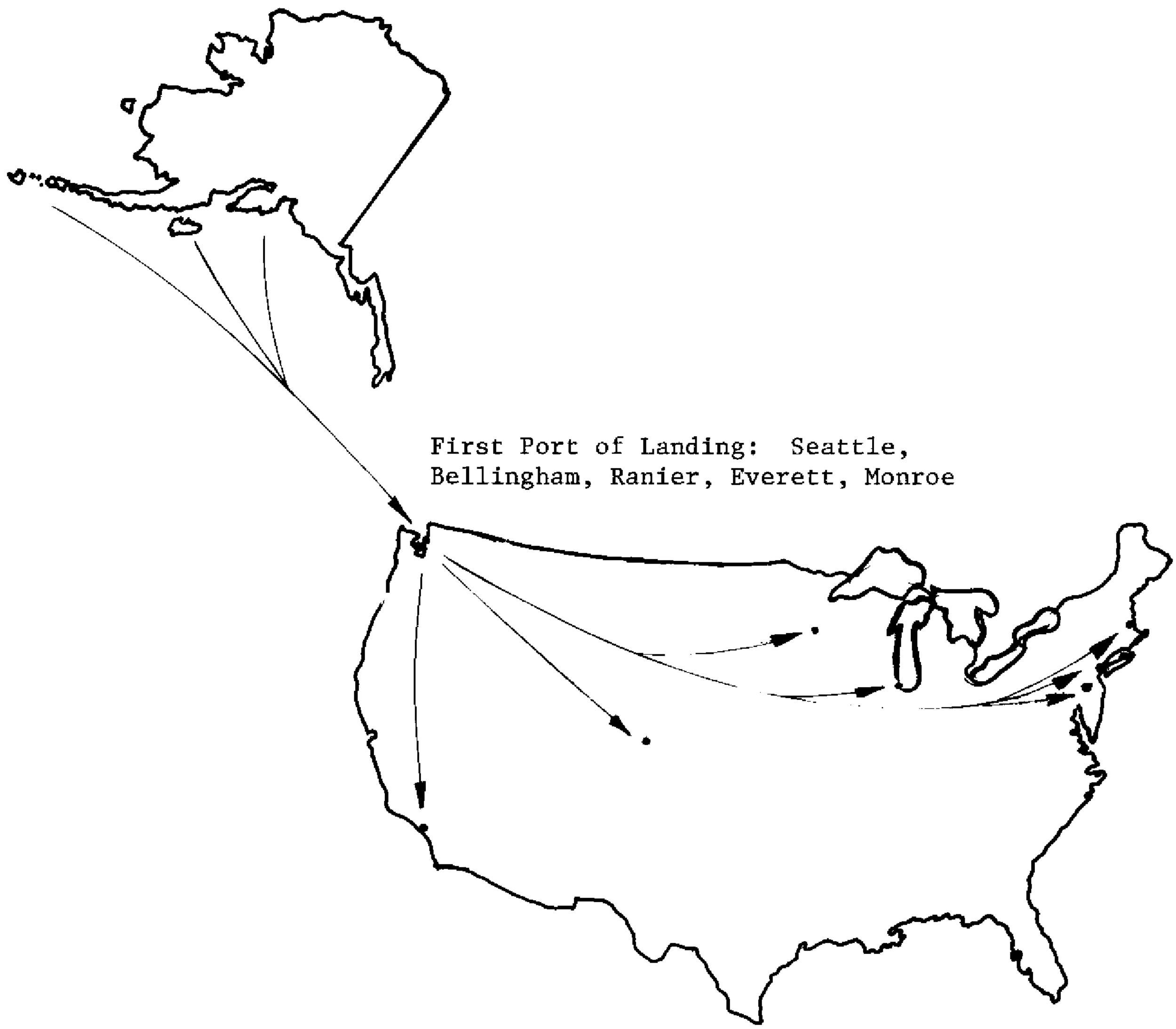

FIGURE 19. DISTRIBUTION OF ALASKAN SHELLFISH PRODUCTS BY MAJOR CENTERS OF DISTRIBUTION

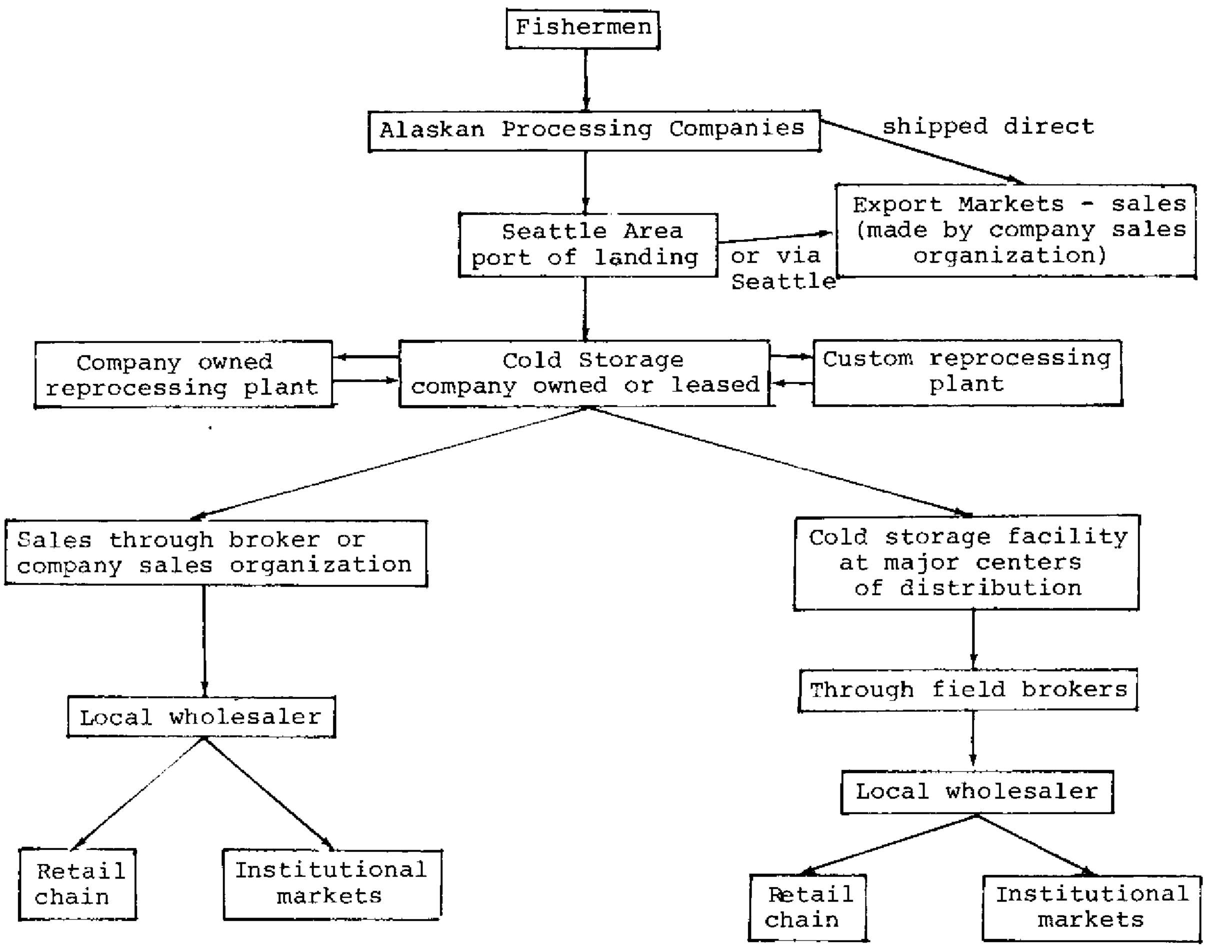

FIGURE 20. MARKET CHANNELS FOR FROZEN KING AND TANNER CRAB PRODUCTS

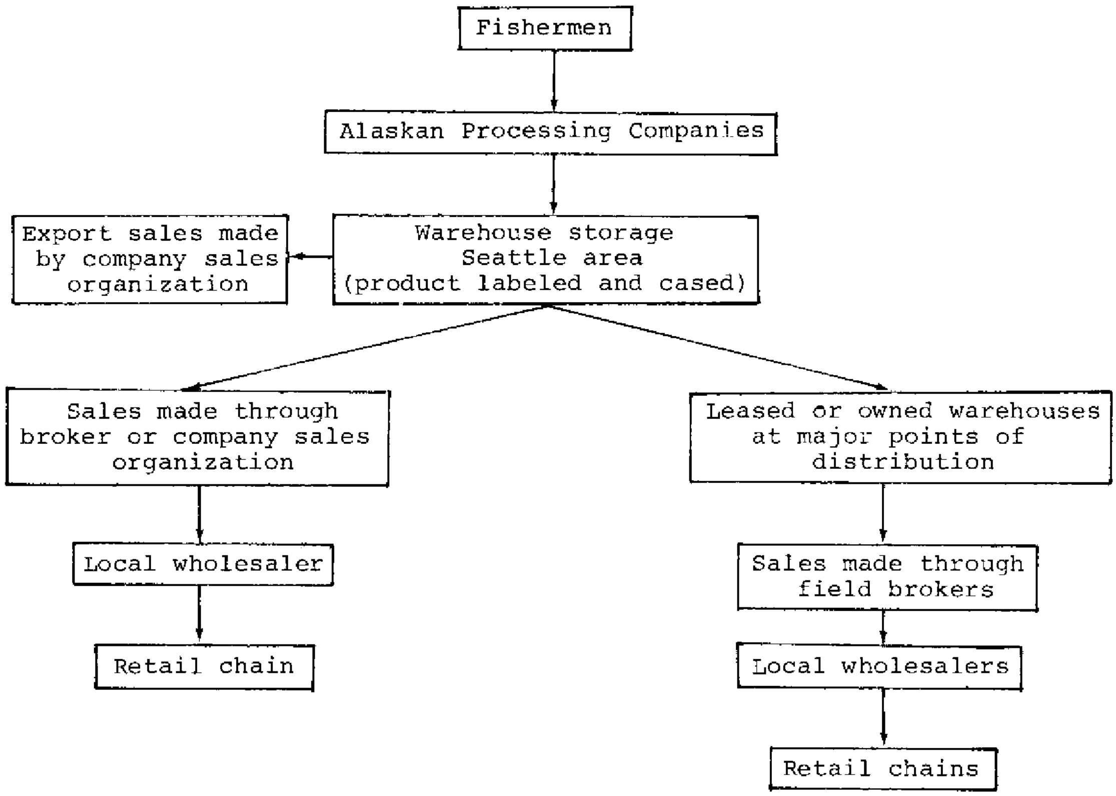

FIGURE 21. MARKET CHANNELS FOR CANNED ALASKAN SHELLFISH PRODUCTS

Most of the product sold is to local wholesalers. They obtain title to the product from the processing company when the invoice is made; effectively when the product leaves the cold storage facility. The price to the wholesaler can include delivery or, if they pick up product themselves, a haul allowance is made on the price of the product. The price to the wholesaler will also vary depending on amounts ordered, promotional discounts, and other variables.

Product destined for markets in other parts of the country is shipped from the Seattle area to storage facilities in the major distribution centers. These facilities are owned or leased by the Seattle processing company. Sales are made through field brokers who act as independent agents selling for a commission. Wholesale transactions at the distribution centers are handled as they are at the Seattle processing plants. This is described in the paragraph above.

The major buyers from the wholesaler are retail food store chains and institutional markets. The institutional market, which includes individual restaurants and restaurant chains, is the major purchaser of frozen king and tanner crab products. A smaller percentage of the product goes to food stores where it is purchased for home consumption.

A flow chart of these market channels is shown in Figure 20.

Canned King and Tanner Crab. The major market for canned king and tanner crab is the retail food chain supplying product for home consumption. As previously mentioned, there is a declining market for canned crab, especially king crab due to the high cost. At the present cost of five to six dollars for a half-pound can off the supermarket shelf, most consumers will substitute a less expensive product. The market channels for the amount of canned crab which is produced is shown in Figure 21. The individual steps of distribution of the product are the same as described for frozen product.

Import and Export Markets

Data on imports and exports of king and tanner crab are not available in a complete form. There are limited data available, however, and these are presented and discussed in this section.

The U.S. exports of frozen and prepared king crab are shown in Tables 79 and 80, by country of destination for the years 1968 to 1977. The amount of frozen king crab exported has increased over this period from 847,000 pounds in 1968 to over ten million pounds in 1977. During this first five-year period, Canada and the Netherlands were the countries importing the largest amount, an average of 151,000 pounds and 124,000 pounds, respectively per year. During the second five-year period, from 1973 to 1977, these two countries increased their imports to an average of 540,000 pounds and 531,000 pounds per year. Japan was the only country which exceeded these amounts of imports of king crab, importing an average of almost 2.5 million pounds per year during the second five-year period. In 1977 alone, Japan imported 7.5 million pounds of king crab out of a total of 10.1 million pounds by all countries.

TABLE 79

U.S. EXPORTS OF FROZEN KING CRAB BY COUNTRY OF DESTINATION 1968 TO 1977
(In Pounds)

Country	1968	1969	1970	1971	1972	5-year Average
Australia	55,357	64,931	40,405	129,852	153,224	88,754
Belgium	75,325	20,784	5,913	77,685	290,290	93,999
Bermuda	46,429	21,080	15,585	16,687	32,294	26,415
Canada	239,707	84,956	166,432	75,653	191,815	151,713
Denmark	15,939	35,636	9,563		16,324	15,492
France	15,388	12,880			23,630	10,380
Japan	21,889	21,816				8,741
Netherlands	115,993	65,460	82,326	91,771	266,506	124,411
Sweden	23,605	45,962	13,850	11,544	74,351	33,862
United Kingdom	100,215	51,378	42,006		38,532	46,426
West Germany	14,043	15,355	30,367	22,669	54,809	27,449
Other	123,418	55,927	73,172	96,919	185,164	
Total	847,308	496,165	479,619	522,779	1,326,939	
Imports for later export:		14,020	14,052	6,535	7,906	

Country	1973	1974	1975	1976	1977	5-year Average
Australia	109,973	477,506	148,025	175,926	209,617	224,209
Belgium	945,359	327,693	256,049	410,297	495,155	486,911
Bermuda	101,446	33,102	43,347			35,579
Canada	184,806	277,407	657,724	630,051	951,090	540,216
Denmark				85,180	99,903	37,017
France		84,564	78,720	69,959	131,386	72,926
Japan	1,970,991	401,659	764,552	1,729,650	7,498,861	2,473,143
Netherlands	848,033	370,700	459,750	577,074	401,406	531,393
Sweden	188,190	328,223	88,813	105,140	70,880	156,249
United Kingdom	185,853	65,405		84,494	48,949	76,940
West Germany		45,660	56,614	88,158	41,797	46,446
Other	195,225	120,498	158,368	142,579	233,217	
Total	4,729,876	2,532,417	2,711,962	4,098,508	10,182,261	
Imports for later export:	1,000	2,260	1,060	36,697	5,170	

Source: U.S. Bureau of Census, FT 140, Schedule B. Commodity by Country, 1968 to 1977.

TABLE 80

U.S. EXPORTS OF PREPARED OR PRESERVED KING CRAB BY COUNTRY OF DESTINATION 1968 TO 1977
(In Pounds)

Country	1968	1969	1970	1971	1972	5-year Average
Australia		8,250				1,650
Belgium			69,466			13,893
Canada						
Denmark	47,412			4,655		10,413
France						
Japan						
Netherlands		13,403	12,017	10,020		7,088
Sweden	53,246		38,656	11,550		20,690
United Kingdom	20,378		18,250			7,726
Other	50,756	29,165	61,282	14,235	20,642	
Total	171,792	50,818	199,671	40,460	20,642	
Imports for later export:	30,200	270		37,655	210	

Country	1973	1974	1975	1976	1977	5-year Average
Australia	46,400	69,628	18,408			26,887
Belgium	24,070	27,729	76,221	16,669	24,177	33,773
Canada	14,170	15,589		29,725	30,800	18,057
Denmark	27,572					5,514
France	458,231	34,313	67,627	29,101	98,742	137,603
Japan	557,882	393,042	101,115	195,960	58,263	261,252
Netherlands	248,902	31,768	64,081	39,799	25,763	82,063
Sweden	130,639	8,742	25,380	14,960		35,944
United Kingdom		88,531	41,445			25,995
Other	16,342	37,538	51,714	43,913	30,205	
Total	1,524,208	706,880	445,991	370,127	267,950	
Imports for later export:	39,863		16,092	1,750	3,404	

Source: U.S. Bureau of Census, FT 140, Schedule B. Commodity by Country, 1968 to 1977.

The exports of king crab were at a fairly low level during the first five-year period. The amount of exports during the second five-year period, 1973 to 1977, was considerably more significant, but the total amount exported has decreased from 1.5 million pounds in 1973 to only 268,000 pounds in 1977. This is consistent with the decreased amount of canned crab demand in the domestic market due to the high costs of the canned product. The main importing countries are Japan and France with the remainder of exports going to other European countries.

Data for exports of tanner crab are not available; however, it is possible to make some estimates of the amounts using Japanese import data. Japan is the major export market for tanner crab, importing approximately one-half of the total U.S. production, mostly in frozen section form. A summary of Japanese imports of fresh and frozen crab is shown in Table 81. Assuming that the Japanese imports of crab from the U.S. are restricted to king and tanner crab, the amount of tanner crab imported can be calculated by subtracting the imports of king crab (from Table 82) from the total imports. This calculation gives the results for amounts of U.S. frozen tanner crab products exported to Japan during 1970 to 1976.

The U.S. imports of frozen and canned crab are shown in Tables 83 and 84. These data are not broken down by species; however, it is reasonable to assume that the only imports of king and tanner crab come from Japan and Canada. Of the countries exporting crab products to the U.S., these two countries are the only ones harvesting and processing king and tanner crab.

The imports from Canada are probably _Chionoecetes opilio_ which they market under the name "queen crab." The amounts imported have remained fairly constant throughout the period from 1968 to 1977 for both frozen and canned products.

The U.S. imports of frozen crab products increased from 1968 to 1977, especially during the second five-year period. It is not known what percentage of the total amounts are king or tanner crab. The U.S. imports of canned crab from Japan have decreased very significantly during the 1968 to 1977 period from 4.2 million pounds to 292,000 pounds. The species composition of these imports can be calculated by subtracting Japanese exports of canned tanner crab to the U.S. (from Table 85) from the total amount of crab imported from Japan (from Table 83). Assuming that the U.S. crab imports are entirely king or tanner crab, Table 86 can be calculated.

Demand

No demand analysis for Alaska's king crab, tanner crab, and shrimp has been attempted within the context of this study because of the dearth of available time series data. Nor has there been any previous work on demand estimates for these species published by other research groups or agencies with the exception of some preliminary work on tanner crab.[1] This is an

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[1] A preliminary model for U.S. demand of tanner crab has recently been formulated. This report is: Abby H. Gorham and Franklin L. Orth, United States Market Demand and Japanese Marketing Channels, Alaska Sea Grant Report No. 78-12. Estimation of the model was hampered by the lack of necessary data.

TABLE 81

SUMMARY OF IMPORTS OF FRESH OR FROZEN CRAB INTO JAPAN[1]
(In Thousands of Pounds)

Year	Total Imports	Imports from the U.S.	Percent of Total
1970	1,972.9	63.3	3.2
1971	3,151.8	68.9	2.2
1972	5,541.7	51.0	.9
1973	23,558.0	13,806.3	58.6
1974	20,542.2	7,755.3	37.8
1975	23,019.5	4,186.5	18.2
1976	27,493.0	9,913.4	36.1

Source: From Clinton E. Atkinson, Statistics of the Crab Fisheries of Japan, forthcoming: Suisan Boeki Tokei (Fisheries Agency), 1972 to 1974, Nihon Boeki Geppo (Ministry of Finance), various years, Imports of Marine Products by Country (Japan Marine Products Association), various years.

[1]Import statistics for crab--live or frozen--were included in a general category prior to 1970.

TABLE 82

U.S. EXPORTS OF FROZEN TANNER CRAB TO JAPAN 1970 to 1976
(In Thousands of Pounds)

1970	63.3
1971	68.9
1972	51.0
1973	11,835.3
1974	7,353.7
1975	3,421.9
1976	8,183.8

Source: Calculated from Tables 79 and 81.

TABLE 83

U.S. IMPORTS OF CRABS AND CRAB MEAT FRESH, CHILLED, OR FROZEN
(In Pounds)

Country	1968	1969	1970	1971	1972	5-year Average
Canada	1,595,344	1,978,939	1,577,903[1]	2,467,003	2,131,124	1,950,063
Dominican Rep.		142,774	225,264	417,677	178,797	192,902
Japan	1,116,243	904,670	392,498[2]	709,750	1,213,493	867,331
Venezuela			110,447	264,476	342,444	143,473
Other	56,592	158,179	11,657	54,539	150,311	
Total	2,768,179	3,184,562	2,317,769	3,913,445	4,016,169	
Imports for consumption or later export:	56,395	40,816		7,000	28,746	

Country	1973	1974	1975	1976	1977	5-year Average
Canada	2,129,853	1,517,966	1,988,280	1,232,788	1,018,383	1,577,454
Dominican Rep.	307,195	218,798	268,243	234,279	240,190	253,741
Japan	659,513	989,655	1,431,986	2,482,522	2,575,460	1,627,827
Venezuela	444,471	210,030	216,823	262,895	165,059	259,856
Other	847,180	650,552	317,281	497,974	2,092,488	
Total	4,388,212	3,587,001	4,222,613	4,710,458	6,091,580	
Imports for consumption or later export:	6,696					

Source: U.S. Bureau of Census, FT 135, U.S. General Imports, Schedule A Commodity by Country, 1968 to 1977.

