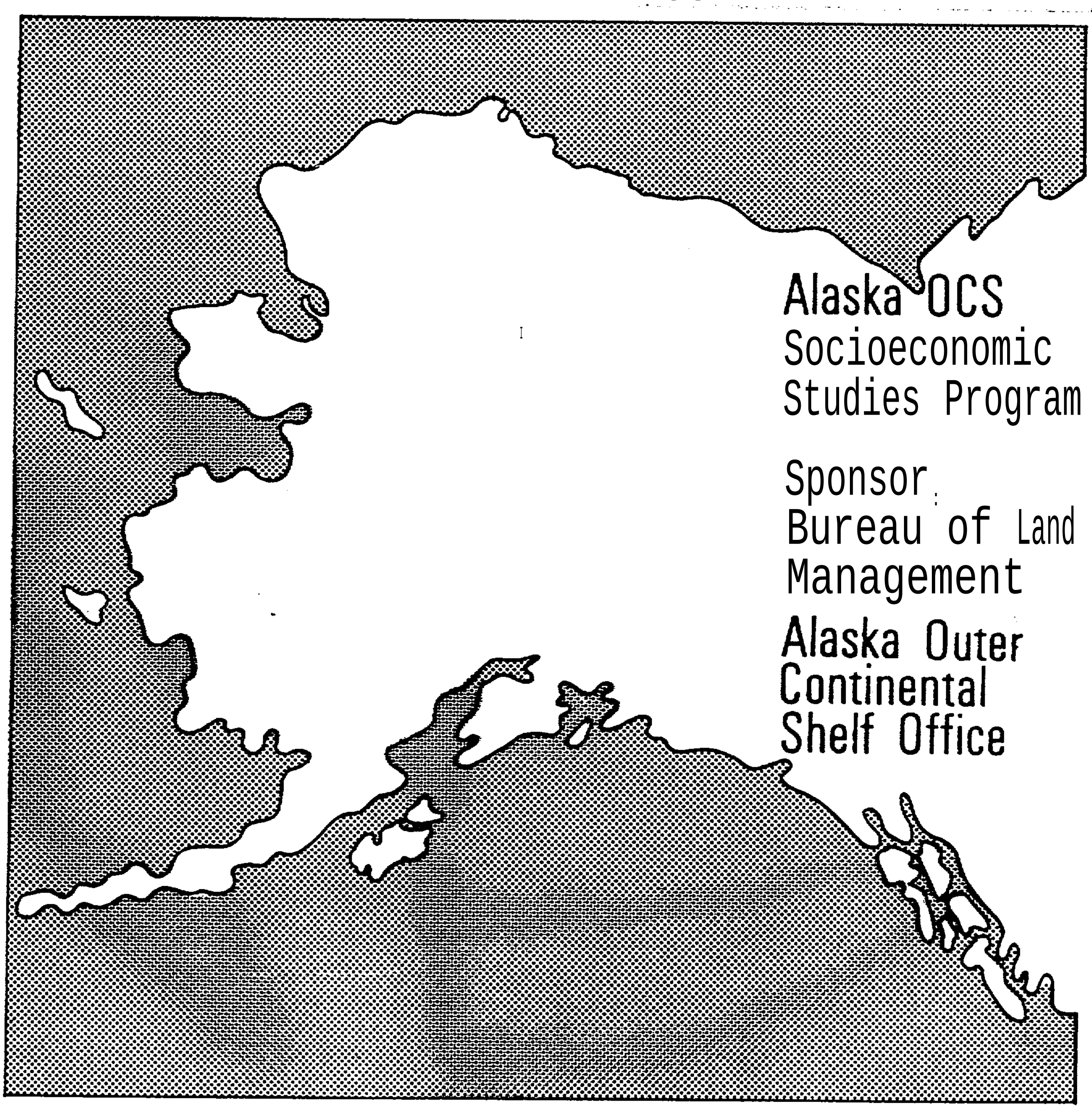
Technical Report Number 30

Appendixes A,B, & C



Alaska OCS Socioeconomic Studies Program

Sponsor: Bureau of Land Management

Alaska Outer Continental Shelf Office

Northern and Western Gulf of Alaska Petroleum Development Scenarios

Commercial Fishing Industry Analysis

The United States Department of the Interior was designated by the Outer Continental Shelf (OCS) Lands Act of 1953 to carry out the majority of the Act's provisions for administering the mineral leasing and development of offshore areas of the United States under federal jurisdiction. Within the Department, the Bureau of Land Management (BLM) has the responsibility to meet requirements of the National Environmental Policy Act of 1969 (NEPA) as well as other legislation and regulations dealing with the effects of offshore development. In Alaska, unique cultural differences and climatic conditions create a need for developing additional socioeconomic and environmental information to improve OCS decision making at all governmental levels. In fulfillment of its federal responsibilities and with an awareness of these additional information needs, the BLM has initiated several investigative programs, one of which is the Alaska OCS Socioeconomic Studies Program (SESP).

The Alaska OCS Socioeconomic Studies Program is a multi-year research effort which attempts to predict and evaluate the-effects of Alaska OCS Petroleum Development upon the physical, social, and economic environments within the state. The overall methodology is divided into three broad research components. The first component identifies an alternative set of assumptions regarding the location, the nature, and the timing of future petroleum events and related activities. In this component, the program takes into account the particular needs of the petroleum industry and projects the human, technological, economic, and environmental offshore and onshore development requirements of the regional petroleum industry.

The second component focuses on data gathering that identifies those" quantifiable and qualifiable facts by which OCS-induced changes can be assessed. The critical community and regional components are identified and evaluated. Current endogenous and exogenous sources of change and functional organization among different sectors of community and regional life are analyzed. Susceptible community relationships, values, activities, and processes also are included.

The third research component focuses on an evaluation of the changes that could occur due to the potential oil and gas development. Impact evaluation concentrates on an analysis of the impacts at the statewide, regional, and local level.

In general, program products are sequentially arranged in accordance with BLM's proposed OCS lease sale schedule, so that information is timely to decisionmaking. Reports are available through the National Technical Information Service, and the BLM has a limited number of copies available through the Alaska OCS Office. Inquiries for information should be directed to: Program Coordinator (COAR), Socioeconomic Studies Program, Alaska OCS Office, P. O. Box 1159, Anchorage, Alaska 99510.

TECHNICAL REPORT NO. 30

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ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM

NORTHERN AND WESTERN GULF OF ALASKA PETROLEUM DEVELOPMENT SCENARIOS:

COMMERCIAL FISHING INDUSTRY ANALYSIS

APPENDIXES A, B, AND C .

PREPARED FOR

BUREAU OF LAND MANAGEMENT
ALASKA OUTER CONTINENTAL SHELF OFFICE

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NOTICE

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM
NORTHERN AND WESTERN GULF OF ALASKA PETROLEUM DEVELOPMENT SCENARIOS: COMMERCIAL FISHING INDUSTRY ANALYSIS

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February 1980

APPENDIX A

FISHERY BIOLOGY

APPENDIX A

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FISHERY BIOLOGY

This appendix is an introduction to the biology of the commercial ' fisheries of the Gulf of Alaska, and as such it provides information that is useful both in projecting the development of these commercial fisheries and in appreciating the great uncertainty that is associated with any such projections. The topics addressed include causes of fluctuation in resource abundance and biological characteristics of each species. The latter include life histories, species specific causes of fluctuations in resource abundance, and factors affecting the harvesting season.

Causes of Fluctuation in Resource Abundance

The objective of this section is to describe the major causes of fluctuation* in the abundance of a resource that are common to many fisheries. The causes of fluctuation that are of particular importance in each fishery are discussed in a latter section which describes fishery biology by species. A glossary of biological terms is included at the end of this chapter.

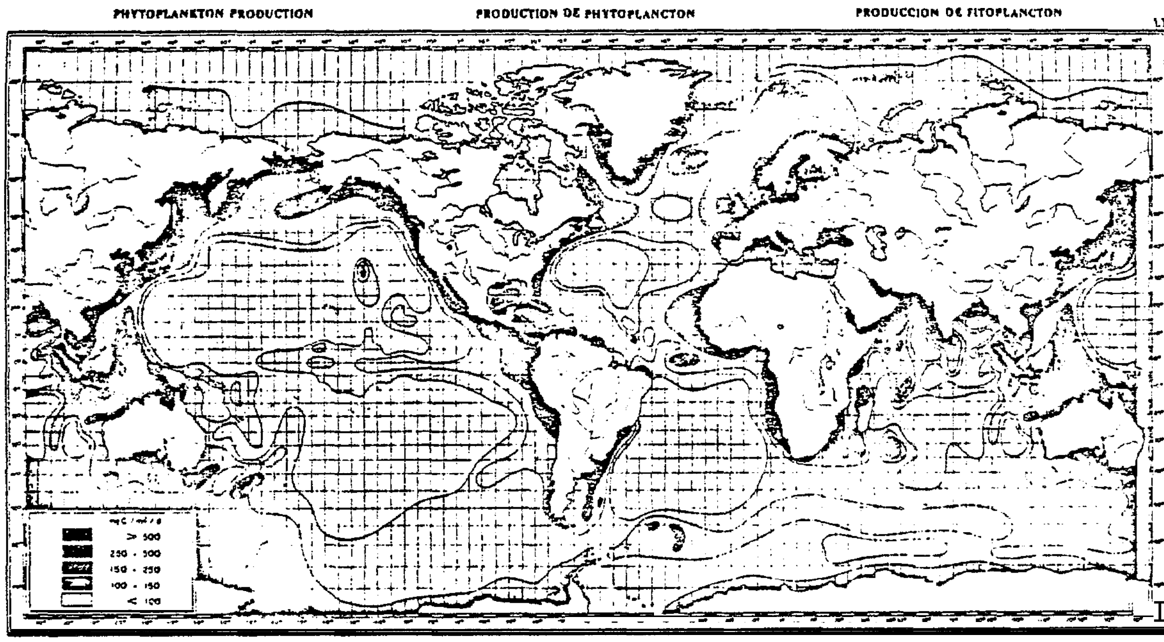
FLUCTUATIONS IN WORLD FISHERIES: AN INTRODUCTION

At present, the world catch of marine fisheries resources amounts to some 70 million metric tons (NT). The majority of this catch is comprised of herring-like and cod-like fishes (Cushing, 1975). The trend of world fisheries, despite recurrent fluctuations, is toward gradual expansion in terms of both harvesting effort and the development of new methods for the utilization of an ever-decreasing list of underutilized marine species. Gulland (1970) has published a conservative estimate of the world potential catch of fish and shellfish at the level of 120 to 140 MT, although this yield might be less due to intervening economic factors.

Apart from the problems associated with the maximal harvest of available resources, the world fisheries are beset by periodic fluctuations in the catch of conventional species. The history of most fisheries indicates that oscillations in catch are the result of any of a number of natural and artificial causes, a number of which will be discussed in the course of this section. The principal elements involved in the determination of catch include: the abundance of the organism, the 'availability of the organisms, and the amount of harvesting effort (Sette, 1961). While harvesting effort is large' y the product of economic conditions, the abundance and availability of mar ne resources is largely the product of environmental factors with stress associated with commercial exploitation acting most often in a secondary capacitv. Many fisheries failures are not the result of declines in absolute abundance but rather represent changes in geographic distributions. The ultimate cause of fisheries fluctuations in terms of abundance involves changes in reproductive potential, larval and adult survival, and recruitment (Uda, 1960). The relation of trends in fishing success to environmental factors in the water masses and to overlying climatic factors has been suggested and may be particularly applicable to the fisheries of the North Pacific Ocean (Ketchen, 1956). Ayushin (1965) states that many of this planet's processes exhibit a periodic nature, the length of each cycle being about 85 years, and that fluctuations in the abundance of various marine resources might be linked with changing physical environment factors. As a consequence, fluctuations in some pelagic fisheries, herring and salmon being notable, seem also to occur on a world-wide scale and may correspond to these same geophysical events (Uda, 1961).

FIGURE A.1

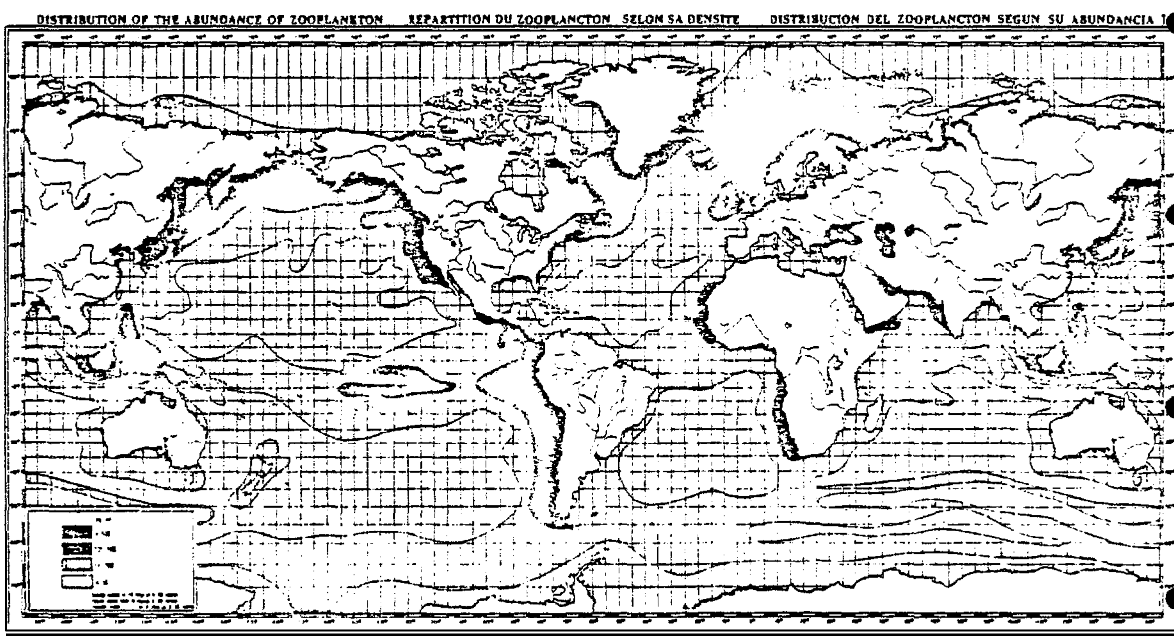
First trophic level: Phytoplankton production



Source: Gulland, 1971

FIGURE A . 2

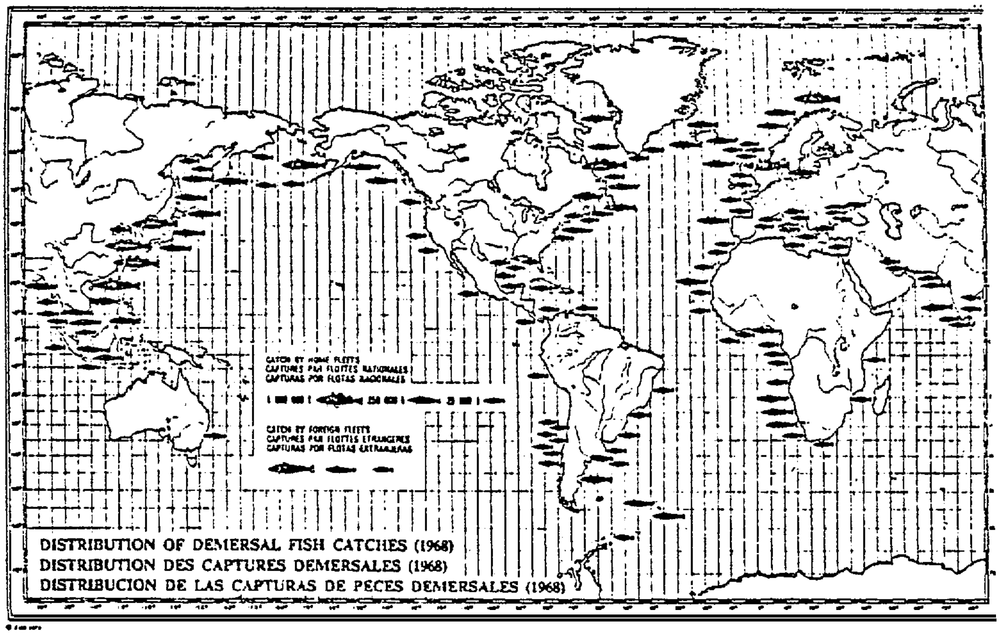
Second trophic level: Zooplankton production



Source: Gulland, 1971

FIGURE A.3

Trophic levels above zooplankton: World fish catches

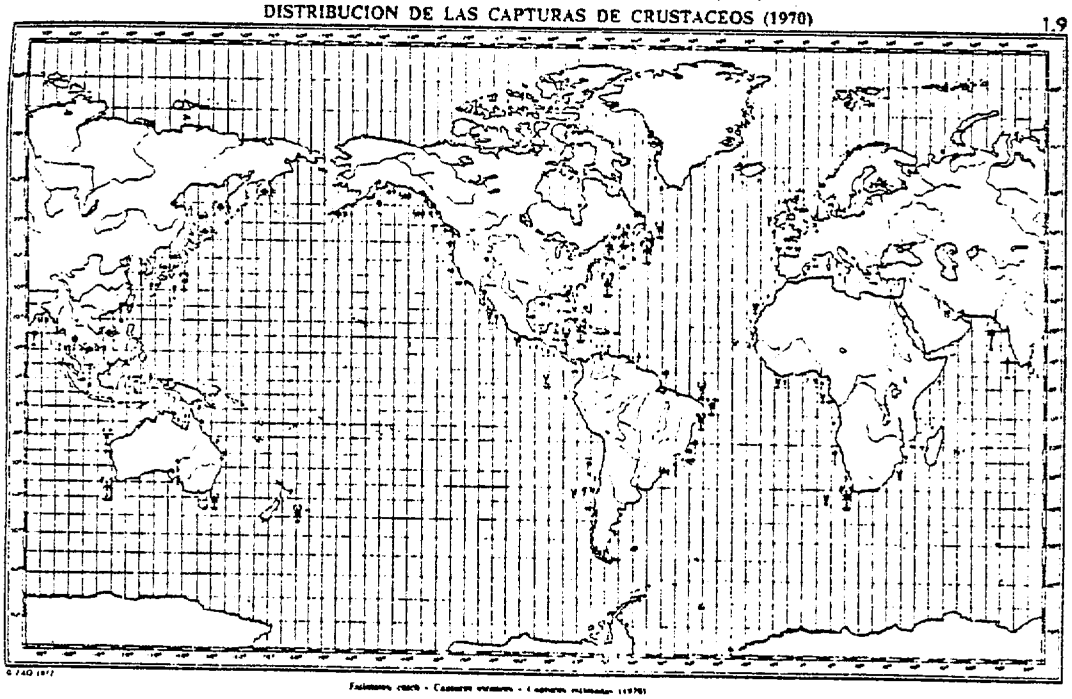


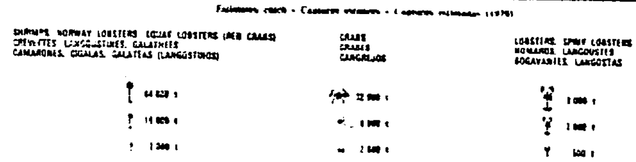
Source: Gulland, 1971

FIGURE A.4

Distribution of world crustacean catches

DISTRIBUTION OF CRUSTACEAN CATCHES (1970)
DISTRIBUTION DES CAPTURES DE CRUSTACES (1970)
DISTRIBUCION DE LAS CAPTURAS DE CRUSTACEOS (1970)



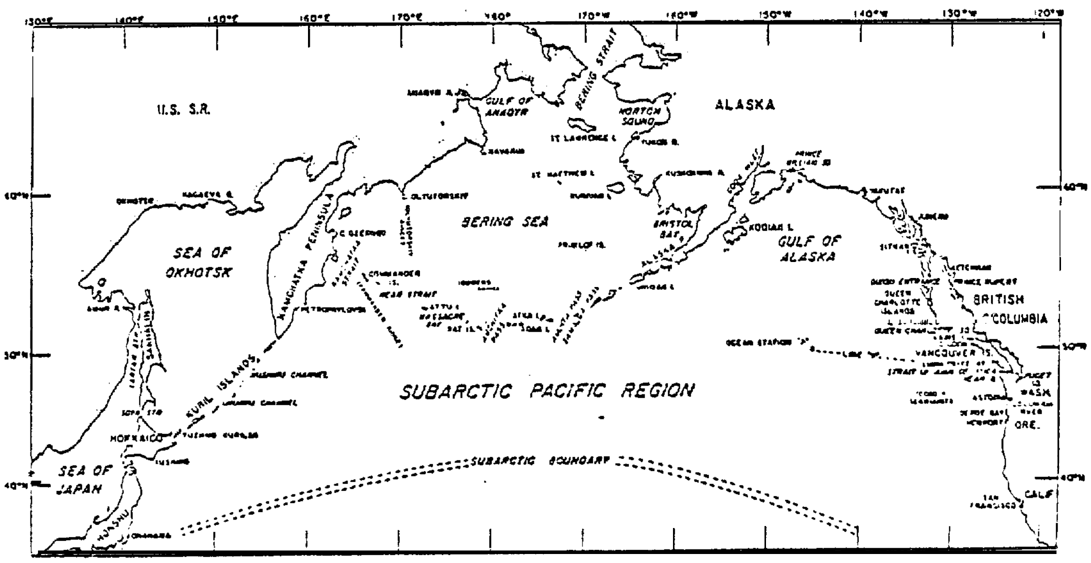


Source: FAO, 1972

FLUCTUATIONS IN MARINE RESOURCES: THE NORTH PACIFIC IN PERSPECTIVE

Long-term and short-term natural fluctuations both in total species biomass and in the availability of different species are normal phenomena on the fishing grounds of the Gulf of Alaska and the North Pacific in general. Under complex natural environmental conditions as well as artificial conditions including overfishing and habitat degradation via the addition of pollutants of human origin, fish populations undergo periodic oscillations in abundance accompanied by changes in distribution. The annual harvest of each species proceeds in parallel, moderately buffered fluctuations, fisheries often being depensatory in character, with intervals between major trends of slightly less than a century, or 20 to 30 years, or 50 to 60 years (Auyshin, 1965; Uda, 1961).

FIGURE A.5



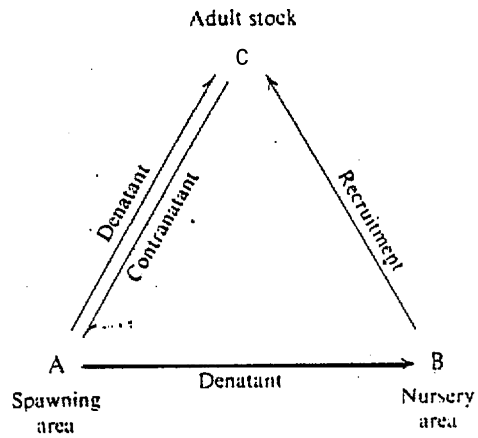
FRONTISPIECE. Subarctic Pacific Region (area including Sea of Okhotsk and Bering Sea is ● pprawtwdv 13 x 10⁶ Km²).

Source: Favorite, et al., 1976

The extended history of natural fluctuations in the Pacific can be seen in the historic abundance of the northern anchovy, _Engraulis mordax_, and the Pacific hake, _Merluccius productus_, as deduced from scale remnants in bottom sediment strata. According to Rounsefell (1975) the anchovy was most abundant 1,500 years ago with a progressive decline over the ensuing 1,200 years. The hake demonstrated wide fluctuations with periods of abundance every 300 to 350 years. Nagasaki (1973) has classified fluctuations in abundance as long, intermediate, and short term. Long term changes are caused by major environmental change as seen in the abandonment of traditional spawning grounds as in the case of the Hokkaido herring. Intermediate-term fluctuations in abundance are caused by events, environmental or otherwise, which lead to variations in the survival of larval organisms. Short-term fluctuations are apparent"ly random in their occurrence and, again, largely influence the survival of the organism in question during some particularly vulnerable period of its life history.

The abundance of coastal pelagic resources has been subject to rapid fluctuations which have largely frustrated resource managers in terms of finding stabilizing solutions. The list of major dislocations in the North Pacific during the past half-century include the collapse of the sardine, Sardinops mel anasticta, in Japan and Korea (1930s and 1940s); the decline of the California sardine, Sardinops caerulea (1930s); the collapse of the Hokkaido herring previously mentioned; and the recent sudden decline of the British Columbia herring (Kasahara, 1973).

A description of regional fluctuations, of which this is a brief review, must include mention of stabilizing elements in the life history of the various species. Current fisheries theory separates marine organisms in discrete or semi-discrete stocks, each of which is usually fixed within a given current system (Cushing, 1973), The stability of the stock is maintained by the adherence of the members of the stock to relatively fixed migratory pathways, the most critical segment of which is termed the larval drift and involves, basically, the movement of developing larvae from the spawning grounds to a relatively f· xed nursery area (Cushing, 1975).



The triangle of fish migration; maturing fish move against a current, contranatantly to the spawning ground. Spent fish drift, denatantly, from spawning ground to feeding ground; larvae drift denatantly to the nursery ground in the same current. Recruits migrate from the nursery ground to join the adult stock on the feeding ground. The terms *contranatant* and *denatant* describe the nature of migration and carry no connotation of orientation.

FIGURE A. 6 Source: Cushing, 1973; Jones, 1968

Each migratory circuit is considered to be characteristic of a particular stock and, with a limited degree of movement in accordance with slight environmental change, is geographically fixed to a particular section of the ocean for most species. The timing of the circuit is generally synchronized with the production cycle of the region through which the larval drift occurs. Because of the seasonal or discontinuous nature of the production cycle in temperate and subarctic waters, spawning must occur during a limited season in order that the specialized food needs of larvae can be satisfied. The stability of a particular stock is most significantly dependent upon the matching of larvae with appropriate food particles. As a consequence, the spawning of most northern fish occurs on relatively restricted grounds, while others, including salmon, spawn on genetically fixed grounds (Cushing, 1975),

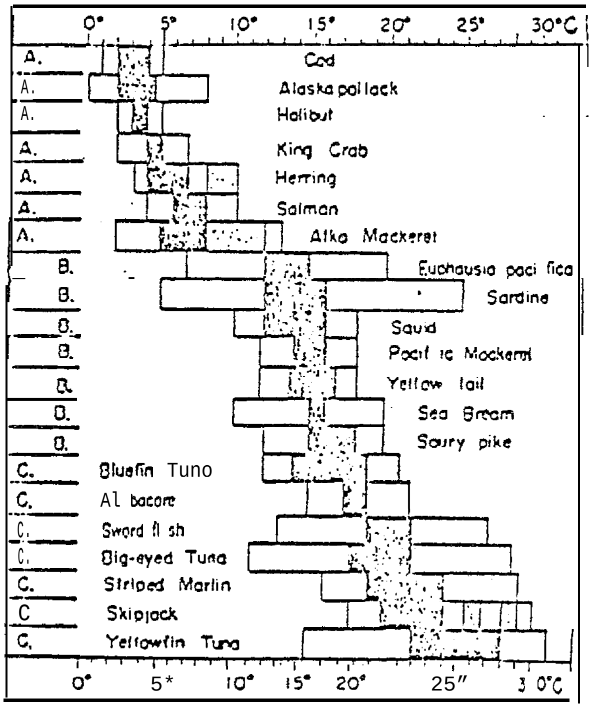
As a consequence of the above events, a stock of fish in temperate waters will be found in generally the same area from year to year. In order to maintain a relatively fixed areal distribution, at some point in the annual cycle of most fish, active compensatory migrations by gravid adults must be undertaken in order that larval drift can occur in a particular current system (Skud, 1977), Among the various Pacific species which undertake extensive compensatory migrations are: Pacific salmon, Oncorhynchus spp.; albacore, Thunnus alalunga; sablefish, Anoplopoma fibria; and numerous species of marine mammals (Royce, et al., 1968). Stability is preserved through the annual flow of organisms through a fixed migratory circuit operating in relatively unmodified biotic and abiotic environments. Perturbations directly involving the stock organisms during some part of the circuit or involving the supporting environment will result in the natural fluctuations which are the subject of this paper.

THE INFLUENCE OF PHYSICAL FACTORS IN THE ENVIRONMENT ON THE ABUNDANCE AND AVAILABILITY OF MATURE MARINE ORGANISMS

The biological processes operating within the physiological makeup of marine animals require a particular range of physical environment values for their continuance and proper functioning. This limited range of adaptability insures the presence of marine organisms in geographic areas where physical conditions, as well as biological conditions, are supportive with general movement toward optimal conditions. Thus, changes in the marine environment may cause alterations in the primary productivity of a localized area or larger region, the magnitude of areal change dependent upon the nature of the perturbation, alterations in the food chain at higher trophic levels, and the eventual displacement or concentration of various marine species (Parsons, et al., 1972). Nikolsky (1963) expanded on this list by stating that changes in the marine environment are most commonly of a local, non-periodic nature and influence the stability of stocks by altering spawning or overwintering conditions, among others.

Of the several physical parameters to the marine environment, possibly the most significant and the best known is that of temperature. Physiological processes operate optimally only within narrow temperature ranges, although some exceptions are known (Rounsefell, 1975). The optimum temperatures (dark areas) are indicated on the following figure for a number of North Pacific species:

Figure A.7



Optimum water temperature spectra of important fisheries in Japan (Uda 1957).

Source: Uda, 1961

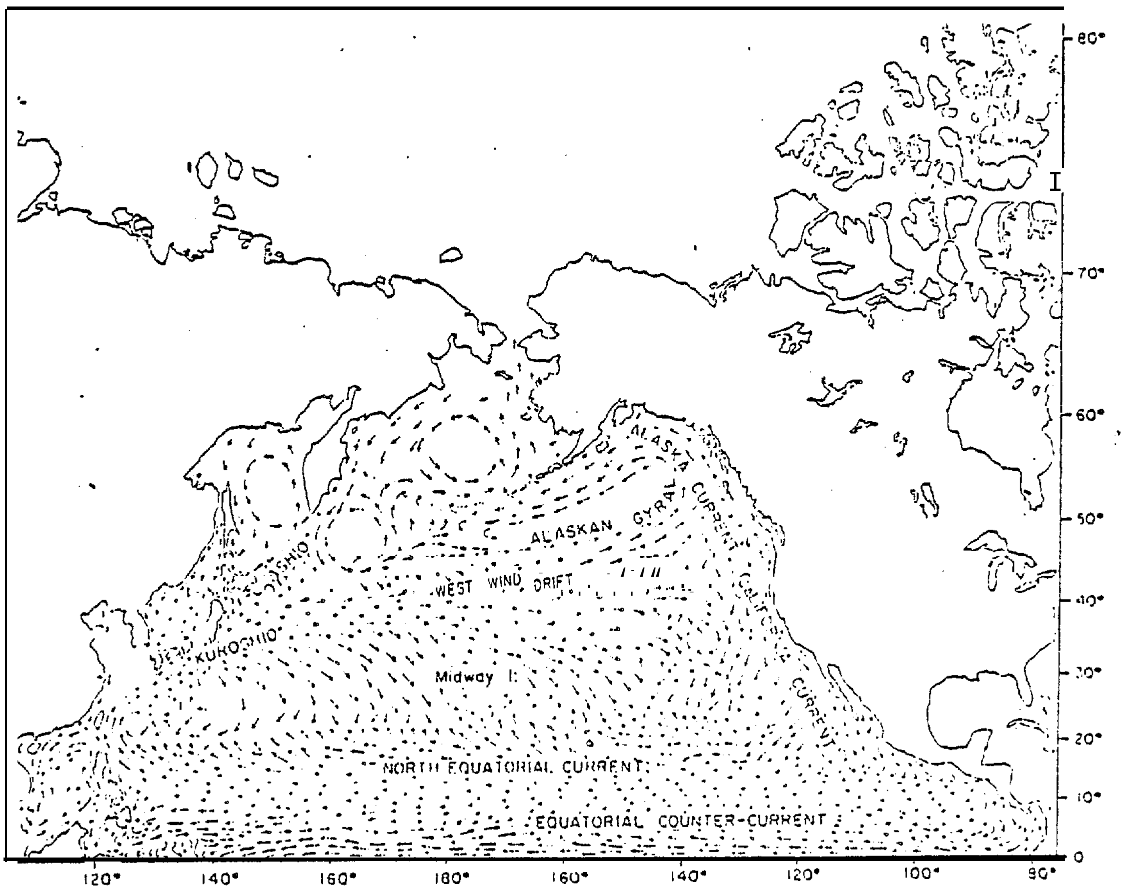
What is notable about this distribution is that the temperature range in white indicates the water temperature of regions in which 98 percent of the total catch for each species was harvested (Rounsefell, 1975). Poikilotherms generally remain in their optimal temperature range, seasonal cooling or warming of water masses being accommodated by shifts in geographic or bathymetric position. Several important benthic species of the Gulf of

Alaska demonstrate movements onto the shelf during spring and summer with shifts to the deeper waters of the continental shelf during periods of seasonal cooling. Numerous pelagic species make similar physiological accommodations by making long seasonal migrations, most commonly in a southward direction. The sablefish serves as an example of a representative example of the benthic group and the albacore tuna of the pelagic group.

Growth and longevity are also influenced by temperature. Fish of more southern waters tend to grow faster, mature earlier, and die younger than fish in northern waters which, as a consequence of greater longevity, tend to reach larger sizes than similar southern species. An example of differential growth following latitudinal gradients is given by the Pacific razor clam, *Siliqua patula*. At the southern extreme of the razor clams range, longevity extends to approximately 4.4 years whereas 19 years is the known longevity of some clams in the northern range of this species (Rounsefell, 1975). In this case, temperature has also caused the razor clam to reach a considerably larger size than those to the south.

Although it is generally agreed that temperature changes can modify the distribution of marine species, some contention remains concerning the impact of temperature anomalies on abundance. Fisheries data is often found to be inadequate in determining whether a species has undergone a change in abundance as a result of temperature changes or if the species changed its vertical or horizontal distribution and moved beyond the range of commercial fleets without any changes in abundance. Large fluctuations in the landing of squid and other species are experienced in Japanese waters due to hydrographic changes, most notably temperature changes brought about by the movement and position of the Kurashio current (Nagasaki, 1973). The existence of other major current systems in the subarctic region of the northeastern Pacific and Gulf of Alaska would seem to suggest that similar fluctuations could be expected elsewhere in this ocean basin. The quantitative impact of temperature anomalies will be dealt with in a later portion of this paper (See Herring).

FIGURE A.3



The surface water currents in the North Pacific Ocean after Defant (1961) and Neave (1964). (Outline based on Admiralty Chart.)

Source: Jones, 1968

Changes in the inflow of current systems, whether regional or local, will lead to changes in the temperature regime of associated water masses, this last alteration affecting the distribution of adult fish (Nikolsky, 1963). Although changes in the distribution and abundance of Pacific halibut, *Hippoglossus stenolepis*, due to warming trends is contested (Ketchen, 1956; Bell and Pruter, 1958), the movement of Atlantic cod, *Gadus morhua*, into far northern waters of the Atlantic Ocean is thought to be the result of warming trends (Rounsefell, 1975). The warming of the North Pacific appears to be responsible for the low abundance of the Pacific herring south of the latitude of Cape Flattery, Washington (Rounsefell, 1975), while this same warming trend in Arctic and sub-arctic regions may have had a causal relationship with the decline of Asiatic and Alaskan salmon (Uda, 1961).

A number of other parameters to the physical environment occupied by marine species are known to have significant impact on the distribution and abundance of these same species. Among these additional factors are the overblooming of planktonic organisms leading to mass vertebrate and invertebrate mortalities due to the ingestion of toxic materials and salinity changes which are significant in the seasonal movements of many organisms. Water strata with considerable salinity gradients may serve as partial barriers to migrations. Such haloclines thus may alter the abundance of various organisms and may cause local fluctuations in the relative abundance of commercially important organisms (Aron, 1960). Salinity changes are also important to the distribution, abundance, and survival of estuarine and littoral organisms, notably oysters and clams, both of which have specific and varying salinity needs depending on life history stage (Rounsefell, 1975).

As a summary to this section dealing with the influence of physical factors on fluctuations in the distribution and abundance of marine species, reference will be made to Uda's (1961) "principles of distribution." A partial listing of these principles will be included because of their practical nature and their importance in predicting the location of fish concentrations and their use as partial explanations of natural fluctuations in abundance and availability.

(A) Marine organisms are distributed in association with water masses to which they are physiologically adapted.

Rounsefell (1975) reports that one possible outcome to a northward extension of isotherms would be the northward expansion of both the northern and southern range limits, with no gain in area.

(B) The concentration of fish is determined by the narrowness of water zone with optimal qualities, such as temperature and salinity. Oceanic fronts or boundaries between different water masses are particularly favorable fishing locations.

The waters of the northwestern Pacific and the Bering Sea are the locations of one of the world's most intensive fisheries. As compared to the surface waters of the northeastern Pacific, the Asiatic waters are characterized by much greater seasonal temperature changes, leading to the formation of sharp temperature gradients or boundaries resulting in marked seasonal movements and concentration of pelagic species (Kasahara, 1973). Similar gradients do not occur in the northeastern Pacific.

(C) The intrusion of warm and cold water into populated water masses bring about the concentration of fish and produce good fishing areas.

(D) The fertilization of water zones by natural or artificial means brings about increased production and may become potential areas for fishing (also known as Brandt's Theory).

(E) Schooling of fishes responds to a number of conditions including temperature. Stable conditions over protracted periods is an indication of poor fishing potential while marked spatial gradients involving any of a number of conditions may lead to concentrated schooling and the production of good fishing areas.

(F) Schools of fish during feeding migrations generally seek out areas where appropriate food particles (organisms) are abundant and can be expected to arrive when food is abundant.

(G) Spawning migrations tend to follow instinctively determined routes following appropriate environmental patterns.

(H) Each fish species demonstrates unique phototactic behavior and respond to specific luminosity ranges when fish lamps are employed to attract fish concentrations. Bright moonlight tends to disperse fish, fish lamps being less effective at these times.

(I) Spawning migrations are marked by the concentration of fish in ' favorable water masses. Such fish become more concentrated as they approach the spawning grounds. Delay during migrations generally result in decreased reproductive potential and may result in fluctuations in future catch.

(J) Bottom characteristics may affect the migrations of fish.

(K) Fish which migrate in mid-water layers tend to be concentrated both vertically and horizontally by unfavorable water strata.

(L) Fish tend to make upward migrations when they are actively feeding. For many fish, the period of most active feeding extends from sunset to sunrise. The turn of the tide is another indication of good fishing.

(M) The approach of atmospheric disturbances leads to the concentration of fish in coastal surface layers. Similar disturbances over oceanic waters tends to disperse fish and decrease catches.

(N) The productiveness of a particular fishing area will vary for each species present, with each species reacting in a unique manner to the set of influences.

(O) Long-term fluctuations in commercial fisheries are the result of cyclic environmental changes. The magnitude of the fluctuation is dependent upon the degree of departure of conditions from the optimum conditions for each species.

THE IMPACT OF COMMERCIAL FISHERIES ON FLUCTUATIONS IN THE ABUNDANCE OF MARINE RESOURCES

Traditionally, fisheries biologists have tended to underestimate the influence of fishing and overestimate the influence of natural environmental change on the stocks of marine organisms. This situation has largely been caused by the supposed insignificance of a given fisheries operation in the face of large natural fluctuations. For example, some marine stocks have been known to disappear completely only to reappear after an interval of years, all events seemingly independent of fishing effort. What is known is that various stocks of fish, particularly pelagic stocks, do undergo long-term fluctuations in abundance and that profound changes in an ecosystem including many species must be the anticipated outcome (Cushing, 1975). The matter can be summarized in the following quotation (Bell, et al., 1958): "The relative effects of fishing and natural factors on the abundance of marine species. . and upon yields therefrom have been the object of a great amount of study throughout the world. There is agreement that man's impact upon the stocks has introduced an additional element into the already complex and fluctuating conditions under which a species may exist. But differences of opinion as to. ..the effects of the removals by man as opposed to changes . ..brought about by environmental factors appear to arise from the incompleteness of our knowledge. ..”

The recent history of world fisheries shows the extinction of several large industries exploiting once abundant pelagic and demersal marine stocks including the Japanese sardine, the California sardine, the Hokkaido herring, all previously mentioned, and the Norwegian herring (Cushing, 1975), not to mention the potential demise of important stocks in the northeastern Pacific including the Pacific Ocean perch, Sebastes alutus, and the weathervane scallop, Partinapecten cauvius. While Nagasaki (1973) contends that the impact of fishing on many stocks is small or even insignificant, Kasahara (1973) concedes that while the initial sharp decline in abundance might result from natural environmental causes, continued fishing pressure would prevent the stocks from recovering. Cushing (1973) apparently agrees with this latter process in stating that several great pelagic fisheries have disappeared following protracted periods of chronic recruitment failure. Continued exploitation in the form of “recruitment overfishing” caused the final decline of these stocks. In the cases of commercial species exploited along the fringes of their natural range, highly variable recruitment tends to be the role due to environmental constraints or abundance. Several species from the Gulf of Alaska are in this category of organisms subject to wide fluctuations in recruitment, the need for highly organized management being the obvious implication.

The population dynamics of marine species present an array of problems. What is generally held, however, is that when the growth rate of a stock is high, reproductive maturity will set in early through a feedback process causing reproductive potential to remain in a position to compensate for total natural and fishing mortality, and, assuming food resources remain stable, the catch per unit effort and total catch will remain at a relatively constant level over a number of seasons. However, when natural or artificial conditions intervene such that the reproductive potential of the stock falls below the level of total mortality, then the fishery will decline and management efforts must be directed to the improving of reproductive capacity (Nikolsky, 1963). It has been demonstrated experimentally that total mortality above the maximum level for which the species can compensate, the natural environment remaining unperturbed, will lead to instability and wide fluctuations in abundance. It is suspected that in the case of the Peruvian anchovy the combination of fishery mortality and natural mortality exceeded this compensation level or maximum sustainable yield (including yield to marine predators) and resulted in the inevitable outcome of the collapse of the fishery (Murphy, 1977).

Apart from population dynamics, the evolution of a commercial fishery presents unique problems for the manager. Most historic fisheries have developed around a single species which tended to have a predominant value and provided the necessary incentive for development. Such a fishery would tend to become successional in character since, when the original species has been fished down and depleted, the industry would then move on to an unexploited resource. The problem with such a fishery is that it is largely density-independent in its influence on a stock: that is, it attempts to take a relatively constant number of organisms regardless of the actual abundance of the stock. Managers are often politically obliged to maintain a minimal harvest even when a stock is depleted. The danger exists that, in the course of the continuing natural fluctuation of the stock, fishing might exert a far greater mortality than anticipated leading to the reduction of reproductive capacity far below levels from which rapid recovery can be anticipated. Single resource-based fisheries tend to be unstable because of this problem. Both the fishery and the resource base are vulnerable to the effects of excessive fishing (Garrod, 1973).

Fluctuation in the yield of coastal pelagic fish stocks and other resources is a direct cause of instability in the corresponding fisheries. Because of changing biotic and abiotic factors in the environment, it is often impossible to predict the catch of an important species, leaving the local industry unprepared for a number of possible outcomes (Nagasaki, 1973). The actual causes of rapid fluctuations of most species remain largely unknown. It has been noted, however, that the combined catches of a number of species in Japanese coastal waters have remained approximately constant for a protracted period. Diversity provides an element of stability. Thus, according to Kasahara (1973), a practical way of managing a fishery is to allow for sufficient versatility such that the industry can take advantage of the most abundant of a number of species. The risk of damage to a particular resource which may be at low level of abundance is less likely when the fishery is integrated over a number of resources. Diversification enables the load of exploitation to be spread over a number of species, reproduction potentials of each remaining at high levels (Garrod, 1973).

The foregone conclusion developed to this point is that fishing mortality coupled with environmental mortality and stress can and will act to suppress the abundance of a species to extremely low levels. A considerable history of such events has occurred in several major world fisheries particularly when heavy exploitation was brought to bear against species noted for considerable natural fluctuations. Diversification of fishing effort in the northeastern Pacific and associated waters, particularly the Gulf of Alaska, might take several forms. One means of diversification would be to seek out underexploited traditional species and the other would involve the exploitation of non-traditional species which hitherto have received very little attention.

In the Gulf of Alaska and Bering Sea most stocks of commercially important demersal and pelagic species, including salmon, halibut, king crab, Pacific Ocean perch, and sablefish, are either at or above the level of maximum sustainable yield. The catches of these species could not be expected to increase substantially as fishing is further intensified (Kasahara, 1973). On the other hand there still exist stocks of traditional species in the North Pacific which are either little exploited or entirely unexploited, most of which are found in the eastern half of he region. A partial listing of these species include the anchovy (Engraulis mordax), herring in some areas, squids, capelin (Mallotus villosus), saury (Cololabis saiva), sandeels (Ammodytes spp.), the pomfret (Brama vaii), sea urchins, and some pandalid shrimps. Substantial increases in the harvest of pollock (Theragra chalcogramma) in the Gulf of Alaska can also be anticipated. The increase in total yield brought about by fisheries involving the above species has been estimated to be several million metric tons per year (Kasahara, 1973).

As the demand for fishery products increases in world markets, it is to be expected that all traditional species might eventually be fully utilized. A further potential line of development might be the use of deep-water

D. Natural fluctuations in terms of changes in fecundity (general).

Cushing, 1973

Cushing and Harris, 1973

Nikolsky, 1963

E. Natural fluctuations in terms of changes in fecundity (with particular attention to predator and environmental influences).

Bagenal, 1966

Craig, 1977

Healey, 1975

Hunter, 1975

Lawler, 1965

Nikolsky, 1963

Nikolsky, et al., 1973

Shulman, 1972

F. Natural fluctuations in terms of the oceanic production cycle (general).

Aron, 1962

Cushing, 1973

Cushing, 1975

Favorite, 1976

Parsons, et al., 1972

Ryther, 1969

G. Natural fluctuations in terms of hatching success (with particular attention to environmental influences).

Lawler, 1965

Nikolsky, 1963

Ponomarenko, 1973

Rounsefell, 1975

Schopka and Hempel, 1973

H. Natural fluctuations in terms of hatching success (with particular attention to the influences of predators).

Nikolsky, 1963

I. Natural fluctuations in terms of larval mortality (general).

Bagenal, 1973

Cushing, 1973

Cushing, 1975

Hunter, 1975

May, 1974

Nikolsky, 1963

Rounsefell, 1975

Sette, 1961

J. Natural fluctuations in terms of larval mortality (with particular attention to the influences of predators).

Cushing, 1973

Cushing and Harris, 1973

Hunter, 1975

Nikolsky, 1963

Northcote, 1966

Rounsefell, 1975

K. Natural fluctuations in terms of recruitment processes (general).

Cushing, 1973

Cushing, 1975

Hunter, 1975

Johnson, 1972

Johnson, 1976

Nikolsky, 1963

Sette, 1961

Uda, 1961

L. Natural fluctuations in terms of recruitment processes (with particular attention to environmental influences).

Cushing, 1973

Healey, 1975

Johnson, 1976

Peterman, 1977

Sette, 1961

Biological Characteristics by Species

SALMON

Life History, King Salmon

Taxonomy

King salmon (*Oncorhynchus tshawytscha*) are members of the family Salmonidae and are the largest of the five Pacific salmon. Local names vary by location. In Washington and Oregon, king salmon are called "chinook", while in British Columbia they are surnamed "spring salmon". Other local names are "quinnat", "tyee", "tule", and "blackmouth".

Distribution

King salmon range in western North America from Ventura River in southern California to Point Hope, Alaska, adjacent to the Chukchi Sea. In Asia they range from Hokkaido, Japan, north to the Anadyr River in Siberia.

Physical Description

A mature king salmon averages 102 cm (40 inches) in length and 18 kg (40 pounds) in weight; however, a 57.2 kg (126 pounds) salmon was taken near Petersburg, Alaska, in 1949.

Adult king salmon are distinguished by the black, irregular spotting on the back, dorsal fins and on both sides of the caudal fin. 'They are also character zed by a black pigment along the gum line. In the ocean the king salmon is a robust, deep-bodied fish. It has a blue-green coloration on its back, fail ng to a silvery color on the sides with white on the belly.

Depending upon location and degree of maturation, spawning colors vary from red to copper to almost black. Males are more deeply colored than females. Males are also distinguished by their "ridgeback" condition and their hooked upper jaw.

In fresh water, juvenile king salmon are recognized by well-developed parr marks which are bisected by the lateral line.

Life History

Like all species of Pacific salmon, king salmon are anadromous. They hatch in fresh water, spend part of their life in the ocean, then return to fresh water to spawn.

King salmon may become sexually mature between their second and seventh years. As a result, fish in any spawning run may vary greatly in size. For example, a mature three-year-old generally weighs less than 23 kg (50 pounds), while a mature seven-year-old may exceed 23 kg (50 pounds). Females are usually older than males at maturity. With the exception of six and seven-year age groups, male spawners generally outnumber female spawners. Small king salmon that mature after spending only one winter in the ocean are commonly referred to as "jacks". These are usually males.

In Alaska, mature king salmon start to ascend larger rivers from May through July and often make lengthy fresh-water migrations to reach their home streams. Spawners destined for the Yukon River headwaiters in Canada are known to travel more than 3220 km (2,000 miles) in a 60-day period.

King salmon do not feed during the freshwater migration, causing their physical condition to gradually deteriorate. During this period they utilize stored body material for energy and for the development of reproductive products.

King salmon may spawn immediately above the tidal limit, but most travel upstream. Spawning generally occurs in the main channels of larger streams. Optimum substrate composition is 55 to 95 percent medium and fine gravel (no more than 15 cm in diameter) with less than eight percent silt and sand. Optimum stream discharge is 14.2 to 56.6 liters/see (0.5 to 2.0 ft^3/see).

The spawning act is essentially the same for all five species of Pacific salmon. The female selects a spawning site, usually a riffle area, and digs the nest or redd by turning on her side and beating with her tail. Redd size varies from 1.2 to 9 meters in diameter. Usually a dominant and several accessory males are in attendance. When the redd is completed and the female is ready to spawn, she swims across the redd and lowers her anal fin into it. The dominant male comes alongside the female and quivers. The eggs from the female and sperm (milt) from the male are released simultaneously. After egg deposition, the female digs upstream from the redd and covers the eggs with grave" . A female may dig several redds and spawn with more than one male.' Males may a' so spawn with several females. Females may contain from 3,000 to 14,000 eggs. The eggs are comparatively large (six to seven mm in diameter) and are orang sh-red in color. Shortly after spawning activity ceases, the adult king salmon die.

Dependent upon water temperatures, the eggs hatch in about seven to nine weeks. The newly-hatched fish, called alevins, remain in the gravel for two to three weeks while they gradually absorb the food in the attached yolk sac. Fry emerge from the gravel by early spring. Following emergence they school, but soon become territorial. Juvenile king salmon predominately migrate to the ocean after hatching, but may reman n in freshwater one or two years before migrating.

During the freshwater stage they eed largely on plankton, aquatic insect larvae and terrestrial organisms. In the ocean king salmon consume a wide variety of organisms, including: herring, pilchard, sandlance, rockfish, eulachon, amphipods, copepods, euphausiids, and larvae of crabs and barnacles. King salmon grow rapidly in the ocean, often doubling their body weight during a summer season. King salmon feed in marine waters for a period of one to six years before returning to spawn in freshwater.

The preceding ascription of the life history of king salmon was provided by: McClean, R. F. et al, 1977.

Clemens, W. A. and G. V. Wilby. 1961. Fishes of the Pacific coast of Canada. 2nd ed. Bull. Fish. Res. Bd. Canada 68. 443 p.

Hart, J. L. 1973. Pacific fishes of Canada. Fish. Res. Bd. Canada. Bull. 180. 740 p.

McPhail, J. O. and C. C. Lindsey. 1970. Freshwater fishes on north western Canada and Alaska. Bull. 173. Fish. Res. Bd., Canada. 1970. 381 p.

Sockeye salmon remain in ocean feeding areas from one to four years. With the onset of sexual maturity, they begin migrating back to coastal waters and finally their native streams.

The preceding description of the life history of sockeye salmon was provided * provided by: McClean, R. F. et al, 1977.

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McPhail, J. D. and C. C. Lindsey. 1970. Freshwater fishes of northwestern Canada and Alaska. Bull. 173. Fish. Res. Bd., Canada. 1381 p.

Life History, Coho Salmon

Taxonomy

Coho salmon (*Oncorhynchus kisutch*) is a member of the family Salmonidae. In common usage, coho salmon are generally referred to as "silver salmon".

Distribution

Coho salmon are distributed in western North America from Monterey Bay, California, north to Point Hope, Alaska. In northeastern Asia they range from Hokkaido, Japan, north to the Anadyr River in Siberia. In Alaska cohos are abundant from the Dixon Entrance (Southeastern Alaska) north to the Yukon River. Evidence suggests cohos are rare north of Norton Sound.

Physical Description

The average weight of a mature coho salmon is from 2.7 to 5.4 kg (six to 12 pounds). The average length at maturity is 74 cm (29 inches). During 'ocean residency, adults are metallic blue on the dorsal surface, silvery on the sides and ventral surface and cuadal peduncle. Irregular black spots are present on the back and usually on the upper lobe of the tail. Spots and gums are not as darkly pigmented as in king salmon. The caudal peduncle is unusually broad, and a silvery plate is evident on the tail. During the spawning phase, both sexes turn dark, with a maroon-reddish coloration on the sides. The male develops an extremely hooked snout and its teeth become enlarged. The male also develops a "humped" back, but it is not as extreme as those found in spawning sockeye or pink salmon males. Occasionally, males return to spawn after only three to six months at sea. These small "jacks" resemble adults, but possess more rounded tail lobes.

Juvenile coho have parr marks evenly distributed above and below the lateral line. The parr marks are narrower in width than the interspaces, No black spots are visible on the dorsal fin. The anal fin has a long, leading edge usually tipped with white. All other fins are frequently tinged with orange.

Life History

In Alaska coho salmon enter spawning systems from August through November, usually during periods of peak high water. Actual spawning occurs between September and January. Although spawning may occur in main channels of large rivers, locations at the head of riffles in shallow tributaries or narrow side channels are preferred. Optimum substrate composition is small-medium gravel. However, coho salmon are extremely adaptable and will tolerate up to ten percent mud. Optimum stream discharge is 96.3 liters/see. (3.4 $ft.^3$/see). The nest, or redd, site is generally larger than that for sockeye salmon and averages 2.8 m in the Columbia River basin.

Fecundity ranges from 2,400 eggs to 5,000 eggs in larger females. Eggs are orangish-red in color and smaller than most other salmon eggs, ranging' from four to six millimeters in diameter.

Eggs in the gravel develop slowly during the cold winter months, hatching in about six to eight weeks. This interval is highly variable due to the influence of environmental factors. The sac-fry remain in the gravel and utilize the yolk material until emerging two to three weeks later. Upon emergence, the fry school in shallow areas along the shores of the stream. These schools break up rather quickly as fry establish territories. The fry defend these "territories from other juvenile coho with aggressive displays. This territory is usually along the shoreline or behind a log or boulder. From such a location the young fish do not have to fight the current and can dart out to feed on surface insects or drifting insect larvae.

Juvenile coho grow rapidly during the early summer months and spend the winter in deeper pool areas of spring-fed side ponds. Coho salmon also rear in ponds or lakes, where they feed along shoreline areas. Rearing also occurs in brackish, lagoon areas.

In the spring of their second, third, or fourth year, coho smelts migrate to the sea. They remain inshore and near the surface during the first few months, feeding on herring larvae, sandlance, kelp, greenling, rockfish, eulachon, insects, and various crustaceans such as copepods, amphipods, and barnacles. They also feed on crab larvae and euphausiids. After several months inshore, they move out into the open ocean where their principal foods are squid, euphausiids, and various species of small fish. .

Information concerning the coho's ocean residency is scant. However, tagging in the Gulf of Alaska has indicated that a large number of southeast Alaska coho move north along the coastline until reaching the Kodiak Island vicinity. This movement corresponds with the Alaskan Gyre, which is a counterclockwise pattern of ocean currents moving across the North Pacific to the coast of British Columbia, northwest along the coast to the Gulf of Alaska and then southwest toward the Alaska Peninsula. Other species of Pacific salmon are thought to follow this counterclockwise pattern during ocean residency. Coho salmon spend from one to three years in marine waters before returning to spawn in their native streams.

The preceding description of the life history of coho salmon was provided by: McClean, R. F. et al, 1977,

Clemens, W. A. and G. V. Wilby. 1961, Fishes of the Pacific coast of Canada. 2nd ed. Bull. Fish. Res. Bd. Canada 68. 443 p.

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McPhail, J. D. and C. C. Lindsey. 1970. Freshwater fishes of northwestern Canada and Alaska. Bull. 173. Fish. Res. Bd., Canada. 1970. 381 p.

Life History, Pink Salmon

Taxonomy

Pink salmon (*Oncorhynchus gorbuscha*) are members of the family Salmonidae. Pink salmon have also been called "bumpy" or "humpback" salmon because of the enlarged hump that develops on the back of the spawning male.

Distribution

Pink salmon occur in streams from northern California to the Arctic Ocean in North America, and from the Arctic Ocean south to Hokkaido Island of northern Japan in Asia. Their oceanic distribution extends from North America to Asia north of the 40th parallel through the Bering Strait into the Arctic Ocean. Although several attempts have been made to transplant pink salmon to waters outside their natural range, no new fishery has been established to date.

Physical Description

The average length of a mature pink salmon is from 41 to 56 cm (16 to 22 inches), with an average weight of 1.8 kg (four pounds). Adults have large black spots on the back, adipose and both lobes of the caudal fin. The spots on the caudal fin are oval. The largest of these spots are at least as large as the eye diameter.

Fry have a general silvery appearance and their backs are often deep blue to green. A lack of parr marks easily distinquishes them from other salmon fry. During the first three months after the fry's entry into the ocean, they have a silvery color common to all salmon. Pink salmon fry can also be readily distinquished by small and numerous scales, with subtle differences in scale shape, color, and internal structure.

Spawning adult males develop an elongated and hooked snout, enlarged teeth and pronounced hump behind the back. The back and sides of the fish become dark, with green-brown blotches on the sides. Spawn· ng females do not develop these characteristics as distinctly.

Life History

In Alaska mature pink salmon begin migration to spawning streams from mid-June to late September, usually ascending streams only short distances. In Bristish Columbia and California some pink salmon have been known to migrate more than 322 km (200 miles), and in Asia migrations have been reported up to 644 km (400 miles) from the sea.

In Alaska pink salmon spawn in the lower reaches of short, coastal streams. Some prefer intertidal areas of these streams, where eggs are alternately bathed by fresh and brackish waters. Spawning areas with medium-size gravel are preferred. Optimum stream flow is 0.03m/sec. (0.10 ft/see) or greater.

Spawning generally begins in August or September when stream temperatures are approximately 10 degrees C (50 degrees F). Pink salmon tend to spawn earlier in colder streams and later in warmer ones. Because pinks are smaller than the other salmon, the nests, or redds, dug by the female are not as large. In Southeast Alaska, redd size averages 1.1 m in diameter and 9.3 cm deep. The egg deposition and fertilization process is similar to the other species of Pacific salmon. The mature female usually carries between 1,500 and 2,000 eggs, which are orangish-red in color and roughly six mm in diameter. From the time of spawning to the fry s emergence from the gravel, less than 25 percent of the deposited eggs surv· ve. This heavy mortality is caused by digging in the redds by other females, poor oxygen supply to the eggs, poor water circulation in the streambed, dislodgement of eggs by flooding and scouring, freezing of eggs during severe and prolonged cold, and predation by other fish.

The developmental period of the egg is critically affected by water temperature. Hatching normally occurs from December through February. Alevins remain in the grave? for several weeks and emerge in April or May. The fry migrate downstream to estuaries immediately after hatching, migrating at night and hiding in the gravel by day. Migrating fry generally do not feed, but if the distance is great, they may consume larval insects.

Fry form large schools in estruarine areas, remaining inshore throughout their first summer. In September they move into deeper water. In April and June their principal food consists of copepods. By July increased growth enables them to supplement their diet with larger organisms such as insects and small fishes. In the estuaries of southeastern Alaska, fry may reach 15 to 23 cm (six to nine inches) before migrating into the open ocean.

Maturing pink salmon remain in ocean feeding grounds until the following summer. Growth is rapid during the last spring and summer in the sea and throughout most of the spawning migration through coastal waters.

Pink salmon reach sexual maturity when they are 14 to 16 months old and average 41 to 56 cm (16 to 22 inches) in length. Little data concerning estuarial and ocean survival is available. Evidence suggests that roughly three-fourths of the fry entering the estuary waters die before reaching the ocean. Of those entering the ocean, approximately three fourths die before reaching sexual maturity. Predation is believed to be the principal cuase of these mortalities.

Pink salmon have the shortest and simplest life history of any Pacific salmon. With a two-year cycle, they have two genetically distinct stocks. These stocks are called “odd” or “even” year, and are based upon the year adults spawn. Differences in the number and size of fish in the two stocks have been the subject of speculation for many years. In some areas of Alaska, only odd-year runs predominate in the Frase River and in southern British Columbia. Even-year runs predominate in northern British Columbia and the Queen Charlotte Islands. Switches from odd-year to even-year dominance have been recorded in

Asian streams to a significant extent. In Puget Sound and Southeastern Alaska the odd-year runs dominate, while in Kodiak, Cook Inlet and Bristol Bay, even-year runs are in the majority. Long-term averages in Prince William Sound indicate a higher abundance of even-year stocks; however, odd-year stocks have periodically sustained several years of high abundance.

The preceding description of the life history of pink salmon was provided by: McClean, R. F. et al, 1977.

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Prince William Sound Aquiculture Corp., 1975. Salmon culture program (unpublished).

Life History, Chum Salmon

Taxonomy

Chum salmon (Oncorhynchus keta) are members of the family Salmonidae and sub-order Salmonidea. Chum salmon are commonly referred to as "dogs" or "dog salmon", This name can be attributed to the hooked snout and protuding teeth of spawning males.

Distribution

Chums are the most widely distributed of the five Pacific salmon and second to the pink salmon in abundance. In western North America they range from California north to the Bering Strait and east to the MacKenzie River. In northeast Asia they run from near Pusan, Korea, north along the Asian coast to the Arctic Ocean. They also range west along the Arctic coast to the Lena River of Siberia. Primarily, distribution is above latitide 46°N in the colder waters of the subarctic region.

Physical Description

Adult churn salmon have been recorded as large as 102 cm (40 inches) in length and weighing as much as 15 kg (33 pounds). The average is 76 cm (30 inches) long and 3.6 kg (eight pounds) in weight. In marine waters they are metallic blue on dorsal surfaces with occasional black speckling. The pectoral, anal, and caudal fins have dark tips. In fresh water, maturing chums show reddish or dark streaks (or bars) and large blotches, with white tips on the pelvic and anal fins. The spawning male develops an elongated, hooked snout, and its teeth become enlarged.

Chum salmon fry have six to 14 short parr marks that rarely extend below the lateral line. The back is mottled green, while the sides and belly are silvery with a pale green iridescence.

Life History

From July through September, sexually mature chum salmon leave ocean feeding grounds and migrate to freshwater spawning habitat. These habitats may range from tidal flats of short, coastal streams to springs in the headwaters of large river systems. The longest known spawning migration occurs in the Yukon River, where chum salmon swim more than 2,410 km (1,500 miles) upstream from the Bering Sea.

Spawning usually occurs in riffle areas, with gravel size comparable to that used by pink salmon. Spawning also occurs in coarser gravel and even in bedrock areas atop loose rubble. Chum salmon generally avoid areas where there is poor circulation of water through the streambed. Optimum stream flow is 0.1-1.0 m/sec (0.3-3.3 ft/see). The nest, or redd, size is considerably larger than that for pink salmon and averages 2.25 m in diameter in the Columbia River Basin. Optimal size is considered to be 3 m in diameter.

Females produce an average of 3,000 orangish-red eggs approximately six to seven mm in diameter. Hatching occurs from December through March. Experiments have revealed that at a constant temperature of $10^{o}C$ (50 'F), eggs hatch in about 50 days. Alevins emerge from the gravel from April through May to begin their seaward migration.

When fry reach the estuary, they are usually about 3.8 cm (1.5 inches) long. They feed near shore for several months and migrate to open sea in September. Growth during the first months of marine residence is rapid, with juveniles reaching lengths of 15 to 29 cm (six to nine inches) in their first year. The diet of maturing chum salmon is similar to that of other Pacific salmon,

Chum salmon return to spawn after spending two to four years at sea. Counting freshwater growth, they are between three and five years old when they leave the ocean.

The preceding description of the life history of chum salmon was provided by: McClean, R. F. et al, 1977.

Clemens, W. A. and G. V. Wilby. 1961. Fishes of the Pacific coast of Canada. 2nd ed. Bull. Fish. Res. Bd. Canada 68. 443 p.

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Prince William Sound Aquiculture Corp., 1975. Salmon culture program (unpublished).

Harvesting Season

The theoretical duration of an aggressive commercial salmon fishery is twelve months per year, ignoring management, climatic and technological constraints. Such a fishery would operate in at least three phases: oceanic, estuarine, and freshwater, with the latter being terminated upon the advanced physiological depletion of the salmon. Maximum product. quality would be realized in the oceanic and estuarine phases of the theoretical fishery. Management control of the resource would be maximized in a fishery limited to the estuarine (near-shore) and freshwater phases. In actuality, the domestic salmon fishery is limited to two phases of operation: estuarine and near-shore for most commercial efforts and freshwater for subsistence fishing. This limits the commercial harvest of salmon to no more than four months, typically mid-May through mid-September.

The time interval of May through September also approximately coincides with that of an "optimal" salmon fishery. An optima? fishery will be considered for all the species being considered in this project, in addition to salmon. Such a fishery will operate somewhat out of the realm of current fisheries regulations and would include the following as guiding principals:

- Harvesting fish, whenever possible, during periods of peak somatic or body condition. The determination of the timing for harvest of "prime" fish would be accomplished through the seasonal plotting of energy content. The example given is of the American plaice, Hippoglossoides platessoides (see Figure A.9).

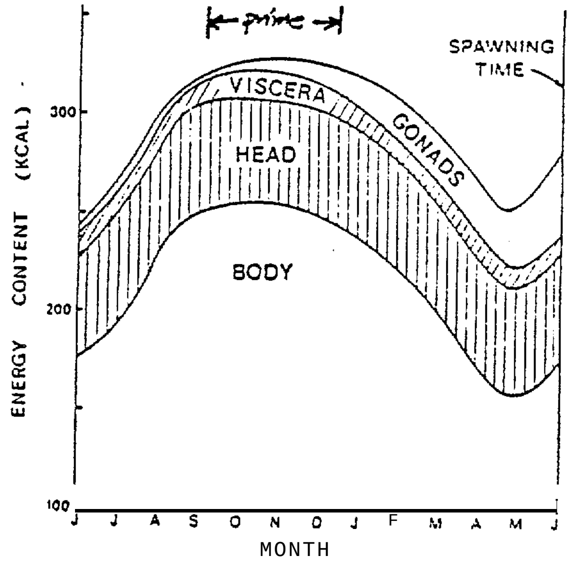


FIG. A.9 Seasonal pattern of energy storage in components of a mature 35-cm female American plaice from St. Margaret's Bay, N.S.

- Harvesting on a maximum sustainable yield basis, but with the continuation of the current trend of modifying yield levels based on sampling of life stages and constraining environmental factors, including ecosystem-level interactions.
- Timing of harvest with market conditions.
- Use of harvesting methods considered to be most efficient providing that biotic and abiotic degradation is not a possible outcome. In some cases, this would have the effect of increasing the scale of operations in several fisheries, most notably the coupling of optimal harvesting equipment to vessels of such a length and horsepower in order that fishing could be efficiently pursued.

- Expansion of the use of mobile processing facilities, including the use of processing ships on the high seas.

The optimal salmon fishery would occur during periods of maximum fish concentration. Although some stocks will be somewhat removed from the level of peak somatic development, the concentration of runs in waters close to the coast more than compensates for the dispersed distribution of stocks in off-shore waters during earlier periods in the salmon life cycles.

In spite of management efforts, the Gulf of Alaska salmon fishery has been chronically depressed for the past several decades. Causes of decline in natural runs are several and include the deterioration and elimination of spawning habitat, overfishing, and the possibility of alterations in the marine environment. Current management trends include scheduled closures and emergency closures during the fishing season in order that escapement goals can be reached, the opening of new spawning habitat, the revitalization of deteriorated spawning habitat, construction of artificial spawning channels, and public and private hatchery operations. To further accelerate the recovery of salmon stocks in certain situations, for example, in the case of chinook salmon east of the longitude of Cape Suckling, management practices will become increasingly stringent. In the case of chinook salmon, a proposal has been forwarded for the limitation of the traditional in-shore and off-shore troll fishery.