[1]Includes 15,521 pounds imported and held in storage from a previous year.

[2]Includes 9,815 pounds imported and held in storage from a previous year.

TABLE 84

U.S. IMPORTS OF CRAB AND PROCESSED CRAB MEAT
(In Pounds)

Country	1968	1969	1970	1971	1972	5-year Average
Canada	135,925	450,265	118,101	362,866	179,236	249,279
Taiwan	231,627	38,838		79,199	294,918	128,916
Japan	4,281,581	2,925,482	2,625,766	3,351,673	1,737,532[1]	2,984,407
Thailand						
Venezuela					342,789	68,558
Other	70,817[3]	21,187	37,220[2]	23,324	21,618	
Total	4,719,950	3,435,772	2,781,087	3,817,062	2,576,093	
Imports for consumption or later export:	3,865	7,153	86,796	134,982	4,680	

Country	1973	1974	1975	1976	1977	5-year Average
Canada	498,718	323,638	418,670	302,733	301,600	369,072
Taiwan	852,444	1,087,508	301,314	536,182	1,443,504	844,190
Japan	154,964	457,153	64,468	281,424	292,172	250,036
Mexico					432,046	86,409
Thailand			34,236	145,086	413,900	118,644
Venezuela	532,135	672,196	679,544	795,516	631,771	662,232
Other	76,197	165,221	77,416	199,461	131,961	
Total	2,114,458	2,705,716	1,575,648	2,260,402	3,646,954	
Imports for consumption or later export:	30,950					

Source: U.S. Bureau of Census, FT 135, U.S. General Imports, Schedule A Commodity by Country, 1968 to 1977.

[1]Includes 240,177 pounds imported and held in storage from a previous year.

[2]Includes 12,000 pounds imported and held in storage from a previous year.

[3]Includes 57,758 pounds imported and held in storage from a previous year.

TABLE 85

SUMMARY OF JAPANESE EXPORTS OF CANNED TANNER CRAB
(In Thousands of Pounds)

Year	Total Exports	Exports to U.S.	Percentage of Total
1965	1,176.2	95.2	8.1
1966	1,425.0	55.7	3.9
1967	2,300.3	349.4	15.2
1968	5,762.8	2,606.0	45.2
1969	3,631.7	1,342.7	37.0
1970	1,742.1	742.4	42.6
1971	3,205.9	977.7	30.5
1972	1,605.5	609.1	37.9
1973	140.0	20.3	14.5
1974	505.1	259.8	51.4
1975	441.8	65.8	14.9
1976	699.8	264.3	37.8

Source: Statistics of the Crab Fisheries of Japan, Clinton E. Atkinson, March 1978.

TABLE 86

CANNED KING AND TANNER CRAB IMPORTS FROM JAPAN 1968 to 1976
(In Thousands of Pounds)

Year	King	Tanner	Total
1968	1,675.6	2,606.0	4,281.6
1969	1,582.8	1,342.7	2,925.5
1970	1,883.4	742.4	2,625.8
1971	2,554.0	977.7	3,531.7
1972	1,128.4	609.1	1,737.5
1973	134.7	20.3	155.0
1974	197.4	259.8	457.2
1975	0.0	65.8	64.5[1]
1976	17.1	264.3	281.4

Source: Calculated from Tables 84 and 85.

[1]In 1975, there was more tanner crab imported from Japan than the total amount of crab imported. This is caused by a discrepancy between data sources.

area which should be regarded as a priority item for future research, assuming that some way can be found to overcome data limitations. This work would be useful for both the domestic demand and for foreign demand for Alaskan shellfish products.

During the course of the study, some general information on factors influencing demand were suggested by persons within the processing industry. These are listed below by species to try to present some overview of the current consumer demand.

King Crab. The domestic market for king crab is almost entirely institutional (food service industry). Through the 1960s, there were significant amounts of the production of canned king crab sold through retail supermarkets; however, this amount has since declined to almost nothing. The cause of this change in consumption patterns was suggested to be the price of a can of king crab having risen to the point where it is prohibitive to the retail consumer. For the same reason, retail sales of frozen meats have also been slowly phased out. In order to keep the package price low enough so that consumers will purchase the product, package sizes have been decreased to as small as six-ounce and three-ounce packages. This has resulted in retailing problems with shoplifting, and many chain stores are removing it from their stores.

All Japanese imports of king crab are frozen sections. After arrival in Japan, they are reprocessed into a canned or frozen meat product form. In addition to the demand in the food service industry, reference was made to the fact that retail consumer demand for canned king crab is somewhat seasonal. At certain times of the year, such as the New Year, it is popular to give canned king crab as gifts which contributes to a seasonal demand increase.

In a paper, Additional Japanese Comments on the Tanner Crab Issue, presented to the NPFMC in December 1976 as part of the Japanese review of the Draft Management Plan for Tanner Crab, the following comments concerning Japanese crab marketing were made:

> "Crab is a luxury food item for the Japanese people. Therefore, demand for tanner crab fluctuates with the general economic situation. In the long run, there is certainly a good possibility for an expanded crab market. However, we would like to stress that only through the marketing efforts of Japanese fishing companies selling the product which they themselves catch will the general expansion of the market for both domestic and imported tanner crab be feasible. For example, in the case of king crab, after Japan had been phased out of the fishery by the United States and the Soviet Union, the Japanese domestic market for king crab shrank. Contrary to expectations, imports decreased rather than increased. Therefore, the continuation of the Japanese tanner crab fishery is necessary for the maintenance and expansion of the Japanese domestic market."

This quote indicates that Japanese imports of king crab have decreased as a result of the Japanese exclusion from the fishery. As the Japanese domestic fishery for king crab was phased out, marketing activity within the country also ceased. It is stated that without this marketing activity, demand will decrease in Japan for U.S. imports of king crab. From Table 82 it can be seen that this has not been the case. In fact, imports of frozen king crab have increased markedly. This could be caused by a multitude of factors: a relatively price inelastic demand for king crab in Japan; an expansion of the distribution and marketing system making king crab available in new markets--a result partially caused by the devaluation of the dollar relative to the yen making the imports less expensive; or other factors.

Tanner Crab. Tanner crab was originally marketed in the U.S. as a lower priced substitute for king crab. It has since emerged with a separate product identity [2] with consumer recognition and popularity.

In the distribution of tanner crab products, approximately 50 percent is exported to Japan. Of the remaining 50 percent, approximately 15 percent goes to retail markets and the rest to the institutional markets. The Red Lobster chain purchased an estimated six million pounds of tanner crab in 1977. Restaurant chains like the Red Lobster comprise the largest market.

As is the case for king crab, demand for canned tanner crab has declined as the price has increased. The production of frozen product is less labor intensive and, therefore, relatively less costly than canning.

The Japanese demand for tanner crab is entirely for sections, mostly brine frozen and a small amount shrink wrapped. Several marketing persons with Alaskan processing companies stated that at present there is no Japanese market for tanner crab meats. They can apparently produce enough from the Bering Sea allocation of *C. opilio* to meet the domestic demands.

Prices

The data in Tables 87 through 90 on king and tanner crab prices are included only to give an indication of the trend of ex-vessel and wholesale prices. Price series data sufficiently complete for demand analysis are not available. Tables 88 and 89 were compiled from ADF&G published statistics in order to deflate ex-vessel and wholesale values for king and tanner crab by the consumer price index. This was done to compare the increases in values with the increases in amount of catch. These data should be taken only as indicative due to lack of reliability in the quality of the data used.

Marketing of Shrimp

The majority of the Alaskan shrimp processed are small pink or humpy shrimp. These shrimp are marketed primarily as cocktail or salad shrimp. It is important to recognize that they are a separate product from the larger shrimp and prawns from the Gulf of Mexico and imported from other countries. The fact that they are a different product makes obtaining necessary data difficult since most of the available data is for these larger shrimp.

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[2] The Bering Sea Tanner Crab Resource: U.S. Production Capacity and Marketing, Appendix D, Snow Crab Market Survey - California Region, Alaska Sea Grant Report 77-5, May 1977.

TABLE 87

KODIAK EX-VESSEL PRICES OF KING AND TANNER CRAB 1970 TO 1977
(In Cents Per Pound)

Month	1970		1971		1972		1973		1974		1975		1976		1977	
	King	Tanner	King	Tanner	King	Tanner	King	Tanner	King	Tanner	King	Tanner	King	Tanner	King	Tanner
Jan.			34	10		11		13		20	35		65	20	1.00	30
Feb.				10				14		20				20		31
March				10				16		20				20		33
April				10		11		16		20		14		20		35
May	...	11		10		12		17		20		14		23		37
June	...	11		10		12	50	19		20		14		22		37
July		11		11		12	50	19		20		14				
Aug.	25		30				68		45							
Sept.	25		30		36		80		45		44		60		1.09	
Oct.	26		30		36		82		45		42		60		1.38	
Nov.	28	9		11	46	13			37		45	20	79		1.43	
Dec.	34	10		11	51	13		20	40		58	20	95		1.45	40

Sources: U.S. Department of Commerce, NOAA, NMFS, Fishery Market News Report, Seattle, Washington various issues 1970-77.

TABLE 88

WHOLESALE PRICES FOR KING AND SNOW CRAB MEAT, MONTHLY 1974 TO 1977
(In Dollars per Pound)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
King Crab												
Chicago												
1974	5.20	5.15	5.15	5.12	4.99	4.89	4.80	4.58	4.18	3.79	3.34	3.20
1975	3.04	2.88	2.99	3.18	3.45	3.45	3.45	3.14	3.50	3.65	2.82	3.92
1976	4.12	4.14	4.29	4.44	4.65	4.72	...	...	...	5.88	5.93	5.99
1977	6.08	5.96	5.97	6.09	6.25	6.41	6.67	6.83	6.92	7.09	7.24	7.39
New York												
1974	5.21	5.15	5.15	5.18	5.00	4.84	4.70	4.52	4.12	3.68	3.28	3.18
1975	2.94	2.87	3.05	3.20	3.40	3.45	3.35	3.24	3.52	3.64	3.70	3.96
1976	4.21	4.28	4.36	4.48	4.69	5.01	5.32	5.58	5.60	...	5.98	6.01
1977	6.01	5.92	5.92	6.14	6.35	6.30	6.69	6.88	7.01	7.22	7.20	7.59
Snow Crab												
Chicago												
1972	...	...	3.30	3.31	3.18	2.97	2.94	2.70	2.40	2.30	2.32	2.23
1973	...	2.89	...	3.15	3.16	3.06	3.07	3.10	3.26	3.38	3.34	3.35
1974	...	...	3.30	3.31	3.18	2.97	2.94	2.70	2.40	2.30	3.32	2.23
1975	2.28	1.98	2.16	2.22	2.52	2.52	2.52	2.49	2.45	2.60	2.48	2.48
1976	2.62	2.62	...	...	3.45	3.45	...	...	3.72	3.72	3.72	3.78
1977	3.78	3.79	3.82	3.82	...	4.02	4.05	4.05	3.94	3.92	3.90	...
New York												
1974	3.25	3.26	3.35	3.41	3.33	3.11	2.88	2.80	2.55	2.46	2.28	2.27
1975	2.18	2.06	2.09	2.22	2.35	2.43	2.44	2.43	2.48	2.51	2.48	2.50
1976	2.61	2.78	3.22	3.70	3.80	3.96	3.90	3.61	3.53	3.51	3.45	3.58
1977	3.60	3.92	3.90	3.88	3.89	4.10	4.10	4.08	3.84	3.85	3.86	3.95

Source: NMFS, Current Economic Analysis S-40, Shellfish Market Review and Outlook, March, 1978.

TABLE 89

LANDINGS, LANDED VALUES, AND WHOLESALE MARKET VALUE OF ALASKAN KING CRAB 1960 TO 1977
(In Thousands of Pounds and Thousands of Dollars)

Year	Volume of Landings[1]	Index of Landings 1969 = 100	Value of Landings: Actual[2]	Value of Landings: Constant Dollars 1967 = 100[3]	Value of Landings: Constant Index 1969 = 100	Wholesale Market Values: Actual[4]	Wholesale Market Values: Constant Dollars 1969 = 100[3]	Wholesale Market Values: Constant Index 1969 = 100
1960	28,570.0	100	2,286.1	2,577.3	100	5,294.9	5,969.4	100
1961	43,411.6	152	3,913.7	4,368.0	171	9,625.5	10,742.7	182
1962	52,782.1	185	5,278.2	5,819.4	231	11,861.8	13,078.0	224
1963	78,740.2	276	7,607.4	8,286.9	333	16,770.6	18,268.6	317
1964	86,720.7	304	8,186.2	8,802.3	358	21,262.3	22,862.7	402
1965	131,670.7	461	12,729.4	13,470.3	557	31,665.0	33,507.9	598
1966	159,201.7	557	15,670.5	16,121.9	685	44,367.9	45,646.0	838
1967	127,715.9	447	14,969.8	14,969.8	655	36,948.0	36,948.0	698
1968	82,037.5	287	21,878.1	20,996.3	957	42,520.7	40,806.8	803
1969	57,729.8	202	15,643.8	14,247.5	684	26,852.0	24,455.4	496
1970	52,061.0	182	13,189.7	11,341.1	577	24,836.0	21,355.1	469
1971	70,703.1	247	19,077.2	15,727.3	834	32,352.0	26,671.1	611
1972	74,426.6	260	21,886.9	17,467.6	957	44,044.4	35,151.2	832
1973	76,824.1	269	44,702.2	33,585.4	1,955	72,957.4	54,814.0	1,378
1974	95,213.8	333	39,153.9	26,509.1	1,713	48,411.2	32,776.7	914
1975	97,628.9	342	38,251.4	23,729.2	1,673	83,837.0	52,008.1	1,583
1976	105,824.9	370	67,893.0	39,819.9	2,970	116,794.2[5]	68,501.0	2,206
1977	99,448.6	348	...	...	...	...	...	...

[1]ADF&G Statistical Leaflets 1960-75, Preliminary data 1976 and 1977.

[2]ADF&G Statistical Leaflets 1960-75; C.F.E.C., Alaska Shellfish Economic Data Base, Table 2, 1976. Note: Value of landings does not include year end bonuses paid to fishermen by processing companies.

[3]Bureau of Labor Statistics, Consumer Price Index, all items.

[4]ADF&G Statistical Leaflets 1960-75, 1976 estimated from computer aggregation of processor's annual reports.

[5]Calculated by Sea Grant from: (a) actual reported values reported in annual reports from processing companies; and (b) from estimated average wholesale prices by area for each product form times production for that area.

TABLE 90

LANDINGS, LANDED VALUES, AND WHOLESALE MARKET VALUE OF ALASKAN TANNER CRAB 1960 TO 1977
(In Thousands of Pounds and Thousands of Dollars)

Year	Volume of Landings[1]	Index of Landings 1969 = 100	Value of Landings			Wholesale Market Values		
			actual[2]	Constant Dollars 1967 = 100[3]	Constant Index 1969 = 100	Actual[4]	Constant Dollars 1969 = 100[3]	Constant Index 1969 = 100
1967	118.4	1	11.8	11.8	1	19.5	19.5	1
1968	3,246.8	29	323.6	310.6	28	551.1	528.9	21
1969	11,206.7	100	1,133.0	1,031.9	100	2,623.8	2,389.6	100
1970	14,473.2	129	1,417.3	1,218.6	125	3,664.0	3,150.5	140
1971	12,880.1	115	1,368.5	1,128.2	121	2,893.8	2,385.6	110
1972	30,135.4	269	3,731.2	2,977.8	329	8,909.6	7,110.6	340
1973	61,719.4	551	10,755.9	8,081.1	949	33,687.7	25,310.1	1,284
1974	63,906.0	570	13,052.4	8,837.1	1,152	15,653.1	10,597.9	596
1975	46,857.0	418	7,019.5	4,354.5	620	19,372.6	12,017.7	738
1976	80,712.2	720	16,021.1	9,396.5	1,414	37,043.9[5]	21,726.6	1,412
1977	98,328.9	877	...	...	...	...	...	...

[1]ADF&G Statistical Leaflets 1960-75, Preliminary data 1976 and 1977.

[2]ADF&G Statistical Leaflets 1960-75; C.F.E.C., Alaska Shellfish Economic Data Base, Table 2, 1976. Note: Value of landings does not include year end bonuses paid to fishermen by processing companies.

[3]Bureau of Labor Statistics, Consumer Price Index, all items.

[4]ADF&G Statistical Leaflets 1960-75, 1976 estimated from computer aggregation of processor's annual reports.

[5]Calculated by Sea Grant from: (a) actual reported values reported in annual reports from processing companies; and (b) from estimated average wholesale prices by area for each product form times production for that area.

The product forms into which Alaskan shrimp are processed include: frozen whole, frozen peeled, and frozen tails for the larger shrimp. The packages for these products are: 15-pound blocks, frozen IQF packaged into a "pillow pack," frozen vacuum-canned, frozen in five-pound cans, and canned conventionally.

As is the case for Alaskan crab products, much of the Alaskan production is repackaged after it reaches the Seattle area. The 15-pound blocks are cut into three five-pound sections and are packaged in individual waxed cardboard cartons and packed six to a shipping carton. The bulk IQF packages are also packaged into smaller packages, as small as eight ounces for retail sale.

Canned shrimp (and other canned products) are shipped from Alaska in "bright stack." These are unlabeled cans stacked on a shipping pallet and wrapped with plastic, colored for ownership and product identification. When canned shrimp reach Seattle or another point of landing, they are moved into company owned warehouses for labeling and repackaging (into 24-or 48-can cases), or they can be custom warehoused for labeling and repackaging. The cans are labeled by grades according to instructions from the processing company and cased. An example of the different grades used for Alaskan shrimp are tiny, small, and broken. The labels which are put on the same product may differ according to the purchaser. Many processing companies have their own brand names under which they sell product. They may also sell product to chain stores which label with their own private brand label. After labeling and casing, the shrimp are ready for shipment.

Another type of marketed product, which has had limited production to date, is the larger Alaskan shrimp--coonstripes and sidestripes. One Kodiak vessel has been producing a high quality pack of these shrimp for the past several years and exported it to the Japanese specialty market. These shrimp have been frozen raw onboard the vessel within four hours of landing. This provides a high quality shrimp product for which there is a strong demand in Japan. The company involved has been unsuccessful to date in selling any of their product in the U.S. They are unable to compete with Gulf of Mexico prawns on a basis of price or consumer appeal.

Market Channels

The market channels for shrimp are basically the same as for crab products. Exports are made mostly through processing company sales personnel directly to the foreign buyer, domestic sales organization, or through brokers who act as independent agents selling for a commission. For the Pacific Northwest, the product is shipped from warehouse storage around Seattle. For sales to other areas, the product is shipped to storage warehouses in major sales areas, and sold through field brokers to retail and institutional buyers. Flow charts showing the market channels for frozen and canned products is shown in Figures 20 and 21.

Geographic Distribution

No quantitative data are available or were collected to establish the geographic distribution of Alaskan shrimp products. For discussion with marketing organizations at processing companies, however, some estimates of the product distribution were obtained. It is hoped these will provide some insight as to where Alaskan shrimp are marketed.

A significant percentage of shrimp go for export. The main countries importing Alaskan shrimp were the Scandinavian countries, England, and Canada. Export statistics from the Bureau of Census include only a general shrimp category, therefore, it is not possible to defferentiate between pandalid shrimp and all others in order to quantify the volumes exported.

Within the country only gross estimates of distribution of product were available from marketing information sources. It was estimated for canned shrimp, for example, that 30 percent of the total U.S. consumption was by the western states of Washington, Oregon, and California. The midwest area around Chicago receives about 30 percent, and the New York area also accounts for 30 percent. The remaining 10 percent of the total domestic distribution goes to diverse locations around the country. Similar estimates for frozen shrimp, even on such a simple level were not available. It was suggested that the markets for frozen shrimp are diverse and spread all over the country, making estimations of percentage distribution by area difficult.

Import and Export Markets

As mentioned above, import and export data are not available for pandalid shrimp differentiated from the total U.S. shrimp production. It is known that European markets provide a significant market for Alaskan processed shrimp. Without data on the amount of pandalid shrimp exports to those countries, however, the importance of the markets cannot be determined.

Demand

As was the case for king and tanner crab, no detailed analysis was attempted because of lack of available time series data. There are demand analyses that have been published for shrimp from the Gulf of Mexico. Some information on demand for Alaska shrimp was obtained through discussion with marketing people at some of the processing companies and these comments are listed below.

- Alaska shrimp compete for markets with shrimp harvested and processed in Washington and Oregon. Alaska is the major producer of pandalid shrimp; however, the landings of Washington, Oregon, and California are increasing.

- The export markets for the Scandinavian countries depend upon the shrimp catch levels within those countries. When they have low production years there is a market for Alaskan shrimp. During normal or high production years these markets are not available. Scandinavian shrimp is cooked and frozen onboard ship, resulting in a consistently high quality product. Alaskan shrimp is seen by Scandinavians as an inferior product and so, when it is available, domestically processed shrimp is preferred.

- The suggestion was made that Alaskan processed canned shrimp was being priced out of some of its traditional export markets (for example, United Kingdom). Without data on exports of shrimp product to the United Kingdom, this cannot be confirmed; however, persons dealing on a day-to-day basis with the export markets should have more current information than export statistics would provide.

An indication of the domestic demand for shrimp in general is shown by the increase in per capita consumption of shrimp, listed in Table 91. Per capita consumption of shrimp has increased from 0.75 pounds per year in 1950 to 1.59 pounds per year in 1977.