Causes of Fluctuation in Resource Abundance, Pacific Salmon

An examination of natural fluctuations in the abundance and availability of the five species of Pacific salmon spawning in North American drainages will uncover a variety of proposed causes and solutions. Natural fluctuations, occasionally of tremendous magnitude (Ricker, 1950), have been observed and measured since the inception of the salmon fishery in Alaskan and Canadian waters. In terms of management, the salmon and its fluctuations have presented special problems too numerous to be adequately dealt with here. A partial listing of major concerns would include: the allocation of catches in high seas fisheries, the determination of the origin of salmon in high seas and coastal fisheries, protection of freshwater habitat, securing optimum numbers of spawners, forecasting, enhancement operations and others. The management system has undergone considerable refinement since the early days, having evolved from simple quota systems to sophisticated systems used in the harvesting of multiple stocks.

At one time it was generally believed that if more salmon were allowed to escape to a particular spawning ground, increased future production would be the result. Evidence now exists that spawning in excess of the carrying capacity of the drainage will not increase subsequent yield, but may reduce it (Van Hyning, 1973). The management theory in general use at present states that for many major stocks of salmon, recruitment or the return of future spawners is maximum at some intermediate stock size, and that the maximum sustained commercial harvest or maximum sustained yield can be realized when the optimum escapement is held within the range of one-third to one-half of the unfished population equilibrium. The commercial harvest or maximum sustained yield represents the surplus of spawners above the optimum escapement. According to this theory, failure to remove this surplus will result in a' decline of subsequent runs (Larkin, 1977). In the specific example of Columbia River chinook salmon, spawning beyond optimum escapement levels leads to a variety of difficulties including interference in spawning due to aggressive displays, the superimposition of eggs from multiple spawnings, spawning in marginal areas due to crowding, and others. The outcome is a lowering of reproductive potential below levels which could be realized with more moderate spawning and the subsequent decline of the run (Van Hyning, 1973). As a consequence, a fluctuation has been induced which may be repeated through a number of cycles, or over a number of years before the run is again stabilized at optimal levels. The economic impact of periodic oscillations can take on considerable proportions, on one occasion providing the processing industry with too few fish and, on the other, providing a surplus for which the industry does not have the capacity or was in some other way unprepared.

The theory presented states that a relationship exists between the 4
optimum number of spawners and the number of recruits which will be harvested in the future. Other researchers would contend that such a relationship would be fortuitous, that the relationship is mainly that of random unrelated events (Thompson, 1962). According to this position the spawner/recruit relationship has a number of major intervening steps representing environmental constraining factors, including major parameters such as freshwater temperature, predator density, the marine production cycle, and others, all of which can be highly variable. For example, studies correlating the success of fry emergence in pink salmon to future adult yield have been frustrated by highly variable constraining factors operating in the marine environment. A more productive study involving Fraser River

pink salmon involved relationships of various freshwater and estuarine environmental factors, with a close correlation existing between sea surface temperatures during a specific season and the abundance of adult salmon the following year (Royal, et al., 1961), It is a foregone conclusion that a multitude of factors are involved in the survival rates of a given salmon stock. In spite of such objections, the optimum escapement hypothesis remains a dominant management tool and provides an approximation of the relationship between spawners and resulting recruits.

A more graphic way of presenting the nature of fluctuations in salmon abundance is to compute the outcome of the reproductive process. Given the average fecundity of each salmon species, along with the sex ratio, average freshwater survival rates, and the average number of spawners involved during various years, it is possible to estimate the number of fry entering marine waters. Using this system, over 230 x 10^6 juvenile salmon could be expected to enter estuaries of the Gulf of Alaska and Bering Sea in an ' average year and nearly 600 x 10^6 in a peak year (Stern, et al., 1976). The disparity between a low year and peak year could be even greater.

Since the 1930s, Asian and Alaskan salmon stocks have gone through a period of progressive decline. The.cause of the decline in catches may be traced to a number of factors, some of which were previously mentioned, and including, among others, harvesting at levels which could not be compensated for by the reproductive potential of the stocks (Larkin, 1977). In addition to lower average catches, strong periodic variations of two years in pink salmon and four to five yearsin sockeye salmon have further increased year to year variability. In comparison, the Atlantic salmon, _Salmo salar_, shows a periodicity of ten to eleven years between peak and low runs (Nkiolsky, 1963). In a summary of suspected causes, Ricker (1962) included predation in freshwater and marine water, cannibalism, fouling of spawning grounds, commercial and subsistence fishing practices, and food competition as factors acting either alone or in various combinations which might be responsible for the observed oscillations in abundance and availability.

Summary

Trend: Continued depressed catches for most species in many areas.

Causes: Degradation of freshwater habitat; historic exploitation beyond the reproductive capacity of the stocks; and possibility of long-term changes in the marine environment.

Alaska Aquiculture Projects: An Overview

The fishery resource enhancement and rehabilitation projects that are and will be conducted by both public and private entities will tend to increase resource abundance. This section contains a brief discussion of such projects and their potential impact on salmon harvests.

The development of salmon enhancement projects in the State of Alaska, as well as in the other Pacific states, is distinguished by a rather dubious history. Many early efforts, particularly in terms of hatcheries, were frustrated by recurrent technological and biological complications, the general result being operation that were not cost effective. However, a number of political, economic, and biological changes with respect to hatcheries have led to a resurgence in the view that artificial enhancement projects of several types, under adequate management sensitive to ecological factors, can initiate the accelerated production of a number of species, the Pacific salmon being most notable.

The current wave of hatchery development projects, to name only one of several types of enhancement methods, is in response to a number of factors including:

past and continued degradation of freshwater spawning and rearing habitat (this has been less of a probelm in Alaska than elsewhere in the U.S.)

the possibility of marine trophic level interactions leading to decreased return of natural runs

recurrent overharvesting of some salmon resources leading to a long-term reduction in reproductive potential

- the use of artificially propagated runs as means of effectively managing short-term oscillations in production
- the possibility that healthy natural runs can be enhanced through the introduction of hatchery fish and other methods including spawning channels and the use of fish passes enabling previously inaccessible drainages to become commercially productive.

The selection of coastal sites for most enhancement projects is a product of geography and, more significantly, the target species. Although all salmon species are scheduled or are currently being reared in various projects, the dominant target species are pink and chum salmon. A number of biological considerations underlie the focused enhancement efforts on these two species. Among these are:

- the short generation time of both species

pink salmon	two years
chum salmon	three to five years

- accelerated smelting in both species resulting in greatly reduced rearing time (months compared to the several years required for other salmon species)
- increased efficiency of the facility as a producer of fry due to decreased juvenile mortality rates while the fish are held in the facility because of the reduced rearing time.

Although it is expected that furture efforts will be primarily concentrated on these two species, hatchery developmental projects for other species of salmon, including the hybridization of various salmon species for improved growth and survival characteristics, and for non-salmon species such as shrimp may also occur.

Summary of Salmon Harvest Statistics

Harvest objectives for Alaska salmon (all species):

Objective	Term	Harvest
Short-term	1986	49.25×10^6 fish
Long-term	1996	70.10×10^6 fish

Current Alaska salmon harvest statistics:

- . Average harvest for years 1961-1977 (all species)

$= 43.74 \times 10^6$ fish

$= 108.48 \times 10^3$ MT

Present harvest as percentage of short-term objective = 89.6%

Present harvest as percentage of long-term objective = 63.0%

Present harvest tabulated by species (in terms of average state harvest for years 1961-1977)

Species	Fish	Metric Tons
Pink	24.87×10^6	44.77×10^3
Chum	5.03×10^6	20.62×10^3
Coho	1.83×10^6	6.22×10^3
Sockeye	11.96×10^6	32.20×10^3
Chinook	0.45×10^6	4.57×10^3
	44.14×10^6 fish	108.48×10^3 MT

The short- and long-term salmon harvest objectives include harvest from a variety of enhancement projects, either in operation, under construction, or proposed. Projected salmon harvest generated from enhancement projects is as follows:

Species	Total harvest from (projected)	Total harvest from projects (projected)	Total harvest from all, enhancement programs (projected)
Pink	2.50×10^{6} fish	11.28×10^{6} fish	13.78×10^{6} fish
Chum	13.00×10^{6}	1.09×10^{6}	14.10×10^{6}
Coho	1.20×10^{6}	0.44×10^{6}	$1.64. \times 0^{6}$
Sockeye	0.76×10^{6}	0.19×10^{6}	0.95×10^{6}
Chinook	0.32×10^{6}	O*O2 $\times 10^{6}$	0.34×10^{6}
	17.80×10^{6} fish	13.02×10^{6} fish	30.81×10^{6} fish

The projected harvest from enhancement project production exceeds 40 percent of the total long-term salmon harvest objective of 70.1 million fish.

HALIBUT

Life History

Taxonomy.

The Pacific halibut, _Hippoglossus stenolepis_ (Schmidt), is a member of the order Pleuronectiformes, which includes such species as flounders, sole and brill. Until 1904 halibut were regarded as a circumpolar species common to the Atlantic and Pacific Oceans. The Atlantic form is now recognized as _Hippoglossus hippoglossus_ (Linneaus).

Physical Description.

The order Pleuronectiformes is characterized by a greatly compressed body which is somewhat rounded on the eyed side and flat on the blind side.

In young flatfish the body is upright and symmetrical with an eye on each side of the head. Very soon a metamorphosis occurs and one eye migrates to the opposite side of the head. Eventually, both eyes are on' the upper or darker side. The fish then settle to the bottom and swim horizontally.

In the Pleuronectidae or flounder family, to which the halibut belongs, the eyes and colored surface are typically on the right side of the fish (dextral). The halibut mouth is large and symmetrical, with the maxillary extending to or behind the pupil of the eye. The teeth are developed on both sides of the jaws.

Halibut are the largest of all flatfishes and one of the larger fishes in the world. The adult male halibut may reach 140 cm (4 feet 7 inches) in length and attain an average weight of 18.1 kg (40 pounds). An adult female may grow to 267 cm (8 feet 9 inches). Females have been recorded weighing 213 kg (470 pounds) at an age of 35 years or more. The largest Pacific halibut on record was caught near Petersburg, Alaska. and weighed 225 kg (495 pounds).

Halibut are dark brown and irregularly blotched with lighter shades on the eyed side and white on the blind side. By controlling the contraction and expansion of chromatophores of various colors, halibut and other flatfishes have the ability to change their external shades and color patterns to blend in with the immediate surroundings. These changes are activated by visual stimulation.

Distribution.

The species range from Santa Rose Island off Santa Barbara in southern California to the Bering Sea, as far north as southern Chukchi Sea. They are also distributed about halfway between St. Matthew and St. Lawrence Islands. On the Asiatic coast, they range from the Gulf of Anadyr in the north and as far south as Hokkaido, Japan. Halibut are found in very shallow waters and to depths of 1,100 m (600 fathoms). They generally range between 55 to 412 m (30 to 225 fathoms).

Spawning.

Spawning takes place from November to Janaury along the slopes of the continental shelf in depths from 220 to 457 m (125 to 250 fathoms).

Fecundity in females is proport·onate to the size of the fish. A large female of 63.5 kg (140 pounds) may have as many as 2.7 million eggs. The eggs, or ova, are about 0.318 cm (1/8 inch) in diameter and bathypelagic, being laid and fertilized in proximity to the bottom, but subsequently drifting in the middle to upper water levels. The eggs and larvae drift passively with the ocean currents at depths down to 686 m (375 fathoms). As development proceeds, they gradually rise toward the surface and drift into shallow water with the inshore surface currents.

The germinal disc of the egg goes through the normal processes of cell division to form the embryo that lives off the yolk. The yolk comprises the main mass of the egg. Eggs hatch after about 15 days, with the larvae living off nourishment from the yolk sac. After absorption of the yolk, post-larvae must depend upon the external environment for their food. As with the eggs, the larvae and post-larvae continue to be free floating. They are transported many hundreds, if not thousands, of miles by the westward moving ocean currents.

The free floating stage lasts about six months. After rising to the surface water layers, they tend to be propelled by the prevailing winds toward the shallower sections of the continental shelf. The larvae undergo metamorphosis and begin their bottom existence as juvenile halibut far from the spawning grounds. Thus, the floating eggs, developing larvae and the post-larvae are dispersed far westward from the points where they were produced.

With advancing size and age, the young halibut move into deeper water. Fema es grow faster than males. The age of sexual maturity in females is from 8 to 16 years, averaging about 12 years.

Tagging operations have shown that immature halibut move within very restricted areas, whereas mature fish may migrate extensively to and from the spawning grounds. Halibut have been known to migrate as far as 3,220 km (2,000 miles).

Halibut prey on a variety of animals, and their diet changes with age, season and area. Juveniles feed considerably on small crustaceans and shrimp. Older fish shift more to a fish diet, particularly of flounders (Novikov, ?964). Among flounders, yellowfin sole (Limanda aspera) is the halibut's principal prey in the southeastern Bering Sea.

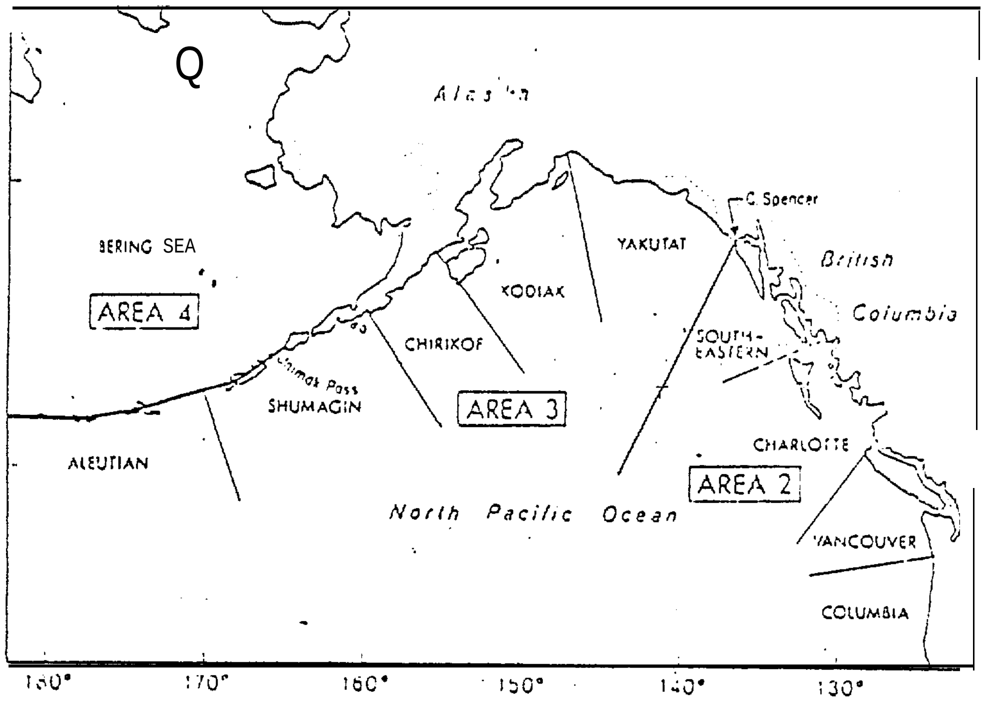
Harvesting Season

The northeast Pacific halibut fishery is theoretically capable of supporting a year-around fishery. However, management and climatic constraint has restricted the fishery to a regulated season extending generally from May through September. Safeguarding spawning concentrations has been a factor in the seasonal closure of the fishery. Although the halibut is a highly fecund fish, little attention has been made in the literature to the flesh quality of gravid and spent fish. This factor apparently is not significant in terms of the annual closure of the fishery.

The optimal fishery for halibut would occur during the late spring and early to mid-summer seasons. This period coincides with both the time of maximum concentration in terms of depth of distribution as well as the time of prime somatic condition.

Causes of Fluctuation in Resource Abundance, Pacific Halibut

Annual catch and catch per unit effort patterns of the Pacific halibut indicate periodic oscillations since shortly after the turn of the century. Whether these flactuations are reflective of changes in the absolute abundance or in the availability of the species due either to changes in distribution or the efficiency of fishing gear is largely a matter for conjecture. It is apparently the contention of the International Pacific Halibut Commission that the indicated fluctuations are primarily the result of fishing pressure and that alterations in the biotic and abiotic environments have been secondary factors chiefly applicable to short term changes in the stocks (Bell, et al., 1958).



Regulatory Areas 2, 3, and 4 and regional divisions of the coast. Area 1 (Columbia Region and south) was incorporated as part of Area 2 in 1967.

FIGURE A.10 Source: Skud, 1977

The briefest review of halibut catches would indicate a period of rapid decline from 1915 to the early 1920s, a period of increase from 1926 to 1936, rapid increase from 1936 to 1944, followed by a period of discontinuous decline to present. The Pacific halibut stocks in IPHC statistical areas 2 and 3 are currently at low levels of absolute abundance. Early researchers of halibut fluctuations concluded that the abundance patterns followed periodic environmental events, possibly involving overwintering conditions. These studies forwarded the hypothesis that catches reflected the prevailing winter water temperatures 10 to 15 years prior to the actual catch. Higher winter water temperatures, following this vein, were favorable to larval development during the time of drift, increasing juvenile survival and ultimately increasing recruitment (Ketchen, 1956). Correlation between temperature anomalies and strong year-classes was the tentative conclusion of later researchers with for areas 2 and 3, respectively (Bell, et al., 1956). Much of this evidence has been contested by Bell due to the lack of strong statistical proof.

A characteristic of Pacific halibut in the Gulf of Alaska has been the appearance of year-classes of various strength which have exerted short term effects on yield. The irregular appearance of unusually strong year-classes as well as other variations in year-class strength have generally been attributed to factors other than fishing (Bell, et al., 1958). The exclusiveness of this hypothesis has been challenged in recent years (Skud, 1977).

A review of the life history of this species indicates that a migratory circuit is involved and includes specific spawning grounds, a period of larval drift, nursery grounds, regular feeding grounds, and active ' contranatant movement to compensate for the initial drift. The possibility exists, then, that a variety of environmental events are capable of perturbing this series of life history events through long or short term environmental changes. Current systems are subject to change and might result in the unfavorable distribution of eggs and larvae into deep offshore waters including the Alaska Gyre. Year-class variations would be the outcome of variations in distribution, the most favorable distribution being the placement of large numbers of larvae on the continental shelf following metamorphosis (Skud, 1977). Increased winter temperatures would accelerate development of larvae and, as a consequence, decrease the period of larval drift and decrease the effects of grazing by pelagic predators.

The migratory patterns of tagged juvenile halibut indicate extensive compensatory movements in terms of the initial larval drift. Significant numbers of tagged fish released in statistical area 3, the western Gulf of Alaska, have been recovered to the southeast in area 2. Similar movements from statistical area 4, the Bering Sea, to area 3 have also been reported, indicating qu· te possibly a strong trend in the migratory circuit of this species that s a gradual return to original spawning locations or some approximation thereof. The obvious inference is that the incidental catch of juvenile halibut will ultimately influence the traditional fishery of adult halibut to the south. The heavy concentration of foreign trawl effort in IPHC statistical areas 4 and 3 with the resulting incidental harvest of juveniles less than 65 cm in length, for which the trawls have been shown to be selective, have ultimately influenced yields in areas 3 and 2. This series of events, coupled with fluctuating biotic and abiotic environmental factors serve as a partial explanation to the very low levels of abundance currently experienced in statistical area 2. The effects of fishing in one area cannot be considered to be independent of future events in another area (Skud, 1977).

<u>Summary</u>

Trend: Chronic decline to current low levels of abundance.

Cause: Primary cause of decline is the incidental capture of juvenile halibut by year-around trawl fisheries. Previous to the period of intensive trawl fisheries, the apparent primary factor determining abundance was. environmental in nature. Prognosis for future is for stabilization and increase in abundance through protection of juvenile stocks.

PACIFIC HERRING

Life History

Taxonomy.

The Pacific herring is a member of the order Clupeiformes. Its family, Clupidae, is characterized by an elongated, compressed body. In general, all Pacific herring have similar characteristics, but minor differences may exist between the herring in Alaska and those in other areas.

Physical Description.

The species can grow to lengths of 330 mm (13 inches), but an average large specimen is 230 to 250 mm (nine to ten inches) long and weights about 0.15 kg (1/3 pound). They are bluish-green dorsally and silvery on the ventral side, having relatively large scales. Herring are fast swimmers and occur in schools of up to one million or more fish. They feed principally on planktonic crustaceans and store large quantities of oil in their bodies. The common maximum life is about nine years, although some fish may live more than 15 years. They attain sexual maturity in their third or fourth year of life and spawn each year thereafter.

Distribution.

Pacific herring occur all around the North Pacific rim, in the Bering Sea and along the shores of the Arctic Ocean. In Alaska the largest commercial quantities occur around Kodiak Island, Prince William Sound, and in much of southeastern Alaska. Recent developments in fishing techniques and gear have resulted in the discovery of additional concentrations of Pacific herring in the Bering Sea, where thousands of tons are now taken annually by Soviet and Japanese trawlers.

Life History.

The life history of Pacific herring from the time adults spawn until the developing juveniles move from inshore waters is well documented, but little is known about what occurs in the two and one-half years while herring are maturing.

Adult Pacific herring usually mature at about age three or four years in Alaska at a size of about 150 to 200 mm. However, this may vary somewhat between areas. Spawning occurs throughout the spring months, late April through mid-June, and slightly earlier in more southern areas. Water temperatures appear to be one of the main factors that influence spawning timing, and spawning usually begins when water temperatures reach approximately 4.17° to 4.44°C (39.5° to 40.0°F).

A female can produce about 10,000 eggs when she is three years old, and as many as 59,000 when she is eight. The older and larger females produce more eggs than the younger ones, but approximately 20,000 eggs per spawning is average. The eggs are adhesive, and the female deposits them on solid surfaces rather than broadcasting them loosely in the water. The generally preferred surface for spawning is living plants. Those plants most often used are eel grass (Zostera), rockweed (Fucus) and girdle (Laminaria).

A spawning female makes physical contact with the substrate and deposits her eggs in narrow bands upon it. The male herring does not pair off with any particular mate, but wanders among the spawning females, extruding milt (sperm) at random. The thousands, or perhaps millions, of fish spawning on a beach usually product so much milt that the water becomes discolored.

A heavy spawning does not always result in more adult herring. In some cases, mortality caused by crowding of the eggs may actually produce fewer young herring than more moderate spawning. Moreover, if many of the eggs of a heavy spawning hatch successfully, high mortality may result as the millions of larvae compete for a limited food supply.

The eggs of the Pacific herring are small (1.0 to 1.5 mm in diameter). They are spherical, slightly heavier than seawater, and adhesive. The incubation time is governed by the temperature of the water, and ranges between 12 and 20 days. Higher temperatures accelerate development. Even under ideal conditions, millions of eggs fail to hatch and mortalities in the egg stage can range from 50 percent to as high as 99 percent. During the incubation period, eggs laid with in the intertidal area are alternately exposed and covered by tides. In warm weather, great numbers of eggs may dehydrate and die when exposed by low tides. Severe mortality may also result from coastal storms if the egg-covered ell grass or kelp is torn from the bottom and cast up on the beach. The alternating exposure and covering of the eggs by the tide makes them available to both aquatic and terrestrial predators.

Upon hatching, a larva receives nourishment from a small quantity of yolk that remains in the egg. When the yolk has been utilized the larva begins to feed. The herring larva is almost transparent and about six mm (1/4 inch) long. The transition from yolk subsistence to active feeding is perhaps one of the most critical periods in the herring's life. If water currents are unfavorable, thousands of larvae may be swept out to sea or to areas without proper food. The larvae are constantly exposed to predation by marine animals such as arrow worms, comb jellies and other fish.

The change from a larva to a scaled juvenile takes place from six to eight weeks after the egg is hatched. At this stage the herring is approximate 65 mm (2 1/2 inches) long. The young collect in small schools and gradually move seaward toward the mouths of bays and inlets in which they were hatched. By early fall they are about 100 mm (4 inches) long and consolidate into large schools of perhaps one million fish or more. Most of the schools move into deep or offshore water by late fall. They return two and one-half years later as mature adults ready to spawn for the first time.

The preceding description of the life history of Pacific herring was provided by: McClean, R. F., et al., 1977.

Clemens, W. A., and G. V. Wilby. 1961. Fishes of the Pacific coast of Canada. 2nd ed. Bull. Fish. Res. Bd. Canada 68. 443 p.

Hart, J. L. 1973. Pacific Fishes of Canada. Fish. Res. Bd, Canada. Bull. 180. 740 p.

McPhail, J. D. and C. C. Lindsey. 1970. Fresh water fishes of northwestern Canada and Alaska. Bull. Fish. Res. Bd. Canada 1973. 381 p.

Reid, Gerald M. 1972. Fishery facts - 2, Alaska's fishery resources - the pacific herring. U.S. Dept. Comm., NMFS, U.S. Government printing office, Washington, D. C. 20 p.

Harvesting Season

The fishery for herring is largely restricted to those times and places where the fish have become concentrated into spawning aggregations. Although some successful winter fisheries have existed due to the presence of concentrations, feeding or otherwise, the Alaskan fishery is largely restricted to the late-April through mid-June period because of economic rather than management constraints. A further factor complicating the timing of the current fishery is the need to harvest the fish at the proper degree of ripeness for the sac roe market. Product quality is acceptable only in a relatively limited time span.

Due to the apparent diffused distribution of adult stocks in neritic and oceanic waters, the timing of the optimal fishery for herring would coincide with that of the traditional commercial fishery. The somatic condition of the fish is not prime at this time; however, this is of little concern because of the concentrations found at the termination of spawning migrations and because of the value of genital products which are either approaching or at prime condition during all but the end of this period.

Causes of Fluctuation in Resource Abundance

The clupeoid fishes, of which the Pacific herring is a member, are a dominant commercial species in world fisheries due to their extreme abundance. The dynamics of abundance are largely determined by trophic relationships, the closer the feeding pattern to the sources of primary production, the greater the inclination towards abundance. The clupeoids are generally filter feeding and particulate feeding plankton consumers, the herbivores of the sea, and are positioned approximately 1 to 2 trophic levels away from the primary producing phytoplankton (Murphy, 1977). The only exception to this feeding behavior are northern herrings which will accept larger particles when such food is in abundance. It has been reported that adult Pacific herring will consume pink salmon fry (Gilhausen, 1962)., The herring is a major forage fish representing a key link in the marine food chain and, as such, experiences high mortality rates particularly during pre-adult stages (Murphy, 1977).

The world herring fishery is notable for great fluctuations in catch which in turn are reflections of abundance and availability. These fluctuations have been classified as short and long-term, representing time intervals of 3 to 7 and approximately 85 years, respectively (Ayushin, 1965). Fluctuations in herring stocks are the results of a number of factors including the magnitude of environmental change, the range in age at recruitment, the frequency of strong year-classes, the number of exploited age-groups in the adult population, shifts in the area of recruitment, and reduced recruitment caused by fisheries on immature herring (Ziglstra, 1963). From this, it can be deduced that the abundance of a herring stock is dependent on the frequent appearance of strong year-classes and availability is largely the result of the recruitment of strong year-classes into the stock being exploited rather than another more remote stock. The abundance of a herring stock has been found most constant in those cases where a particular stock is composed of a number of semi-isolated spawning units with differences in timing and location, the outcome being a buffering of short term fluctuations in recruitment and, ultimately, in abundance (Hempel, 1963).

In terms of the population dynamics of this species, the parameters of abundance are fecundity (reflective of growth), longevity (reflective of the number of potential spawning), and the age at maturity (Murphy, 1977). The stability of a stock is dependent upon the balancing of combined mortality factors, including environmental, predator and fishing effects, with the reproductive potential of the fish. Exceeding this reproductive potential would seemingly suggest the collapse of a fishery, however, due to a suspected feedback loop in the reproductive physiology of the species, stress may lead to a number of effects including accelerated growth, earlier maturation, and increased fecundity. The overall effect would be the rapid stabilization of stock abundance assuming that environmental factors remain favorable and intense exploitation has been suspended.

The abundance and availability of herring are primarily the result of constraining biotic and abiotic environmental factors. It is a perverse characteristic of clupeoids in general to have very wide variations in recruitment, the size of year-classes being for all practical purposes independent of a wide range of spawning stock sizes (Murphy, 1977). This characteristic is largely the product of environmental factors which, among other things, determine the survival of the adhesive egg masses and the larvae, the size and age of recruits, migratory patterns, and the segregation of recruitment among various semi-isolated stocks, with the overall effect of environmental constraints being the establishment of short and long-term fluctuations (Hempel, 1963). Herring stocks inhabiting waters near the extremes of their normal distribution are particularly sensitive to fluctuations in climate, some Alaskan stocks being included in this category. However, in most cases, the collapse of the stock has been observed when the population was also heavily fished (Murphy, 1977).

The biological reasons for the appearance of strong year-classes is largely a matter for conjecture since the correlation of an infinite variety of hydrographic and biotic conditions in the water masses with survival data is a difficult statistical process (Murphy, 1977; Hempel, 1963). In the northwest Pacific, short and long-term fluctuations are believed to stem from changes in the major current systems, particularly the Karoshio current. Increased year-class abundance tends to coincide with the weakening of this system (Ayushin, 1965). The influence of the climate in the Gulf of Alaska will be included in a part of this section.

In addition to influencing the abundance of herring stocks, hydrological conditions also influence the distribution of stocks both horizontally and vertically within their natural range of distribution and effects the availability of the stock to the commercial fishery. Herring tend to keep to waters which closely approximate optimum conditions, particularly in regard to temperature (Nikolsky, 1963; Shulman, 1962). The conditions of the water masses tend either to concentrate the herring population into discrete schools or to disperse them in more diffuse ' aggregations. The occurrence of optimum physical conditions in deeper layers during spawning migrations particularly in coastal waters might have the effect of placing the herring population beyond the vertical range of harvesting methods. Moreover, because Pacific herring stocks do not necessarily spawn at fixed locations , environmental change can alter migratory circuits with a corresponding alteration in spawning locations, a potential complication in a commercial fishery (Uda, 1961),

A primary determiner of future abundance of herring is hatching success and larval survival, events under the control of an array of environmental factors. The Pacific herring spawns in intertidal to slightly subtidal locations at selected spawning locations, the overall timing following a latitudinal cline extending from December in California waters (San Diego) to June (St. Michael, Alaska) and beyond in Alaskan waters (Rounsefel 1, 1975). Spawning occurs within a certain range of water temperatures, and because of the progressive seasonal warming of waters into the optimal range, it i's possible to follow the spawning of individual herring stocks as one moves from south to north. The advantages of intertidal spawning of Pacific herring over the deeper, benthic spawning of Atlantic herring are not clearly understood although somewhat reduced predation on egg masses is suspected to be a factor (Murphy, 1977). Other determiners of spawning success irregardless of location include the conditions of spawning and development, and the quantity and quality of spawn. Both quantity and quality of the reproductive products are large y the result of the age composition of the stock, older fish generally being more fecund and laying eggs of higher quality, and the feed ng conditions faced by the parent stock in the preceding season (Nikolsky, 1963).

The influence of water temperature on the hatching success, larval survival and the future abundance of adult herring.has several effects. Studies of herring from Prince William Sound indicate higher survival when March to June water temperatures were warmer than usual. Warmer temperatures have the effect of accelerating embryonic development and shortening hatching time, thus increasing survival by decreasing the exposure time to intense terrestrial (bear and waterfowl, particularly black brant) and marine predation. Increased temperatures may also have the secondary effect of enhancing primary production in nursery areas and alleviating the stress associated with the transition of larvae to active, particulate feeding (Rounsefell, 1975). Improved feeding conditions, in turn, would lead to rapid growth and the rapid passage of the juvenile herring through the specific feeding ranges of numerous predators (Cushing, 1973). One possible negative aspect of heightened temperatures is that at the time of particularly copious spawning, when numerous layers of eggs are present on the available substrate, increased respiratory need is suspected to lead to the suffocation and subsequent decomposition of the innermost 1 ayers. This would cause the still viable egg mass to break free and pass into a current system and to an unknown fate.

The period of larval drift and the development of herring stocks tend to coincide with the timing of the production cycle, an event which itself is the product of light, nutrient and temperature regimes. The coincidence of the transition to active feeding with the presence of appropriate food particles has the overall effect of enhancing survival and increasing the probability of a larger then normal brood stock (Cushing, 1973). The actual quantification of changes in the matching of juvenile herring to the food supply is difficult, particularly as it applies to underlying regimes. However, Laevastu (1978), via computer modeling has estimated that in the eastern Bering Sea a winter temperature anomaly of 0.8^{o}C. has the effect of 10,300 MT (11,300 tons) of annual herring catch increase or decrease depending on whether increased or decreased temperatures are involved. It was also estimated that a change in catch of 10,300 MT (11,300 tons) was equivalent to 90,700 MT (100,000 tons) annual biomass change.

Herring stocks also demonstrate fluctuations in terms of the presence or absence of competitors for food resources (Murphy, 1977), as well as the relative abundance of predators. Reduction of competitors and predators might well lead to the increased abundance of herring stocks. As previously mentioned, the clupeoids represent a major, if not dominant, forage species.

As a consequence, natural mortality may be extremely high and approach the maximum compensatory powers of the species reproductive potential. The gamut of predators would include whale stocks and other marine mammals, sea birds and carnivorous fish. It has been theorized that natural predators in stable ecosystems, like their human counterparts, tend to maximize the yield from their prey populations (Slobodkin, 1962). This would suggest that some stocks, such as the Peruvian anchovy, were yielding near the maximum before the inception of fishing (Murphy, 1977). It would also suggest that the harvesting of competitors and predators, many of which are traditional fisheries species, would decrease herring mortality, particularly of juveniles (Hempel, 1963).

In terms of the harvest of juvenile and adult herring, apart from environmental considerations, the annual consumption of herring by marine mammals, including toothed whales and pinnipeds, is estimated to be 10 times the annual catch (Laevastu, 1978). The annual consumption by carnivorous fishes is apparently even larger, with an inverse relationship between pollock and herring biomass in the eastern Bering Sea being suggested by 4
Laevastu. Therefore, taking predation into account, it has been suggested that long and short-term changes in the abundance of pollock, marine mammals, and other predators would induce reverse fluctuations in the herring stocks involved. In the management of herring stocks, including the computation of maximum yields, the state of predator stocks needs to be considered and the need for a unified management body is inferred.

The commercial fishery for herring in the Gulf of Alaska and in British Columbia waters has shown considerable variations in annual catch patterns; although whether these variations are due to changes in abundance or availability is not clear. Heavy natural mortality is a factor, particularly with regard to the operation of offshore current systems produced by north-easterly winds. The effect of such currents would be to displace larvae to inhospitable oceanic regions, an effect not limited to herring alone (Uda, 1961). It has been concluded that the commercial fishery in this region has a considerable influence on the age structure of the stocks which, in turn, influences the dynamics of the species during periods of environmental fluctuation. Commercial harvesting has maximum impact on stocks when heavy fishing pressure is placed on stocks already depressed due to adverse environmental factors (Ayushin, 1965). Apparently, the rapid recovery of British Columbia stocks is the product of stable environmental factors, drastically reduced fishing, and the absence of ecologically similar competitors (Murphy, 1977).

The conclusion reached here is that a commercial fishery has the effect of removing old, mature fish from the stock. The less intensive' methods of fishing previous to current methods probably were not capable of overfishing stocks inhabiting hospitable water masses. More advanced methods including offshore trawling have reduced the margin of error to the point where it is possible to overfish healthy herring stocks (Ayushin, 1965). Changes which signal the impending decline of a stock include: the restriction of spawning time and location, increased growth rates, and accelerated maturity (Murphy, 1977). The characteristic shrinking of range with declines in abundance of a herring stock has the potentially disastrous implication, in the absence of effective management, that the fishing fleet can be expected to concentrate on the remanant concentrations, inflicting even higher than usual mortality (Murphy, 1977). Herring fluctuations are, consequently, the product of a complex array of biotic, abiotic, and artificial factors.

Summary

Trend: British Columbia -- recovery. Northern Gulf of Alaska -- moderate levels of abundance. Eastern Bering Sea - abundant. Northern Bering Sea -- decline.

Cause: Complex array of physical factors and predators working at each life stage. Fishing pressure implicated in the decline of several stocks previously weakened by adverse environmental factors.

GROUNDFISH

The groundfish fishery in the Gulf of Alaska has been almost entirely a foreign fishery. The foreign fleets are self-contained units and have had no direct impact on Alaskan communities. Interest is growing in the development of a domestic groundfish industry and under the provisions of the Fisheries Conservation and Management Act of 1976, the domestic industry has been given the right to displace the foreign industry as rapidly as it can. The groundfish resources that will become available to the domestic industry as it develops will include Pacific pollock, Pacific cod, sablefish, Pacific Ocean perch, various species of flounder and other species. The first four species are either the dominant species or are representative of the dominant groups of groundfish in the Gulf of Alaska. Life histories are only provided for these four dominant and/or representative species. '

Life History, Pollock

Taxonomy.

The walleye or Pacific pollock, Theragra chalcogramma (Pallas), is a member of the family Gadidae. In common usage, it is also often called the "whiting" or "bigeye" pollock.

Physical Description.

The adult pollock is recognized by (1) three well-separated dorsal fins, (2) anus below the space between the first and second dorsal fins, (3) a minute or no barbel on the lower jaw, and (4) a slightly projecting lower jaw.

Scales are small and cycloid, with the lateral line canal arching high anteriorly then sloping down to mid-body below the middle of the second dorsal fin. Adults are olive green to brown on the dorsal surface, silvery on the sides, and dusky to black on the fins. In juveniles, two (occasionally three) narrow, light yellow bands are present along the sides.

Length may reach (three feet) 91 cm.

Distribution.

Several populations of *Theragra* have been recognized as species or subspecies around the North Pacific Basin. Analysis led to the conclusion that such distinctions are not justified. In this account, only one species is recognized. Accordingly, the range is from Carmel, California, through the Bering Sea to St. Lawrence Island and on the Asian coast to Kamchatka, Okhotsk Sea and southern Sea of Japan. Centers of abundance lie off Japan, Korea, the Kamchatka Peninsula, the eastern Bering Sea and in the western Gulf of Alaska.

Pollock inhabit the waters of the continental shelf and upper slope from the surface to depths of 366 m (200 fathoms). At 366 m (200 fathoms), it is suspected to be bathypelagic.

Life History

There is no apparent sexual dimorphism in pollock. Chang (1974) stated that size and age of maturation of pollock is closely related to the rate of growth and environmental factors. Krivobak and Tarkovskaya (1964) reported that female pollock from the southeastern Bering Sea attained sexual maturity at 40 cm and males at 32 cm. Serobaba (1971) reported that pollock from the same area reached maturity at lengths of 31 to 32 cm (three to four years of age), but that mature individuals were encountered at lengths of 24 cm.

Spawning is protracted, occurring between March and mid-July, peaking in May for Bering Sea stocks. Fertilization is external. The fertilized egg is planktonic and occurs at depths of 13 to 300 m, but rarely at greater depths. Eggs and larvae inhabit near-surface waters, but juveniles exhibit a distinct vertical movement, rising to the surface at night to feed and descending to mid or bottom depths during the day (Kobayashi, 1963).

Yusa (1954) and Gorbunova (1954) described and illustrated the development of eggs and larvae of pollock. Yusa's work indicated that larvae hatched in 12 days at incubation temperatures of 6° to 7°C. Gorbunova reared pollock eggs at average temperatures of 3.4°C (range 0° to 11.5°C), and 8.2°C (range 2.0° to 12.2°C). The development took 20.5 days at the lower mean temperature and 10 days at the higher temperature.

Hami, et al., (1 971) studied the effect of temperature on the growth and mortality of early stages of pollock. These workers obtained the following relationship between development and temperatures:

$$\log 1/t = \frac{m}{2} \frac{1}{T} + C, \text{ where}$$

t = time in days required for the eggs to reach a certain stage

T = the average absolute temperature

m = Arrhenius temperature characteristic ("Absolute)

c = constant

The incubation time from fertilization to 50 percent hatching was 10 days at 10°C, 13.8 to 14.4 days at 6°C and 24.5 to 27.4 days at 2°C.

According to Gorbunova (1954), newly hatched larvae (eggs incubated at 8.2°C) were 3.5 to 4.4 mm in length and apparently float upside down at the surface of the water due to the buoyancy of their large yolk sac (Yusa, 1954). The yolk sac is absorbed at about 7.0 to 7.5 mm. The actual time from hatching to transformation to the juvenile phase is not known, but according to Gorbunova (1954), pollock become demersal at lengths of 35 to 50 mm and reach 90 to 110 mm in the first year of life.

In the eastern Bering Sea, the growth of pollock is relatively rapid during the first four years of life. By age one pollock are about 170 mm long. From age one to four they may grow an average of 80 mm per year. Beyond age four, the growth rate is much reduced.

After yolk sac absorption, larval pollock of seven to ten mm in length feed on diatoms, copepod eggs and nauplii. As the larvae grow, they feed primarily on zooplankton, and by 20 to 35 mm feed mainly on copepods. At 35 to 50 mm, pollock feed on pelagic copepods and euphausiids. Such organisms dominate stomach contents at least until pollock reach 117 mm in length (Gorbunova, 1954). Adult pollock feed on a variety of organisms, but predominant food items include pelagic or semi-pelagic crustaceans, particularly euphausids, copepods and amphipods. Takashashi and Yamaguchi (1972) observed that young pollock (zero to one year old) may constitute over 50 percent of the stomach content of pollock over 50 cm in length.

The preceding description of the life history of Pacific pollock was provided by: McClean, R. F., et al., 1977.

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Harvesting Season, Walleye Pollock

The walleye pollock is theoretically and currently a twelve month fishery. This fishery involves both mid-water and bottom-trawls and is regulated by the North Pacific Fishery Management Council. Major constraints on bottom-trawling, depending on depth of operation, include low allowable incidental catches of halibut among other considerations. The closure of this fishery due to the incidence of halibut beyond established levels is consistent with that experienced by other bottom-trawling fisheries and is under the regulation of the above-mentioned council. The quality of pollock has been considered to be somewhat lower than that of the Pacific ocean perch, thus the concentrated fishing on and depletion of this latter species. The decline of the perch and the apparent increased abundance of the pollock will undoubtedly lead to increased harvest pressure on the pollock, the fishery operating on a twelve month basis.

An optimal fishery for this species would occur from late summer through the fall months. This period coincides with the commencement of rapid somatic buildup following spawning, although actual depletion of somatic reserves might be minor during gametogenesis. The bathymetric distribution of the species is relatively restricted at this time.

Causes of Fluctuation in Resource Abundance, Walleye Pollock

The evolution of the demersal fishery in the Bering Sea and the Gulf of Alaska has demonstrated a continuous advance through a number of species including cod, halibut, yellowfin sole, Pacific ocean perch and, currently, the pollock. As of 1973, the combined catch of pollock accounted for 30 percent of the tota? catch of a marine species in the Bering Sea and the northeastern Pacific (Kasahara, 1973). While the eastern Bering Sea remains the principle fishing area, substantial quantities are also present in the Gulf of Alaska. Although reliable initial abundance information is not available for these regions, it is believed that this species is on the ascendance.

The rise of the pollock in the northeastern Pacific comes at a time when other heavily exploited species, particularly the Pacific ocean perch, are being fished down to low levels of abundance. The fish species involved are zooplankton feeders for at least a portion of their life histories, the inference being that pollock is acting as a replacement species (Kasahara, 1973). The developing course of events is perhaps reminiscent of replacement of the California sardine by the anchovy (Cushing, 1975). The phenomenon of species replacement includes the placement of some original species in the position of being subjected to heavy commercial exploitation and, simultaneously, with environmental change which results in chronic year-class failure. Another species, previously in a suppressed state, but with a more rapid recycling time and positioned at essentially the same trophic level then can increase exponentially until the carrying capacity of the environment is reached. Replacement of one species, the Pacific ocean perch, by another, the pollock, is a possible outcome. A possible substantiation to this possibility lies in the fact that at least three strong year-classes have occurred in the Gulf of Alaska during the past decade, one of which, 1970, was exceptionally strong.

Fluctuations in pollock abundance are largely dependent on the number of juveniles recruited into the older age groups while changes in the availability of pollock largely involve the dispersal of juveniles and complex hydrological factors. The size of the juvenile population is, in turn, dependent upon many of the same parameters as seen in other species including age at maturity, fecundity, quality of spawn, larval drift, and related mortality factors. One of the major factors suppressing the juvenile year-classes is grazing by predators, including sablefish, and cannibalism by adult pollock. It is estimated that the adult population gains 50 percent of its food requirements by this pathway (Laevastu, et al., 1976). The intensity of cannibalism, however, is dependent upon the size of the adult population, being most intense when the adult population is large. The resulting cycles of intense cannibalism and low recruitment of juveniles during peak adult biomass moving to rapid juvenile growth and recruitment during periods of low adult biomass gives rise to periodic fluctuations in adult abundance with peaks occurring approximately at intervals of 12 years.

The tendency for wide fluctuations in abundance is reduced by several factors when the population is exposed to heavy commercial exploitation. The present fishery, by cropping the older age-groups, decreases juvenile mortality via cannibalism and also decreases grazing mortality by the adults of other species taken incidentally. Decreased mortality in this scenario gives rise to increased recruitment and the eventual return of the adult biomass to preharvest levels. Another stabilizing factor is that for at east part of the year the juveniles are distributed in areas containing 1 Ow adult concentrations, resulting in decreased cannibalism (Laevastu, et al . 1976). A third stabilizing factor tending to keep pollock abundance within a restricted range deals with the pattern of depth distribution of the juveniles, a pattern which limits the accessibility of the juveniles to trawls (Alton, et al., 1976).

<u>Summary</u>

Trend: Increase in abundance.

Cause: Replacement of less dominant species which have been driven to low levels of abundance by overfishing. Availability may be expanded by dispersal of juvenile pollock to areas of low abundance.

Life History, Pacific Cod

Taxonomy.

The Pacific cod (*Gadus macrocephalus*) is a member of the family Gadidae and the order Anacanthini. The scientific name *Gadus macrocephalus* is derived from the Latin gadus (codfish) and the Greek macros (large) and cephalos (head). Common usage may continue to refer to this species as "plain" cod, "gray" cod, or "true" cod to distinguish it from the other species currently referred to as varieties of cod. Other members of the family Gadidae are: the' whiting (*Theragra chalcogrammus*), pacific tomcod (*Microgadus proximus*), and longfin cod (*Antimora rostrata*).

Physical Description.

The Pacific cod has a brown to gray coloration on the dorsal surface, shading into lighter hues on the ventral surface. Brown spots are numerous on the back and sides, and are more or less dusky on the fins. The outer margin of all unpaired fins is white, and the white becomes wider on the anal and caudal fins. The Pacific cod is noted for three separate dorsal fins, with the anus below the second dorsal fin. The barbel below the lower jaw is as long or longer than the eye. This species may attain lengths up to 99 cm (three feet three inches),

Distribution.

Pacific cod are mostly benthic, but are occasionally taken in quite shallow water. They have been caught at depths up to (300 fathoms) 550 meters. The species ranges from Santa Monica in southern California through Alaska and the Bering Sea to the Chukchi Sea. On the Asian side, they are distributed past the Kuril Islands to Kamchatka, Okhotsk Sea, Sea of Japan, off Honshu, Korea and in the Yellow Sea to Port Arthur. Toward the southern part of its center of abundance, cod occur in temperatures throughout the year between 6° and 9°C.

Life History

Spawning takes place in the winter. The eggs are slightly more than 1 mm in diameter and show no oil globule. The eggs are pelagic and slightly adhesive. They hatch in eight or nine days at 11°C and in 17 days at 5°C, but will take about four weeks at 2°C in northern waters. The hatching period for a batch of eggs lasts over several days. Egg survival is high at 5°C. Newly hatched larvae are approximately 4.5 mm in length. At 5°C, the yolk sac is absorbed in about 10 days. Young about 20 mm in length have been found to eat copepods.

The female cod is sexually mature at approximately 40 cm of body length and two to three years of age. The length at which 50 percent of the females are sexually mature is 55 centimeters (Foerster, 1964). Half the males are mature at two years of age. At 60 cm, a female may produce 1.2 million eggs. At 78 cm, she may produce 3.3 million.

Cod generally move into deep water in the autumn and return to shallow water in the spring. Feeding includes a wide variety of invertebrates and fishes including: worms, crabs, molluscs and shrimps, herring, sand lance, walleye pollock and flatfishes.

The preceding description of the life history of Pacific cod was provided by: McClean, R. F., et al., 1977.

Clemens, W. A. and G. V. Wilby, 1961. Fishes of the Pacific coast of Canada. 2nd ed. Bull. Fish. Res. Bd. Canada 68. 443 p.

Hart, J. L. 1973. Pacific fishes of Canada. Fish. Res. Bd. Canada. Bull. 180. 740 p.

Harvesting Season, Pacific Cod

The current Pacific cod harvest remains at levels far below the MSY for this species. A considerable part of this catch is taken incidentally in the harvest of other species. Recent declines in the Atlantic cod harvest coupled with increased demand for fish blocks suggests that larger harvests should be anticipated. Due to seasonal bathymetric movements, with Pacific cod found in relatively shallow, easily fished water during the summer and dispersion of the cod into deeper waters during the more inclement winter months, it can be anticipated that the cod fishery would occur during the late-spring to early fall months. The optimal fishery for this species would occur through the spring and summer months. Availability and meat condition would be maximal during this period.

Causes of Fluctuation in Resource Abundance, Pacific Cod

The history of the cod fishery in the Bering Sea and the Gulf of Alaska predates that of any other major American fishery in the region. During this early time, the Pacific cod was plentiful throughout its range. However, by the year 1948, the cod had become relatively scarce in its northern range (Ketchen, 1956). The demise of the cod fishery, for the most part, predates this decline. Ketchen (1956) states that the past fishery for the species probably was not responsible for this decline, rather the cause was quite possibly the result of a long-term alteration in the physical environment. Following this period, the Pacific cod became particularity plentiful in its southern range off British Columbia and Washington.

It is suspected that the cod is involved in an ecosystem complex demonstrating alternate dominance with the walleye pollock now in ascendance in the Gulf of Alaska. The complex involves both the sablefish and the cod with the biomass of the pollock (Laevastu, 1978). The principle cause of decline involves the rapid expansion of pollock stocks possibly facilitated by the sudden reduction of Pacific ocean perch stocks by overfishing and recent recruitment failures. Juvenile pollock and cod occupy similar trophic levels and have similar feeding specificities, with the pollock being the successful competitor, The actual mechanics of competition are not clearly known. A possible consequence of competition in such cases might be the reduction in the growth of juvenile cod with the cod staying within the prey-size range of its predators for longer than normal periods of time. The operation of this competition mechanism would be further complicated by alterations in the physical environment as reported by Ketchen.

Summary

Trend: Decline in the Gulf of Alaska. Distribution of abundance centered off British Columbia and Washington.

Cause: Environmental change in northern range which is of negative survival value. Strong possibility of alternate dominance with the walleye pollock.

Life History, Sablefish

Taxonomy.

The sablefish (*Anoplopoma fimbria*) is a member of the order Scorpaeniformes, which was originally established to include those fishes having a perch-like form of body. The order now includes many groups that are quite varied from the basic percoid character. One of these is the suborder Scorpoenoidea, to which the sablefish belongs. Within its family Anoplopomatidae or the skilfishes, sablefish are known to various names such as "skil," "coalfish" and "black cod." However, the latter term is inappropriate since the fish is not a cod.

Physical Description.

The body of the sablefish is long and slightly compressed, tapering into a long, slender, caudal peduncle. It is usually slate black or greenish-gray on its dorsal surface and lighter on the ventral side. Males do not grow as large as females, and they reach maturity at an earlier age. Females may attain lengths of one m or greater. It is 'estimated that a 1,02 m (40-inch) sablefish is about 20 years old. Large individuals 0.9 m (three feet) in length and 18.1 kg (40 pounds) in weight have been captured on the halibut banks at depths down to 311 m (170 fathoms). Their food consists of crustaceans, worms and small fishes. In captivity sablefish are indiscriminate feeders. They have been observed actively feeding on saury and blue lanternfish.

Distribution.

The species ranges from Cedros Islands in southern California to the Bering Sea and is quite abundant in Alaskan and Canadian waters. On the Asian side of the North Pacific, they range from Hokkaido, Japan, north to the Kamchatka Peninsula off Siberia. Commercial quantities of adults are most abundant in water deeper than 366 m (200 fathoms) and down to 915 m (500 fathoms). Although tagging studies have shown certain individuals to travel more than 1,930 km (1,200 miles), sablefish tend to be localized in most cases.

Life History.

Sablefish spawn in the early spring with rising water temperatures and their eggs are pelagic, drifting with the current after fertilization. In late May post-larval individuals have been found on the ocean surface at distances from 161 to 298 km (100 to 185 miles) off the coast of Oregon. In the post-larval phase, sablefish are subject to heavy predation by larger organisms.

The preceding description of the life history of sablefish was ' provided by: McClean, R. F., et al., 1977.

Clemens, W. A., and G. V. Wilby. 1961. Fishes of the Pacific Coast of Canada. 2nd. ed. Bull. Fish. Res. Bd. Canada 68. 443 p.

Hart, J. L. 1973. Pacific fishes of Canada. Fish. Res. Bd. Canada. Bull. 180. 740 p.

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Life History, Pacific Ocean Perch

Taxonomy and Physical Description.

Pacific Ocean perch, Sebastes alutus (Gilbert), are one of some 54 or more species in the genus Sebastes (previously placed in Sebastodes) occurring in the north Pacific Ocean (Major and Shippen, 1970; Amer. Fish. Soc., 1970). Sebastes alutus can be differentiated from closely related species by (a) a prominent forward-directed symphyseal knob and (b) a mouth color which is red. Phillips (1957), Barsukov (1964) and Hitz ("1965) published keys to the identification of rockfish in the genus Sebastes.

Barsukov (1964) proposed that Sebastes alutus be divided into two subspecies: (1) S. alutus alutus, distributed from California to the Gulf of Alaska and along the Komandorskiy-Aleutian Arc; and (2) S. alutus paucispinosus, extending from the Pacific coast of Honshu Island into the Bering Sea. The subspecies were found to overlap in the region of the Aleutian and Komandorskiy Islands; therefore, Barsukov recognized the need for further study because this was a provisional division. Other workers (Hart, 1973; Quast and Hall, 1972; Chikuni, 1975) do not recognize sub-specific differentiation.

Distribution.

Pacific Ocean perch live along the eastern and northern rim of the Pacific Ocean from La Jolla, California, to Kamchatka and in the Bering Sea. According to Alverson, et al., (1964), no fish of the genus Sebastes appear to have penetrated the Bering Strait.

Pacific Ocean perch are commonly found along the outer continental shelf and on the upper continental slope. Commercial quantities generally occur at depths between 100 and 500 m (Quast, 1972). This species is common in and along gullies, canyons and submarine depressions of the upper continental slope. Adults occur in abundance over a variety of substrates, 'including clay and jagged rock, but their occurrence may be determined more by food and hydrographic factors than substrates (Quast, 1972).

Life History.

Pacific Ocean perch are an oviparous species; eggs are fertilized internally and retained in the ovary during incubation. At present, controversy exists as to when actual fertilization of eggs occurs (see Lyubimova, 1963 and 1965; Snytko, 1971b; Pautov, 1972; and Gunderson, 1971).

Pacific Ocean perch spawn once a year, with actual mating time varying among regions. Chikuni (1975) suggested that copulation takes' place during October to February, with spawning occurring in March to June. Moiseev and Paraketsov (1961) reported that spawning of ocean perch in the Bering Sea occurred at depths of about 360 to 370 m. Spawning timing (from Major and Shippen, 1970) by region is shown in Table A.1 .

TABLE A.1

Area	Spawning Season	Water Temperature CO	Reference
Bering Sea (south and south-east of the Pribilof Islands)	March-Flay	3.8-4.2	Paraketsov (1963)
Gulf of Alaska (north	March-April	--	Lyubimova {1963)
Coastal waters off southwest Vancouver Island, B.C.	March	--	Westrheim,Harl ing and Davenport (1968)
Gulf of Alaska (south)	May-June	--	Lyubimova (1963)
Coastal waters off Washington-Oregon	January-March	6,0-8.0	Snytko ~~(1968)~~

During the first year after birth, ocean perch are planktonic and their distribution is determined by the movement of the water into which they were born. Paraketsov (1963) reported that larvae are spawned in the Pribilof Islands area in spring and swept by currents toward the shores of the Aleutian Islands and the Alaska mainland. The age at which ocean perch become demersal is not known. Paraketsov (1963) stated that during their second year juvenile S. alutus resume life near the ocean bottom. Snytko (1971) believed that young S. alutus of the Vancouver-Oregon region lead a pelagic life for the first two to three years and then switch to a benthopelagic life. Carlson and Haight (1976) suggested, however, that juvenile Pacific Ocean perch become demersal during their first year of life.

Following their change to a demersal existence, young ocean perch remain in waters from 125 to 150 m deep until they reach the age of sexual maturity, according to Moiseev and Paraketsov (1961) and Paraketsov (1963). Young perch (under 36 cm) in the Vancouver-Oregon region were found at depths of 120 to 210 m and mature specimens (over 36 cm) at depths of 170 to 300m (Snytko, 1971b).

Pacific Ocean perch are slow growing and have a long life span. Alverson and Westrheim (1961) reported that Pacific Ocean perch may live to age 30. Paraketsov (1963) reported that females from the Bering Sea matured at six to seven years of age at lengths of 22 to 25 cm. Pautov (1972) reported that Bering Sea ocean perch reach sexual maturity at lengths of 26 to 31 cm and at ages of six to nine years. He indicated that males matured earlier than females, the former maturing at six to seven years and the latter at eight to nine years. Chikuni (1975) indicated that "fish in every stock" begin to mature at age five and all individuals finish their sexual maturation by age nine. He indicated that 50 percent of the stock matures at age seven.

Thompson (1915) reported S. alutus as one of the important constituents in the diet of halibut, Hippoglossus hippoglossus stenolepis. Tomilin (1957) observed Sebastes spp. in the stomachs of sperm whales.

The intensity of feeding by Pacific Ocean perch is apparently not the same throughout the year. Feeding intensity is apparently related to availability of food, temperature conditions and the physiological status of the perch (spawning}. Lyubimova (1963) noted that the Gulf of Alaska population foraged near Unimak Island in May to September. She also contended that during the rest of the year the adult perch almost wholly abstain from feeding but that immature fish feed year-round. Perch captured during the winter were leaner than those taken during the foraging period, and their quality as food was inferior (Lyubimova, 1965). Pautov (1972) reported that the Bering Sea perch fed most intensively during the spring-summer period (April to September) and during the remainder of the year their food intake decreased. Syntko (1971a) considered spring, summer, and fall as the prime feeding times for perch in the Vancouver-Oregon region. During mating (September to October), sexually mature males feed very lightly. The same behavior has been observed in females during spawning of larvae (February to March). Pautov (1972) reported that perch fed voraciously in morning and evening hours and that the frequency of feeding decreased at night.

The preceding description of the life history of Pacific Ocean perch was provided by: McClean, F?. F., et al., 1977.

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Harvesting Season, Pacific Ocean Perch

Pacific ocean perch are currently subject to a year-around fishery which is under the regulations of the Gulf of Alaska Fishery Management Plan. This fishery was depleted by foreign pulse fishing at annual levels consistently above the MSY for the species. It is also possible that physical environment factors have intervened to depress recruitment. A further complication in the management of this species has been the rapid increase in abundance of the walleye pollock, a species which originally predominated in the Bering Sea. The recovery of Pacific ocean perch to virgin biomass evels will be slowed by this replacement species. The managed harvest of this resource will be at very low levels in comparison to harvests during the inception of this fishery. In spite of apparent differences in the quality of the flesh of this species before, during and after the reproductive period, Pacific ocean perch is harvested through the year.

The timing of the optimal fishery for this species, were it at higher levels of abundance, would occur in the approximate time period of October through February. This would correspond to the time when adult sex ratios would approximate 1:1 and when somatic condition would be approaching prime condition. Very considerable concentrations of fish occur at this time.

Causes of Fluctuation in Resource Abundance, Pacific Ocean Perch

The Pacific ocean perch is one of the more obliquitous species found in the Gulf of Alaska, having a natural range extending from Southern California to the Bering Sea and the waters of Honshu Island (Carlson, et al., 1976).

As a member of the family scorpaenidae, the perch has a unique reproductive adaptation in that fecundity has been reduced in favor of ovoviviparous reproduction or the spawning of larvae as opposed to eggs (Gunderson, 1971). The migratory circuit for the species corresponds, with slight modifications, to the three-part circuit proposed by Jones (1968). An important feature of the life history of this species is the segregation of juveniles, once metamorphosis has been reached, from adult perch as well as from the adults of other species. Upon recruitment the juveniles move into deeper waters of the continental shelf and slope and take up the adult migratory circuit. The segregation of juvenile perch to shallow inshore waters and bays may be an adaptation for survival in that the opportunity for cannibalism is reduced.

Due to extensive migrations by adults, larval drift, and related movements, this species is faced with many of the same mortality factors experienced by other species. In the unexploited state up to the 1950s,' the Pacific ocean perch was probably at the level of maximum abundance and distribution in the Gulf of Alaska. At this point the population was close to or at the carrying capacity of the environment and was stable in terms of its ability to compensate for cyclical fluctuations in mortality factors. Fluctuations experienced to this time were environmentally induced (Quast, 1972). At this time the total biomass of Pacific ocean perch in North American waters was in the range of $1,250 \times 10^3$ MT to $1,590 \times 10^3$ MT, a high fraction of which was present in the Gulf of Alaska. This species was probably the dominant demersal species in the region.

An important characteristic from the standpoint of the population dynamics of the species is that it is slow growing, has considerable longevity (30 years), and matures slowly. A characteristic of commercial significance is that adult perch form dense schools which rise up off the bottom and are easily accessible to trawls (Quast, 1972). Another characteristic of the species is the periodic appearance of extreme variations in year-class strength, including the failure of individual year-classes (Carlson, et al., 1976), In short, despite the initial abundance of this species, a combination of environmental , vertical distribution, and population dynamics factors had the combined effect of making the perch particularly vulnerable to unregulated fishing.

According to the reasoning of Alverson and Pereyra (1969), a population such as the Pacific ocean perch is at the level of maximum sustainable yield when the annual commercial harvest is approximately one-half of natural mortality in the unexploited state. The computed maximum sustainable commercial yie d for the region off western North America including the Gulf of Alaska s in the range of 125,000 to 250,000 MT (138 x' 10^3 to 276 x 10^3 tons) per year. Comparison with actual catch statistics indicate that the reproductive potential of the species was exceeded by substantial margins and that the current low levels of abundance are due, in part, to the stress of overfishing. A number of factors have contributed to the decline of the species until now it is present at levels of abundance which are small fractions of the species' original abundance in the Gulf of Alaska and other regions (Quast, 1972).

A complicating factor in the future recovery of perch stocks is the advent of the pollock in the Gulf of Alaska. Another is that recovery will be slowed or halted by the incidental catch of juvenile and adult perch in other fisheries, thus suggesting that natality may lag progressively

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further behind mortality as the population ages. The ecosystem present in the Gulf of Alaska may be one in which another example of alternating dominance is in operation. The juveniles of pollock and perch are in approximately the same trophic position but with the pollock maturing at an earlier age and probably out-competing the perch for food resources in the northern part of the species' range. Quast (1972) makes the prediction that decades may be required for even moderate recovery.

Summary

Trend: Decline

Cause: Overfishing by foreign fleets coupled with changes in the biotic and abiotic environments.

KING CRAB

Life History

Taxonomy.

King crabs are anomuran crabs of the superfamily Pagur·dea found throughout the circum-arctic region of North America. Eldr·dge (1972) has described their taxonomy as follows:

Order:	Decapoda
Section:	Anomura
Superfamily;	Paguridea
Family:	Lithodidae
Sub-family:	Lithodinae
Genus:	Paralithodes

Of the three species found in Alaskan waters, "red" king crab (Paralithodes camtschatica) are the most abundant and commercially valuable. Although "blue" king crab (Paralithodes platypus) are not as abundant, they are morphologically similar to Paralithodes camtschatica. The Japanese have developed a modest fishery for this species in the Pribilof Island region of the Bering Sea. "Brown" or "golden" king crab (Lithodes aequispina) are found in the deeper waters 183 to 366 m (100 to 200 fathoms) of Southeastern Alaska. The Japanese refer to the king crab as "tarabagani" whereas the Russians label is "Kamchatka" crab. Americans usually reserve the name "king crab" for Paralithodes camtschatica. The term "king crab" will refer to Paralithodes camtschatica for the remainder of this section.

Distribution.

King crab are abundant on both sides of the North Pacific Ocean. In Asian waters, they are found from the Sea of Japan northward into the Sea of Okhotsk and along the shores of the Kamchatka Peninsula; the northern limit on the Asiatic coast and have been reported at Cape Olyutorskiy (60°N latitude). The species occurs throughout the Aleutian Islands and the southeastern Bering Sea where large fisheries exist. On the western coast of North America, the northern limit for king crab appears to be Norton Sound (65°N latitude) in the northeastern Bering Sea. King crab are also abundant in the Gulf of Alaska where major fisheries for them exist in Cook Inlet, Kodiak Island and the south Alaska Peninsula. Moderate numbers of king crab are found in Prince William Sound and Southeastern Alaska. The southern limit of this species in the northeastern Pacific appears to be Vancouver Island, British Columbia (Butler and Hart, 1962).

During various life stages, king crab segregate from one another. In particular, males are separate from females except during the mating season and, in general, adults appear to inhabit different areas from those frequented by juveniles. Male king crab also may school by size.

King crab are distributed to depths of 370 m (1,200 feet), although' the commercial fishery is generally confined to depths less than 180 m (600 feet). Females and smaller males appear to be most abundant in intermediate depths. Juveniles are most abundant in inshore waters and in relatively shallow waters, although they have been found to depths of 106 m (58 fathoms) (Powell and Reynolds, 1965).

The favorite bottom habitat of king crab appears to be mud or sand. King crab are stenohaline and adapted to cold waters.

<u>Maturity.</u>

King crab of both sexes reach sexual maturity when their carapace (back) length is approximately 100 mm (3.9 inches), or at an age of about five years. All females participate in breeding shortly after attaining sexual maturity. However, it appears that few males less than 120 mm in carapace length mate, possibly due to competition from larger males.

Mating.

King crab follow distinct annual migration patterns associated with their mating season. During winter months they migrate to water depths of less than 91 m (50 fathoms) along the shoreline and onto the offshore ocean banks. Young adults precede old adults; males precede females (Powell and Nickerson, 1965). Females molt and mate from February through May. Females normally, but not necessarily, molt while being grasped by the male. The precopulatory embrace (grasping) is an intrinsic behavior of adult king crab which serves to keep breeding adults together until subsequent mating has occurred. It additionally affords a protective mate to the female before and during the molt, and aides the female in molting.

Immediately after the female molts, the attendant male deposits spermatophore material around the female's gonopores and releases her. The female then ovulates into her abdominal pouch where eggs mix with the sperm mass and are fertilized. Fertile eggs are carried by the female for 11 to 12 months, hatching prior to the female's next annual molt. Female king crab not mating after molting will not extrude eggs.

Female king crab mate with only one male annually. Male king crab are polygamous.

Fecundity.

The number of eggs each female carries varies with her size. Female king crab in Asiatic waters apparently carry less eggs than their counterparts in the northeastern Pacific. In this regard, Nakazawa (1912) reported that females in Japanese waters could carry as many as 345,000 eggs, while the average female carried approximately 220,000 eggs. A later study (Sate, 1958) found that the number of eggs carried by females in Japanese waters varied between 15,000 and 204,000, with a mean of 102,000 eggs, At Kodiak, small females have been reported to carry between 50,000 and 100,000 eggs, with large females carrying as many as 400,000 eggs.

Eggs and Larvae.

The embryos develop into pre-zoea after about five months' growth and remain in this state while they are carried by the female. During this period, the embryos within the eggs become well developed and are easily visible. During hatching, which occurs between March and June, all of the eggs carried by an individual will hatch in about a five-day period. After hatching, the pre-zoea larva molts and assumes the first zoeal stage. During the pelagic phase, the larvae are active swimmers and feed primarily on diatoms. After the fifth molt, the larvae assume a benthic, or bottom, existence as glaucothoe larvae. In the next molt, which occurs during the first summer of life, they assume the first adult form.

Juveniles.

During their first year of life, the juveniles assume a solitary, benthic existence. Larvae are quite abundant in waters close to shore in the Gulf of Alaska. In the Bering Sea large concentrations of juveniles have been found in depths of 53 m (29 fathoms).

Two-year-old king crab are known to aggregate in large groups, commonly piling upon one another and moving as a conglomerate. The practice is known as "podding" and is a social behavior which affords the crab protection from predators. Aggregates, although constantly changing, are maintained by both sexes until they attain sexual maturity. At that point, the crab segregate by sex and size.