Again, this data is for all shrimp and may or may not apply to Alaskan processed pandalid shrimp.

Prices

There are limited price data for Alaskan processed shrimp. Ex-vessel price series are available only for the Kodiak area, and are listed in Table 92.

Up until 1972, the price remained stationary at four cents per pound. Since then, it has climbed rapidly to the present price of 16.5 cents per pound.

An indication of the relative increases of ex-vessel and wholesale value increases, deflated by the general consumer price index, is shown in Table 93. While this will give some indication of the comparative increases, there is some question of the accuracy of the ex-vessel and wholesale value data (see Appendix I, Part II for a discussion of the inconsistencies in the data).

TABLE 91

PER CAPITA CONSUMPTION OF SHRIMP 1950 to 1977

Year	Pounds	Year	Pounds
1950	0.75	1964	1.16
1951	.87	1965	1.24
1952	.92	1966	1.21
1953	.92	1967	1.29
1954	.94	1968	1.37
1955	.98	1969	1.31
1956	.93	1970	1.44
1957	.83	1971	1.39
1958	.88	1972	1.44
1959	1.04	1973	1.36
1960	1.08	1974	1.51
1961	1.01	1975	1.41
1962	0.02	1976[1]	1.50
1963	1.17	1977[1]	1.59

Source: NMFS, Fisheries of the United States, 1977.

[1]Preliminary data.

TABLE 92

KODIAK EX-VESSEL PRICES FOR SHRIMP 1960 TO 1978

Year	Cents Per Pound
1960	4
1961	4
1962	4
1963	4
1964	4
1965	4
1966	4
1967	4
1968	4
1969	4
1970	4
1971	4
1972	5.25
1973	5.25 until late Feb., 6 cents until July 1, 6.5 cents to 8 cents July through Dec.
1974	8 Jan. to Aug., 9 cents Sept. to Dec.
1975	9 Jan. to May, 10 cents May to Dec.
1976	8 Jan. to May, 10 cents May to Dec.
1977	11.5 Jan. to May, 13.5 cents May to Dec.
1978	13.5 Jan. to May, 16.5 cents June to Dec.

Source: U.S. Department of Commerce, NOAA, NMFS, Fishery Market News Report, Seattle, Washington, various issues 1970 to 1977, plus 1960 to 1960 (data from industry sources and ADF&G reports).

TABLE 93

LANDINGS, LANDED VALUES, AND WHOLESALE MARKET VALUES OF ALASKAN SHRIMP 1960 TO 1977
(In Thousands of Pounds and Thousands of Dollars)

Year	Volume of Landings[1]	Index of Landings	Value of Landings			Wholesale Market Values		
		1969 = 100	Actual[2]	Constant Dollars 1967 = 100[3]	Constant Index 1969 = 100	Actual[4]	Constant Dollars 1969 = 100[3]	Constant Index 1969 = 100
1960	7,436.2	100	297.4	335.3	100.0	1,128.7	1,272.5	100
1961	15,980.5	215	639.2	713.4	214.9	1,861.0	2,077.0	165
1962	16,943.1	228	731.4	806.4	245.6	3,385.4	3,732.5	300
1963	15,127.0	203	605.1	659.2	203.5	4,163.3	4,535.2	369
1964	7,726.8	104	309.1	332.4	103.9	1,514.4	1,628.4	134
1965	16,818.9	226	756.9	801.0	254,5	1,880.7	1,990.2	166
1966	28,192.6	379	1,287.6	1,324.7	445.4	3,339.7	3,435.9	296
1967	41,812.6	562	1,700.5	1,700.5	571.8	7,787.5	7,787.6	690
1968	42,077.1	566	2,303.2	2,210.4	743.2	7,089.0	6,803.2	628
1969	47,850.6	643	1,909.0	1,738.6	584.6	7,905.8	7,200.2	700
1970	74,256.3	998	2,979.6	2,562.0	861.5	14,204.0	12,213.2	1,258
1971	94,891.3	1,276	3,909.0	3,222.6	1,083.6	15,780.2	13,009.2	1,398
1972	83,829.7	1,127	4,493.2	3,586.0	1,203.8	16,235.6	12,957.4	1,438
1973	119,963.7	1,613	3,964.5	2,978.6	1,001.5	26,525.5	19,929.0	2,350
1974	108,741.4	1,462	11,090.9	7,509.1	2,524.9	24,280.3	16,438.9	2,151
1975	98,984.2	1,331	7,904.1	4,903.3	1,648.7	25,409.7	15,762.8	2,251
1976	128,974.8	1,734	12,074.2	7,081.6	2,381.1	30,476.6[5]	17,874.8	2,700
1977	116,915.3	1,572	...	...	...	...	...	...

[1] ADF&G Statistical Leaflets 1960-75, Preliminary data 1976 and 1977.

[2] ADF&G Statistical Leaflets 1960-75; C.F.E.C., Alaska Shellfish Economic Data Base, Table 2, 1976. Note: Value of landings does not include year end bonuses paid to fishermen by processing companies.

[3] Bureau of Labor Statistics, Consumer Price Index, all items.

[4] ADF&G Statistical Leaflets 1960-75, 1976 estimated from computer aggregation of processor's annual reports.

[5] Calculated by Sea Grant from: (a) actual reported values reported in annual reports from processing companies; and (b) from estimated average wholesale prices by area for each product form times production for that area.

APPENDIX I

REVIEW OF PROCEDURES FOR DATA FILE REFINEMENT

PART I: Resolution of Problems

PART II: Recommendations for Improvements in Alaska's Fisheries Data

PART I

Resolution of Problems

Alaska fisheries production data, from the processors' annual reports filed with Alaska Department of Fish and Game (ADF&G), required correcting and editing before they could be used for the purposes of this study. This report is completed by each seafood processing plant in Alaska, detailing the year's production by species and product form processed. Some of the specific problems encountered were missing reports, multiple reports filed by the same plant, or statistics for two or more plants combined on one report, incomplete reports, incorrect product form, double counting of custom-packed seafood, and changes in format through time.

The problems encountered were handled in several ways. In areas having a more significant impact on the study, the processors were contacted for clarification of information reported on forms for Period 2 (1973 to 1975) of this study. Less significant cases and those cases for which no response was received (or available) were solved either by making educated decisions and applying those decisions consistently or by leaving out the material in question and coding it as missing.

Classification of Plants

One coding decision involved the type of operation--whether it was a shore plant, floater, or fisherman "direct sell." A shore plant is a shore-based operation (including moored floaters), floaters are floating processors (for example, floating canneries and freezer ships), and fishermen direct sell are those who sell their catch directly to consumser.[1]

The type of operation was unclear in many cases because either the type was not checked on the forms, or, with limited choices, inappropriate boxes were checked. In some cases it was not clear if floating processors were moored or moving, or if a "floating processor" was actually just a fishing vessel. When the buyer box was checked, it could mean buying from a processor or buying from a fisherman for tendering, direct sell, or processing. This definitional problem was also apparent when some retail stores have submitted processing reports, listing the number of employees in the store as the number engaged in processing. Unless they are processing or acting as an intermediary, these companies should not complete a return. When there was a question as to the type, decisions were made based on information supplied by ADF&G from Intent to Operate forms. No entries were made for buyers such as intermediaries and those who bought fish that were already processed.

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[1]Fishermen-direct sell includes buyers such as stores and restaurants who buy directly from fishermen and sell fresh. (The catch is not processed by fisherman or buyer). Buyers were not included if it appeared by the price they reported that the fish had already been processed. Note: In a couple of cases there were fishermen who sold their catch retail but processed it in some way and so were coded as "shore plant" or "floater," depending on where the processing took place.

Twenty-one reports were not entered because there was some question about the type of operation they were running. This excluded companies which were obviously buyers or recipients of custom-pack who did no production of their own, but involved tenders, intermediaries, a few Japanese companies which filed reports for roe production at other plants, and cases where even minimal information was not supplied. These deletions were made because of information received from ADF&G's Intent to Operate forms and from clues on the Annual Reports themselves. These exclusions were a very small percentage of production.

Fisherman-Direct Sell

The fisherman-direct sell category appeared in Periods 2 (1973 to 1975) and 3 (1976) only and was composed of just a small percentage of the totals, that is, 0.3 percent of Period 2 and 0.4 percent of Period 3. By general area, fisherman-direct sell was distributed as shown in Table 1-1.

Since fisherman-direct sell is not involved in the processing sector but hits the local market only, the amounts were excluded from most calculations of this study. This omission has a minimal impact because of the small percentages it involves.

Custom-Packing

Another major problem area was custom-packing production of one company's fish by another company. The predicament was knowing whether the custom-pack which was received or produced by a company was included in that company's other production. If the itemized custom-pack had been included in the general totals of the producing company, then to include that itemization in the data base of the study would result in a double entry. Conversely, if it was assumed that an itemized custom-pack had been included in the general totals of the producing company, and therefore was not included in the data base of the study, there would be no entry at all for that custom-pack if in reality it had been excluded from the general totals of the producer. Custom-packs were entered in the data base as production of the producing company, so that if the recipient of a custom-pack also included that pack in his production totals, then there would be another double entry.

The problem arises because of the ambiguous commercial operator reporting forms. In the more recent forms, there were 39 cases which needed clarification. A questionnaire was sent to those firms in May 1977. In August 1977 25 reminders were sent to companies who had still not returned the questionnaires. There was about a 50 percent return.

According to ADF&G, the processors had been instructed that custom-packing they produced should be included in their totals, but custom-packing they received should not. To reduce the chance of double entries or no entry at all for custom-packs, the reports were cross-checked against each other, when possible, to confirm the figures. But in some cases, it was still necessary to make the following assumptions:

TABLE 1-1

FISHERMAN-DIRECT SELL BY GENERAL AREA

Area	Number of Fishermen-Direct Sell	Production (In Pounds)
Period 2 (1973 to 1975)		
Southeastern	13	539,039
Central	11	65,569
Western		
Arctic-Yukon-Kuskokwim	8	159,016
Period 3 (1976)		
Southeastern	8	1,035,681
Central	4	3,921
Western	1	2,841
Arctic-Yukon-Kuskokwim	4	11,160

Source: Compiled from data provided by ADF&G.

1. In general, it was assumed that a plant was reporting its own production only (when no other information was available). That is,

   (a) When a plant reported receiving a custom-pack but did not say if it had been included in their totals, it was assumed to have been excluded.

   (b) When a plant reported distributing a share, but did not say if it was included in their totals, it was assumed to have been included (unless the total custom-pack figures were higher than their totals, in which case the custom-pack figures were added to the totals).

   (c) On some packs a plant would report receiving a share from a plant that did not report distributing that share, or a plant that did not report receiving that share. In either case, the amount was ignored and it was assumed to have been included in the totals of the producing plant only.

2. In cross-checking custom-pack shares, if the figures that a plant reported distributing did not match up with the figures the receiving company reported, it was assumed that the figures of the producing company were correct (these were usually larger and affected the custom-pack tally only).

3. For the Halibut Producers Co-op and similar operations, production was entered for the agents.

4. When one plant of a company transferred its catch to another plant of the same company, it was not considered a custom-pack (not added to the custom-pack tally). But, to be consistent with the above, it was assumed that the processing plant included the amounts in their totals. If the sending plant also reported the finished product, it was ignored.

It was not always possible to make sure that the pack shares were entered only for the producing plant. Each plant involved may have reported its share only and not listed the plant which actually did the processing. Also, if the plant which had the custom-packing done did not itemize the amount in the Processors Annual Report, the production could not be attributed to the actual producing plant.

Table 1-2 is a tally of the custom-pack figures by product form for each year (1956 to 1958 and 1973 to 1976).

The custom-pack problem was related to the production of salmon roe. The forms for 1973 and 1974 included a chart for roe production which was ambiguous so that ownership of the roe was unclear. There were 11 firms which produced roe using the facilities of other companies. (Roe was entered for the companies owning the facilities and was not added to the custom-pack roe tally). The firms are:

TABLE 1-2

CUSTOM-PACK TALLY

Salmon	Canned	Frozen	Mild Cured
1956 (48 Custom-Pack Producers)			
King	185,410	81,968	58,774
Red	11,419,238	45,136	
Coho	950,730	72,348	
Pink	12,741,427	898	
Chum	5,565,028	9,606	
General	651,024	925,145	317,371

Frozen Halibut = 616,758
Herring Reduction = 5,170,640

Salmon	Canned	Frozen	Mild Cured
1957 (46 Custom-Pack Producers)			
King	266,630	61,626	102,859
Red	13,977,616		
Coho	1,071,140	160,649	5,880
Pink	11,244,084	1,425	
Chum	8,612,824	7,500	
General	311,520	860,587	351,200

Frozen Halibut = 2,102,445

Salmon	Canned	Frozen	Mild Cured
1958 (28 Custom-Pack Producers)			
King	724,811	213,236	234,963
Red	6,571,876		
Coho	1,233,876	173,898	36,186
Pink	18,685,240	8,095	
Chum	9,015,426	5,123	

Roe = 52,314
Frozen Halibut = 559,745

Salmon	Canned	Frozen	Mild Cured
1973 (37 Custom-Pack Producers)			
King	56,104	1,724,461	
Red	5,385,484	551,414	
Coho	276,191	1,184,738	
Pink	5,858,697	242,576	
Chum	3,017,107	1,750,422	
General	598,626		

Roe = 705,103
Frozen Halibut = 5,362,483
Frozen King Crab = 173,717 (meat-weight equivalent)
Frozen Shrimp = 6,793

Salmon	Canned	Frozen	Fresh	Salted	Cured
1974 (35 Custom-Pack Producers)					
King	12,846	1,389,780	3,913		
Red	5,192,458	19,903			
Coho	885,748	922,098			
Pink	6,327,168	128,109			
Chum	3,541,519	416,130			
General	1,266,640				

Roe = 615,582
Frozen Halibut = 3,364,223
Frozen Herring Bait = 895,821

Salmon	Canned	Frozen	Fresh	Salted	Cured
1975 (30 Custom-Pack Producers)					
King	17,508	735,114	3,145		
Red	6,529,692	597,356		1,936	
Coho	272,966	206,234			
Pink	8,062,524	31,699			
Chum	1,052,301	375,203		5,685	
General	39,600				

Roe = 24,260
Frozen Halibut = 993,840
Frozen King Crab = 87,388 (meat-weight equivalent)

Salmon	Canned	Frozen	Fresh	Salted	Cured
1976 (33 Custom-Pack Producers)					
King	57,768	934,979	1,064		132
Red	9,566,853	1,323,804			106,828
Coho	256,801	1,509,503			
Pink	10,395,241	236,476			131
Chum	3,027,634	695,698	1,242		5,462
General		32,354			

Roe = 671,740
Frozen Halibut = 649,738
Frozen King Crab = 41,040 (meat-weight equivalent)
Herring Roe = 995,698

Source: Compiled from data provided by Alaska Department of Fish and Game.

Ataka American, Inc.
Co-op Trade Japan, Ltd.
Kyoko USA, Inc.
Marubeni Iida American Corp.
Mitsui & Co.
Mitsubishi Intl. Corp.
Nissho Luai American Corp.
Sumitoma Shoji America
Bunsen & Davis Company
Puget Sound Salmon Egg Co. (Seattle)
Schenk Seafoods Sales, Inc. (Bellingham)

Also, in general, more roe production was reported in 1973, 1974, and 1976[2] probably because there was a special section for reporting roe products on the 1973, 1974, and 1976 reports only. And except for the 1973 and 1974 forms, bait roe was not distinguished from caviar. All "salmon egg" production was coded as roe-caviar.

Another inconsistency in the roe information was the process given. Roe production is a combination of salting and chilling. On most forms the process was stated as "salted." So when the process was not given, it was assumed to be salted. But on the 1976 reports, there is one line reserved for roe production in the fresh or frozen category so that most roe was reported as frozen. For the purposes of this study, this was irrelevant since all processes of roe were grouped together in the market characteristics files.

Herring roe, on the other hand, was a problem on the 1976 reports. The forms had two categories for herring roe: "Herring Sac Roe" and "Sac Roe Alone," but no space for whole frozen herring. The values of "Herring Sac Roe" were running about one-tenth those of "Sac Roe Alone." Apparently processors were filling in whole herring under "Herring Sac Roe" since it was shipped whole for the roe to be extracted later. It was coded as whole.

Recovery and Conversion Factors

Recovery and conversion factors were another major area of concern. Since all figures were given in product weights, it was necessary to convert production to meat equivalent weight so that production would be comparable across product forms. For canned production of salmon and crab, the conversion tables furnished by ADF&G were used (see Appendix Table 1-3). The conversion factors did not take into account density variation of species or area of catch. Another problem was that processors sometimes reported can size as the actual weight of the can and other times as the drained meat weight. For canned shrimp, a few processors were contacted and it was found that, besides the old-style canned shrimp of one-pound can size, there are only two other can sizes.

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[2]About five million pounds was reported in 1973 and 1974, and almost six million pounds in 1976 compared to a little over three million pounds in 1975 and about 750,000; 400,000; and 220,000 in 1956, 1957, and 1958 respectively.

TABLE 1-3

CONVERSION FACTORS FOR CANNED PRODUCTION

Can Size (In Ounces)	Number of Cans/Case	Drained Weight Meats[1] (In Ounces)	Meat Per Case (In Pounds)
Salmon			
6.5	48	6.5	19.50
6.5	24	6.5	9.75
7.0	48	7.0	21.00
7.0	24	7.5	10.50
8.0	48	8.0[2]	24.00
8.0	24	8.0	12.00
16.0	48	16.0[3]	48.00
Crab			
6.5	48	5.0	15.00
6.5	24	5.0	7.50
7.0	48	5.5	16.50
7.0	24	5.5	8.25
.5	48	6.5	19.50
16.0 (#1 can)	48	13.0	39.00
16.0 (#1 can)	24	13.0	19.50
20.0 (#2 can)	48	16.0	48.00
20.0 (#2 can)	24	16.0	24.00
4.5	24	3.5	5.25
Shrimp			
4.0	24	2.5	3.75
7.0	24	4.5	6.75
16.0	24	12.0	18.00

Source: Compiled from data provided by Alaska Department of Fish and Game and from information supplied by Pacific Seafood Processors Association.

[1]For salmon, weight refers to net content.

[2]7.75 oz in Period 2 (1973 to 1975).

[3]15.50 oz in Period 2 (1973 to 1975).

As an aside: A few freezer ships (as coded on the processors' annual reports) reported their production as canned when actually they froze it and transported it to plants in the Seattle area where it was canned. This was not a general practice since freezing salmon before canning results in a less desirable product. The production was coded as frozen, and the canned meat weights were converted back to dressed weights by the following:

canned meat weight X factor X 75 percent; the factors being:

king	red	coho	pink	chum
1.52	1.46	1.58	1.58	1.63

(Factor converts canned weight back to whole weight and was obtained from the following: for a 1 pound/48 case it takes 73 pounds of kings, 70 pounds of reds, 76 pounds of pinks, and 78 pounds of chums; these are 1966 ADF&G figures--75 percent converts whole to dressed.)

Crab recovery factors for obtaining meat equivalent weights from whole crab, sections, etc., varied by species and these were obtained by taking averages in the data. These averages were calculated from cases where live weight and product weight were both given. The figures and procedures we used follow:

Fresh and Frozen Crab:

Claws:		95% round weight to meat weight
King:	Meat	23% live weight to meat weight
	Sections	57% live weight to section weight
	$\frac{23\%}{57\%}$ gives:	40% section to meat weight
Tanner:	Meat	15% live weight to meat weight
	Sections	55% live weight to section weight
	$\frac{15\%}{55\%}$ gives:	27% section to meat weight
Dungeness:	Meat	22% live weight to meat weight
	Sections	57% live weight to section weight
	$\frac{22\%}{57\%}$ gives:	39% section to meat weight

Procedures:

(1) For whole crab, the reported weight was multiplied by the "live weight to meat weight" factor to get the meat equivalent.

(2) For crab sections, the product weight was multiplied by the "section to meat weight" factor unless the live weight was given, in which case the "live weight to meat weight" factor was used.

(3) If claws and tails were grouped together, they were coded as claws (with recovery factor 95 percent).

Shrimp was classified into two categories:

small shrimp - pinks (Pandalus borealis)
humpy (P. goniurus)

large shrimp - sidestripe (Pandalopsis dispar)
coonstripe (P. hypsinotus)
spot (P. platyceros)

Besides canned shrimp, there were three product forms--whole, tails, and meats. Depending on several factors, the live weight to meat weight recovery of small shrimp (picked by machine) can vary from six percent to 24 percent. An average of 18 percent was used which is an industry-wide estimate of average recovery determined from discussions with processing companies in Alaska and also calculations of recovery factors from the processors annual reports. The years 1956, 1957, and 1958 preceded the introduction of machine pickers so that small shrimp were hand picked and, therefore, had a recovery factor of 33 percent (industry source). Large shrimp are picked by hand so that the recovery factor of whole to meat weight is also 33 percent. Tails (heads off, shells on) are always the large shrimp and recovery from whole to tails is about 49 percent (industry source). So tail weight was converted to meat weight by first multiplying by two, then dividing by three (33 percent/ 49 percent = 67 percent.

Incomplete Data

A general problem involved salmon and crab when species breakdown was not given. For the recent reports, processors were contacted by letter and telephone, and again there was about a 50 percent response. In the cases where breakdown of salmon was not available, species proportions were estimated from the catch information. However, if the catch information was not known, it was necessary to code it as "salmon general."

Because in most cases species-specific recovery factors were used for crab, a crab general category could not be used. And so when the species of crab was not given (usually in the 1956-1958 forms), species were assigned according to the area, value, product form, etc. Generally, the species was assumed to be tanner. Other assumptions were that dungeness will usually be canned, and that king will be in various forms--frozen, sections, etc. For the area variable, dungeness is generally found in Southeastern Alaska, king in the Western area, Bristol Bay, etc., and both can be found in Southcentral Alaska and Kodiak.

Another less frequent problem with the salmon and crab was quantity given in numbers of fish or crab instead of pounds. To approximate dressed weight of salmon, the average weight per species (given below) was multiplied by 75 percent:

king = 20 pounds
red = 6 pounds
coho = 9 pounds
pink = 4 pounds
chum = 8 pounds

Round weight of dungeness was found by using the formula 1 dozen crab = 29 pounds. Weights of king and tanner were needed on only one form and, in that case, averages of six pounds per crab for king and two pounds per crab for tanner were used.

Missing information was a frequent problem that usually affected the employment and value figures. These missing figures were so pervasive (for example, 54 missing employment figures in 1973, 1974, and 1975) that the figures that were available were not used. The value figures were particularly unreliable since the concern was for wholesale value, but many of the figures given were ex-vessel, retail, or totally out of line.

Other frequently missing variables were the process and product forms. When the information was unavailable, it was assumed that the process was frozen (except for roe which was coded as salted) since most processing other than canned was frozen. If the product form was missing, it was assumed (under the same reasoning) to be whole in most cases.

The National Canners Association was consulted for definitions of old-style terms such as "Halifax." They assumed "Halifax" to be a type of fillet cut (which was coded as salted when the process was not specified). "Japanese style" is salting. Shrimp and crab "cold pack," "raw frozen," and "wet pack" (in cans) were coded as frozen (following the coding of ADF&G). The weight of herring oil was approximated by 7.5 pounds per gallon and the weight of salmon fish oil was found by using 7.667 pounds per gallon.[3]

Apparent Accuracy of Edited Data File and Published Statistics

As a check on the accuracy of the production data used in this study, the production amounts were converted back to live weight. The results were compared with the catch statistics from ADF&G reported landings for each species. This comparison showed a discrepancy between the catch and production amounts for every year (Tables 1-4 and 1-5). In most cases, the production figures converted back to live weight fall short of the catch figures.

This type of error probably was caused by missing processors' annual reports for companies which did operate (as mentioned in the previous section), or by the reporting of erroneous information on the reports. The fishermen-direct sales of product would also be a contributing cause of this discrepancy; however, because the total amounts are small statewide, these amounts are not significant. The production for some years (1957 dungeness crab, 1958 and 1973 tanner crab) showed an error in the other direction, that is, showing more production than was actually caught. It is less likely that these errors

[3]This is an average calculated from statistics obtained from the National Canners Association.

TABLE 1-4

COMPARISON OF ADF&G REPORTED LANDINGS WITH PRODUCTION FROM PROCESSORS' ANNUAL REPORTS FOR KING CRAB, TANNER CRAB, DUNGENESS CRAB, AND SHRIMP FOR 1973 TO 1975 AND 1956 TO 1958
(Converted to Live Weight[1] in Pounds)

Species	1976	1975	1974	1973	1958	1957	1956
King Crab							
Catch	105,824,996	97,628,996	95,213,796	76,824,103	11,211,554	13,077,000	8,796,000
Production	99,310,168	94,659,899	76,704,081	73,162,514	7,831,061	12,188,735	6,078,115
Difference	6,514,828	2,969,034	18,509,715	3,661,589	3,380,493	888,265	2,717,885
Tanner Crab							
Catch	80,712,199	46,857,047	63,906,037	1,719,386	...	...	...
Production	78,088,866	46,355,657	57,806,765	78,547,836	2,260	...	...
Difference	2,623,333	501,390	6,099,272	-16,828,450	-2,260	...	...
Dungeness Crab							
Catch	1,538,126	3,033,677	3,817,823	6,423,157	1,746,999	552,000	2,446,000
Production	1,324,195	2,712,477	3,628,895	6,262,368	841,209	686,841	1,609,755
Difference	213,931	321,200	178,928	160,789	905,790	-134,841	836,245
Shrimp							
Catch	128,974,815	98,984,224	108,741,434	119,963,729	7,862,366	2,380,000	3,044,000
Production	92,055,492	83,982,579	97,147,724	93,032,505	3,375,499	1,723,725	1,413,607
Difference	36,919,323	15,001,645	11,593,710	26,931,224	4,486,867	656,275	1,630,393

Source: ADF&G Catch and Production Leaflets 1973 to 1975, Processors' Annual Reports, and USDI Annual Summaries for 1956, 1957, and 1958. Cumulative Monthly Shellfish Report for 1976.

[1]Recovery factors used for calculations are:

King Crab	23 percent live weight to meat weight
	57 percent live weight to section weight.
Tanner Crab	15 percent live weight to meat weight
	55 percent live weight to section weight.
Dungeness Crab	22 percent live weight to meat weight
	57 percent live weight to section weight.
Shrimp	18 percent live weight to peeled weight.

TABLE 1-5

COMPARISON OF ADF&G REPORTED LANDINGS WITH PRODUCTION FROM PRODUCTION STATISTICS FROM ADF&G STATISTICAL LEAFLETS (Converted to Live Weight[1] in Pounds)

Species	1975	1974	1973
King Crab			
Catch	97,628,933	95,213,796	76,824,103
Production	62,473,117	70,323,543	73,411,985
Difference	35,155,816	24,890,253	3,413,118
Tanner Crab			
Catch	46,857,047	63,906,037	61,719,386
Production	25,321,652	46,524,231	78,492,316
Difference	21,535,395	17,381,806	- 16,772,930
Dungeness Crab			
Catch	3,033,677	3,817,823	6,423,157
Production	2,625,650	7,902,240	7,266,936
Difference	408,027	- 4,084,417	- 843,779
Shrimp			
Catch	98,984,224	108,741,434	119,963,729
Production	38,238,594	59,523,357	110,514,088
Difference	60,745,630	49,218,077	9,449,641

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Recovery factors used for calculations are:

King Crab	23 percent live weight to meat weight 57 percent live weight to section weight.
Tanner Crab	15 percent live weight to meat weight 55 percent live weight to section weight.
Dungeness Crab	22 percent live weight to meat weight 57 percent live weight to section weight.
Shrimp	18 percent live weight to peeled weight.

were caused by the processing data and may indicate errors in the catch statistics for those years. Most of the errors in reported production (for example, missing reports) tended to understate production amounts.

The production data accuracy, as indicated by these tables, is admittedly less than ideal. These data were checked as thoroughly as possible, however, even to the extent of checking back with the individual processing companies in some cases, and so represent as accurate a form of these data as possible given the problems with the processors' annual reports.

A similar comparison of production figures from ADF&G Statistical Leaflet series (converted back to live weight) against the catch statistics was also completed. These data, which are compiled by ADF&G, come from the primary data source as was used in the study (the processors' annual reports). This comparison showed much greater discrepancies than the data which were edited and corrected for use in this study. The probable reasons for these inconsistencies are outlined in the previous section.

PART II

Recommendations for Improvements in Alaska's Fisheries Data

From the experience gained in working with the available Alaska fisheries data during the course of this study, several deficient areas can be identified where necessary data are non-existent, inaccurate, not consistent through time, or not available in a timely manner. The Alaska Department of Fish and Game has the responsibility for providing state fisheries data. However, their major emphasis to date has been on the data necessary for biological stock management such as catch data by area and catch per unit of effort. There has been much less emphasis by ADF&G placed on providing data required for economic management of the fisheries resources. This shortcoming is demonstrated by the fact that the statistical leaflet, which is the ADF&G fisheries data publication, is not yet available for 1976 or 1977, and the 1975 leaflet has only been issued in a preliminary form which is subject to revision. As rapidly as the fisheries in the state are developing, it is not sufficient to provide management agencies such as the North Pacific Fishery Management Council with preliminary 1975 data to be used in making decisions in mid 1978 on fisheries resource use. Necessary decisions will be made using the best information available at the time. The use of inaccurate or out-of-date information makes these decisions more difficult and subject to error.

There are several basic data requirements for fisheries economic data. Most of these data are presently collected in some form. As pointed out in the previous section, however, there are problems with the accuracy, completeness, and timeliness of these data. These basic requirements are listed below.

Catch and Landing Data by Species and Area

These data are included in the ADF&G statistical leaflet which is available at this time up to 1975. Data for 1976 to the present, are available in preliminary form from the ADF&G monthly catch reports for salmon and shellfish.

Production Data by Species, Product Form, and Area

These data are presently collected and compiled from the ADF&G Commercial Operators Annual Report, required by law to be completed by all seafood processors in Alaska. As pointed out previously, there are several problem areas that require correction. The entire responsibility for collection, compiling, editing, correcting, and publishing of these data has rested with one position at ADF&G in Juneau. The lack of manpower available for this task has resulted in the present delay in publication. Also, review and corrective follow-up, where necessary, of the data submitted by processing companies has not been possible, even where obviously incorrect forms have been submitted. There are cases where processing companies which did operate during the year did not even submit an annual report to ADF&G, and their production has gone unrecorded. This type of error is not caught by ADF&G because there has not been time for the one person involved to follow-up and correct omissions. In addition to insufficient manpower, there has also been a problem with staff turnover in the position responsible for these data. With this situation, continuity of effort has not been possible. In order to upgrade the quality and timeliness of these data, more emphasis by ADF&G in this area is required in the future.

Price Series Data by Species and Area

(1) Ex-vessel Prices. Price series data at the ex-vessel level are presently available from two sources for Alaska. One is the spot price series for Kodiak which appears in the NMFS Fishery Market News Report. This report is a good price data source for some species in Kodiak but this is the only area for which price data are available. For purposes of statistical analysis, it is necessary to be able to match price series data with landings over the equivalent period. For the Kodiak and Westward areas, monthly catches by area are published by the monthly shellfish report by ADF&G in Kodiak. These data are necessary for the other areas of the state. It is possible to calculate annual average ex-vessel price from the table, "Value to Fishermen by Region," which appears in the ADF&G Statistical Leaflet; however, an annual price series is not sufficient for purposes of analysis. There is a space on the ADF&G fish ticket for the price paid to the fishermen, which could be filled in and compiled to provide ex-vessel price data, but it is either left blank or not used if it is filled in. Reportedly, the reason that this section of the fish ticket is left blank is that ADF&G feels that processing companies are sensitive to releasing price data, and that it is better not to force the issue and possibly jeopardize the quality of other data which are filled in on the tickets.

In discussions with managers of processing companies in Alaska, reservations were expressed about releasing the current prices they were paying for fish or shellfish. If these prices are not released for a couple of weeks however, they are deemed to be old business and are no longer held as confidential. It is felt that some method could be found to collect price data by area from the fish ticket which would not compromise the processing companies' wishes for maintaining confidentiality of current prices paid to fishermen.

One other problem is that recorded ex-vessel prices do not reflect any consideration of bonus payments paid to fishermen. These payments may be in many forms such as year-end cash bonuses, interest-free loans, gifts of seafood products, or others, but all are a component of the price paid for raw product. These data are necessary for agencies such as the Commercial Fisheries Entry Commission, in order to determine accurate earnings estimates for Alaskan fishermen. Information of bonus payments is held very confidentially, though, and no method to include them in determination of ex-vessel price has been reached.

(2) Wholesale Prices. Wholesale value for Alaskan processed seafood is available on an annual basis, by area, from the ADF&G Statistical Leaflet. This data, however, is not an accurate indication of wholesale value due to incompleteness or errors. Some spot wholesale prices are available from NMFS "pink sheets" and weekly summary sheets, and an annual summary is available from Fisheries Statistics of the United States for selected areas. Multiplying these prices by the Alaska seafood production amounts, however, results in a very marginal estimation of the value of the production of Alaskan seafood.

To obtain an accurate indication of the contribution of Alaskan fisheries to the state, more complete and detailed wholesale prices or wholesale value data are required.

Employment Statistics by Area

ADF&G does collect employment statistics on the processors' annual reports. The report only provides peak annual employment for each plant and is left blank in many cases. More thorough employment statistics are collected by the Department of Labor for the processing sector, and unless there are fewer than three processing companies in an area, they can provide these data. It would be useful to have employment data by specific fishery, but these data are not available.

To identify and try to arrive at recommendations to correct some of the deficiencies in Alaska fisheries data, two meetings of fisheries data users were held in 1977. The first of these was an ad hoc Fisheries Information Exchange, held in conjunction with the Alaska Science Conference. The purpose of this meeting was to review fisheries management data needs and to initiate some type of action toward meeting these needs. The participants of this meeting included representatives from:

Alaska Commercial Fisheries Entry Commission
Alaska Department of Fish and Game
Washington Department of Fisheries
National Marine Fisheries Service
Alaska Department of Commerce,
  Division of Economic Enterprise
Alaska Sea Grant Program, University of Alaska
Institute of Social and Economic Research,
  University of Alaska
NORFISH, University of Washington
Association of Pacific Fisheries

At this meeting, the concept of a "clearinghouse" for fisheries data was discussed as a possible solution to prevent duplication of effort in data collection by different groups working in the same research areas. Functions of the clearinghouse would include a referral service to deal with requests for socio-economic fisheries data, a library and publication depository for publications and data, and serve as "bulletin board" for those involved in fisheries research by publishing a newsletter describing all current fisheries research projects in Alaska.

As a result of this first meeting, a second meeting was held for further discussion of the clearinghouse concept and of specific problems with fisheries data and to formulate suggested plans to eliminate these problems. These suggestions were presented to the advisor to the Governor in charge of a committee to make recommendations for structural changes within ADF&G, who had called the meeting. At the conclusion of this meeting, it was resolved that the advisor would pursue correction of the specific data problems mentioned, and the Arctic Environmental Information and Data Center would explore the possibility of acting as "clearinghouse" for Alaska Fisheries Data. Neither one of these proposed actions has yielded any apparent results and the issue seems to be dormant again. The fisheries data problems still exist, so the same sort of exercise will undoubtedly be run through again in the near future. It is hoped that the requirements for fisheries data by groups such as the NPFMC will exert enough pressure to make changes happen.

APPENDIX II

STRUCTURE OF UNITED STATES SEAFOOD PROCESSING INDUSTRY

PART I

Conceptual Framework of Industrial Organization

Private business firms play a major role in determining the nature and direction of economic activity. These relatively autonomous entities, in aggregate, provide most goods and services, employment, and other elements of interest to society. Since the performance of the economy depends in large part upon the independent actions of business firms, it is in the interest of society to be certain that firms behave in a manner consistent with the enhancement of social welfare. Analysis of the performance of business firms, operating under different sets of constraints is one useful method of studying business performance and social welfare. The following is a brief overview of contemporary methods for analyzing industrial organization.

Business firms perform as buyers in the markets for basic factors of production, as coordinators of productive facilities, and as buyers and sellers in the markets for goods and services they produce or use. In the latter activity, product designs, prices, outputs, and the like, are determined in response to changing conditions in commodity markets; the performance of firms as buyers and/or sellers in these markets is generally the focus of most studies of market performance of business firms.

Organization or structure of industries, and market conduct of firms within industries, exert strong influences on the performance of the economy. Organizational elements include buyer and seller concentration, barriers to entry and vertical integration, while price and non-price competition and advertising, comprise market conduct (see Table 2-1). Since associations between structure, conduct, and performance are usually not apparent, it is necessary to assess the relative influence of structure and conduct on performance in actual markets for goods and services. Identification, description, and classification of structural and conduct elements of groups of firms participating in such markets (an industry) is one method of determining the relationships of structure, conduct, and performance.

A market is a relevant entity to analyze for structural aspects, since it is a focal point for buyers and sellers of similar products. Elucidating relationships between sellers and buyers, and between established sellers and potential entrants is facilitated because the number of participants is limited and can be clearly defined.

Ideally, the researcher would like to be able to assess market structure, conduct, and performance by examining a group of firms which interact in a common geographic and product market. Frequently, however, available data does not allow the researcher this luxury; most often the researcher must use data available from the Bureau of Census and other sources. In such cases, firms which participate in the relevant market must be identified and described using data that usually do not facilitate identification. As an example of this problem, consider the following:

TABLE 2-1

MODEL OF INDUSTRIAL ORGANIZATION ANALYSIS WITH APPLICATION TO THE U.S. SEAFOOD PROCESSING INDUSTRY

Basic Conditions	
Supply for Product	Demand for Product
Market Structure	
Buyer Concentration Seller Concentration Barriers to Entry Product Extension Product Differentiation Economies of Scale Fisher Organization	Industry Growth Cost Structure Vertical Integration Horizontal Integration Plant Diversification
Market Conduct	
Price Competition Collusive Tactics (overt or tacit)	Non-price Competition Advertising
Market Performance	
Profits Price-cost Margins	Innovation Full Employment

Source: Adapted from Capalbo (1976), p. 64; Scherer (1970), p. 5; Koch (1974), p. 74.

Let the task be to determine the economic structure of a group of firms buying tanner crab in the state of Alaska and selling frozen tanner crab sections to fish dealers who are located throughout the United States. It should be noted in this case that the relevant species is tanner crab, that interest focuses upon processors who buy crab in the state of Alaska only, and that a frozen process form is sold in a national market. These aspects weigh heavily in the ability to interpret structural elements; this point will be elaborated later in this section.

Given the above delineation, the task at hand is to identify firms which participate in the relevant geographic (Alaska) and product (frozen tanner crab sections sold nationally) markets. Often the researcher, faced with a budget constraint, must rely on census or other secondary sources of data, as mentioned previously. Suppose census data is the only available information. To identify relevant firms using such data, the initial step would be to find the food and kindred products listing (SIC code 20[1]) within the manufacturing sector. Food and kindred products are broken down in more detail into three-and four-digit codes; three digit listings are classified as product groups. More often than not, such classifications (even the four-digit) group firms together which participate in a variety of product and geographic markets.

A flow chart of the above process is diagrammed in Figure 2-1. In the figure, it can be seen that the four-digit codes 2091, and 2092, Canned and Cured Fish and Seafood, and Fresh or Frozen Packaged Fish and Seafood, respectively, are relevant for the task. At this point a decision must be made as to whether interest centers are on the buying or selling side. If the major concern is the selling side, attention would appropriately be focused on firms listed under SIC code 2092. On the other hand, if the major interest were the buying side, both codes would be relevant. Both would be necessary since the processing firms may be diversified (sell frozen and canned process forms, for example).

To describe structural parameters of the buying side, SIC codes 2091 and 2092 are relevant. Firms producing tanner crab (and therefore purchasing the same) in Alaska must be identified within these classifications and described. Careful scrutiny is required as firms can be quite diversified.

Figure 2-1 also illustrates how firms buying (producing) tanner crab are identified. Numbers represent firms and letters represent "seafood industries."[2] Assume that firms 1, 2, 3, and 5, produce tanner crab. Under this assumption,

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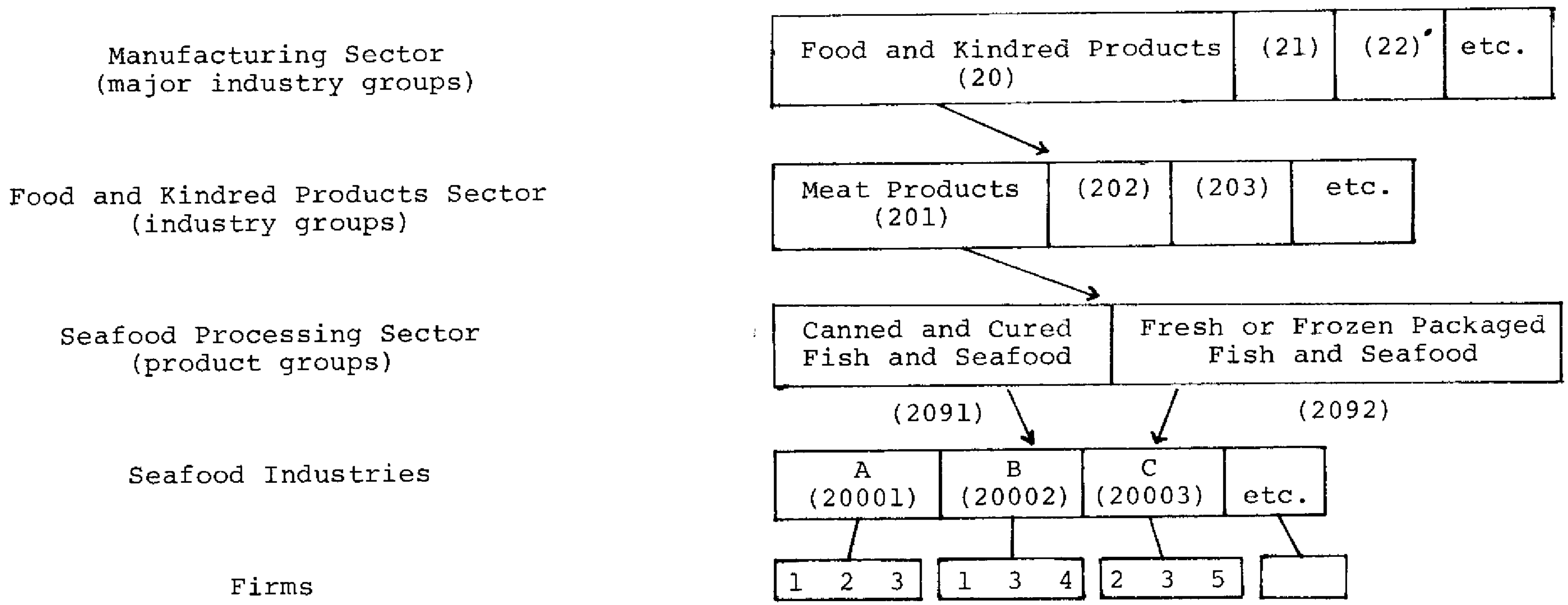
[1]Such codes are developed in the Standard Industrial Classification Manual, Bureau of Census.