Sculpins, cod, and halibut have been reported to prey on juvenile king crab. In addition, Gray (1964a) has reported that halibut prey on king crab when they are in the soft-shell condition. Evidence suggests that once king crab attain sexual maturity, they are relatively immune to predation, except during the molting phase.

Growth.

During each of the first several years of the king crab's life, growth is rapid, and it molts or sheds the hard outer. shell several times in order to accommodate the increased body size. At the time of molting, the crab sheds the carapace, eyes, antennae, mouth, esophagus, stomach, calcerous teeth, gills, and tendons. In other words, the entire outer body covering is molted. Juvenile male and female crab steadily increase in carapace length at a rate of 24 and 23 percent per molt, respectively, (Powell, 1967) until reaching sexual maturity.

After reaching sexual maturity, growth rates and molt frequency for male and female crab differentiate. Adult females molt annually and average four mm per molt. Adult males molt annually through the eighth year and average 20 mm per molt. After eight years, an increasing proportion molt biennially. A few male crab molt less frequently than biennially. Maximum size is reached at an average of 14 years of age. Growth rate for males decreases slightly following the eighth year.

Food Habits.

King crab are omnivorous during both the juvenile and adult stages of life. In a study of food items found in the stomachs of king crab in the Bering Sea, the following occurred (in descending order of frequency):

Mollusca (clams, etc.), Polychaeta (marine worms), algae (marine plants), other crustacea, and Coelenterates (jellyfish). Other food organisms found less frequently were foraminiferans, nematode worms, tunicates, echiuroids, and fish (McLaughlin and Hebard, 1959).

Diseases.

Sindermann (1970) has reported that P. camtschatica and P. platypus from the eastern north Pacific are occasionally affected by "rust disease", which seems to result from the action of chitin-destroying bacteria of the exoskeleton. However, this disease appears to be relatively rare. Sinderman (1 970) has also reported that P. platypus from Alaskan waters are occasionally invaded by rhizcephalans.

The preceding description of the life history of king crab was provided by: McClean, R. F., et al., 1977.

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Sindermann, C. J. 1970. Principal diseases of marine fish and shellfish. Acad. Press, New York. 369 p.

Harvesting Season

The king crab harvest following a period of extensive harvests suffered a number of reversals in the period 1966-71. Refinement of management techniques has facilitated a slow recovery beginning in 1972. Current management is aimed at expanding the age structure available for harvest rather than a harvest limited to recruit crabs only. The commercial season for this species faces a number of restraints, some climatic, but most noteworthy, detailed regional management plans regulating the harvest along a number of parameters. This regulation, indicated on the following map, includes opening dates, species quotas, males only, minimum carapace size, among other considerations. The fishery for this species is a part-year operation only, with crews and vessels moving to other crabbing grounds under the control of strict regulations, or moving to entirely different species. Product quality is not a major restraining factor throughout most of the legal season provided that vessels are provided with adequate live tanks. Product quality would, however, be a constraint if it were not for management regulations which prohibit fishing during the mating season. Despite the fact that the quality of the meat is not affected, soft shelled crabs are generally not marketable.

The so-called optimal fishery for this species would occur after the completion of spawning migrations and the annual molt. Concentrations of adults would be of considerable density at this time and would occur at relatively shallow depths. Inclement weather would be a serious constraining factor during this time.

Causes of Fluctuations in Resource Abundance

Summary

Trend: Stabilization by management practices in most areas following period of precipitous decline.

Cause: Decline a result of recruitment overfishing; stabilization due to establishment of multiple year-classes in adult population.

TANNER CRAB

Life History

Taxonomy.

Tanner crab are members of the brachyuran crab of the superfamily Oxyrhycha found throughout the circum-arctic region of North America. Garth (1958) has described their taxonomy as follows:

Order:	Decapoda
Section:	Brachyura
Superfamily:	Oxyrhyncha
Family:	Majidae
Sub-family:	Oregoniinae
Genus:	Chionoecetes

The genus of Chionoecetes may actually consist of two polytypic species, C. opilio and C. angulatus. C. opilio may have given rise to C. opilio elongatus and C. bairdi, while C. angulatus may have given rise to C. tanneri and C. japonicus (Garth, 1958). All of these species are present in the North Pacific.

Crabs of the genus Chionoecetes have been referred to as "spider", "Tanner" and "snow crab" in English literature. In Japanese literature, this genus is referred to as zuwai crabs. In an attempt to capitalize on the excellent reputation of the king crab, American processors initially attempted to sell Tanner crab under the trade name "Queen Crab." However, the U.S. Food and Drug Administration has since ruled that "Snow Crab" will be the official trade name for the Tanner crab. In common usage, Tanner crab has become the accepted name for the genus.

Distribution.

Tanner crab belong to the sub-family Oregoniinae, which has a circum-arctic distribution extending into the temperate waters on the east and

Maturity.

Due to the difficulty of aging crustaceans, the age at which Tanner crab reach sexual maturity is not known with certainty, although the size at maturity is known for most species. Alaska Department of Fish and Game Tanner crab research has determined that the average male *C. bairdi* reaches maturity at 110 mm carapace width. The same research puts the size of 50 percent maturity for female *C. bairdi* at 83 mm (Donaldson, 1975). Studies conducted in the Sea of Japan indicate that *C. opilio* reach sexual maturity after about the tenth molt, or six to eight years after hatching. Male and female *C. opilio* in Japanese waters reach sexual maturity at a size of approximately 50 to 65 mm in carapace width (Ito, 1970). Female *C. tanneri* off the Oregon coast reach sexual maturity at 75 to 126 mm in carapace width, while male *C. tanneri* mature at 103 to 181 mm in carapace width (Pereya, 1966).

Mating.

As a genus, Tanner crab appear to be polygamous. Initial mating is believed to take place in the spring or early summer shortly after the female has molted and grown to maturity. Some evidence is available which suggests that, unlike king crab females, Tanner crab females are capable of breeding while hard-shelled. Hartnoll (1969) contends that only hard-shelled male Tanner crab are successful at mating. Female Tanner crab are apparently capable of producing more than one hatch of fertile eggs from one mating (Matson, 1970; Bright, 1967).

Fecundity.

The number of eggs produced by female Tanner crab is extremely varied. The range of 24,000 to 318,000 eggs Per female C. bairdi (Hilsinger, 1975) compares with 20,000 to 140,000 and 6,000 to 130,000 eggs per female C. opilio in Canada (Watson, 1969) and Japan (Ito, 1963), respectively. The large egg number variation exists between females of both varying and similar sizes. Some of this variation can be accounted for by a decrease in clutch size in very old animals.

Eggs and Larvae.

After mating, the female lays a clutch of bright orange eggs. The eggs are attached to pleopods under the female's abdomen and are carried for approximately twelve months before hatching. A steady loss of eggs following fertilization has been documented for C. bairdi (Hilsinger, 1975) and C. opilio (Ken, 1974). The total loss may amount to as much as 45 percent. The decrease in egg number is attributed to death and disintegration of abnormal embryos and predation. Hatching of the eggs (larval release) appears to coincide with the plankton blooms. The free-swimming larvae molt and grow through several distinct stages before settling to the bottom as juveniles where they cover themselves with debris and begin feeding on detritus. The growth rate from larval to juvenile stage is dependent upon water temperature, with warmer temperatures producing faster growth. At water temperatures of 11° to 13°C, the free-swimming developmental period between the larval and juvenile stages may last approximately 63 to 66 days (Ken, 1970).

Plankton studies in the Sea of Japan indicate that free-swimming larvae of Tanner crab underto diurnal vertical migrations. This migration is a feeding response to the diurnal movements of plankton blooms.

Juveniles.

There is very little published material concerning the habitat and distribution of juvenile Tanner crab. Exploratory work in the Japan Sea indicates that juveniles settle along the sea bottom at depths ranging between 298 and 349 m (163 and 191 fathoms) (Ito, 1968). Alaska Department of Fish and Game biologists in Kodiak have collected juvenile C. bairdi as small as 6.5mm in 18.3 m (10 fathoms). The National Marine Fisheries Service has records of juvenile Tanner crab as small as 12 mm caught in shrimp trawls off Kodiak in 55 to 146m (30 to 80 fathoms). This information suggests that distribution of juvenile Tanner crab is widespread and not depth dependent. The actual diet of the juveniles is uncertain, but they are believed to feed primarily on dead and decaying molluscs and crustaceans which accumulate in the detritus along the sea floor. Fish remains and small planktonic organisms are also ingested to a limited degree.

Adults .

Adult Tanner crab are into' erant and restricted in their distribution by low salinities and high temperatures. Laboratory experiments in Canada have demonstrated that C. opilio will die within 24 hours if kept in salinities less than 22.5°/oo (anonymous, 1971). At a salinity of approximately 31°/00 to 32°/oo, McLeese (1968) determined that C. opilio reached the 50°/00 mortality point after 18.8 days when held at 16°C. Thus, it is reasonable to expect that the southern range of Tanner crab distribution may be limited if water temperatures exceed 16°C.

Adult Tanner crab appear to have few predators, although it is likely that during molting they may be vulnerable to large fish and perhaps other large crustaceans such as the king crab. In addition to predation, it is speculated that king and Tanner crab may compete for food and space. The concept of competition between the king and Tanner crab is interesting in that it poses the question of whether the populations of Tanner crab are affected by the abundance of king crab. In this regard, the depletion of the larger male king crab by the present intensive fishery might have a favorable effect on the abundance of Tanner crab.

Growth .

Dimensional growth occurs in Tanner crab when the hard exoskeleton is periodically cast off or molted. The animal is then able to take water into its tissues and increase in size before the rehardening occurs. Male and female crab display similar growth rates and molt frequently prior to reaching sexual maturity. Males continue to molt after becoming sexually mature, but the intervals between molts increase with age. Female crab normally do not molt after reaching sexual maturity. In females, the molt to maturity is considered the terminal molt. Growth may vary from one geographic location to another. The maximum age of Tanner crab is probably 8 to 12 years, although this is not known with certainty.

Diseases.

Brown (1971) reported a black encrustment on the carapace which has been labeled “shell syndrome.” The meat of the crab is not affected by the “syndrome,” but it may cause mortality in individuals which have undergone their terminal molt due to disablement of the mouth parts and eyes. There is some evidence that the indiscriminate dumping of wastes from crab processing plants may be a factor contributing to the spread of the disease.

Gordon (1966) reported that some polyclad Turbellaria are ectoparasitic on crab. Specifically, *Coleophora chionoecetes* has been found on the eggs of Tanner crab.

Oka (1927) reported that the leech, *Carcinobdella kanibir*, is occasionally found on *C. opilio* in Asiatic waters.

Migration and Local Movement.

Little is known concerning the migrations and local movements of Tanner crab. However, tagging studies conducted by Canadian scientists (Watson, 1970) indicated that tagged male crab travel relatively little, with 85 percent of the returns recaptured within 16 km (10 miles) of the release point. The farthest recapture in the study was a male that traveled 45 km (28 miles). A limited tagging experiment in Auke Bay, A"laska, concluded that Tanner crab may return to a "home" area to mate and molt each year (anonymous, 1971).

Numerous trawl surveys conducted in the Gulf of Alaska and the Bering Sea indicate that Tanner crab are more concentrated in some areas than others. These data indicate that Tanner crab may school, but further work is needed for clarification.

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Harvesting Season

The current Tanner crab catch, particularly at Kodiak, exceeds that of the king crab. Earlier processing difficulties involving the removal of meat from the carapace of the tanner crab has been solved and product quality and acceptance, though somewhat below that of king crab, remains adequate throughout the legal season. The fishery for the Tanner crab is a males only operation similar in most regards to that of the king crab but is not as stringently regulated. The temporary decline of the king crab harvest has prompted the increased pressure on this species and is probably responsible for the initiation of the Tanner crab industry. The nature of the Tanner crab fishery will undoubtedly remain closely coupled to that of the king crab. Current catch levels of the Tanner crab remain well below the MSY's for this species in most areas. The optimal fishery for Tanner crab would be similar to that described for the king crab.

Causes of Fluctuation in Resource Abundance

Summary

Trend: Continued increase in commercial harvest.

Cause: Expansion of industry into previously unfished waters; information on population dynamics of species largely absent.

Development and Market Structure

The development and market structure of the Alaskan Tanner crab fishery is similar to that of the king crab; for that reason, they are presented together in the king crab sub-chapter.

DUNGENESS CRAB

Life History

Taxonomy.

Dungeness crab, Cancer magister, are members of the brachyuran crabs of the family Cancridae. Mayer (1972) described their taxonomy as follows:

Phylum:	Arthropoda
Class:	Crustacea
Superorder:	Eucarida
Order:	Decapoda
Suborder:	Brachyura
Family:	Cancridae
Genus:	Cancer
Genotype:	Cancer magister (Dana, 1852)

Crab of the species Cancer magister have been referred to as "market crab", "common edible crab", "Pacific edible crab", "commercial crab", "Dungeness crab", and "Dungeoness crab". At present, "Dungeness crab" is the accepted common name.

Distribution.

Dungeness crab are found in the shallow, nearshore waters of the North Pacific along the western North American coast. They range from a northern limit of Unalaska to a southern limit in Monterey Bay, California (McKay, 1943), Crab inhabit bays, estuaries and open ocean near the coast from the intertidal zone to depths of approximately 90 m (50 fathoms). Favored substrate is a sand or sand-mud bottom, although Dungeness crab may be found on almost any bottom substrate. Unlike king and Tanner crab, Dungeness crab inhabit shallow water most of the year. Juveniles are commonly associated with stands of eelgrass or, in the absence of eelgrass, with masses of detached algae, which are believed to afford them protection (But' er, 1956).

Water temperatures and salinity appear to be contro'ling factors in the seasonal distribution of Dungeness crab. Studies by Cleaver (1949) indicate that crab abundance, as estimated from catch per unit effort data, increases with rising spring water temperatures and decreases with dropping fall temperatures. Changes in winter catch appear to be in response to fluctuating low salinities. McKay (1942) determined that adult Dungeness crab migrate offshore during the winter and return to the nearshore in the early spring and summer.

Sexuality.

Dungeness crab are heterosexual and sexually dimorphic. There is considerable variation in morphology between male and female crab, with males being significantly larger than females. Adult ma"les have an acute and narrow abdomen, while adult females have a round and broad abdomen.

Maturity.

According to Butler (1960), male Dungeness crab from the Queen Charlotte Islands, British Columbia, reach sexual maturity at a carapace width of 110 mm, or at about three years of age. He found, however, that sexual activity was not appreciable until the crab obtained a carapace width of 140 mm. McKay (1942) found by examination of gonads that male crab matured at a carapace width of about 137 mm.

Butler (1960) found mature female Dungeness crab with a carapace width of 100 mm which were approximately two years old. Weymouth and McKay (1936) also determined that female crab reach sexual maturity at about 100 mm carapace width.

Mating. 1

The mating of Dungeness crab, as observed in aquaria, has been reported by Cleaver (1949), Butler (1960) and Snow and Nielsen (1966). No observations made under natural conditions have been reported. Crab copulate only after the female has recently molted. Snow and Nielsen (1966) found that within one hour and 32 minutes after the female has molted, copulation took place.

Fecundity.

McKay (1942) found that a single egg mass contained, 1,500,000 eggs and speculated that a single female Dungeness crab may spawn three to five million eggs during a lifetime.

Eggs and Larvae.

After mating, the female's oviduct is closed by a secretion which hardens in contact with sea water. The spermatozoa are sealed in the oviduct where they remain viable for several months. Upon extrusion, the eggs are fertilized (McKay, 1942). Egg-bearing occurs during October to June in, British Columbia. Larvae emerge from the egg masses between December and April in Oregon waters (Reed, 1969). Egg-and larvae development is dependent upon water temperature, with warmer temperatures producing faster growth. In California waters, Poole (1966) determined that the developmental period between egg and juvenile may last 128 to 158 days.

Predation and cannibalism are major causes of mortality among larval Dungeness crab. Heg and Van Hyning (1951) found the larvae of C. magister as prey items in stomachs of chinook and silver salmon taken along the ' Oregon coast. McKay (1942) cites observations of C. magister larvae commonly found in the stomachs of salmon, herring and pilchard.

Reed (1969) investigated the effects of temperature and salinity on the growth of laboratory-reared C. magister larvae. He found that optimum ranges of temperature and salinity for _C. magister_ larvae are 10.0" to 13.9°C and 25°/oo to 35°/00, respectively.

Juveniles.

Juvenile Dungeness crab are commonly associated with stands of eelgrass or, in the absence of eelgrass, with masses of detached algae, which are believed to afford them protection from predation (Butler, 1956). Butler (1954) reports the common occurrence of juvenile crab, about three-eighths of an inch, in the stomachs of adult crab.

The diet of juveniles is assumed to be similar to that of adults, with crustaceans and molluscs accounting for the principal food items.

Growth during the juvenile stage is fairly rapid, with crab reaching their eleventh or twelfth molt by age two.

Adu? ts .

After reaching sexual maturity at two to three years of age, Dungeness crab continue to grow, with males obtaining their maximum size at age five. Female growth is similar to that of the male Dungeness crab during the first two years of life, but decreases afterward (Butler, 1961). Butler (1960) concluded that the maximum age for _C. magister_ is eight years. McKay and Weymouth (?935) felt that the maximum age was not more than ten years, with the average life expectancy being eight years.

The diet of adult Dungeness crab is varied, consisting primarily of other crustaceans, molluscs, worms and occasionally seaweed (McKay, 1942). The cannibalism of juvenile and larval crab by adults is reported by Butler (1954).

Temperature tolerance for adult *C. magister* in Puget Sound, Washington, has been reported by Stober, Mayer and Salo (1971). In general, no mortality was observed at temperatures below 24°C

Adult Dungeness crab are subjected to heavy predation, particularly while in the soft-shelled condition fol owing a molt. Waldron (1958) found ling cod, the great marbeled sculpin, wolf-eels, halibut, octopus and some rockfish to be voracious predators upon adult *C. magister*. Predation is particularly heavy on small, immature crab, but is not exclusive of adults, McMynn (1951) observed two *C. magister*, which were 114 mm wide, and four smaller crab in the stomach of one rockfish.

Diseases.

A "black spot" or "rust spot" is occasionally found on the legs of Dungeness crab. Although no discussion of this disease was found in the literature, it may be similar to the chitininvrous bacteria-caused disease described for the European Dungeness crab, *C. pagurus* (Sinderman, 1970).

The occurrence of a species of worm adhering to the carapace and among the egg masses was reported by McKay (1942). Sinderman believes the worms to have been a marine leech.

Migration and Local Movement.

Little is known concerning the migrations and local movements of Dungeness crab. However, Cleaver (1949) has divided the migration of *C. magister* nto two types: (1) the onshore-offshore movements, and (2) coastwise Cleaver concluded that adult crab migrate offshore during the winter months and return to the nearshore in the early spring and summer. This seasonal migration is apparently in response to seasona changes in water temperatures. Furthermore, Cleaver observed that crab which were tagged in early winter moved northward with the approach of summer. Although he had no evidence of a return migration, he believed that one might exist in the deeper waters. Presumably, these migrations may also be in response to seasonal changes in water temperature.

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Harvesting Season

The Dungeness crab goes through seasonal movements opposite those of the king crab. Warming water temperatures cause the Dungeness crab to move into shallower waters of inshore areas, particularly into water masses with temperatures within the optimal range of 10 to 14°C and with a bottom of firm sand or mixed-sand. The fishery for the Dungeness crab as employed in Alaska occurs in water depths of 9 to 37 m (5 to 20 fathoms) and is timed to coincide with seasonal inshore movements. Cooling surface temperatures initiate the offshore movement of this crab to deeper waters. This event marks the cessation of most commercial operations with the effective (legal) season in Kodiak waters north of the latitude of Boot Bay extending from May 1 through December 31. Early June through mid-September generally marks the most active portion of the legal season. This latter time period also coincides with that of the optimal fishery for this species.

The quality of Dungeness crab meat generally remains high throughout the regulated season. For most areas the annual molt occurs during the late-summer to winter period and the resulting "soft-shell" crab are not marketable. In more southern fisheries the appearance of crab with soft shells usually mark a temporary end to the season. The current Gulf of Alaska Dungeness crab fishery is exploiting primarily a single age-class, making the fishery subject to fluctuations of considerable amplitude due to recruitment alterations. The decline of Oregon and Washington Dungeness crab populations might be expected to put further strain on the Gulf of Alaska crab by increasing demand.

Causes of Fluctuations in Resource Abundance

Summary

Trend: Decline in most areas.

Causes: Reduction in average size of adults from several areas suggestive of recruitment overfishing; possibility exists that environmental change has resulted in weak year-classes; population dynamics information largely absent.

SHRIMP

Life History

Commercial catches of shrimp in the north Pacific Ocean are made up of three families: Crangonidae, Hippolytidae and Pandalidae. The first species exploited by the west coast shrimp fisheries were members of the family Crangonidae in intertidal areas. Now, however, members of the Crangonidae and Hippolytidae are considered of little commercial value and are only taken incidentally in catches of Pandalidae. Consequently, this life history report will consider only the pandalid shrimps.

Taxonomy.

Fox (1972) defines the suprafamilial taxonomic relationships of the family Pandalidae as follows:

Phylum:	Arthropoda
Class:	Crustacea
Subclass:	Malacostraca
Order:	Decapoda
Suborder:	Natantia
Section:	Caridea
Family:	Pandalidae

Rathbun (1904) lists 14 species of pandalid shrimps found off the northwestern coast of North America which are divided between the two genera Pandalus and Pandalopsis. They are as follows:

Pandalus borealis*	Kroyer
Pandalus danae	Stimpson
Pandalus goniurus*	Stimpson
Pandalus gruneyi	Stimpson
Pandalus hypsinotus*	Brandt
Pandalus jordani	Rathbun
Pandalus leptocerus	Smith
Pandalus montagui tridens	Rathbun
Pandalus platyceros*	Brandt
Pandalus stenolepsis	Rathbun

Pandalopsis aleutica	Rathbun
Pandalopsis ampla	Bate
Pandalopsis dispar*	Rathbun
Pandalopsis longirostris	Rathbun

Only five, identified by asterisk above, of the 14 species are caught by commercial fisheries in significant quantities in Alaskan waters. The remainder of this life history report will be devoted entirely to these five species.

Distribution.

Shrimps of the family Pandalidae are found throughout the higher temperate and boreal latitudes of the world, with centers of concentration varying with the species. In the northeastern Pacific, shrimp are distributed in bays and on offshore banks. Their range extends from the Bering Sea to southern California with commercial fisheries occuring off every Pacific state. Specific distribution data for the five major shrimp species found in Alaskan waters is given as follows:

The northern pink shrimp, Pandalus borealis, has been found from the Bering Sea southward to the Columbia River in depths of 18 to 640 m (10 to 350 fathoms). It is the most abundant shrimp in the north Pacific Ocean and Bering Sea. The greatest concentrations occur from the southeastern tip of the Kenai Peninsula, Kodiak and Shumagin Island groups and along the south side of the Alaska Peninsula west to Unalaska Island. Small concentrations also occur along the eastern Kenai Peninsula, portions of Prince William Sound, Yakutat Bay and throughout southeastern Alaska. Optimum depth where the greatest commercial catches may be taken varies somewhat by area but is generally between 55 and 180 m (30 and 100 fathoms) (Rathjen and Yesaki , 1966) .

The "bumpy" shrimp, Pandalus goniurus, has been caught from the Arctic coast of Alaska southward to Puget Sound, Washington, in depths of 5.5 to 180 m (3 to 100 fathoms) (Rathjen and Yesaki, 1966). The greatest concentrations are off southeastern Kodiak Island and in the Shumagin Islands. Although overlapping in distribution, the "bumpy" shrimp is not as abundant as the northern pink shrimp.

The coonstripe shrimp, Pandalus hypsinotus, has been found from the Bering Sea to the Strait of Juan de Fuca in depths of 5.5 to 180 m (3 to 100 fathoms), very similar in range to that of the "bumpy" shrimp (Fox, 1972). High concentrations occur off Kodiak Island and in the Shumagin Islands. Coonstripe shrimp comprise a relatively small portion of the commercial catch, largely since they inhabit depths and bottom types that are seldom trawled. A small directed fishery for this species occurs in Kachemak Bay on the Kenai Peninsula Coonstripe are often taken incidentally to pot fisheries for spot shrimp. The largest prawn size individuals are commonly retained and sold.

The spot shrimp, Pandalus platyceros, has been reported from Unalaska Island to San Diego, California, in depths of 3.7 to 487 m (2 to 266 fathoms) (Fox, 1972), While the other pandalid shrimps are generally found in areas suitable for trawling, P. playtceros is found in rocky areas unsuitable for trawling. Consequently, areas of major concentration are not well known. Ronholt (1963) reported small quantities taken off Lapush, Washington, and in southeastern Alaska. In addition, pot fisheries are located in the Puget Sound-Vancouver Island area (Butler, 1964) and in scattered areas off central Alaska, principally Kachemak Bay (Barr, 1970a). There are indications from small commercial ventures that Kodiak Island and Alaska Peninsula waters may contain stocks as large or larger than those in other Alaskan waters (McCrary, 1977, personal communications).

The sidestripe shrimp, *Pandalopsis dispar*, is distributed from the Bering Sea, west of the Pribilof Islands, southward to Manhattan Beach, Oregon, in depths ranging from 37 to 642 m (20 to 351 fathoms) (Fox, 1972). Next to the northern pink shrimp, it is the most abundant shrimp taken commercially in the north Pacific Ocean. The greatest concentrations occur off Kodiak Island and in the Shumagin Islands. The greatest concentrations of sidestripe shrimp are found somewhat deeper than northern pink shrimp, generally from 110 to 219 m (60 to 120 fathoms) (Ronholt, 1963).

Most pandalid shrimps are found on mud or sand and mud-mixed bottoms. However, they are not found in all areas where these types of bottoms occur. References to green mud bottoms in relation to large concentrations of the northern pink shrimp, *P. borealis*, and the ocean pink shrimp, *P. jordani*, have been made by many authors who infer that the organic content of the bottom is more important in determining distribution than bottom consistency. It should be noted, however, that most sampling has been conducted with trawls which work well only on the type of bottom described above. It is, therefore, inconclusive whether or not many pandalid shrimp concentrate on harder or rockier bottoms. *P. platyceros* and, to a lesser extent, *P. hypsinotus* are known to. perfer coarse, rocky and coral-covered bottoms (Fox, 1972).

Sexuality.

The reproductive life history of pandalid shrimps is rather unique among shellfish. Although reproduction is bisexual, pandalid shrimps exhibit protandric hermaphroditism.

Pandalid shrimps, to a large extent, mature first as males and then later in the life cycle transform into functional females. The morphological changes that accompany sex change usually occur within six to eight months. Individuals who the previous year spawned as a male will spawn the current year as a female. Once an individual has become a female, it remains so throughout the rest of its life.

The literature contains reports on a phenomenon called "primary" females. Primary females may be defined as those individuals who never function as males or, more strictly, as those individuals who mature directly as females, never being hermaphrodites. Dahlstrom (1970) reported primary females in P. jordani off northern California, a few were found by Tegelberg and Smith (1957) off Washington and 47 of a sample by Butler (1964) off British Columbia were primary females. The production of early maturing (or primary) females may be environmentally related or may be a density dependent phenomenon. At any rate, the early maturation of females is a survival adaptation beneficial to the population. Primary females have also been noted in P. borealis and P. hypsinotus in British Columbia (Butler, 1964). Primary females have not been positively documented in Alaskan pandalid shrimp populations, and it is strongly indicated that their occurrence is rare.

A far more important sexual variation is that known as secondary female development. In this instance, male characteristics develop but are repressed before maturity. Sexual maturity and functioning for the remainder of life is as a female. Secondary females are common in southeastern Alaska populations of P. borealis, goniurus and hypsinotus but have not positively been shown to occur in other Alaskan areas. McCrary (1977, personal communication) found some populations of females, especially P. borealis and goniurus, to be comprised of over half secondary females. Numerous authors have reported similar findings for P. jordani off the lower west coast states and British Columbia.

Maturity.

The age at sexual maturity varies with the species and by geographical location within a species. The normal situation for pandalid shrimps is that they are protandric hermaphrodites, maturing first as males and then later transforming into functional females. P. danae and P. goniurus apparently mature as males during their first autumn and function again as males at 1 1/2 years in British Columbia (Butler, 1964). The age at first maturity as males is 1 1/2 years for P. borealis, P. hypsinotus, P. jordani, P. platyceros and Pandalopsis dispar (Butler, 1964; and Dahlstrom, 1970). Ivanov (1964a) estimates that P. boraelis in the Pribilof Islands area of the Bering Sea do not mature as males until 2 1/2 years. McCrary (1971, personal communication) found the same to be true for P. borealis, Pandalopsis dispar and, to a lesser extent, P. goniurus and P. hypsinotus in Kodiak and Shumagin Island waters. The same author also found these pandalids and P. platyceros to mature at 1 1/2 years in certain southeastern Alaska populations.

The age at transition to functional female also varies with the species and by geographical location within the species. By and large, most shrimp function two years as a male before transforming to a female.

W "

During summer and early fall eggs ripen in the ovaries of the females and the forming eggs may be seen as a greenish, blueish or yellowish-brown mass, depending on species, lying dorso-laterally under the carapace. Breeding and egg deposition occur from late September through mid-November. The male attaches a sperm mass to the underside of a female between the last two pairs of pereiopods (walking legs). This usually occurs within 36 hours after the female molts into breeding dress (Needler, 1931). Fertilization and oviposition occur as the eggs stream from the oviducts over the sperm masses and become attached to the forward four pairs of pleopods (abdominal appendages) and abdominal segments.

Fecundity.

Pandalid shrimps have a high fecundity. The number of eggs per clutch ranges from 500 to 2,500 for P. jordani and P. borealis (Dahlstrom, 1970). McCrary (personal communication or unpublished ADF&G data) found 626 specimens of P. borealis to carry egg clutches ranging from 478 to 2117. In southeastern Alaska, the same author found full clutch sizes of P. borealis to range from 809-1642' (N=21); P. dispar 674-1454 (N=21); P. goniurus 97?-3383 (N= 11); P. hypsinotus 1083-4528 (N=25); and P. platyceros 4044-4528 (N=2). The number of eggs extruded is positively correlated with the size of the shrimp.

Eggs arid Larvae.

Females carry their eggs externally for about five to six months until hatching. Hatching-occurs mainly from March through April for P. borealis. P. dispar, however, often have ovigerous periods which overlap in the June-July period, meaning that the latest hatchers are present at the same time as the earliest egg layers (McCrary, 1977, personal communication). The lengths of spawning, carrying, and hatching periods vary inversely with the water temperature, at least for P. borealis (Haynes and Wigley, 1969). In laboratory studies, Berkeley (1930) found that most larvae hatch at night during periods of vigorous pleopod movement by the female. Hatching an entire clutch of eggs may take as long as two days. The larvae remain planktonic for about two to three months, passing through six stages to become juveniles, and then settle, taking up a benthonic existence like the adults (Berkeley, 1930).

Juveniles.

Little information is available on juvenile shrimp prior to their maturation as adult male shrimp. Differential rearing areas and migration patterns appear to exist between juvenile and adult shrimp. More specific information on this is available in the Migration and Local Movement section of this life history report.

Adults

Mortality rates are high for adult pandalid shrimps. *P. borealis* survive a maximum of four to seven years off the Pacific coast with growth decreasing and age increasing as one proceeds north and west. This is true for other pandalid species studied by ADF&G (McCrary, 1977, personal communication). Estimates of annual survival rates for *P. jordani* off California range from 30 to 52 percent for the years 1960 to ?966 (Dahlstrom, 1970), These estimates were made in the presence-of a fishery, so they represent both natural and fishing mortality.

The growth of pandalid shrimps may be generalized as follows: (1) the animal molts, ridding itself of a rigid exoskeleton; (2) water is absorbed, increasing the size of the animal; (3) a new exoskeleton is formed; and (4) the water is gradually replaced by new tissue. Growth in size, therefore, is a step function, increasing in increments at each molt but remaining constant between molting periods.

The most comprehensive study of the growth of Pacific pandalid shrimps is that of Butler (1964). He found that based on ultimate size *P. platyceros* becomes the largest, followed by *Pandalopsis dispar* and *P. hypsinotus*. However, until about two years of age, *P. hypsinotus* is larger than *Pandalopsis dispar*. Butler further reported that *P. borealis* and *P. jordani* both reach about the same size. Dahlstrom (1970) reports a somewhat faster growth rate for *P. jordani* off northern California and Oregon, but a slower growth rate off Washington. Studies by Ivanov (1969) indicate that the growth rate for *P. borealis* in the Bering Sea is slower than those of the western Gulf of Alaska or of British Columbia. ADF&G studies (unpublished, McCrary, 1969) show that the. growth of *P. borealis*, *P. dispar* and *P. goniurus* around Kodiak Island and Shumagin Islands is slower than for these species in southeastern Alaska. Hence, it appears that the growth rate of *P. borealis* is dependent upon latitude and, consequently, upon water temperature. It is assumed that the other pandalid species exhibit similar growth characteristics.

Pandalid shrimps are carnivorous bottom feeders and feed both by scavenging dead animal material and by preying on living organisms such as amphipods, euphausiids, limpets, annelids and other shrimps.

Pandalid shrimps are subject to a high level of predation, both as planktonic larvae and as benthonic adults. Virtually any large fish in, their vicinity is a potential predator. Those noted as feeding on shrimp include the Pacific hake, Pacific cod, sablefish, lingcod, sole, various rockfish, spiny dogfish, skates and rays, Pacific halibut, salmon and even harbor seals (Skalin, 1963; Barr, 1970a; Butler, 1970; and Dahlstrom, 1970).

Pandalid shrimp distribution and range is dictated, to a large degree, by temperature and salinity tolerances. On the basis of water temperature, *P. borealis* and *P. jordani* are diametrically opposed, with *P. borealis* being concentrated in colder water (Fox, 1972). The other pandalid species are not so easily delineated. *P. goniurus*, however, is not found in appreciable quantities off British Columbia or southward, yet it reaches its greatest abundance in the western Gulf of Alaska and Gulf of Anadyr on the Asian coast. *P. goniurus* is apparently selective toward colder waters.

Butler (1964) reported finding all species but *P. goniurus* in temperatures of 7 to 11°C off British Columbia. Butler's data does not represent minima and maxima since Dahlstrom (1970) reports *P. jordani* from 5.6 to 11.5°C off northern California. Ivanov (1964b) found fishable concentrations of *P. borealis* down to 0.5°C in the Bering Sea and Allen (1959) reported specimens of *P. borealis* taken from water 1.68°C off Europe.

Salinity tolerances are more difficult to find in the literature, with *P. jordani* having the highest range, 28.7 to 34.6°/oo (Dahlstrom, 1970), and *P. borealis* the lowest, 23.4 to 30.8°/oo (Butler, 1964). Ivanov (1963), however, found *P. borealis* at 32.34°/oo off the Shumagins. The remaining ranges reported by Butler (1964) are *P. hypsinotus*, 25.9 to 30.6°/oo, *P. platyceros*, 26.4 to 30.8°/oo, and *Pandalopsis dispar*, 26.7 to 30.8°/oo. McCrary (1977, personal communication) found ranges to be similar to Butler's for southeast Alaska stocks, including *P. goniurus*.

Diseases.

Little is known about the diseases and parasites of pandalid shrimps. Yevich and Rinaldo (1971) reported a condition in *P. borealis* off Maine termed the black spot gill disease. This disease results in the destruction of gill lamellae and in the formation of a chitinous growth over the damaged area producing a black spot. A similar condition was observed by Fox (1972) and ADF&G staff in a few specimens of *P. borealis* caught off Kodiak Island.

Butler (1970) reported the infestation of a male P. *platyceros* by a rhyocephalan, *Sylon* sp., in British Columbia waters. He stated that there are no records of isopod parasites on *P. platyceros*. However, Fox (1972) reports that most species of pandalid shrimps are parasitized to some degree by bopyroid isopods (*Bopyrus* sp.). McCrary, (1977, personal communication) has observed *P. borealis* and *P. goniurus* to be commonly infested by a rhyocephalon in southeast Alaska and bapyrid isopods to be common on *P. dispar* throughout the Gulf of Alaska. The isopods, a large female and the smaller male together, attach in the gill area. The shrimp's carapace then forms around them after molting and produces the characteristic "bubble".

Migration and Local Movement.

Pandalid shrimps are known to undergo migrations onshore-offshore, coastwise, and vertically in the water column. Extensive migrations in European waters are well documented (Mistakidis, 1957), but less so in the northeastern Pacific Ocean.

Migration associated with age has been documented by Berkeley (1930) for *P. borealis*, *P. hypsinotus*, *P. platyceros* and *Pandalopsis dispar*. Freshly hatched larvae were found around or near the vicinity of the spawned adults. At about the third stage of development, the larvae were found segregated in shallower water 9 to 64 m (5 to 35 fathoms) deep where they spent their first summer. Later, during their first winter, the juveniles joined the adult population in deeper waters. Dahlstrom (1970), however, states that juvenile *P. jordani* are found among the adults throughout their life cycle. McCrary (1976, unpublished report) reported that *P. borealis* generally exhibits an inshore to offshore distribution by size, although adults and juveniles inhabit a wide range of depths, especially from late spring through early fall. McCrary further reported that adults of all ages are occasionally found in commercial quantities in the 27 to 46 m (15-25 fathom) range, although it is generally smaller males (1+ and 2+ age groups) that frequent these relatively shallow waters. ADF&G sampling with try nets over a broad depth zone by season has indicated that during the first year of life, P. borealis is primarily found at depths ranging from about 64 m (35 fathoms) to over 220 m (120 fathoms). First year shrimp are most abundant at depths and in the areas where adults are found. Thus, it would appear that the larval stages are completed and post-larval shrimp aggregate in areas near the points of larval release by adults. From one to two years of age, juveniles begin utilizing bottom habitats of 37 to 73 m (20 to 40 fathoms) -with increasing frequency, although dense aggregations are still found at depths of 91 to 130 m (50 to 70 fathoms). Utilization of shallower bottom habitats occurs primarily from spring through fall. During the winter, P. borealis is generally absent from inner bay waters of less than 30 fathoms when bottom temperatures may be less than 2°C and ice cover may be present. At the same time, in middle and outer bays and gullies where northern shrimp are most concentrated, temperatures may range from 1 to 2°C warmer than inner-most bays of comparable depth.

A genera? tendency that seems to hold for all pandalid shrimp encountered during ADF&G studies is that pandalids are distributed in one of two ways: (1) younger age groups shallower, older age groups deeper; and (2) older age groups offshore, younger age groups inshore. Reasons for this are suggested by the evidence with regard to salinity and temperature. Older, sexually mature shrimp, especially ovigerous females, prefer deeper depth zones where these two parameters are more stable and less variable. Conversely, the younger individuals, particularly those prior to first sexual maturity, are tolerant of a broader range of salinities and temperatures and are often abundant in the shallower depth zones where these two parameters are generally more variable (McCrary, 1976, unpublished report).

Area migrations of the adult populations are less well documented. P. jordani off California are known to exhibit short spawning migrations during the winter into deeper water and short summer migrations, ostensibly in search of food (Dahlstrom, 1970). .

Diel vertical migrations are common among some pandalids. Many P. borealis leave the bottom during late afternoon or evening and return to near, or on, the bottom about dawn in Kachemak Bay (Barr, 1970b). The period of time that the shrimp remained away from the vicinity of the bottom varied-directly with the season's number of hours of darkness. Pearcy (1970) reported the same phenomenon for P. jordani off the coast of Oregon. He suggested that diel migrations are related to feeding behavior since the shrimp fed mainly on euphausiids and copepods which also make diel migrations. Pearcy also suggested that these movements may be evolutionary protection and dispersal mechanisms. Chew, et al., (1971) stated that P. platyceros exhibited a diel bathymetric distribution after finding high catches in' shallow water at night in Dabob Bay, Washington, but in deeper water during the day.

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Harvesting Season

The Alaska shrimp fishery operates on a year-around basis subject to local closures when total catch has reached predetermined levels. Other seasonal restrictions include climatic restraints, processing plant capacities, and biological factors including the relatively dispersed distribution of the stocks at certain times." Product quality remains acceptable throughout the year and the potential for increased harvests in terms of the MSY's of the various species remains high. The optimal fishery for the various shrimp species would occur during the spawning/breeding season when concentrations tend to be at maximum densities.

Causes of Fluctuations in Resource Abundance

Summary

Trend: Stable to increased catches in most areas.

Cause: Presence of healthy population in inshore waters; potential for harvest of underexploited stocks with the refinement-of methods.

SCALLOP

Life History

Taxonomy.

The weathervane sea scallop, Patinopecten caurinus, is a member of the Lamellibranchia clams of the family Pectinidae. Keen (1963) described its taxonomy as follows:

Class:	Pelecypoda
Subclass:	Pteriomorphia
Order:	Pteroconchida
Superfamily:	Pectinacea
Family:	Pectinidae
Genus:	Patinopecten (formerly known as Pecten [Gould])

Distribution.

Although sma 1 numbers of weathervane sea scallops have been taken incidental to other fisheries from California to Alaska, the major commercial concentrations of this species are centered in the Kodiak Island and the Cape Fa rweather to Cape Saint Elias area (Yakutat region) of the Gulf of Alaska Hennick, 1970a). Trace amounts of scallops have also been dredged off the lower Kenai Peninsula, Shelikof Strait, and off Montague Island. Exploratory surveys in the Bering Sea and Alaska Peninsula area have revealed no extensive beds of scallops (Hennick, 1970b). Ronholt and Hitz (1968) reported that commercial quantities of weathervane sea scallops did not appear to be present in waters off Oregon. Thus, it appears that the Kodiak Island and Yakutat areas are the only regions that can support commercial exploitation of scallops in the Gulf of Alaska.

Exploratory surveys, largely conducted by the National Marine Fishery Service, have indicated that weathervane sea scallops are most abundant in depths of between 55 and 128 m (30 and 70 fathoms) (Alverson, 1968). Gravel and sand, with some mud, is typical of Alaska scallop beds (Hennick, 1973).

The three major commercial scallop beds in Alaska may be described as follows (Hennick, 1973):

AREA 1	Yakutat, between Cape Saint Elias and Cape Spencer. Primarily mud-sand-clay or silt overburden. Productive areas between 30 and 60 fathoms in depth, 20 to 40 miles offshore.
AREA 11	Westside Kodiak Island, between Cape Skolik to Afognak Island including that area of the Alaska Peninsula bordering Shelikof Strait adjacent to Kodiak Island proper. Primarily gravel-sand-mud or silt bottom. Productive areas 30 to 70 fathoms within three miles of shore.
AREA 111	Albatross, Marmot, Portlock Banks. Primarily rock, gravel, and sand bottoms. Productive areas between 25 to 75 fathoms, extending inshore and out to 50 miles or more offshore.

Sexuality.

The weathervane sea scallop is heterosexual and sexually dimorphic. The sex of mature adult scallops can be distinguished by the characteristic white coloration of the testes and the bright orange of the ovaries (Hennick, 1970a). There are no superficial characteristics that indicate the sex.

Maturity.

Scallops are aged by counting the growth rings, or annuli, on the shell. Although this method may not always provide the correct age, especially with older scallops, it gives a good estimate of age for younger scallops. Studies conducted in the Yakutat and Kodiak areas indicate that most weathervane sea scallops attain sexual maturity at age three and that all scallops at age four are mature (Hennick, 1970a). In addition, Hennick found that most scallops which exceed 100 mm in shell height are sexually mature.

Mating.

Studies conducted by Hennick (1970a) indicate that weathervane sea scallops spawn only once annually. The spawning period normally occurs during June and ear" y July and is apparently triggered by rising water temperatures. The sexes are separate and fertilization occurs externally. As the eggs and spermatozoa ripen, they are re-1 eased through the kidney and are expelled into the water where fertilization is a random occurrence.

Fecundity.

No information is available in the literature describing the fecundity of weathervane sea scallops.

Eggs and Larvae.

After fertilization occurs in the open water, the eggs settle to the bottom and become attached to objects in the substrate. Hatching occurs within two to three days time (Hennick, 1973). Development is dependent upon water temperature, with higher temperatures producing faster growth. The larvae at this stage are capable of swimming and become planktonic, drifting with the tides and currents. During this planktonic stage, meta-morphological changes take place and within two and one-half to three weeks the larvae settle to the bottom substrate and assume an adult form (Hennick, 1973) .

Mortality is high during the larval stage, both from environmental factors and predation. Planktonic feeders, both fish and shellfish, in-cluding adult scallops, feed upon the drifting planktonic scallop larvae.

Juveniles.

Complete basic studies on the life history cycle of weathervane sea scallops have not been conducted, especially in the juvenile stage. Hence, little information is available for this life stage. Based on studies of sea scallops elsewhere, however, the following observations can be made. After the larva settles to the bottom, the juvenile scallop may attach itself to the bottom, move around through the use of the foot appendage which later becomes residual, or swim. The juvenile at this stage is leptocephalus or transparent. Within a few months, pigmentation of the shell takes 'place and the animal appears identical to the adult form.

Adults.

After reaching sexual maturity at about three to four years of-age, weathervane sea scallops continue to grow. Studies conducted by Hennick (1973) indicate that growth is more rapid during the first 10 to 11 years, then tends to slow as age advances. The meats of old, aged scallops actually tend to decrease in weight (Hennick, 1973). In light of this growth phenomena, weathervane sea scallops should ideally be harvested between seven and eleven years of age, both from a biological and economic viewpoint.

There is little documented information on the longevity of weathervane sea scallops. Exploratory surveys and commercial catch data indicate a scarcity of scallops over 15 years of age. However, Hennick (1973) reported scallops recovered with as many as 28 annual rings.

The growth rate of weathervane sea scallops is subject to regional differences. Based on Hennick's (1973) studies, the meat of scallops from the Yakutat area at a given age are much smaller than that from either of the Kodiak Island areas. Additionally, scallops from the Marmot, Albatross, and Portlock areas of Kodiak Island are the largest at any given age of all scallops in the Gulf of Alaska. This phenomena is of great importance to the commercial fishermen as scallops from the Kodiak area have average meat weights nearly twice as large as those from the Yakutat area, meaning only half as many need be handled in order to obtain the same volume of salable product.

Weathervane sea scallops are planktonic filter feeders, consuming bottom detritus and drifting plankton. The opening and closing of the valves draws water into the mantle cavity. The circulation of water within the mantle cavity and gill areas provides a food source and enables respiratory functions to occur.

It is interesting to note that scallops are the only bivalve molluscs capable of swimming (Hennick, 1973). This is accomplished through relaxation of the adductor muscle, causing the valves to part and draw water into the mantle cavity. The scallop then rapidly contracts the large adductor muscle forcing water out. Rapid repetition of this function enables the scallop to rise off the bottom and essentially swim.

Predation is often high on weathervane sea scallops, with the major predators including cod, plaice, wolffish, and starfish.

Disease.

Hennick (1973) reported the presence of marine boring worms on the shells of weathervane sea scallops from the Yakutat region. Nearly all of the scallops were heavily infected. However, infestation by marine boring worms in the Kodiak region is rare.

igration and Local Movement.

Little information is available concerning the migrations and local movements of weathervane sea scallops. Adult scallops are capable of independent movement, but the extent or direction of any movement is not known.

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Harvesting Season

The scallop fishery in the eastern region of the Gulf of Alaska is principally managed on a year-around.open season basis with a minimum size required for retention. The western region is marked with similar size restrictions and with seasonal and area closures to protect valuable crab resources from incidental damage.

It would be difficult to fix an optimal season for this species because of chronic recruitment failures and the complication of incidental damage to other resources through the use of scallop dredges. However, because the adductor muscles remain at nearly constant weight and quality through the year, it would seem that the timing of the season would most likely occur during lulls in other fisheries and when appropriate weather conditions were present.

Causes of Fluctuation in Resource Abundance

Summary

Trend: Continued low level of production.

Cause: Recruitment overfishing and depletion of fishing grounds; chronic poor recruitment considered a general problem; closure on some grounds to protect vulnerable crustacean resources; failure to locate new fishing grounds.

RAZOR CLAM

Life History

Taxonomy.

The razor clam, *Siliqua patula*, is a member of the Lamellibranchia clams of the family Solenidae. Nosho (1972) described its taxonomy as follows:

Phylum:	Mollusca
Class:	Lamellibranchia
Family:	Solenidae
Genus:	*Siliqua*
Species:	*S. patula*

Distribution.

The razor clam is found from Pismo Beach, California, to the Bering Sea (Amos, 1966). It occurs in commercial quantities from Tillamook Head, Oregon, to the western end of the Alaska Peninsula. In Alaska, commercial stocks are found on the shores of Cook Inlet, Orcas Inlet, the Copper River delta near Cordova, and the mainland side of Shelikof Strait.

Razor clams are found intertidally to several fathoms in depth on the sandy ocean beaches of the open coast. Fine sand with some glacial silt, as found at Karls Bar located at Orcas Inlet near Cordova, is typical of Alaska clam producing areas (Weymouth and McMillan, 1931). Near Kodiak, the large beds at Swickshak and Hallo Bay consist of fine sand, volcanic ash and some glacial mud. In Cook Inlet, razor clams are found in substrata varying from almost entirely coarse white sand (Deep Creek area) to a fine sand-clay-gravel mixture at Clam Gulch (McMullen, 1967).

Razor clams may be found in the mouths of coastal harbors, but growth is usually inferior in these locations. They are not found in enclosed bodies of water, Sexuality.

The razor clam is heterosexual and sexually dimorphic. However, only through examination of the gonads is it possible to tell the sex of the clam. There are no superficial characteristics that indicate the sex. Examination of the contents of the gonads reveals a marked difference between sexes. The female ova have a granular appearance, in contrast to the viscous homogeneous mass in which the sperm is found.

Maturity.

Razor clams are aged from growth rings on the shell. Although the method may not always provide the correct age, especially with older clams, it gives a good estimate of age for younger clams. In addition, accurate aging is hindered by the presence of summer growth checks (false annuli) on the shell which, it is believed, are caused by disturbed growth through tidal action.

Razor clams in the northwest Pacific reach sexual maturity after two or more years, or a shell length of approximately 100 mm (Nosho, 1972). Razor clams of the northern beds do not reach sexual maturity until much later. Clams of the Swikshak and Cordova beaches do not mature until their fifth and sixth years, respectively (Weymouth and McMillan, 1925). However, Cook Inlet clams appear to grow much faster, reaching maturity in their third year (McMullen, 1967).

Mating.

Spawning occurs in the spring or summer when rising water temperatures reach 13^{o}C (Nosho, 1972). In Alaska, this usually occurs in July. Studies conducted in Prince William Sound indicate that spawning timing can be computed by monitoring the cumulative maximum daily water temperature (personal communication with Richard Nickerson, ADF&G, Cordova, 1975). Razor clams spawning occurs when the cumulative maximum daily water temperature reaches 1,350 temperature units; with the cumulative total computed by summing the daily maximum degree units above or below $0^{o}C$ ($32^{o}F$) from January 1 on. The 50 percent spawning level is generally reached when the cumulative total reaches 1,500 temperature units.

Spawning occurs for several weeks as eggs and sperm ripen and are discharged through the excurrent siphon. Fertilization occurs in the open water with surf action mixing the eggs and sperm.

Fecundity.

The number of eggs carried by the female razor clam ranges between six to ten million eggs annually (McMullen, 1967).

Eggs and Larvae.

After fertilization occurs in the open water, the eggs hatch into larvae within a few hours to a few days. Development is dependent upon water temperatures, with higher temperatures producing faster growth rates. The larvae exists as free swimming veligers (ciliated larvae) for five to sixteen weeks (Oregon Fish Commission, 1963). After the veliger stage, the young clams develop a shell and settle to the bottom where they "set" into the top layer of sand upon reaching an average shell length of 13 mm (Tegel berg, 1964). In years of heavy setting, as many as 1,000 to 1,500 young clams per 929 square cm (square foot) of beach may be found.

Mortality is extremely high during the larval stage. The pelagic larvae are subjected to a high level of predation by planktonic feeders. Unfavorable currents may also carry the larvae away from desirable habitats.

Juveniles.

After settling to the bottom, juvenile growth is slow throughout the fall and winter. Growth accelerates during the spring and summer with warmer waters and increased food supply. After the first winter, young clams reach a length of about four-fifths of an inch in the Cordova district. An average length of 2 cm (four and one-half inches) is attained in three and one-half years in the southern beds as compared to six and one-half years in the Cordova region (Amos, 1966).

The growth rate varies with locality. In Alaska, initial growth rate’ is slower than in the northwest states; however, after several years, the relative growth rate is higher (Weymouth and McMillan, 1931). Generally, razor clams have a larger final size and grow older in the northern beds than in the southern beds.

Adults,

The maximum age for razor clams is highly variable with clams of the northern beds living longer than those of the southern beds. Clams collected at Pismo Beach, California, do not exceed five years in age, while Washington clams grow up to nine years. In Alaska, ages up to 19 years have been recorded (Weymouth and McMillan, 1931).

Adult razor clams live in the intertidal zone where they lie buried in the sand with their necks, or siphons, protruding above the surface. During the low water stages, when the clams are exposed, their siphons are covered with a thin layer of sand which makes detection of the clams difficult. The clams can move through the sand very rapidly, averaging several feet per minute. Their unusual ability to move so fast is due to their foot, which is an effective burrowing organ. In digging, the foot of the clam is projected half the length of the shell and pushed into the sand. Below the surface the tip of the foot expands forming a strong anchor. Then the foot muscles contract pulling the clam downward. The clam can repeat this movement in rapid succession. It has been observed that clams laid on the top of the sand have buried themselves completely in less than seven seconds (Loosanoff, 1947).

Razor clams are filter feeders, consuming bottom detritus and drifting plankton. Food particles are brought in along with water through the in-current tube. Small hairlike structures (cilia) on the gills filter the food particles out. The food particles are then passed to the sensitive palps near the mouth for sorting, and are then ingested.

Predation is often high on razor clams, with the major predators including starfish, crabs, rays, octopus, and starry flounders.

Disease.

As with all animals, razor clams are subject to disease. Marine bacteria and fungi are often injurious to clam larvae. In addition, razor clams are also subject to the problem of paralytic shellfish poisoning (PSP), as are all bivalve molluscs. PSP is associated with plankton blooms and is properly called *Gonyaulax* poisoning (Hayes, 1967). The causative organisms are believed to be the dinoflagellates *Gonyaulax catenella* and *G. acatenella.* The toxin is accumulated as a direct result of feeding on these organisms. PSP is extremely toxic and is one of the most potent materials known to man. The poison is a metabolic product of the dino-flagellate. It is believed that PSP directly affects the nerve and muscle membrane, blocking the passage of nervous impulses, and eventually resulting in paralysis of the diaphragm and death by suffocation if enough toxin is ingested.

Razor clams, unlike other molluscs, do not retain the toxin over a long period of time. The toxin is rapidly eliminated from the tissue by normal metabolic activity. In addition, the toxin does not build up to high levels in the tissue, but is concentrated in the digestive tract. Thorough cleaning and removal of the digestive tract will remove most, if not all, of the toxin.

Migration and Local Movement.

Little is known concerning the migrations and local movements of razor clams. At the present, there is little evidence that razor clams move horizontally or migrate between areas. However, heavy surf action along exposed beaches is often responsible for the movement of razor clams laterally along the beach as well as onshore-offshore movements.

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Harvesting Season

The present razor clam fishery is managed without seasonal or area closures in certified areas. Certified beaches are three in number and include Pony Creek (Cook Inlet), Copper River Flats (Prince William Sound), and Simkshall (South Peninsula), and it is only from these that clams can be harvested for human consumption. All other beaches are suspected of paralytic shellfish poisoning and only can be used for bait purposes such as in the Dungeness crab fishery after being dyed with vital stains.

In addition to the constraints placed on the clam industry by the PSP regulations, other chronic problems include the lack of skilled diggers, aggressive eastern clam competition, slow development of mechanical digging devices, and the effects of the 1964 earthquake, particularly in Prince William Sound. The industry has also been plagued by local overharvesting leading to depletion and is now confronted with recreational harvesters whose demands approach the MSY's of some areas. The ultimate solution of PSP and mechanical harvester problems coupled with the continued decline of Washington clams may do much to revive this industry.

The timing of the optimal season for razor clams would occur some time following the beginning of the primary production cycle. Meat quality is significantly improved during these times. Production would be facilitated through the use of mobile mechanical devices or dredges which could operate somewhat independently of tides.

Causes of Fluctuation in Resource Abundance

Summary

Trend: Industry being re-established, present trend uncertain.

Cause: Fishery plagued by economic problems rather than problems of abundance; three Alaskan beaches certified safe for commercial harvest, yet market difficulties, problems with the development of mechanical harvesters, and seasonal labor shortages have depressed development; in early years of industry, depletion of major clam beds occurred because of poor distribution of harvest and recruitment failures.

Glossary of Biological Terms

Acclimatization	Adjustment of an organism to a new or strange environment.
Amphipod	Belonging to large order of Crustacea; most species marine, burrowing or moving about on bottom or in bottom debris.
Anadromous	Species spawning in fresh water that make some or most of their growth during a vist or visits to the sea.
Anomuran	Pertaining to one of three suborders in the crustacean section Reptantia; includes hermit crabs, sand crabs, and related forms .
Autochthonous	Organisms or materials arising in the same environment.
Autotroph	Plants and other organisms capable of converting inorganic matter into organic forms via photosynthesis.
Barbel	Fleshy projection found below the lower jaw, under the snout, and around the mouth of certain animals particularly fish.
Bathymetric	Pertaining to the depth of a body of water.
Bathypelagic	Species living in the water column between approximately 1000 and 4000 m or at the 4°C isotherm.
Benthic	Pertaining to the benthos, or to the bottom in a pelagic area.
Benthopelagic	Species varying their habitat seasonally between the bottom and the near-bottom portion of the water column.
Benthos	Bottom-dwelling (benthic) organisms.
Biomass	The total wet weight of all living organisms or of a particular organism beneath a unit surface area of water or in a specified volume of water.
Bopyroid	Pertaining to a genus of Isopods; parasitic on marine crabs.
Carapace	Exoskeleton plate covering the head and thorax.
Carrying Capacity	Maximum quantity of fish or other organisms that a particular habitat can support for an extended period of time.

Continental Rise	Gradually sloping bottom between the steep continental slope and the abyssal plain.
Continental Slope	Steep slope seaward of the edge of the continental shelf.
Contranatant	Moving against prevailing current; applied to return migration of adult fish to upcurrent spawning locations.
Copepod	Belonging to the crustacean subclass Copepoda; important component of zooplankton.
Demersal	Benthic; dwelling on or close to the bottom.
Denatant	Pertaining to movement with prevailing currents.
Density-dependent	As applied to life histories, mortality factors of the environment whose severity is dependent upon the density of the population.
Density-independent	As applied to life histories, refers to mortality factors of the environment whose severity is not dependent upon the density of the population.
Detritus	Finely divided organic matter from animal and plant remains.
Diatom	Unicellular plant which is a principle component of the plankton.
Diel	Referring to the twenty-four hour day as opposed to the hours of sunlight.
Dimorphism	Marked difference between the sexes of an organism.
Enhancement	Referring to projects that attempt to increase the size of fish populations.
Epilimnion	Portion of the water column lying above the thermocline.
Estuarine	Pertaining to a protected body of water in which the salinity departs significantly from the adjacent sea or ocean.
Fecund	Referring to the fecundity of an organism; reproductive potential as indicated by the number of mature ova present in the mature organism.
Gravid	Possessing mature gonads.
Homoiotherm	Animal having a relatively constant body temperature regardless of the temperature of its environment
Hypolimnion	Portion of water column lying below the thermocline

Isopleth	Contours that delimit the values of a dependent variable plotted against two other variables.
Isopod	Belonging to a major crustacean order; most commonly found in bottom debris; some parasitic representatives.
Isotherm	Contour of equal temperature.
Krill	Common name for euphausiids.
Lamella	Any thin, platelike structure.
Littoral	In the sea, the shallow portion of the bottom extending from the shoreline to a depth of 200 m.
Neritic	All waters over the continental shelf,
Parr	Young salmon or trout in fresh water before reaching the migratory or smelt stage.
Pelagic	Of or pertaining to the open waters of the sea, particularly where the water is more than 20 m. deep.
Percoid	Pertaining to a very large sub-order of bony fishes; worldwide in distribution; many Alaskan species included.
Phototaxis	Behavioral movement response of an animal to light; positive phototaxis refers to movement towards light.
Phytoplankton	Members of the plankton community capable of photosynthesis.
Planktonic	Pertaining to the plankton; plankton are organisms generally incapable of moving against prevailing water currents.
Poikilotherm	Cold-blooded vertebrate in which body temperature fluctuates widely in harmony with external temperature.
Polyclad	Belonging to a class of marine Turbellaria.
Productivity	Yield of organisms in a particular body of water.
Protandric	Referring to organisms capable of changing sex during a particular developmental stage as a normal life process.
Recruitment	The advancement of a juvenile organism to sexual maturity or the development of an organism to the point where it becomes available to commercial exploitation.
Redd	Nest dug in gravel bottom by a salmonid fish.
Riffle	Pertaining to the stream section referred to as the rapids.
Smo 1 t	Juvenile salmonid capable of movement to and existence in estuarine and marine environments.

Spent	Pertains to fish which have recently spawned and which, as a consequence, are either temporarily or permanently physiologically depleted.
Stenohaline	Lacking in ability to withstand wide changes in salinity.
Thermocline	Portion of water column in which rapid change in temperature with increasing depth encountered; between hypolimnion (below) and epilimnion (above) layers.
Trophic	Energy levels; refers to organization of organisms to discrete levels based on food or energy production specializations.
Year-class	All the progeny of the reproduction from any particular year class.
Zoea	Larval stage in some crustaceans.
Zooplankton	Animal components of the plankton primarily dependent upon phytoplankton for food.

APPENDIX B

AN OVERVIEW OF THE ALASKA COMMERCIAL FISHING INDUSTRY

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This appendix is an overview of the Alaska commercial fishing industry. It serves as a reference to the development, market characteristics, and statistics of the industry and the governmental environment in which the industry operates, and it serves as a basis for determining the market and governmental environments that are expected to exist during the forecast period of 1980 through 2000.

The sections include a brief discussion of the relative importance of individual fisheries, an overview of fishery development by species, and a discussion of the market and governmental environments shared by many Alaska fisheries.

Alaskan Fisheries in Perspective

Alaska has a number of important commercial fisheries; included among these are salmon, halibut, herring, groundfish, king crab, Tanner crab, and Dungeness crab, shrimp, clam, and scallop fisheries. These fisheries provide employment in Alaska as well as in other areas of the U.S. and abroad. Due to the lack of adequate markets in Alaska, a very small proportion of the output of the Alaska Seafood industry is consumed in the state and much of that which is, is at least partially processed elsewhere.

Since the late 1800s, salmon has been the dominant Alaska fishery, however, between 1961 and 1974, the absolute and relative importance of the shellfish fishery, in particular shrimp, king crab, and Tanner crab increased dramatically

The Alaska groundfish fishery which is just beginning to develop, has the potential of becoming a dominant Alaska fishery. To date, however, the groundfish resources off the coasts of Alaska have been almost exclusively harvested by foreign fishing vessels. For this reason, groundfish are excluded from the following tables which summarize the relative importance of various fisheries.

TABLE E.1
COMPARATIVE CATCH STATISTICS 1961 - 1977

	Average Catch (in 000's) POUNDS	VALUE[1]	Range of Catch (in 000's) POUNDS	VALUE[1]
King Salmon	10,075	$4,116	6,942 - 12,042	$2,243-$ 7,880
Red Salmon	71,216	18,112	32,246 - 150,812	7,644 - 37,249
Coho Salmon	13,719	4,204	7,128 - 20,968	1,997 - 8,678
Pink Salmon	98,691	14,188	28,822 - 162,866	3,241 - 22,093
Chum Salmon	45,465	7,055	22,668 - 64,823	2,377 - 17,716
All Salmon	239,161	47,675	131,603 - 346,465	24,631 - 67,975
Halibut	38,180	15,878	16,490 - 57,218	10,382 - 21,020
Herring[2]	25,400	853	7,418 - 49,465	81 - 4,130
All Finfish[3]	299,752	64,407	186,955 - 404,708	36,300 - 85,552
King Crab	87,765	18,714	43,412 - 159,202	3,914 - 44,702
Dungeness Crab	7,256	1,454	1,177 - 13,242	442 - 3,427
Tanner Crab	24,919	2,588	0 - 98,329	0 - 13,052
Shrimp	62,296	3,330	7,727 - 128,975	309 " 11,091
Razor Clams	214	50	32 - 926	8 - 120
Scallops[4]	559	640	0 - 1,888	o " 1,606
All Shellfish[5]	183>010	26,777	64,918 - 317,315	5,116 - 69,646
All Fish[6]	482,762	91,184	376,303 - 595,869	53,800 - 153,038

[1] Value data are for 1961 - 1975 only.

‘All the herring data is for 1961 - 1975 only.

[3] For the purposes of this table, finfish include salmon, halibut, and herring.

[4] The averages have not been adjusted to reflect the fact that this fishery did not exist prior to 1967.

[5] For the purposes of this table, shellfish include king, dungeness, and tanner crab; shrimp, scallops and razor clams.

[6] All fish include finfish and shellfish as defined above.

Source: ADF&G Statistical Leaflets for various years.

TABLE B.a

THE ALASKAN FINFISH AND SHELLFISH FISHERIES

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)
1961	430,479	$54,595	$0.13
1962	448,355	68,355	0.15
1963	413,236	53,800	0.13
1964	511,979	64,121	0.13
1965	508,945	80,989	0.16
1966	595,869	90,146	0.15
1967	376,303	54,521	0.14
1968	473,940	87,756	0.19
1969	407,571	83,190	0.20
1970	550,389	106,077	0.19
1971	481,708	91,133	0.19
1972	431,796	98,912	0.23
1973	462,420	153,038	0.33
1974	459,366	148,680	0.32
1975	440,490	132,434	0.30
1976	581,458		
1977	632,646		
1978			
Average	482,762	91,184	

Source: ADF&G Statistical Leaflets for various years.

TABLE B.3

THE ALASKAN FINFISH FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	POUNDS
1961	365,561	$49,479	$0.14	90.6	84.9
1962	368,942	61,265	0.17	89.6	82.3
1963	306,876	44,178	0.14	82.1	74.3
1964	404,708	54,141	0.13	84.4	79.0
1965	351,473	66,481	0.19	82.1	69.1
1966	403,377	72,574	0.18	80.5	67.7
1967	194,926	36,300	0.19	66.6	51.8
1968	331,709	59,918	0.18	68.3	70.0
1969	277,505	61,317	0.22	73.7	68.1
1970	398,303	85,551	0.21	80.7	72.4
1971	298,311	65,108	0.22	71.4	61.9
1972	236,575	66,732	0.28	67.5	54.8
1973	196,150	83,392	0.43	54.5	42.4
1974	186,955	82,653	0.44	55.6	40.7
1975	193,518	77,003	0.40	58.1	43.9
1976	264,143				45.4
1977	316,754				50.1
1978					
Average	299,752	64,407			

Source: ADF&G Statistical Leaflets for various years.

TABLE Ɛ.4

THE ALASKAN SHELLFISH FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	POUNDS
1961	64,918	$5,116	$0.08	9.4	15.1
1962	79,413	7,090	0.09	10.4	17.7
1963	106,360	9,622	0.09	17.9	25.7
1964	107,271	9,980	0.09	15.6	21.0
1965	157,472	14,508	0.09	17.9	30.9
1966	192,492	17,572	0.09	19.5	32.3
1967	181,377	18,221	0.10	33.4	48.2
1968	142,231	27,838	0.20	31.7	30.0
1969	130,066	21,873	0.17	26.3	31.9
1970	152,086	20,525	0.13	19.3	27.6
1971	183,397	26,025	0.14	28.6	38.1
1972	195,221	32,180	0.16	32.5	45.2
1973	266,270	69,646	0.26	45.5	57.6
1974	272,411	66,026	0.24	44.4	59.3
1975	246,972	55,430	0.22	41.9'	56.1
1976	317,315				54.6
1977	315,892				49.9
1978					
Average	183,010	26,777			

Source: ADF&G Statistical Leaflets for various years.

An Overview of Development by Fishery

SALMON

Development and Market Structure

No other fishery can rival the importance of salmon in the development of Alaska. Much of Alaska's colorful past has depended heavily upon boom or bust ventures, and the salmon fishery, in a broad sense, has fulfilled this pattern. Though a viable commercial enterprise for over 100 years, it remains to be seen if salmon will ever again be present in Alaskan waters in the magnitude of the late 1800s and the first 30-PIus years of the ?900s. As happens with many natural resources, the Alaskan salmon stocks were severely over-exploited for a number of years before effective steps were taken to protect them. Though many recognized that the fishery was not well managed, various political and other influential concerns prevailed, and overfishing resulted until well after the demise of the fishery was evident. Not until the State of Alaska assumed management of the salmon shortly after statehood were conscientious attempts made to assure the maintenance of a stable yield, and hopefully, a resurgence of stocks.

Salmon are known to have provided sustenance to various groups of Alaska Natives for hundreds of years. It has been estimated that, at one time, over 75,000 Natives resided within the salmon area of Alaska. However, as various non-Native groups became interested in Alaska for its wealth of resources, the Natives' lifestyles were altered and the main importance of salmon shifted to the raw resource for a growing industry.

The oldest salmon cannery in Alaska is located at Klawak, on the western side of Prince of Wales Island, between Wrangell and Howkan. A saltery had been located-at Klawak until 1878, when it was purchased by the North Pacific Trading and Packing Company, and a cannery was constructed the same year. The original cannery remains operable to this day. By the end of 1878, one other cannery had been built in Alaska.

As the salmon stocks were found to range from Southeast Alaska to the Chukchi Sea, the salmon fishery developed in a very dispersed manner. On-board refrigeration was in its infancy, therefore, the distance fishermen and tenders could range from a processing plant and still deliver a quality product was limited. This situation required that the processors locate within reasonable proximity of the catch areas and led to a rapid increase in the number of canneries.

This unique need for so many canneries drew investment capital from many sources, and resulted in diverse and often absentee ownership. However, in 1893 a group known as the Alaska Packers Association was formed. The resultant amalgamation put approximately 90 percent of the canneries and 72 percent of the total Alaska salmon output under the control or ownership of one firm, and left a fluctuating number of other less powerful and financially secure canneries to process the remainder of the pack. Through the years Alaska Packers Association's total dominance was broken as other firms grew and consolidated. However, the industry is still characterized by a few dominant firms controlling a large portion of the production and many smaller operators regularly enter and leave the industry. By 1959 six firms owned 50 percent of Alaska's salmon canneries and produced 53 percent of the total output. In 1978 the basic structure of the salmon processing industry remains unchanged.

The major change that has occurred during the life of the fishery is that processors have exercised increasingly less control over the salmon resource. Alaska's distance and remoteness from major population centers and markets could be turned to the advantage of financially powerful canneries. Alaska was too far away for most west coast fishermen or processing laborers to undertake the journey on a yearly basis to a fishery lasting only a few months. There was usually no other work available in the area after the fishery closed, preventing these people from remaining in Alaska year around. To remedy this problem, canneries recruited fishermen and cannery workers from along the west coast and provided transportation to the fishing areas. The canneries furnished the fishing vessels and gear and provided living accommodations for everyone. The capital necessary for operations of this type was immense. Firms large enough to undertake such a venture gained direct control over much of their raw resource, greatly enhancing their position when bargaining with independent fishermen or competing with other processors. Until the 1930s for most of Alaska, and until 1951 for Bristol 8ay, fishing vessels owned by individuals, whether Alaska residents or not, were the exception.

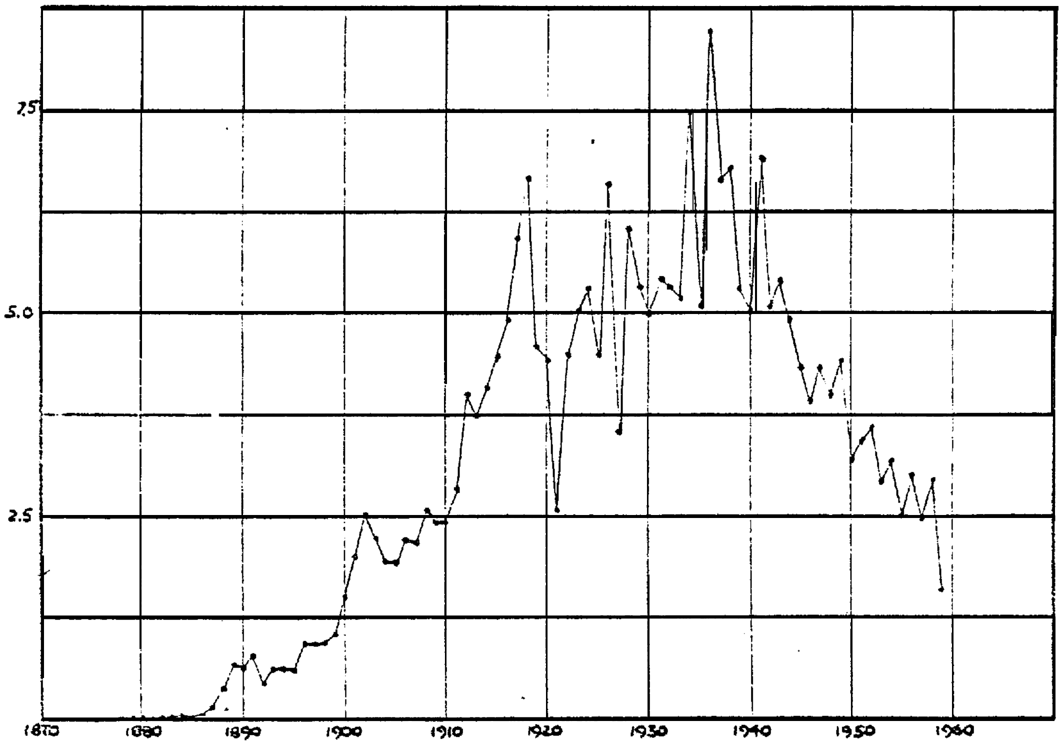
One of Alaska's first legislative actions upon becoming a state in 1959 was banning the use of fish traps by canneries and commercial fishermen. Though the banning was claimed to be primarily a resource conservation move, the economic ramifications were probably equally as significant. The traps' efficiency far surpassed that of any other gear ever devised, and together with company-owned fishing fleets provided the canneries almost exclusive control of the resource. Nearly 90 percent of the traps were controlled by canneries, accounting for over 40 percent of the total salmon catch, and almost 25 percent of the catch during their last year of use. Abolishment of the fish traps immediately diminished the bargaining power of firms which formerly maintained nearly total control of their resource procurement. The canneries' loss of control of the salmon resource, due to loss of the fish traps and the passing of company-owned fishing fleets, placed new emphasis on the importance of independent fishermen. The trend toward less control of the resource by companies was reinforced when salmon became a limited entry fishery in 1975. Limited entry regulations specify that permits can only be held by individuals. The fishing privilege must be utilized by the owner of the permit, and canneries and other companies cannot be issued or purchase a permit.

During the early years of the Alaska salmon fishery, production grew steadily (Figure 3.1). New salmon areas were fished, more fishermen and gear entered the fishery and more efficient gear was developed. The abundance of salmon and good fishing areas were so great that increased production was assured simply by expending a little more effort.

However, the steadily increasing production tended to over-shadow several other important developments. With the exception of brief deviations, the number of salmon fishermen increased from the birth of the fishery until the 1970s. The original abundance of salmon produced ever-increasing yields as new areas and stocks of salmon were fished. But as. early as 1910, the average catch per fisherman began to decrease. The increasing effort managed to offset the decreasing catch per effort until after the peak production of 1936. After this peak, not even increased fishing effort could bolster production to former peak levels. The salmon stocks had been depleted too severely to maintain high production at any level of effort. Just as the salmon industry had rapidly and steadily "boomed" into a giant among west coast fisheries, it experienced a "bust" starting after 1936, which extended through the 1950s, and from which the industry has never fully recovered.

FIGURE 8.1

TOTAL PACK OF CANNED SALMON IN ALASKA, 1878-1959*
(In millions of cases)



* Figures represent full cases of 43 pounds net.

Source: R.A. Cooley, 1963. Politics and Conservation, The Decline of the Alaska Salmon.

Due largely to the lack of regulation of the salmon fishery, another phenomenon occurred that compounded the resource abundance problem of the declining fishery. A steady demand for salmon maintained lucrative prices which enticed more fishermen into the fishery. Though average catch per fisherman continued downward, the increasing value per unit of catch kept the fishery profitable. Therefore, as the number of salmon decreased, economic reward caused fishing effort to increase, further depressing the stocks.

The Alaska salmon fishery entered a new era when Alaska became a state and obtained control of its fisheries from the federal government. The state established closely-controlled fishing seasons, gear regulations, and quotas. But having received control of its fisheries in 1960, the year after the smallest salmon pack since 1900, state regulatory agencies faced an uphill battle in their attempts to rejuvenate the annihilated fishery.

The existence of a strong demand for salmon, which eventually helped lead to over-exploitation of the fishery as explained previously, was not entirely a natural happening. In the very early 1900s, the salmon industry undertook a worldwide advertising campaign with the aid of the federal government. The results were very favorable: marketing conditions improved greatly and the industry entered a period of dynamic growth. At about the same time the "Iron Chink," a machine which beheaded, gutted, and cleaned the salmon, was introduced, marking a great advance in the speed of processing. The machine initially displaced so many oriental cannery laborers that it became known as the "Iron Chink," a name that is still commonly used in the industry today. The Iron Chink removed a bottleneck from the salmon cannery processing line and led to further growth of the industry, which ultimately resulted in many more workers being hired than were displaced by the machine. Increased processing efficiency and improved processing techniques which improved the quality and marketability of salmon contributed to the development of a market which has always remained healthy.

Canned salmon is the most commonly produced form of processed salmon (Figure 3.2); and salmon has been processed this way more than any other commercial fish species in Alaska. However, as with shellfish and other finfish, freezing is becoming increasingly more common. Until around 1970, freezing constituted a minor portion of the total salmon pack. During the early 1970s, freezing quickly increased in popularity, and has been accounting for a growing portion of the total pack. Data sources revealing salmon product form are often contradictory concerning the amount of salmon frozen, but it is now commonplace for many processors to freeze up to 100 percent of their pack. Production figures for the industry indicate that frozen production is relatively more stable than canning. Canning capacity is more versatile than freezing, and tends to comprise a larger portion of the total pack in years of high salmon catch when processing capacity must increase.

Five species of salmon are harvested in Alaska: reds (sockeye), which are the second-most abundant and usually the most valuable; kings (chinook), which are the largest species; silvers (coho), which have lighter flesh than the reds or kings; pinks (humpback), the smallest and most abundant of all five species; and the chums (dog), which are the least valuable. All five species are canned, with the pinks, reds, and chums predominating. Reds and pinks take turns at being the largest portion according to cycle years. It is not uncommon for a considerably smaller run of reds to be of more value than a larger pack of pinks. Silvers and the large kings are often frozen or undergo a curing process, or fill the demand for fresh salmon. Pinks are occasionally used for this purpose a" so.

Figure 3.2 **Processing Steps for Canned Salmon**

Salmon caught by commercial fishermen

↓

Larger vessels serve as tenders to purchase salmon and transport them to cannery (some tenders have refrigeration facilities for the fish).

↓

Separated by species and quality

↓

Preparation for Iron Chink, placed on belt to Iron Chink

↓

Iron Chink (performs heading, finning, splitting, gutting, cleaning, cleansed with water spray)

↓

Washed and Inspected

↓

Cut into can-size pieces by gang knives, normally one-pound tall or half-pound flat

↓

Filling machine fills cans with salmon, another machine , adds correct amount of salt

↓

Cans are weighed, topped off manually if underweight

↓

Cans are vacuum sealed

↓

Cans are retorted

↓

Usually receive initial cooling by water bath if adequate water supply

↓

Transported in “bright stack” (without labels) to lower states for labeling and further distribution

As with other Alaskan fish products, most salmon is shipped to the lower states, predominately the Seattle area, for reprocessing and/or further distribution. The frozen salmon arrives in a whole frozen form and may undergo steaking or filleting, or be distributed whole. The canned salmon merely requires that the proper label be applied and the cans be packed suitably for distribution. Retail grocery stores remain a major domestic outlet for canned salmon, but industry sources indicate that sales of fresh and frozen product is decreasing in these stores. Increasing institutional and restaurant demand is compensating for this decrease, as frozen products are becoming more prevalent from the processors.

The United States imports and exports sizable quantities of both canned and fresh or frozen salmon (Table B.6). Exports to various buyers worldwide, with France and Japan presently being the major buyers, usually more than offset imports. Japan has only recently become a major salmon importer, due to restrictions on its fishing fleets arising from many countries extending their fishing zones. Data sources for specific salmon products being imported or exported are rarely in agreement and usually combine the entire west coast, but generally indicate that a large portion of the frozen salmon from Alaska may be exported, along with a significant but smaller portion of the canned pack.

A lucrative export market to Japan has developed for salmon roe. Under the direction of Japanese technicians, the roe is stripped, treated in brine and packed in wooden containers for transport, being reprocessed abroad for final consumption. This market is growing, as nearly 2,720 MT (six million pounds) of roe were produced in 1976, compared to less than 113 MT (250,000 pounds) in 1956. Growing interest in this market can also be seen as a result of restrictions the Japanese are facing on most

Table 3.6

UNITED STATES SALMON IMPORTS AND EXPORTS 1960 - 1977
(in thousands of pounds)

YEAR	FRESH/FROZEN		CANNED	
	Imports	Exports	Imports	Exports
960	13,472	NA	19,113	NA
961	12,309	NA	7,167	7,275
962	9,735	NA	6,843	9,038
963	8,898	4,888	1,250	10,141
964	8,818	22,560	236	20,944
965	7,861	10,559	101	24,912
966	8,296	19,845	589	20,503
967	8,815	18,911	121	20,503
'368	9,811	16,234	4,955	5,732
969	8,425	30,553	2,217	15,432
970	7,448	28,201	2,441	16,755
971	7,684	32,891	1,551	18,298
972	18,696	34,685	11,647	21,385
973	18,237	55,696	7,859	16,976
974	12,483	26,109	8,553	8,377
975	9,250	45,696	3,265	22,487
976	7,742	38,418	2,521	19,621
977	5,708	65,559	586	NA

Source: U. S. Department of Commerce, N.M.F.S., Fisheries of the United States, 1960 - 1977.

foreign fishing grounds. Iron·cally, salmon roe was discarded with the viscera and other wastes for years until the initial roe pack in the mid-1950s. Even now, many plants do not utilize the roe, indicating a potential for future expansion of the market.

Statistics

Catch and Prices, All Salmon,

The salmon fishery is the dominant commercial fishery in Alaska. Between 1961 and 1977 the annual salmon catch accounted for between 29.5 percent to 62.9 percent of the total commercial catch in Alaska and from 1961 to 1975 salmon accounted for 39.2 percent to 65.5 percent of its value (Table 3.7). During this 17-year period the annual salmon catch has ranged from 59,700 MT (131.6 million pounds) in 1974 to 157,000 MT (346.5 million pounds) in 1970, while during the first 15 years of this period the value of the annual catch ranged from $24.6 million in 1967 to $68.0 million in 1970.

There is no well defined trend in the annual fluctuation of catch, but due to increases in the ex-vessel price of salmon, the value of catch has tended to increase over time. The dominance of the salmon fishery, particularly in terms of catch, has tended to decrease due to increases in the shellfish catch.

Catch and Prices, King Salmon

The king salmon catch is a relatively minor part of the total salmon catch measured either in weight or value. Between 1961 and 1977 the annual king salmon catch ranged from 3,130 MT (6.9 million pounds) in 1975 to 5,440 MT (12.0 million pounds) in 1977 and accounted for between 2.8 percent and 7 percent of the total salmon catch (Table 3.2). The annual catch has

TABLE B.7

THE ALASKAN SALMON FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL FINFISH CATCH VALUE	POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	POUNDS
1961	264,814	$35,741	$0.13	72.2	72.4	65.5	61.5
1962	277,848	42,119	0.15	68.7	75.3	61.6	62.0
1963	223,063	31,298	0.14	70.8	72.7	58.2	54.0
1964	311,623	41,359	0.13	76.4	77.0	64.5	60.9
1965	274,844	48,274	0.18	72.6	78.2	59.6	54.0
1966	333,325	54,202	0.16	74.7	82.6	60.1	55.9
1967	138,517	24,631	0.18	67.9	71.1	45.2	36.8
1968	285,272	49,455	0.17	82.5	86.0	56.4	60.2
1969	219,150	42,428	0.19	69.2	79.0	51.0	53.8
1970	346,465.	67,975	0.20	79.5	87.0	64.1	62.9
1971	251,705	51,411	0.20	79.0	84.4	56.4	52.3
1972	189,784	45,295	0.24	67.9	80.2	45.8	44.0
1973	136,493	60,059	0.44	72.0	69.6	39.2	29.5
1974	131>603	65,579	0.50	79.3	70.4	44.1	28.6
1975	137,607	55,302	0.40	71.8	71.1	41.8	31.2
1976	243,975				92.4		42.0
1977	299,647				94.6		47.4
1978							
Average	236,161	47,675					

Source: ADF&G Statistical Leaflets for various years.

TABLE B.X
THE ALASKAN KING SALMON FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SALMON CATCH VALUE	PERCENTAGE OF TOTAL SALMON CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961	8,541	$2,243	$0.26	6.3	3.2	4.1	2.0
1962	8,739	2>699	0.31	6.4	3.1	3.9	1.9
1963	9,161	3,127	0.34	10.0	4.1	5.8	2.2
1964	11,567	3,662	0.32	8.9	3.7	5.7	2.3
1965	11,009	3,049	0.28	6.3	4.0	3.8	2.2
1966	9,351	2,949	0.32	5.4	2.8	3.3	1.6
1967	11,632	3,100	0.27	12.6	8.4	5.7	3.1
1968	11,246	3,865	0.34	7.8	3.9	4.4	2.4
1969	10,746	3,506	0.33	8.3	4.9	4.2	2.6
1970	11,546	5,035	0.44	7.4	3.3	4.7	2.1
1971	11,972	4,688	0.39	9.1	4.8	5.1	2.5
1972	9,973	3,732	0.37	8.2	5.3	3.8	2.3
1973	8,917	7,880	0.88	13.1	6.5	5.1	1.9
1974	9,290	6,945	0.75	10.6	7.1	4.7	2.0
1975	6,942	5,258	0.76	9.5	5.0	4.0	1.6
1976	8,601				3.5		1.5
1977	12,042				4.0		1.9
1978							
Average	10,075	4,116					

Source: ADF&G Statistical Leaflets for various years.

been relatively stable with no well defined trends. Due, however, to increases in ex-vessel prices, the value of king salmon catch has tended to increase. The value of the annual catch ranged from $2.2 million in 1961 to $7.9 million in 1973 and accounted for between 5.4 percent and 13.1 percent of the value of the tota? salmon catch. The disproportionately high value results from ex-vessel price of king salmon being higher than those of other types of salmon.

Catch and Prices, Red Salmon

Red salmon are a major resource of the Alaskan salmon fishery. Between 1961 and 1971 the annual red salmon catch accounted for from 17.1 percent to 51.7 percent of the total salmon catch and from 24.4 percent to 63.8 percent of its value (Table B.9). During this period the red salmon catch ranged between 14,600 MT (32.2 million pounds) in 1974 and 68,400 MT (150.8 million pounds) in 1970. The annual catch exhibits large fluctuations, periods of recovery lasting generally two years, periods of contraction lasting three to five years, but no strong tendency to increase or decrease for the period as a whole. Increases in the ex-vessel price of red salmon have created an upward trend in the value of catches.

Catch and Prices, Coho Salmon

Coho salmon have not generally been a major component of the salmon catch in terms of weight or value. From 1961 through 1977 the annual coho salmon catch amounted to between 3.4 percent and 9.7 percent of the total salmon catch and from 1961 through 1975 it accounted for between 5.2 percent and 13.6 percent of the value of the total Alaskan salmon catch (Table B.10). The annual coho salmon catch has been less volatile than that of red or pink salmon,

TABLE [illegible]
THE ALASKAN RED SALMON FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SALN1ON CATCH VALUE	PERCENTAGE OF TOTAL SALN1ON CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961	95,230	$17,539	0.18	49.1	36.0	32.1	22.1
1962	52,946	11,130	0.21	26.4	19.1	16.3	11.8
1963	35,456	7,644	0.22	24.4	15.9	14.2	8.0
1964	54,132	12,247	0.23	29.6	17.4	19.1	10.6
1965	142,034	30,802	0.22	63.8	51.7	38.0	27.9
1966	92,767	19,737	0.21	36.4	27.8	21.9	15.6
1967	53,522	11,865	0.22	48.2	38.6	21.8	14.2
1968	48,696	12,723	0.26	25.7	17.1	14.5	10.3
1969	71,735	18,046	0.25	42.5	32.7	21.7	17.6
1970	150,812	37,249	0.25	54.8	43.5	35.1	27.4
1971	87>288	22,849	0.26	44.4	34.7	25.1	18.1
1972	41,984	13,180	0.31	29.1	22.1	13.3	9.7
1973	35,248	15,327	0.43	25.5	25.8	10.0	7.6
1974	32,246	22,119	0.69	33.7	24.5	14.9	7.0
1975	42,762	19,230	0.45	34.8	31.1	14.5	9.7
1976	82,685				33.9		14.2
1977	91,124				30.4		14.4
1978							
Average	71,216	18,112					

Source: ADF&G Statistical Leaflets for various years.

TABLE II.10

THE ALASKAN COHO SALMON FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SALMON CATCH VALUE	POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	POUNDS
1961	11,386	$1,997	$0.18	5.6	4.3	3.7	2.6
1962	15,321	3,162	0.21	7.5	5.5	4.6	3.4
1963	17,581	3,008	0.17	9.6	7.9	5.6	4.3
1964	20,953	3,582	0.17	8.7	6.7	5.6	4.1
1965	17,666	4,362	0.25	9.0	6.4	5.4	3.5
1966	16,113	3,705	0.23	6.8	4.8	4.1	2.7
1967	13,022	3,343	0.26	13.6	9.4	6.1	3.5
1968	20,968	5,362	0.26	10.8	7.4	6.1	4.4
1969	8,034	2,229	0.28	5.3	3.7	2.7	2.0
1970	11,898	3,512	0.30	5.2	3.4	3.3	2.2
1971	11,459	2,820	0.25	5.5	4.6	3.1	2.4
1972	13,035	5,583	0.43	12.3	6.9	5.6	3.0
1973	9,837	7,470	0.76	12.4	7.2	4.9	2.1
1974	12,820	8,678	0.68	13.2	9.7	5.8	2.8
1975	7,128	4,246	0.60	7.7	5.8	3.2	1.6
1976	10,644				4.4		1.8
1977	15,363				5.1		2.4
1978							
Average	13,719	4,204					

Source: ADF&G Statistical Leaflets for various years.

ranging between 3,220 MT (7.1 million pounds) in 1975 and 9,530 MT (21.0 million pounds) in 1968 during the 17-year period.

The annual catch exhibits various patterns of fluctuation combined with a downward trend. The value of the annual catch also exhibits various patterns of fluctuation, but due to an upward trend in the ex-vessel price of coho salmon, the value of the catch has tended to increase.

Catch and Prices, Pink Salmon

During the past 17 years, pink salmon have been the largest component by weight of the total Alaskan salmon catch in all but four years. Red salmon were the largest component in those years. Due, however, to the lower ex-vessel price for pinks, the value of the pink salmon catch exceeded that of red salmon in only five years between 1961 and 1975. From 1961 through 1977 between 20.8 percent and 56.1 percent of the total salmon catch was comprised of pinks, and from ?961 through 1975 between 15.9 percent and 48.2 percent of its value was attributable to pinks (Table B.11).

The annual pink salmon catch has been very notable during the past 17 years, ranging from 13,100 MT (28.8 million pounds) in 1967 to 73,900 MT (162.9 roil"lion pounds) in 1966 but without a trend toward increasing or decreasing. The value of the annual catch has ranged from $3.2 million to $22.1 million; the years of minimum and maximum value coincided with those for catch.

Catch and Prices, Chum Salmon

The annual catch of chum salmon has been relatively stable in the last 17 years, ranging from 10,300 MT (22.7 million pounds) in 1969 to 29,400 MT (64.8 million pounds) in 1972 (Table B.12). Due to increases in the ex-vessel price of chum salmon the value of the catch has been less stable, ranging from $2.4

TABLE B.11
THE ALASKAN PINK SALMON FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SALMON CATCH VALUE	PERCENTAGE OF TOTAL SALMON CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961	103,538	$10,115	$0.10	28.3	39.1	18.5	24.1
1962	143,279	20,296	0.14	48.2	51.6	29.7	32.0
1963	125,117	14,472	0.12'	46.2	56.1	26.9	30.3
1964	162,281	17,174	0.11	41.5	52.1	26.8	31.7
1965	74,873	7>684	0.10	15.9	27.2	9.5	14.7
1966	162,866	22,093	0.14	40.8	48.9	24.5	27.3
1967	28,822	3,241	0.11	13.2	20.8	5.9	7.7
1968	148,446	20,490	0.14	41.4	52.0	23.3	31.3
1969	105,967	15,712	0.15	37.0	48.4	18.9	26.0
1970	117,718	15,563	0.13	22.9	34.0	14.7	21.4
1971	86,260	13,518	0.16	26.3	34.3	14.8	17.9
1972	59,969	10,882	0.18	24.0	31.6	11.0	13.9
1973	36>610	11,666	0.32	19.4	26.8	7.6	7.9
1974	40,072	13,861	0.35	21.1	30.4	9.3	8.7
1975	49,969	16,053	0.32	29.0	36.3	12.1	11.3
1976	102,401				42.0		17.6
1977	129,550				43.2		20.5
1978							
Average	98,691	14,188					

Source: ADF&G Statistical Leaflets for various years.

TABLE B.12
THE ALASKAN CHUM SALMON FISHERY IN PERSPECTIVE

	CATCH (in 000's)		PRICE	PERCENTAGE OF TOTAL SALMON CATCH		PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH	
YEAR	POUNDS	VALUE	($'s per pound)	VALUE	POUNDS	VALUE	POUNDS
1961	46,121	$3>846	$0.08	10.8	17.4	7.0	10.7
1962	57,653	4,832	0.08	11.5	20.7	7.1	12.9
1963	35,748	3,047	0.09	9.7	16.0	5.7	8.7
1964	62,690	4,695	0.07	11.4	20.1	7.3	12.2
1965	29,263	2,377	0.08	4.9	10.6	2.9	5.7
1966	52,229	5,718	0.11	10.5	15.7	6.3	8.8
1967	31,518	3>083	0.10	12.5	22.8	5.7	8.4
1968	55,916	7,015	0.13	14.2	19.6	8.0	11.8
1969	22,668	2,934	0.13	6.9	10.3	3.5	5.6
1970	54,491	6,616	0.12	9.7	15.7	6.2	9.9
1971	54,726	7,536	0.14	14.7	21.7	8.3	11.4
1972	64,823	11,919	0.18	26.3	34.2	12.1	15.1
1973	45,881	17,716	0.39	29.5	33.6	11.6	9.9
1974	37,174	13,975	0.38	21.3	28.2	9.4	8.1
1975	30,805	10,514	0.34	19.0	22.4	7.9	7.0
1976	39,643				16.2		6.8
1977	51,569				17.2		8.2
1978							
Average	45,465	7,055					

Source: ADF&G Statistical Leaflets for various years.

million in 1965 to $17.7 million in 1973. The price increases have also tended to increase the value of catch overtime despite the lack of a discernible trend in catch. Chum salmon have been a moderately important component of the salmon fishery, accounting for between 10.3 percent and 34.2 percent of the total salmon catch by weight and between 4.9 percent and 29.5 percent of the total salmon catch by value.

Production

Salmon products continue to dominate Alaskan processing despite decreases in salmon production and increases in the production of other fish. Between 1966 and 1975 salmon production accounted for from 39.1 percent to 80.0 percent of all Alaskan processing production (Table 3.13). During this period annual salmon production averaged 66,200 MT (146.0 million pounds) and ranged from 44,000 MT (97.0 million pounds) in 1974 to 102,000 MT (224,2 million pounds) in 1966. The average annual production for the first five years is greater than that for the period as a whole indicating that salmon production has tended to decrease.

At the same time that total salmon production has tended to decrease, the change in the product mix between fresh/frozen products and canned and other products has resulted in an increase in fresh/frozen production. The fresh/frozen share of total production increased from 12.4 percent in 1966 to 32.9 percent in 1975. The increase in the relative importance of fresh/frozen products means that the production of canned and other products decreased more rapidly than did total salmon production.

TABLE B.13

Salmon Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966	79	61	224,188	27,814	196,374	12.4	87.6	70.9
1967	70	56	97,954	19,933	78,021	20.3	79.7	55.4
1968	69	61	192,050	26,908	165,142	14.0	86.0	80.0
1969	71	62	134,770	19,329	115,441	14.3	85.7	71.3
1970	72	77	217,245	34>931	182,314	16.1	83.9	76.3
1971	62	80	172,640	23,395	149,245	13.6	86.4	72.2
1972	60	88	120,271	31,191	89,080	25.9	74.1	59.6
1973	47	95	101,307	38,164	63,643	37.5	62.5	44.8
1974	49	91	96,981	27,178	69,803	28.0	72.0	39.1
1975	57	100	102,365	33,673	68,692	32.9	67.1	47.2
1976								
1977								
Average (1966-1970)			173,241	25,783	147,458	15.4	84.6	70.8
Average (1966-1975)			146,027	28>521	117,776	21.5	78.5	61.7

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

Factors of Change

Harvesting Technology

Alaska's salmon fishery has undergone only minimal change in terms of harvesting technology during the past two decades, and other than restrictions placed on gear, little has changed since the industry's infancy in the 1800s. Today's primary methods of commercial salmon catching are trolling, gill-netting, and purse seining, with a very few fish wheels in operation at specifically allowed sites.

When the State of Alaska formally assumed management responsibility for its fisheries in 1960, a fourth major fishing method, the fish trap, was almost immediately banned. This device, usually constructed and operated only by canneries due to high costs, was perhaps the most efficient fish harvesting method ever devised by men. Fish traps had the potential to catch up to 100 percent of the salmon passing through an area, depending on the portion of their migratory route blocked by the trap, creating a situation where improper use of fish traps could annihilate entire salmon runs.

The major changes that have affected salmon fishing are labor saving devices. Fishermen who troll for salmon and other fish species have been using a "gurdy" since the late 1940s. The gurdy reels in the individual trolling lines and is usually hydraulically powered, although electric motors and power take-offs have been important steps along the way. Some trollers using smaller, lighter gear use hand powered gurdies.

Gillnetting accounts for a major portion of Alaska's salmon catch, with the use of set nets or drift nets. Whether the gear is stationary or drifting, salmon are caught the same way: the migrating salmon attempt to swim through the net placed in their pathway and become entangled when their gill area snags. Other than the utilization of more modern materials, the fishing procedure for gillnetting is essentially unchanged since first used to fish along the Pacific coast. The labor requirement for drift gillnetting, however, has been reduced somewhat by adoption of the gillnet power reel. The reel is most often hydraulically driven, and the speed of the reel can be controlled by the person picking the fish from the net as it is wound onto the power reel. Where pulling the net aboard was once a difficult task for two men, most drift gillnetters are now able to perform all the tasks necessary for successful fishing without assistance.

Purse seining was the method of salmon fishing most influenced by labor-saving inventions. Power drums were first used around 1952 to assist with hauling the heavy, pursed seines. However, the equipment was quickly regulated out of use in Alaska, supposedly because of its great efficiency at catching salmon. In 1955 the Puretic Power Block was introduced to purse seiners, and it quickly affected seining worldwide. The Power Block is extended above the fishing vessel's working area on a boom and is powered hydraulically. A non-skid rubber V-shaped roller turns under hydraulic power and feeds the purse seine through, hauling the catch out of the water and onto the fishing vessel's work area. The Power Block is relatively simple and inexpensive compared to some of today's exotic equipment, and has reduced the crew size necessary on a salmon seiner from around ten persons to five or six. The extraordinary impact of the Power Block is well emphasized by the United Nations Food and Agricultural Organization's estimate that over 40 percent of all the commercially caught fish in the world are taken by the Puretic Power Block.

The fishing vessels used for salmon fishing cover a wide spectrum of sizes and amenities. Generally, gillnet fishermen are using slightly larger vessels than in the past, commonly being around 9 m (30 feet) in length and having more power ul engines. Bowpickers, those with the power reel mounted in a work. area at the front of the boat, have become increasingly popular among gil netters since around 1970. These provide only minimal protection from the elements, but are extremely adept at maneuvering in the area fished and are usually fast enough to change fishing areas quickly.

Much gillnetting is still performed from vessels which appear more similar to a sport fisherman's rowboat than would be expected of a commercial fishing vessel. At the other end of the range are the larger purse seiners that may have a full compliment of the latest electronic navigational gear, with capabilities of entering other fisheries and traveling out of the protected waters usually fished by gillnetters. Purse seiners are confronted with a 17.7 m (58. feet) limit on the overall length of purse seine vessels, known as the "Alaska limit". This limit was established in the 1920s, as a means of limiting the catching capability of individual vessels. Though of questionable merit today, the limit will probably remain due to the large investment in vessels which conform to the limit.

Production Technology

Salmon processing in today's canneries is much the same as it was fifty years ago and before. Growth of the salmon industry, which peaked in 1936, was brought about due to adequate canning techniques having already been developed at the time. Though improvements have taken place in canning methods and machines are improved, no advancements within the recent past stand out as especially significant. Some of the older canneries in Alaska that have been closed for many years still contain canning lines that are utilized for maintenance parts in some of the operating canneries, or may have entire lines refurbished and moved into other plants for use.

The Iron Chink is the one outstanding development that greatly influenced the salmon industry. Whereas many facets of the food preservation industry benefited from canning improvements, the Iron Chink's usefulness was valuable only to salmon processors. The first Iron Chinks appeared in 1904, deriving the name from the vast number of Chinese laborers displaced by its appearance. The 1904 version was very crude compared to its modern-day counterpart. In brief, the machine performs the following to each salmon: beheading, removing the fins, opening the belly and removing the viscera, and cleaning the body cavity. Though the Iron Chink initially replaced many laborers, it eliminated a bottleneck in the canning process that ultimately allowed the salmon industry to grow to a size requiring more workers than were utilized before the machine appeared.

During the late 1960s and the 1970s the salmon industry has shown a marked tendency toward freezing a greater portion of the pack and canning less. This action appears related to increasing canning costs and favorable market response to the frozen product, among other influencing factors.

Salmon roe, formerly a waste product from salmon processing, is now a valuable commodity for export to Japan. Prior to 1965 most salmon eggs were discarded or used as bait. By 1968 almost all of Alaska's salmon roe was saved for the newly discovered Japanese market. Roe processing in the Alaskan plants is usually under the supervision of Japanese technicians, whose companies oversee the marketing of the roe once it leaves the United States.

Regulation

The Alaskan salmon fishery has evolved from a condition of nearly no regulation to extremely strict regulation. Until 1959 when Alaska became a state and was granted the power to regulate its fisheries, the federal government exercised regulatory control over the territory's resources. This period covered the late 1800s through 1959. Though many concerned individuals during this time realized that the salmon fishery was being over-utilized and voiced their warnings, no real policy was developed to conserve or rehabilitate the remainder of the stocks.

Upon receiving management control of its fisheries, the State of Alaska set about establishing a long term policy aimed at restoring the Alaska salmon fishery. The state's new Department of Fish and Game had very little historical data, scientific or biological information, or expertise on which to base their planning. Therefore, encouraging results were slow in coming and proper management practices are still being developed, but recent increased salmon catches and other biological factors being monitored indicate that progress is being made toward rebuilding an depleted fishery.

The Alaska Department of Fish and Game has utilized regulation of fishing gear and fishing seasons as its major management tools. Gear regulations state the exact size of legal gear, how it can be used, and when and where fishing is allowed. Many of the gear restrictions, such as banning of fish traps and specifying where gillnets can be set, are actually designed to decrease the efficiency of fishing effort. Implementation of closed fishing periods in specific areas offsets the high efficiency of the fishermen, allowing 100 percent escapement during those periods.

Even with the multitude of regulations governing salmon fishing throughout the 1960s and early 1970s, participation in the fishery remained extremely high. In 1974 the salmon fishery was placed under a limited entry permit system designed to accomplish four major goals: 1) prevent additional gear from entering an overcrowded fishery; 2) encourage use of under-developed fisheries; 3) stabilize the amount of gear in each fishery at levels that will allow fair dollar returns, effective fisheries management, and upgrading of vessels and gear; and 4) promote professional and diversified commercial fisheries.

The limited entry program, though not without its negative effects., has great;u improved the financial condition of those remaining in the salmon fishery. The greater financial returns, along with growing and more regular stocks of returning salmon, have helped make strict regulation of the fishery more palatable.

Other Governmental Policy

The State of Alaska has undertaken an extensive program aimed at rehabilitating Alaska's salmon stocks. As a general guideline, effort is being directed at increasing the presently depressed stocks to levels existing around the 1930s when salmon were most abundant. As an initial step in this direction, the 1971 State Legislature created the Division 'of Fisheries, Rehabilitation, Enhancement, and Development (F.R.E.D.), as part of the Alaska Department of Fish and Game.

The F.R.E.D. Division has invested considerable resources in creating an aquiculture program. The division had ten salmon hatcheries operating in 1976, with several more planned. As a means of encouraging private participation in the rehabilitation and enhancement of salmon stocks, provision was made in the legislation for nonprofit private hatcheries, with loans available from the state to assist with initial construction and operating costs.

The hatcheries are assigned specific streams or areas in which to release their artificially-hatched fry. The fry receive fin notches or coded wires to identify them when they return several years later to their specific area of release to spawn. A hatchery's success is determined by the portion of released fry that return as adults to the same area to spawn or are caught by fishermen. Returns are usually considered good at 1 to 2 percent, with 5 to 6 percent being extremely successful.

The nonprofit private hatcheries depend upon a certain portion of the return to eventually cover operating costs and repay loans from the state. A smaller portion is necessary for obtaining milt and roe for raising more fry for release. The bulk of each return is designated for harvest by fishermen, who are to be the primary benefactors of the program.

The aquiculture program has shown considerable potential thus far, as hatcheries are generally achieving adequately high returns to merit continuation. Most hatcheries that have been underway for several years have only received one or two years of returns to evaluate so far, therefore it will be sometime before the cumulative effects of the program can be accurately examined. Management personnel at one of the first private hatcheries have indicated that they hope to have returns great enough to meet the organization's financial obligations by about their sixth year of operation.

The federal government expressed increased concern for the United States' fisheries resources when the fisheries conservation zone was extended to 200 miles (322 km) off our coasts, However, this extension has not completely protected salmon from uncontrolled foreign fishing efforts, as it is becoming known that Alaskan-spawned salmon migrate over vast areas outside the 200 mile (322 km) zone. The migration range of Alaska's salmon was grossly underestimated even within the present decade. Japan in particular has harvested millions of immature Alaska-spawned salmon, while adhering to agreements with the United States concerning salmon fishing areas. In an attempt to rectify this situation, appropriate U.S. government agencies have recently persuaded Japan to cooperate with U.S. management attempts throughout the entire migratory path of Alaskan salmon. Fisheries experts are finding that salmon migrating from sources along the Gulf of Alaska are not as commonly found in the Japanese high seas fishing areas as those from Bristol Bay and other western Alaska areas. Therefore, curtailment of the Japanese salmon harvest should not greatly influence Gulf of Alaska salmon runs.

CONFLICTS WITH OTHER FISHERIES AND OTHER COMMERCIAL VESSELS

The principle conflicts between the salmon fishery and other commercial fisheries result from competition for space in small boat harbors, overcrowding being the normal condition in most Alaskan small boat harbors. There are conflicts between the various commercial salmon fisheries (e.g., purse seine, drift gillnet, etc.) in that they are competing for the same limited resource, though generally at different times during the season and or in different areas.

The conflicts between the commercial and sport salmon fisheries exist primarily because both are competing for the same resource. The magnitude of conflict tends to increase as the size of the sport fishery increases. This is most likely to occur where there is easy access for sport fishermen from more heavily populated areas. A conflict between these fisheries will also exist if they compete for space in small boat harbors.

There are also conflicts between commercial and subsistence fisheries due to their competition for the same fishery resources.

The conflict between the commercial salmon fisheries and commercial vessel traffic is minimized due to the nature of gear and the location of the fishery activity.

HALIBUT

Development and Market Structure

The rapid development of the Alaskan halibut industry which began in the late 1800s was primarily due to two factors: the Atlantic halibut fishery was deteriorating after years of heavy American and European fishing, and refrigerated railroad transportation between the Pacific Northwest and the East Coast was improving. The former created a market opportunity for a new source of halibut, and the latter allowed the Alaskan and Pacific Northwest halibut industries to take advantage of the market opportunity.

The first Pacific Northwest cold storage plant was built in Washington in 1892, and four more were operating by 1903. As the fishermen ventured further north, cold storage plants were established at Ketchikan and Sitka, Alaska, in 1909 and 1913, respectively. In 1913 when a cold storage facility was built and railroad access was completed to Prince Rupert, Canada, Alaska's importance to the halibut fishery was firmly established.

In the late 1800s and early 1900s, Seattle was the major halibut buying center in the United States. As the fishery expanded north to Canada and Alaska and as processing plants were established in these areas, Seattle assumed less importance and the fishery decentralized. Due to fuel costs and perishability of the product, fishermen started selling directly to the more local buyers. Alaska's catch of halibut, although decreasing as in most other areas, has attained increasing importance; it accounted for 47.9 percent of the world catch in 1976 (Table 3.14), and 97 percent of the total U.S. catch in that year (Orth, et al., 1978, Preliminary Draft).

TABLE 3.14

Comparison of Alaska's Relative Importance with the Rest of the World in the Catch of Halibut (Hippo glossus sp.) Including Japanese and Russian Catch in 1976

In Metric Tons Live Weight[1]

	Alaska	Other North Pacific (Includes Japan, Russia and others)	North Atlantic	Total	Alaska Percent
1932[3]	22,363,136	16,511,884	17,907	56,782,020	39.8
1976	15,594,?89	9,974,934[2]	.6,947[2]	32,542,934	47.92

1 Alaska and North Atlantic figures for 1932, as veil as components of catch under other North Pacific, were taken from various IPHC statistical reports.

2 Components of this total were taken from the 1976 FAO Yearbook of Fisheries Statistics.

3 1932 was one year after one of the lowest catches in history for U. .S. and Canada.

Source: Orth et al., 1978. (Preliminary Draft)

As the world's largest consumer of halibut, the United States consumes the bulk of its domestic catch and imports large quantities of halibut (Tables 3.15 and 3.16). Total consumption of halibut in the United States, however, has decreased drastically; Americans consumed over three times more halibut in 1960 than in 1976 (Table 3.17). This is evidently a result of decreased supplies, as the existence of a strong demand is substantiated by the consistent price increases over the same period (Table 3.18). In an attempt to halt and reverse the trend of decreasing halibut stocks, the International Pacific Halibut Commission (IPHC) has imposed strict catch quotas, thereby establishing the maximum quantity of halibut that will be supplied during any period.

The decreasing supply and increasing value of halibut have increased the bargaining power of the fishermen vis-a-vie the processors. Processors now vie for the fishermen's catch in an attempt to have guaranteed sources of halibut. This situation has helped assure fishermen of competitive prices for their catch, and has resulted in processors resorting to nonprice forms of competition such as free or reduced prices for ice and bait, in-port services to fishermen including parts supply, hotel reservations, use of automobiles, and laundry service, and assisting fishermen in obtaining loans, less expensive fuel or fishing gear. Although put in a competitive position to obtain the required raw resource, processors do have the benefit of knowing beforehand the quantity of halibut that will be harvested if quotas are met.

The price fishermen receive for their catch may depend upon the grade it falls within. The medium grade halibut, 4.5 to 27 kg (10 to 59 pounds) inclusive, are most sought by processors. The whale grade 27 kg (60 pounds) and over, were formerly less desirable but are now in demand

TABLE B.15

U. S. Imports of Fresh Chilled or Frozen Halibut
Not Scaled: Whole or Beheaded
(In Thousands of Pounds and Dollars)

Year	CANADA Quantity	CANADA Value	JAPAN Quantity	JAPAN Value	NORWAY Quantity	NORWAY Value	OTHER Quantity	OTHER Value	TOTAL Quantity	TOTAL Value
1977	5,369	7,989	48	59			491	212	5,908	8,260
1976	5,421	7,462	1,764	2,334			215	145	7,400	9,941
1975	6,948	7,307	827	689			181	33	7,956	8,029
1974	4,416	4,469	826	667			115	58	5,357	5,194
1973	16,472	8,544	2,052	1,519			95	55	12,619	10,118
1972	12,736	8,521	3,888	2,233			106	38	16,730	10,792
1971	19,746	8,118	67	33	63	39	96	38	19,972	8,228
1970	18,131	8,086	55	27			27	10	18,213	8,123
1969	19,934	8,489	103	50	13	7	44	17	20,094	8,563
1968	17,836	5>553	180	40	51	28	15	5	18,082	5,626
1967	15,430	4,781	68	22	27	15	42	19	15,567	4>837
1966	19,421	7,497	19	8	22	13	34	13	19,496	7>531
1965	21,451	7,406	28	8	134	54	40	47	21,653	7,515
1964	22,303	6,126	138	36	114	46	4	1	22,559	6,209
1963	3,923	1,157	15	3	155	64	22	6	4,115	1,230
1962	23,548	7,791	394	107	808	296	27	7	24,776	8,201

SOURCE: U. S. Department of Census, Imports for Consumption by Year.

TABLE B.16

Halibut Fillets and Other Processed Forms,
Fresh Chilled and Frozen,
Imported for U. S. Consumption
(In Thousands of Pounds and Dollars)

Year	CANADA Quantity	CANADA Value	JAPAN Quantity	JAPAN Value	ICELAND Quantity	ICELAND Value	OTHER Quantity	OTHER Value	TOTAL Quantity	TOTAL Value
1977	206	395	1,094	1,982	288	473	12	8	1,600	2,858
1976	225	364	2,442	3,907	330	381	47	64	3,044	4,716
1975	102	180	4,230	5,508	142	157	91	31	4,565	5,876
1974	240	268	3,178	2,899	201	146	16	13	3>635	3,326
1973	362	520	8,011	7,326	251	167	174	117	8,798	8,130
1972	564	657	11,657	7,259	302	205	227	91	12,750	8,212
1971	1,738	1,468	3,694	1,874	183	127	134	52	5,749	3,521
1970	1,719	1,473	4,517	2,325	252	177	13	6	6,501	3,981
1969	2,871	2,163	4,238	2,078	175	101	73	39	7,357	4,380
1968	6,574	2,872	3,822	1,313	211	129	103	31	10,710	4,345
1967	6,242	2,457	1>949	819	115	77	70	25	8,376	3,378
1966	3,316	1,904	2,051	1,055	135	67	197	53	5,699	3,079
1965	3,448	2,455	2,232	1,085	131	60	31	8	5,842	3,608
1964	3,075	1,745	2,224	776	121	55	118	30	5,842	3,608
1963	976	568	849	285	28	13	56	13	1,909	879
1962	2,406	1,550	4,335	1,723	282	120	108	37	7,131	3,430

SOURCE: U.S. Department of Census, Imports for Consumption by Year.

Table B.17

U. S. CONSUMPTION OF HALIBUT 1960 - 1976
(pounds in 000's)

Total Consumption	Total Resident Population	Per Capita Consumption
75,349	179,979,000	.4187
70,052	182,992,000	.3828
73,100	185,771,000	.3935
48,503	188,483,000	.2573
71,105	191,141,000	.3720
63,069	193,526,000	,3259
59,103	195,576,000	.3022
62,025	197,457,000	.3141
60,657	199,399,000	.3042
58,486	201,385,000	.2904
56,092	203,810,000	.2752
60,211	206,219,000	.2920
49,456	208,234,000	.2375
44,799	209,859,000	.2135
31,477	211,389,000	.1489
32,533	213,032,000	.1527
24,448	2.4,649,000	.1139

Source: Orth et al., 1978 Preliminary Draft

TABLE B.18

New York Wholesale Price Per Pound
(Cents/Lb.) of Dressed Frozen Pacific Halibut by Month and Year
with Corresponding Real Prices for the Yearly Average Price

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year Average	Halibut Index	WPI MP&F	Avg. Price WPI MP&F
1958	31.2	31.5	32.0	33.8	34.5	40.0	40.0	37.0	36.6	34.3	34.0	33.7	34.9	84.3	102.8	34.0
1959	33.5	33.2	33.3	33.0	34,6	34.0	33.5	34.8	32.7	31.8	31..0	31.2	33.1	80.0	94.5	35.0
1960	30.3	29.2	29.2	30.0	30.2	33.5	34.3	35.5	30.8	30.5	29.8	30.0	31.1	75.1	93.1	33.4
1961	30.0	32.0	32.7	33.3	34.8	37.0	35.0	38.0	39.0	34.7	35.0	35.5	34,8	84.1	90.9	38.3
1962	37.3	39.7	39.5	45.0	41.3	44.0	45.0	47.0	42.8	43.8	43.8	43.0	42.7	103.1	94.4	45.2
1963	43.3	42.5	41.3	40.0	35.8	36.0	36.0	38.5	43.5	43.9	32.8	32.5	38.8	93.7	88.9	43.6
1964	32.5	30.5	30.2	28.0	34,3	36.2	40.0	41.5	55.0	55.5	38.0	40.0	38.5	93.0	86.5	44.5
1965	40.0	39.7	39.7	40.5	40.5	43.8	50.0	50.5	51.0	48.0	47.5	47.7	44.9	108.5	96.2	46.7
1966	47.7	47.0	47,5	47.5	47.5	47.3	48.8	48.0	48.0	47.0	48.0	48.0	47.8	115.5	105.0	45.5
1967	48.0	47.0	44.0	41.0	37.5	37.5	36.0	42.0	44.5	40.8	39.0	39.0	41.4	100.0	100.0	41.4
1968	39.0	34.5	34.5	34.5	34.3	37.2	39.4	41.6	40.6	45.2	38.5	39.0	38.2	92.3	103.1	37.0
1969	41.3	41.3	43.0	47.0	47.0	58.0	62,0	62.0	66.0	60.0	63.0	58.0	54.1	130.7	113.8	47.5
1970	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.0	57.3	56.7	55.3	54.9	56.9	137.4	115.8	49.1
1971	54.2	54.2	55.0	53.0	53.0	53.0	53.1	53.1	53.1	53.5	55.0	58.5	54.1	130.7	11.6.0	46.6
1972	62.0	62.1	67.6	72.0	76.8	77.0	85.0	90.1	92,2	95.0	95.0	95.0	80.8	195.2	130.0	62.2
1973	91.8	91.7	90.4	88.0	97.1	99.6	99.6	105.0	105.0	105.0	102.5	102.5	98.0	236.7	167.5	58.5
1974	102.5	102.5	103.0	105.0	99.8	95.8	98.3	98.3	105.0	105.0	105.0	105.0	102.1	246.6	163.5	62.5
1975	105.7	107.1	108.3	11.5.0	115.0	120.0	120.0	127.0	145.5	149.0	150.0	150.0	126.0	304.4	191.0	66.0
1976	150.0	150.0	150.0	150.0	1,50.0	165.0	165.0	170.0	173.0	173.0	170.0	170.0	161.4	389.9	181.6	88.9
1977	170.0	1.70.0	170.0	170.0	170.6	172.9	173.5	175.0	175.0	180.0	180.0	180.0	173.9	420.1	182.0	95.6
1978	180.0	180.0	182.0	186.0									182.0	439.6	193.6	94.0

Source: Fishery Market News Report, National Marine Fisheries Service, New York Market Statistics, as reported in Food Fish Market Review and Outlook, December 1977. Wholesale price Indices obtained through Bureau of Labor Statistics Handbook of Labor Statistics, 1971 and 1976, and monthly updates for 1977 and 1978.

Orth et al., 1978, Preliminary Draft

due to the increasing popularity of large fillets called fletches. Chicken halibut less than 4.5 kg (10 pounds) have been illegal to catch since 1973 under IPHC regulations. Within each grade the fish are divided into #l's and #2's. The #l's are of the better quality, while #2's have less desirable carcasses due to bruises, wounds, mishandling, etc. The general trend has been emphasis on quality of fish. Although processors, facing a seller's market, usually are lenient on grading of fish to insure that fishermen will continue doing business with them.

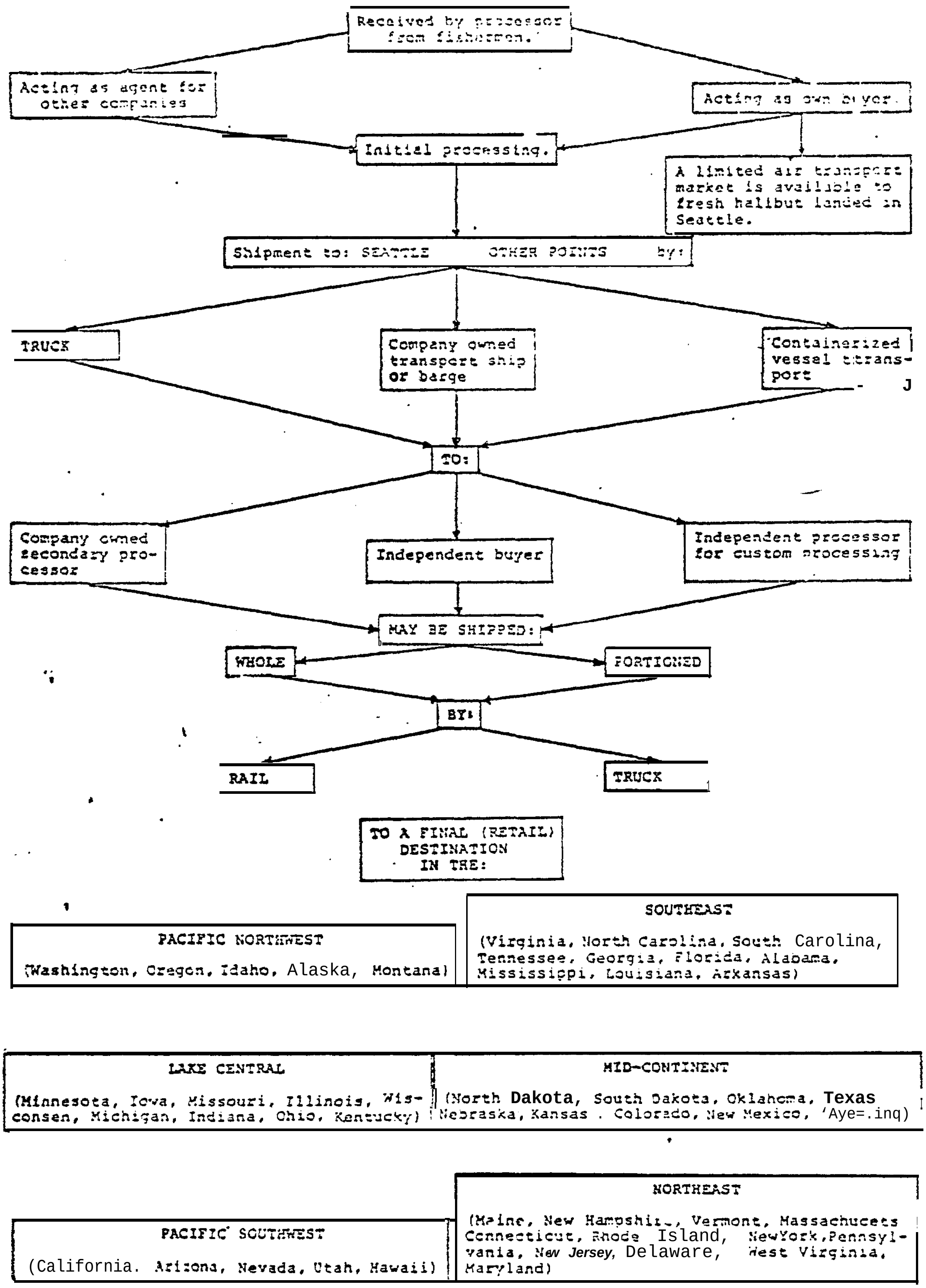
Due to the high operating costs in Alaska, notably labor and transportation, most halibut receives only preliminary processing before being transported south. The fish have usually been drawn (gilled and gutted) at sea by the fishermen, and the whole, headed fish is frozen and glazed at the processing plant. Most Alaskan halibut is then shipped to the lower states, usually Seattle, to undergo further processing. Although no longer the buying center for halibut, Seattle is the center for reprocessing. Halibut is purchased by processors who perform the preliminary processing in Alaska and is then shipped to the Seattle area for further processing. The same company many own both plants or the secondary processing may be done by a custom packer. A custom packer is a processor that processes fish for another processor, Transportation is usually by freighter or barge, with the fish packed in refrigerated container vans or in boxes weighing 320 or 816 kg (750 or 1,800 pounds), called totes. With proper freezing, halibut may be kept in good condition for at least a year; this permits a more stable release of product onto the market and allows sellers to utilize market ng techniques not possible with quickly perishable items. -

The whole halibut is usually steaked or filleted into large portions. Steaks are placed into shipping boxes of 2.3, 4.5 or 6.8 kg (five, ten, or fifteen pounds) for further distribution; fillets are larger and sold for further portioning. The final portioning is done as close to the final consumer as possible to help maintain the superior shelf life of the final product. Larger portions have less surface area per volume exposed for degradation or damage. Also, persons involved in the Alaska halibut industry have indicated that transportation costs are less for large portions than for the more processed smaller portions. The market channels, processing, and distribution of Alaska halibut are summarized in Figures 3.3 and 3.4 .

Halibut, as with many seafoods, has its largest final consumer market in the restaurant and other institutions sector. Halibut industry sources claim a marked reduction in sales of their product to retail grocery outlets over the past several years, with restaurants and other institutions accounting for a growing share of the market.

The American halibut industry, even with the consistent demand for its product, has sometimes felt it necessary to undertake serious lobbying and advertising campaigns. As early as 1928, halibut fishermen and processors expressed concern with the presence of Greenland "halibut" on the American market. The Greenland product was more abundant than the traditional halibut and sold for lower prices. In 1960 the Halibut Association of North America started an advertising campaign to inform the public that the products were actually different species of fish, and emphasized the more desirable nutritional characteristics of real halibut. In 1967 the Food & Drug Administration (FDA) declared Greenland "halibut" would thereafter be marketed in the United States under the name "turbot". This success in achieving product differentiation may be

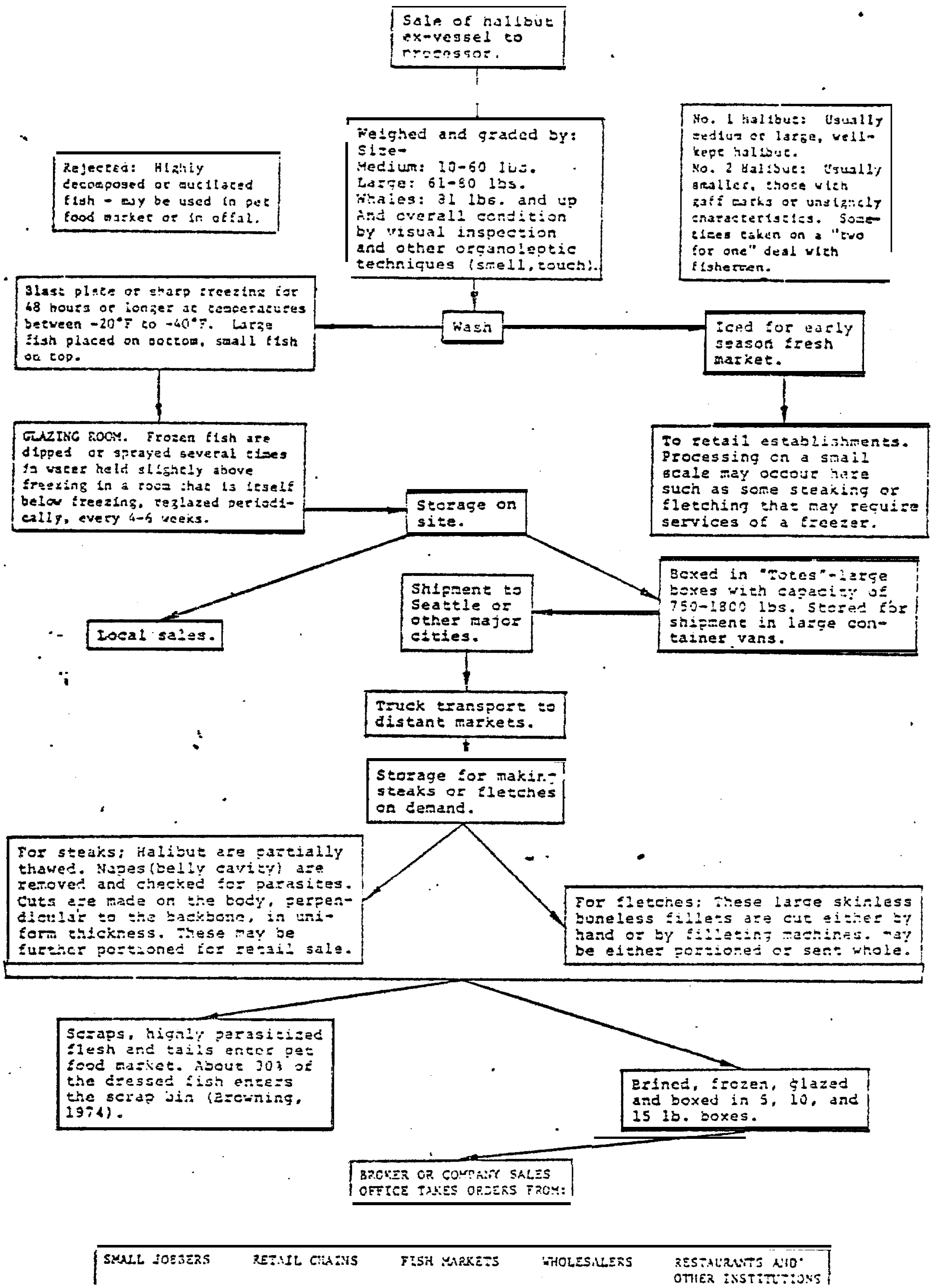
FIGURE B.3



THE MARKET CHANNELS FOR HALIBUT
LANDED AT ALASKAN PORTS

Source : Orth, et al, 1978, Preliminary Draft.

FIGURE B.4



THE PROCESSING AND DISTRIBUTION OF HALIBUT

Source: Orth et al., 1978, Preliminary Draft.

partially responsible for the present healthy halibut market, characterized by increasing halibut prices despite increased imports of Greenland turbot.

Statistics

Catch and Prices.

The annual catch of halibut in Alaskan waters has decreased dramatically in the past 17 years (Tab" e 3.19). Between 1961 and 1977 the annual catch decreased in all but four years ranging from 25,900 MT (57.2 million pounds) in 1962 to 7,480 MT (16.5 million pounds) in 1974. Due to increasing ex-vessel prices, the value of the annual catch has been more stable, ranging from $10.4 million in 1968 to $21.0 million in 1972, and has not tended to decrease.

The importance of the halibut relative to all Alaskan fisheries has tended to decrease whether the importance is measured by the weight or value of the catch. Since 1961 the halibut catch has accounted for between 2.7 percent and 12.8 percent of the total Alaskan catch by weight and from 1961 through 1975 it accounted for between 8.7 percent and 27.5 percent of the value of the total Alaskan catch.

Production.

The production of halibut products has been relatively stable in the last 10 years in both absolute and relative terms. Neither the average annual halibut production nor the average percentage of total Alaskan processing attributable to halibut production is much different for the five years and the period as a whole, (Table 3.20).

Between 1966 and 1975 annual halibut production averaged 8,710 MT (19.2 million pounds) and ranged from 4,490 MT (9.9 million pounds) in 1968 to 13,1OOMT (28.8 million pounds) in 1966. The proportion of total Alaskan processing attributable to halibut production averaged 8.4 percent and ranged from 4.1 percent in 1968 to 13.5 percent in 1967. There has been no change in product mix; halibut production consists almost entirely of fresh/frozen products.

TABLE '1?. 1'/

THE ALASKAN HALIBUT FISHERY IN PERSPECTIVE '

YEAR	CATCH (in 000's) POUNDS	VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL FINFISH CATCH VALUE	POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	POUNDS
1961	51,282	$13,179	$0.26	26.6	14.0	24.1	11.9
1962	57,218	18,767	0.33	30.6	15.5	27.5	12.8
1963	52,597	12,412	0.24	28.1	17.1	23.1	12.7
1964	45,181	12,063	0.27	22.3	11.2	18.8	8.8
1965	50,993	17,847	0.35	26.8	14.5	22.0	10.0
1966	50,796	18>083	0.36	24.9	12.6	20.1	8.5
1967	44,912	11,497	0.26	31.7	23.0	21.1	11.9
1968	38,311	10,382	0.27	17.3	11.5	11.8	8.1
1969	45,224	18,632	0.41	30.4	16.3	22.4	11.1
1970	44,420	17,412	0.39	20.4	11.2	16.4	8.1
1971	36,489	13,428	0.37	20.6	12.2	14.7	7.6
1972	32,741	21,019	0.64	31.5	13.8	21.3	7.6
1973	24,787	20,672	0.83	24.8	12.6	13.5	5.4
1974	16,490	12,944	0.78	15.7	8.8	8.7	3.6
1975	20,336	19,827	0.98	25.7	10.5	15.0	4.6
1976	20,168				7.6		3.5
1977	17,107				5.4		2.7
1978							
Average	38,180	15,878					

Source: ADF&G Statistical Leaflets for various years.

TABLE 8.20

Halibut Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966		19	28,070	27,838	232	99.2	0.8	8.9
1967		21	23,936	23,927	9	100.0	0.0	13.5
1968		24	9,939	9>939	0	100.0	0.0	4.1
1969		26	16,696	16,696	0	100.0	0.0	8.8
1970		28	22,757	22,758	0	100.0	0.0	8.0
1971		28	20,938	20,939	0	100.0	0.0	8.8
1972		33	22,119	22,118	1	100.0	0.0	11.0
1973		41	18,890	18,879	11	99.9	0.1	8.3
1974		42	12,607	12,606	1	100.0	0.0	5.1
1975		40	16,017	16,017	0	100.0	0.0	7.4
1976								
1977								
Average (1966-1970)			20,280	20,232	48	99.8	0.2	8.6
Average (1966-1975)			19,197	19,172	25	99.9	0.1	8.4

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

Factors of Change

Harvesting Technology

The Alaskan halibut fishery remains somewhat different than most other Alaskan fisheries, as entry is not limited and excessively expensive gear is not necessary. For this reason, vessels designed for salmon gill-netting and seining and those from the herring fishery have entered the halibut fishery, along with a variety of other vessels that meet the demands of the fishery. As a result, halibut vessels are no longer characterized by the typical halibut schooner of past years.

Fishing gear for halibut is the longline, which has remained essentially unchanged since the Pacific halibut fishery's beginning, other than to adopt the use of more modern materials. The work involved with retrieving a set-line has been lessened due to the power gurdy which pulls the line aboard the fishing vessel, and the automatic toiler which coils the line in a manner which readies it for the next set.

The smaller fishing vessels are able to participate in the halibut fishery largely due to the use of snap-on gear. This modification to the long-line appeared about 20 years ago, but has become popular only within the past several years. The snap-on equipment allows a power drum, such as that common on salmon gillnet boats, to reel in the longline, and the hooks and accompanying paraphernalia are unsnapped and hung on racks to avoid tangling. If the snap-on gear was not available, a larger working area would be necessary for orderly coiling of the line, and the power drums utilized for gillnetting would no longer be suitable for coiling longlines without creating massive entanglements.

Halibut are usually iced on board as a means of preservation. If performed consc·entiously, this method results in high quality product being delivered to processing plants. At one time it appeared that on-board freezing might become popular. However, the short fishing seasons in recent years have made such expensive conversions unneeded.

Production Technology

Halibut is most commonly marketed fresh or frozen, in whole, steaked, or filleted form. Attempts have been made at canning, smoking, and other methods of preserving halibut, but with little success. Since freezing is becoming a more popular means of preserving almost all seafood, it is unlikely that halibut processing will pursue methods other than freezing within the near future.

The industry is presently searching for improved methods of packaging halibut portions that will preserve quality and improve presentability to consumers. Oftentimes, fish products are incorrectly displayed in retail grocery stores, resulting in dripping, unappealing packages. Vacuum packaging in clear plastic film is being considered as a means of presenting a more attractive product to consumers, as it would eliminate the need to glaze the fish to prevent freezer burn and drying, and assure a more consistent product.

Regulation

The Alaskan halibut fishery is unique in that the Alaska Department of Fish and Game does not exercise regulatory control of the fishery. Rather, the International Pacific Halibut Commission (IPHC), consisting of Canadian and American representation, oversees the halibut fishery along the Pacific Coast of North America. The Commission was formally organized in 1923, when a great deal of new gear was entering the fishery, but the catch per unit effort was decreasing. The purpose of the organization was to conduct research into the state of the fishery. Based on the results of its research, the Commission was granted increasingly more regulatory authority over the years, eventually being able to strictly regulate open fishing seasons, type of allowable gear, and catch quotas.