[2]In most instances, the census classification, "seafood industries," does not conform to the economic concept of a market.



Source: Adapted from _Standard Industrial Classification Manual_, 1972, Bureau of Census Publication, U. S. Department of Commerce.

FIGURE 2-1. IDENTIFICATION OF FIRMS UTILIZING CENSUS DATA it is apparent that most tanner crab processing firms are diversified (belong to more than one "seafood industry"). If any one "seafood industry" were used as the sole source of firms producing tanner crab, over or under-inclusion of firms may result. Thorough investigation of available data is therefore a prerequisite to proper structural analysis.

In sum, to characterize the competitive environment within which firms exist, it is important to identify and describe a group of firms which operate in the geographic and product market of interest. This process is fundamental to the interpretation and validity of the empirical analysis.

PART II

A Literature Review

Introduction

The economic structure of the U.S. seafood processing sector is characterized in its literature primarily by the degree of seller concentration, verticle integration, and barriers to entry. Some studies provide information on other structural elements such as diversification, trends in concentration, inequality in plant size, etc. The literature review which follows focuses primarily on the work of Capalbo (1976). This study is augmented and supplemented by other studies, primarily regional in nature and often directed toward a particular species. Primary emphasis is placed upon describing seller concentration, vertical integration, barriers to entry, and diversification in the fresh, frozen, canned, and cured process form sectors. Other elements of economic organization are included when available and where appropriate. Occasionally, description of elements is specific to a species of fish or shellfish within a process form sector.

Economic Structure of Process Form Sectors

Overview

In 1976, there were 1,668 seafood processing plants in the United States; average seasonal and yearly employment were 77,951 and 60,397 persons, respectively (Fisheries Statistics of the United States, 1977). The number and average size of seafood processing firms[3] was quite small when compared with non-seafood (food) processing firms. Even large seafood processing firms (annual sales greater than $10 million) were quite small when compared with large non-seafood (food) processing firms. Fewer than 44 seafood processing firms had annual sales in excess of $10 million (U.S. Fishing Industry 1976).

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[3]Some publications used the firm as the unit for analysis while others used the plant; occasionally both are used in the same publication. Since most of the review is derived from Capalbo (1976), the plant is the predominant analytical unit. In spite of the plant's prevalence herein, the firm is used occasionally. The reader should be aware of such usages as the two are not interchangeable.

Fresh Process Form Sector

1. Physical Attributes. Capalbo (1976) reported that approximately half of the largest 20 plants producing the fresh process form are located in the New England region.[4] The other half of the 20 largest plants are fairly evenly distributed among the Middle Atlantic, South Atlantic, Gulf, and Pacific regions. Although half of the 20 largest plants are located in New England, the Chesapeake region specializes in the production of the fresh process form; this process form is the volume and value leader for the region.

Available data constrain ownership patterns of firms to be reported together with the frozen sector. Capalbo (1976) found that single unit (one plant) firms were more common than multi-unit firms in the combined sectors. Multi-unit firms, however, tended to dominate value of production. Corporations were the major type of ownership in both single and multi-unit firms in 1972.

Plants are typically small, family-run operations employing 15 to 20 people per production line, a total of 30 to 40 workers, with an average of two production lines per plant. Space devoted to both processing and storage facilities averages 10,000 square feet (Marcus 1974).

2. Structural Elements.

(a) Seller concentration - Capalbo (1976) found that concentration in the fresh process form sector increased from 1965 to 1974, but at no time during this period was the sector considered concentrated[5] (Table 2-3). Capalbo (1976) conducted a similar analysis for the New England and Middle Atlantic regions and reached conclusions identical to the above (see also Table 2-2).

A study by Kolhonen (1976) of concentration among firms producing fresh and frozen fillets[6] indicated that there were low levels of concentration in this product market. Ratios were 27 percent and 39 percent at the four- and eight-firm levels, respectively.

(b) Vertical integration - Backward integration into harvesting activities exists to some extent as some corporate processing firms own vessels or control their activity through various arrangements. Documentation of these practices is, however, generally not available for this sector.

Capalbo (1976) Found forward integration to be prevalent at both the national and regional levels. On a national basis in 1974, 30 percent of the largest 20 plants were integrated while from 60 to 100 percent of the 20

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[4]States included in regions are listed in Table 2-2.

[5]An industry is considered concentrated if at the four-plant level, the concentration level is greater than 30 percent, or if at the eight-plant level it is greater than 70 percent.

[6]Fresh and frozen fillets include cod, cusk, flounders, haddock, hake, ocean perch, and pollock.

TABLE 2-2

STATES INCLUDED IN NATIONAL MARINE FISHERIES SERVICE REGIONS

New England	Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut.
Middle Atlantic	New York, New Jersey, Pennsylvania, Delaware.
South Atlantic	North Carolina, South Carolina, Georgia, Florida.
Chesapeake	Maryland, Virginia.
Gulf	Florida, Alabama, Mississippi, Louisiana, Texas.
Great Lakes	New York, Pennsylvania, Ohio, Michigan, Illinois, Wisconsin, Minnesota.
Mississippi River	Alabama, Arkansas, Colorado, Idaho, North Dakota, South Dakota, Illinois, Iowa, Kansas, Kentucky, Oklahoma, Louisiana, Minnesota, Mississippi, Missouri, Tennessee, Texas, Wisconsin.
Pacific	Alaska, Washington, Oregon, California.
Other	Hawaii, American Samoa, Puerto Rico.

Source: Capalbo, 1976.

TABLE 2-3

CONCENTRATION RATIOS FOR FOUR, EIGHT, AND TWENTY LARGEST FRESH SEAFOOD PROCESSING PLANTS, NATIONAL, NEW ENGLAND, AND MIDDLE ATLANTIC REGION 1965 TO 1968, 1970 TO 1974

Year	National	New England Region	Middle Atlantic Region
	Four-Plant Concentration Ratio		
1965	.062	.21	.39
1966	.056	.20	.41
1967	.061	.19	.38
1968	.071	.19	.41
1970	.087	.22	.50
1971	.080	.22	.48
1972	.080	.27	.38
1973	.086	.28	.47
1974	.108	.35	.44
	Eight-Plant Concentration Ratio		
1965	.109	.38	.51
1966	.105	.37	.53
1967	.102	.33	.50
1968	.106	.33	.55
1970	.137	.38	.64
1971	.125	.38	.62
1972	.124	.44	.51
1973	.139	.46	.61
1974	.170	.51	.59
	Twenty-Plant Concentration Ratio		
1965	.199	.65	.72
1966	.204	.62	.76
1967	.198	.61	.75
1968	.186	.59	.80
1970	.239	.67	.83
1971	.234	.66	.84
1972	.218	.67	.77
1973	.241	.69	.84
1974	.262	.71	.84

Source: Adapted from Capalbo, 1976.

largest plants exhibited such integration in the South Atlantic, North Central, and Pacific regions. Integration at the 20 plant level in other regions was similar or somewhat less than the national level of 30 percent.

(c) Barriers to entry - Concentration levels may be determined, in part, by barriers to entry. Generally when barriers are low, a sector exhibits rather low concentration indices and it is said to be "competitive." In the fresh process form sector, this appears to be the case; concentration levels are the lowest of all sectors and barriers appear low to moderate.

From 1965 to 1974, the total number of fresh seafood processing plants in the U.S. decreased slightly (Capalbo 1976). The largest decreases were in the Middle Atlantic region. Capalbo also found that most entry and exit occurred in smaller firms where the annual value of production was from \$1,000 to \$199,000. It appears as though larger plants or firms in the sector were "better established" than smaller plants or firms and were better able to cope with changing conditions. Although reasons for the persistence of larger firms were not explicitly forwarded in the studies, it appears that barriers in this sector include, to some extent, cost advantages associated with larger plant size and geographic location advantages.

(d) Other structural elements - Capalbo (1976) found that seven plants in the top 20, nationally, produced process forms other than fresh. Comparison with other process form sectors revealed that on a national basis the top 20 plants in the fresh sector were more diversified than the top 20 plants in other process form sectors.

On a regional basis, Capalbo found plants in the top 20 to be more diversified in the New England region than in the Middle Atlantic. Generally, more than half of the New England region plants were diversified during 1965 to 1974.

Inequality in plant size in the New England and Middle Atlantic regions was low to moderate. Most plants had annual sales in the \$1,000 to \$199,999 range, a few had sales in the \$200,000 to \$499,999 range, and very few had sales greater than \$500,000.

Frozen Process Form Sector

1. Physical Attributes. Capalbo (1976) found that in 1974 the 20 largest frozen processing plants were fairly evenly distributed among the regions. All regions except for the Chesapeake and Pacific specialized (in terms of volume and value) in the production of the frozen process form.

The average plant in this sector employs 30 workers per production line and typically contains up to eight such production lines per plant (Marcus 1974). Frozen fish processing plants are more capital intensive, more automated, and employ fewer workers per pound of fish product than fresh fish plants (Capalbo 1976).

2. Structural Elements.

(a) Seller concentration - Although there has been a trend toward increased concentration from 1965 to 1974, at no time during this period was the frozen sector, on a national basis, concentrated (Capalbo 1976). On a regional basis, however, Capalbo found that the New England and Middle Atlantic regions were significantly concentrated during this period. Concentration ratios for this sector are listed in Table 2-4; ratios for most regions are not available.

Studies by Alvarez et al. (1976) and Orth et al. (1977), investigated concentration levels in product markets. The former found that Florida shrimp processing firms which primarily produce shrimp are concentrated at the four- and eight-firm levels; the values are 73.77 and 94.94 percent, respectively. The latter reported that tanner crab processing firms (companies which produce primarily frozen sections and canned meats) were significantly concentrated in the frozen sections market.

In sum, the frozen sector has recently been quite concentrated at the national level, in regions which have been analyzed, and in those species for which information is available.

(b) Vertical integration - Little information on the existence or extent of backward integration is available for this sector. One study (Alvarez et al. 1976), however, found that six shrimp processing firms, representing 37 percent of industry sales, were integrated into the ownership or control of raw supply. Apparently it was not uncommon for such firms to own vessels and unloading facilities or to enter into contracts with fishers and unloaders.

Capalbo (1976) found that five percent of the largest 20 plants on a national basis, were integrated forward in 1974. The Pacific, South Central, and North Central regions exhibited significantly greater levels of forward integration than the national figure; the remaining regions were integrated at a level slightly greater than the national level.

(c) Barriers to entry - Conditions of entry in this sector appear more rigorous than those found in the fresh sector. Alvarez et al. (1976), found that the availability of shrimp influences the nature and rate of industry growth. It appeared as though larger firms were able to outbid smaller firms for inputs (usually shrimp and occasionally labor), making it more difficult for small firms (and potential entrants) to attain economies of scale associated with large plant size or higher levels of output.

The above finding is consistent with Capalbo (1976). This study reported that from 1965 to 1974, the total number of plants increased in the U.S. Most entry and exit occurred at small to medium ($1,000 to $500,000 annual value of production) plant sizes while the majority of exit occurred at small plant sizes ($1,000 to $200,000 annual value of production). In addition, Capalbo found trends in the New England and Middle Atlantic regions toward larger plants and a higher concentration of product. Thus, national

TABLE 2-4

CONCENTRATION RATIOS FOR FOUR, EIGHT, AND TWENTY LARGEST FROZEN SEAFOOD PROCESSING PLANTS, NATIONAL, NEW ENGLAND, AND MIDDLE ATLANTIC REGION 1965 TO 1968, 1970 TO 1974

Year	National	New England Region	Middle Atlantic Region
	Four-Plant Concentration Ratio		
1965	.175	.48	.71
1966	.168	.49	.75
1967	.155	.50	.65
1968	.187	.51	.60
1970	.173	.50	.70
1971	.163	.47	.69
1972	.140	.49	.65
1973	.153	.50	.65
1974	.169	.52	.73
	Eight-Plant Concentration Ratio		
1965	.295	.63	.89
1966	.285	.63	.90
1967	.265	.67	.87
1968	.296	.72	.87
1970	.289	.70	.90
1971	.281	.68	.92
1972	.253	.70	.93
1973	.261	.68	.94
1974	.278	.70	.95
	Twenty-Plant Concentration Ratio		
1965	.501	.84	.99
1966	.491	.83	.99
1967	.469	.87	.99
1968	.494	.91	.99
1970	.501	.87	.99
1971	.485	.87	.99
1972	.463	.88	.99
1973	.456	.89	.99
1974	.489	.90	.99

Source: Adapted from Capalbo, 1976.

and regional trends seem to indicate that there may be economies of scale associated with larger plant size.

Excess productive capacity, in addition to the above, could explain the exit of smaller firms (Alvarez et al. 1976). Excess productive capacity could also have a negative influence on the viability of potential entrants.

In sum, the differential ability to procure raw supply, economies of scale associated with larger plant size, and excess productive capacity appear to pose obstacles to entry in this sector.

(d) Other structural elements - Diversification in this sector was not common among the 20 largest plants on a national basis in 1974 (Capalbo 1976). Only two of the top plants extended production to other process forms in 1974. On a regional basis a greater number of plants in the top 20 were diversified; six plants in the New England region and eight plants in the Middle Atlantic region (of the top 20 in each region) extended production to other process forms.

Canned Process Form Sector

1. Physical Attributes. The Pacific region contains most of the 20 largest plants in the U.S. and specializes in the production of the canned process form (by volume and weight). Most canning plants, in number, are single unit firms; 82.5 percent of the value of production in 1972 was, however, produced by multi-unit firms (Capalbo 1976). Corporations were the dominant ownership type for both single and multi-unit firms.

2. Structural Elements.

(a) Seller concentration - At the national level and in the Pacific region the canned process form sector is highly concentrated and has become more concentrated during the period 1965 through 1974 (see Table 2-5). Jensen (1975) stated that substantial concentration in the Pacific salmon processing industry resulted primarily from consolidation and merger of established firms. Jensen also found that the top ten firms in this region have maintained their relative position over the last ten to 15 years.

The canned shrimp and canned tuna markets also appear to be quite concentrated. Kolhonen (1976) reported that the four- and eight-firm concentration ratios for shrimp were 47.9 and 66.7, respectively, while those for tuna were 80.5 and 97.7 percent, respectively.

Finally, Orth et al. (1977), found that Alaskan firms producing canned tanner crab meat were highly concentrated at the four-firm level in 1976 (there were only five firms).

(b) Vertical integration - Little documentation concerning the level of backward integration exists at the present time. A study by Jensen (1975) suggests that many of the large firms in the Washington State salmon processing industry exert control over raw supply through the extension of credit to fisheries. Other means include free boat moorage, repair facilities, etc. Further study of backward integration in the canned process form sector is necessary to better characterize the extent of such in this sector.

TABLE 2-5

CONCENTRATION RATIOS FOR FOUR, EIGHT, AND TWENTY LARGEST CANNED SEAFOOD PROCESSING PLANTS, NATIONAL AND PACIFIC REGION 1965 TO 1968, 1970 TO 1974

Year	National	Pacific Region
	Four-Plant Concentration Ratio	
1965	.322	.57
1966	.309	.54
1967	.295	.55
1968	.312	.57
1970	.342	.59
1971	.361	.59
1972	.407	.64
1973	.395	.63
1974	.422	.62
	Eight-Plant Concentration Ratio	
1965	.521	.82
1966	.511	.83
1967	.504	.80
1968	.511	.86
1970	.539	.87
1971	.539	.82
1972	.594	.89
1973	.575	.89
1974	.611	.89
	Twenty-Plant Concentration Ratio	
1965	.754	.95
1966	.784	.96
1967	.763	.96
1968	.762	.97
1970	.816	.98
1971	.797	.97
1972	.853	.98
1973	.848	.98
1974	.860	.98

Source: Adapted from Capalbo, 1976.

Capalbo (1976) found that none of the 20 largest plants were integrated forward on a national basis in 1974. On a regional basis, however, the South Atlantic, North Central, and Pacific regions exhibited significant levels of integration.

(c) Barriers to entry - Barriers in this sector appear to be excess capacity, differential ability to procure raw supply, geographic location and the differential price (temporarily) of venture capital. Kolhonen (1976) found that plant capacities in the canned shrimp and tuna industries were geared to take peak landings. Because the availability of raw supply fluctuated, there was usually excess capacity in these industries. Jensen (1975) cited similar reasons for excess capacity in the salmon processing industry. Faced with high fixed costs and large capacities, established firms probably had incentives to outbid smaller firms (and potential entrants) for factor inputs.

Jensen (1975) found that entrants into the salmon processing industry usually must secure raw supply through primarily non-price means. Examples of non-price competition included locating processing facilities in more convenient locations and enticing fishers with free boat moorage, repair facilities, and generous credit. Since smaller firms or potential entrants were not as strong financially as larger firms, they were at a relative disadvantage in this instance.

Jensen (1975) also found that established firms began with and, in many cases, continue to enjoy generous lease and credit terms. Potential entrants, faced with less generous terms, would incur increased average costs per unit over the entire production range.

In sum, barriers to entry appear to be rather formidable in some canned species sectors, notably salmon, and perhaps shrimp and tuna. Barriers in the canned sector are most likely higher than in the other sectors.

(d) Other structural elements - Diversification in the canned sector is quite limited as only three of the top 20 plants, nationally and in the Pacific region, extended production to other process forms (Capalbo 1976).

Cured Process Form Sector

1. Physical Attributes. Most of the 20 largest plants in this sector are located in the Middle Atlantic and Pacific regions (Capalbo 1976). The Middle Atlantic region specializes to the greatest extent in cured process form production; 17.7 percent of its total production was cured in 1974 (Capalbo 1976).

2. Structural Elements.

(a) Seller concentration - Concentration ratios at the four- and eight-plant level, on a national basis, increased from 1965 to 1974 and were well in excess of the critical values in 1974 (Table 2-6). Concentration levels on a regional basis are not available.

TABLE 2-6

CONCENTRATION RATIOS FOR FOUR, EIGHT, AND TWENTY LARGEST CURED SEAFOOD PROCESSING PLANTS, NATIONALLY 1965 TO 1968, 1970 TO 1974

Year	National
Four-Plant Concentration Ratio	
1965	.304
1966	.305
1967	.341
1968	.361
1970	.351
1971	.353
1972	.389
1973	.406
1974	.506
Eight-Plant Concentration Ratio	
1965	.486
1966	.495
1967	.539
1968	.544
1970	.538
1971	.566
1972	.603
1973	.588
1974	.656
Twenty-Plant Concentration Ratio	
1965	.729
1966	.741
1967	.776
1968	.769
1970	.787
1971	.794
1972	.817
1973	.824
1974	.833

Source: Adapted from Capalbo, 1976.

(b) Vertical integration - Fifteen to 71 percent of the top 20 plants were forward integrated on a regional basis while ten percent were integrated on a national basis (Capalbo 1976).

(c) Barriers to entry - Not available.

(d) Other structural elements - Very few firms in this sector were diversified in the past. In 1974, and in most previous years, an average of two of the top 20 plants, on a national basis, extended production to other process forms.

Summary

Structural elements of process form sectors are summarized in Table 3 of the text. Most information in the table is derived directly from the Capalbo (1976) paper; occasionally some areas are supported by other studies. These areas included product extension and backward integration.

PART III

Glossary

Barriers to entry	Economic advantages possessed by an established firm in a sector or industry relative to a potential entrant.
Concentration	The number and size distribution of sellers (buyers) in a sector or industry. Construction of an index to characterize concentration involves choosing a unit of measurement (assets, value of shipments, sales, etc.), deciding whether to include some or all firms in the index, and evaluating the desirability of including a measure of firm inequality. Since any one concentration index highlights only particular aspects of the number and size distribution of firms, the choice of an index depends upon the nature of the problem at hand.
Concentration ratio	A partial index (includes only a portion of firms) which indicates the percent share of a market accounted for by a few of the largest firms in that market. It is typically calculated at the four, eight, or 20 firm level.
Diversification	The production of two or more products (by a plant or firm) which are sold in more than one industry. A plant (firm) may produce products with low substitutability and/or sell to different groups of buyers, in which case it would be considered diversified.

Economies of scale	Changing the levels of all inputs to achieve different levels of output. (For additional definition, see Bain 1968).
Firm	A privately owned business enterprise which engages in production activity of any sort with the opportunity of making a profit. The enterprise may be owned by one or a group of owners and be composed of one or more plants producing the same or different products. Enterprises are commonly referred to as firms, companies, or corporations.
Geographic market	The physical scope of trade between sellers and a common group of buyers.
Herfindal index	A sum of the squares of the relative sizes of all firms in a market. It approaches zero as firms become equal in size, and nears one as the number of firms becomes very small.
Industry	A group of firms which compete in the same geographic and product market.
Lorenz curve	An economic graph depicting the relation of the percentage of total production or market value of shipments to the percentage of firms in the market, cumulated from smallest to largest or vice versa. The curve, in contrast to the concentration ratio is a summary index, and it measures relative rather than absolute concentration levels.
Market	A formal or informal mechanism for exchange of products or services and information about same. It can be a physical facility or informal communication among buyers and sellers. The market for a particular product or service is a high degree of substitutability among the offerings of sellers and similarity in the needs of buyers.
Market conduct	A firm's behavior in trying to attract customers or response to rivals' competitive practices (Dirlam 1971).

Market performance — Composite productivity of a firm or industry's end result in the dimensions of price, output, production costs, selling costs, and product design (Alvarez 1976).

Market share — A firm's share of total industry or sector production.