In 1931 the Pacific halibut catch reached its all-time low. Prior to this time the IPHC had been fulfilling its research role, with management of the fishery barely begun. However, IPHC management practices soon began showing dividends, as the fishery recovered, and in 1962 catch was almost double that of 1931.

Foreign trawl fleets entered the halibut grounds prior to 1962, ignoring the management procedures that had rebuilt the stocks. The results of foreign fishing efforts became evident after 1962, as American and Canadian halibut catches began a steady decline.

The most recent attempt by the IPHC to better manage halibut stocks, has been the split season, a series of openings and closings with each usually lasting around two weeks, occurring until catch quotas are harvested or the season ending deadline arrives. However, some authorities familiar with the situation feel that the North Pacific halibut fishery will not recover again until foreign trawling is brought under strict control.

Conflicts With Other Fisheries and Other Commercial Vessels

One of the major sources of conflict is competition for limited space in small boat harbors. An additional conflict is the incidental catch of immature halibut by other fisheries.

Conflicts also occur between halibut fishermen and commercial vessels over gear losses. The Coast Guard is attempting to minimize this problem by keeping commercial traffic in well defined shipping lanes, HERRING

Development and Market Structure

The development of the Alaska herring fishery was historically based on the demand for herring as an industrial fish, not as a food fish. Alaska herring have been used in the production of oil, fertilizer, feed additives, paint, soap, and other industrial products. The first herring reduction plant in Alaska was built in Southeast Alaska on the Upper Chatham Strait in 1882. This was the sole Alaskan plant of this sort until 1919; but by 1920, there were seven reduction plants in the Chatham Strait area and two in Prince William Sound. The output of the Alaska herring reduction industry peaked at 68,000 MT (150 million pounds) in 1926.

Typically, each reduction plant processed only herring and was dependent on herring caught in the local area. The dependence on local stocks was a result of harvesting capacity in excess of processing capacity and the poor keeping characteristics of herring which could not be overcome with the limited onboard refrigeration technology which then existed.

During the early 1900s, Alaskan processors attempted to capture a portion of the domestic market for pickled and dry salted herring, but with little success. The market gains which resulted from new packing methods and World War I were offset by a bad pack in 1918, and the market dominance by the New England, Norwegian, and British herring industries was not affected.

With few exceptions, herring remained an industrial fish in the United States until the 1960s. This led to a decline in the Alaska herring fishery which accelerated during the 1950s due to the discovery of substitutes for herring in several industrial users. Detergents came into use, thereby decreasing the demand for herring in the production of soap; the Atlantic and Gulf Coast menhaden fisheries and then the Peruvian anchovy fishery expanded greatly and provided huge quantities of herring-like fish for industrial users; and soybeans began replacing fishmeal as a feed additive.

Due to the large decreases in the world demand for herring, as well as decreases in the Alaskan herring stocks, the Alaskan herring fishery became basically a bait fish industry with only one reduction plant remaining in the mid-1960s.

In 1963 while exploring potential Alaskan salmon roe resources, the Japanese discovered Alaska's potential for herring products, especially roe and roe on kelp available in the spring. This new market for herring products soon grew into an industry surpassing the bait herring fishery (Table 3.21). In 1964, 10.4 MT (23,000 pounds) of roe were exported to Japan by a Kodiak Island producer, and by 1971 there were ten processors handling herring products. The areas of major processing importance are Southeast Alaska, the Kenai Peninsula, and Cordova (Figure 3.5). Some buyer ships and mobile freezer ships operate in the areas of Kodiak, Cook Inlet, Prince William Sound, and points of Southeast, but they are a minor portion of the total state output.

Herring roe is the most important of all herring products. Alaska Department of Fish and Game Preliminary Estimates for 1976 attribute the following percentages of the herring industry, at the producer level, to: roe and roe on kelp, 71 percent; bait herring, 6.7 percent; whole herring (includes frozen roe herring for export to Japan), 20.5 percent; and meal, 1.8 percent. The present emphasis is being placed on freezing whole round roe herring for export to Japan, or with increasing incidence to Korea, to utilize cheaper labor in completing the processing.

	PFBAL	RINS	FUND	FUND77	EXBITEL	R99L	B99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.452
1978	48.975	46.954	666.184	602.483	0.134	568.508	595.271	-4.416
1979	153.275	46.878	968.037	834.862	0.131	622.528	650.896	301.853
1980	275.	68.529	1329.02	1090.28	0.133	718.529	748.6	360.987
1981	411.475	94.407	1912.53	1485.75	0.125	806.194	838.069	583.505
1982	563.425	135.934	2618.32	1915.61	0.115	913.258	947.046	705.793
1983	731.699	186.1	3357.59	2350.46	0.121	1044.37	1080.69	739.275
1984	948.649	238.69	4499.3	3055.09	0.136	1127.96	1165.92	1141.71
1985	1187.55	319.694	5924.33	3864.14	0.133	1170.41	1210.65	1425.03
1986	1437.35	420.641	7294.83	4546.06	0.128	1251.35	1294.01	1370.51
1987	1684.2	517.825	8650.86	5142.83	0.126	1364.55	1409.77	1356.04
1988	1935.8	613.981	9961.52	5645.79	0.123	1498.44	1546.37	1310.66
1989	2193.07	706.985	11216.7	6061.66	0.122	1647.41	1698.22	1255.19
1990	2444.52	796.134	12258.6	6330.14	0.122	1811.72	1865.57	1041.86
1991	2688.87	870.322	13168.2	6504.09	0.121	1971.74	2028.83	909.632
1992	2936.75	935.218	14005.7	6613.5	0.12	2138.53	2199.04	837.469
1993	3188.27	995.08	14763.8	6659.93	0.118	2321.21	2385.35	758.145
1994	3437.02	1049.41	15361.9	6620.39	0.117	2531.73	2599.72	598.117
1995	3680.52	1092.52	15775.8	6491.89	0.116	2756.67	2828.74	413.906
1996	3923.72	1122.71	16038.	6298.77	0.114	3012.38	3088.77	262.215
1997	4168.14	1142.28	16126.3	6047.45	0.113	3294.49	3375.47	88.266
1998	4413.22	1149.68	16014.6	5734.77	0.112	3597.97	3683.8	-111.66
1999	4659.57	1143.09	15702.6	5363.66	0.11	3926.83	4017.82	-312.094
2000	4907.07	1122.48	15153.5	4937.91	0.109	4310.29	4406.73	-549.035

	EXBITES	VIABL2	RENSRAT
1977	0.229	0.604	0.068
1978	0.25	0.506	0.057
1979	0.24	0.468	0.047
1980	0.234	0.443	0.043
1981	0.219	0.438	0.041
1982	0.204	0.443	0.043
1983	0.222	0.431	0.049
1984	0.251	0.415	0.054
1985	0.25	0.403	0.051
1986	0.25	0.393	0.051
1987	0.249	0.392	0.053
1988	0.247	0.392	0.054
1989	0.246	0.394	0.056
1990	0.247	0.397	0.059
1991	0.245	0.404	0.06
1992	0.241	0.411	0.062
1993	0.237	0.419	0.063
1994	0.233	0.429	0.065
1995	0.229	0.44	0.067
1996	0.223	0.453	0.069
1997	0.22	0.466	0.071
1998	0.216	0.478	0.073
1999	0.212	0.493	0.075
2000	0.208	0.508	0.078

Table R.21

ALASKA HERRING PRODUCTION, 1960 - 1976
(Continued)

Year / Product Form	Pounds	Value
1968		
Fresh/frozen bait	4,317,378	99,074
Cured roe on kelp	126,269	126,270
Cured roe	278,094	544,101
Meal	284>710	20,338
1969		
Fresh/frozen bait	5,542,420	247,034
Cured roe on kelp	14,587	22,317
Cured roe	200,475	323,306
Meal	141,971	11,356
1970		
Fresh bait	1,000	900
Frozen whole	333,200	19,973
Frozen bait	6,485,133	269,714
Cured roe on kelp	79,553	59,329
Cured roe	252,029	417,719
Cured herring	13,900	3,109
Meal	56,600	5,238

Year / Product Form	Pounds	Value
1971		
Fresh whole	1,123,176	77,000
Fresh bait	140,000	1,752
Frozen roe	3,180	4,134
Frozen whole	405,000	28,350
Frozen bait	4,177,272	275,538
Cured roe on kelp	636,004	1,040,518
Cured roe	330,889	535>088
Mea 1	52,300	4,285
1972		
Fresh whole		
Fresh bait	43,721	15,320
Fresh roe		
Frozen whole	1,935,550	217,069
Frozen bait	5,333,402	336,383
Cured roe on kelp	620,150	873,769
Cured roe	256,539	451,167
Mea 1	40,158	3,604
1973		
Frozen whole	8,297,659	1,499,251
Frozen bait	10,998,645	768,713
Cured roe on kelp	287,746	381,450
Cured roe	1,378,585	3,399,041
Meal	154,260	28,340

Table B.21

ALASKA HERRING PRODUCTION, 1960 - 1976
(Continued)

Year	Product Form	Pounds	Value
1974			
	Fresh whole	1,645,092	135,957
	Fresh bait	83,500	8,375
	Frozen whole	7,377,197	1,139,464
	Frozen bait	50,452,725	5,032,913.
	Cured herring	24,554	24,554
	Cured herring roe	4,477,120	2,738,810
	Cured roe on kelp	1,099,182	440,251
	Meal	141,400	2,348
1975			
	Fresh/frozen whole/ dressed	13,009,024	1,714,216
	Fresh/frozen bait	1,444,723	184,636
	Fresh/frozen roe	28,664	72,000
	Fresh/frozen roe dressed	142,227	193,480
	Cured whole/dressed	10,320	19,917
	Cured roe	1,577,107	3,747,743
	Cured roe on kelp	761,833	1,077,761
	Meal	---	----
1976			
	Bait	3,734,279	400,644
	Roe	2,656,210	3,642,457
	Herring	4,617,828	1,339,776
	Roe on kelp	339,866	618,651
	Meal	638,600	110,478

Source: Orth, et al., 1978, Preliminary Draft.

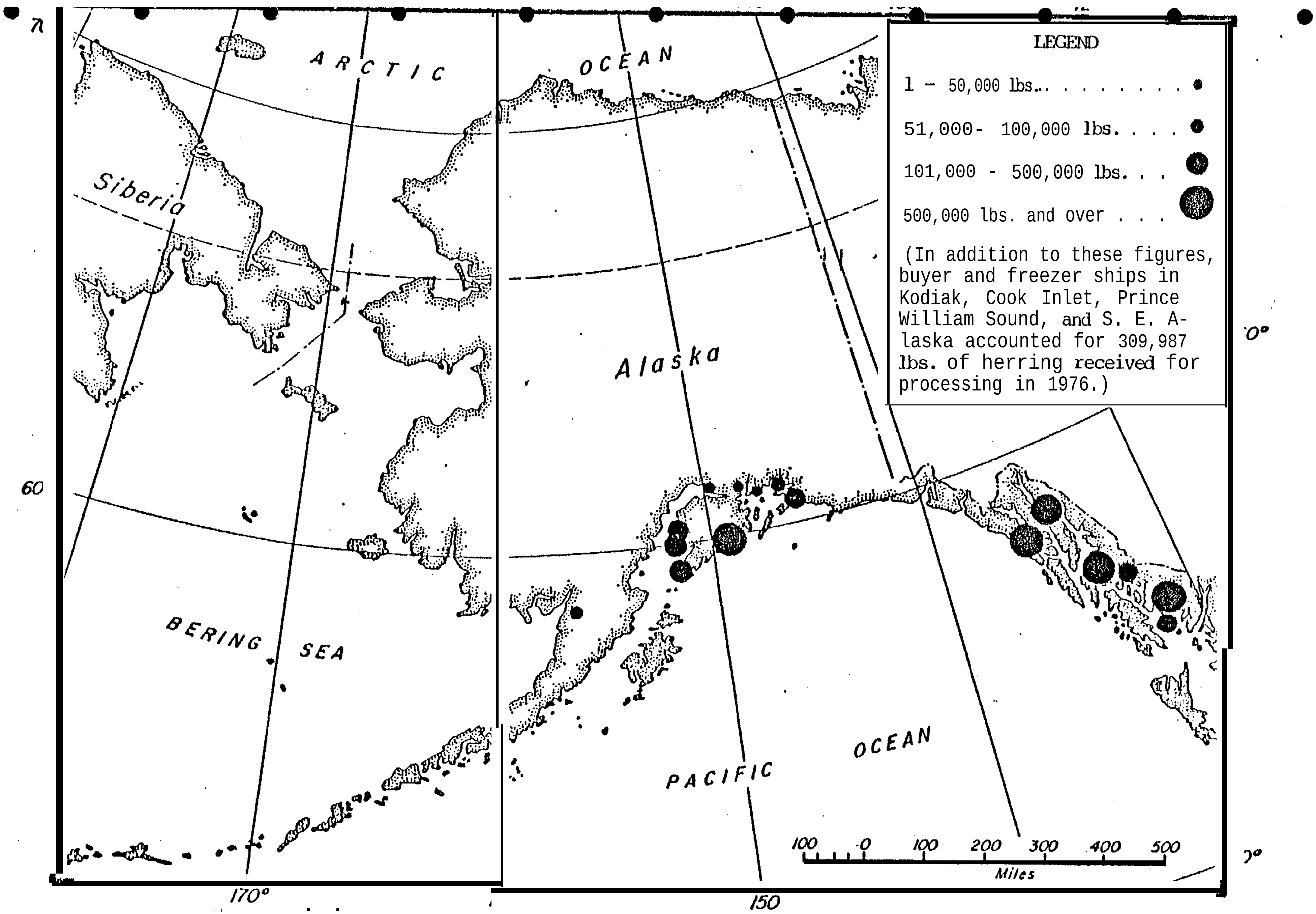


Figure B.5 A Map of Alaska, Showing the Major Processing Areas For Herring, and the Relative Importance of Each Area Based on 1976 Processors Reports.

SOURCE : Orth et al., 1978, Preliminary Draft.

The processing of roe is a strictly controlled procedure. Harvesting at the proper time is the initial step in producing a good product. After delivery to the processors, technicians supplied by the foreign buyers usually supervise the entire roe processing operation. The roe and types and quantities of ingredients that are often secrets of the technicians, are usually packed in five gallon (19-liter) or fifty-pound (23 kg) containers. The price of the final product is often partially dependent upon who supervised the processing. Most roe and roe on kelp is exported to the Hokkaido wholesale market in northern Japan, where it is bid upon by smaller Japanese processors who further process the product into final consumer portions. The processing channels for Alaskan roe herring are summarized in Figure 3.6 .

For biological as well as market reasons, the Alaskan herring roe fisheries have been boom or bust fisheries. The biological problem is that the period in which herring must be harvested to obtain roe of good quality is so short that fishermen sometimes miss all or part of the season. The marketing problems are that the Japanese market for roe is not well understood and the Japanese market for herring roe imports is dominated by Canada. It is predicted by Japanese industry sources that in 1978 Canada will furnish approximately 85 percent of Japan's herring roe imports, while Alaska will provide only about five percent.

Due to the relative size of the Canadian exports and the fact that the Alaskan season is after the Canadian season, the demand or Alaskan roe is 9
heavily dependent on the Canadian supply of roe and a relatively small change in the Canadian supply can result in a tremendous change in the demand for Alaskan roe. Using the 1978 figures, a 170 percent increase in the Alaskan supply of roe would be necessary to offset a 10 percent decrease in the Canadian supply.

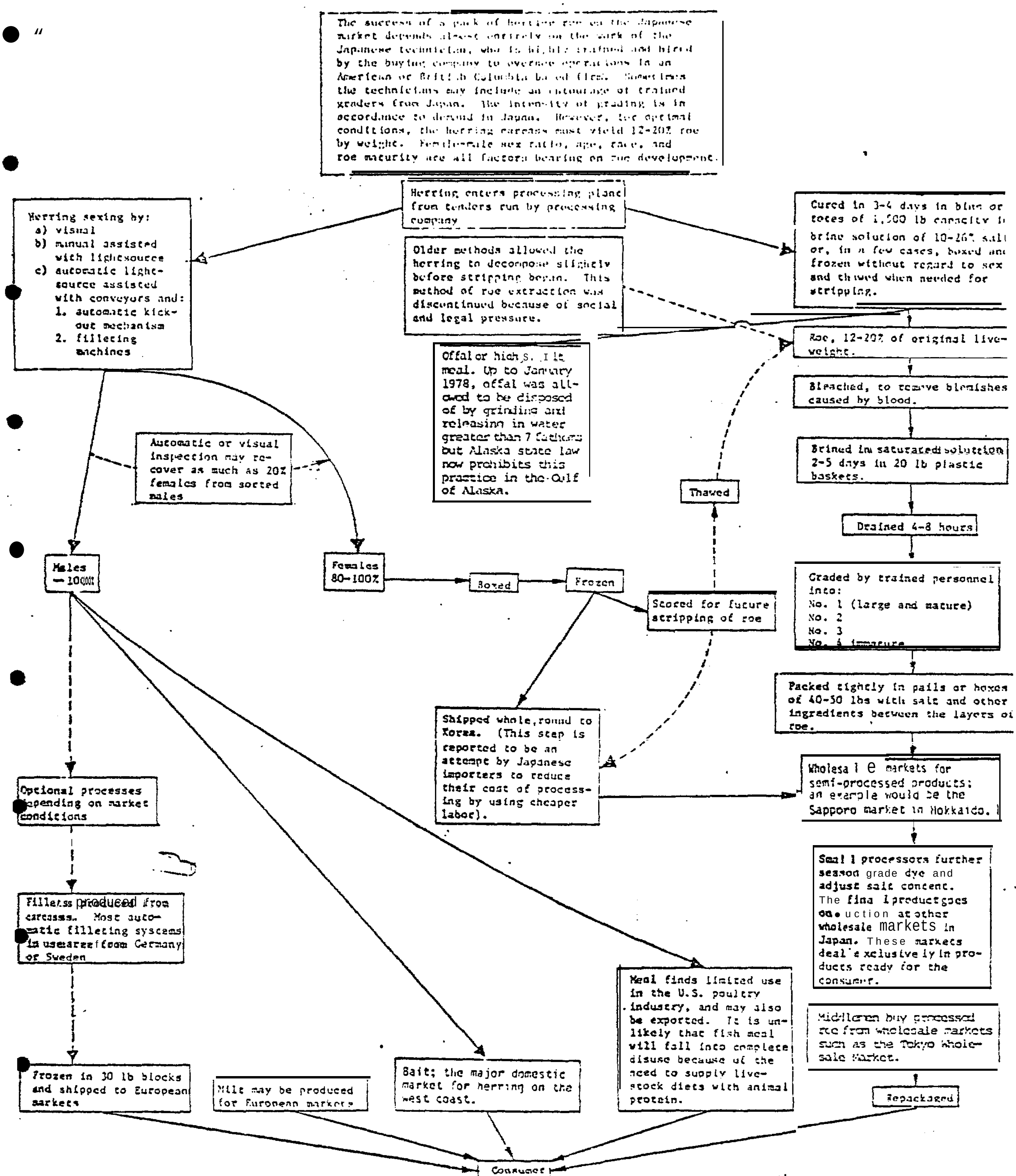


FIGURE 3. PROCESSING CHANNELS SPRING HERRING ROE FISHERY

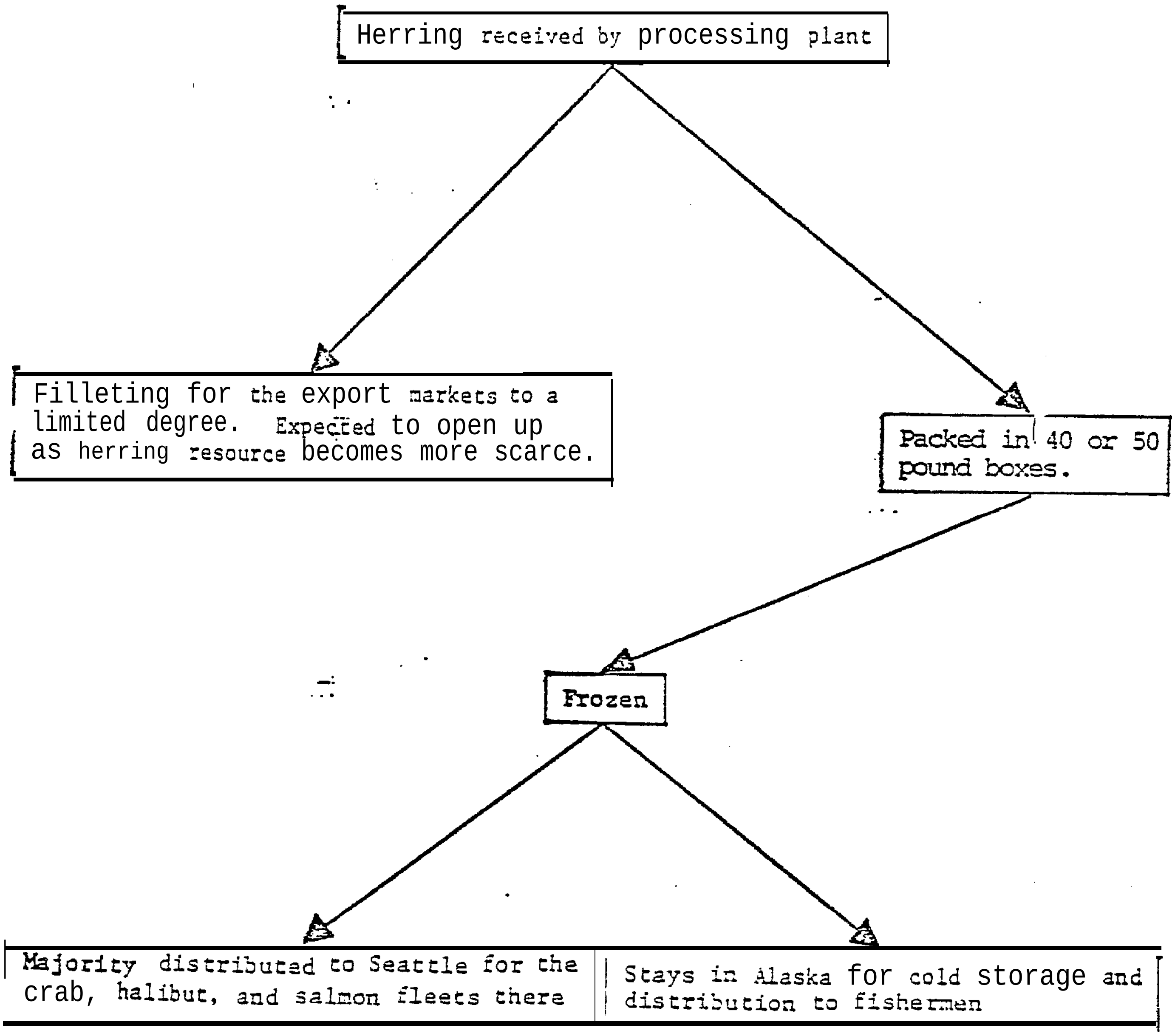
Source: Orth et al., 1978, Preliminary Draft

For some time, the primary domestic use of Alaskan herring has been as bait. Adequate stocks are available, and minimal handling technique is required; the only requirement being harvesting at the correct time. The bait fishery is generally a winter endeavor, with regulations for seasons and areas being minimal compared to the sac roe season. The returns are very stable and predictable when compared with those of the roe fishery.

In the past bait herring was either kept alive in ponds or frozen. Frozen bait storage has become predominant, and most herring for this purpose is boxed and frozen (Figure 2.7).

The bait herring is usually used by halibut, salmon and crab fishermen; the factors that affect the demand for bait herring, therefore, include: 1) the level of activity in the crab, halibut, and salmon fisheries, 2) efficiency in the use of bait in these fisheries, and 3) the availability of and preference for other bait such as bottomfish or octopus. These factors have tended to offset each other thus allowing only temporary expansions or declines in the fishery between 1960 and 1978. (See Table 2.32).

FIGURE 3.7



PROCESSING CHANNELS
FALL AND WINTER BAIT HERRING FISHERY

Source: Orth et al., 1978, Preliminary Draft

TABLE 8.22

YEARLY CRAB CATCH AND BAIT PRODUCTION
1960 - 1976

YEAR	CRAB CATCH 1,000 lbs	U.S. HALIBUT CATCH, ALL AREAS 1,000 lbs	BAIT 1,000 lbs
1960	33,303	38,058	4,232
1961	48,011	39,863	3,726
1962	61,783	40,239	6,622
1963	90,824	34,139	4,128
1964	99,444	26,232	4,594
1965	140,566	30,254	4,380
1966	164,256	30,114	5,239
1967	139,432	29,719	6,678
1968	98,532	19,181	4,317
1969	80,241	24,763	5,542
1970	76,230	25,783	6,486
1971	87,332	21,158	4,319
1972	110,010	20,363	5,377
1973	144,966	17,290	10,998
1974	162,938	13,938	12,110
1975	147,520*	16,259	4,532*
1976	73,570*		3,734*

Source: Alaska Department of Fish and Game Catch and Production Statistics; International Halibut Commission

*Preliminary

Statistics

Catch and Prices

The annual Alaskan herring catch has been subject to large fluctuations in both weight and value. Between 1961 and 1975, the annual catch ranged from 3,360 MT (7.4 million pounds) in 1970 to 22,500 MT (49.5 million pounds) in 1961 while the value of the catch ranged from $81,000 in 1968 to $4,130,000 in 1974 (Table B.23). During the first 10 years of this period, catch tended to decrease but during the last five years it has tended to increase. The value of catch has followed a similar pattern. The importance of the herring catch re" ative to the total commercial catch in Alaska has followed the same pattern. During this 15 year period, the annual herring catch accounted for between 1.3 percent and 11.5 percent of the weight of the total annual Alaskan catch and between 0.01 percent and 2.8 percent of its value.

Production

Herring production became increasingly important between 1966 and 1975. The average annual production of herring is significantly higher for the period as a whole than it is for the first five years and the average percentage of total Alaskan processing accounted for by herring production is also much higher for the period as a whole than for the first five years (Table B.24). Between 1966 and 1975 annual production averaged 29,700 MT (15.6 million pounds) and ranged from 2,270 MT (5.0 million pounds) in 1968 to 29,700 MT (65.4 million pounds) in " 974. As with most other fisheries, the product mix has changed with fresh/frozen products increasing their share of the total herring production

TABLE B. 23
THE ALASKAN HERRING FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL FINFISH CATCH VALUE	PERCENTAGE OF TOTAL FINFISH CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961	49,465	$ 559	$0.01	1.1	13.5	1.0	11.5
1962	33,%76	379	0.01	0.6	9.2	0.6	7.6
1963	31,216	468	0.01	1.1	10.2	0.9	7.6
1964	47,904	719	0.02	1.3	11.8	1.1	9.4
1965	25,636	360	0.01	0.5	7.3	0.4	5.0
1966	19,256	289	0.02	0.4	4.8	0.3	3.2
1967	11,497	172	0.01	0.5	5.9	0.3	3.1
1968	8,126	81	0.01	0.1	2.4	0.1	1.7
1969	13,131	257	0.02	0.4	4.7	0.3	3,2
1970	7,418	164	0.02	0.2	1.9	0.2	1.3
1971	10,117	269	0.03	0.4	3.4	0.3	2.1
1972	14,050	418	0.03	0.6	5.9	0.4	3.3
1973	34,870	2,661	0.08	3.2	17.8	1.7	7.5
1974	38,862	4,130	0.11	5.0	20.8	2.8	8.5
1975	35,575	1,874	0.05	2.4	18.4	1.4	8.1
1976							
1977							
1978							
Average	25,400	853					

Source: ADF&G Statistical Leaflets for various years.

TABLE B.24

Herring Production in Alaska
By Type of Processing and in perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966		10	10,000	5,240	4,760	52.4	47.6	3.2
1967		10	7,836	6,679	1,157	85.2	14.8	4.4
1968		7	5,006	4,317	689	86.2	13.8	2.1
1969		11	7,603	5,542	2>061	72.9	27.1	4.0
1970		15	7,221	6,819	402	94.4	5.6	2.5
1971		13	6,870	5,850	1,020	85.2	14.8	2.9
1972		21	8,230	7,313	917	88.9	11.1	4.1
1973		24	21,116	19,296	1,820	91.4	8.6	9.3
1974		29	65,390	59,648	5,742	91.2	8.8	26.4
1975		17	16,973	14,624	2,349	86.2	13.8	7.8
1976								
1977								
Average (1966-1970)			7,533	5,719	1,814	78.2	21.8	3.2
Average (1966-1975)			15,625	13,533	2>092	83.4	16.6	6.7

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

Factors of Change

Harvesting Technology

There have been no significant changes in the methods used for catching herring since the inception of the Alaskan herring fishery. Purse seiners have always accounted for a large portion of the total catch, with set and drift gillnets growing in popularity.

Purse seining offers the opportunity to harvest large volumes of fish when selectivity for size is not especially important, such as in the bait fishery. Purse seining underwent its most important change in 1954, when the Puretic Power Block reached the market and quickly found its way on board most seining vessels. The power block assisted in hoisting the pursed, and hopefully full, seine aboard. (The device is covered in more detail in the salmon harvesting technology section.)

There are more gillnets in the herring fishery since herring roe has become a lucrative export to Japan. As compared to seines, gill-nets catch the herring at a slower rate, allowing a more consistent flow of raw fish to the processors and therefore resulting in a higher quality product. Gillnets also tend to be selective in catching more females (containing the valuable roe) of desired maturity, which is idea" for the roe herring fishery.

Production Technology

Huge volumes of herring were once caught off Alaska's coast and used primarily to supply the needs of reduction plants. This fishery all but disappeared years ago, leaving little market for herring. Use as bait by other fisheries, particularly halibut and crab, was the main market for herring after the demise of the reduction industry. Bait herring has been kept in ponds in the past, but most bait herring is now frozen in boxes and distributed to fishermen in frozen form.

During the early 1960s, the Japanese discovered Alaska's potential for herring products, especially roe. United States processors were inexperienced at supplying such items for the Japanese market, so Japanese importers furnished their own technicians to the American processors to supervise the handling of the roe. Even so, after exporting herring roe to Japan for around 15 years, Japanese technicians still oversee the roe processing in American plants.

Removing herring roe is a labor intensive operation. However, a relatively new machine, referred to as a herring sexer is gaining acceptance. By examining each herring carcass with light, the machine quickly detects females and speeds the stripping process. Many processors are still not using the machine, preferring to wait until it is more. thoroughly refined.

Regulation

The Alaskan herring fishery, like salmon, became a limited entry fishery in 1974, because it too faces a situation of excessive participation. (Greater detail of limited entry policy is included in the salmon regulation section.)

The herring fishery was primarily for bait until the Japanese demand for roe instilled new vigor into the industry. As the new interest for roe herring grew, new regulations were implemented. Previous to the roe fishery, many herring fishery regulations were intended as a means of preventing incidental salmon catches. Usually, the closure of certain areas to herring fishing during salmon runs was the extent of regulation.

Herring seasons and legal fishing areas are still somewhat dependent upon salmon management goals. Due to use of similar gear, incidental salmon catches by herring fishermen could be significant if unregulated. However, effort directed at herring management has become great enough that regular seasons are now enforced in some areas, along with catch quotas. Herring seasons are often opened and closed by emergency orders, announced by the Alaska Department of Fish and Game. These orders are based on immediate catch and stock information, and may sometimes occur with very little advance notice.

<u>Conflicts With Other Fisheries and Other Commercial Vessels</u>

Competition for space in small boat harbors creates conflicts between the herring fishery and other commercial fisheries. These conflicts are' reduced to the extent that the herring fishery fleet is comprised of boats that also participate in the salmon fisheries which typically occur after the spring herring season.

The conflict between herring seiners and commercial vessel traffic is increased due to the limited period in which roe herring are of the desired quality and in high concentrations.

GROUNDFISH

e

Development and Market Structure

The commercial exploitation of groundfish in the Gulf of Alaska began in 1867 when, following Alaska's purchase from Russia, the United States established a setline fishery for cod. Prior to this period, Native subsistence fishermen had long been taking catches of Pacific halibut, cod, herring and other species and had often traded them with the Russians and, later, the Americans.

The first foreign exploitation began with Canada's interest in cod and halibut in the early 1900s, but not until 1962, with the appearance of a Soviet fishing fleet of 70 trawlers, did modern, large-scale commercial fishing of groundfish begin in the Gulf.

The major species of groundfish which inhabit the Gulf of Alaska are , Alaska pollock, Pacific cod, sablefish, Pacific ocean perch, halibut, turbot, flathead sole, rock sole, and Atka macherel. The Russians initially targeted on Pacific ocean perch. The following year, 1963, a smaller fleet of Japanese vessels fished the Gulf of Alaska targeting on Pacific ocean perch and sablefish. It was noted in the Fishery Management Plan for the Gulf of Alaska groundfish fishery during 1978 that the Japanese, until 1963, had demonstrated a reluctance to establish a fishery in the Gulf because of its potential impact on halibut stocks. Discussions among the governments of Japan, Canada, and the U.S. were occurring on this topic at the time. When the Soviet fleet started fishing in the Gulf in 1962, Japan changed her conservative outlook and began fishing operations a year later. Unlike the Soviet Union, whose operations are solely trawling, the Japanese also used gillnets (1963 only), longlines and pot gear.

Catches of Pacific ocean perch peaked in 1965 at 380,000 MT, and subsequently declined to about 48,000 MT in 1974. As declines accelerated, target species expanded to include larger catches of pollock, sablefish, flounders and Atka mackerel. In fact, large pollock stocks now present in the Gulf are specifically attributed to declines in the stocks of Pacific ocean perch and sablefish.

Other foreign countries with fishing interests in the Gulf of Alaska are Korea, Poland and Taiwan. Poland began fishing for sablefish in 1972 using setline gear, and in 1976 a small trawling operation took place. Poland had small reported catches of pollock, Atka mackerel and rockfish in 1974 and 1975 (100MT in 1974 and 2,000 MT in 1975) using factory stern trawlers similar to those used by the Soviet Union. Three Taiwanese long-liners and one factory stern trawler were observed fishing in the Gulf in 1976.

Domestic catches of groundfish do not match the scale of foreign exploitation, as can be seen in Table 3.35. The United States has traditional been involved in fishing for halibut, sablefish (using setline and trap), a bait fishery and several other smaller fisheries for pollock, flounders, and rockfish. The history of domestic halibut exploitation will be treated in a separate section.

Ninety percent of the domestic setline fishery catch of sablefish comes from marine inside waters of Southeast Alaska. Most of the catch (80 percent) is taken using longline gear, but recently traps have been utilized by some vessels. The fishery began in Southeast Alaska about 1906. The catch peaked in 1946 at about 2,800 MT. Current annual catches are in the vicinity of 1,100 MT. It is mainly an off-season fishery pursued by halibut, crab, and salmon fishermen.

TABLE 3.45

GROUNDFISH CATCHES (APPROXIMATE)

FROM THE GULF OF ALASKA, 1967-75

In 1,000 Metric Tons

SPECIES	COUNTRY	1967	1968	1969	1970	1971	1972	1973	1974	19,+/
Rockfishes (primarily Pacific ocean perch)	U. S.	tr	tr	tr	tr	tr	tr	tr	tr	tr
	USSR	66	45	19	2/	30	24	4	17	10
	Japan	54	56	55	45	49	53	54	41	34
	R.O.K.	0	0	0	0	0	0	2/	2/	2/
	Poland	0	0	0	0	0	0	2/	2/	2/
	TOTAL	120	101	74	45	79	77	58	58	44
Pollock	U. S.	0	0	0	0	0	0	0	tr	tr
	USSR	2/	2/	2/	2/	tr	20	30	31	38
	Japan	6	6	18	9	9	14	7	30	10
	R.O.K.	0	0	tr	0	0	1	1	2/	2/
	Poland	0	0	0	0	0	0	2/	2/	2/
	TOTAL	6	6	18	9	9	35	38	61	48
Atka mackerel	U. S.	0	0	0	0	0	0	0	0	0
	USSR	2/	2/	2/	2/	2/	2/	9	18	20
	Japan	0	0	0	0	0	0	0	0	0
	R.O.K.	0	0	0	0	0	0	0	0	0
	Poland	0	0	0	0	0	0	2/	tr	1
	TOTAL	0	0	0	0	0	0	9	18	21
Sablefish	U. S.	tr	tr	tr	tr	tr	1	1	1	1
	USSR	2/	2/	2/	2/	tr	1	1	tr	tr
	Japan	5	15	19	24	25	36	27	24	18
	R.O.K.	0	0	0	0	0	0	1	3	2
	Poland	0	0	0	0	0	0	2/	2/	2/
	TOTAL	5	15	19	24	25	38	30	28	21
Flounder	U. S.	0	tr	tr	tr	tr	tr	tr	tr	tr
	USSR	2/	2/	2/	2/	2/	2	1	2	2
	Japan	5	3	3	4	2	8	19	7	2
	R.O.K.	0	0	0	0	0	0	0	2/	2/
	Poland	0	0	0	0	0	0	2/	2/	tr
	TOTAL	5	3	3	4	2	10	20	9	4
Halibut	U. S. 3/	19	17	20	20	16	14	11	7	9
	USSR	2/	2/	2/	2/	2/	tr	tr	tr	tr
	Japan	0	0	0	0	0	0	0	0	0
	R.O.K.	0	0	0	0	0	0	0	0	0
	Poland	0	0	0	0	0	0	2/	2/	tr
	TOTAL	19	17	20	20	16	14	11	7	9
Others (cod and unidentified fish)	U. S.	tr	tr	tr	tr	tr	tr	tr	tr	tr
	USSR	11	14	1	9	1	22	8	10	9
	Japan	4	4	2	3	3	2	7	10	9
	R.O.K.	0	0	0	0	0	0	tr	tr	tr
	Poland	0	0	0	0	0	0	tr	tr	1
	TOTAL	15	18	3	12	4	24	15	20	19
TOTAL	U. S. 3/	19	17	20	20	16	15	12	8	10
	USSR	77	59	20	9	31	69	53	78	79
	Japan	74	84	97	85	88	113	114	112	73
	R.O. K.	0	0	0	0	0	1	2	3	2
	Poland	0	0	0	0	0	0	tr	tr	2
	TOTAL	170	160	137	114	135	198	181	201	166

1/ Japan's catch is for the months of January to October, 1975.
2/ Catch, if any, included under 'other.'
3/ Includes Canadian catch of halibut.
4/ Excluding discarded incidental catch.

SOURCE : Fishery Management Plan for the Gulf of Alaska Groundfishery during 1978, North Pacific Fishery Management Council, Peak catches of sablefish in the 1940s coincided with large increases in the demand for vitamins found in liver. Demand and catch per unit effort. subsequently declined after this period, and poor prices and poor stock levels produced low landings and effort in the late 1960s and early 1970s. In 1972 rising prices rejuvenated effort somewhat. A quota of 454 MT was instituted in northern districts of Southeast Alaska in 1973 to stop serious stock declines. Effort was down again in 1974 due to rising costs, poor stock conditions and low prices.

The bait fishery arose from a need for bait in the crab and halibut fisheries. Groundfish bait is usually taken incidentally in the shrimp fishery although there have been recent trends to target on bait if the price is high. Fishing for bait is done from Prince William Sound to the Aleutians with two-thirds of the catch landed in Kodiak. Recorded catch of bait in 1976 was 303 MT; however, catch which goes unrecorded may equal or exceed that amount.

Other, smaller domestic groundfisheries include a pollock and flounder fishery in Petersburg begun in 1976. Three trawlers landed 120 MT of flounders and 60 MT of pollock. An additional 126 MT of pollock was landed by salmon seiners. Halibut and sablefish fishermen caught 128 MT of rockfish incidentally in 1976 in Southeast, and 2,700 MT of capelin and juvenile pollock classified as "waste fish" were caught incidentally in the Alaska shrimp fishery.

To a large extent, domestic groundfishing efforts have been over-shadowed in recent times by the large foreign effort. It is expected that control of foreign fishing under the Fishery Conservation and Management Act of 1976 will play a large role in stimulating expansion of domestic fisheries for groundfish.

Statistics

Catch and Prices.

The groundfish catch has been increasing but still remains relatively insignificant. Between 1966 and 1975 the annual domestic catch ranged from 136 MT (0.3 million pounds) in 1968 to 1,540 MT (3.4 million pounds) in 1973, averaged 771 MT (1.7 million pounds), and did not amount to more than 0.5 percent of the catch of all Alaskan fisheries (Table 3.20).

Production

Despite substantial increases in the production of groundfish products in Alaska between 1966 and 1975, these products remained relatively unimportant. The annual production averaged less than 680 MT (1.5 million pounds) and accounted for at most 1.1 percent of total Alaskan processing output (Table 3.27). There has been no change in product mix; the production consists almost entirely of fresh/frozen products.

TABLE B.26
ANNUAL ALASKA BOTTOMFISH* CATCH IN PERSPECTIVE

YEAR	CATCH (in 000's of lbs)	CATCH (in 000's of $'s)	PRICE ($'s per pound)	PERCENTAGE OF ALASKAN CATCH FOR ALL FISHERIES: Percentage of weight	PERCENTAGE OF ALASKAN CATCH FOR ALL FISHERIES: Percentage of value
1966	1,662	278	0.17	0.3	0.3
1967	1,711	220	0*13	0.5	0.5
1968	284	35	0.12	0.1	0.4
1969	527	71	0*13	0.1	0*1
1970	895	156	0.17	0.2	0.2
1971	878	137	0.16	0.2	0.2
1972	1,830	475	0.26	0.4	0.5
1973	3,377	651	0.19	0.7	0.4
1974	3,134	822	0.26	0.7	0.6
1975	3,061	864	0.28	0.7	0.7
1976					
1977					
Average: 1966-1970	1,016	152	0.15	0.2	0.2
Average: 1966-1975	1,736	371	0.19	0.4	0.3

*Bottomfish include: sablefish, rock fish, and other fish referred to as bottomfish by ADF&G.

Source: ADF&G, Catch and Production Reports, 1966 - 1975.

TABLE B.27

Bottomfish Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966		11	1,537	1,536	1	99.9	0.1	0.5
1967		11	1,671	1,671	0	100.0	0.0	0.9
1968		8	200	199	1	99.5	0.5	0.1
1969		4	239	237	2	99.2	0.8	0.1
1970		7	1,100	1,099	1	99.9	0.1	0.4
1971		10	658	658	0	100.0	0.0	0.3
1972		14	1,915	1,913	2	99.9	0.1	0.9
1973		17	2,434	2,434	0	100.0	0.0	1.1
1974		20	2,499	2,469	30	98.8	1.2	1.0
1975		9	2>283	2,283	0	100.0	0.0	1.1
1976								
1977								
Average (1966-1970)			949	948	1	99.7	0.3	0.4
Average (1966-1975)			1,454	1,450	4	99.7	0.3	0.6

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

Factors of Change

At the present time, no domestic groundfish fishery exists in Alaska or its bordering waters which is of commercial significance. Historically, nearly all groundfish harvested off Alaska have been caught by foreign fleets. However, considerable domestic interest in groundfish has arisen recently, due largely to governmental actions and policies that have made harvesting of our underutilized species appear more attractive. Therefore, a summary of the present situation, though not necessarily a factor of change in all instances, is presented.

Harvesting Technology.

Alaskan fishermen do not possess extensive experience with the gear used to catch groundfish, nor do most vessels even have the capability of using groundfish trawl gear without some modification. The Alaskan shrimp fishery most nearly parallels groundfish catching, as trawl gear is used in both instances. Therefore, a small segment of the total Alaskan fishing fleet could probably adapt to groundfish harvesting very quickly.

For the past several years, the owners of the newer king crab vessels have kept an eye to the future, usually designing their craft for inexpensive conversion to groundfish catching. The harvesting capability of the king crab fleet has become so great that season openings may last only a few weeks before quotas are met. The present king crab fleet is one of the world's most modern and capable. These vessels represent a great potential for groundfish harvesting if economic returns attract their effort.

Foreign trawl fleets possess the most experience and knowledge concerning groundfish catching. The Russian and Japanese fleets in particular have experimented with numerous combinations of fleet sizes, vessel sizes, and processing arrangements. These two countries, and many others, have accumulated a wealth of information that could speed the growth of Alaska's groundfish industry by years. As growth of America's groundfish fishery may displace foreign fleets and reduce U.S. imports of their catches, foreign knowledge and technology may not be as openly shared as Americans would desire.

Production Technology

Groundfish production technology is another aspect of the fishery's development that may be dependent upon foreign assistance. Besides the presen· economic situation within the fishery which has not attracted very many f·shermen or processors, producing a quality product is of major con- tern. Groundfish reportedly suffer quality loss within a few hours after 1 anded if not properly preserved. Little information exists concerning whether American fishing vessels can properly preserve groundfish until delivered to a processor, or if they can carry large enough quantities to afford the frequent trips to processing plants, barring the use of tenders or floating processors.

The fish processing lines in the processing plants may be the best prepared for eventual growth of the fishery. European countries have shown great interest in supplying the necessary equipment for high volume pro- cessing of groundfish. Though very few plants are actually equipped for groundfish processing, a potential exists for quickly gearing up and utilizing proven expertise.

As groundfish are usually caught and processed in great volume, machines have been developed to assist in trimming off waste parts of the carcass and removing the viscera. The success of these machines is often dependent upon having fish of very consistent size. Perfection of this type of machine is desired by almost every finfish processing industry, with probably the most successful to date being the Iron Chink of the salmon processing industry.

Regulation.

For all practical purposes, the Alaskan groundfish fishery has been nearly unregulated, from a domestic point of view. Almost all areas are open to fishing year-round, with the gear to be used left to the fishermen's discretion. Lack of regulation by State of Alaska authorities has been due to almost negligible participation in the fishery by Alaskan fishermen.

With the growing interest in Alaska groundfish, the Department of Fish and Game has declared that some areas are closed to groundfish harvesting with certain gear, during specified periods. This serves more to protect other fisheries at selected times than to manage groundfish stocks.

Other Governmental Policy.

Enactment of the Fisheries Conservation and Management Act of 1976 (FCMA) was the prime instigator of the surging interest in Alaska's groundfish. The FCMA extended United States management of commercial fish species to 200 miles (322 km) from the coastline. The expectation of many domestic fishermen was that foreign fleets fishing within the extended zone would be forced to leave immediately. To many people's surprise this did not occur. Rather, the act provided for domestic fishermen to be given preferential treatment in quota allotments when they possess the capability of harvesting such an allotment and intend to do so. The FCMA allows foreign participation whenever domestic catch effort is not sufficient within any fishery to utilize that which is available for harvest as determined by U.S. regulatory agencies.

Eight regional councils were created to carry out objectives of the fishery management program. Alaska is included in the jurisdiction of the North Pacific Fisheries Management Council. Many problems have been encountered concerning the 200-mile limit and fisheries management since 1976. There are claims that the councils do not provide preferential treatment to domestic fishermen when demand for certain fish exceeds quotas, and that the quotas are often based on insufficient information. Policy decisions having international impact have sometimes become very complex, as the U.S. Department of Commerce maintains ultimate authority over the regional councils. Presently, major attention concerning Alaskan fisheries is focused on whether foreign processor ships should be licensed to purchase American caught groundfish and how this should be applied to quotas. A definite long-term policy on this matter has yet to be developed, as the final policy decision and subsequent regulations could have major influence on development of the groundfish industry for years to come.

Conflicts With Other Fisheries and Other Commercial Vessels.

The principle conflict with other commercial fisheries, other than that caused by competition for limited space in small boat harbors, is with the halibut fishery. Incidental catch of immature halibut is the source of the conflict. The problem can be, and to some extent has been, reduced by avoiding areas of high concentrations of juvenile halibut.

KING CRAB

Development and Market Structure

Although they are different species of crab, the American king crab and Tanner crab (often called snow crab) fisheries have developed in much the same manner. Both species also undergo similar processing and follow almost identical marketing channels, although the final products are not necessarily interchangeable in filling specific demands of consumers. Therefore, emphasis placed on any activity necessary to move the crab from its natural habitat to the final consumer may rely on many variables, such as relative abundance of the two species, and consumer preference for a particular product form or species.

The Japanese pioneered both the king and Tanner crab fisheries in the seas bounding Alaska. Japan started taking king crab in 1930, with an initial catch of 450 MT (one million pounds), using one mothership operation. The fishery quickly peaked in 1933, with over 9,000 MT (20 million pounds) of crab being caught by the Japanese. The catch decreased steadily through 1939, with World War II impending. The fishery was maintained at minimal levels throughout the war. From 1947 through 1954, U.S. trawlers harvested no more than 250,000 king crab annually. The Japanese returned to the Eastern Bering Sea king crab fishery in 1953; and American effort and catch leveled off and then decreased, remaining at a negligible level from 1957 until the early 1960s, when U.S. fishermen returned north of Unimak Island in the pot fishery.

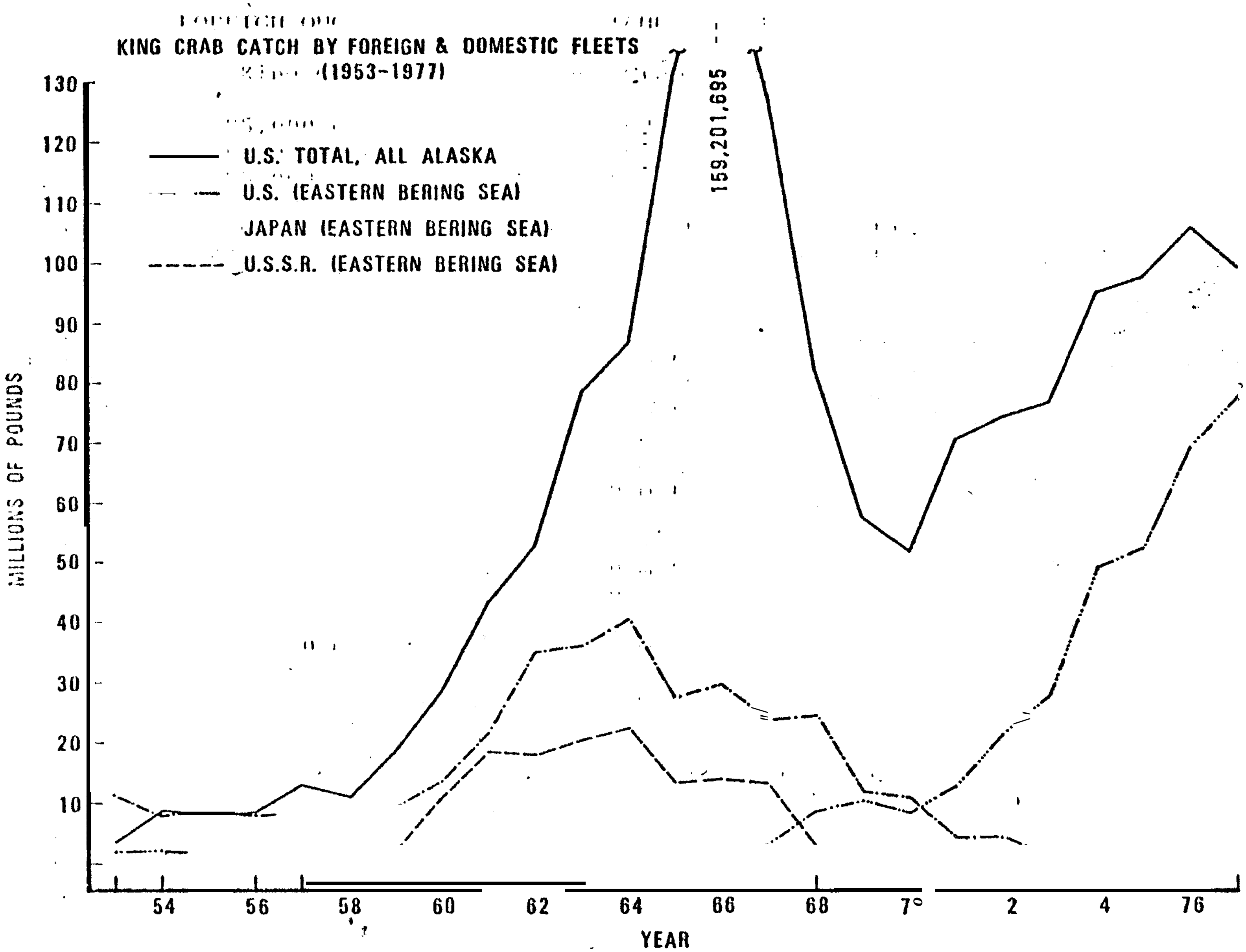
In 1959, after intermittent past involvement, Russia recentered the king crab fishery in the same areas as the Japanese fished. The two countries competed fiercely until their landings peaked in 1964. In 1965 and 1966 Japan moved to other areas because of gear loss and conflicts with the Soviets.

The United States entered into bilateral agreements with both Japan and Russia, setting king crab quotas for 1965 and 1966. Their quotas were adjusted downward every two years to allow the U.S. king crab fishery to expand. Figure 3.8 graphically illustrates the effect on the U.S. fishery of the quotas for Japanese and Russian catch.

The U.S. trawl fishery in the Eastern Bering Sea had contributed most of the total American king crab catch until 1953. However, the fishery around Kodiak had been growing and became the major king crab area after 1954. The regional catch statistics tend to indicate Kodiak's rise to prominence was earlier; however, other areas such as Cook Inlet were contributing heavily prior to 1954. The vessels involved in crabbing were growing both in numbers and size, and often had circulating sea water tanks which greatly increased the distances they could venture. The catching capability of the fleet quickly outgrew the capacity of the Kodiak processors.

In March of 1964, a tidal wave following an earthquake destroyed three of the four canneries that processed crab, and many of the crab boats. But , by April, 1965, four new canneries with larger capacities were operating, and many new replacement vessels were arriving. The years 1965, 1966, and 1967, were the most productive ever for the king crab fishery, for Kodiak and the entire state of Alaska (Table 3.33).

As with king crab, the Japanese were first to harvest tanner crab in the Eastern Bering Sea. They experimented with tanner crab from 1953 to 1964, and started increasing their efforts immediately when the United States implemented quotas decreasing the king crab harvest. Japan caught 1.03 million tanner crab in 1965, and increased this to 18.2 million in 1970. The U.S. included tanner crab quotas in the bilateral agreements with Japan and the U.S.S.R. starting in 1971. The Russians had also



SOURCE: Orth et al., 1978, Preliminary Draft

Figure B.X

TABLE B.28

DOMESTIC CATCH OF ALASKA KING CRAB
BY REGION, 1941 - 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	752,568
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
3.953	--	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	--	18,833,47S
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	36,585,630	131,670,712
1966	105,899	117,305,088	41,790,708	159,201,595
1967	599,078	83,010,695	44,106,117	1.27,715,390
1968	2,199,772	37,559,518	42,278,206	82,037,496
1969	1,895,168	20,274,859	35,539,781	57,729,803
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	105,824,995
1977	312,355	16,084,094	83,032,208	'29,448,657

Source: U. S. Department of the Interior, Fish and Wildlife Service, Fishery Statistics of the U.S., Statistical Digest No's. 1-51, (1941-1959) ; and, ADF&G Commercial Fisheries Catch and Production Statistics 1960-75, ADF&G Shellfish Catch Report (preliminary data) 1976-77.

shifted more emphasis to Tanner crab as the king crab quotas decreased, but left the Tanner crab fishery entirely after ?971.

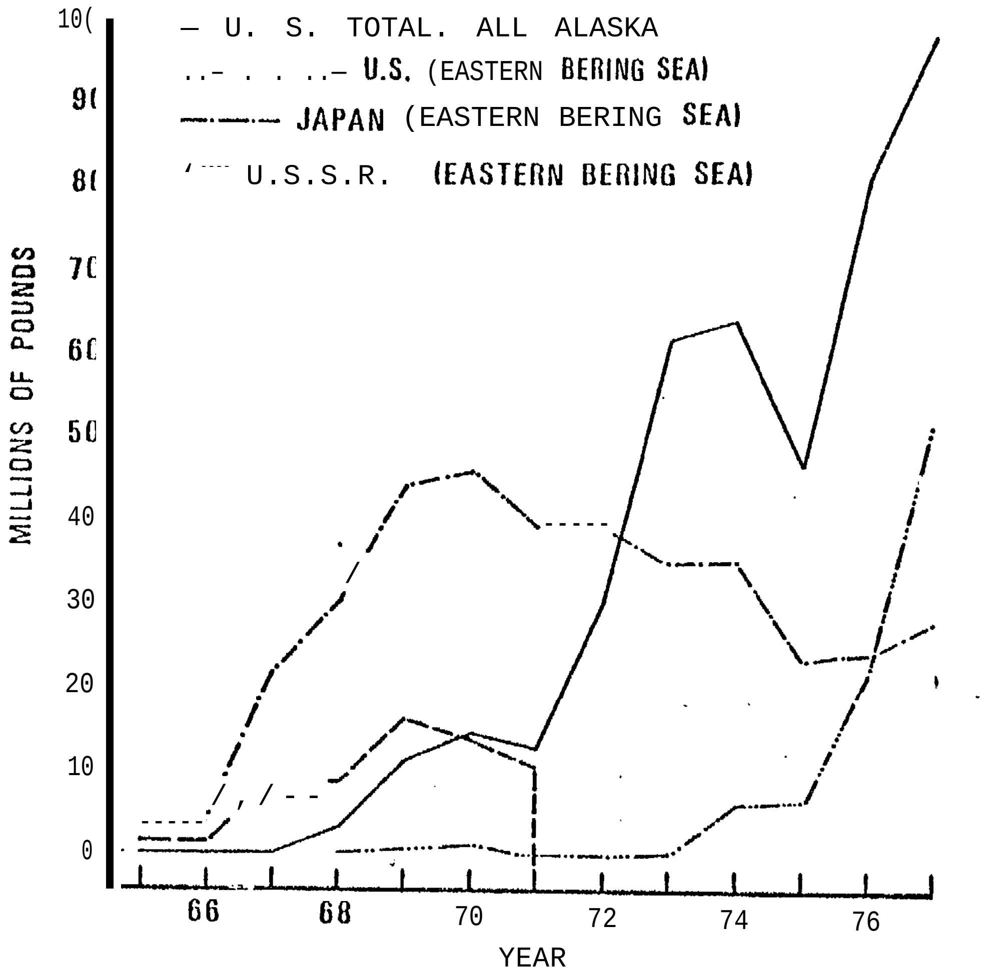
The first significant Tanner crab catch by the U.S. was in 1968. The fishery became attractive as king crab catches declined, and gained further importance as a source of supplemental income when king crab seasons were closed. American Tanner crab catch increased through 1977, except for the strike year of 1975, and in 1977 Tanner crab nearly equaled king crab in weight caught. In 1975 many fishermen opted to refrain from fishing until they had completed negotiations with processors to establish minimum prices. As with king crab, the American catch increased with the implementation of" quotas for Japan and Russia (Figure 2.9). Tanner crab will surpass king crab in weight caught for al? of Alaska in 1978, if the expected increase in Bering Sea Tanner crab landings is realized.

The Alaska crab fisheries have gradually been shifting westward for some time, which can be observed in catch Table 2.29 for Tanner crab, and Table 2.28 for king crab. This trend may indicate serious economic impact on Kodiak as more facilities are becoming available west of Kodiak to accommodate the Bering Sea harvest. In 1967 the Kodiak area produced 93.8 percent of the total Alaska Tanner crab, while in 1977 it produced only 21.1 percent of the state total, The trend has been similar for king crab.

Though king crab and Tanner crab have generally emerged as differentiated products with certain demands for each, the processing and marketing channels of both are almost identical. Alaska king crab is the most widely recognized of the three Alaskan crab species commercial'ly harvested, and brings the highest price. An attempt was made at one time to market Tanner crab under the name "queen" crab, but an FDA ruling was issued prohibiting the implied similarity to king crab. Thereafter, Tanner crab has commonly been marketed as snow crab.

FIGURE [illegible]

TANNER CRAB CATCH BY FOREIGN & DOMESTIC FLEETS
11965-1977)



SOURCE : Orth et al., 1978, Preliminary Draft

TABLE B.29

CATCH OF TANNER CRAB BY AREA

(in thousands of pounds)

YEAR	SOUTH-EAST	P.W. SOUND	COOK INLET	KODIAK	CHIGNIK	S. PENINSULA	EAST ALEUTIANS	WEST ALEUTIANS (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		18.1	3,243.6
1967	2.7			111.1	1.6	3.0				118.4

SOURCE : ADF&G STATISTICAL LEAFLETS 1960 - 1975; 1976 - 3.977 PRELIMINARY DATA

Whole crabs are rarely marketed except through small local markets within Alaska. Whole crabs are too large and bulky to ship economically. Sections, consisting of the natural ratio of four legs and one claw, are the most common product of initial processing at Alaska plants, as they are less labor intensive than other product forms. This expedites transport out of oftentimes overcrowded Alaska cold storage facilities, and helps lessen the need for expensive, and sometimes unavailable, Alaskan labor. The sections leave the plants in brine frozen bulk packages, usually weighing 34 to 68 kg (75 to 150 pounds).

Frozen meat is the second most common crab product from Alaska processing plants. The extracted meats are frozen into blocks often weighing around 6.8 kg (15 pounds), and shipped to the lower states.

Alaskan crab for domestic use is usually shipped to Seattle or other nearby cities for reprocessing and further distribution. Firms may own plants in both Alaska and the Seattle area, or have the re-processing performed on a custom basis. Reprocessing usually consists ' of extracting meat from the sections for freezing or less often for canning, or of portioning the bulk frozen blocks into 2.3 kg (five-pound) blocks which are then packaged six to a container. Canning, whether performed in Alaska or another location, is becoming less popular. The expenses associated with canning coupled to the increasing price of raw , crab are resulting n a final product of such high price that it meets consumer resistance Packages of crab claws only are marketed too, but as with whole crab, they are considered a specialty item and are a small sector of the entire crab products market. There has been a move away from whole crab and extracted meats, and an increasing tendency to produce crab sections in Alaskan processing plants. It must be stressed that much of the Alaskan product undergoes reprocessing, and Alaska output is not necessarily representative of the product mix that reaches the final consumer.

Seattle serves as a trans-shipment point for most Alaskan crab that is exported, with the remainder being exported directly from Alaska. Crab that is exported usually remains in bulk portions for reprocessing after arriving at the foreign destination. As Japan's fishing fleets have come under increasing regulation and its catch quotas have been lowered, its imports of crab from Alaska have increased significantly. Japan's imports of Alaskan crab have risen from almost negligible levels in the late 1960s, to volumes making Japan the largest buyer through the mid and late 1970s (Tables 2.20 and 2.21). 9

King crab and Tanner crab usually follow the same marketing channels (Figures 2.5 and 2.[illegible]). After reprocessing, the products are stored in the Seattle area. This location serves as the direct distribution point for the northwestern United States. Product destined for other areas is shipped to the major distribution centers for storage in facilities owned or leased by the processing company (Figure 2.2). Data revealing the amounts of various products passing through these centers are not readily available. However, in 1965, over half of the Alaska king crab marketed in the U.S. was sold on the east coast (Youde & Wix, 1967). Local wholesalers are the primary buyers from the distribution centers, with brokers serving as the intermediaries. The major buyers from wholesalers are institutional markets, including restaurants, and retail food stores, with institutional buyers dominating the market.

TABLE B.20

UNITED STATES EXPORTS OF PREPARED OR PRESERVED
AND FROZEN KING CRAB, 1968 - 1977

Year	Prepared or Preserved[1] (000's)	Frozen (000's)
1968	171.8	847.3
1969	50.8	496.2
1970	199.7	479.6
1971	40.5	522.8
1972	20.6	1,326.9
1973	1,524.2	4,729.9
1974	706.9	2,532.4
1975	446.0	2,712.0
1976	370.1	4 ,398.5
1977	268.0	10,182.3

SOURCE : United States Bureau of Census FT 410 Schedule B.
Commodity by Country, 1968 - 1977.

[1] Includes canned king crab.

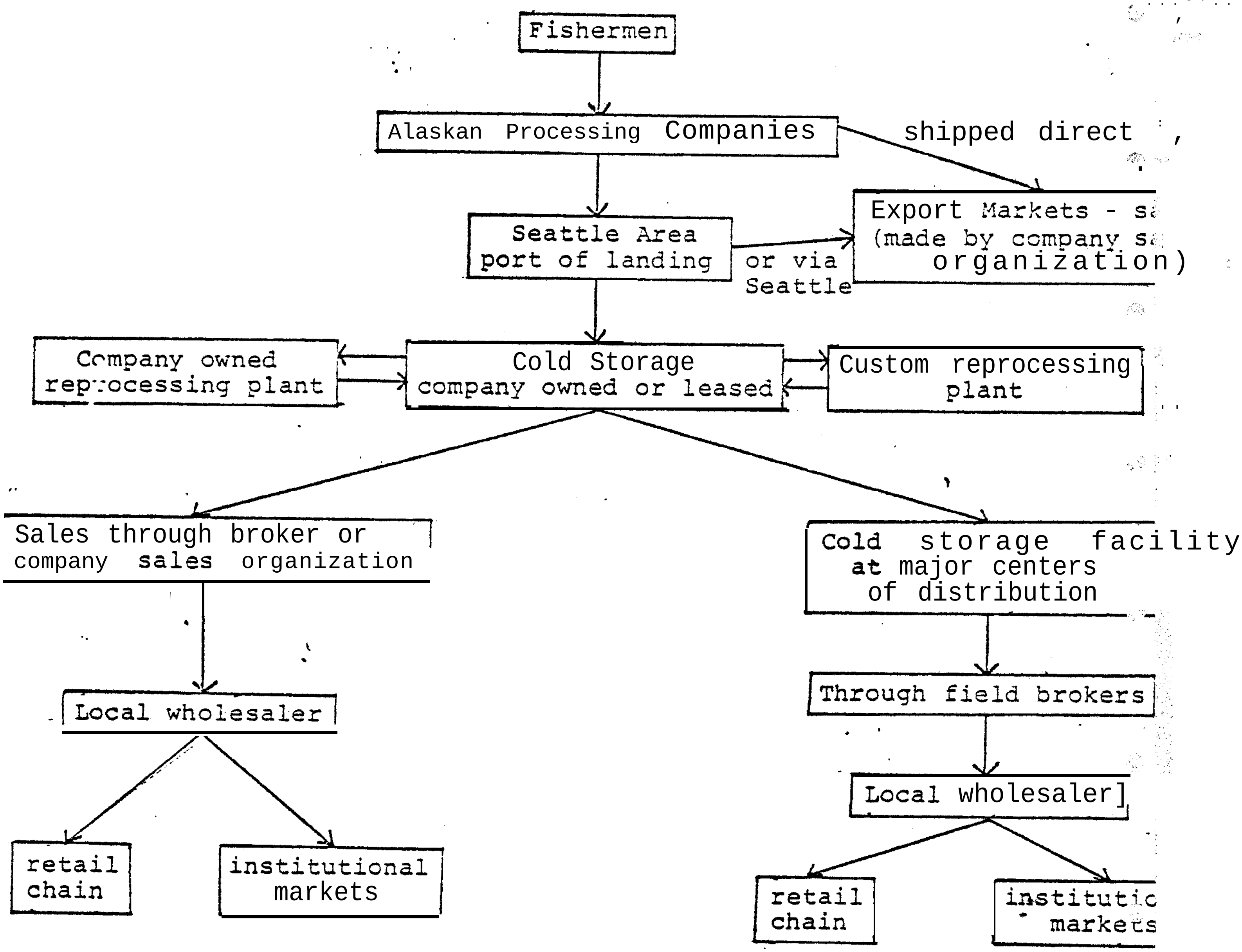
TABLE B.2.

UNITED STATES EXPORTS OF FROZEN TANNER CRAB
TO JAPAN, 1970 - 1976

Year	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 : Orth, et al., 1978, Preliminary Draft.

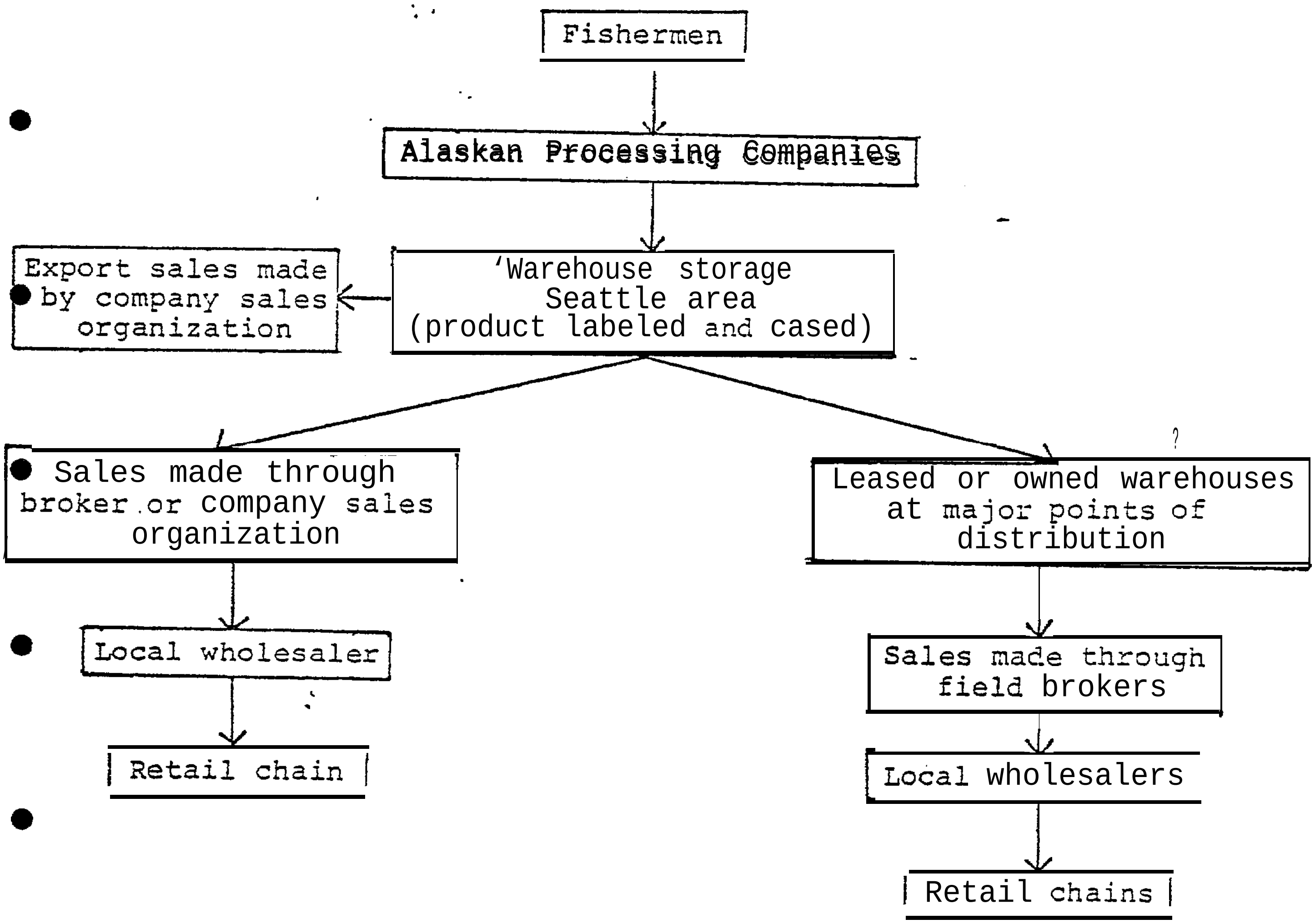
MARKET CHANNELS - FROZEN KING AND TANNER CRAB PRODUCTS



SOURCE : Orth et al., 1978, Preliminary Draft

Figure B.10

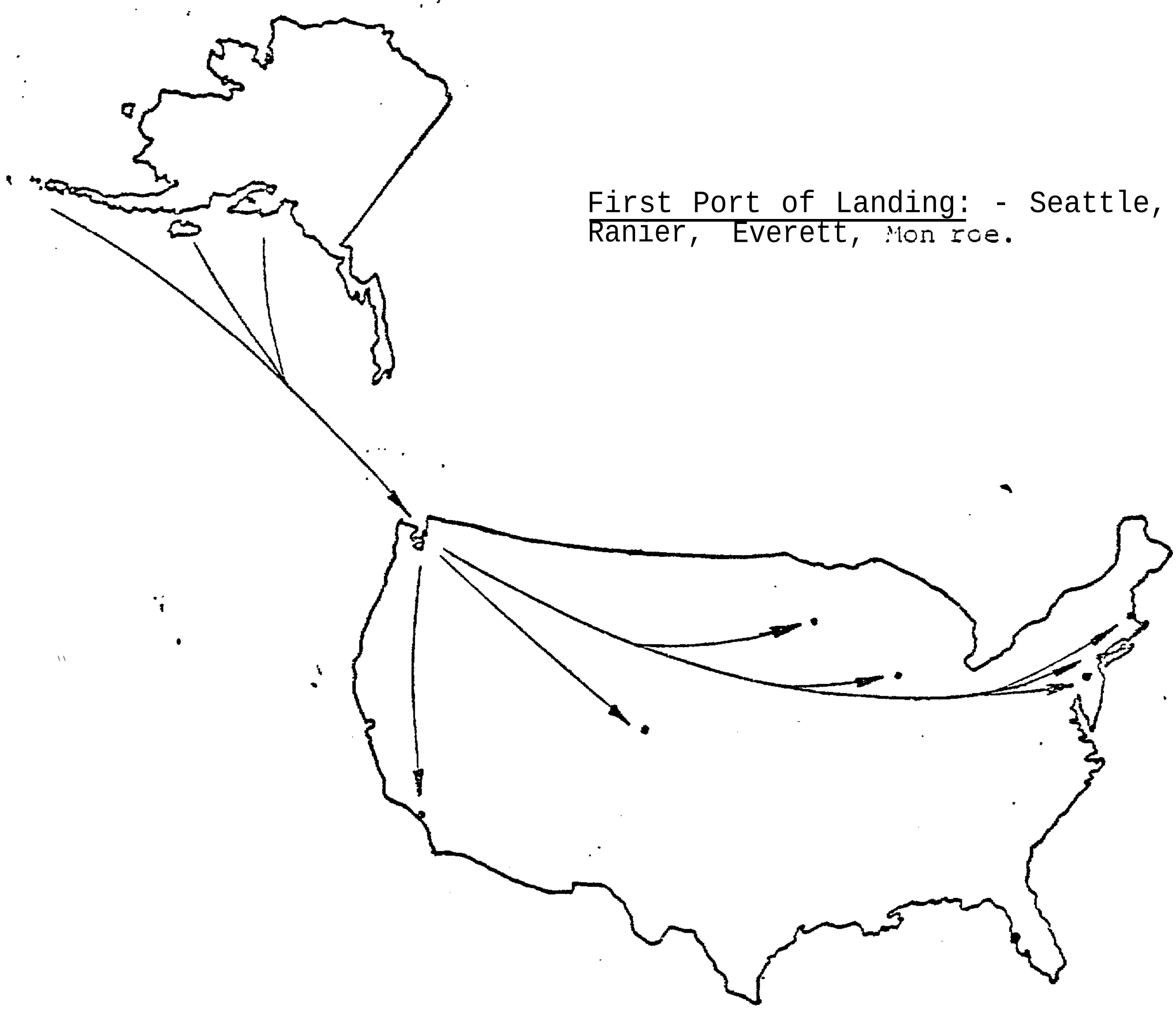
MARKET CHANNELS - CANNED ALASKAN SHELLFISH PRODUCTS



SOURCE: Orth et al., 1978, Preliminary Draft

Figure 2.1

Distribution of Alaskan Shellf
Products by Major Centers of
Distribution



First Port of Landing: - Seattle, Belli
Ranier, Everett, Mon roe.

Major Centers of Distribution: Los Ang
Denver, Minneapolis , Chicago, Philadelp
New York, Boston.

SOURCE : Orth et al., 1978, Preliminary Draft

Figure 3.12

Statistics

Catch and Prices

The king crab fishery is among the most important commercial fisheries in Alaska in terms of both weight and value of catch. Between 1961 and 1977, the annual catch ranged from 19,700 MT to 72,200 MT (43.4 million pounds to 159.2 million pounds), and accounted for between 31 percent and 84 percent of the Alaskan shellfish catch and between 9 percent and 34 percent of the Alaska catch of both finfish and shellfish (Table [illegible]). The value of the annual catch for 1961 through 1975 ranged from $3.9 million to $44.7 million and accounted for between 59 percent and 89 percent of the value of all Alaskan shellfish and between 7 percent and 29 percent of value of the total Alaskan catch.

After rapid increases between 1961 and 1966, and then decreases from 1967 through 1970, the annual king crab catch in Alaska began to increase again, but by 1977 the catch was still only 62 percent of the record catch of 1966. Due to increases ·n the ex-vessel price of king crab, the value of the catch has tended to ncrease. Between 1967 and 1975, there were six years in which the value of catch exceeded that of 1966. Despite both the increases in the price of king crab and the recent increases in catch, the dominance of king crab in the Alaskan shellfish fisheries is decreasing in terms of catch and value of. catch.

Production

King crab products have been the largest single component of shellfish processing in Alaska. From 1966 through 1975, annual king crab production

TABLE E.32
THE ALASKAN KING CRAB FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SHELLFISH CATCH VALUE	POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	POUNDS
1961	43,412	$3,914	$0.09	76.5	66.8	7.2	10.1
1962	52,782	5,278	0.10	74.4	66.4	7.7	11.8
1963	78,740	7,607	0.10	79.1	74.0	14.1	19.1
1964	86,721	8,186	0.09	82.0	80.8	12.8	16.9
1965	131,671	12,729	0.10	87.7	83.6	15.7	25.9
1966	159,202	15,670	0.10	89.2	82.7	17.4	26.7
1967	127,723	14,970	0.12	82.2	70.4	27.5	33.9
1968	81,905	21,816	0.27	78.4	57.6	24.9	17.3
1969	57,730	15,644	0.27	71.5	44.4'	18.8	14.2
1970	52,061	13,190	0.25	64.3	34.2	12.4	9.5
1971	70,703	19,077	0.27	73.3	38.5	20.9	14.7
1972	74,427	20,519	0.28	63.8	38.1	20.7	17.2
1973	76,824	44,702	0.58	64.2	28.8	29.2	16.6
1974	95,214	39,154	0.41	59.3	34,9	26.3	20.7
1975	97,629	38,251	0.39	69.0	39.5	28.9	22.2
1976	105,825				33.3		18.2
1977	99,449				31.5		15.7
1978							
Average:	87,765	18,714					

Source: ADF&G Statistical Leaflets for various years, averaged 11,500 MT (25.4 million pounds), ranged between 5,810 MT (12.8 million pounds) in 1959 and 20,900 MT (46.1 million pounds) in 1966, and on the average accounted for 11.0 percent of the total Alaskan processing output (Table 3.33). Although total production has not tended to increase or decrease, there has been a substantial decrease in the production of other than fresh or frozen products. The product mix of fresh or frozen products is summarized in Table 3.34 .

TABLE [illegible]

King Crab Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & (ITHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966	10	35	46,068	37,372	8,696	81.1	18.9	14.6
1967	14	38	29,888	22,088	7,800	73.9	26.1	16.9
1968	12	43	19,344	17,507	1,837	90.5	9.5	8.0
1969	13	40	12,823	11,468	1,355	89.4	10.6	6.8
1970	13	30	14,842	13,753	1,089	92.7	7.3	5.2
1971	5	35	17,146	16,173	973	94.3	5.7	7.2
1972	5	43	19,794	18,768	1,026	94.8	5.2	9.8
1973	4	61	28,588	27,642	946	96.7	3.3	12.8
1974	4	47	25,508	24,697	811	96.8	3.2	10.3
1975	3	49	40,350	39,276	1,074	97.3	2.7	18.6
197fj								
1977								
Average (1966-1970)			24,593	20,438	4,155	85.5	14.5	10.3
Average (1966-1975)			25,435	22,874	2,561	90.8	9.2	11.0

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

TABLE 12.34

Fresh and Frozen King Crab Production
In Alaska by Product Type
1966 - 1975

YEAR	TOTAL PRODUCTION (000's lbs.)	WHOLE (000's lbs.)	SECTIONS (000's lbs.)	MEAT (000's lbs.)	PERCENTAGE WHOLE	PERCENTAGE SECTIONS	PERCENTAGE MEAT
1966	37,341	6,534	5,593	25,214	17.5	15.0	67.5
1967	22,087	2,710	2,439	16,938	12.3	11.0	76.7
1968	17,506	5,879	3,644	7,983	33.6	20.8	45.6
1969	11,467	1,102	1,094	9,271	9.6	9.5	80.8
1970	13,753	1,651	5,061	7,041	12.0	36.8	51.2
1971	16,174	24	6,266	9,884	0.1	38.7	61.1
1972	18,768	766	8,199	9,803	4.1	43.7	52.2
1973	27,635	576	18,782	8,277	2.1	68.0	30.0
1974	24,697	4,035	10,438	10,224	16.3	42.3	41.4
1975	39,276	30,488	4,201	4,587	77.6	10.7	11.7
1976							
1977							
Average (1966- 1970)	20,431	3,575	3,566	13,289	17.0	18.6	64.4
Average (1966- 1975)	22,870	5,376	6,572	10,922	18.5	29.7	51.8

Source: Alaska Department of Fish and Game, Catch and Production Statistical Leaflets, 1966 - 1975.

Factor of Change

Harvesting Technology

The primary harvesting methods of Alaska's three commercial crab species, king, Tanner, and Dungeness, have not changed greatly since the Alaskan crab fisheries began growing noticeably after World War II. Pots are used almost exclusively for the catching of all three species, although ring nets and diving gear are legal. Prior to 1954, trawl gear, used mostly in the Bering Sea, accounted for a small but significant portion of Alaska's king crab catch. Since that time, trawling for crab has been abolished for domestic fishermen. In 1964 the same ban was implemented for foreign fleets who were issued quotas for the amount of crab they could catch within American regulated areas.

The pots used by the three crab fisheries are quite similar in construction, with modifications appropriate to the target specie. King crab pots are normally the largest, about 2.1 m by 2.1 m by 76 m (7 feet by 7 feet by 2 1/2 feet), with Tanner crab pots being scaled down replicas or pyramidal in shape. Dungeness pots are the smallest, and usually round rather than square. The basic design of pots has changed little. However, it is not uncommon for individual fishermen to experiment with modifications to the openings, and use "odd-shaped" pots.

The hydraulic pot hauler has made crabbing safer, as well as easing the manual work load. This device is capable of adjusting for changing stress on the pot line, decreasing the chance of snapping the line and losing the pot. The pot hauler has been invaluable in the fisheries for Tanner and king crab, which brave possibly the world's most adverse fishing conditions during winter in the Bering Sea.

The crab vessels themselves have undergone the most drastic changes within the fisheries. King and Tanner crab are harvested primarily during winter months, when seas are roughest and icing conditions are common. As these fisheries expanded into the Bering Sea, even more severe weather was to be dealt with. The original crabbing vessels were converted seiners, halibut schooners, and almost any other type of vessel imaginable. Good prices for king crab soon encouraged the construction of a modern fleet of 27 m (90 foot) and larger vessels, designed for great stability and hauling capacity. The fleet grew swiftly during the late 1960s, with new vessels still arriving on a steady basis.

Besides the adequate size of new vessels, they are equipped with sophisticated navigational gear and refrigeration systems. Loran A and C are navigational systems based on determining one's position at sea by the use of transmissions from specific points. Crab vessel operators claim accuracy to within 91.4 m (100 yards) of their desired destination point, making the once tedious task of locating crab pot buoys less time consuming. The large vessels also have fish holds with refrigerated sea water circulation systems for holding the crab alive. Many fishing grounds would be inaccessible due to travel time if the circulating systems were not utilized, as dead crab cannot be accepted by processors, and the crab will perish if their water is not changed about every twenty minutes.

Most of the newer crab vessels have been designed for rapid conversion to other fisheries and gear, the most common being trawling gear for groundfishing. Due to the huge catching capacity of the crab fleet, it is becoming imperative that such large vessels be versatile enough to enter other fisheries.

Production Technology

Present crab processing is very similar to that of twenty years ago. The Japanese had developed considerable expertise at crab preservation prior to World War II, but were not generous in sharing their knowledge as the American crab fisheries developed following the war. However, by 1955, American methods had advanced rapidly and U.S. packs of crab, both frozen and canned, were supposedly superior in quality of Japan's. Americans froze the majority of the catch during the first years of the fisheries, because it was the only method capable of providing quick enough processing to avoid loss of quality. Canning methods were improved and became more prevalent during the 1960s. Canning declined significantly during the past ten years or so as freezing became more common in the preservation of almost all fish species.

Regulation

Alaska's crab fisheries, though decades old by 1960, were never subjected to massive overfishing before the State of Alaska assumed regulatory control of the fisheries. Thus, the opportunity to proceed cautiously with their development was utilized, resulting in king and Tanner crab fisheries that have avoided the "boom or bust" situation characterizing many fisheries. Due to Dungeness crab competition from southern Pacific states, Alaska's Dungeness fishery has been less steady, attracting effort as prices rose or as a secondary fishery for vessels temporarily out of work. However, minimal regulation of the Dungeness fishery has been necessary due to the relative lack of interest.

Crab, as with shrimp, have proven a difficult species to properly manage. The population often increases or decreases for yet unknown reasons in unfished areas as well as in fishing grounds. This occurrence has been somewhat responsible for decreased catches in areas that have received adequate fishing constraint.

Crab fishing regulations specify type of gear, amount of gear, open seasons, anti sex and size of legal crabs. Only male crabs can be harvested, with minimum sizes specified for each spec· es during certain times of the year. Until 1971 the Tanner and king crab fisheries were nearly unregulated. In 1971 for the first time, specific seasons and quotas were established. Catch data revealed that a significant decrease of king crab in the Kodiak area was occurring at the time. The major effects of lower king crab catches and stricter regulation in the Kodiak area was expansion of the fishery westward and diversification into Tanner crab.

As effort increased in the Tanner and king crab fisheries and new crab areas were developed, the Department of Fish and Game implemented appropriate seasons and quotas to maintain adequate stocks. In recent years, the Bering Sea and western Aleutian area have become the most important crabbing area in Alaska, and even these remote areas are subject to catch quotas and season closures.

Other Governmental Policy.

Until the early 1970s, the Russian and Japanese fishing fleets harvested significant amounts of king and Tanner crab from Alaskan waters. As the American crab fisheries rapidly developed the capacity to harvest available stocks, the federal government negot· ated agreements with Japan and Russia, establishing quotas for each country that would decrease annually. (This situation is covered in more detail n the market structure section for Tanner and king crab.)

Conflicts With Other Fisheries and Other Commercial Vessels.

In addition to the conflict caused by competition for space in crowded small boat harbors, conflicts arise with other fisheries and, in particular, non-fishing commercial vessels due to the nature of crab fishery gear. Pots are lowered to the ocean floor and then left, their location being marked by a float. If the float is torn loose from the pot by the gear or hull of other ships the pot cannot be recovered. The Coast Guard has tried to reduce such losses due to non-fishing commercial vessels by establishing well defined shipping lanes.

A conflict exists between the halibut and king crab fishery due to occasional incidental catch of immature halibut in crab pots.

TANNER CRAB

Development and Market Structure

The development of the Tanner crab fishery is discussed in the king crab sub-chapter. .

Statistics

Catch and Prices.

The Tanner (snow) crab fishery has grown from an incidental catch fishery in 1961 to a dominant shellfish fishery, with an annual catch approaching that of king crab in 1977 and expected to surpass it in 1978 (Table 3.35). Between 1961 and 1977, the annual catch ranged from zero in 1963 and 1965 to 44,600 MT (98.3 million pounds) in 1977, and accounted for between none and 31 percent of the total shellfish catch. The catch and its importance in the total shellfish fishery increased annually in all but two years between 1966 and 1977 Generally stable or increasing prices resulted in a similarly steady ncrease in the value of catch. Between 1961 and 1975, the value of the annual Tanner crab catch ranged from $0 in the years for which no landings were recorded to $?3.1 million in " 974 and accounted for up to 19.8 percent of the value of the total shellf· sh catch.

Production.

Tanner crab production has become increasingly important and may soon rival king crab as the leading shellfish product, Between 1966 and 1975 annual Tanner crab production averaged 3,490 MT (7.7 million pounds) which is more than six times the average for 1966-1970, ranged from less than 45.4 MT (0.1 million pounds) in 1968 to 10,600 MT (23.3 million pounds) in 1973, and

TABLE B.39

THE ALASKAN TANNER (SNOW) CRAB FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SHELLFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961	7	$ 0.7	$ 0.10	0.01	0.01		
1962	11	1.1	0.10	0.02	0.01		
1963							
1964	13	1.39	0.10	0.01	0.01		
1965							
1966	0.2	0.01	0.05				
1967	118	11.8	0.10	0.06	0.06	0.02	0.03
1968	3,248	323.6	0.10	1.2	2.3	0.4	0.68
1969	11,207	1,133	0.10	5.2	8.6	1.4	2.7
1970	14,473	1,417	0.10	6.9	9.5	1.3	2.6
1971	12,880	1,369	0.11	5.3	7.0	1.5	2.7
1972	30,135	3,731	0.12	11.6	15.4	3.8	7.0
1973	61,719	10,756	0.17	15.4	23.2	7.0	13.3
1974	63,906	13,052	0.20	19.8	23.5	8.8	13.9
1975	46,857	7,019	0.15	12.7	19.0	5.3	10.6
1976	80,712				25.4		13.9
1977	98,329				31.1		15.5
1978							
Average	24,919	2,588					

Source: ADF&G Statistical Leaflets for various years.

accounted for up to 10.2 percent of the total Alaskan processing output (Table 3.--). As with other fish, the percentage of total production consisting of fresh/frozen products has increased.

In addition to the change in product mix between fresh/frozen and other products, there has been a change in the product mix of fresh/frozen products: the production of whole crab and sections has increased and that of meat has decreased, see Table ?..?-.

Factors of Change

Due to the similarit· es between the factors of change for the Tanner crab and king crab fisher· es, they are presented together in the king crab sub-chapter.

Conflicts with Other Fisheries and Other Commercial Vessels

See the appropriate section in the king crab sub-chapter.

TABLE [illegible]

Tanner Crab Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966	--	--						
1967	--	--	43	38	5	88.4	11.6	0.0
1968	2	22	816	783	33	96.0	4.0	0.3
1969	10	20	2,116	1,550	566	73.3	26.7	1.1
1970	10	20	3,115	2,286	829	73.4	26.6	1.1
1971	4	16	2,324	15795	529	77.2	22.8	1.0
1972	6	35	7,503	6,808	695	90.7	9.3	3.7
1973	7	49	23,301	22,203	1,098	95.3	4.7	10.2
1974	7	44	18,303	17,255	1,048	94.3	5.7	7.4
1975	6	33	19,095	18,390	705	96.3	3.7	8.8
1976								
1977								
Average (1966-1970)			1,218	931	287	76.4	23.6	0.5
Average (1966-1975)			7,662	7,111	551	92.8	7.2	3.4

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

TABLE U.37

Fresh and Frozen Tanner Crab Production
In Alaska by Product Type
1966 - 1975

YEAR	TOTAL PRODUCTION (000's lbs.)	WHOLE (000's lbs.)	SECTIONS (000's lbs.)	MEAT (000's lbs.)	PERCENTAGE WHOLE	PERCENTAGE SECTIONS	PERCENTAGE MEAT
1966						-	
1967	38	'lo	'27	1	26.3	71.1	2.6
1968	783	269	377	137	34.4	48.1	17.5
1969	1,550	988	38	524	63.7	2.5	33.8
1970	2,286	2 1	1,099	1,166	0.9	48.1	51.0
1971	1,794		691	1,092	0.6	38.5	60.9
1972	6,808	1,01	2,831	2,974	14.7	41.6	43.7
1973	22,203	782	14,937	6,484	3.5	67.3	29.2
1974	17,255	1,323	14,025	1,907	7.7	81.3	11.1
1975	18,389	17,100	1,047	242	93.0	5.7	1.3
1976							
1977							
Average (1966 - 1970)	931	258	308	366	27.6	33.1	39.3
Average (1966 - 1975)	7,111	2,151	3,507	1,453	30.2	49.3	20.4

Source: Alaska Department of Fish and Game, Catch and Production Statistical Leaflets, 1966 - 1975.

DUNGENESS CRAB

Development and Market Structure

Dungeness crab plays a very minor role in the Alaska crab fishery in comparison to Tanner or king crab, although the fishery, concerning domestic harvesting, predates the other two. The Alaska Dungeness fishery was just reaching substantial size after World War II when the king crab fishery began tremendous growth. Only 227 MT (500,000 pounds) of Dungeness crab was harvested in Alaska in 1954, a considerable drop from previous years. Alaska Dungeness catch data prior to 1954 was not available for comparison, but 227 M (500,000 pounds) constituted only 1.8 percent of the tots" American catch in 1954. This is much lower than in any of the years for which complete data were available, ranging from 8.8 percent to 55 2 percent (Table 2.38).

Referring to Table 2.38, it is easily seen that the Dungeness crab fishery commonly fluctuates. Catch levels do not dip as low as the 1954 harvest, but have recently been around only 1,360 MT (three million pounds) per year after remaining nearly 4,540 MT (10 million pounds) or more per year during the late 1960s.

The effort directed toward Dungeness crab varies greatly because of the Alaska fishery's dependence upon the well-being of the Dungeness fisheries of the lower Pacific states. Oregon, Washington, and California all harvest significant volumes of Dungeness crab. Due to lower processing costs and an obvious locational advantage that reduces transportation expenses, processors can afford to pay more for crab landed at processing plants located in the lower states than at Alaskan plants. The Oregon, Washington, and California crab fishermen usually supply nearly all the Dungeness crab that processors care to purchase. However,

TABLE B.[illegible]

U.S. AND ALASKA DUNGENESS CRAB LANDINGS, 1961 - 1975.

Year	Total U.S. Catch (000)	Alaska Catch (000)	Portion of Total Caught in Alaska[1] (%)	$ Value of Alaska Catch (000)	Price per Pound of Alaska Catch[1] (¢)
1961	32,699	4,592	14.0	442	9.6
1962	23,364	8,990	38.5	1,001	11.1
1963	24,863	12,084	48.6	1,358	11.2
1964	23,043	12,709	55.2	1,465	11.5
1965	28,913	8,895	30.1	1,000	11.2
1966	39,718	5,053	12.7	606	12.0
1967	42,437	11,598	27.3	1,508	13.0
1968	49,970	13,242	26.5	1,774	13.4
1969	48,055	11,304	23.5	1,620	14.3
1970	58,509	9,696	16.6	1,414	14.6
1971	42,679	3,749	8.8	610	16.3
1972		5,448		1,968	36.1
1973		6,423		3,427	53.3
1974		3,818		1,973	51.6
1975		3,034		1,649	54.3

SOURCE : Alaska Department of Fish and Game, Statistical Leaflet No. 28 NMFS, Basic Economic Indicators, King and Dungeness Crabs, 1947 - 1972.

[1] Calculated from source data

when the lower states' harvest falls short of meeting demand, processors start bidding the price up in order to obtain sufficient supplies. This in turn increases the prices offered in Alaska and attracts fishermen into the fishery. The price offered in Alaska will still be lower, reflecting the transportation costs associated with moving the crab to the market, usually Seattle.

Growth of the king crab fishery had a doubly detrimental effect on the Alaskan Dungeness crab fishery. Besides attracting a considerable amount of effort away from Dungeness crab fishing, king crab captured a significant portion of the market that Dungeness crab had historically supplied, while expanding into new markets. This left the lower Dungeness crab fisheries to supply a dwindling demand.

The smaller Dungeness crab are commonly frozen and shipped whole from Alaska. This product form is impractical for the larger Tanner and king crab. Dungeness crab are also portioned and frozen, or utilized for canning.

Dungeness crab is generally marketed through the same channels as Tanner and king crab, and the market structure section for those crab can be referred to for greater detail on the matter. Dungeness crab is normally not marketed as widely as Tanner and king crab, as the western United States accounts for the majority of sales. Also, due to being available whole, Dungeness crab is sometimes able to supply a specialty market not open to the larger species of crab.

Factors of Change.

The factors of change for all the crab fisheries are presented in the king crab sub-chapter, Conflicts With Other Fisheries and Other Commercial Vessels,

The conflicts of the Dungeness crab fishery and others are somewhat similar to those of the other crab fisheries. Differences can arise, however, since the Dungeness crab fishery tends to operate closer to shore than do the other fisheries.

Statistics

Catch and Prices.

Unlike the king crab fishery, the dungeness crab fishery has not dominated the Alaskan shellfish fisheries. Between 1961 and 1977, annual catch ranged from 544 MT (1.2 million pounds) in 1977 to 5,990 MT (13.2 million pounds) in 1968 and accounted for between 0.4 percent and 12 percent of the state's shellfish catch (Table 2.34). From 1961 through 1975, the annual value of the Dungeness crab catch ranged from $0.4 million in 1961 to $3.4 million in 1973 and accounted for between 2.3 percent and 14.7 percent of the value of the Alaskan shellfish catch. Since 1968 the catch has tended to decrease, but due to almost annual increases in the ex-vessel price of Dungeness crab, the value of the catch has fluctuated, but with no tendency to increase or decrease. The importance of the Dungeness crab relative to the tota? shellfish fishery has tended to decrease in, terms of catch and value of catch.

Production.

Dungeness crab have become less important in Alaskan processing in the past 10 years. Both the average annual production of Dungeness crab and the average percentage of Alaskan production attributable to Dungeness crab production were higher for 1966-1970 than for 1966-1975, (Table [illegible]). Between 1966 and 1975 annual production averaged 1,950 MT (4.3 million pounds), ranged from a low of 1,090 MT (2.4 million pounds) in 1971 to a high of 2,950 MT (6.5 million pounds) in 1967 and accounted for no more than 3.6 percent of total Alaskan production of all fish. As with other fish, fresh/frozen products have increased their share of total production. The change in the product mix of fresh/frozen products is summarized in Table [illegible] .

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TABLE B.21
THE ALASKAN DUNGENESS CRAB FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SHELLFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961	4,592	$ 442	$0.10	8.6	7.1	0.8	1.1
1962	8,990	1,001	0.11	14.1	11.3	1.5	2.0
1963	12,084	1,358	0.11	14.1	11.4	2.5	2.9
1964	12,709	1,465	0.12	14.7	11.8	2.3	2.5
1965	8,895	1,000	0.11	6.9	5.6	1.2	1.7
1966	5,053	606	0.12	3.4	2.6	0.7	0.8
1967	11,598	1,508	0.13	8.3	6.4	2.8	3.1
1968	13,242	1,774	0.13	6.4	9.3	2.0	2.8
1969	11,304	1,620	0.14	7.4	8.7	1.9	2.8
1970	9,696	1,414	0.15	6.9	6.4	1.3	1.8
1971	3,749	610	0.16	2.3	2.0	0.7	0.8
1972	5,448	1,968	0.36	6.1	2.8	2.0	1.3
1973	6,423	3,427	0.53	4.9	2.4	2.2	1.4
1974	3,818	1,973	0.52	3.0	1.4	1.3	0.8
1975	3,034	1,649	0.54	3.0	1.2	1.2	0.7
1976	1,538				0.5		0.3
1977	1,177				0.4		0.2
1978							
Average	7,256	1,454					

Source: ADF&G Statistical Leaflets for various years.

TABLE E.40

Dungeness Crab Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966	7	13	2,614	2,506	108	95.9	4.1	0.8
1967	6	17	6,459	6,216	243	96.2	3.8	3.6
1968	5	21	5,770	5,267	503	91.3	8.7	2.4
1969	6	22	5,215	5,027	188	96.4	3.6	2.8
1970	6	20	5,252	5,147	105	99.0	2.0	1.8
1971	6	25	2,392	2,346	46	98.1	1.9	1.0
1972	2	27	3,719	3,626	93	97.5	2.5	1.8
1973	3	34	4,487	4,468	19	99.6	0.4	2.0
1971	1	40	4,257	4,247	10	99.8	0.2	1.7
1975	0	27	2,438	2,438	0	100.0	0.0	1.1
1976								
1977								
Average (1966-1970)			5,062	4,833	229	95.6	4.4	2.3
Average (1966-1975)			4,260	4,129	131	97.3	2.7	1.9

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

TABLE E.41

Fresh and Frozen Dungeness Crab Production
In Alaska by Product Type
1966 - 1975

YEAR	TOTAL PRODUCTION (000's lbs.)	WHOLE (000's lbs.)	SECTIONS (000's lbs.)	MEAT " (000's lbs.)	PERCENTAGE WHOLE	PERCENTAGE SECTIONS	PERCENTAGE MEAT
1966	2,505	135	1>443	927	5.4	57.6	37.0
1967	6,216	2,073	3>777	366	33.3	60.8	5.9
1968	5,268	807	2,998	1,463	15.3	56.9	27.8
1969	5,027	2,705	2,243	79	53.8	44.6	1.6
1970	5,147	2,584	2,406	157	50.2	46.7	3.1
1971	2,345	1,281	948	116	54.6	40.4	4.9
1972	3,625	2,619	958	48	72.2	26.4	1.3
1973	4,468	2,653	1,334	481	59.4	29.9	10.8
1974	4,246	2,081	1,458	707	49.0	34.3	16.7
1975	4,876	2,190	248	2,438	44.9	5.1	50.0
1976							
1977							
Average (1966- 1970)							
	4,832	1,661	2,573	598	31.6	53.3	15.1
Average (1966 - 1975)							
	4,372	1,913	1,781	678	43.8	40.3	15.9

Source: Alaska Department of Fish and Game, Catch and Production Statistical Leaflets, 1966 - 1975.

SHRIMP

Development and Market Structure

Alaska's first shrimp processing plant was located on Thomas Bay, north of Petersburg. It became operational in 1915, and was joined by three additional plants in southeast Alaska by 1921. Alaskan shrimp were taken almost exclusively by beam trawl at the time, with 74.4 MT (164,000 pounds) being caught in 1916. The southeast Alaska catch increased to 998 MT (2.2 million pounds) in 1921, and fluctuated between 771 and 2,490 MT (1.7 and 5.5 million pounds) through 1956. Southeast Alaska's shrimp fishery peaked in 1958, at 3,450 MT (7.6 million pounds), then decreased to less than 454 MT (one million pounds) per year since 1970.

Shrimp processing had always been very labor intensive due to hand picking (removing the shrimp from their shells), and until 1957 a shortage of hand laborers had slowed growth of the fishery. In 1957, a mechanical peeler was used in Wrangell, and by 1958 several peelers were operating in Kodiak. The advent of the mechanical peeler greatly increased shrimp processing capacity by removing the constraints created by labor force size. As a result of the increased processing capability, rich shrimp grounds around Kodiak were the subject of increased fishing effort, and after 1958 the Kodiak area developed into Alaska's major shrimp producer. Kodiak's shrimp catch peaked at 37,300 MT (82.2 million pounds) in 1971, and accounted for over 80 percent of the total Alaskan catch from 1965 to 1972. After 1971 shrimp catch quotas were implemented which slowed the growth of Kodiak catches. Regulations in the Kodiak area, along with a growing market for the shrimp, prompted increased fishing activity along the southern Alaska Peninsula, especially the Chignik area. In recent years effort in this expanding westward area has resulted in catches of over double that of the Kodiak area. The processing capacity in the newer fishing areas has grown to accommodate the large harvests.

Japan and Russia have participated in the Alaskan shrimp fishery, but did not help pioneer the fishery as they did with such species as Tanner and king crab. The Japanese first fished for shrimp off Alaska in 1961, in the Bering Sea north of the Pribilof Islands. One factory ship and 16 trawlers were used during the first year, and over 14,100 MT (31 million pounds) of shrimp were caught. Japan's catch from the eastern Bering Sea peaked in 1963, at over 27,700 MT (61 million pounds), then decreased through 1968 to less than 454 MT (one million pounds) per year. This drastically depressed catch is believed by some to have been a result of overfishing the area. Japan also fished the Gulf of Alaska for shrimp from 1963 through 1968, with a factory ship operation. The yearly Japanese catch for the area fluctuated, with a low of 83.9 (185,000 pounds), and a high of 2,360 MT (5.2 million pounds). After 1968 Japan abandoned shrimp fishing off Alaska, taking only incidental catches. Commencing with the 1977-78 fishing season, even incidental catches were returned to the sea. In 1979 the North Pacific Fisheries Management Council will issue decisions on whether foreign fishing fleets will be given any shrimp harvesting quotas off Alaska.

The Soviet Union entered the Alaska shrimp fishery in 1963, fishing in the Bering Sea north of the Pribilof Islands with six large freezer/trawler vessels. In 1964 their effort was directed off the southeast coast of Kodiak Island. After 1964 the entire Russian effort was shifted to the Gulf of Alaska, peaking in 1966, with 18 freezer/trawlers and one cannery/factory ship. The Soviet catch of shrimp from the Gulf of Alaska grew to over 11,300 MT (25 million pounds) in 1967, then rapidly declined as the United States became more emphatic about enforcing the newly enacted (October, 1966) 12 mile (19 km) contiguous fisheries zone. In 1974 several substantial fines were levied on Soviet fishing vessels for encroachment of the fisheries zone, and they have not fished off Alaska for shrimp since.

Five species of shrimp are harvested in commercial quantities off Alaska. They are pinks (*Pandalus* borealus), humpies (*P.* goniunus), sidestripes (*P.* dispar), coonstripes (*P.* hypsinotus), and spots (*P.* platyceros). The pinks comprise around 85 to 98 percent of the total shrimp catch in all areas of Alaska. Humpies are the second most abundantly. caught, with the remaining three species being of considerably less commercial importance. Alaska's contribution to the world's *Pandalid* shrimp supply is quite significant, in most years accounting for over 50 percent of that landed on the west coast of North America (Table 3.41), and between 25 percent and 50 percent of the world catch. Even with recent large growth in the California and Oregon shrimp fisheries, Alaska will probably maintain its dominance throughout the foreseeable future.

The Alaskan pinks and humpies, as well as the other larger Alaskan shrimp, are usually considered as a distinctly different product than the large prawns and shrimps from the Gulf of Mexico or imported shrimp. The smaller Alaskan shrimp have always returned a rather low income per unit of catch, necessitating large catches to remain profitable. Ex-vessel prices for most Alaskan shrimp were around four cents per pound throughout the 1960s, then steadily increased during the 1970s, to the present high of around 16 cents per pound (Table 3.42). This represents approximately a 300 percent increase in ex-vessel price since 1971.

The larger Alaskan species are caught in lower volumes, but command much higher prices. The larger species of Alaskan shrimp, coonstripes and sidestripes, are processed almost exclusively for export to Japan, and presently have an ex-vessel price in excess of 40 cents per pound. However,

TABLE 8.42

ANNUAL PANDALID SHRIMP LANDINGS, 1965-1977, BY REGION[1]

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	1,537,600	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	2,520,000	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	9,224,098	25,300,000	3,470,000	175,475,945
1977	116,871,605	6,200,000	11,400,000	48,580,022	15,663,451	198,715,078

[1] Preliminary

Source: Pacific Marine Fisheries Commission: Annual Report, 1976

Orth et al., 1978, Preliminary Draft

TABLE 3.46

KODIAK EX-VESSEL PRICES FOR SHRIMP, 1960-78
cents per pound

1960	4
1961	4
1962	4
1963	4
1964	4
1965	4
1966	4
196?	4
1968	4
1969	4
1970	4
1971	4
1972	5¼
1973	5¼ until late Feb., 6¢ until July 1, 6½-8¢ July thru
1974	8 Jan. to Aug., 9¢ Sept. to Dec.
1975	9 Jan. to May, 10¢ May to Dec.
1976	8 Jan. to May, 10¢ May to Dec.
1977	11½ Jan. to Nay, 13½¢ May to Dec.
2928.	13½ Jan. to May, 16½¢ June to Dec.

Source: U.S. Department of Commerce, N.O.A.A., N.M.F.S., Fishery Market News Report, Seattle, Washington various issues 1970-1977, plus 1960-69 (data from industry sources and ADF&G reports.

Orth et al., 1978, Preliminary Draft

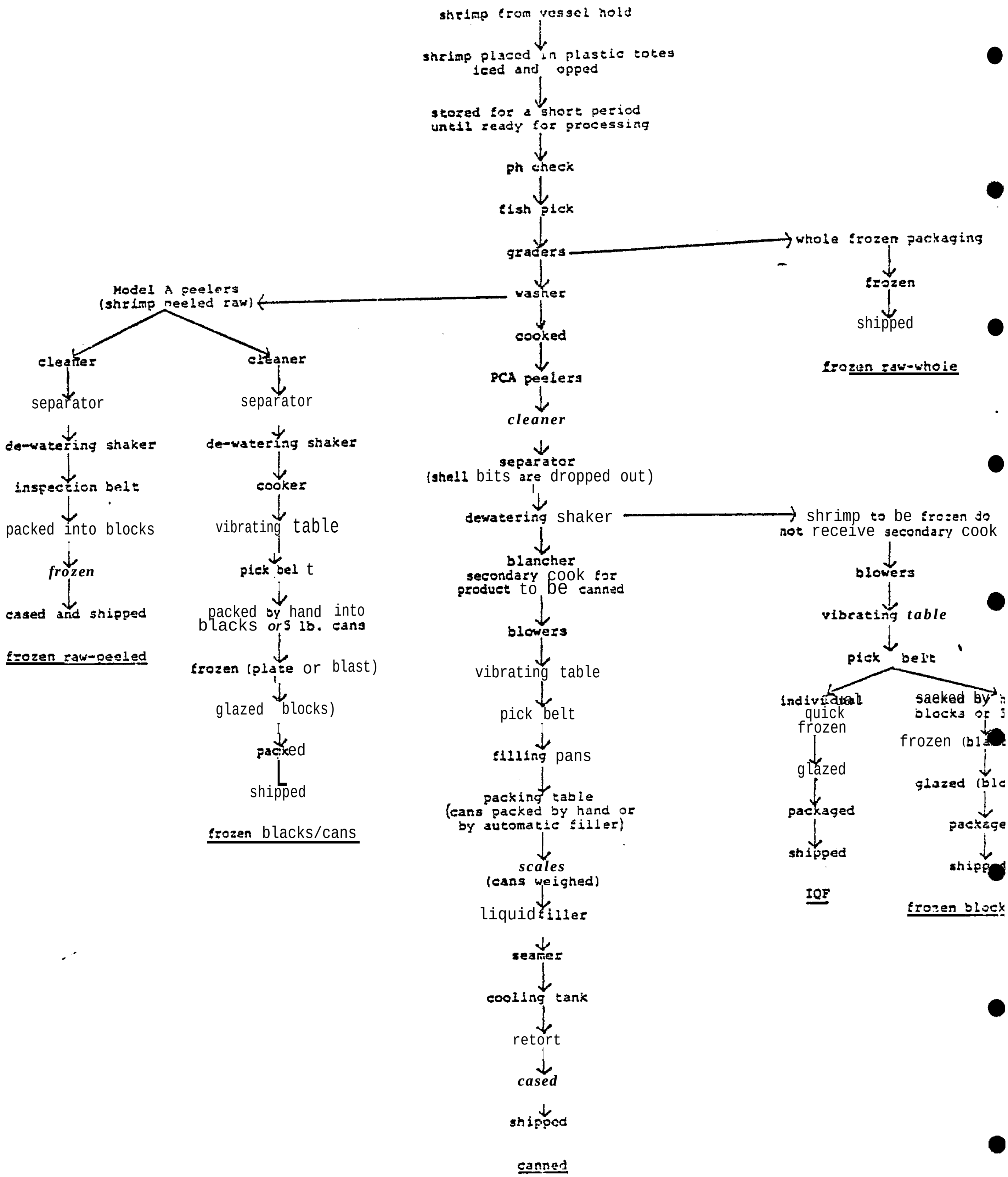
these Alaskan shrimp have not been able to compete with the Gulf of Mexico product in terms of price or consumer acceptance. The Alaskan species apparently have a unique flavor that consumers do not find as satisfactory.

Though mechanical shrimp peelers greatly increased the capacity of Alaskan processors, a product quality problem was created. The hand picking of shrimp had resulted in an exceptionally high quality product that consumers learned to expect. But the original peelers required "conditioning" of the shrimp before removing the shells. In essence, conditioning consisted of allowing the raw shrimp to rot for a couple of days so the shell could be more easily removed. The resultant product was no longer as fresh as consumers desired, and an undesirable change of color also took place during the conditioning. Due to continual refinement, since their introduction, shrimp peelers no longer require that shrimp be partially decomposed to work effectively, and models are available to peel either raw or cooked shrimp.

Shrimp is either canned, or frozen raw or cooked (Figure 3.13). When frozen raw, it is either in the whole form or peeled. Frozen raw-whole, is usually for the larger of the Pandalus species, such as sidestripe. The whole frozen product is formed into blocks or low count per pound packages. Shrimp that are peeled and frozen raw are formed into blocks, then frozen and glazed. Some shrimp is cooked before freezing. The cooking may take place before or after peeling, and the shrimp is hand packed into blocks or five-pound (2.3 kg) cans and frozen (and glazed, if blocks). The third form of frozen shrimp is individually quick frozen. The process is similar to other freezing except the shrimp are frozen

FIGURE 2.13

FLOW CHART FOR SHRIMP PROCESSING



SOURCE : Orth et al., 1978, Preliminary Draft individually, glazed and packed. Regardless of the method of processing, recovery rate for shrimp averages around 16 to 18 percent, though skill and conscientiousness of the processing laborers can result in rates considerably below or above the norm.

The marketing and distribution system of Alaskan shrimp is much the same as for crab, with most of it being reprocessed after reaching the lower states. Company sales personnel are responsible for disposal of some of the product, and brokers throughout the U.S. expedite sales of the remaining supply. The 15 pound blocks that leave Alaska are reduced to five pound blocks and packed six per carton. The bulk individually quick frozen shrimp are also repacked into suitable portions for further distribution. Canned shrimp is usually not labeled in Alaska in order that the desired label of any particular buyer can be applied, or the processing firm may market the product under its own brand name.

Most Alaskan shrimp of the smaller varieties is marketed for domestic use as either cocktail or salad shrimp. Although comprehensive data concerning distribution are not available, informal estimates by industry personnel indicate the west coast, midwest, and northeast United States each consume about 30 percent of the supply. The trend of increasing consumption of shrimp per capita by Americans indicates a healthy market exists and can be expected to expand (Table 3.44) In 1950 the average American consumed 0.34 kg (.75 pounds) of shrimp, and in 1977, this amount had grown to 0.72 kg (1.59 pounds) per person, while the U.S. population had increased by over million people.

Due to the absence of a domestic market for the larger Alaskan shrimp, they are prepared primarily for export to Japan. Accurate

TABLE 3.44

PER CAPITA CONSUMPTION OF SHRIMP, 1950-77

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	[illegible]	1975	1.41
1962	0.02	1976[1]	1.50
1963	1.17	1977[1]	1.59

[1] Preliminary

Source: NMFS, Fisheries of the United States, 1977.
Orth et al., 1978, Preliminary Draft.

export data are not available. Pinks and humpies face a sporadic export market, mainly to Scandinavian countries and England and Canada. The Scandinavians in particular consider the Alaskan shrimp as inferior to their domestic packs, and these countries tend to import only as necessary to supplement their domestic supplies in years of poor catch.

Statistics

Catch and Prices.

In terms of weight landed, the shrimp fishery is among the dominant commercial fisheries in Alaska with an annual catch exceeding that of the king crab fishery since 1970. Between 1961 and 1977, the annual catch ranged from 3,490 MT (7.7 million pounds) in 1964 to 58,500 MT (129.0 million pounds) in 1976 and accounted for between 7.2 percent and 51.7 percent of the total Alaskan shellfish catch (Table 3.45). The annual catch was very stable from 1961 through 1965, with the exception of the record low catch of 1964, fluctuating between 6,850 and 7,670 MT (15.1 and 16.9 million pounds). The fishery then began to grow rapidly and continuously through 1971. Since then, catch has fluctuated between 38,000 and 58,500 MT (83.8 and 129.0 million pounds) while tending to increase.

Due to the relatively low ex-vessel price of shrimp (from four cents to 10 cents per pound), the shrimp fishery is much less important in terms of the value of catch. Between 1961 and 1975 the annual value of shrimp landings ranged from $309,000 in " 964 to $-1.1 million in 1974 and accounted for, at most, 16.8 percent of the value of Alaskan shellfish landings. Due to the stability of ex-vessel prices until 1972, the patterns of fluctuation of catch and value of catch were similar. Large increases in the price of shrimp in 1972 through 1974 and a decrease in the price in 1975, have resulted in a divergence in their recent fluctuations.

Production.

Shrimp processing has become increasingly important. Both the average annual production and the average percentage of total processing output

TABLE B.45
THE ALASKAN SHRIMP FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SHELLFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961	15,981	$ 639	$ 0.04	12.5	24.6	1.2	3.7
1962	16,943	731	0.04	10.3	21.3	1.1	3.8
1963	15,126	605	0.04	6.3	14.2	1.1	3.7
1964	7,727	309	0.04	3.1	7.2	0.5	1.5
1965	16,819	757	0.05	5.2	10.7	0.9	3.3
1966	28,193	1,288	0.05	7.3	14.6	1.4	4.7
1967	41,813	1,701	0.04	9.3	23.1	3.1	11.1
1968	42,023	2,300	0.05	8.3	29.5	2.6	8.9
1969	47,851	1,909	0.04	8.7	36.8	2.3	11.1
1970	74,256	2,980	0.04	14.5	48.8	2.8	13.5
1971	94,891	3,909	[illegible]	15.0	51.7	4.3	19.7
1972	83,830	4,493	0.05	14.0	42.9	4.5	19.4
1973	119,964	9,341	0.08	13.4	45.1	6.1	25.9
1974	108,741	11,091	0.10	16.8	39.9	7.5	23.7
1975	98,984	7,904	0.08	14.3	[illegible]	6.0	22.5
1976	128,975				40.6		22.2
1977	116,915				37.0		18.5
1978							
Average	62,296	3,330					

Source: ADF&G Statistical Leaflets for various years.

consisting of shrimp products are significantly higher for 1966-1975 than they are for 1966-1970 (Table B.46). From 1966 through 1975, annual shrimp processing output averaged 5,810 MT (12.8 million pounds), ranged between 1,540 MT (3.4 million pounds) in 1966 and 11,000 MT (24.2 million pounds) in 1973, and accounted for up to 10.6 percent of the total annual Alaskan processing output. As with other fish, fresh/frozen products have won a larger share of total production. The changes in the product mix among fresh/frozen products is summarized in Table B.47.

TABLE 5-46

Shrimp Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966	4	12	3,354	2,073	1,281	61.8	38.2	1.1
1967	4	13	8,816	6,300	2,516	71.5	28.5	5.0
1968	5	14	5,677	1,901	3,776	33.5	66.5	2.4
1969	6	20	8,028	2,077	5,951	25.9	74.1	4.2
1970	5	16	11,444	4,003	7,441	35.0	65.0	4.0
1971	5	20	14,822	7,328	7,494	49.4	50.6	6.2
1972	5	26	15,598	7,919	7,679	50.8	49.2	7.7
1973	6	25	24,160	14,344	9,816	59.4	40.6	10.6
1974	5	26	19,984	12,994	6,990	65.0	35.0	8.1
1975	2	24	16,484	12,831	3,653	77.8	22.2	7.6
1976								
1977								
Average (1966-1970)			7,864	3,271	4,193	45.5	54.5	3.3
Average (1966-1975)			12,837	7,177	5,650	53.0	47.0	5.[illegible]

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

TABLE B.47

Fresh and Frozen Shrimp Production
In Alaska by Product Type
1966 - 1975

YEAR	TOTAL PRODUCTION (000's lbs.)	WHOLE (000's lbs.)	SECTIONS (000's lbs.)	MEAT (000's lbs.)	PERCENTAGE WHOLE	PERCENTAGE SECTIONS	PERCENTAGE MEAT
1966	2,073	1,688	59	326	81.4	2.8	15.7
1967	6,300	5,982	11	307	95.0	0.2	4.9
1968	1>901	1,401	7	493	73.7	0.4	25.9
1969	2,077	129	18	1,930	6.2	0.9	92.9
1970	4,002	1,055	23	2,924	26.4	0.6	73.1
1971	7,327	2,249	1,310	3,768	30.7	17.9	51.4
1972	7,921	2,804	2,629	2,488	35.4	33.2	31.4
1973	14,348	5,205	3,902	5,241	36.3	27.2	36.5
1974	12,994	11,304	1,583	107	87.0	12.2	0.8
1975	12,831	11,709	612	510	91.3	4.8	4.0
1976							
1977							
Average (1966 1970)							
	3,271	2,051	24	1,196	56.5	1.0	42.5
Average (1966 - 1975)							
	7,177	4,353	1,015	1,809	56.3	10.0	33.7

Source: Alaska Department of Fish and Game, Catch and Production Statistical Leaflets, 1966 - 1975.

Factors of Change

Harvesting Technology.

As in most Alaskan fisheries, shrimp harvesting is accomplished primarily with gear that was in use long before shrimp were of commercial importance in Alaska. Two types of gear are utilized for shrimp fishing: pots and trawls. Pots account for less than one percent of the total Alaskan catch, but are usually directed toward catching the larger spots and coonstripes. The pots are more suited to fishing exceptionally rough bottoms, where trawls are less adept.

Most shrimp are harvested by trawls, with double otter trawls comprising over half the shrimp gear licensed for the Kodiak area, which licenses more shrimp vessels than any other area. The double otter trawls evolved from similar gear used to fish shrimp in the Gulf of Mexico. The primary advantage of using smaller double trawls rather than a larger single trawl is that a wider area is passed over by the dual gear without increasing the resistance of the trawl gear. The actual trawl gear is of rather typical design, but considerable effort has been expended to develop a selective trawl that will eliminate the catch of scrap fish. This endeavor has been partially successful.

The Alaskan shrimp fleet has gradually been modernized, starting like many new fisheries with a conglomeration of vessels originally designed for other target species. The newer vessels usually have a stern ramp for hauling the trawl gear, with a hydraulically-powered drum to wind the net in. Electronic navigational gear is common, with sonar and depth recorders, allowing the vessels to trawl areas that were previously too irregular for proper maneuvering of the trawls. Net recorders are coming into use also, riding on the trawl's headrope, with the ability to take soundings up, down, and forward. The net recorder is presently thought most suitable for groundfishing, but has an obvious application for shrimp trawling as well.

Vessels constructed primarily for shrimp fishing are usually within the 18 m to 27 m (60 foot to 90 foot) length class. This size has proved satisfactory for traveling to sometimes distant fishing areas, while providing acceptable maneuverability. The newer vessels with the stern haul ramp and the cabin far forward also provide a less obstructed working area for the crew.

On-board handling usually consists of icing the catch in bins in the hold. Some vessels are beginning to use refrigerated brine in which to preserve the shrimp, but wide acceptance of this system may take a number of years due to the. high cost of installing such a system.

Production Technology.

Shrimp processing has experienced only one major change that has had a marked effect on the Alaskan fishery. Shrimp processing had always required large amounts of manual labor to remove the meats from the shells. In 1957 the first mechanical shrimp peeler was brought to Alaska and operated in the Southeast area. In 1958 the peeler was introduced to Kodiak, establishing a new fishery that was to eventually dominate Alaskan shrimp production. Until the mechanical peeler was introduced, Alaska's vast shrimp resources were largely untapped. Hand processing had produced an extremely high quality product, but the large labor requirement limited further growth of the fishery.

Less shrimp is being canned now than in the past, with freezing becoming much more common. The institutional markets, which are consuming a greater portion of Alaska's fish products than ever before, are developing a preference for the frozen product. Also, canning expenses are rising, and canned seafood products in general are losing popularity among retail grocery store customers.

Regulation.

Regulation of the shrimp fishery developed much as it did in the crab fisheries. As recently as 1970, the Alaska Department of Fish and Game's commercial fishing regulations specified a year-round open season for shrimp and no quotas. In 1971 quotas were implemented, and season closures are now largely dependent upon harvest success.

Gear restrictions are directed primarily at excluding trawlers from certain areas. Pots are often allowed in areas that are off limits to trawls, as pots do not have the capability of catching nearly all of the shrimp within its working area as do trawls.

Other Governmental Policy.

Russia and Japan both harvested significant quantities of shrimp in Alaskan waters, particularly close to Kodiak Island, even after American effort in the-fishery had become quite substantial. (More specific information about the situation is included in the market section for shrimp.)

Conflicts With Other Fisheries and Other Commercial Vessels.

In addition to the often mentioned conflict due to competition for ocean space, there are conflicts arising with others due to the nature of the gear used in the shrimp fishery. In most areas the predominant gear is a trawl, either an otter or a beam trawl. The problems associated with this gear are the incidental catch of juvenile halibut and the removal of pot floats.

SCALLOPS

Development and Market Structure

The Alaska scallop fishery is very young when compared to most of Alaska's other fisheries. Only since 1967 has enough effort been directed at the catching of scallops to record commercial landings. Unlike the major Alaskan shellfish fisheries, domestic effort in the scallop fishery was not preceeded by foreign fishing. The scallop fishery evolved solely because of some underutilized king crab vessels attempting to develop an alternative fishery in 1967.

Due to the moderate success of the king crab vessels in 1967, the Alaska Department of Fish and Game and the United States Bureau of Commercial Fisheries jointly sponsored a survey of the state's scallop potential in 1968. The joint venture enlisted the" assistance of an experienced scallop fishing crew from New Bedford, Massachusetts, complete with their 27' m (90 foot) vessel and fishing gear, as Alaskans generally lacked proper gear and the New Englanders' experience of generations of scallop fishing.

The vessel chartered for the experimental fishing fulfilled its commitments in late June 1968, having confirmed substantial stocks of scallops along the entire coast of the Gulf of Alaska from Cape Spencer, which lies almost directly west of Juneau, north and west all the way to Kodiak Island.

The original charter vessel, and three other New Bedford vessels which had started for Alaska before the end of the exploratory charter, immediately started harvesting the newly exposed resource. Eight more scallop vessels made the trip from New Bedford by the end of 1968, but by then the original four New Bedford boats and three or four Alaskan vessels, crewed by New Bedford fishermen, had harvested the prime beds.

Over 771 MT (1,7 million pounds) of meat were recovered during 1968, which accounted for nearly 10 percent of the United States total catch (Table B.45).

TABLE B.42

ALASKAN SCALLOP CATCH, 1967 - 1975

Year	Shucked weight (pounds)
1967	7,788
1968	1,734,402
1969	1,888,287
1970	1,444,338
1971	931,151
1972	1,167,034
1973	1,?09,405
1974	504,438
1975	435,672

SOURCE: Alaska Department of Fish and Game, Statistical Leaflet No. 28

An even larger volume was harvested in 1969. Thereafter, the entire scallop industry stagnated, and the Alaska fishery began to decline. Recent harvesting of scallops has been of little significance, although several processors have indicated an interest in establishing a small, but sustained fishery.

After bringing the catch on board, scallops are usually shucked and the meats placed in bags for icing until delivered to a processor. Early Alaskan scallop fishermen did not always adhere to the on-board shucking practice. The processors clean the meats, and then box them for freezing.

Scallop marketing is similar to that of other frozen seafoods from Alaska. The boxed, frozen scallops are generally transported to the Seattle area, where they may undergo repackaging into containers appropriate for the various markets, and then distributed through marketing channels common to most Alaskan seafood products.

The marketing of almost all frozen Alaskan fish products is quite similar and is described in greater detail in the king and Tanner crab market structure section.

Statistics

Catch and Prices.

The scallop fishery in Alaska was explosive, but shortlived. After what was principally an exploratory catch of 3.54 MT (7,800 pounds) in 1967, the catch increased by a factor of more than 200 with the arrival of a scallop fleet in 1968 and then peaked at 860 MT (1.9 million pounds) in 1969 (Table 3.49). The annual scallop catch has decreased in all but one of the past eight years, resulting in a catch for 1977 of only 9.98 MT (22,000 pounds). During the few years in which this was a booming fishery, the scallop catch never accounted for as much as one percent of the total shellfish catch or eight percent of its value. The value of the scallop catch is high, relative to its weight because scallops are shucked onboard.

Production.

Between 1968, when scallop production began, and 1975, the annual production of scallops ranged from 181 MT (0.5 million pounds) in 1975 to 1,040 MT (2.3 million pounds) in 1972 and accounted for from 0.2 percent of all Alaskan production (Table 3.50). Scallop production consists entirely of fresh/frozen products.

TABLE 16.44

THE ALASKAN SCALLOP FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SHELLFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961							
1962							
1963							
1964							
1965							
1966							
1967	7.8	$ .545	$0.07				
1968	1,734	1,606	0.93	5.8	1.2	1.8	0.4
1969	1,888	1,542	0.82	7.0	1.5	1.9	0.5
1970	1,440	1,484	1.03	7.2	0.9	1.4	0.3
1971	931	990	1.06	3.8	0.5	1.1	0.2
1972	1,167	1,400	1.20	4.4	0.6	1.4	0.3
1973	1,109	1,331	1.20	1.9	0.4	0.9	0.2
1974	504	656	1.30	1.0	0.2	0.4	0.1
1975	436	593	1.36	1.1	0.2	0.4	0.1
1976	265				0.1		
1977	22						
1978							
Average	559	640					

Source: ADF&G Statistical Leaflets for various years.

TABLE B.50

Scallops Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED &OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966								
1967								
1968		8	1,578	1,578	0	100	0	0.7
19G9		8	1,399	1,399	0	100	0	0.7
1970		5	1>458	1,458	0	100	0	0.5
1971		3	893	893	0	1.00	0	0.4
1972		4	2,323	2,323	0	100	0	1.2
1973,		4	2 , 1 0 8	2,108	0	100	0	0.9
1974		2	1,032	1,032	0	100	0	0.4
1975		1	410	410	0 .	100	0	0.2
1976								
1977								
Average (1966-1970)			887	887	0	100	0	0.4
Average (1966-1975)			1,120	1,120	0	100	0	0.5

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

Factors of Change

Harvesting Technology

Only two types of gear are legal for harvesting scallops in Alaskan regulated waters: the scallop dredge and the trawl. The scallop dredge is constructed specifically for scallop fishing, whereas trawls can be directed at a wide variety of target species with appropriate modification and adequate skill of the operator. The dredge basically consists of a chain link flexible basket attached to a rigid rectangular opening at the front. As the gear is pulled along the bottom, scallops are displaced from their resting place and caught in the metal basket.

No significant changes have occurred in harvesting techniques during the short life of the Alaska scallop fishery. The scallop dredge, often accompanied by"New England fishermen to direct its proper use and provide years of experience, was borrowed directly from the New England scallop fishery. This effective harvesting apparatus was already available when Alaskans decided to harvest scallops, avoiding time-consuming gear development which most often is a trial and error process.

Production Technology

Freezing is the normal method of preserving scallops. Due to the rather small quantities of scallops processed in Alaska, there has been little incentive for innovation in scallop preservation. Alaskan fishermen have adopted the East Coast practice of "shucking" the meats from the shells while on board the fishing vessels, resulting in a cleaner product that is better preserved when delivered to processors. The meats are bagged and iced for on-board storage.

Regulation.

As a means of maintaining adequate management control over a fishery, regulations pertaining to the target species increase in number and become more specific as the fishery grows. Prior to 1967, there was no indication that Alaskan fishermen were truly interested in establishing scallops as a regular commercial fishery, therefore, the scallop fishery faced nearly any controls of any type. Regulatory authorities were so unconcerned-with scallops that the fishermen who harvested them during 1968, the first boom year in the fishery, were not even required to purchase licenses from the state, a matter quickly changed by the Alaska Legislature.

A lack of scallops in extremely large quantities has tended to suppress fishing effort directed at them, therefore, the need for strict quotas and seasons is absent. Authorities have learned that scallop dredging can be detrimental to king crab stocks and other important bottom dwellers within the area, and mainly for this reason have declared certain areas closed to scallop dredging at specified times of the year.

Conflicts With Other Fisheries and Other Commercial Vessels.

The principle conflict between the scallop fishery and other fisheries is due to the nature of the scallop gear. A scallop dredge can potentially change the habitat of the area fished in a way that is detrimental to other shellfish.

RAZOR CLAMS

Development and Market Structure

The razor clam fishery is one of the oldest commercial shellfish fisheries in Alaska, but due to both the decline in this fishery and the rapid expansion of the other shellfish fisheries since late mid-1950s it has become insignificant. The Cordova earthquake in 1964 was the primary cause of the more recent decline in clam production. Other factors contributed to the decreasing use of clams for human consumption. These included the withdrawal of Alaska from the National Shellfish Sanitation Program (NSSP) from 1955 to 1975 and increasing competition from East Coast surf clams which became more profitable to harvest due to new advances in mechanical dredging and processing. A variety of other factors are cited to explain the recent decreases in harvesting. Activity decreased in part as a result of relatively low Dungeness crab harvest starting in 1975. Razor clams are the preferred bait for Dungeness crab. Another factor which probably contributed to the decline was the already high and increasing labor costs associated with the razor clams, most of which are dug by hand with shovels.

At present there are only three razor clam areas in Alaska certified under the National Shellfish Sanitation Program (NSSP) for human consumption. These are the Swikshak area across Shelikof Strait from Kodiak Island, the Pony Creek area across Cook Inlet from Anchorage, and the Copper Bering Rivers and Prince William Sound area near Cordova. Clams may also be harvested from other areas which are uncertified, but these can not be sold for human consumption. Unshucked clams not certified for human consumption must be dyed with #5 yellow in order to so signify. These clams are used for Dungeness crab bait.

During 1978 only two processors in Alaska have filed Intent to Sell statements for razor clams with ADF&G. One is in Anchorage and has been selling small amounts of frozen clams for human consumption to Japan and to local Anchorage markets. The other processor is in Cordova and has been selling small amounts of clams for Dungeness crab bait. A small amount of clams are also utilized in the Cordova area by restaurants for human consumption. There is no interstate sale of razor clams originating from Kodiak or Cordova. During 1977, only one processor in Kenai and one in Cordova dealt with clams. These were all utilized for crab bait. These companies are primarily involved in processing crab and other shellfish products. The razor clam activity is so small as to make no appreciable difference to the firms' operating costs, income and employment.

Most of the razor clams landed are sold directly to crab fishermen or landed by the crabbers themselves. This situation will probably continue given the current level of the Dungeness crab harvest, the poor marketing situation for clams for human consumption, and the high ex-vessel price for clams that processors would have to pay.

Razor clams are the preferred bait for Dungeness crab. Crab fishermen are currently paying $1.00 per pound for razor clams. Given the present supply and price for razor clams, clams processed for human consumption in the Kodiak and Cordova area would not be competitive with other clam products from the East Coast and the lower 48 Pacific Coastal states. A price of $1.00 per pound shell weight translates into a meat weight cost of $2.85 per pound, assuming a 35 percent recovery rate. The retail price for the processed clam meat would then be well over $5.00 per pound. An increased supply of clams from mechanized harvesting and more certified areas would be necessary to bring down the cost to processors for unshucked clams.

A study of the Alaska clam industry (Orth, et al., 1975) concluded that the best potential market form for razor clams for human consumption would be a frozen pack. Frozen razor clams could serve the Pacific coastal states which already have some familiarity with the product. Canned clams, on the other hand, would have to compete, probably unsuccessfully, with canned clams from the East Coast. However, unless the ex-vessel price of unshucked clams falls considerably from $1.00 per pound to about half that price, markets will continue to be limited to quality restaurants and specialty retailers. This is the status of current markets for Washington and Oregon razor clams which are retailing at about $5.00 per pound.

In 1977, out of 121 shovel permits issued, 67 were to Cordova residents and 7 to Kodiak residents. In addition to 37 permits to other Alaska residents, 10 out-of-state residents received permits. Five dredgers, three in Cordova, one in Kodiak and one in Kenai, also received permits and one experimental dredge in Cordova received a permit. Thus, most fishing effort can be said to be "local." To render a non-local effort economically viable, it would seem that an operation of significant duration would be a prerequisite. Since there have been few landings in recent years, the probability of a non-local effort is reduced. All of the diggers are independent and not employed by the processors that purchase their clams, although often crab fishermen will dig their own clams for use as bait, and they are included in the commercial clam work force.

Factors of Change

Harvesting Technology.

The principle harvesting method consists of individual clam diggers armed with clam shovels. An experienced digger can dig 90-180 kg (200-400 pounds) of razor clams during the four hour period in which the tide is out (Orth, et al., 1975). The alternative method is to use a hydraulic dredge.

The technology of hydraulic dredges has apparently advanced in recent years. Yet the dredge remains essentially an unknown quantity. Some feel that the dredge is efficient and actually enhances the razor clam environment. Others doubt its efficiency and maintain that it has a negative effect upon the continued viability of clams and other resources. Until these differences of opinion are put to rest, either by empirical research or trial and error, the differences are likely to remain. At present, the dredge is regulated in a conservative manner. Not knowing the probable impacts of dredge operation, regulating authorities have opted for a restrictive "trial and error" approach. Some dredges are currently permitted to operate on some portions of certified sites. As the nature of dredge impacts becomes known, it appears as though the regulating authorities will act based on this new knowledge. This method of regulation is perhaps least costly from an administrative standpoint, but it does not forcefully promote the advancement of technology.