Market structure — The market organization characteristics that influence both market conduct and performance of firms within an industry.

Product differentiation — Real or perceived differences in close substitute products offered by different sellers. The differences, whether real or fancied, lead to buyer preference of one product over another.

Product market — The scope of trade between buyers and sellers of close substitute products.

Sector — One or more private enterprises which engage in similar activities, for example the seafood processing sector as distinguished from the food processing sector. A sector will usually be composed of firms that can be assigned to industries based on the degree of substitutability of their outputs.

Turnover — The complete disappearance of a firm from a sector or industry, or the disappearance of a firm from the top echelon of firms in a sector or industry. Such changes alter market shares among firms. Turnover is not a complete summary index of economic structure because it does not include, for example, vertical and conglomerate power.

Vertical integration — Direct or tacit combinations of two or more firms that formerly operated at different levels in a production process.

APPENDIX III

INDUSTRY SURVEY: SURVEY FORM AND RESPONSES

PART I

Survey Form

University of Alaska

Statewide System of Higher Education

ALASKA SEA GRANT PROGRAM
Fairbanks, Alaska 99701

April 14, 1978

Attention:

Gentlemen:

The Alaska Sea Grant Program is in the final year of a major study of the Alaska seafood processing industry. This research is intended to provide baseline economic information to management agencies and to individual companies who desire to compare their own company against industry norms. This study has been coordinated with industry associations, North Pacific Fisheries Management Council, National Marine Fisheries Service, Alaska Department of Fish and Game, and other Sea Grant institutions in the Pacific Northwest.

The universal concern about such a study among industry executives has been the maintenance of confidentiality. This concern is shared equally by the Alaska Sea Grant Program which has established the following safeguards: 1) a locked file system to which only authorized researchers have access; 2) the return of information, without copying, to its original source after recording needed information in an anonymous form; 3) industry review and assistance in developing the enclosed survey and; 4) industry review of a typed draft of the report before publication to insure the maintenance of confidentiality.

Several of the questions in the enclosed survey form involve ownership patterns of the industry. The responses to these sensitive questions, as well as the responses to all other questions, will be consolidated to avoid disclosure. Where consolidation is not possible, the information will not be reported in any manner. The questions are intended to provide a description of industrywide patterns built up in the only way possible from individual firm responses.

It is our hope that your company will take the enclosed survey seriously and that you will view each question as your company's input into consolidated industrywide statistics. Each decision not to respond to a particular question will detract from the overall contribution made by the other respondents. If your company does decide that it cannot respond to particular questions, please complete the remainder of the questions to which you have no objections.

The procedure we propose is as follows: 1) Please complete the enclosed, self-addressed postcard within ten days of receipt of this letter, indicating whether your company will respond to the survey and, if you will, what time during the month of May would be the most convenient for me or my representative to visit with the respondent(s) within your company. The purpose of the personal contact is to insure uniformity of interpretation of each question so that in fact the responses can be meaningfully consolidated. 2) When the survey forms are complete, they should be mailed to the Alaska Sea Grant Program in the return envelope provided. They should be returned no later than May 31, 1978. 3) The information will be extracted from the survey form and placed on a data sheet where individual firm identity will be removed. 4) The survey form will be returned within three weeks, without copying, by registered mail. 5) The report, of which the consolidated survey responses will be a part, will be reviewed by an industry committee before publication as a final safeguard against the disclosure of confidential information. The shellfish (crab and shrimp) report should be available for review by August 1, and the finfish (salmon, halibut, herring) report by October 1.

The report will, of course, recognize the contribution of the companies cooperating with this survey and/or other parts of the Alaska seafood processing industry study.

If I may be of any assistance in reaching a decision with respect to this survey, please call me at (206) 232-3991.

Thank you.

Sincerely,

Franklin L. Orth
Senior Economist

FLO:mk
Enclosures

North Pacific Fishery Management Council

Harold E. Lokken, Chairman
Jim H. Branson, Executive Director

Suite 32, 333 West 4th Avenue
Post Office Mall Building

Mailing Address: P.O. Box 3136DT
Anchorage, Alaska 99510

Telephone: (907) 274-4563
FTS 265-5435

Dear Alaskan Seafood Processor:

The enclosed questionnaire has been developed by Dr. Frank Orth in consultation with Walt Yonkers and other members of the seafood industry to solicit needed information for the University of Alaska's Sea Grant study of Alaska seafood processing. The study, which will be completed this fall, should give us some basic data on the industry that is badly needed for the development of fishery management plans by the North Pacific Fishery Management Council. While this project is not funded by the North Pacific Council, the results will be available to it and are expected to be used in virtually all of the management plans currently under development.

While the study is being done by the Alaska Sea Grant Program, it should be noted that Dr. Orth is now employed as the Senior Economist for Earl R. Combs, Inc., but will continue his association with the University of Alaska under contract until October 31st of this year. Dr. Orth has worked closely with the industry in developing this questionnaire and it appears that most of the problems relating to confidentiality and the elimination of questions with no direct bearing to the study in question have been resolved.

On behalf of the North Pacific Council, I urge you to cooperate with Dr. Orth in this Sea Grant study. I appreciate the time required to complete this questionnaire and the misgivings many of you have about releasing some of the requested information, but this basic economic data is sorely needed if we are to comply with the provisions of the Fishery Conservation and Management Act of 1976. The Council itself has no interest in anything but the completed study. I will do my utmost to insure that data from individual companies will be treated in the strictest confidentiality. It is not expected that Council members or staff will need or will have access to any individual data.

Thank you for your cooperation.

Sincerely,

Jim H. Branson

Jim H. Branson
Executive Director

ASSOCIATION OF PACIFIC FISHERIES
1600 SO. JACKSON ST.
SEATTLE, WASHINGTON 98144
(206) 323-3540

April 7, 1978

TO: All Members

FROM: Walt Yonker Walt Yonker

RE: Alaska Sea Grant Program - Seafood Processing Industry Studies

Dr. Frank Orth, Senior Economist for Earl R. Combs, Inc. and formerly with the Alaska Sea Grant Program, has a contract from the Alaska Sea Grant Program to complete an economic study of the Alaska seafood processing industry. This study was endorsed by the North Pacific Fisheries Management Council to develop required economic information so that the Council can manage the fishery resources under its jurisdiction.

Dr. Orth requested that the Pacific Seafood Processors Association act as an industry contact for coordinating this study with its members.

The original questionnaire as proposed by Dr. Orth was not acceptable to the PSPA members so a small committee composed of Dave Forbush, Bumble Bee; Dexter Lall, Peter Pan; Roy Hendrickson, Whitney-Fidalgo and Ray Lewis, Alaska Packers, worked with me to bring this study into a format which might be answered by industry.

This committee's work has now been completed and a number of industry suggestions for additions, deletions and changes have been incorporated in the final questionnaire which is enclosed with this letter. A number of the questions about which the committee expressed concerns have been modified but not withdrawn because Dr. Orth held the view that they were necessary to provide the North Pacific Fisheries Management Council with the information which it requested.

Both the committee and Dr. Orth have made a sincere effort to take into account each other's view on the matter and the questionnaire is being presented to you for your individual corporate decisions on a response.

WVY/kw
Enclosure

INSTRUCTIONS AND DEFINITIONS FOR COMPLETING SURVEY FORM

1. All figures on financial items (dollar value of sales, assets, equity, etc.) should be taken from December 31, 1976, or nearest fiscal year end, financial statements.

2. This survey is directed to firms that operate one or more seafood processing establishments in Alaska under a generally recognized company identity. If your company is a wholly owned subsidiary or a separate division of another company but still retains a generally recognized and separately identifiable company identity, your responses should correspond only to your own operations unless otherwise specified (as in question III. 3.a.). If your company is a parent company, your responses should exclude only that information which corresponds to subsidiaries or division which are themselves generally recognized and identified as separate.

   If you have any questions about the appropriate company entity to which your answers should correspond, please contact Frank Orth (206) 232-3991 or Jim Richardson (907) 479-7961, prior to completion of this survey form.

3. Definition of terms used in survey.

   a. Advance: Providing money, gear, supplies or other items of value prior in time to a requirement of direct repayment or the provision of some other form of consideration.

   b. Wholesaler: For purposes of this survey, DISC corporations are included with wholesalers.

   c. Promotional Allowances: These include price discounts from list price, coupons, advertising assistance and other similar promotional devices.

   d. 1976: All references to 1976 refer to December 31, 1976, or nearest fiscal year end.

   e. Integration: The existence or formation of an economic relationship with another fish processor (horizontal integration) or with fishermen or distributors (vertical integration).

COMPANY CODE ________ CONFIDENTIAL

ALASKA SEA GRANT PROGRAM

SEAFOOD PROCESSING INDUSTRY STUDIES

Seafood Processor Survey

I. General Company-wide Information

1. Please mark with an "X" the species-process-product produced by your company in Alaska during 1976.

Answer	Species	Process	Product
______	Salmon	Canned	Conventional
______	Salmon	Canned	Smoked
______	Salmon	Fresh/frozen	Whole
______	Salmon	Fresh/frozen	Steaks/fillets
______	Salmon	Mild-cured	Whole
______	Salmon	Smoked	Whole
______	Salmon	Smoked	Strips
______	Salmon	Salted	Whole
______	Salmon	Salted	Roe
______	Salmon	Frozen	Roe
______	Salmon	Fresh	Roe
______	Salmon	______ (Other)	______ (Other, please specify)
______	Salmon	______ (Other)	______ (Other, please specify)
______	Halibut	Fresh	Whole
______	Halibut	Frozen	Whole
______	Halibut	Frozen	Fillets
______	Halibut	Frozen	Cheeks
______	Halibut	______ (Other)	______ (Other, please specify)
______	Herring	Frozen	Fillets
______	Herring	Frozen	Whole
______	Herring	Salted	Whole
______	Herring	Frozen	Roe
______	Herring	Frozen	Roe on kelp
______	Herring	Salted	Roe
______	Herring	Salted	Roe on kelp
______	Herring	Frozen	Bait
______	Herring	______ (Other)	______ (Other, please specify)

I. General Company-wide Information (Continued)

Answer	Species	Process	Product
______	King crab	Frozen	Sections
______	King crab	Frozen	Meats
______	King crab	Frozen	Claws
______	King crab	Canned	Conventional
______	King crab	Fresh	Whole
______	King crab	______ (Other)	______ (Other, please specify)
______	Tanner crab	Frozen	Sections
______	Tanner crab	Frozen	Meats
______	Tanner crab	Frozen	Claws
______	Tanner crab	Canned	Conventional
______	Tanner crab	______ (Other)	______ (Other, please specify)
______	Dungeness crab	Frozen	Whole
______	Dungeness crab	Frozen	Sections
______	Dungeness crab	Frozen	Meats
______	Dungeness crab	Fresh	Whole
______	Dungeness crab	______ (Other)	______ (Other, please specify)
______	Shrimp	Frozen	Whole
______	Shrimp	Frozen	Tails
______	Shrimp	Frozen	Meats
______	Shrimp	Canned	Conventional
______	Shrimp	Fresh	Whole
______	Shrimp	Fresh	Tails
______	Shrimp	Fresh	Meats
______	Shrimp	______ (Other)	______ (Other, please specify)

Please add any species-product-process not covered above.

______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______

I. General Company-wide Information (Continued)

2. Please indicate your company's 1976 fish-product dollar sales as a percentage of total 1976 dollar sales: ______________

3. Please indicate the number of fish-processing plants by area and the percent of your company's total fish-product dollar sales contributed by the plants in each designated area.

	Number of Plants	% of Your Company's Total Fish-Product Dollar Sales
a. In Alaska		
b. In Washington		
c. In Oregon		
d. In California		
e. In remainder of U.S. and territories		

4. What is the size of your company as measured by the 1976 dollar value of total assets (from balance sheet) less merchandise inventory, and as measured by 1976 dollar value of total sales?

____
(1976 dollar value of total assets less merchandise inventory)

____
(1976 dollar value of total sales)

5. What percent of 1976 total assets less merchandise inventory are financed by capital accounts (par value of stock, capital surplus, retained earnings; from 1976 balance sheet)? ______________
(Percent)

6. Is the ownership of your company (select one)

   a. Public (stock traded on organized exchange)? ______________
   b. Private (stock closely held, not traded) ? ______________
   c. Sole proprietorship ? ______________
   d. Partnership ? ______________
   e. Cooperative ? ______________
   f. Wholly owned subsidiary of another company ? ______________
   g. A division of another company without separate capital stock ? ______________

II. Horizontal Integration

1. a. Was your company owned by a domestic parent concern or concerns in 1976?

   ________ Yes ________ No

   b. If yes, please indicate the name(s) of the domestic parent concern(s), their respective percentage of 1976 equity ownership, and their primary lines of business.

Name	Percent Ownership	Lines of Business

2. a. Did your company own significant (5 percent or greater) holdings of the stock of another domestic company with seafood or seafood related (i.e., involved in production and/or distribution of seafood products) lines of business in 1976?

   ________ Yes ________ No

   b. If yes, please indicate the name of these domestic companies, give the percent of 1976 equity owned, and give a brief description of their primary lines of business.

Name	Percent Ownership	Lines of Business

III. Vertical Integration

1. a. Did your company, parent company, or subsidiary company own fishing vessels in 1976?

   ______ Yes ______ No

   b. If yes, please list the number owned by the primary area and species fished.

	Number	Species
Alaska	____	________
Washington	____	________
Oregon	____	________
California	____	________
Remainder of U. S. and territories	____	________

   c. Is it your observation that, over the past ten years, the practice of processors owning fishing vessels has generally increased, decreased, or remained unchanged in importance in the Alaska seafood processing industry? ________. Is there any particular Alaska fishery in which a trend in processor fishing-vessel ownership is especially evident?

   ______ Yes ______ No

   If yes, name the fishery and indicate whether the trend is toward increasing or decreasing ownership.

Fishery	Indicate Increasing or Decreasing Ownership
____________	__________
____________	__________
____________	__________
____________	__________

2. a. Does your company, parent company, or subsidiary company advance money, gear, or supplies to independent fishing vessels?

   ______ Yes ______ No

   b. If yes, is interest typically charged on such advances?

   ______ Yes ______ No

III. Vertical Integration (Continued)

2. c. Is it your observation that, over the last ten years, the practice of advancing money, gear, or supplies has increased, decreased or remained unchanged in frequency in the Alaska seafood processing industry?

_____ increased _____ decreased _____ unchanged

Please note any specific trends that you consider important.

____

____

____

3. a. Does your company, parent company, or subsidiary company have an ownership interest in brokerage, wholesale or retail seafood businesses?

_____ Yes _____ No

b. If yes, please specify the type of operation or operations (brokerage, wholesale, retail) for each such company (not necessary to name company) in which there is an ownership interest.

	Type of Operation(s)
Company A	_______________
Company B	_______________
Company C	_______________
Company D	_______________
Company E	_______________

c. Has the practice of seafood processors owning interests in brokerage, wholesale or retail seafood businesses increased, decreased or remained unchanged in importance over the past ten years in the Pacific Northwest seafood industry?

_____ Yes _____ No

Please note any specific trends that you consider important.

____

____

____

IV. Transportation

1. a. For each species indicated, please rank in descending order of importance (i.e., 1 - most important; 2 - second most important, etc.) the typical methods of transportation of raw product from the fishing grounds to your Alaska plants.

	SPECIES				
Type of Tendering	Salmon	Halibut	Herring	Crab	Shrimp
Direct delivery by fishing vessels	____	____	____	____	____
Company-owned tenders	____	____	____	____	____
Company-chartered tenders	____	____	____	____	____
____ (Other, please specify)	____	____	____	____	____

b. For each product form indicated, please rank in descending order of importance the typical methods of transporting your processed product from Alaska.

	Finfish			Shellfish		
Transportation Method	Fresh	Frozen	Canned	Fresh	Frozen	Canned
Commercial air	____	____	____	____	____	____
Commercial barge	____	____	____	____	____	____
Processor-owned vessel	____	____	____	____	____	____
Buyer-owned vessel	____	____	____	____	____	____
____ (Other, please specify)	____	____	____	____	____	____

c. Are there any significant trends in the methods or practices of transportation of fish or shellfish from Alaska harvesting areas to processing facilities? ____________________

____

____

____

d. Are there any significant trends in the methods or practices of transporting fish or shellfish products from Alaska plants to distribution centers? ____________________

____

____

____

V. Domestic Sales: General Practices and Trends

1. Of your total 1976 fish-product dollar sales, what percent is sold through brokers ______ (percent); through wholesalers ______ (percent); or directly to retailers ______ (percent)?

2. a. In general, what method of sale does your company typically use for canned and fresh/frozen seafood products? Please check most common method of sale for each process form; if more than one method of sale is typically used, please rank (1, 2, 3 . . . in descending order of importance.)

	Process Form	
Method of Sale	Canned	Fresh/frozen
Normal terms*	______	______
Consignment	______	______
Delayed billing	______	______
______ (Other, please specify)	______	______

*Canned: 2%/10 n 30; Fresh/frozen: n 30

b. Please indicate any significant trends over the past decade concerning methods of sale in the Pacific Northwest seafood industry. ______

______

______

______

______

V. Domestic Sales: General Practices and Trends (Continued)

3. a. Does your processing business typically do custom processing for other seafood processing firms?

   ______ Yes ______ No

   b. If yes, does your company typically receive production advances from the firms for whom you custom process?

   ______ Yes ______ No

   c. Do production advances to processors usually carry interest charges?

   ______ Yes ______ No

   d. Please list the species-process-product forms (refer to Question I. 1.) in which your company typically does significant amounts of custom processing for other seafood processing firms.

Species	Process	Product

   e. Please list the most important factors which determine the amount of custom processing that your company is requested to perform for others.

   ____

   ____

   ____

   ____

   ____

   f. Are there any significant trends in the practice of custom processing which you feel are important? Please respond by species and product form, if possible.

   ____

   ____

   ____

   ____

   ____

V. Domestic Sales: General Practices and Trends (Continued)

4. a. Does your processing business typically receive sales advances from the domestic seafood-distribution firms to whom you sell products?

   ______ Yes ______ No

   b. Do sales advances usually carry interest charges?

   ______ Yes ______ No

   c. Please indicate any other frequently used sales incentives provided by buyers of your products. ______________________

   ____

   ____

   ____

   ____

   d. With what species-process-product forms (refer to Question I. 1.) are sales advances or other sales incentives most common?

Species	Process	Product

   e. Please indicate any significant trends in sales incentives that are used by buyers of your products, or by seafood buyers generally, that you as a seafood processor have observed.

   ____

   ____

   ____

   ____

5. a. Does your company make promotional allowances to buyers of your fish products?

   ______ Yes ______ No

V. Domestic Sales: General Practices and Trends (Continued)

5. b. If yes, what form(s) of promotional allowance does your company typically use? Please give your response by process form, and if more than one form of promotional allowance is used, please rank (1 most important, etc).

	Process Form	
Type of Promotional Allowance	Canned	Fresh/frozen
Discount from list price	______	______
Coupons	______	______
Advertising assistance	______	______
______ (Other, please specify)	______	______
______ (Other, please specify)	______	______

VI. International Trade

1. a. Is your company owned in whole or part by a foreign country (other than Japanese)?

______ Yes ______ No

b. If yes, name company(ies), give the percent control held of your company in 1976, and give a brief description of the lines of business of the holding company.

Company	Percent Ownership	Lines of Business
A	______	______
B	______	______
C	______	______
D	______	______
E	______	______
F	______	______

2. a. Does your company own significant (5 percent or greater) holdings of the stock of any (Japanese or other) foreign company with seafood or seafood-related lines of business?

______ Yes ______ No

VI. International Trade (Continued)

2. b. If yes, please indicate the nationality of the owned company, give percent owned in 1976, and give a brief description of the lines of business of that company.

Company	Country	Percent Owned	Lines of Business
A	______	______	______
B	______	______	______
C	______	______	______
D	______	______	______

3. a. Does your company receive production or sales advances from any foreign company with whom you do business?

______ Yes ______ No

b. If yes, is interest typically charged?

______ Yes ______ No

c. And, if yes, indicate the percent of your company's total liabilities in 1976, that is owed to that company.

Company	Percent of Total Liabilities
A	______
B	______
C	______
D	______

4. a. Is your company participating in long-term purchasing contracts with foreign buyers?

______ Yes ______ No

b. Do such contracts typically involve advances or other consideration?

______ Yes ______ No

c. And, if advances are made as part of these contracts, is interest typically charged?

______ Yes ______ No

VI. International Trade (Continued)

4. d. If your company is participating in long-term purchasing agreements which include advances, do the advances carry options for conversion to equity in your company?

_______ Yes _______ No

5. a. Does your company typically make advances to foreign companies to whom you sell your seafood products?

_______ Yes _______ No

b. If yes, is interest typically charged?

_______ Yes _______ No

c. And, if yes, indicate the percent of your company's total receivables in 1976 that were due from foreign companies to whom you made advances.

_______ Percent of total receivables

VII. Entry and Exit

1. a. Do you anticipate entering into any other fisheries in the Pacific Northwest?

_______ Yes _______ No

b. If yes, please list the target fishery area, code, and expected year of entry.

Target Fishery	Area	Expected Year of Entry
Ground fish		
Salmon		
Shrimp		
Crab		
Mollusks		
Herring		

Area Code for Questions VI.1.b. and VI.1.c.

Area	Code
Bering Sea	1
Western Gulf of Alaska	2
Northern Gulf of Alaska	3
Eastern Gulf of Alaska	4
Washington Coast	5
Oregon Coast	6

VII. Entry and Exit (Continued)

c. Please list Pacific Northwest fisheries that have been entered or exited by your company since January 1, 1970.