The wide use of dredge technology under the present system also depends upon the number of beaches certified for human consumption. At present there are only two areas certified near Cordova and Kodiak; to add another would take at the very minimum one year and more likely two or three. The state currently lacks the resources to sample new sites and to analyze the samples from the sites. State labs now have their "hands full" with hi-weekly samples from the existing certified beaches. Compounding the problem is that the federal and state agencies involved with the razor clam resource cannot agree on the form of a cost-reducing sampling method/ program. Given these constraints, it is unlikely that a new site will be certified in the near future.

Without expansion in the number or size of certified sites, the dredge technology may develop and/or come into usage quite slowly. Only an alteration of the current regulations would hasten the technological development and application.

It appears as though a change in the system may be in the offing. Recently, an industry-government survey of the surf clam resource north of the Alaska Peninsula, utilizing a hydraulic dredge, has "discovered" a large stock of surf clams. Plans are under way to create a "sub-sampling" system which would in effect eliminate many of the costs associated with surveys, sampling, and analysis. Essentially, the catch from a given "lot" would be sampled and sent to a lab for analysis. A negative analysis (within PSP standards, toxin levels, etc.) would indicate that the catch could be sold for human consumption; a positive analysis the opposite. While analysis is conducted, the catch would be kept alive in tanks or frozen; it is anticipated that analysis time would be cut from three to four weeks to as little as one day.

The merits and implications of the above are quite obvious. Sampling is done by fishermen in "lots" where they are permitted to fish. Sampling cost is all but eliminated and lab facilities less burdened. Fishermen have more latitude in time, space and gear. A similar program is being prepared for Prince William Sound for all clams, including the razor clams,

Production Technology.

Due in part to the almost incidental processing of razor clam products for human consumption, there have not been major changes in processing methods in Alaska.

TABLE B.51

THE ALASKAN RAZOR CLAM FISHERY IN PERSPECTIVE

YEAR	CATCH (in 000's) POUNDS	CATCH (in 000's) VALUE	PRICE ($'s per pound)	PERCENTAGE OF TOTAL SHELLFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH CATCH POUNDS	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH VALUE	PERCENTAGE OF TOTAL SHELLFISH AND FINFISH CATCH POUNDS
1961	926	$120	$0.13	2.3	1.4	0.2	0.2
1962	687	79	0.11	1.1	0.9	0.1	0.2
1963	410	52	0.13	0.5	0.4	0.1	0.1
1964	100	19	0.19	0.2	0.1		
1965	87	22	0.25	0.2	0.1		
1966	44	8	0.18				
1967	117	30	0.26	0.2	0.1	0.1	
1968	79	19	0.24	0.1	0.1		
1969		25	0.29	0.1	0.1		
1970	1%	40	0.25	0.2	0.1		
1971	243	70	0.29	0.3	0.1	0.1	0.1
1972	214	69	0.32	0.2	0.1	0.1	0.1
1973	231	89	0.39	0.1	0.1	0.1	0.1
1974	228	100	0.44	0.2	0.1	0.1	0.1
1975	32	14	0.44				
1976							
1977							
1978							
Average	214	50.4					

Source: ADF&G Statistical Leaflets for various years.

TABLE B.52

Razor Clams Production in Alaska
By Type of Processing and in Perspective

YEAR	Number of Plants: CANNED PRODUCTS	Number of Plants: FRESH & FROZEN PRODUCTS	TOTAL PRODUCTION (000's lbs.)	FRESH & FROZEN PRODUCTION (000's lbs.)	CANNED & OTHER PRODUCTION (000's lbs.)	PERCENTAGE FRESH & FROZEN	PERCENTAGE CANNED & OTHER	PERCENTAGE OF ALASKAN PRODUCTION OF ALL FISH
1966	3	2	6	4	2	66.7	33,3	0.0
1967	3	3	59	53	6	89.8	10.2	0.0
1968	3	1	8	3	5	37.5	62.5	0.0
1969	4	4	85	82	3	96.5	3+5	0.0
1970	4	6	235	233	2	99.1	0.9	0.1
1971	3	10	249	245	4	98.4	1.6	0.1
1972	2	17	143	142	1	99.3	0.7	0.1
1973	1	10	1 6 2	161	1	99.4	0.6	0.1
1974	1	5	206	205	1	99.5	0,5	0.1
1975	0	6	23	23	0	100.0	0.0	0.0
1976								
1977								
Average (1966-1970)			79	75	4	77.9	22.1	0.03
Average (1966-1975)			118	115	3	88.6	11.4	0.05

Source: Alaska Department of Fish and Game, Catch and Production Report Leaflets, 1966 - 1975.

Conflicts Among Commercial Fisheries, Recreational Fisheries and Non-Fishing Marine Traffic

The conflicts among commercial fisheries, recreational fisheries, and non-fishing marine traffic have, except in a few notable instances, been relatively minor and have therefore not tended to constrain the development of the commercial fishing industry in Alaska. The following sections provide an overview of the nature of these conflicts.

COMPETITION FOR SMALL BOAT HARBORS

The demand for small boat harbors in Alaska has increased more rapidly than the supply; this combined with a reluctance to use the price mechanism to allocate the scarce harbor space has resulted in a shortage of harbor space in many coastal communities. The commercial fisheries compete with each other and with other small boat harbor users (primarily recreational boaters) for the limited harbor space that is available. The term "small boat harbor" is perhaps a bit misleading; in Alaska the harbor facilities designed principally for fishing and recreational boats are referred to as small boat harbors although they may serve vessels over 40 meters (131 feet) in length. Harbor masters have demonstrated a great deal of imagination and dexterity in their handling of the overcrowding problem, and it would appear that the competition for harbor space has typically not hindered the development of a commercial fishery, There are, of course, limits on what can be done with a given harbor facility; this in part explains the harbor improvement plans underway in many communities.

COMPETITION FOR FISHERY RESOURCES

In Alaska the principal competition for fishery resources occurs in the salmon fisheries where commerical fishermen using various gear types compete with each other and with recreational and subsistence fishermen for the limited amounts of harvestable salmon. The competition and the resulting conflicts between gear types (e.g., purse seine, drift gill net, set gill net, beach seine, and troll) are in many cases limited by allocating different areas and/or periods to different gear types. The competition between commercial and recreational fishermen and the resulting conflicts are greatest in the areas which are most accessible to the one large metropolitan area of the state, Anchorage. In most other areas, recreational fishing is insignificant compared to commercial fishing and/or targets on species that are of less importance to commercial fisheries, therefore, the competition and the conflicts have been minimal. As the population of Alaska and/or regions of Alaska increase and as recreational fishing increases in terms of the size of catch and the areas fished, the conflicts between commercial and recreational fishing will increase. In the fisheries other than salmon, there is generally little competition among commercial fishermen using different types of gear.

When the conflicts among commercial fishermen and/or recreational fishermen have arisen, the Alaska Board of Fisheries has often set policies to assign the resource to one user group. Such policies limit the physical if not the political conflicts between user groups. An example of such a policy is Policy #77-27-FB; see Exhibit 3.1 .

COMPETITION FOR OCEAN SPACE

A third source of conflict for commerical fisheries is the competition for ocean space in which to develop and/or harvest fishery resources. When two or more fisheries compete for the same ocean space, gear conflicts can cause gear losses and/or affect the abundance of other fishery resources. Gear loss conflicts are most likely to occur when fixed gear (e.g., crab or shrimp pots, and halibut long line gear) and nonfixed gear (e.g., trawl or dredge) are

Exhibit B.1

Policy #77-27-FB

COMPREHENSIVE MANAGEMENT POLICY FOR THE UPPER COOK INLET

The dramatically increasing population of the Cook Inlet area has resulted in increasing competition between recreational and commercial fishermen for the Cook Inlet salmon stocks. Concurrently, urbanization and associated road construction has increased recreational angler effort and may adversely affect fisheries habitat. As a result the Board of Fisheries has determined that a policy must now be determined for the long-term management of the Cook Inlet salmon stocks. This policy should rest upon the following considerations:

1. The ultimate management goal for the Cook Inlet stocks must be their protection and, where feasible, rehabilitation and enhancement. To achieve this biological goal, priorities must be set among beneficial uses of the resource.

2. The commercial fishing industry in Cook Inlet is a valuable long-term asset of this state and must be protected, while recognizing the legitimate claims of the non-commercial user.

3. Of the salmon stocks in Cook Inlet, the king and silver salmon are the target species for recreational anglers while the chum, pink, and red salmon are the predominant commercial, fishery.

4. User groups should know what the management plan for salmon stocks will be in order that they can plan their use consistent with that plan. Thus, commercial fishermen must know if they are harvesting stocks which in the long-term will be managed primarily for recreational consumption so that they may plan appropriately. Conversely, as recreational demands increase the recreational user must be aware of what stocks will be managed primarily for commercial harvest in order that he not become overly dependent on these fish for recreational purposes.

5. Various agencies should be aware of the long-term management plan so that salmon management needs will be considered when making decisions in areas such as land use planning and highway construction.

6. It is imperative that the Department of Fish and Game receive long-range direction in management of these stocks rather than being called upon to respond to annually changing Board directives. Within the Department, divisions such as F.R.E.D., must receive such long-term direction.

Therefore, the Board establishes priorities on the following Cook Inlet stocks north of Anchor Point. In so doing it is not the Board's intent to establish exclusive uses of salmon stocks; rather its purpose is to define the primary beneficial use of the stock while permitting secondary uses of the stock to the extent it is consistent with the requirements of the primary user group.

1. Stocks which normally move in Cook Inlet to spawning areas prior to June 30, shall be managed primarily as a non-commercial resource.

2. Stocks which normally move in Cook Inlet after June 30, shall be managed primarily as a non-recreational resource until August 15; however existing recreational tar9et fish shall only be harvested incidental to the non-recreational use; thereafter stocks moving to spawning areas on the Kenai Peninsula shall be managed primarily as a non-commercial resource. Other stocks shall continue to be managed primarily as a non-recreational resource.

3. The Susitna coho, the Kenai king, and the Kenai coho runs cannot be separated from other stocks which are being managed primarily as non-recreational resources; however, efforts shall be made, consistent with the primary management goal, to minimize the non-recreational catch of these stocks.

Nicholas G. Szabo, Chairman
Alaska Board of Fisheries

ADOPTED: December 13, 1977

VOTED: 5-0

used in the same area at the same time. The timing and location of fisheries has tended to limit this type of conflict; but as the groundfish fishery, which will be primarily a trawl fishery, develops in the areas of ocean space used by the traditional fisheries, the potential for gear loss conflicts will increase.

Examples of gear conflicts which affect stock abundance in other fisheries include the following:

1) destruction of juvenile king crab by scallop dredge
2) incidental catch of a species that is the target species of another fishery (e.g., halibut and perch)
3) destruction of juveniles by trawls

An additional source of conflict of ocean space use is that the species targeted on by some fisheries are food for other species, for example, the harvest of salmon, a predator of herring will depend to some degree on the harvest of herring. All else being equal, there will tend to be an inverse relationship between the salmon and herring harvest. The gear conflicts other than gear losses will also tend to increase as the groundfish fishery develops. The major conflict being the incidental catch of halibut in groundfish trawl gear.

In addition to the competition for ocean space among commercial fisheries, there is also competition between commercial fisheries and other users of ocean space (e.g., vessels engaged in marine commerce). The potential impacts on commercial fisheries of this competition are the costs associated with collisions and gear losses. These costs include the costs of actual losses as well as the costs incurred in attempting to reduce actual losses. Due to the relatively small amount of non-fishery marine traffic in most areas of the . Gulf of Alaska, the costs associated with this type of conflict have not been significant. An exception to this would be in Cook Inlet, where freighter and tanker traffic has been sufficiently heavy that attempts have been made to restrict such marine traffic to designated areas or lanes. The establishment of sea lanes through fishing grounds has, however, proved to be a difficult task. The fishermen favor a single narrow lane for other users so a small amount of fishing area is lost, while the marine transport users favor more and broader lanes to reduce the probability of congestion and/or collisions. The potential for conflict will increase in Alaska as its marine transportation system grows and as more distant fisheries (e.g., groundfish) develop. The extent to which the conflict will remain concentrated in Cook Inlet will depend on the rates of growth of the various regions of Alaska and the ability of the ports of Seward, Whittier, or Valdez to compete with the Port of Anchorage for marine commerce.

Fishing Vessel Accidents*

Approximately 25,000 fishing vessels of five net tons or larger are currently documented with the U.S. Coast Guard (USCG). It is estimated that nearly four times that number of fishing vessels are less than five net tons and registered by individual states. These smaller boats accounted for only five percent of the casualty incidents recorded by the U.S.C.G. during the 1972-1977 fiscal year period and, therefore, comprose a minor portion of the data utilized for analysis of fishing vessel casualties.

There has been a 51 percent increase in the number of American fishing vessels over the past 12 years. Along with this growth of the fishing fleet has been a 53 percent increase in the number of fishing vessel casualties (Figure B.14), The U.S. Coast Guard separates vessel casualties into five categories: operational collisions; grounding; explosion/fire; flooding/ foundering/capsizing; and material failure.. No particular type of casualty clearly predominated throughout the 1972-1977 period, but grounding and flooding/foundering/capsizing were the most prevalent casualties during the latter years of the period (Figure B.15). Each of the five categories experienced at least some net growth from 1972 to 1977, with large annual fluxuations in the occurrence of any particular type of casualty being quite common.

Nearly 13 percent of the United States' documented fishing vessels are located in Alaska (Table B.53). Additionally, many vessels migrate to Alaska

* Data used in this section referes to fiscal year 1972-1977 period, and includes U.S. Coast Guard documented fishing-vessels which are five net tons or larger.

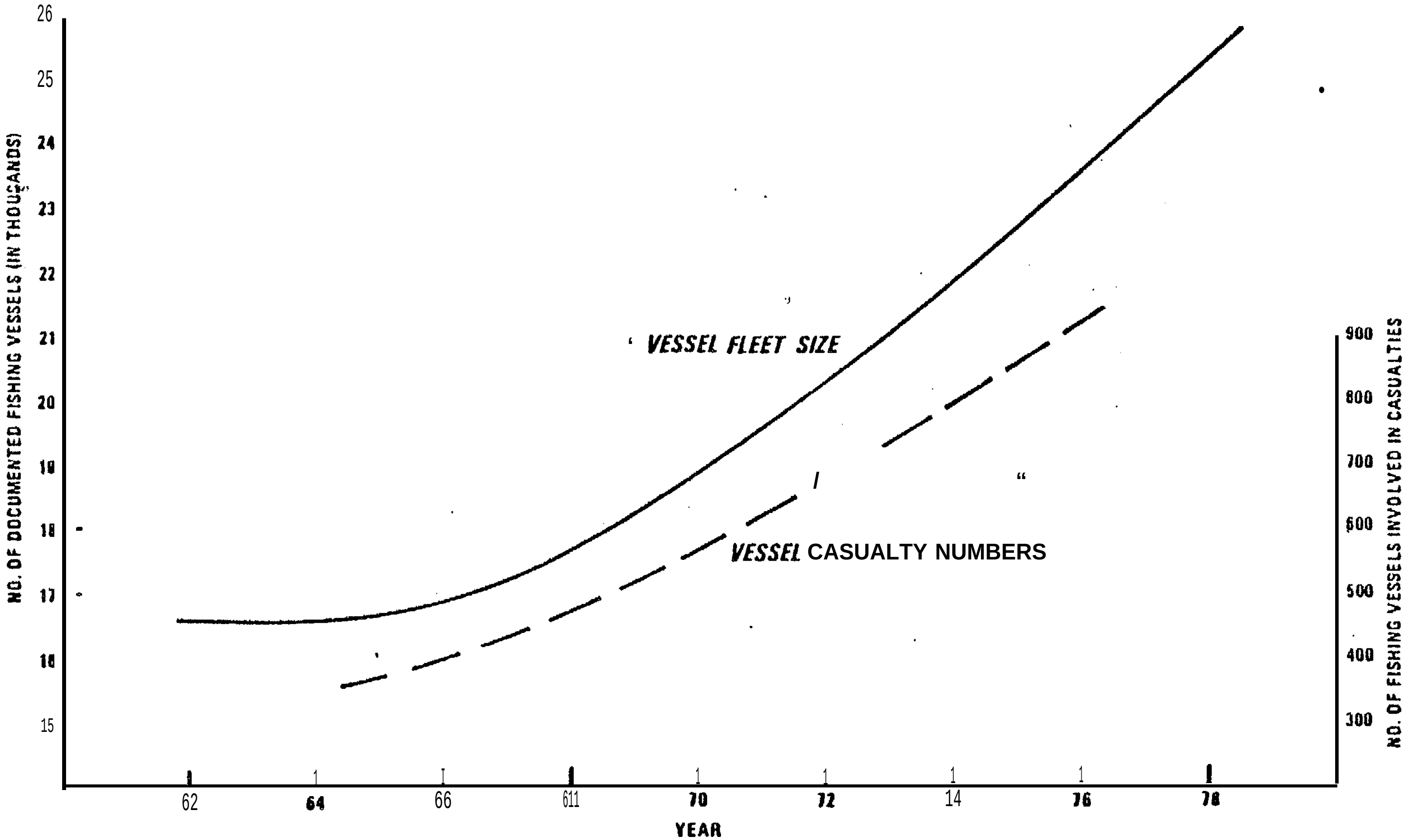


Figure B.14 : Growth of the Documented Fishing Fleet & Growth of Fishing Vessels Reporting Casualties

Source: Ecker, Commander William J., <u>Safety Analysis of Fishing Vessel Casualties,</u> U.S. Coast Guard. 1978.

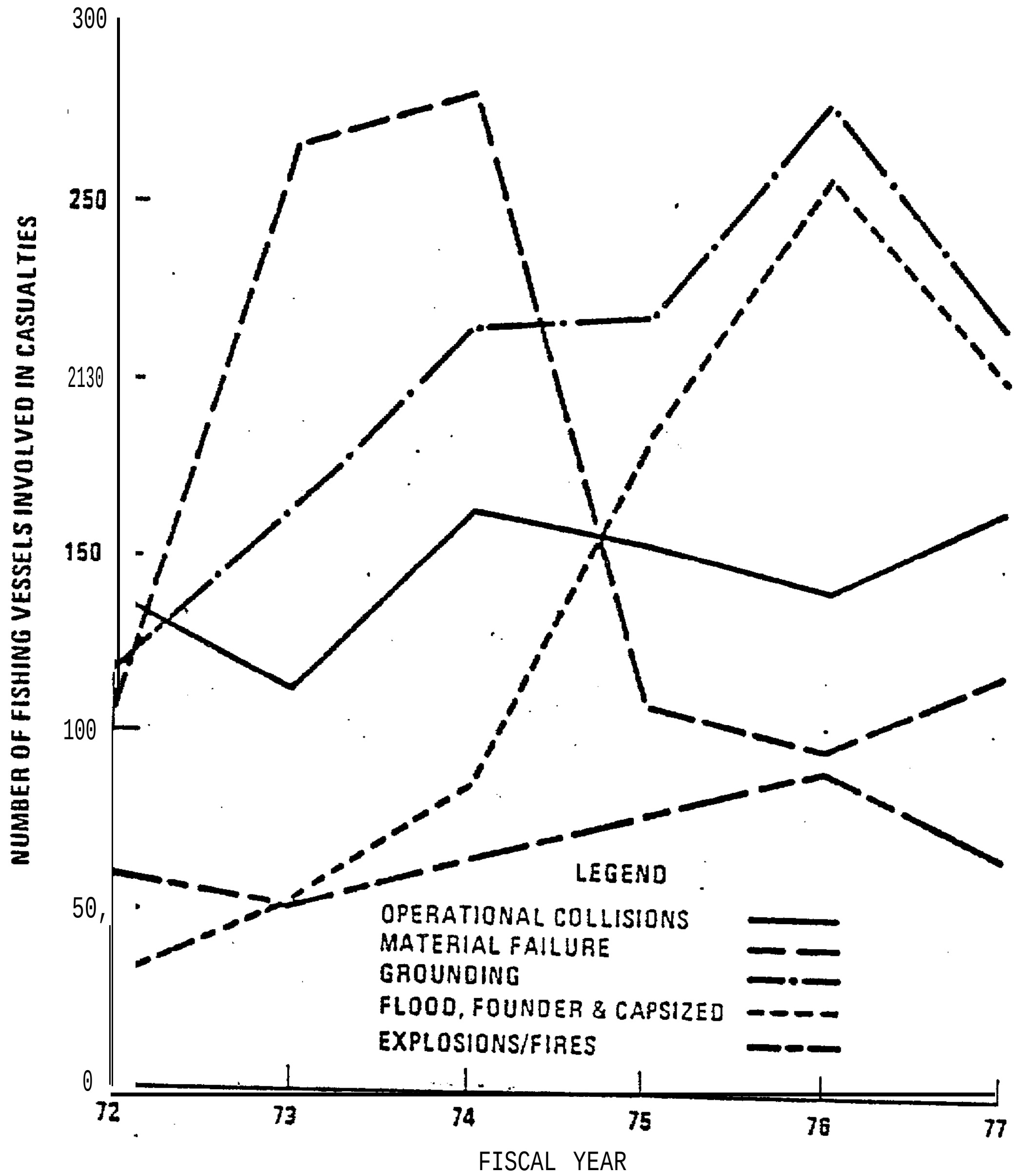


Figure B.15: Fishing Vessel Casualties
No. of vessels involved in specific type casualties by fiscal year,

Source: Ecker, Commander William J., A Safety Analysis of Fishina Vessel Casualties, U.S. Coast Guard. 1979.

TABLE B.53

U.S. FISHING VESSEL FLEET GEOGRAPHIC GROUPINGS - SELECTED AREAS

Area	Num. Vess.	Percent of Fleet	
New England Maine, Mass., R.I., Corm.	1,723	6.8%	32.1% Atlantic Coast
Middle Atlantic - North NY, NJ, Penn., Del.	828	3.3%	
Middle Atlantic - South MD, VA, Wash DC, NC, SC	3,729	14.7%	
Southern Atlantic Gee., Fla., Virg. Is., Puerto Rico	1,856	7.3%	
Gulf Fla., Ala., Miss., LA, Texas	6,065	24.0%	24. 0% Gulf Coast
Southern California San Diego, Los Angeles	1,075	4.3%	41.7% Pacific Coast
Northern California SF, Eureka	1,881	7.4%	
Pacific Northwest Oregon, Wash.	4,410	17.4%	
Alaska	3,196	12.6%	

Source: Ecker, Commander William J., A Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard, 1978. USCG Documentation Records (vessels of 5 net tons or more).

from other states, particularly Washington, to participate in various fisheries throughout the year, and effectively increase the percentage of fishing vessels that actually operate in Alaskan waters. Though only 13 percent of America's fishing vessels were registered in Alaska, 24 percent of the fishing vessel-related deaths and 20 percent of fishing vessel losses occurred in Alaska (Table B.54), attesting to the harsh conditions that vessels are subjected to and the danger faced by anyone who experiences emergency survival in Alaska's cold waters.

Flooding/Foundering/Capsizing (F/F/C) and grounding rated first and second respectively as causes of fishing vessel casualties in Alaska, in terms of number of deaths as well as number of vessels lost (Table B.54). This compares very closely with the ranking of casualty causes for the entire United States (Table B.55). The specific causes of F/F/C and grounding are presented in Tables B.56 and B.57 . However, the information in Tables B.56 and B.57 , is comprised of incidents from all portions of the United States, and it is very likely that adverse weather conditions were involved in a higher proportion of. Alaskan casualties than in other parts of the country. Personnel fault was most commonly named as the cause of F/F/C and grounding, with inattention and navigational problems being most prevalent. Explosion/fire, material failure, and operational collisions are the remaining categories of fishing vessel casualties in Alaska, in order of frequency, with specific causes listed in Tables B.58, B.59 , and B.60 . Operational collisions are attributed to personnel fault nearly half of the time, while explosion/fire and material failure are more commonly the result of equipment failure.

TABLE B.54

SPECIFIC LOCATION* COMPARISON

Location	Operational Collisions		Grounding		Explosion/ Fire		Flood/ Found/Cap.		Material Failure		Total	
	Deaths	Vess. Lost	Deaths	Vess. Lost	Deaths	Vess. Lost	Deaths	Vess. Lost	Deaths	Vess Lost"	Deaths	Vess. Lost
Maine		1		3		2	16	6	1		17	12
Massachusetts	4	3		5	1	7	11	21		8	16	44
Rhode Island				2		1	6	8		4	6	15
Corm, NY, NJ	1	1		3		4	10	12		10	11	30
Del. Bay		1		1			1	3			1	5
Del, MD, VA coast						1	1	2			1	3
Chesapeake Bay	4	6		3	3		17	12	6	5	30	26
North Carolina			4	3	3	8	4	7		2	11	20
South Carolina		1		9		2	1	5		5	1	22
Georgia		2		6		13	1	6	2	1	3	28
Florida East		4	1	8	3	9	4	15	5	5	13	41
Florida West	2	5		11		10	5	11	5	7	12	44
Alabama		2		4	3	9	1	4		1	4	20
Mississippi		2		1			4	2		2	4	9
Louisiana	1	9		5		10	1	8	6	2	8	34
Texas		25	1	32		16	11	16	1	19	13	108
Southern Calif.		4		26		14	10	27		10	10	81
Northern Calif.	4	10	1	10	2	8	8	22	8	10	23	60
Pacific Northwest	3	7	3	15	4	28	11	34	7	14	28	98
Alaska	5	8	13	45	4	38	36	59	8	21	66	171
TOTAL	24	91	23	192	23	180	159	280	49	128	278	871
Alaska, % of total	20.8	8.8	56.5	23.4	17.4	21.1	22.6	21.1	16.3	16.4	23.7	19.6

*All locations not included.

Source: Ecker, Commander William J., A Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard, 1978.

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TABLE B.55

CASUALTY TYPE AND SERIOUSNESS OF CONSEQUENCES, FISHING VESSEL CASUALTIES FY 72 - 77

Selected Casualty Type	Casualty Freq.		Casualty Deaths		Vessels Lost	
	Num. Vessels	Ranking	Num. Vessels/ Num. Deaths	Ranking	Num. Vessels	Ranking
Grounding	1,221	1	19/29	3	218	2
Material Failure	980	2	36/63	2	158	4
Operational Collisions	880	3	14/24	4	114	5
Flooding, Foundering, & Capsizing	819	4	121/238	1	397	1
Explosion/Fire	412	5	16/20	5	215	3
All Others	542		23/40		72	

Source: Ecker, Commander William J., Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard, 1978.

TABLE B.56

PRIMARY CAUSES

Casualty type: Flooding/foundering/capsizing
Casualty period: FY 72 thru 77

PRIMARY CAUSES	PERCENT
1. Personnel Fault	17.6
a. carelessness/inattention (18.8%)	
b. improper securing of vessel (13.9%)	
c. poor seamanship (9.0%)	
d. misjudge effects of current, wind, etc. (6.3%)	
2. Storms, Heavy Weather	15.3
a. large swell across bar (37.6%)	
b. structural failure (11.2%)	
c. gale force winds (8.8%)	
d. hurricane winds (4.8%)	
e. cargo shift (3.2%)	
f. ice (2.4%)	
3. Equipment Failure	14.9
a. drainage system (27.0%)	
b. electrical (8.2%)	
c. other (48.4%)	
4. Structural Failure	10.7
a. wasted plates & internals (53.4%)	
5. Striking Submerged Object	7.0
6. Unseaworthy	5.1
a. failure of wood hull. (54.8%)	
b. failure of steel hull (14.3%)	
c. unsuitable for route (16.7%)	
7. Improper Maint. - Failure of Wood Hull	2.9
8. Exact Cause Unknown	24.5
a. progressive flooding (28.4%)	
b. questionable stability (10.4%)	
c. vandalism (8.0%)	
d. improper mooring (7.0%)	

Source: Ecker, Commander William J., A Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard. 1978.

TABLE B.5₇

PRIMARY CAUSES & CONTRIBUTING FACTORS

Casualty type: Grounding
Casualty period: FY 72 thru 77

PRIMARY CAUSES	PERCENT
1. Personnel Fault a. navigation - failed to ascertain position (43.6%) b. carelessness/inattention (11.3%) c. misjudge wind/current (11.1%) d. poor seamanship (4.3%) e. lack of Local Knowledge (4.3%) f. failed to determine height of tide (2.0%)	62.3
2. Equipment Failure	11.9
3. Heavy Weather, Storms, Currents	10
4. Depth Less Than Charted	9.4
5. Other Causes	6.4

CONTRIBUTING FACTORS FREQUENTLY MENTIONED

1. Restricted Maneuvering in Channel
2. Heavy Weather
3. Unusual Currents
4. Equipment Failure - Main Propulsion, Steering Gear, Rudder, Propeller Loss
5. Congested Area
6. Lack of Proper Lookout

Source: Ecker, Commander William J., A Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard. 1978.

TABLE B.58

PRIMARY CAUSES & CONTRIBUTING FACTORS

Casualty Type: Explosion/Fire
Casualty Period: FY 72 thru 76

PRIMARY CAUSES		PERCENT
1.	Equipment Failure a. electrical (38.4%) b. fuel oil system (14.5%) c. ventilation (5.0%)	38.6
2.	Engine Room Fires	20.6
3.	Fire From Undetermined Sources	14.8
4.	Personnel Fault a. improper safety precautions (54.3%) b. carelessness (30.4%)	11.2
5.	Unknown	6.7

CONTRIBUTING FACTORS FREQUENTLY MENTIONED

1. Diesel and Gasoline Engines
2. Electrical - Wiring
3. Gas/Oil Heaters
4. Galley Equipment - Ovens & Ranges
5. Ventilation Systems
6. Yard Repairs

Source: Ecker, Commander William J., A Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard. 1978.

TABLE B-59

PRIMARY CAUSES

Casualty type: Material Failure
Casualty period: FY 72 thru 77

PRIMARY CAUSE	PERCENT
1. Failure of On-Board Equipment a. electrical (9.3%) b. fuel oil system (6.1%) c. lube oil system (5.7%) d. salt water system (3.8%) e. fresh water system (3.5%) f. hydraulic (3.0%) g. hull drainage (1.5%)	74.8
2. Structural Failure - No Personnel Fault a. wasted plates/rotted hull (58.6%)	8.9
3. Unseaworthy a. failure of wood planking (81%)	4.3
4. Storms, Heavy Weather	2.9
5. Personnel Fault	2.4
6. Unknown	4.5

Source: Ecker, Commander William J., A Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard. 1978.

TABLE B.60

PRIMARY CAUSES & CONTRIBUTING FACTORS

Casualty type: Operational Collisions
Casualty period: FY 72 thru 77

	PRIMARY CAUSES	PERCENT
1.	Personnel Fault a. rules of road (44.8%) b. improper lookout (22.6%) c. carelessness/inattention (6.2%) d. misjudge wind/current (4.8%) e. poor seamanship (2.1%)	47.7
2.	Presence of a Submerged Object	9..8
3.	Equipment Failure	3.6
4.	Fault Other Vessel	28.4
5.	Other Causes	10.5

CONTRIBUTING FACTORS FREQUENTLY MENTIONED

1. Restricted Maneuvering in Channel
2. Congested Area
3. Lookout not Alert
4. Poor Visibility
5. Currents & Tides
6. Weather, Generally

Source: Ecker, Commander William J., A Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard. 1978.

Though operational collisions are not the most prevalent vessel casualty in Alaska, this type of incident is of special interest in respect to increased marine traffic which may occur due to petroleum development in an area. Collisions in which vessels are meeting involve the most fishing vessels, . followed by collisions with submerged objects (Table B.61). The frequency of vessel meeting collisions involving fishing vessels increased steadily throughout the study period of 1972-1977, while the frequency of other types of collisions showed little gain or sizable decreases.

Table B.62 reports the frequency of fishing vessel casualties according to the fishing activity at the time of the incident. U.S. Coast Guard documentation records indicate that approximately one-third of Amercian fishing vessels participated in the shrimp fishery during the study period, and a similar number fished for salmon. An additional five percent were involved in the crab fisheries and the remainder of the American fishing fleet pursued other species of fish. However, it must be remembered that many vessels participated in more than one fishery. Forty-nine percent of the vessels lost and 34 percent of the fishermen killed were involved with shrimping, while only eight percent of the vessels lost and 11 percent of the fishermen killed were fishing for salmon. Six percent of the vessels lost and nine percent of the deaths were related to crabbing. Specific data were not available to indicate the proportion of accidents which were attributable to Alaska, nor the proportion of boats in each fishery. However, since Alaska is the top producer of crab and salmon, and has a very substantial shrimp fishery, it can be assumed that data concerning Alaska would indicate that crabbing and shrimping are relatively hazardous, and that salmon fishermen face less danger,

TABLE B.61

Trend Chart by Year
OPERATIONAL COLLISIONS - INCIDENTS & VESSEL INVOLVEMENT

	VESSEL MEETING			VESSEL CROSSING			COLLISION-VESSEL OVERTAKING			COLLISION-VESSEL ANCHORED OR MOORED			COLLISION-SUBMERGED OBJECT		TOTAL-OPERATIONAL COLLISIONS		
	Num Incid	Num Fishing Vess	Num Multiple Fish Vess Incid	Num Incid	Num Fish Vess	Num Multiple Fish Vess Incid	Num Incid	Num Fish Vess	Num Multiple Fish Vess Incid	Num Incid	Num Fish Vess	Num Multiple Fish Vess Incid	Num Incid	Num Fish Vess	Num Incid	Num Fish Vess	Num Multiple Fish Vess Incid
1972	16	26	9	18	26	8	12	16	4	21	35	12	35	36	102	139	34
1973	21	26	5	15	18	3	8	10	2	17	27	10	30	31	91	112	21
1974	26	35	9	17	26	9	10	13	3	33	50	15	42	42	138	166	36
1975	23	35	12	22	31	8	15	21	6	27	49	15	19	19	106	155	41
1976	33	41	8	8	12	4	12	15	3	26	47	16	27	27	106	142	31
1977	55	85	30	4	7	3	6	6	0	26	41	13	27	27	118	166	46
TOTALS	174	248	73	84	120	35	63	81	18	150	249	81	180	182	661	880	209

Source: Ecker, Commander William J., A Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard. 1978.

TABLE B.62

SPECIFIC FISHING ACTIVITY[1]

VESSEL ACTIVITY/ CONFIGURATION	NUM LOST VESSELS	% OF TOTAL	NUM PERSONS KILLED	% OF TOTAL
Shrimping[2]	294	49	59	34
Ground fishing	124	21	18	10
Salmon[2]	48	8	20	11
Tuna	36	6	15	8
Oystering	11	2	5	3
King crab[2]	26	4	11	6
Crab[2]	12	2	5	3
Menhaden	1	<1	3	2
Lobster	25	4	20	11
Clam	13	2	12	7
Scallop	4	<1		
Halibut[2]	5	1	3	2
Snapper/grouper	4	<1	5	3
Total	603		176	

[1]Where specifically noted on casualty report.

‘Fisheries of substantial importance in Alaska.

Source: Ecker, Commander William J., Safety Analysis of Fishing Vessel Casualties, U.S. Coast Guard. 1978.

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Alaska Marine Oil Spills

Information concerning Alaska marine oil spills from 1973 through 1977 was obtained from data contained in the Pollution Incident Reporting System (PIRS), a system maintained at U.S. Coast Guard Headquarters in Washington, D. C. All Alaska marine-related oil spills recorded by the PIRS were examined in an attempt to expose any trends or occurrences which may be related to Alaska's increasing volume of marine traffic, and to its growing petroleum industry. With the exception of more spills being reported in recent years, which was fully expected based upon increasing marine activity, it appears that there was no substantial change in the types of spills occurring through-out the data period.

Inspection of Tables B.63 through B.70 quickly verifies that oil spills are extremely diversified in quantity, source, cause, and even material spilled. Spills of 1,000 gallons. or greater are presented individually in Tables B.63 through B.67, but many more spills of only one to five gallons were recorded* by the Coast Guard, and the remainder lie between these extremes. Of particular interest may be the fact that in 1975, 1976 and 1977, the occurrence of spills in excess of 1,000 gallons actually declined by over one-third relative to 1973 and 1974 levels. Also, it is notable that in most years, a single spill has accounted for around three-fourths of the total recorded petroleum pollution in Alaska waters.

Light diesel fuel is the most common pollutant involving large spills (Table B.68). Light diesel is used extensively in Alaska, providing power

TABLE B.63

1973 ALASKA MARINE OIL SPILLS ≥ 1,000 GALLONS

Material	Quantity (gallons)	Source	Cause
Light Diesel	196,182	Tankship 10,000-19,999 gross tons	Hull Rupture or Leak
Unidentified Heavy Oil	5,000	Onshore industrial plant or processing facility	Tank Rupture or Leak
Heavy Diesel	2,500	Onshore industrial plant or processing facility	Intentional discharge
Light Diesel	1,500	Onshore Non-transportation-related facility	Valve Failure
Light Diesel	8,000	Miscellaneous	Pipe Rupture or Leak
Light Diesel	3,700	Other vessel	Equipment Failure
Light Diesel	7,980	Tugboat or towboat	Tank Rupture or Leak.
Other Oil	4,200	Onshore fueling	Intentional discharge
Light Diesel	1,500	Fishing vessel	Tank Rupture or Leak.
Light Diesel	6,500	Other vessel	Structural Failure
Light Diesel	4,500	Tank barge 1,000-9,999 gross tons	Tank Rupture or Leak
Light Diesel	22,500	Miscellaneous	Pipe Rupture or Leak
Natural Occurrence	9,200	Natural source	Natural Phenomenon
Light Diesel	3,800	Miscellaneous	Tank Overflow
Total	277,062 gallons		

Largest single oil spill: 196,182 gallons
Average quantity spilled: 19,790 gallons
Average quantity spilled excluding largest spill: 6,222 gallons

All 1973 Alaska Marine Oil Spills (all quantities):

Number: 133
Total quantity: 281,506 gallons
Average quantity per spill: 2,117 gallons
Number of fishing vessel oil spills: 36
Average quantity per fishing vessel oil spill: 51 gallons

Source: United States Coast Guard Pollution Incident Reporting System data.

TABLE B.64

1974 ALASKA MARINE OIL SPILLS ≥ 1,000 GALLONS

Material	Quantity	Source	Cause
Light diesel	19,000	Land transportation facility	Personnel error
Light diesel	6,000	Tugboat or towboat	Hull rupture or leak
Jet Fuel	5,000	Miscellaneous	Equipment failure
Light diesel	5>200	Other vessel	Tank rupture or leak
Light diesel	40,000	Onshore non-transportation-related facility	Pipe rupture or leak
Light diesel	33,000	Onshore non-transportation-related facility	Pipe rupture or leak
Light crude oil	1,050	Offshore bulk cargo transfer	Improper equipment handling or operation
Light diesel	7>000	Miscellaneous	Structural failure
Light diesel	10,000	Onshore fueling	Tank rupture or leak
Light diesel	2,500	Land transportation facility	Value failure
Light diesel	33,000	Miscellaneous	Tank overflow
Gasoline	5,800	Unknown type of source	Unknown cause
Light diesel	1,200	Onshore non-transportation-related facility	Pipe rupture or leak
Light diesel	3,200	Onshore bulk cargo transfer	Transportation Pipeline rupture or leak
Light diesel	1,600	Highway vehicle liquid bulk	Natural or chronic phenomenon
Total	173,550 gallons		

Largest single oil spill: 40,000 gals. Average quantity spilled: 11,570 gals.
Average quantity spilled excluding largest spill: 9,539 gals.

All 1974 Alaska Marine Oil spills (all quantities):
Number: 153 Total quantity: 181,409 gals. Average quantity per spill: 1,186 gals.
Number of fishing vessel oil spills: 24
Average quantity per fishing vessel oil spill: 71 gals.

Source: United States Coast Guard Pollution Incident Reporting System data.

TABLE B.65

1975 ALASKA MARINE OIL SPILLS ≥ 1,000 GALLONS

Material	Quantity	Source	Cause
Light diesel	1,100	Highway vehicle liquid bulk	Natural or chronic phenomenon
Heavy diesel	5,000	Fishing vessel	Hull rupture or leak
Light diesel	1,000	Miscellaneous	Unknown causes
Jet fuel	1,500	Onshore bulk storage facility	Equipment failure
Light diesel	2,000	Highway vehicle liquid bulk	Personnel error
Light diesel	65,000	Onshore pipeline	Pipeline rupture or leak
Gasoline	300,000	Onshore fueling	Tank rupture or leak
Total	375,600 gallons		

Largest single oil spill: 300,000 gallons
Average quantity spilled: 53,657 gallons
Average quantity spilled excluding largest spill: 12,600 gallons

All 1975 Alaska Marine Oil Spills (all quantities):

Number: 136
Total quantity: 380,275 gals.
Average quantity per spill: 2,796 gals.
Number of fishing vessel oil spills: 30
Average quantity per fishing vessel oil spill: 201 gals.

Source: United States Coast Guard Pollution Incident Reporting System data.

TABLE B.66

1976 ALASKA MARINE OIL SPILLS $\geq$ 1,000 GALLONS

Material	Quantity	Source	Cause
Heavy diesel	40,000	Onshore bulk storage facility	Transportation pipeline rupture or leak
Jet fuel	9,000	Rail vehicle liquid bulk	Railroad accident
Light crude oil	2,000	Onshore oil or gas production facility	Hose rupture or leak
Gasoline	1,500	Aircraft	Aircraft accident
Mixture of two or more petroleum products	2,000	Offshore production facility	Equipment failure
Light diesel	2,000	Onshore bulk storage facility	Tank rupture or leak
Light diesel	1,000	Fishing vessel	Tank rupture or leak
Light diesel	1,000	Railway fueling facility	Improper equipment handling or operation
Jet fuel	395,670	Tankship 10,000-19,999 gross tons	Hull rupture or leak
Light diesel	4,000	Highway vehicle liquid bulk	Highway accident
Light diesel	9,000	Onshore non-transportation-related facility	Improper equipment handling or operation
Total	467,170		

Largest single oil spill: 395,670 gals. Average quantity spilled: 42,470 gals.
Average quantity spilled excluding largest spill: 7,150 gals.

All 1976 Alaska Marine Oil Spills (all quantities):

Number: 234 Total Quantity: 475,820 gals. Average Quantity per Spill: 2,033 gals.
Number of fishing vessel oil spills: 48
Average quantity per fishing vessel oil spill: 75 gals.

Source: United States Coast Guard Pollution Incident Reporting System data.

TABLE B.67

1977 ALASKA MARINE OIL SPILL > 1,000 GALLONS

Material	Quantity	Source	Cause
Jet fuel	?0,192	Onshore bulk storage facility	Pipe rupture or leak
Light diesel	72,280	Fishing vessel	Hull rupture or leak
Light diesel	1,000	Fishing vessel	Hull rupture or leak
Heavy diesel	8,000	Fishing vessel	Hull rupture or leak
Light diesel	1,000	Onshore bulk cargo , transfer	Personnel error
Light diesel	10,000	Onshore industrial plant or processing facility	Highway accident
Light diesel	8,000	Fishing vessel	Hull rupture or leak
Light diesel	2,600	Onshore non-transportation-related facility	Tank overflow
Unidentified light oil	1,600	Onshore fulk storage facility	Pipe rupture or leak
Total	114,672		

Largest single oil spill: 72,280 gals.
Average quantity spilled: 12,741 gals.
Average quantity spilled excluding-largest spill: 5,299 gals.

All 1977 Alaska Marine Oil Spills (all quantities):

Number 229
Total quantity: 123,633 gals.
Average quantity per spill: 540 gals.
Number of fishing vessel oil spills: 56
Average quantity per fishing vessel spill: 1,600 gals.

Source: United States Coast Guard Pollution Incident Reporting System data,

TABLE B.68

NUMBER OF ALASKA MARINE OIL SPILLS ≥ 1,000 GALLONS,
BY MATERIAL SPILLED 1973-1977

Number of Incidents

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Material Spilled	1973	1974	1975	1976	1977
Light Crude Oil		1		1	
Gasoline		1	1	1	
Jet Fuel		1	1	2	1
Light Diesel Fuel	10	12	4	5	6
Heavy Diesel Fuel	1		1	1	1
Mixture of Two or More Petroleum Products				1	
Unidentified Light Oil					1
Unidentified Heavy Oil	1				
Other Oil	1				
Natural Occurrence	1				
Total	14	15	7	11	9

Source: United States Coast Guard Pollution Incident Reporting System data.

TABLE B.69

NUMBER OF ALASKA MARINE OIL SPILLS ≥ 1,000 GALLONS, BY CAUSE 1973-1977

Cause of Oil Spill	1973	1974	1975	1976	1977
Structural Failure or Loss					
Hull Rupture or Leak	1	1	1	1	4
Tank Rupture or Leak	4	2	1	2	
Transportation Pipeline Rupture or Leak		1		1	
Other Structural Failure	1	1			
Equipment Failure					
Pipe Rupture or Leak	2	3	1		2
Hose Rupture or Leak				1	
Valve Failure	1	1			
Other Equipment Failure	1	1	1	1	
Personnel Error (Unintentional Discharge)					
Tank Overflow	1	1			1
Improper Equipment Handling or Operation		1			
Other Personnel Error					
Intentional Discharge	2				
Other Transportation Casualty					
Railroad Accident				1	
Highway Accident				1	1
Aircraft Accident				1	
Natural or Chronic Phenomenon	1	?	1		
Unknown Causes		1	1		
Total	14	15	7	11	9

Source: United States Coast Guard Pollution Incident Reporting System data.

TABLE B.70

NUMBER OF ALASKA MARINE OIL SPILLS ≥ 1,000 GALLONS, BY SOURCE OF SPILL 1973-1977

Source of Oil Spill	1973	1974	1975	1976	1977
Other Vessel	2	1			
Tankship 10,000-19,999 gross tons	1				
Tank Barge 1,000-9,999 gross tons	1				
Tugboat or Towboat	1	1			
Fishing Vessel	1		1	1	4
Onshore Bulk Cargo Transfer		1			1
Onshore Fueling	1	1	1		
Offshore Bulk Cargo Transfer		1			
Rail Vehicle Liquid Bulk				1	
Highway Vehicle Liquid Bulk		1	2	1	
Aircraft				1	
Other Land Transportation Facility		2			
Railway Fueling Facility				1	
Onshore Pipeline			1		
Other Onshore Non-Transportation-Related Facility	1	3		1	1
Onshore Bulk Storage Facility				2	2
Onshore Industrial Plant or Processing Facility	2				1
Onshore Oil or Gas Production Facility				1	
Offshore Production Facility				1	
Miscellaneous - or Natural Source	4	3	1		
Unknown Type of Source		1			
Total	14	15	7	11	9

Source: United States Coast Guard Pollution Incident Reporting System data.

in a large portion of the boats and to produce electricity in most communities outside the Anchorage-Cook Inlet area. Therefore, many opportunities exist for diesel spills when large quantities are being loaded onto or unloaded from bulk supply vessels, and whenever a diesel-powered boat experiences problems which allow fuel to escape. Discarded waste oils and lubricating oils account for a sizable portion of small spills of several gallons or less. These incidents often occur within or near small boat harbors, and are often associated with the performance of minor boat maintenance. However, harbormasters have reported that the occurrence of such spills is decreasing due to stricter prevention measures and better cooperation by boat operators who are becoming increasingly aware of environmental concerns.

The causes of oil spills and the sources of the polutants cover a wide range (Tables B.&9 and 8.70). In many cases, rather large quantities of ail , were lost in shore-based operations such as refueling and fuel tank overflow . Large shore-based spills far outnumbered large nonshore-based spills which were often attributable to hull rupture or leak or tank rupture or leak. Smaller oil spills often involve the intentional discharge of waste oils, or losses in which rather moderate maounts of lubricating oils, hydrolic fluids, or engine fuels escape unintentionally, Frequently personnel error or equipment malfunction is the primary cause of small spills.

The number of fishing vessels involved with oil spills increased between 1973 and 1977. The proportion of total spills attributable to fishing vessels fluctuated from approximately 15 percent to 24 percent of all spills, but it did not exhibit a secular trend. Most fishing vessel incidents involved diesel fuel, lubricating oils or hydrolic oils, or waste oil, and only rarely were spills larger than a few hundred gallons.

Very little information was available concerning the affect the oil spills had upon the environment. Beginning with 1977 data, some oil spills were recorded with an assessment of their environmental impact. Prior to 1977, a damage assessment was not included. Many 1977 spills did not include assessments, however, and none of the spills of 1,000 gallons or more were assessed, All spills of which the degree of impact was evaluated received a rating of "potential" or "negligible", except for one spill rated "slight". Depending upon the location of the spill, the resources most likely to be affected by the spills were boats and fish.

Processing Plant Siting Requirements

Fish processors have a number of criteria that must be met when choosing a site for a land-based plant. Oftentimes sites are chosen in close proximity to population centers so as to utilize already existing amenities. Other times, plants are located in quite remote areas to maintain closeness to the fishing grounds, and must be completely self-sufficient. However, the particular needs are met, almost all plants, processing nearly any species of fish, have similar basic needs

Adequate and suitable land must be available in a desirable location. Various processors have indicated that around 0.8 hectares (two acres) of land is adequate for a fairly large plant, but an additional 1.2 or 1.6 hectares (three or four acres) of open storage area would be very desirable. Additional space would allow storage of container vans away from the plant, greatly reducing congestion. Also, many fishermen do not have adequate storage facilities for their gear, especially the large crab pots, and safe storage of their gear is a service which many plants try to extend to regular customers when space allows.

A plant must have a means of obtaining the raw fish for processing. This normally necessitates the locations of the plant where facilities can be constructed for off-loading of fishing vessels. Fishing boats often have a draft of around 2.4 m (8 feet), but drafts in excess of 3.7 m (12 feet) when loaded are no longer rare. Also, the current trend toward larger, multi-purpose vessels must be considered to insure usefulness of the facilities well into the future. Some plants presently receive considerable portions of their fish by air freight or truck, This suggests that with ingenuity, sites that at first appear inappropriate for fish processing facilities and are located away from the shore may actually prove adequate and more readily available.

Electricity and fresh water are indispensable for the operation of a fish processing plant. Both must be readily available to supply the plant at peak usage levels. Fish processing is usually seasonal, and a plant's entire pack for the year may be produced in a few short weeks during which the lines run nearly full time. Vast amounts of water are needed at various points along the processing lines, with cleaning accounting for the largest consumption. Electricity powers most of the machinery along the processing lines and must be provided by a reliable source, as any delays in processing fish can result in considerable quality loss. Some plants opt to generate their own electricity, often due to having no other source available. The use of electricity has grown more critical to the fish processing industry with the growing prevalence of freezing, as freezing consumes much more electricity than the canning process it is replacing,

Due to increasingly stringent environmental protection regulations, plants must provide adequate means of industrial waste disposal. More leniency is exercised in remote areas where several plants are not grouped together. Particular EPA waste disposal requirements for any potential plant site could noticeably alter construction and operating costs.

Modes of transportation available for servicing the plant site are a critical consideration. Most Alaskan fisheries products are eventually transported to the Seattle area by freighter or barge in container vans for further processing and distribution. Plants must be serviced regularly and with such frequency to assure a supply of vans for loading so freezing and warehousing facilities do not become overburdened, thus resulting in a production bottleneck.

Many other factors, such as availability of labor and certain economic factors, enter into the choice of a fish processing plant site. However, unless essential physical criteria are first met by a site, further investigation is unnecessary.

GOVERNMENTAL ENVIRONMENT

The Commercial fishing industry is regulated, promoted, hindered, and in other ways influenced by governmental entities. This section provides a brief summary of the objectives of some of the more influential governmental entities in an attempt to describe the governmental environment in which the commercial fishing industry is expected to operate during the forecast period of 1980 through 2000.

Federal Policy

Legal sanction for a broadened more comprehensive national policy for marine fisheries was provided by the passage of the Fisheries Conservation and Management Act of 1976 (FCMA). Much of the policy embodied in the FCMA parallels that developed in the National Plan for Marine Fisheries submitted to the Secretary of Commerce on December 1975 by the Director of the National Marine Fisheries Service in cooperation with the Department of State. Implementation of these goals is borne by the Department of Commerce (and its sub-agency the National Marine Fisheries Service) in cooperation with the Department of State and the eight Regional Councils created by the FCMA.

The Policy goals developed in the National Plan and the FCMA as well as a discussion of the NOAA Aquiculture Plan prepared by the National Marine Fisheries Service and the Office of Sea Grant will be the topic of this section. The goals of the National Plan are:

- To restore, maintain, enhance, and utilize in a rational manner fisheries resources of importance to the United States;
- To improve the contribution of marine resources to recreation and other social benefits;
- To develop and maintain healthy commercial and recreational fisheries industries; and
- To increase the supply of wholesome, economically priced seafood products to the consumer.

These goals are regarded as fixed and constant points of reference for future decisions in the realm of national policy and priority. (National Plan for Marine Fisheries p. ii).

To achieve these national goals the plan outlines five major recommendations, they are as follows:

1) Establish policies, plans, and institutional management arrangements to restore, maintain, and enhance fish stocks within U.S. jurisdiction, to insure the equitable allocation of these stocks, and to assist in the conservation of stocks of importance to the United States outside U.S. waters.

- Manage fish stocks for optimum utilization.
- Establish state and federal institutional arrangements for management of domestic fisheries resources.
- Insure that interested parties have opportunity to advise on the needs for fisheries management plans and the contents of them.
- Develop a sound statistical and scientific data base for the fisheries resources to be managed.
- Improve and expand federal and state surveillance and enforcement capabilities as needed.
- Establish a mechanism which would permit limiting entry into fisheries where biological, economic and social evidence shows such action to be appropriate.
- Develop a funding system to pay management costs.
- Provide continued opportunity for U.S. fishermen to participate in fisheries for highly migratory species wherever they are found, to have access to areas of historical U.S. fishing that may be within the jurisdiction of other nations, and to participate where appropriate in fishing for underutilized species within other nations' jurisdictions, and not subject historically to U.S. fishing.
- Strengthen international arrangements with respect to salmonid stocks of U.S. origin and other fish stocks shared with adjacent nations.

2) Reverse the downward trends in quantity and quality of fish habitats by minimizing further losses and degradation of these habitats, restoring and enhancing them where possible, and establishing sanctuaries where necessary, while recognizing other compatible essential uses of fish habitat areas.

- Improve the consideration given to fish habitats in decision making processes.
- Mitigate losses of habitat where possible, restore habitats lost or degraded, and develop economically feasible enhancement opportunities.
- Establish sanctuaries, reserves, or other systems where necessary to protect critical fish habitats, fish production, and associated recreational and esthetic values.
- Improve the quality, and increase the dissemination of information required for fish habitat conservation activities.

3) Strengthen the U.S. commercial industry to enable it to provide increased supplies at competitive prices.

- Establish an effective fisheries development program to enable the U.S. commercial fishing industry to enlarge its share of markets through increased productivity, lower costs, and increased acceptability of fishery products to the consumer.
- Design fisheries management plans and revise unnecessarily restrictive regulations to permit increased industry efficiency and lower production costs.

4) Improve opportunities for participation in marine recreational fishing.

- Expand and accelerate research needed for the improvement management and use of recreational fisheries, and improve the distribution of information thus obtained.
- Increase the amounts and kinds of fisheries resources available for recreational use.
- Increase access for anglers and recreationists to shorelines, waters, and fish.
- Determine the needs of commercial enterprises for assistance in developing access, facilities, and services upon which marine recreational fishermen depend.

5) Ensure the availability to the U.S. consumer of supplies of wholesome fishery products from U.S. sources sufficient to provide for projected increases in consumption.

- Increase U.S. landings by 1.04 million MT (2.3 billion pounds) by 1985 to provide for the projected increases ' in U.S. consumption.
- Encourage the development of public" and private aquaculture for selected species of fish and shellfish.
- Assure the wholesomeness and identity of fishery products to U.S. consumers through a comprehensive program of inspection of U.S. and foreign production facilities and supplies.

As stated previously, the legislative impetus for implementation of these goals was the FCMA. The following sections of Public Law 94-265, express the policy goals of the FCMA.

SEC. 2. FINDINGS, PURPOSES AND POLICY

(a) FINDINGS. -- The Congress finds and declares the following:

(1) The fish off the coasts of the United States, the highly migratory species of the high seas, the species which dwell on or in the Continental Shelf appertaining to the the United States, and the anadromous species which spawn

in United States rivers or estuaries, constitute valuable and renewable natural resources.

These fishery resources contribute to the food supply, economy, and health of the Nation and provide recreational opportunities.

(2) As a consequence of increased fishing pressure and because of the inadequacy of fishery conservation and management practices and controls (A) certain stocks of such fish have been overfished to the point where their survival is threatened, and (B) other such stocks have been so substantially reduced in number that they could become similarly threatened.

(3) Commercial and recreational fishing constitutes a major source of employment and contributes significantly to the economy of the nation. Many coastal areas are dependent upon fishing and related activities, and their economics have been badly damaged by the overfishing of fishery resources at an ever-increasing rate over the past decade. The activities of massive foreign fishing fleets in waters adjacent to such coastal areas have contributed to such damage, interfered with domestic fishing efforts, and caused destruction of the fishing gear of United States fishermen.

(4) International fishery agreements have not been effective in preventing or terminating the overfishing of these , valuable fishery resources. There is danger that irreversible effects from overfishing will take place before an effective international agreement on fishery management jurisdiction can be negotiated, signed, ratified, and implemented.

(5) Fishery resources are finite but renewable. If placed under sound management before overfishing has caused irreversible effects, the fisheries can be conserved and maintained so as to provide optimum yield on a continuing basis.

(6) A national program for the conservation and management of the fishery resources of the United States is necessary to prevent overfishing, to rebuild overfished stocks, to insure conservation, and to realize the full potential of the nation's fishery resources.

(7) A national program for the development of fisheries which are underutilized or not utilized by the United States fishing industry, including groundfish off Alaska, is necessary to assure that our citizens benefit from the employment, food supply, and revenue which could be generated thereby.

(b) PURPOSES -- It is therefore declared to be the purposes of the Congress in this Act--

(1) to take immediate action to conserve and manage the fishery resources found off the coasts of the United States, and the anadromous species and Continental Shelf fishery resources of the United States, by establishing (A) a fishery conservation zone within which the United States will assume exclusive fishery management authority over all fish, except highly migratory species, and (B) exclusive fishery management authority beyond such zone over such anadromous species and Continental Shelf fishery resources;

(2) to support and encourage the implementation and enforcement of international fishery agreements for the conservation and management of highly migratory species, and to encourage the negotiation and implementation of additional such agreements as necessary;

(3) to promote domestic commercial and recreational fishing under sound conservation and management principles;

(4) to provide for the preparation and implementation, in accordance with national standards, of fishery management plans which will achieve and maintain, on a continuing basis, the optimum yield from each fishery;

(5) to establish Regional Fishery Management Councils to prepare, monitor, and revise such plans under circumstances>(A) which will enable the states, the fishing industry, consumer and environmental organizations, and other interested persons to participate in, and advise on, the establishment and administration of such plans, and (B) which take into account the social and economic needs of the states; and

(6) to encourage the development by the U.S. fishing industry of fisheries which are currently underutilized or not utilized by United States fishermen, including groundfish off Alaska.

(c) POLICY -- It is further declared to be the policy of the Congress in this Act--

(1) to maintain without change the existing territorial or other ocean jurisdiction of the United States for all purposes other than the conservation and management of fishery resources, as provided for in this Act;

(2) to authorize no impediment to, or interference with, recognized legitimate uses of the high seas, except as necessary for the conservation and management of fishery resources, as provided for in this Act;

(3) to assure that the national fishery conservation and management program utilizes, and is based upon, the best scientific information available; involves, and is responsive to the needs of, interested and affected states and citizens; promotes efficiency; draws upon federal, state, and academic capabilities in carrying out research, administration, management, and enforcement; and is working and effective;

(4) to permit foreign fishing consistent with the provisions of this Act; and

(5) to support and encourage continued active United States efforts to obtain an internationally acceptable treaty, at the Third United Nations Conference on the Law of the Sea, which provides for effective conservation and management of fishery resources.

16 USC 1802

SEC 3. DEFINITIONS

(17) The term "national standards" means the national standards for fishery conservation and management set forth in section 301.

(18) The term "optimum", with respect to the yield from a fishery, means the amount of fish--

(A) which will provide the greatest overall benefit to the nation, with particular reference to food production and recreational opportunities; and
(B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social, or ecological factor.

90 STAT. 335

TITLE III--NATIONAL FISHERY MANAGEMENT PROGRAM

USC 1851.

SEC. 301. NATIONAL STANDARDS FOR FISHERY CONSERVATION ANO MANAGEMENT.

(a) IN GENERAL--Any fishery management plan prepared, and any regulation promulgated to implement any such plan, pursuant to this title shall be consistent with the following national standards for fishery conservation and management:

(1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery.

(2) Conservation and management measures shall be based upon the best scientific information available.

(3) To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

(4) Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

(5) Conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

90 STAT. 345

To capsulize somewhat, the goals most far reaching in their effect on commercial fishing are those pertaining to the restoration, maintenance and enhancement of fish stocks within U.S. jurisdiction. To accomplish this a concept defined as optimum yield will be utilized and, if necessary, a system of limiting entry will be instituted if "...biological, economic and social evidence shows such action to be appropriate." Further, direct encouragement will be given in the development of the U.S. commercial fishing industry.

In Alaska one visible evidence of this encouragement is manifested in the Alaska Fisheries Development Corporation's application for Saltonstall-Kennedy funds administered by the Department of Commerce. If granted, the funds will be used in a variety of projects to encourage development of the groundfish industry in waters off Alaska.

The need for the funds and expected results are identified in their proposal and repeated here:

DEVELOPMENT PROPOSAL FOR BOTTOMFISH OFF ALASKA

8. Urgency of Need for Project:

The U.S. fishing fleet must show its willingness and capability to compete with and displace the foreign fishing effort if it is to maintain and increase the TAC for U.S. fishermen.

The U.S. fisherman can contribute favorably to the U.S. balance of payments if he takes advantage of the vast resource now available to him in the U.S. 200 mile zone.

- Many fishermen need to see lucrative working demonstrations of groundfishing before they will invest large sums of money and time into personal efforts.

The Alaska economy can be stabilized and developed by providing employment and investment opportunities in fish catching, processing, and allied industries,

There is need to enhance economic viability of the Pribilof Island communities.

11. Description of Expected Results (To include Cost Benefit Estimates) for Each Fiscal Year:

	FY '78	FY '79	FY '80	FY '85
Landings in pounds round weight	35,000,000	200,000,00	600,000,000	2,000,000,000
Value of end products as they leave primary processors. This will be benefit to U.S. balance of trade	14,700,000	96,700,000	290,000,000	1,000,000,000
Employment: (no. of people employed full time)				
On vessels	60	170	500	1,670
In plants	200	800	2,400	8,000
Indirect	120	1,120	4,800	16,000
Total employment	380	2,090	7; 700	25 ,670
Total personal income	8,800,000	45,200,000	164,000,000	549,000,000

Note: The groundfish program of the AFDC is the catalyst, applied in - 1978 and 1979, with some follow-through in 1980, which will be instrumental in creating a large new industry in Alaska. This new industry will stimulate supporting activity in Washington, Oregon, and other states which either build boats for Alaska, supply the seafood industry or process primary seafood products originating in the Northwest. The main benefit will be realized in about 1985 when the new industry will have grown to a substantial percentage of its potential. By 1990 it will be even larger but considering the year 1985 as an example, we expect the following from the new Alaskan groundfish industry:

1) An annual improvement in the U.S. balance of trade of $1,000,000,000.

2) Total new employment in the U.S. of 25,670 people full time. (Of this at least 18,000 will be in Alaska).

3) A total of new annual personal income of $549,000,000.

Against the above benefits we have total out of pocket costs in 1978-80 by government and industry (excluding capital expenditures) of about $7,200,000.

By 1985 private industry investment in vessels and plants will have reached $600,000,000.

Weight should be given to the fact that with good fishery management under the 200-mile zone law these economic benefits in the form of improved foreign exchange balance, employment, and personal incomes will be perpetual. We are building upon a renewable resource.

NOAA Aquiculture Plan

The goals of aquiculture development and likely target species are outlined in the NOAA Aquiculture Plan issued in May of 1977.

GOALS AND OBJECTIVES

- The primary NOAA goal for fisheries is to maintain or increase the national availability of a broad spectrum of aquatic resources and products for the U.S. consumer. As related to aquaculture, the goal is to have public hatcheries or private husbandry increase production of selected species that are in short supply.

- The objectives of NOAA programs are to provide the scientific, technical, legal, and institutional base needed for the development of aquiculture in cooperation with other agencies and groups, and to facilitate early application of research results by information dissemination and extension activities.

Species targeted for development funding are ranked high, medium or low priority and are listed here.

High Priority

Species:

hatchery, pen reared and ocean ranching of salmon (includes Atlantic and Pacific salmon)

Medium Priority

Species:

butter clam
geoduck
surf clam
manila clam
bay scallop
spot prawn

Low Priority

Species:

sablefish
Dungeness crab

Environmental Protection Agency.

EPA has yet to promulgate final seafood processing effluent regulations for Alaska. Preliminary regulations are expected to be somewhat modified. However, new regulations are not expected until an existing industry law suit against EPA is settled.

According to Jim Bray, an Economist with the Marine Advisory Program at the University of Washington, the major impact of the regulations will be to eliminate the small "mom and pop" type processing plants. Most larger plants already have the technology to comply with EPA regulations or are pumping effluent to deep water.

The major impact of EPA regulations will be an acceleration of concentration of facilities and ownership in seafood processing. EPA regulations may also accelerate the move to offshore processing where the regulations are not applicable.

References for Federal Policy

Public Law 94-265 94th Congress, H.R. 200 April 13, 1976.

NOAA Aquiculture Plan, prepared by National Oceanic and Atmospheric Administrate on, National Marine Fisheries Service and Office of Sea Grant. John B. Glude, ed. Aquiculture Program Coordinator May 1977.

A Marine Fisheri s Program for the Nation. U.S. Department of Commerce, Washington, D.C. July 1976.

Development Proposal for Bottomfish off Alaska. Alaska Fisheries Development Corporation. February 1978.

Economic Analysis of Interim Find Effluent Guidelines, Seafood Processing Industry. U.S.E.P.E. , EPA 230/1-74-047, February 1975, Washington, D.C.

Review of Economic Analysis of Effluent Guidelines, Seafood Processing Industry. James W. Bray. University of Washington, Seattle, Washington, August 5, 1976.

State Fisheries Policy

Fisheries policy in the State of Alaska has historically been one which seeks to provide the maximum benefit to Alaska residents from fishery resource use. One method of accomplishing this goal has been to support measures which assure and/or encourage onshore processing. The raw fish tax differential for product processed at sea is a good example of this policy.

With the advent of federal 200-mile (322 km) limit legislation, prospects for developing fisheries off Alaska, particularly groundfish, improved substantially. With foreign fishing now under strict management controls by the North Pacific Fishery Management Council and the Department of Commerce, the development of a domestic groundfish industry seems both attractive and likely.

In response to the growth potential, the Hammond administration created a position for a coordinator for groundfish development within the office of the governor. Staff services and program development coordination are provided by the Department of Commerce and Economic Development.

Under this development program broad concepts of state fishery policy are emerging. Retaining the goal of Alaska's fisheries for Alaskan's, the state seeks to expand its role in fisheries development in the following ways:

1. To expand knowledge of fishery technique by gear demonstration projects.

2. Encouragement of community-based production.

3. Adoption of policies and programs designed to increase fishing effort by Alaska fishermen with particular emphasis on development of non-seasonal effort.

4. Management of fisheries on an optimum sustained yield basis.

5. Provision of community development support to handle effects of increased fishing effort:

   a. port facility development
   b. transportation
   c. communication
   d. utilities
   e. state and local government land policies
   f. housing, health care, water supply, waste disposal, recreational facilities.

6. Emphasis in all policies and programs placed on n building a long-term fishing industry. (Speech by Jim Edenso, Coordinator for Bottomfish Development, delivered at the 29th Alaska Science Conference, August 78, Fairbanks, Alaska.)

Programs now in effect which support these goals are:

The Alaska Renewable Resources Corporation. Legislation to create the Alaska Renewable Resources Corporation was introduced this year by the House Special Committee on the Alaska Permanent Fund and supported by Governor Jay Hammond. The corporation is designed to:

1. Assist in the rehabilitation, enhancement, and development of the state's renewable resources;

2. Sponsor research and development of technologies and innovations which are appropriate to the use of these resources; and

3. Identify new products and markets for renewable resource industries in the state, assist in the demonstration of their technical and economic feasibility, and help to introduce newly proven products and technologies into commercial markets.

It is a public corporation within the Department of Revenue but legally autonomous from the state. It will be governed by a three-member board of trustees appointed by the governor and confirmed by the legislature. The corporation will evaluate proposed projects and provide technical assistance and financial aid to qualified applicants in the form of loans, grants, or equity participation. The corporation will be funded with five percent of state mineral revenues from leases, bonuses, and royalty payments that will be divided between a trust fund and a development fund (Alaska Public Forum).