				Method of Entry or Exit (state one)		
Species	Area Code	Exit or Entry	Year of Exit or Entry	Purchase or Sale of Subsidiary	Purchase or Sale of Existing Plant and/or Equipment	Add or Discontinue Product Line

VIII. Product Promotion

1. a. Does your company engage directly in product promotion or advertising?

   ____ Yes ____ No

   b. Does your company participate in cooperative product promotion or advertising through assessments to an industry association product-promotion effort?

   ____ Yes ____ No

   If yes, please list the associations (including the Alaska King Crab Marketing and Quality Control Board) in which your firm holds memberships. ______________

   ____

   ____

   ____

   c. If either or both 1.a. or 1.b. are answered yes, what is the ratio of your company's

$$\frac{\text{total product-promotion \$ expenditures on fish products, 1976}}{\text{total fish-product \$ sales, 1976}} ?$$

____________ Percent

PART II

Survey Responses

SURVEY RESPONSES (19 RESPONDENTS)

I. *General Company-wide Information*

1. *Please indicate your company's 1976 fish-product dollar sales as a percentage of total 1976 dollar sales:*

   no response = 1
   0 - 25% = 0
   >25% - 50% = 0
   >50% - 75% = 1
   >75% -100% = 17 (14 were 100%)

2. *Please indicate the number of fish-processing plants by area and the percent of your company's total fish-product dollar sales contributed by the plants in each designated area.*

	# of Companies				
# of plants	Alaska	Washington	Oregon	California	Remainder of U.S. and territories
1	11	2			1
2	2		1		
3	2				
5	1	1			
7	1				
10	1				
13	1				

no response = 0

percent	Alaska	Washington	Oregon	California	Remainder of U.S. and territories
0 - 25%					
>25% - 50%					
>50% - 75%					
>75% - 100%	17 (all were 100%)	1			

no response = 6 (This involved 2 surveys -- one of which had 4 figures, and the other 2 figures, for plants in different areas.)

3. *What is the size of your company as measured by the 1976 dollar value of total assets (from balance sheet) less merchandise inventory, and as measured by 1976 dollar value of total sales?*

	1976 dollar value of total assets less merchandise inventory	1976 dollar value of total sales
$ 0 - $ 250,000	1	
$ 250,001 - $ 500,000	2	
$ 500,001 - $ 1,000,000	2	1
$ 1,000,001 - $ 5,000,000	4	8
$ 5,000,001 - $10,000,000	3	1
> $10,000,000	5	7

no response = 2

I. 4. *What percent of 1976 total assets less merchandise inventory are financed by capital accounts (par value of stock, capital surplus, retained earnings, from 1976 balance sheet)?*

0 - 25% = 4
>25% - 50% = 2
>50% - 75% = 1
>75% - 100% = 7

no response = 5
(one "no response" had the following comment: "Banks provide 5 - 7 million to finance the pack. Company assets used as collateral.")

5. *Is ownership of your company -- (select one)*

a.	Public (stock traded on organized exchange)	= 1
b.	Private (stock closely held, not traded)	= 13
c.	Sole proprietorship	= 0
d.	Partnership	= 1
e.	Cooperative	= 0
f.	Wholly owned subisdiary of another company	= 3
g.	A division of another company without separate capitol stock	= 1

no response = 0

II. *Horizontal Integration*

1a. *Was your company owned by a domestic parent concern or concerns in 1976?*

yes = 5
no = 14
no response = 0

II. 2. *Did your company own significant (5% or greater) holdings of the stock of another domestic company with seafood or seafood related (i.e. involved in production and/or distribution of seafood products) lines of business in 1976?*

yes = 5
no = 14
no response = 0

III. *Vertical Integration*

1a. *Did your company, parent company, or subsidiary company own fishing vessels in 1976*

yes = 9
no = 9
no response = 1

1b. *If yes, please list the number owned by the primary area and species fished.*

(Each "yes" response listed separately)

(1)	3	vessels	in	Alaska	fishing	for	salmon
(2)	40	"	"	Alaska	"	"	salmon, king crab, tanner
	30	"	"	Wash.			
	6	"	"	rem U.S.	"	"	shrimp, scallops
(3)	10	"	"	Alaska	"	"	salmon
(4)	2	"	"	Alaska	"	"	crab
(5)	5	"	"	Alaska	"	"	crab
	15	"	"	Wash.	"	"	salmon
(6)	90-100	"	"	Alaska	"	"	salmon (reduced to 30-40 during '77)
(7)	3	"	"	Alaska	"	"	crab
(8)	5	"	"	Alaska	"	"	king crab, tanner, shrimp
(9)	2	"	"	Alaska	"	"	salmon

1c. *Is it your observation that, over the past ten years, the practice of processors owning fishing vessels has generally increased, decreased, or remained unchanged in importance in the Alaska seafood processing industry?*

increased = 1
decreased =13
unchanged = 1
no response = 4

Is there any particular Alaska fishery in which a trend in processor fishing-vessel ownership is especially evident?

yes = 6
no = 8
no response = 5

If yes, name the fishery and indicate whether the trend is toward increasing or decreasing ownership.

Of the 6 "yes" responses, 4 said that fishing vessel ownership was decreasing in the salmon fishery and 2 said that it was increasing in the crab fishery.

2a. Does your company, parent company, or subsidiary company advance money, gear, or supplies to independent fishing vessels?

yes = 16
no = 2
no response = 1

2b. If yes, is interest typically charged on such advances?

yes = 9
no = 6

The remaining "yes" response (to 2a) stated "'no' on open account" and "'yes' on note account."

2c. Is it your observation that, over the last ten years, the practice of advancing money, gear, or supplies has increased, decreased, or remained unchanged in frequency in the Alaska seafood processing industry?

increased = 3
decreased = 5
unchanged = 10
no response = 1

Please note any specific trends that you consider important.

(1) The detailed lending practices are becoming more business-like.
(2) Gov loans easy - good rates - fishermen make more money less need. Interest rate to corp. are high making great cost of loans to fishermen.
(3) Fishermen are now able to get loans from banks and do not need money from processing companies to as high degree. With limited entry, the value of fishing license has increased to the point where fishermen can use it as collateral to obtain loans. Also there are many fishing vessel and loan programs now which did not exist several years ago.
(4) Vessel owners have gained considerable leverage in obtaining processor assistance.

no response = 15

3a. Does your company, parent company, or subsidiary company have an ownership interest in brokerage, wholesale or retail seafood businesses?

yes = 4
no = 15
no response = 0

3b. If yes, please specify the type of operation or operations (brokerage, wholesale, retail) for each such company (not necessary to name company) in which there is an ownership interest.

Of the 4 "yes" responses, 2 noted a brokerage interest in one company and one noted a brokerage interest in 3 companies. One stated "DISC"

3c. Has the practice of seafood processors owning interest in brokerage, wholesale or retail seafood businesses increased, decreased, or remained unchanged in importance over the past ten years in the Pacific Northwest seafood industry?

increased = 4
decreased = 1
unchanged = 5
no response = 6

(Because of the wording of the question there were also 3 "yes" responses)

Please note any specific trends that you consider important.

(1) Large companies all have their own in-house brokerage or sales department.

2 "yes" responses had the following comments:

(2) The major companies within the industry have their own sales departments.

(3) Processors sell more to direct customers less field brokers.

IV. Transportation

1a. For each species indicated, please rank in descending order of importance (i.e., 1-most important, 2-most important, etc.) the typical methods of transportation of raw product from the fishing grounds to your Alaska plants.

(There are 3 frequency distributions for this question. One tallying methods ranked most important, the
2nd " " " 2nd most important, and the
3rd " " " 3rd most important.)

1st most important type of tendering	Salmon	Halibut	Herring	Crab	Shrimp
	Number of Companies				
Direct delivery by fishing vessels	6	7	4	9	7
Company owned tenders	4				
Company chartered tenders	7		3		
2nd most important type of tendering					
Direct delivery by fishing vessels	2				
Company owned tenders	1	1	2		
Company chartered tenders	3		1		
3rd most important type of tendering					
Direct delivery by fishing vessels	1		1		
Company owned tenders	2				
Company chartered tenders		1			

(Note: The above is based on 18 surveys since one ranked tendering by species instead of vice versa.)

IV. 1b. For each product form indicated, please rank in descending order of importance the typical methods of transporting your processed product form Alaska.

1st most important Transportation Method	Finfish Fresh	Finfish Frozen	Finfish Canned	Shellfish Fresh	Shellfish Frozen	Shellfish Canned
Commercial air	5	2		1		
Commercial barge		3	3		3	1
Processor owned vessel		1				
Buyer owned vessel						
Other: Sealand, Commercial con. vessel or freight.	1	6	4		6	4
2nd most important Transportation Method						
Commercial air		1			1	
Commercial barge		1				
Processor owned vessel					1	
Buyer owned vessel	1				2	
Other: Sealand, Commercial con. vessel or freight.						

3rd most important Transportation Method	Finfish Fresh	Finfish Frozen	Finfish Canned	Shellfish Fresh	Shellfish Frozen	Shellfish Canned
Commercial air		1				
Commercial barge						
Processor owned vessel	1				2	
Buyer owned vessel		1			1	
Other: Sealand, Commercial con. vessel or freight.						

4th most important Transportation Method	Finfish Fresh	Finfish Frozen	Finfish Canned	Shellfish Fresh	Shellfish Frozen	Shellfish Canned
Commercial air						
Commercial barge	1				1	
Processor Owned vessel		1			1	
Buyer owned vessel						
Other: Sealand, Commercial con. vessel or freight.						

Note: The above is based on 17 surveys because one ranked transportation by product instead of vice-versa and there was one "no response".

IV. 1c. Are there any significant trends in the methods or practices of transportation of fish or shellfish from Alaska harvesting areas to processing facilities?

(1) More using air transport.
(2) Catcher boats installing brine and making direct deliveries.
(3) Airlift -- we are no longer involved with this, however,
(4) Salmon tenders are becoming larger and faster and have better refrigeration systems. They are traveling greater distances.
(5) Since we are only concerned with crab, they have been and probably will continue to be delivered live by the catcher vessel direct to the processor.
(6) It appears that a larger quantity of fish is shipped fresh to Seattle by air for freezing than in the 1960's. We would like to freeze fish in Togiak, but we lack the long-term capital to install a freezer plant.
(7) More air from Bristol Bay.
(8) In salmon, more brine-colled vessels.
(9) More money being invested in brine refrigeration. There is a tremendous amount of processor's money being directed into this area.
(10) By individual boat.

5 companies answered "no" to the above question
4 companies gave no response

1d. Are there any significant trends in the methods or practices of transporting fish or shellfish products from Alaska plants to distribution centers?

(1) To containers.
(2) Increasing difficulties.
(3) Total volume growing rapidly. Modern van-ship service not expanding rapidly enough to keep pace.
(4) Due to the lack of commercial freighting capacity and the apparent slowness in responding to industry needs, processors are chartering, leasing, or purchasing freighting capacity with increasing difficulty.
(5) It appears that more salmon packers utilize more commercial carriers to move the pack to Seattle than in the past when many packers utilize their own vessels.
(6) Less frozen fish loose, most in fiber totes.
(7) No change
(8) Charter freighter and Sealand

5 companies answered "no" to the above question
6 companies gave no response

V. Domestic Sales: General Practices and Trends

1. Of your total 1976 fish-product dollar sales, what percent is sold through brokers, through wholesalers, or directly to retailers?

Percent	Brokers	Wholesalers	Retailers
0 - 25%	1	13**	15***
>25% - 50%	2	2	
>50% - 75%	1	3	
>75% - 100%	14*		
no response	1	1	1

*10 are 100%
**10 are 0%
***13 are 0%

2a. In general, what method of sale does your company typically use for canned and fresh/frozen seafood products? Please check most common method of sale for each process form; if more than one method of sale is typically used, please rank (1,2,3,... in descending order of importance)

1st most important Method of Sale	Process Form Canned	Fresh/Frozen
Normal terms	9	13
Consignment	1	1
Delayed Billing	1	1
Other (telex)cash before ship.		1

2nd most important Method of Sale	Canned	Fresh/Frozen
Normal terms	1	
Consignment	2	5
Delayed Billing		
Other (telex)cash before ship.		

3rd most important Method of Sale	Canned	Fresh/Frozen
Normal terms	1	1
Consignment		
Delayed Billing		1
Other (telex)cash before ship.		

2b. *Please indicate any significant trends over the past decade concerning methods of sale in the Pacific Northwest seafood industry.*

(1) All sales through sister company
(2) Unknown, but we believe that normal terms are still the prevalent method of sale.
(3) less letter of credit on export
(4) Consignment being used to a lesser extent.
(5) Retail 2%/10-N 30 Food Service 30 Net

no response = 14 (3 of which said "none")

V. 3a. *Does your processing business typically do custom processing for other seafood processing firms?*

yes = 6 (one of these "yes" responses later states
no = 13 -- in *V 3f.* -- that they are not involved
no response = 0 in custom processing)

3b. *If yes, does your company typically receive production advances from the firms for whom you custom process?*

yes = 0
no = 6
no response = 0

3c. *Do production advances to processors usually carry interest charges?*

yes = 0
no = 1
no response = 5

3d. *Please list the species-process-product forms (refer to question I. 1) in which your company typically does significant amounts of custom processing for other seafood processing firms.*

Of the 6 "yes" responses above, 4 said "canned salmon", 1 said "frozen salmon", and 1said "none".

3e. *Please list the most important factors which determine the amount of custom processing that your company is requested to perform for others.*

(1) capacity
(2) Salmon canners often can for one another as a means of avoiding having an undue number of active but under-utilized canneries in Alaska.
(3) price, quality, service, supplies (ice, fuel)
(4) joint aggrements in different areas where one or the other processor does or does not have a processing plant but does have effort.
(5) Seine boats not picked up by their own tenders.

no response =1

3f. *Are there any significant trends in the practice of custom-packing which you feel are important? Please respond by species and product form, if possible.*

(1) salmon canned
(2) No particular trends. The practice of co-packing in salmon will continue, as long as individual companies fishing efforts and canning capacities are mis-matched.
(3) Not involved in custom processing
(4) Receive more requests, salmon, black cod
(5) No

no response = 1

V. 4a. *Does your processing business typically receive sales advances from the domestic seafood-distribution firms to whom you sell products?*

yes = 0
no = 17
no response = 2

4b. *Do sales advances usually carry interest charges?*

yes = 1
no = 3
no response = 15

4c. *Please indicate any other frequently used sales incentives provided by buyers of your products.*

(1) promotional allowances
(2) Offer of advances from Japanese companies. However - usually this curtails profit margin so is not the best means of financing.
(3) advance of fish purchase price against sales
(4) Don't know of any. We have to employ incentives to get customers to buy our products. We use discounts, allowances, advertising and service. Good looking labels.
(5) Advertizing refunds

no response = 14 (4 of which said "none")

4d. *With what species-process-product forms are sales advances or other sales incentives most common?*

(1) canned salmon, bottomfish -- filleting & freezing - plain & breaded fillets, shrimp
(2) canned salmon

no response = 17 (2 of which said "none")

4e. *Please indicate any significant trends in sales incentives that are used by buyers of your products, or by seafood buyers generally, that you as a seafood processor have observed.*

(1) Trend is toward better packaging, protection of products and more portion control. Fresh and frozen is growing faster than canned.
(2) Longer terms 45 to 60 day accounts. difficult to collect.

no response = 17 (4 of which said "none")

5a. *Does your company make promotional allowances to buyers of your fish products?*

yes = 8
no = 10
no response = 1

V. 5b. If yes, what form(s) of promotional allowance does your company typically use? Please give your response by process form and if more than one form of promotional allowance is used, please rank.

1st most important Type of Promotional Allowance	Process Form Canned	Fresh/Frozen
Discount from list price	4	3
Coupons	2	1
Advertising assistance	5	1

2nd most important Type of Promotional Allowance	Canned	Fresh/Frozen
Discount from list price	2	
Coupons		1
Advertising assistance	2	

3rd most important Type of Promotional Allowance	Canned	Fresh/Frozen
Discount from list price		
Coupons	2	
Advertising assistance		1

VI. International Business Arrangements

1a. Is your company owned in whole or part by a foreign country (other than Japanese)?

yes = 0
no = 19
no response = 0

1b. If yes, name company(ies) give % control...

no "yes" responses

2a. Does your company own significant (5% or greater) holdings of the stock of any (Japanese or other) foreign company with seafood or seafood-related lines of business?

yes = 1
no = 18
no response = 0

2b. If yes, please indicate the nationality of the owned company, give percent owned in 1976, and give a brief description of the lines of business of that company.

(The following is a copy of the one "yes" response)

Company	Country	% Owned	Lines of Business
A	Canada	100%	salmon canned, frozen, smoked, fresh, roe; Herring same; Halibut frozen; Bottomfish frozen, fresh; clam frozen; shrimp frozen; tuna canned.
B	W. Germany	50%	marinated, canned, & smoked herring. other species of fish smoked. Fresh&frozen fish.
C	Japan	40%	smoked salmon

VI. 3a. *Does your company receive production or sales advances from any foreign company with whom you do business?*

yes = 5
no = 12
no response = 2

3b. *If yes, is interest typically charged?*

yes = 4
no = 1
no response = 0

3c. *And, if yes, indicate the percent of your company's total liabilities in 1976, that is owed to that company.*

(of the 5 "yes" responses, there was one "no response", 2 comments and 2 percentages for this question as follows:)

(1) Paid off 1976 season
(2) All production advances in aggregate comprised less than 10% of total liabilities.

4a. *Is your company participating in long term purchasing contracts with foreign buyers?*

yes = 3
no = 15
no response = 1

4b. *Do such contracts typically involve advances or other consideration?*

yes = 1
no = 1
no response = 1 (said "sometimes")

4c. *And, if advances are made as part of these contracts, is interest typically charged?*

yes = 1
no = 1
no response = 1

VI. 4d. *If your company is participating in long term purchasing aggrements which include advances, do the advances carry options for conversion to equity in your company?*

yes = 0
no = 3
no response = 0

5a. *Does your company typically make advances to foreign companies to whom you sell your seafood products?*

yes = 0
no = 15
no response = 4

5b. *If yes, is interest typically charged?*

no "yes's"

5c. *And, if yes, indicate % ...*

no "yes's"

VII. *Entry and Exit*

1a. *Do you anticipate entering into any other fisheries in the Pacific Northwest?*

yes = 11
no = 8
no response = 0

1b. *If yes, please list the target fishing area, code, and expected year of entry*

(11 "yes's" responded as follows:)

Target Fishery	Area	Number of Companies
Groundfish	Western Gulf of Ak.	6
"	Bering Sea	1
"	Eastern Gulf of Ak.	1
Salmon	Western Gulf of Ak.	2
Herring	Western Gulf of Ak.	2
"	Bering Sea	1
"	Wash. & AK.	1
Mollusks	Bering Sea	3
"	Northern Gulf of Ak.	1

VII. 1c. *Please list Pacific Northwest fisheries that have been entered or exited by your company since January 1, 1970.*

This tally is 4 lists based on 11 surveys (5 no responses)

Species	Number of Companies Entered	Number of Companies Exited
Salmon	3	1
Shrimp	6	
Halibut	2	
Herring	4	3
Crab	2	
King crab	2	
Tanner crab	3	
Scallops	1	
Bottomfish	2	1

Method of Entry or Exit	Number of Companies Entry	Number of Companies Exit
Purchase or sale of subsidiary	5	
Purchase or sale of existing plant or equipment	15	1
Add or discontinue product line	15	3
No response	1	1

VIII. *Product Promotion*

1a. *Does your company engage directly in product promotion or advertising?*

yes = 8
no = 11
no response = 0

1b. *Does your company participate in cooperative product promotion or advertising through assessments to an industry association product-promotion effort?*

yes = 13
no = 6
no response = 0

If yes, please list theassociations (including the Alaska King Crab Marketing and Quality Control Board) in which your firm holds memberships.

The following is a frequency by number of memberships:

Number of Memberships	Number of Companies
1	3
2	4
3	2
4	1
5	2
no response	1

VIII. 1c. If either or both 1a. or 1b. are answered "yes", what is the ratio of your company's

$$\frac{\textit{total product-promotion \$ expenditures on fish products, 1976}}{\textit{total fish-product \$ sales, 1976}}\ ?$$

Responses for the 15 surveys, that this question applies to, follow:

Percent	Number of Companies
.1 or less	3
.48	2
.5	2
1.7	1
2.	2
2.4	1
nominal	1
no response	3

APPENDIX IV

PERIOD 3 (1976) STRUCTURAL PARAMATERS

TABLE 4-1

GEOGRAPHIC DISTRIBUTION OF SEAFOOD PROCESSING PLANTS AND COMPANIES
PERIOD 3 (1976)

Area	Shore Plants	Floating Plants	Total Plants	Total Companies	Plants/ Companies
Ketchikan	10	2	12	12	
Petersburg/ Wrangell	5	1	6	6	
Sitka	2		2	2	
Juneau	4	1	5	4	
Yakutat	2	1	3	3	
Not given		3	3	3	
Total Southeast	23	8	31	29	1.07
Prince William Sound	13	5	18	18	
Cook Inlet	25	1	26	22	
Kodiak	23	3	26	18	
Chignik	3		3	3	
S. Peninsula	4	3	7	6	
Not given		1	1	1	
Total Central	68	13	81	59	1.37
Aleutians	6	9	15	13	
N. Peninsula	2	1	3	3	
Bristol Bay	15	3	18	17	
Not given					
Total Western	23	13	36	30	1.20
Kuskokwim	3	1	4	4	
Yukon	15	4	19	18	
Norton Sound	2		2	2	
Arctic					
Total AYK*	20	5	25	24	1.04

Source: Compiled from data provided by Alaska Department of Fish and Game.

*Arctic-Yukon-Kuskokwim.

TABLE 4-2

COMPANY FREQUENCY DISTRIBUTION BY NUMBER OF GENERAL AREAS AND SPECIFIC AREAS PERIOD 3 (1976)

Number of General Areas	Number of Companies
1	117
2	6
3	3
4	1

Number of Specific Areas	Number of Companies
1	110
2	10
3	2
4	3
5	1
6	1

Source: Compiled from data provided by Alaska Department of Fish and Game.

TABLE 4-3

DISTRIBUTION OF PRODUCTION OF ALASKA SEAFOOD PROCESSING PLANTS
BY PERCENT CATEGORY
PERIOD 3 (1976)

Percent of Largest Plants	Percent of Total Production	Number of Plants
05	31	8
10	51	17
15	63	25
20	74	34
25	81	42
30	87	51
35	91	59
40	93	68
44	95	76
50	97	85
55	98	94
60	99	102
66	99.5	111
70	99.8	119
75	99.9	128
80	99.9	136
85	99.98	145
89	99.99	153
95	100	162
100	100	171

Source: Compiled from data provided by Alaska Department of Fish and Game.

TABLE 4-4

DISTRIBUTION OF PRODUCTION OF ALASKA SEAFOOD PROCESSING COMPANIES
BY PERCENT CATEGORY
PERIOD 3 (1976)

Percent of Largest Plants	Percent of Total Production	Number of Companies
05	46	6
09	64	12
15	79	19
20	86	25
24	91	31
30	94	38
35	96	44
39	97	50
45	98	57
50	99	63
54	99	69
60	99.7	76
65	99.8	82
69	99.9	88
75	99.95	95
80	99.97	101
84	99.99	107
90	100	114
94	100	120
100	100	127

Source: Compiled from data provided by Alaska Department of Fish and Game.

TABLE 4-5

DIVERSIFICATION OF ALASKA SEAFOOD PROCESSING PLANTS AND COMPANIES AS MEASURES BY THE NUMBER OF PRODUCTS
PERIOD 3 (1976)

Number of Products	Plants	Companies
1	69	55
2	67	40
3	17	13
4	13	13
5	4	5
6	1	1
7	0	0
8	0	0
9	0	0
10	0	0
Average	1.942	2.024

Source: Compiled from data provided by Alaska Department of Fish and Game.

TABLE 4-6

DIVERSIFICATION OF ALASKA SEAFOOD PROCESSING PLANTS AND COMPANIES AS MEASURED BY THE NUMBER OF PROCESSES PERIOD 3 (1976)

Number of Processes	Plants	Companies
1	99	74
2	54	36
3	16	13
4	2	4
5	0	0
Average	1.538	1.583

Source: Compiled from data provided by Alaska Department of Fish and Game.

TABLE 4-7

DIVERSIFICATION OF ALASKA SEAFOOD PROCESSING PLANTS AND COMPANIES AS MEASURED BY THE NUMBER OF SPECIES HANDLED PERIOD 3 (1976)

Number of Species Handled[1]	Plants	Companies
1	122	88
2	23	14
3	18	15
4	7	8
5	1	2
Average	1.491	1.598

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Species are salmon, crab, shrimp, halibut, and herring.

TABLE 4-8

SIZE DISTRIBUTION OF PLANTS BY SPECIES CATEGORY
PERIOD 3 (1976)

Plants' Total Production	Salmon	Halibut	Herring	Crab	Shrimp
1 - 50,000	36	1	9	7	7
50,001 - 150,000	7	1	8	2	1
150,001 - 350,000	8	1	2	5	0
350,001 - 750,000	11	0	2	18	1
750,001 - 1,550,000	8	0	2	5	4
1,550,001 - 3,150,000	6	0	1	3	3
3,150,001 - 6,350,000	8	0	0	2	0
6,350,001 - 12,750,000	4	0	0	0	0
> 12,750,000	0	0	0	0	0

Primary Species Production	Salmon	Halibut	Herring	Crab	Shrimp
1 - 50,000	36	1	6	6	7
50,001 - 150,000	7	1	5	2	1
150,001 - 350,000	7	0	2	2	0
350,001 - 750,000	11	1	1	13	1
750,001 - 1,550,000	7	0	2	7	2
1,550,001 - 3,150,000	7	0	4	5	2
3,150,001 - 6,350,000	8	0	3	5	2
6,350,001 - 12,750,000	4	0	1	2	1
> 12,750,000	1	0	0	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

TABLE 4-9

SIZE DISTRIBUTION OF PLANTS BY PROCESS FORM
PERIOD 3 (1976)

Plants' Total Production	Fresh/Frozen	Canned	Cured	Reduction
1 - 50,000	30	7	13	0
50,001 - 150,000	11	1	1	0
150,001 - 350,000	10	0	1	0
350,001 - 750,000	24	3	0	0
750,001 - 1,550,000	12	10	0	0
1,550,001 - 3,150,000	9	8	0	1
3,150,001 - 6,350,000	7	8	0	0
6,350,001 - 12,750,000	0	6	0	0
> 12,750,000	0	0	0	0

Primary Species Production	Fresh/Frozen	Canned	Cured	Reduction
1 - 50,000	30	7	13	0
50,001 - 150,000	11	1	1	0
150,001 - 350,000	9	0	1	0
350,001 - 750,000	24	2	0	0
750,001 - 1,550,000	11	8	0	0
1,550,001 - 3,150,000	11	9	0	0
3,150,001 - 6,350,000	5	10	0	0
6,350,001 - 12,750,000	2	6	0	0
> 12,750,000	0	0	0	1

Source: Compiled from data provided by Alaska Department of Fish and Game.

TABLE 4-10

PLANT SIZE DISTRIBUTION
PERIOD 3 (1976)

Quantity Produced	Southeast	Central	Western	AYK[1]
1 - 50,000	7	29	6	14
50,001 - 150,000	4	7	1	4
150,001 - 350,000	1	5	2	3
350,001 - 750,000	4	9	10	4
750,001 - 1,550,000	4	7	7	0
1,550,001 - 3,150,000	5	8	5	0
3,150,001 - 6,350,000	5	10	3	0
6,350,001 - 12,750,000	1	5	2	0
> 12,750,000	0	1	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Arctic-Yukon-Kuskokwim.

TABLE 4-11

COMPANY SIZE DISTRIBUTION
PERIOD 3 (1976)

Quantity Produced	Southeast	Central	Western	AYK[1]
1 - 50,000	7	28	6	13
50,001 - 150,000	2	6	1	4
150,001 - 350,000	1	3	2	3
350,001 - 750,000	4	4	5	4
750,001 - 1,550,000	4	3	3	0
1,550,001 - 3,150,000	5	2	8	0
3,150,001 - 6,350,000	5	6	3	0
6,350,001 - 12,750,000	1	3	2	0
> 12,750,000	0	4	0	0

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Arctic-Yukon-Kuskokwim.

TABLE 4-12

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR SHRIMP PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES
PERIOD 3 (1976)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	22	25	15,658,100	.329	.592	.706	.117
Southeast	5	5	81,700	.944	.996	1.000	.830
Central	13	16	14,028,800	.367	.660	.788	.142
Western	4	4	1,547,600	.664	1.000	1.000	.291
Fresh/Frozen - Shell							
Statewide	12	12	840,000	.948	.988	.922	.778
Southeast	4	4	7,400	.758	1.000	1.000	.328
Central	7	7	831,500	.958	.998	1.000	.794
Western	*	*					
Fresh/Frozen - Meat							
Statewide	12	14	11,118,300	.394	.659	.759	.136
Southeast	*	*					
Central	7	9	9,497,400	.462	.771	1.000	.179
Western	4	4	1,546,600	.665	1.000	1.000	.291
Canned Meat							
Statewide	4	4	3,699,900	.709	1.000	1.000	.322
Southeast	...	...					
Central	4	4	3,699,900	.709	1.000	1.000	.322
Western	...	...					

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

*Fewer than three firms.

TABLE 4-13

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR TOTAL CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES
PERIOD 3 (1976)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	38	54	35,127,900	.278	.457	.642	.071
Southeast	7	7	812,500	.651	.925	1.000	.255
Central	22	31	17,657,000	.416	.515	.749	.114
Western	13	16	16,658,400	.431	.631	.870	.137
Fresh/Frozen - Shell							
Statewide	38	53	21,465,200	.321	.493	.687	.083
Southeast	7	7	278,000	.886	.982	1.000	.509
Central	22	31	11,756,500	.398	.570	.797	.133
Western	12	15	9,430,700	.518	.754	.938	.189
Fresh/Frozen - Meat							
Statewide	23	30	11,754,300	.322	.517	.750	.096
Southeast	4	4	534,500	.649	1.000	1.000	.304
Central	11	15	3,992,000	.634	.808	.981	.309
Western	10	11	7,227,700	.337	.612	.930	.125
Canned Meat							
Statewide	6	8	1,908,400	.589	.860	1.000	.226
Southeast	...	...					
Central	6	8	1,908,400	.589	.860	1.000	.226
Western	...	...					

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

TABLE 4-14

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR KING CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES
PERIOD 3 (1976)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	34	49	22,727,400	.277	.436	.646	.072
Southeast	5	5	101,400	.806	.994	1.000	.355
Central	20	28	8,747,200	.373	.509	.737	.103
Western	13	16	13,878,700	.394	.587	.849	.125
Fresh/Frozen - Shell							
Statewide	33	47	13,613,600	.312	.480	.679	.084
Southeast	4	4	51,600	.974	1.000	1.000	.726
Central	20	28	6,332,900	.351	.524	.806	.116
Western	12	15	7,229,100	.500	.741	.945	.189
Fresh/Frozen - Meat							
Statewide	20	26	8,444,800	.280	.503	.827	.097
Southeast	3	3	49,800	.963	1.000	1.000	.616
Central	9	12	1,745,400	.708	.849	1.000[2]	.299
Western	10	11	6,649,600	.324	.587	.924	.121
Canned Meat							
Statewide	4	5	669,000	.653	1.000	1.000	.300
Southeast	...	...					
Central	4	5	669,000	.653	1.000	1.000	.300
Western	...	...					

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

[2]At three significant digits, this ratio rounded to 1.

TABLE 4-15

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR TANNER CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES
PERIOD 3 (1976)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	28	40	12,109,900	.361	.506	.708	.095
Southeast	6	6	484,200	.678	.945	1.000	.306
Central	16	23	8,846,000	.460	.615	.828	.136
Western	9	11	2,779,700	.615	.853	.998	.228
Fresh/Frozen - Shell							
Statewide	26	37	7,641,800	.357	.549	.752	.109
Southeast	4	4	80,400	.940	1.000	1.000	.564
Central	16	22	5,359,900	.482	.654	.866	.171
Western	9	11	2,201,500	.593	.816	1.000[2]	.215
Fresh/Frozen - Meat							
Statewide	16	21	3,228,600	.500	.664	.881	.201
Southeast	4	4	403,900	.768	1.000	1.000	.396
Central	8	11	2,246,600	.695	.903	1.000	.356
Western	5	6	578,100	.701	.994	1.000	.302
Canned Meat							
Statewide	6	8	1,239,500	.669	.907	1.000	.267
Southeast	...	...					
Central	6	8	1,239,500	.669	.907	1.000	.267
Western	...	...					

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

[2]At three significant digits, this ratio rounded to 1.

TABLE 4-16

STATEWIDE AND REGIONAL MARKET CONCENTRATION FOR DUNGENESS CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES
PERIOD 3 (1976)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
Statewide	14	14	290,500	.721	.863	.973	.288
Southeast	6	6	226,800	.923	.989	1.000	.453
Central	8	8	63,700	.647	.909	1.000	.257
Western	...	...					
Fresh/Frozen - shell							
Statewide	14	14	209,700	.721	.856	.975	.295
Southeast	6	6	146,000	.947	.989	1.000	.767
Central	8	8	63,700	.647	.909	1.000	.257
Western	...	...					
Fresh/Frozen - meat							
Statewide	*	*					
Southeast	*	*					
Central	...	...					
Western	...	...					
Canned Meat							
Statewide	...	...					
Southeast	...	...					
Central	...	...					
Western	...	...					

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

*Fewer than three firms.

TABLE 4-17

PRINCE WILLIAM SOUND AND BRISTOL BAY MARKET CONCENTRATION FOR SHRIMP PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES
PERIOD 3 (1976)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
P. W. Sound	*	*					
Bristol Bay	...	...					
Fresh/Frozen - Shell							
P. W. Sound	*	*					
Bristol Bay	...	...					

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding.

*Fewer than three firms.

TABLE 4-18

PRINCE WILLIAM SOUND AND BRISTOL BAY MARKET CONCENTRATION FOR CRAB PRODUCTS BY PERIOD, UNADJUSTED FOR OWNERSHIP INTERTIES
PERIOD 3 (1976)

	Number of Firms	Number of Plants	Total[1] Production	Conc. Ratio of 2 Largest Firms	Conc. Ratio of 4 Largest Firms	Conc. Ratio of 8 Largest Firms	Herfindal Index
Total All Products							
P. W. Sound	3	3	996,800	.823	1.000	1.000	.385
Bristol Bay	...	...					
Fresh/Frozen - Shell							
P. W. Sound	3	3	487,400	.886	1.000	1.000	.503
Bristol Bay	...	...					
Fresh/Frozen - Meal							
P. W. Sound	*	*					
Bristol Bay	...	...					
Canned Meat							
P. W. Sound	*	*					
Bristol Bay	...	...					

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Individual items may not add to totals due to rounding

*Fewer than three firms.

TABLE 4-19

NUMBER AND MEAN SIZE OF PLANTS BY REGION AND SPECIES
BASED ON PRIMARY SPECIES AMOUNTS
PERIOD 3 (1976)

	Number of Plants by Primary Species					Mean Plant Size by Primary Species[1]				
	Salmon	Halibut	Herring	Crab	Shrimp	Salmon	Halibut	Herring	Crab	Shrimp
Area										
Southeast	17	1	5	4	4	1,243,870	336,061	1,093,242	92,385	19,717
Central	28	2	17	22	12	1,592,994	36,395	87,715	600.255	957,690
Western	18	0	2	16	0	1,760,548	...	52,773	1,041,151	...
AYK[2]	25	0	0	0	0	125,314	...	...	...	...

[1]Based on primary species amounts only

[2]Arctic-Yukon-Kuskokwim

ADDITIONAL STATISTICS FOR PLANTS BY REGION AND PRIMARY SPECIES[1]
PERIOD 3 (1976)

Area		Salmon	Halibut	Herring	Crab	Shrimp
Southeast	Std Dev	1,286,015	0	693,748	121,273	36,415
	Range	4,180,004	0	1,784,930	257,778	73,967
	Minimum	60	336,061	140,000	299	352
	Maximum	4,180,064	336,061	1,924,930	258,077	74,319
Central	Std Dev	2,746,332	50,897	115,798	783,491	952,234
	Range	9,799,839	71,979	461,808	3,499,656	2,813,747
	Minimum	780	450	7,752	5,940	151
	Maximum	9,800,619	72,384	469,560	3,505,596	2,813,898
Western	Std Dev	2,415,479	...	53,655	1,055,894	...
	Range	7,896,115	...	75,879	4,261,134	...
	Minimum	1,550	...	14,833	161,230	...
	Maximum	7,897,665	...	90,712	4,422,364	...
AYK[2]	Std Dev	172,486	...	...	...	...
	Range	569,819	...	...	...	...
	Minimum	300	...	...	...	...
	Maximum	570,119	...	...	...	...

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Based on primary species amounts only.

[2]Arctic-Yukon-Kuskokwim.

TABLE 4-20

NUMBER AND MEAN SIZE OF PLANTS BY REGION AND SPECIES
BASED ON TOTAL AMOUNTS
PERIOD 3 (1976)

	Number of Plants by Primary Species					Mean Plant Size by Primary Species[1]				
	Salmon	Halibut	Herring	Crab	Shrimp	Salmon	Halibut	Herring	Crab	Shrimp
Area										
Southeast	17	1	5	4	4	1,588,631	587,593	3,544,155	514,355	19,717
Central	28	2	17	22	12	1,867,947	50,066	701,557	1,992,499	2,041,589
Western	18	0	2	16	0	1,760,548	...	990,227	1,151,758	...
AYK[2]	25	0	0	0	0	125,314	...	...	...	...

[1]Based on total amounts produced

[2]Arctic-Yukon-Kuskokwim

ADDITIONAL STATISTICS FOR PLANTS BY REGION AND PRIMARY SPECIES[1]
PERIOD 3 (1976)

Area		Salmon	Halibut	Herring	Crab	Shrimp
Southeast	Std Dev	1,777,703	0	2,493,069	955,432	36,415
	Range	5,917,805	0	7,009,791	1,944,831	73,967
	Minimum	60	587,593	140,000	711	352
	Maximum	5,917,865	587,593	7,149,791	1,945,542	74,319
Central	Std Dev	3,429,165	70,231	1,133,121	2,899,669	2,657,846
	Range	13,170,186	99,321	3,913,727	12,375,405	8,304,912
	Minimum	780	405	7,752	5,940	151
	Maximum	13,170,966	99,726	3,921,479	12,381,345	8,305,063
Western	Std Dev	2,415,479	...	1,032,862	1,081,580	...
	Range	7,896,115	...	1,460,687	4,261,134	...
	Minimum	1,550	...	259,883	161,230	...
	Maximum	7,897,665	...	1,720,570	4,422,364	...
AYK[2]	Std Dev	172,486	...	...	...	...
	Range	569,819	...	...	...	...
	Minimum	300	...	...	...	...
	Maximum	570,119	...	...	...	...

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Based on total amounts produced.

[2]Arctic-Yukon-Kuskokwim.

TABLE 4-21

NUMBER AND MEAN SIZE OF PLANTS BY REGION AND PROCESS FORM BASED ON PRIMARY PROCESS AMOUNTS PERIOD 3 (1976)

	Number of Plants by Primary Process				Mean Size by Primary Process[1]			
Area	Fresh/Frozen	Canned	Cured	Reduction	Fresh/Frozen	Canned	Cured	Reduction
Southeast	24	6	1	0	1,021,955	1,799,085	60	...
Central	40	23	6	1	840,141	3,169,651	29,086	1,602,800
Western	22	12	2	0	891,350	2,555,183	1,700	...
AYK[2]	17	2	6	0	134,025	206,400	22,348	...

[1]Based on primary process amounts only.

[2]Arctic-Yukon-Kuskokwim.

ADDITIONAL STATISTICS FOR PLANTS BY REGION AND PRIMARY PROCESS[1]
PERIOD 3 (1976)

Area		Fresh/Frozen	Canned	Cured	Reduction
Southeast	Std Dev	1,298,909	1,436,771	0	...
	Range	4,643,319	3,719,912	0	...
	Minimum	352	102,768	60	...
	Maximum	4,643,671	3,822,680	60	...
Central	Std Dev	1,379,184	3,185,370	64,621	0
	Range	6,132,271	11,897,090	160,163	0
	Minimum	151	3,738	780	1,602,800
	Maximum	6,132,422	11,900,828	160,943	1,602,800
Western	Std Dev	1,011,066	2,440,700	989,949	...
	Range	4,403,848	7,702,344	1,400	...
	Minimum	18,516	3,528	1,000	...
	Maximum	4,422,364	7,705,872	2,400	...
AYK[2]	Std Dev	162,281	290,875	41,767	...
	Range	569,569	411,360	104,559	...
	Minimum	550	720	216	...
	Maximum	570,119	412,080	104,775	...

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Based on primary process amounts only.

[2]Arctic-Yukon-Kuskokwim.

TABLE 4-22

NUMBER AND MEAN SIZE OF PLANTS BY REGION AND PROCESS FORM BASED ON TOTAL AMOUNTS PERIOD (1976)

Area	Number of Plants by Primary Process: Fresh/Frozen	Canned	Cured	Reduction	Mean Size by Primary Process[1]: Fresh/Frozen	Canned	Cured	Reduction
Southeast	24	6	1	0	1,191,005	2,042,719	60	...
Central	40	23	6	1	900,862	3,446,373	38,101	12,819,791
Western	22	12	2	0	895,127	2,602,729	4,594	...
AYK[2]	17	2	6	0	141,706	213,693	25,397	...

[1]Based on total amounts produced.

[2]Arctic-Yukon-Kuskokwim.

ADDITIONAL STATISTICS FOR PLANTS BY REGION AND PRIMARY PROCESS[1]
PERIOD 3 (1976)

Area		Fresh/Frozen	Canned	Cured	Reduction
Southeast	Std Dev	1,673,749	1,731,138	0	...
	Range	6,810,969	4,379,819	0	...
	Minimum	352	102,768	60	...
	Maximum	6,811,321	4,482,587	60	...
Central	Std Dev	1,540,545	3,270,876	86,697	0
	Range	6,478,627	12,377,607	214,253	0
	Minimum	151	3,738	780	12,819,791
	Maximum	6,478,778	12,381,345	215,033	12,819,791
Western	Std Dev	1,015,728	2,437,323	4,306	...
	Range	4,403,848	7,702,344	6,089	...
	Minimum	18,516	3,528	1,550	...
	Maximum	4,422,364	7,704,872	7,639	...
AYK[2]	Std Dev	174,523	300,186	40,507	...
	Range	569,569	424,527	140,475	...
	Minimum	550	1,429	300	...
	Maximum	570,119	425,956	140,775	...

Source: Compiled from data provided by Alaska Department of Fish and Game.

[1]Based on total amounts produced.

[2]Arctic-Yukon-Kuskokwim.

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