<u>The Commercial Fisheries and Agriculture Bank</u>. The 1978 A" aska legislature created the Fisheries and Agriculture Bank to:

1. Provide sources of credit for Alaska agriculture and fishing businesses;
2. Encourage harvesting of offshore fisheries that have been ' underutilized by Alaskans in the past;
3. Encourage processing and marketing of underutilized fish species;
4. Encourage technological development of underutilized fish species; and
5. Promote the more rapid development of agriculture.

The bank will provide credit and technical assistance to shareholder farmers and fishermen. The board of directors is not yet appointed and articles of incorporation must be drawn to create the formal structure of the bank and procedures for becoming a stockholder.

In addition, the commercial fishing loan fund has been expanded to provide increased amounts of money per loan for vessel purchase and gear and

and equipment acquisition. The loan fund is administered by the Department of Commerce and Economic Development (Alaska Public Forum).

One of the inherent problems of forecasting Alaska's fishery policy over the long-term is the turnover in state administrations and the resultant effects changes in political climate have on policy goals. It can, however, be said with reasonable certainty that any administration, if it is to be elected, will support and reflect the prevailing policy view of the legislature and, further, it will defend state interests at the expense of out-of-state and foreign interests. How a particular administration views the particular trade-offs involved in this process is impossible to predict. The concept of renewable resource development in Alaska to provide long-run economic stability is, however, a sound one and will doubtless be around for awhile. The extent to which the state in the long-run will nurture this policy will ultimately depend on the degree of support it receives by each succeeding administration. The degree of support will, in turn, be a function of the success of past programs which were designed to enhance the policy. This may sound suspiciously like circuitous reasoning but policy survival is often highly dependent on the success or non-success of its implementation programs.

The state agency most responsible for carrying out state fishery goals in the resource management area is the Alaska Department of Fish and Game (ADF&G). The goal of management of fisheries on an optimum sustained yield basis (item #4 previous) is carried out directly by this agency. Four key words implicit in the function of ADF&G are protection, management, conservation, and restoration of the fish and game resources of the state (A.S. Sec. 16.05.010). One of the functions of the commissioner of fish and game is to "manage, protect, maintain, improve, and extend the fish, game, and aquatic plant resources of the state in the interest of the economy and general well-being of the state" (A.S. Sec. 16.05.020). The goals of restoration and improvement of fish stocks largely fall to the division of fisheries rehabilitation, enhancement and development (FRED). The duties of this division as outlined in A.S. Sec. 16.05.092 are to:

1. develop and continually maintain a comprehensive, co-ordinated state plan for the orderly present and long-range rehabilitation, enhancement and development of all aspects of the state's fisheries for the perpetual use, benefit and enjoyment of all citizens and revise and update this plan annually;

2. encourage the investment by private enterprise in the technological development and economic utilization of the fisheries resources;

3. through rehabilitation, enhancement, and development programs do all things necessary to insure perpetual and increasing production and use of the food resources of Alaska waters and continental shelf areas;

4. make a comprehensive annual report to the legislature, containing detailed information regarding its accomplishments under this section and proposals of plans and activities for the next fiscal year, not later than 20 days after the convening of each regular session. (Sec. 2 ch 113 SLA 1971).

The specific goals with regard to salmon are to:

1. Achieve optimum sustainable yield to the commercial fisheries from naturally and supplementally produced Alaskan salmon stocks.

2. Moderate the low-cyclical harvest fluctuations in the commercial fisheries (Alaska Salmon Fisheries Plan).

To carry out these goals, the FRED division's activities are primarily directed toward establishment of state operated salmon hatcheries, of which there are presently 12 in operation, and the administration of the private-nonprofit salmon aquiculture program. In areas where reg ona associations and local private nonprofit corporations exist it is the FRED division's goal "to cooperate fully and actively support (their) efforts to build and manage their own salmon hatchery facilities" (Alaska's Private Nonprofit Hatchery Program). There are presently four regional associations in existence: Northern Southeast Regional Aquiculture Association, Inc., Sitka, Alaska; Southern Southeast Regional Aquiculture Association, Inc., Ketchikan, Alaska; Prince William Sount Regional Aquaculture Association; Cordova, Alaska; Cook Inlet Reg onal Aquiculture Association, Inc., Soldotna, Alaska.

The Prince William Sound Aquiculture Corporation has identified its , long-range goals in a publication entitled Salmon Culture Program. Similar documents from other associations will undoubtedly be forthcoming in the future. The following statements taken from the Salmon Culture Program outline the plans of the association.

LONG RANGE PLAN OF THE CORPORATION

At the outset of deliberations of the board of directors of this corporation, the long-range goals were tentatively defined as follows:

1. Activities will be primarily confined within the boundaries of the state Area E, the Prince William Sound area, which includes the Prince William Sound, Copper River and Bering

River districts; state law confines to this area the fishermen upon whom the local fisheries economy is based.

2. Pink and chum salmon rehabilitation in the Sound will comprise the first phase of activities since specific technology enabling rapid increase in these runs is available at a favorable cost-benefit ratio, and of the various local salmon fisheries, the pink salmon runs of the Sound are in the most depressed condition.

3. A target level of hatchery capacity of 300 million salmon eggs was set, based on forecasts from pilot programs which show this level will provide an additional five million adult salmon return annually, independent of the average four million return from the wild salmon stocks. The combined nine million return would reinstate the 1925-1945 peak salmon population levels, thus be in conformity with known environmental capacity of the Sound.

4. The role of this corporation is to provide about two-thirds or 200-million egg capacity of this hatchery system. The state and other private corporations are expected to provide the remaining requirements.

5. The large sum of money required to design, construct and operate the corporation system will come from a wide variety of sources. Self assessment of area-wide catches of individual fishermen, grants from fish processors, proceeds of surplus fish sales, grants from the State Renewable Resource Fund and matching grants from the Economic Development Administration are the principal fund sources. Remaining funds are anticipated via loans' from the state Fishermen's Revolving Loan Fund, regular banking institutions and the regional Native corporation, Chugach Natives, Inc.

6. The Prince William Sound hatchery program is to be developed over a 10-year period.

7. Programs related to enhancement of other salmon species in the Sound are to be incorporated gradually; red salmon incubation will await only the solution to a current IHN virus problem in wild broodstocks; some emphasis is to be placed on a desirable sport species, coho and king, in specific areas of growing sport fisheries, thereby avoiding user-group conflicts which have detracted from rehabilitation programs in many other areas of North America.

8. Programs related to the Copper River and Bering River salmon runs will commence after initial phases of the Sound programs are completed. A joint state-corporation research facility for red and coho salmon at Eyak Lake is planned as the first development. Solving of inoculation procedures on the broodstock presently infected with IHN virus must precede this project. Delta stocks of red and coho adversely affected by earthquake

land uplift will receive top priority. All returns from the Eyak and other delta projects will belong to the common property fishery.

9. A portion of surplus funds generated by corporation activities will be utilized for earmarked grants to the state or research institutions to encourage programs designed to cause rehabitation of the wild stocks of salmon of the area.

10. The corporation staff will take a leading role in development of a masterplan for fisheries rehabilitation with state, public and private hatchery corporation involvement.

The above primary goals, if achieved, would make Prince William Sound the first major salmon area of North America to be stablized at a relatively consistent annual level of peak production. Variations of success and failures in the wild runs will still occur, but... total run size will be in a much more acceptable range, e.g., 6-14 million fish versus 1-9 million in present runs."

It should be noted that the State Renewable Resource Fund referenced in item 5 does not exist.

Board of Fisheries.

An integral part of the management decision-making process in Alaska's commercial fisheries is the Board of Fisheries. Alaska Statutes pertaining to its purpose, regulations and its relationship to ADF&G and the Commissioner are as follows:

Sec. 16.05.221. Boards of Fisheries and Game.

(a) For purposes of the conservation and development of the fishery resources of the state, there is created the Board of Fisheries composed of seven members appointed by the governor, subject to confirmation by a majority of the members of the legislature in joint session. The appointed members shall be residents of the state and shall be appointed without regard to political affiliation or geographical location of residence. The commissioner is not a member of the Board of Fisheries, but shall be ex-officio secretary.

Sec. 16.05.251. Regulations of the Board of Fisheries.

The Board of Fisheries may make regulations it considers advisable in accordance with the Administrative Procedure Act (A.S. 44.62) for

(1) setting apart fish reserve areas, refuges and sanctuaries in the waters of the state over which it has jurisdiction, subject to the approval of the legislature;

(2) establishment of open and closed seasons and areas for the taking of fish;

(3) setting quotas and bag limits on the taking of fish;

(4) establishment of the means and methods empl eyed n the pursuit, capture and transport of fish;

(5) establishment of marking and identification requ remen ts for means used in pursuit, capture and transport of fish;

(6) classifying fish as commercial fish, sport fish or predators or other categories essential for regulatory purposes;

(7) engaging in biological research, watershed and habitat improvement, fish management, protection, propagation and stocking;

(8) investigating and determining the extent and effect of . predation and competition among fish in the state, exercising control measures considered necessary to the resources of the state;

(9) entering into cooperative agreements with educational institutions and state, federal, or other agencies to promote fish research, management, education and information and to train men for fish management;

(10) prohibiting the live capture, possession, transport, or release of native or exotic fish or their eggs;

(11) establishing seasons, areas, quotas and methods of harvest for aquatic plants;

(12) establishment of the times and dates during which the issuance of fishing licenses, permits and registrations and the transfer of permits and registrations between registration areas is allowed; however, this paragraph does not apply to permits issued or transferred under ch. 43 of this title. (Sec. 3 ch 206 SLA 1975; am Sec. 2 ch 218 SLA 1976).

Sec. 16.05.270. Delegation of Authority to Commissioner.

For the purpose of administering Sections 251 and 255 of this chapter each board may delegate authority to the commissioner to act in its behalf. If there is a conflict between the board and the commissioner on proposed regulations, public hearings shall be held concerning the issues in question. If, after the public hearings, the board and the commissioner continue to disagree, the issue shall be certified in writing by the board and the commissioner and sent to the governor who shall make a decision. The decision of the governor is final. (Sec. 6 art I ch 94 SLA 1959; am Sec. 5 ch 206 SLA 1975).

NOTE : Section 255 refers to the Board of Game regulations.

The policy of the Board of Fisheries on specific issues is often expressed in resolution or policy statement form. Some recent examples of this are included here.

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ALASKA BOARD OF FISHERIES

Resolution #77-29-FB

'RELATING TO THE INCLUSION OF THE CONTIGUOUS MARINE AND COASTAL WATERS OF THE STATE OF ALASKA INTO THE DEFINITION OF ANADROMOUS STREAMS AND WATERS

WHEREAS, the marine and anadromous fish resources of Alaska's coastal zone and marine waters are critical to the economic, cultural, and social well-being of the citizens of Alaska; and

WHEREAS, these resources constitute a major food source not only for other nations of the world, but also for other forms of marine and terrestrial life; and

WHEREAS, the contiguous marine and coastal waters of the State of Alaska are critical to the spawning and early life history of most of Alaska's commercial fisheries resources including crab, shrimp, herring, smelt, salmon, halibut, and many other pelagic and demersal species of commercial and ecological importance; and

WEREAS, these fisheries resources are particularly vulnerable to damage or destruction during their spawning and early life stages; and

WHEREAS, the nearshore marine and coastal environment itself is particularly susceptible to damage from man's activities in the coastal zone;

BE IT THEREFORE RESOLVED, that Alaska's contiguous marine and coastal waters, out to three nautical miles, should be declared a fisheries conservation zone and that the provisions of Alaska Statute 16.05.870 pertaining to the protection of waters important to the production of anadromous fish be extended to include this area; and

BE IT FURTHER RESOLVED, that a copy of this resolution be sent to the Alaska Coastal Policy Council with a recommendation that it be incorporated into the Guidelines and Standards of the Alaska Coastal Management Plan and included when the plan is sent to the Legislature for approval; and that a copy of this resolution be sent to the Alaska legislature with the recommendation that Alaska Statute 16.05.870 be amended in an appropriate manner during the 1978 Legislative Session.

Nicholas G. Szábo, Chairman
Alaska Board of Fisheries

ADOPTED: December 18, 1977
Anchorage, Alaska

Policy #77-27-FB

COMPREHENSIVE MANAGEMENT POLICY
FOR THE UPPER COOK INLET

The dramatically increasing population of the Cook Inlet area has resulted in increasing competition between recreational and commercial fishermen for the Cook Inlet salmon stocks. Concurrently, urbanization and associated road construction has increased recreational angler effort and may adversely affect fisheries habitat. As a result the Board of Fisheries has determined that a policy must now be determined for the long-term management of the Cook Inlet salmon stocks. This policy should rest upon the following considerations:

1. The ultimate management goal for the Cook Inlet stocks must be their protection and, where feasible, rehabilitation and enhancement. To achieve this biological goal, priorities must be set among beneficial uses of the resource.

2. The commercial fishing industry in Cook Inlet is a valuable long-term asset of this state and must be protected, while recognizing the legitimate claims of the non-commercial user.

3. (If the salmon stocks in Cook Inlet, the king and silver salmon are the target species for recreational anglers while the chum, pink, and red salmon are the predominant commercial fishery.

4. User groups should know what the management plan for salmon stocks will be in order that they can plan their use consistent with that plan. Thus, commercial fishermen must know if they are harvesting stocks which in the long-term will be managed primarily for recreational consumption so that they may plan appropriately. conversely, as recreational demands increase the recreational user must be aware of what stocks will be managed primarily for commercial harvest in order that he not become overly dependent on these fish for recreational purposes.

5. Various agencies should be aware of the long-term management plan so that salmon management needs will be considered when making decisions in areas such as land use planning and highway construction.

6. It is imperative that the Department of Fish and Game receive long-range direction in management of these stocks rather than being called upon to respond to annually changing Board directives. Within the Department, divisions such as F.R.E.D., must receive such long-term direction.

TABLE C.20
KODIAK
OTTER TRAWL BOTTOMFISH FISHERY

CATCH AND EMPLOYMENT OATA

	1969	1970	1971	1972	1973	1974	197s
Pounds Landed (in 000's)	-	72	49	50	153	665	22
Value of Landings	$ -	$ 3,000	$ 6,000	$ 4,000	$ 15,000	$ 133,000	$ 4,000
Number of Boats	1	13	16	6	15	20	4
Number of Landings[1]	-	44	26	7	23	52	7
Boat weeks[2]	-	38	25	7	20	50	7
Man Weeks[3]	-	114	75	21	60	150	21
Number of Landings per Boat	-	3.3a	1.62	1.17	1.53	2.60	1.75
Weeks per Boat	-	2.92	1.56	1.17	i.33	2.50	1.75
Pounds per Landing	-	1,640	1,880	7,140	6,650	12,790	3,140
Value of Catch per Landing	$ -	$ 70	$ 230	$ 571	$ 652	$ 2,S60	$ 570
Value of Catch per Boat	$ -	$ 230	$ 380	$ 670	$ 1,000	$ 6,650	$ 1,000
Value of Catch per Boat Week	$ -	$ 80	$ 240	$ 570	$ 750	$ 2,660	$ 570
Price (i.e. value of catch per lbs.)	$	$ 0.04	$ 0.12	$ 0.08	$ 0.10	$ 0.20	$ 0.18
Index 1[4]		0.92	1.00	0.78	0.96	0.68	0.41
Index 2[5]		1.16	1.04	1.00	1.15	1.04	1.00

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial F Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A s the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoi research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus ar of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by Commission.

These statistics do not include the activities of the following boats that participated in this fishery: 1975, two doub trawlers

It has been estimated that the average crew size in this fishery is 3.

mandated under PMFC's Goal and Objectives. Accordingly PMFC proposed that NMFS/NOAA provide contract support at a level which would permit hiring of an Assistant to the Executive Director, NMFS/NOAA approved that request and provided contract funds of $5,000 for the quarter July-September 1977, and $20,000 for the fiscal year October 1977 through September 1978.

b. Special projects *supportive of Council* needs *and* programs:

Four PMFC special projects have generated cooperative research and management activities pursuant to PMFC's Objective II, and concurrently have provided direct assistance to Regional Fishery Management Council programs.

- Salmon management plan development: In anticipation of needs of the Pacific Fishery Management Council, a project begun in 1976 ($73,000) developed background for an ocean salmon management plan for chinook and coho salmon off Washington, Oregon, and California, and began upgrading of the States' salmon data management capabilities toward a goal of quick-response data collection and analysis. This early planning provided the foundation for the Pacific Council's 1977 ocean salmon management plan. In 1977, a second-phase study ($128,000) began development of background information on inland aspects of salmon management as a contribution to the Pacific Council's comprehensive salmon management plan.

- Regional Mark Processing Center coordination and operation became PMFC responsibilities in 1977. Under a $25,000 contract from the Pacific Northwest Regional Commission, PMFC employed mathematician-programmer Grahame King as Regional Mark Processing Center Coordinator. In accordance with guidelines developed by PMFC's Salmon-Steelhead Committee, King was assigned to upgrade collection, processing, and publication of anadromous fish marking and tagging experiments and recapture information on a timely basis, and to expand the data base to include all information from marking experiments relevant to anadromous fisheries management.

In recognition of the importance of these data management needs coast-wide, including those of the Councils, NMFS provided contract assistance of, $42,000 for operation of the Regional Mark Processing Center for September 1977 through August 1978.

- Chinook and coho salmon sampling programs were expanded off the coasts of Northern California and Oregon in 1977 to recover coded-wire tags in the ocean fishery and otherwise monitor and evaluate the ocean harvest. PMFC coordinated this effort under a $14,000 Federal grant-in-aid project (P.L. 89-304, the Anadromous Fish Conservation Act of 1965).

- Preparation of Coastwide Data Files was begun in 1977 to combine into coastwide files relevant fisherman, vessel, and landings data from Alaska, California, Oregon, and Washington for the three base years of 1974, 1975, and 1976. NMFS contract funds for $10,000 were provided to support computer programming and processing for consolidation of the States' data files.

C. *International Groundfish Committee:*

PMFC's Executive Director continues to serve as U.S. member of the International Groundfish Committee and thereby to encourage and support the activities of its Technical Subcommittee. The Technical Subcommittee is comprised of leading groundfish scientists and managers of the Pacific States, NMFS, and the Canadian Fisheries Service. U.S. members comprise the U.S. Section of that Subcommittee, which Section in 1976 superseded PMFC's long-established Groundfish Committee.

The International Groundfish Committee and its Technical Subcommittee were established nearly two decades ago by the Second Conference on Coordination of Fisheries Regulations between Canada and the United States. Terms of reference include:

1) to review proposed changes in groundfish regulations affecting fisheries of common interest before they are implemented;

2) to review the effectiveness of existing regulations;

3) to exchange information on the status of groundfish stocks of mutual concern, and to coordinate, where possible, programs of research;

4) to recommend the continuance and further development of research programs in order to provide a basis for future management of the groundfish fishery.

In recognition of the accelerating need for effective U.S.-Canada interactions at technical and scientific levels, the Pacific Fishery Management Council in 1977 designated the Technical Subcommittee as its instrument for maintaining these U.S.-Canada cooperative interactions. Annual meetings of the International Groundfish Committee are held in conjunction with PMFC's Annual Meeting.

d. *PMFC* advocacy of *Council needs at Federal* levels:

In three major areas, PMFC successfully advocated major changes in Federal positions with respect to financial support for and operation of the Regional Fishery Management Councils.

In conjunction with the Atlantic and the Gulf States Marine Fisheries Commissions, PMFC campaigned strongly for augmented Federal funding for the Regional Councils and also for support of the State Fisheries Directors' participation in Council affairs. Strong Council, State and constituency support helped bring about a reprogramming of $3.75 million for those purposes in FY 1977 and FY 1978. These funds included $25,000 per year sustaining funding for participation in Council affairs by each State's Fisheries Director.

Concerning interpretations of the Fishery Conservation and Management Act of 1976, PMFC supported Congressional action to shorten the time-frame for processing foreign fishing permit applications in 1977. PMFC also successfully advocated modification of NOAA's interim regulations to restore initiatives for managing transboundary stocks to the Regional Fishery Management Councils.

PMFC vigorously advocated restoration of Federal funding for operation of the NOAA research vessel OREGON, which had been ordered decommissioned as obsolete. Congress concurred; restored the funds, and directed that the OREGON remain in service until a replacement vessel was brought on line.

ACTIVITIES IN SUPPORT OF OBJECTIVES DISTINCT FROM THOSE OF THE REGIONAL COUNCILS

a. Consultant to NOAA's Marine Fisheries Advisory Committee (MAFAC);

By special action of the NOAA Administrator, the executive directors of the three interstate mar ne fisheries commissions have been designated consultants to NOAA's Marine Fisheries Advisory Committee (MAFAC), and as such are full participants in MAFAC reviews and discussions of fisheries issues. 1977 meetings took place in February, May, and October in Washington, D.C

Principal ssues addressed by MAFAC in 197.7 included:

- reviews of Eastland Fisheries Survey recommendations and correlation with the National Plan for Marine Fisheries and its implementation document: *A Marine Fisheries Program for the Nation* (cf. b. following; also review of actions on PMFC Resolution 1, p. 16 of this Annual Report);

- continued monitoring of NMFS operations under extended jurisdiction;

- overview of Regional Fishery Management Council operations as reflected in reports provided by each Council;

- tuna-porpoise and other marine mammal problems (cf. also review of actions on PMFC Resolutions 9 and 10, p. 21);

- "joint ventures" for foreign processing of fish harvested by U.S. fishermen in the Fishery Conservation Zone (reviewed by a special MAFAC subcommittee);

- recreational marine fisheries problems (subcommittee review and recommendations);

- consumer affairs (subcommittee review and recommendations).

West Coast members of MAFAC during 1977 were:

Dr. Donald E. Bevan, Seattle, Washington
E. Charles Fullerton, Sacramento, California
Dennis A. Grotting, Eureka, California
Edward G. Huffschmidt, Lake Oswego, Oregon
Ronald J. Jensen, Monroe, Washington
Edward P. Manary, Olympia, Washington
Or. Stephen B. Mathews, Seattle, Washington
Guy R. McMinds, Taholah, Washington
Mary Depoe Norris, Seattle, Washington
Kathryn E. Poland, Juneau, Alaska
Dr. Haakon Ragde, Seattle, Washington
Elmer E. Rasmuson, Anchorage, Alaska
Oliver A. Schulz, San Francisco, California
Clement Tillion, Juneau, Alaska

Dr. Robert B. Weeden, Fairbanks, Alaska

Melvin H. Wilson, Los Angeles, California

Charles C. Yamamoto, Honolulu, Hawaii

b. *Federal* fun-ding for fisheries *research and* management:

PMFC aggressively supported augmented funding for Federal grants-in-aid to the States under the Commercial Fisheries Research and Development Act of 1964 (P.L. 88-309) through two campaigns in 1977-78.

1) Support for Congressional extension of the Commercial Fisheries Research and Development Act (P.L. 88-309) and for doubling of authorized funding levels to:

- $10 million for Section 4a (general)
- $4 million for Section 4b (disaster relief)
- $0.5 million for Section 4c (new fisheries)

Congress approved this measure (H.R. 6206) in early 1977, and the President signed it into law (P.L. 95-53).

2) PMFC campaigned throughout 1977-78 for increased funding under this new authorization beyond the level-funding which has prevailed since 1970.

c. Completion of *the Eastland Fisheries Survey:*

Two documents published in 1977 summarized nearly two years of work on the Eastland Fisheries Survey. PMFC's area of responsibility was Western United States (including Hawaii and the Pacific Island Territories). The Gulf States Marine Fisheries Commission surveyed States bordering the Gulf of Mexico; the Atlantic States Marine Fisheries Commission was responsible for the Atlantic States and for general supervision of the Great Lakes survey.

The Eastland Fisheries Survey was commissioned by the United States Congress and funded by a special Congressional appropr ation of $500,000, PMFC's share of that funding was $125,000. 1977 imp' ementing actions are reviewed in the summary on actions supporting PMFC Resolution 1 which also lists the two publications describing the Survey in detail (p. 17 of this report). A tabular review of Pacific coast priorities for action is provided in Appendix 3.

d. *Internal interactions of PMFC on fisheries issues of importance:*

PMFC's secretariat continued to place high priority on effective communications and interactions among all components of PMFC structure -- agency Directors and Commissioners, scientific and management staff, and constituent Advisors -- concerning issues and problems of regional concern. This priority reflects solid commitment to PMFC Objective 1, to provide energetic leadership in recognizing and resolving fishery problems.

International Pacific Halibut Commission.

The International Fisheries Commission, later to be renamed the International Halibut Commission (IPHC) was established in 1923 by a Convention between Canada and the United States for the preservation of the halibut (*Hippoglossus stenolepis*) fishery of the North Pacific Ocean and the Bering Sea. The Convention was the first international agreement providing for joint management of a marine resource. The Conventions of 1930 and 1937 extended the Commission's authority and the 1953 Treaty specified that the halibut stocks be developed and maintained at levels that permit the maximum sustained yield.

Three Commissioners are appointed by the Governor General of Canada and three by the President of the United States. The Commissioners appoint the Director who supervises the scientific and administrative, staff. The scientific staff collects and analyzes statistical and biological data needed to manage the halibut fishery. The headquarters and laboratory are located on the campus of the University of Washington in Seattle, Washington. Each country provides one-half of the Commission's annual appropriation.

The commissioners meet annually to review the regulatory proposals made by the scientific staff and the Conference Board which represents vessel owners and fishermen. The regulatory alternatives are discussed with the Advisory Group composed of fishermen, vessel owners, and processors. The regulatory measures are submitted to the two governments for approval. Citizens of each nation are required to observe the regulations that are adopted. The preceding description of the IPHC was taken from the IPHC Annual Report, 1977, 1977).

Bernard Skud, Director of the Commission from 971 to August 1978, expressed his feelings on the future of the ha ibut fishery in the Director's Report found in the 1977 Annual Report for the IPHC.

> The North American longline fleet cannot expect to attain the former peak production of 70 million pounds because of present-day losses to trawl and pot fisheries. However, in the future years, an annual sustained yield of 40 million pounds is probable, providing restraint is exercised and catch quotas are not raised too soon.

Since the Commission is presently designated as the lead agency in the development of the Halibut Management Plan by the North Pacific Fishery Management Council and since IPHC management directives for hal but are strictly b ological in focus, a target harvest of 18,100 MT (40 million pounds) ". . in future years" can be taken as a major policy goa of the Commission.

The Fisheries Conservation and Management act of 1976 required that the Secretary of State renegotiate any treaty pertaining to fishing within the U.S. 200 mile fishery conservation zone. The negotiations between the U.S. and Canada with respect to the IPHC have recently resulted in a tentat ve agreement. With respect to the halibut fish ng in the Gulf of Alaska the relevant aspects of the proposed treaty are that:

1. The IPHC will remain in existence until at least April 1981.

2. Canadian catch in Alaskan waters will be limited to 2 million pounds and then 1 million pounds during the 1979 and 1980 halibut seasons respectively.

3. Canadians will be excluded from U.S. fishing grounds beginning with the 1981 season.

The limitations on Canadian catch in the Gulf of Alaska (including Southeast Alaska) will not, however, tend to have a major effect on landings in Western or Northern Gulf parts since historically there has not been a significant difference between the proportions of U.S. catch and total catch in Area 3 landed n these parts.

Either country can term nate the IPHC with two years notice, therefore the future of the IPHC beyond 1981 is not known; but it is believed that the forces that resulted in its survival in the past set of negotiations wil prevail in the future. These forces include the mutual benefit of international management of an international fishery resource.

MARKET ENVIRONMENT

This section contains a description of the market environment in which the commercial fishing industry is expected to operate during the remainder of this century. It includes assumptions concerning the structure of the fishery industry, the availability of inputs and the rate of technical progress.

FINANCING PROGRAMS AVAILABLE TO COMMERCIAL FISHING VENTURES

Besides commercial bank financing, there are eight other programs available for financing fishing operations as well as a capital construction fund program available through the National Marine Fisheries Service (NMFS). In addition, Alaska Fisheries Development Corporation has been granted a block of SK funds through NMFS to help mitigate risk in the development of the bottomfishery in the waters off Alaska. A brief description of each of these programs will now be given.

The Federal Farm Credit System offers lending programs to fishermen through the Bank for Cooperatives and Production Credit Associations.

Bank for Cooperatives (BC), as its name implies, requires _bona fide_ corporative organizations to qualify for loans. BC provides a full range of credit services requiring 40 percent equity at money market rates with a margin of .5 to 1.0 percent.

The Production Credit Association (PCA) extends short and intermediate credit services to individual borrowers. Maximum term is seven years with a three-year extension possibility. PCA requires a 50 percent equity on loans for used vessels.

The Alaska Commercial Fishing Loan Act (A.S. 16.10.300 - A.S. 16.10.370) provides for loan funds available to individual fishermen through the Alaska Department of Commerce and Economic Development. Loans are available up to $150,000 at an interest rate not to exceed seven percent for a term of up to 15 years.

The Alaska Small Business Loan Program extends credit to resident individuals (one year) or corporations (head-quartered in Alaska) engaging in small business operations. The loan ceiling is $300,000, with 25 percent equity at 8.0 percent interest for up to 15 years.

The Fishing Vessel Obligation Guarantee program is administered by the National Marine Fisheries Service and provides loans for construction, reconstruction or overhaul of vessels over 4.5 MT (five net tons) in weight. Gear integrally a part of an operating vessel, is included. The loan will cover up to 75 percent of cost and fishermen pay a .75 percent charge on the outstanding balance. Conditional fisheries in Alaska (salmon and crab) are not eligible. The Farm Credit System and NMFS have reached an agreement whereby the vessel loan guarantee could be used with PCA loans.

Under moratorium since 1973 is another NMFS loan program, the Fisheries Loan Fund. Author zed by the Fish and Wildlife Act of 1956 as amended, the Fund made secured oans up to $40,000 at eight percent interest for a maximum'term of 14 years if the applicant had no other source of funding. Alaska fishermen s· ill had $91,000 in loans outstanding as of October 1977. Draft legislation was under development as of the same date to revive the Loan Fund as a more comprehensive fisheries development financing program.

NMFS also administers a Fishing Vessel Capital Construction Fund (CCF). The CCF allows fishermen to save taxable income for construction, reconstruction or (under limited circumstances) acquisition of fishing vessels by deferring federal tax payments on program accounts. This, in effect, constitutes an interest-free loan from the government.

The Community Economic Development Corporation (nonprofit) extends credit at low interest rates to rural Native fisheries development businesses who are otherwise not considered creditworthy by other institutions. The Corporation is funded by a grant from the Office of Economic Development, Community Service Administration.

Commercial banking institutions also provide vessel financing for up to 75 percent of construction costs or 60 percent on used vessel acquisition. Financing duration is seven to ten years at a current interest rate of between 11.0 and 11.5 percent.

Alaska Fisheries Development Corporation has been chosen to receive federal SK funds administered through the National Marine Fisheries Service for Technical Assistance, demonstration projects and scientific stock assessment work on groundfish in Alaska waters.

Representatives of the Federal Intermediate Credit Bank and the NMFS Financial Assistance Division indicate that capital is currently seeking investment opportunities in the Alaskan and Pacific Northwest fishing industry. Much of the current boat construction is being financed by surplus cash flow from within the industry. The Capital Construction Fund is a common vehicle for accomplishing this internal financing.

The current capital market situation is in marked contrast to the situation of ten years ago when the internal return on investment and surplus cash flow was somewhat below that of agriculture. and other natural resource based industries[12]. It might be assumed that capital will be available to meet growth needs of the industry for loans of 15 years or less at the prevailing interest rates. Several financial experts concur in this assumption.

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[12] Smith, Fredrick J., September, 1971. "Economic Condition of Selected Pacific Northwest Seafood Firms," Experiment Station Bulletin Special Report No. 27, Oregon State University.

A probable explanation of the increased availability of financing for fishing vessels is the change in property rights to fishery resources that has occurred in the past few years. Both the Fisheries Conservation and Management Act and the implementation of the limited entry- programs in Alaska have done much to increase fishermen's rights to particular resources and thus to increase their ability to borrow investment funds. The former gives domestic fishermen the exclusive right to resources within the 200 mile zone as soon as they are prepared to harvest them and the latter gives those who receive the limited number of gear permits the exclus've right to commercially harvest Alaska salmon and/or herring.

New Boats

The major capital good required for the growth of the Gulf of Alaska fishing industry will be boats capable of harvesting groundfish and pelagic species. The ability of domestic boat yards to meet the annual demand for new boats to be used in the traditional Alaska fisheries has been well established; and since the demand for such boats is not expected to exceed that of the past few years it is believed that the growth of the traditional fisheries will not be constrained by boat yard capacity.

However, the ability of the U.S. boatbuilding industry to produce trawlers in excess of 27.4 meters (90 feet) LOA in adequate numbers is uncertain. Five major boat builders--Marco, Seattle, Washington; Martinac, Tacoma, Washington; Bender, Mobile, Alabama; and Desco and St. Augustine Trawlers--were questioned regarding their capacity and plans for capacity expansion, Four of the five were optimistic that they could meet the increasing need. One (Martinac) was constricted on space and expansion of capacity would be a major undertaking.

The combined current capacity of these five yards is in excess of 30 boats over 27.4 meters (90 feet) in length, per year and Martinac estimates the industry could build 150 new boats per year in the 27+4-36.6 meter (90-120 foot) class with present facilities. Although the Alaska will net be the only source of demand for new vessels it is expected to be the major source since for the remainder of the U.S. the existing fleets are capable of harvesting the entire allowable catch inside the 200 mile zone including current foreign allocations (Keen, 1978).

If the present facilities prove inadequate there are three potential sources of additional boat building capacity. The yards that have traditiona' ly built fishing boats could expand their capacity; the ability of these yards to expand capacity is demonstrated by the over 300 percent increase in capacity of the Hillstrom Shipbuilding Company in Coos Bay, Oregon during the past year and the expansion of the Patti Boatbuilding Industries boat yard in Pensacola, Florida to allow the construction of steel fishing vessels. Both yards are currently building vessels of 26 to 42 meters (85-135 feet) for Alaska fisheries, (Fishing News International, April 1979). Foreign vessels and foreign shipbuilding capacity could be made available to U.S. fisheries through a change in the Jones 'Act; such a change might become politically feasible if the U.S. yards could not meet the demand for new vessels. And finally, boat yards that have not built fishing boats could begin to do so. Examples of such boat yards would include those that are currently building boats under Navy contracts and those currently building offshore oil supply boats. The ability of the latter to build fishing boats is demonstrated both by a supply boat yard, which recently constructed a modified revision of its standard supply boat to be used as a catcher/processor in the Alaska crab fisheries and by the conversion of a supply boat for the use in the same fisheries (National Fisherman, March, 1979). The ability of non-fishing boat yards to serve the fishing industry is further evidenced by the Foss Shipyard in Seattle which until last year concentrated on the maintenance of the Foss tug boat fleet. The Foss yard does not now build fishing boats but it converts boats into fishing boats (National Fisherman, July 1978).

To determine whether boat yard capacity will tend to constrain the development of the Alaska groundfish fishery it is necessary to speculate about the probable rate of growth of the fishery as well as about boat yard capacity. The Alaska groundfish fleet is expected to consist of over 400 vessels by 2000 but the growth of the fleet is not expected to exceed 25 boats per year until the mid-1990s. The largest addition to the fleet is expected to be over 100 boats and is projected to occur in 1999. It is believed that the ability of boat yards to increase the supply of new vessels and the nature of the projected growth of the Alaska groundfish fleet will prevent boat yard capacity from constraining the projected long-term development of the groundfish fishery and/or the projected long-term growth of the traditional fisheries. This does not mean that a prospective boat owner will be able to walk into any boat yard and expect to have work on the boat begun immediately, rather it means that the prospective boat owner can find a boat yard that can build the desired boat within one to two years.

Processing Equipment

A large proportion of domestically used seafood processing equipment is purchased from foreign manufacturers. These manufacturers have demonstrated considerable resilience and flexibility in the past. Although foreign manufacturers of processing equipment were not interviewed directly, there are indications that their ability to manufacture and supply processing equipment will match the industry's needs for the next 20 years.

Perhaps a more significant factor is the existence of a large agricultural food processing equipment manufacturing capability in the U.S. Several of these U.S. firms have experimented with the production of seafood processing equipment but have been unable to compete with the foreign manufacturers--not because of lack of capacity, but because of lack of experience with the product.

One expert felt that the major bottleneck in seafood processing would be the ability of the domestic manufacturing industry to understand the difference between "peeling potatoes" and "skinning a pollock."[13]

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[13] Personal communication with John Peters, Food Technologist, University of Washington.

In the absence of mergers or joint ventures, any equipment manufactured domestically will have to go through a development period already completed by foreign manufactured equipment.

Another problem w ll be the inclination (or lack thereof) of processors to employ a technical expert in their plants. The present approach is to get by with a "shade tree" mechanic who barely keeps the equipment operating. Performance of processing equipment will suffer until this approach is changed.[14] In general, it does not appear that capital goods manufacturing capacity will be a significant deterrent to fishery development in Alaska.

Labor

With respect to the supply of labor, the commercial fishing industry is in a relatively favorable position because its current labor requirements are primarily for seasonal and unskilled labor. Due to both the relatively high wages unskilled workers currently receive in the commercial fishing industry and the high unemployment rate for seasonal and unskilled labor in the U.S., there is, for all practical purposes, an unlimited supply of unskilled labor during the summer months. The industry wage is expected to remain above the minimum wage and high rate of unemployment for unskilled labor in the U.S. is expected to continue, therefore it is assumed that sufficient labor will be available during the summer months to meet the requirements for unskilled abor both on fishing vessels and

[14] Personal communication with Bob Pr ce, Food Technologist, University of California at Davis.

in fish processing plants. The availability of unskilled labor for fishing boats is further demonstrated by boat owners' reports of receiving several letters a week from individuals seeking employment on a fishing boat.

However, the supplies of skilled skippers and year round labor are limited. The spotty record of success of domestic skippers entering new fisheries (e.g. hake and pollock in the Pacific Northwest) suggests that upon entering a new fishery, it takes time for a skipper to learn how to use gear, find fish, and generally become proficient. But once a new fishery begins to develop, the crews of the boats in the developing fishery provide a potential souce of new skippers. For example, if out of a crew of five, including the sk· pper one crew member is capable of becoming skipper the following year the number of skippers can increase . by 100 percent a year-. The rate of development projected for the groundfish fleet would require this to happen in about one out of every four crews.

The availability of adequate year round labor is dependent to a significant degree on the availability of low income housing. Typically there is insufficient low income housing in the Alaska fishing communities of the Gulf of Alaska to meet the current demand and unless substantial increases in housing occur the development of a year round fishery with onshore processing dependent on a permanent labor force will be limited. The development of a year round groundfish fishery may, however, be possible in the absence of housing adequate for a permanent work force. The problem of an inadequate local labor force due to the absence of adequate housing can be reduced by increasing the amount of processing which occurs aboard fishing boats and by using self contained floating processors to reduce the local labor requirement, and/or by rotating a work force in and out of an area to reduce the housing requirements. The State of Alaska is also aware of the housing problem and is at least considering possible remedies.

Whether or not the availability of skippers and/or the size of the permanent " ocal force hinder the development of the commercial fishing industry w· 11 depend on both the rate at which the industry and its labor requirements expand and the extent to which the expansion can be planned for. This is, of course, true for the other inputs.. If the development is steady and thus the input requirements become predictable, the increases in requirements can effectively be planned for and fewer bottlenecks will occur, The development of the groundfish industry is expected to be gradual enough that it can be well planned.

Technology

Predicting technological breakthroughs in the fishing industry is risky at best. Attempting such a prediction for 20 years into the future is a blind plunge into uncertainty.

After consulting with nine technology experts, a rather clear historical pattern emerges. The domestic industry has usually taken up to 20 years to adopt available technology. For example, mid-water trawling techniques have been well developed for 20 years, yet domestic fishermen are only now beginning to adopt this technique. Net transducers have been available for 20 years, but not generally used by domestic fishermen until very recently. Exceptions are notable because they are so rare (i.e., the much publicized power block).

There are, however, factors at work that may tend to change the role the U.S. fisheries have had as followers and slow adopters of harvesting and processing technology. The increased property rights of domestic fishermen to U.S. fishery resources and the opportunities for more assured sources of fish for processors due to the FCMA and the Alaska limited entry and resource enhancement programs have decreased the uncertainty historically associated with the commercial fishing industry and thus have increased the incentive for innovation and/or , more rapid adoption of available technology. Although major changes in harvesting and processing methods will perhaps be more possible in the future than they were in the past, it is not possible to predict what the timing and/or nature of such changes will be; it is, therefore, assumed that due to technical progress, the gradual replacement of labor with capital and economies of scale and regularity of operations, output per unit of labor will increase by two percent a year and that no technological breakthroughs that would radically transform harvesting or processing methods will occur.

Transportation

As the Alaska commercial fishing industry has grown and expanded into new fisheries and as the industry's demand for transportation has increased, it has become increasingly apparent that adequate transportation to obtain needed supplies and to move processed fish products to markets is critical to the development of the industry. This section briefly discusses the dominant characteristics of the transportation system used by the commercial fishing industry and considers the transportation system's potential for providing the increased services that would be required by the expansion of traditional fisheries and the development of an Alaska groundfish industry,

Generally, Alaska fish processing plants do not have large storage capacity, therefore transportation services for processed products are required at frequent intervals. Most Alaska seafood products are shipped in refrigerated truck-trailer vans that are loaded aboard seagoing freighters for reprocessing in the Seattle area or Japan. The direct containerized shipments to Japan began in the Spring of 1979 and are expected to become increasingly important. The vessels serving Alaska from the Seattle area are typically capable of carrying 6,208 metric tons (13.7 million pounds) of processed fish. This capacity figure is based on a freighter carrying 365 vans from 35 to 40 feet in length and holding 35,000 to 40,000 pounds of processed fish and is typical of the Sealand freighters serving Alaska from Seattle. The direct containerized shipments to Japan were initiated by Sealand and American President

Lines (APL). Kodiak and Unalaska/Dutch Harbor will be the initial ports of call and will be serviced by each company approximately once every three weeks. The three week schedule can be provided by one vessel allowing for delays due to maintenance, bad weather, and other circumstances that might prevent one vessel from providing more frequent service. The Sealand freighter serving the direct Alaska-Japan route is smaller than those that typically service Alaska from Seattle; it has a capacity of approximately 2720 metric tons (6 million pounds), (i.e., 172 vans of 35 feet in length); however by mid 1979 Sealand expects to replace this freighter with one capable of transporting 4,445 metric tons (9.8 million pounds), (i.e., 280 35-foot vans). APL has indicated that it will use a smaller freighter capable of carrying 60 vans to service its Alaska-Japan route. *

APL's plans to provide direct service from Kodiak to Japan have temporarily been complicated by Sealand's long term contract for preferential use of the containerized cargo pier and equipment in the port of Kodiak.

The ability of the transportation system to respond to growth in the commercial fishing industry is demonstrated by the interest several fre ght companies have shown in providing service to Kodiak and comments by a Sealand representative indicating that the service to any port can rapidly be increased by contracting the services of available freight vessels. Tine need for increased cargo handling equipment and docking facilities is minimized by the use of onboard cranes.

The industry's demand for transportation services will continue to increase due to enhancement and/or management programs for the traditional fisheries and the expansion of the industry into new fisheries. However, as the following model indicates even a facility capable of loading or unloading only one vessel at a time has a very large freight handling capacity. Industry sources indicate that a vessel can be unloaded and/or loaded in one day; therefore assuming freighters with a capacity of 6,200 metric tons (13.7 million pounds), 2,253,000 metric tons (5 billion pounds) of freight could annually go through a port facility capable of handling one vessel at a time. Allowing for days lost due to bad weather, breakdowns, and days in which the port facility is occupied by vessels that are not servicing the commercial fishing industry, perhaps 200 days per year would be available to the industry; in that case, 1,240,000 metric tons (2.7 billion pounds) of processed fish products could be handled a year. This capacity is in excess of the processed fish products that are expected to be shipped out of Alaska in any one year before the end of this century; the foregoing analysis therefore suggests that the transportation system can rapidly respond to the increases in fish processing that are expected to occur by the year 2000.

For the Alaska commerical fishing industry, air freight is the only viable transport alternative. However, due to both the cost advantages of shipping by sea and the good storage characteristics of frozen fish products, air transportation is used almost exclusively to serve the markets for fresh fish products. At the present time fresh fish products account for a relatively small part of Alaska seafood production. The availability of airports capable of handling jet transports, the current underutilization of these airports, and the excess capacity in the air transport industry should allow a rapid response to increases in the demand for air transportation services.

Many factors will determine whether the transportation systems will be adequate for the expected growth in the commerc· al fishing industry. The growth of both the commercial fishing ndustry and other industries such as agriculture and mineral extraction and the resulting growth in the rest of the economy will generate increased economic activity that may compete for the available transportation services and/or provide the impetus for improved transportation services for all users. Since economies of scale exist in transportation, the latter effect will tend to dominate in the long run, and the short run transportation bottlenecks that occur will not tend to limit the long run development of the industry.

Market Arrangements

Research at Oregon State University indicates that traditional market arrangements and the resulting distribution of risk between the harvester and processor may be a major deterrent to fishery growth in Alaska.[15]

In invest" ng in the exploitation of a new fishery the boat owner retains a high degree of flexibility He can switch from fishery to

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[15] Martin, John B. 1978. "An Eva' uation of the Economic Feasibility of Pollock Processing in Southeast Alaska." MS Thesis, Oregon State University.

fishery in Alaska depending upon relative profitability. He can also fish in other geographic locations and deliver wherever he wants.

The processor, however, must make an investment in inflexible and fixed-in-place processing capability and in market development. The market development investment may be as risky as the capital facilities, If the market development effort succeeds, the initial investor must compete successfully with other entrants to reap the benefits of that initial investment. If the effort fails, the initial investor is the sole bearer of the total development cost.

Fishery development in Alaska may, therefore, be constrained until market arrangements between harvester and processor are modified to more equally distribute the risks and benefits of investing in a new fishery. Delivery contracts between harvesters and processors provide one way of doing this.

Implications of Market Concentration

Alaska Sea Grant Report 78-10, "Market Structure of the Alaska Seafood Processing Industry by F. L. Orth, et al., provides a summary table of the level and trends in market concentration by geographic region and species (see Table B.71). The study was primarily a descriptive work, a prodigious task in itself, but there are some general implications derived for Alaska as a whole.

TABLE B.11

LEVEL AND TRENDS IN MARKET CONCENTRATION, SUMMARY[1]

Species	Final Product Market		Resource Markets: Southeast		Central		Western		AYK	
	Current*	Change[3]	Current[2]	Change[3]	Current[2]	Change[3]	Current[2]	Change[3]	Current[2]	Change[3]
Finfish										
Hal ibut	H	↑	H	↑	VH	n.c.				
Herring	H	n.c.	VH	n.c.	H	↓	VH	n.a.		
Salmon	M	n.c.	M	n.c.	M	net.	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.				

[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. = Not Applicable.

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

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

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 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 (e.g., 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. (Orth, et al., 1978)

Community specific implications of market concentration and its future effects, if any, on amount and type of seafood product output in those communities would be difficult to derive without extensive additional research. The remarks for the state as a whole can, however, be applied in general terms to each of the communities under examination in this report.

The following section deals with Japanese ownership in Alaska Seafood Processing. It appeared in Alaska Sea Grant Report #78-12, "United States Market Demand and Japanese Marketing Channels for Tanner Crab" by A. H. Gorham and F. L. Orth.

<u>Japanese Investment in Alaska Seafood Processing</u>

One of the prerequisites to economic development s mobility of capital; the fishing industry is no exception. Viewed from this perspective, Japanese investment in Alaska fisheries has been a healthy, , if not essential, ingredient. However, there are market power implications associated with foreign ownerships that have probably made it the most controversial area of domestic fisheries policy toward foreign countries.

The potential for enhanced market power from foreign investment derives from three situations:

1. Explicit concentration in the domestic seafood processing industry is already high in some areas of the state. Ownership interties among domestic firms increases actual concentration to much higher levels. Add investments by a large Japanese fishing or trading company in several

2. Accompanying investment in Alaskan companies has been the opening of new markets. Thus it could be argued, for example, that although the market power of Japanese companies kept Tanner crab prices lower than Alaska fishermen perceived to be equitable (in view of prices to Japanese fishermen, retail market prices in Japan, etc.) such investment at least created opportunities to fish at a profit where none existed before. It was, of course, this differential in raw product prices that created the incentive to invest in the first place.

There is no “right” side to the above arguments. Which set of forces have been the most pervasive has differed by fishery, location, and time.

The following table shows Japanese investment as of November 1977, Two sources of irritation that have faced users of such information in the past have been that it remains current for only a very short period of time and it is always possible to find another set of figures that are different. The figures shown in Table 3.[illegible] are the most current available but they do not totally solve these problems. They were obtained directly from Japanese companies and are only as representative of the actual investment situation as the process of collection allowed. However, the timing of the survey coincided with the Council’s deliberations on foreign allocations of Tanner crab, and the companies appeared to be going out of their way to be cooperative. In several cases where a Japanese company could not be interviewed, information was included from other sources which are noted.

In addition to the question of ownership interties between Japanese and Alaskan companies, there remains the question of interties among

Japanese companies themselves. To gain insight into this area, Clinton Atkinson was requested to review pertinent government statistics and the annual reports of major Japanese companies. Table 3.73 shows the resultant information. The overriding impression from these statistics is that ownership interties do exist but they appear to represent financial rather than primary or controlling type investments. The implication is that management participation at the level of detail necessary to overtly or tacitly collude would be nonexistent or minimal.

TABLE B.72

REPORTED JAPANESE INVESTMENT IN ALASKA, NOVEMBER, 1977

COMPANY	INVESTMENT	LOCATION	%	OTHER INVESTORS	%
Taiyo Gyogyo K.K. (Fishing Co.)	Taiyo American, Inc.	New York	100		
	Western Alaska Enterprises, Co.[1]	Seattle	100 (91% Taiyo Gyogyo and Taiyo American 9%)		
	B & B Fisheries, Inc.	Kodiak	100 (100% Western Alaska Enterprises)		
Kyokuyo Co., Ltd.	Kyokuyo, U.S.A.[2] Inc.	Seattle	100		
	Whitney Fidalgo[3]	Seattle, Alaska	99		
	Mokuhana Fisheries	M/V Mokuhana	25 (Whitney-Fidalgo)	Individual	75
	Nefco-Fidalgo Packing Co.	Ketchikan Cannery	50 (Whitney-Fidalgo)	NEFCO	50
	Atlas Fish Products, Inc.	Seattle	100 (Whitney-Fidalgo)[4]		

[1]Engaged in import-export of fishery products.

[2]Engaged in import and export of fishery products.

[3]Plants located in Seattle (H.Q.), Anacortes, Anchorage (2), Cordova, Kodiak, Dutch Harbor, Homer, Ketchikan, Naknek, Petersburg, Port Graham, Unalaska, Uyak Bay, and Whittier.

[4]Bait salmon egg production - eggs supplied by Whitney-Fidalgo.

TABLE B.12 Continued

COMPANY	INVESTMENT	LOCATION	%	OTHER INVESTORS	%
	Emerald Fisheries, Inc.		50		
	Whitney International				
Nichiro Gyo-gyo, Ltd. (Fishing CO.)	Orca Pacific Packing CO.	Cordova	30[5]	Mitsubishi NEFCO	20 50
	Sand Point Packing CO.[6]	M/V Smokwa	30	Mitsubishi NEFCO	20 50
	Hilton Seafoods Co.		40	Mitsubishi NEFCO	10 50
	Adak Aleutian Processors	Adak	30[7]	Hawaiian Fish Co. Individual Alaska Food of Tokyo	20 30 20
	Nichiro Pacific, Ltd.[8]	Seattle	100		
Nippon Suisan (Fishing Co.)	Universal Seafoods, Ltd.	M/V Unisea (Dutch Harbor)	47	Two individuals[9,10,12] Individual[10,12]	47 6

[5] 22% Nichiro, 8% Nichiro Pacific.

[6] Merged into Orca Pacific Packing Co; first moved floater from Sand Point to Cordova, then sold, 1975.

[7] Sold to Whitney-Fidalgo in September, 1977, crab production only; did not retain identity.

[8] A wholly owned subsidiary engaged in import-export of fishery products.

[9] Associated with Vita Seafoods.

[10] Associated with Intersea Fisheries, Ltd., New York.

TABLE B.72 Continued

COMPANY	INVESTMENT	LOCATION	%	OTHER INVESTORS	%
	Dutch Harbor Seafoods, Ltd.	M/V Galaxy (Dutch Harbor)	25	Two individuals[10,11] Two individuals[10,11] and one individual[12] Investing group	20 30 (ten each) 25
	Intersea Fisheries, Ltd.	New York	30	Individual[11,12] Two individuals[9,11,12] Individual[11,12]	21.67 44 5
	Morpac, Inc.	Cordova	46	Mitsui Individual	46 8
	Nippon Suisan, U.S.A.[13]	Seattle	100		
Marubeni K.K. (Trading Co.)	Marubeni Alaska Seafoods, Inc.	Juneau	100	Subsidiary for NEFCO J/V Egegik	
	North Pacific Processors[14]	Seattle[15]	50	Individual	50
	Kodiak King Crab[14]	Kodiak	49.9	Wash. Fish & Oyster	50.1[16]

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[11] Associated with Universal Seafoods

[12] Associated with Dutch Harbor Seafoods

[13] Engaged in import-export

[14] About 1/3 of Marubeni Tanner crab supplied through these sources.

[15] Plants in Kodiak, Cordova, and Seattle.

[16] As reported in other sources, 8.4 percent of this fiqure is owned by Ocean Beauty Seafoods, Inc., a company wholly owned by American interests.

TABLE B.14 Continued

COMPANY	INVESTMENT	LOCATION	%	OTHER INVESTORS	%
	Juneau Cold Storage	Juneau	Division of Kodiak King Crab (thus 49%)		
	Wards Cove Packing co.	Ketchikan Bristol Bay	10[16]		
	Alaska Pacific Seafoods	Kodiak	(Subsidiary of North Pacific Processors, thus 50%)		
	Kodiak Fishing Co.[17]	Kodiak	25	Washington Fish & Oyster	75
	Bering Sea Fisheries	M/V Bering Sea	24	Individual	76
	Togiak Fisheries, Inc.	Bristol Bay	100[21]		
	Cordova Bay Fisheries[18]	Cordova	(Subsidiary of Kodiak King Crab, thus 49%)		
Mitsubishi Shoji K.K. (Trading Co.)	Orca Pacific Packing Co.	Cordova	20	Nichiro Gyogyo, Ltd. NEFCO	30 50
	Sand Point Packing	M/V Smokwa	20	Nichiro Gyogyo, Ltd. NEFCO	30 50
	Hilton Seafoods Co.		10	Nichiro Gyogyo, Ltd. NEFCO	40 50

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17 Main purpose of investment is to secure salmon roe production.

18 Fishing and tender boat operation.

19 In Southeast Alaska, near Hidelberg, Alaska.

20 Merged into Orca Pacific Packing co.

21 Reported in other sources that Marubeni percentage ownership is 89.6 percent.

TABLE E.12 Continued

COMPANY	INVESTMENT	LOCATION	%	OTHER INVESTORS	%
Mitsui Bussan K.K. (Trading Co.) co.)	Morpac	Cordova	46	Nippon Suisan Morgan	46 8
Itoh Chu Shoji K.K. (Trading Co.) or C. Itoh	New Northern Processors	Kodiak Dutch Harbor	50 (Sold interest in 1977)		

SOURCE: Interviews with Japanese companies, or as noted.

TABLE B.13

MAJOR OWNERS OF THE LEADING JAPANESE FISHING AND TRADING COMPANIES (NOVEMBER 1977)

Name of Shareholder	Type of Company	Percent Shares Owned: Fishing Companies: Taiyo Gyogyo	Nippon Suisan	Nichiro Gyogyo	Kyoku-yo	Hokoku Suisan	Trading Companies: Maru-beni	Mitsui	Mitsu-bishi	C. Itoh	Itoh-man
Asahi Kasai Kogyo KK	Chemicals										2.29
Asahi Seimei Hoken Sogo Kaisha	Life Insurance	2.33								3.71	
Dai-ichi Kangyo Ginko	Bank		3.22						2.45	8.68	2.50
Dai-ichi Seimei Hoken Sogo Kaisha	Life Insurance		2.80				3.00				
Daitatsu Kogyo KK	Manufac-turing					0.50					
Daito Tsusho KK	Trading	8.84									
Daiwa Ginko	Bank				7.54						
Daiwa Shoken KK	Securities		2.96								
Fuji Ginko	Bank		2.22				7.26	4.96		3.25	
Hayakane Sangyo KK	Industrial	4.84									
Hayakane Zosen	Shipyard	3.40									
Hikasekune Ichiro	Individual					0.40					
Hitachi Zosen	Shipyard				3.37						
Hokkaido Takushoku	Bank			3.77							
Itoh Hiroshi	Individual										1.77

TABLE [illegible] Continued

Name of Shareholder	Type of Company	Percent Shares Owned: Fishing Companies: Taiyo Gyogyo	Nippon Suisan	Nichiro Gyogyo	Kyoku-yo	Hokoku Suisan	Maru-beni	Trading Companies: Mitsui	Mitsu-bishi	C. Itoh	Itoh-man
Iwatani Kagaku Kogyo KK	Chemicals					1.75					
Iwatani Naoji	Individual					2.50					
Marubeni	Trading				5.27						
Meiji Seimei Hoken Sogo Kaisha	Life Insurance			3.37					4.49		
Mitsubishi Denki	Electric Industry								1.96		
Mitsubishi Ginko	Bank								7.61		
Mitsubishi Jukogyo	Heavy Industry Industry								5.20		
Mitsubishi Shintaku Ginko	Bank	2.00	2.00	2.74					3.78		
Mitsubishi Shoji KK	Trading		2.53								
Mitsui Bussan Ju-gyoin Shintaku	Employee's Mutual							1.78			
Mitsui Ginko	Bank							6.29			
Mitsui Seimei Hoken Sogo Kaisha	Life Insurance							3.30			
Mitsui Shintoku Ginko	Bank		1.89		3.17			2.79			
Nakabe Kenkichi	Individual	3.46									
Nakabe	Individual	2.40									

TABLE E.13 Continued

Name of Shareholder	Type of Company	Percent Shares Owned: Fishing Companies: Taiyo Gyogyo	Nippon Suisan	Nichiro Gyogyo	Kyokuyo	Hokoku Suisan	Trading Companies: Marubeni	Mitsui	Mitsubishi	C. Itoh	Itohman
Nakamura	Individual					0.39					
Nippon Choki Shinyo	Financial			1.70	4.21						
Nippon Chozen Kinyu KK	Bank			2.79							
Nippon Kasai Kaijo Hoken KK	Fire/Marine Insurance						2.82			3.18	
Nippon Kogyo Ginko	Bank	2.00	4.00	1.89							
Nippon Seimei Hoken Sogo Kaisha	Life Insurance	2.38	3.15	4.07			2.71	1.64		3.96	
Nippon Suisan KK	Fisheries					73.32					
Nippon Yusen KK	Steamship Company								2.37		
Nisho Boseki KK	Textiles										3.14
Nissan Jidosha	Automobiles						4.41				
Nissan Kasai Kaijo Hoken KK	Fire/Marine Insurance		6.00								
Osaka Shosen Mitsui Senpaku	Steamship Company							1.38			
Osakaya Shoken KK	Securities					0.29					

TABLE B.13 Continued

Name of Shareholder	Type of Company	Percent Shares Owned: Fishing Companies: Taiyo Gyogyo	Nippon Suisan	Nichiro Gyogyo	Kyoku-yo	Hokoku Suisan	Trading Companies: Maru-beni	Mitsui	Mitsu-bishi	C. Itoh	Itoh-man
Sanko Kisen KK	Steamship Company									2.54	
Sanwa Ginko	Bank		2.22						1.46		
Shin Nippon Seitetsu KK	Iron	1.60									
Sumitomo Ginko	Bank						3.19	1.18		8.68	6.37
Sumitomo Kaijo Kasai Hoken KK	Marine/Fire Insurance				2.83					2.97	
Sumitomo Seimei Hoken Sogo KK	Life Insurance					0.30					4.54
Taisho Kaijo Kasai Hoken KK	Marine/Fire Insurance				2.83			3.42			8.96
Taiyo Kobe Ginko	Bank						4.44				1.75
Teikoku Sangyo KK	Industrial					1.00					
Teinin (?) KK											3.54
Tokyo Ginko	Bank							3.72	2.69	4.64	
Tokyo Kaijo Kasai Hokken KK			2.54	5.64			3.58		7.06	3.49	
Tonen "Tanka" KK	Tanker Company					0.75					
Toshoku KK	Trading Company				2.74						

TABLE B.13 Continued

Name of Shareholder	Type of Company	Percent Shares Owned: Fishing Companies: Taiyo Gyogyo	Nippon Suisan	Nichiro Gyogyo	Kyokuyo	Hokoku Suisan	Trading Companies: Marubeni	Mitsui	Mitsubishi	C. Itoh	Itohman
Toyo Seikan KK	Canning Company	1.60		2.44	2.87						
Yamaguchi Ginko KK	Bank	2.00									
Yasuda Kasai Kaijo Hoken KK	Fire/Marine Insurance						5.39				
Yasuda Shintaku Ginko KK	Bank						2.65				
"Yunichka" (Unique) KK											1.94
Total percent shares owned by ten leading investors in each company		34.85	31.00	30.20	37.57	81.20	39.45	30.46	39.07	45.10	37.43

APPENDIX C

DOCUMENTATION OF THE DEVELOPMENT OF THE COMMERCIAL FISHING INDUSTRIES OF KODIAK, SEWARD, CORDOVA, AND YAKUTAT

APPENDIX C

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APPENDIX C

LIST OF FIGURES

This appendix consists of tables which document the development of the commercial fishing industries of Kodiak, Seward, Cordova, and Yakutat. This data, much of which is referred to in Chapter III, is presented by community.

Kodiak

HARVESTING

TABLE C.1
KODIAK AREA SALNON CATCH 1934 - 1976
(in 000's fish)

YEAR	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
1934	3	1,829	86	7,642	662	10,222
1935	2	1,614	63	10,781	382	12,842
1936	5	2,658	163	5,648	329	8,803
1937	2	1,882	134	16,788	346	19,152
? 938	3	1,966	133	8,398	640	11,140
1939	4	1,786	64	11,741	641	14,236
1940	3	1,318	163	9,997	674	12,155
1941	5	1,730	208	7,601	445	9,989
1942	3	1,281	106	6,093	565	8,048
1943	2	1,991	61	12,480	454	14,988
1944	2	1,818	45	4,956	507	7,328
1945	4	2,041	79	9,045	559	11,728
1946	1	839	71	9,546	298	10,754
1947	1	994	72	8,857	295	10,119
1948	1	1,260	32	5,958	331	7,582
1949	1	892	54	4,928	700	6,575
1950	2	921	41	5,305	685	6,954
1951	2	470	48	2,006	422	2,948
1952	1	631	36	4,554	984	6,206
1953	3	392	39	4,948	490	5,872
1954	1	329	56	8,325	1,140	9,851
1955	2	164	35	10,794	480	11,477
1956	1	306	54	3,349	660	4,370
1957	1	234	35	4,691	1,152	6,113
1958	2	288	21	4,039	931	5,281
1959	2	330	15	1,800	734	2,881
1960	2	362	54	6,685	1,133	8,236
1961	1	408	29	3,926	519	4,883
1962	1	785	54	14,189	795	15,824
1963	-	407	57	5,480	305	6 ,249
1964	1	478	36	11,862	932	13,309
1965	1	346	27	2,887	431	3,692
1966	1	632	68	10,756	763	12,220
1967	1	284	10	188	221	704
1968	2	760	56	8,761	750	10,329
1969	2	604	35	12,493	537	13,671
1970	1	917	66	12,045	919	13,94'2
1971	1	478	23	4,333	1,541	6,376
1972	1	222	14	2,486	1,165	3,890
1973	1	167	4	512	318	1,002
1974	1	409	14	2,635	248	3,307
1975	-	137	25	2,945	85	3,191
1976	1	641	24	11,078	740	12,484
Average	2	883	58	7,058	625	8,626

Source: ADF&G Annual Management Report, Kodiak, 1976.

TABLE C.2

KODIAK

PURSE SEINE SALMON FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	
Pounds Landed (in 000'3)	55 ,606	51,705	28,802	17,931	5,287	14,452	12,472	
Value of Landings	$ 7,354,000	$ 7,087,000	$ 4,661,000	$ 3,532,009	$ 1,893,000	$ 5,815,000	$ 4,296,000	$16,!
Number of Boats	299	360	417	390	308	264	289	
Number of Landings[1]	7,110	7,283	5,587	5,751	2,157	2,940	2,635	
Boat Weeks*	2,333	2,481	2,091	1,960	1,029	1,53?	1,409	
Man Weeks'	11,655	12,40S	10,455	9,800	5,145	7,685	7,045	
Number of Landings per Boat	23.8	20.2	13.4	14.7	7.0	11.1	9.1	
Weeks per Boat	7.80	6.89	5.01	5.03	3.34	5.82	4.88	
Pounds per Landing	7,820	7,100	5,160	3,120	2,450	4,920	4,730	
Value of Catch per Landing	$ 1,030	$ 970	$ 830	$ 610	$ 880	$ 1,980	$ 1,630	$
Value of Catch per Boat	S 24,600	$ 19,700	$ 11,200	$ 9,100	$ 6,100	"$ 22,000	$ 14,900	$
Value of Catch per Boat Week	$ 3,150	$ 2,860	$ 2,230	$ 1,800	$ 1,840	`$ 3,780	$ 3,050	$
Price (i.e. value of catch per lbs.)	$ 0.13	$ 0.14	S 0.16	S 0.20	$ 0.36	S 0.40	$ 0.34	s
Index 1[4]	0.33	0.34	0.34	0.38	0.37	0.39	0.37	
Index 2[5]	3.05	2.94	2.67	2.93	2.10	1.91	1.87	

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongo research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.

2. Boat weeks equals the number of weeks each boat Landed fish. Summed over all boats.

3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus a: of the average number of fishermen employed a week times the number of weeks fished.

4. Index 1 equals the number of Landings divided by the number of species Landed

5. Index 2 equals the average number of Landings per week.

6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by Commission.

It hae been estimated that the average crew size in this fishery is S.

TABLE C.3
Kodiak
Purse Seine Salmon Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	1							
	L[2]								
February	B								
	L								
March	B								
	L								
April	B								
	L								
May	B								
	L								
June	B	158	158	55		71	70		63
	L	846	803	293		339	280		272
July	B	281	341	336	370	278	237	261	341
	L	3,074	4,306	1,899	3,779	1,443	1,349	863	3,901
August	B	287	346	373	345	139	245	280	338
	L	3,054	2,051	3,138	1,533	275	1,270	1,715	2,846
September	B	45	40	114	96	61	24	23	14
	L	135	123	257	165	99	41	56	29
October	B							1	
	L								
November	B								
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE c.4
KODIAK

PURSE SEINE SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	57	55	56	30	11	12	7	17
1- 25	16	25	52	33	26	19	19	18
26- 35	163	199	218	228	193	156	184	209
36- 45	46	60	72	83	64	66	65	80
46- 55	16	20	17	14	13	11	14	34
56- 65	1				1			2
66- 75	-			1				1
76- 85		1	1	1				
86- 95								
96-105								
106-125	-		1					
125-								1

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C. 6
Kodiak
Beach Seine Salmon Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B								
	L								
May									
	B								
	L								
June									
	B	2	3						
	L								
July									
	B	8	8	8	22	15	12	3	17
	L	29	71	21	86	36	32		129
August									
	B	4	10	14	14		11	11	15
	L	7	49	60	33		35	45	99
September									
	B	2	2	2	2			1	4
	L								8
October									
	B								
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission
Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.6
Kodiak
Beach Seine Salmon Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B								
	L								
May									
	B								
	L								
June									
	B	2	3						
	L								
July									
	B	8	8	8	22	15	12	3	17
	L	29	71	21	86	36	32		129
August									
	B	4	10	14	14		11	11	15
	L	7	49	60	33		35	45	99
September									
	B	2	2	2	2			1	4
	L								8
October									
	B								
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.7
Kodiak
Beach Seine Salmon Fishery

Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
0[1] ft.	3	8	4	6	1	--	1	--
1-25 ft.	5	2	10	16	14	14	10	--
26-35 ft.	1	1	1	4				1
36-45 ft.	1	1	1					1
46-55 ft.								
56-65 ft.								
66-75 ft.								
76-85 ft.								
86-95 ft.								
96-105 ft.								
106-115 ft.								
116-125 ft.								
over 125 ft.								

1 All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.8

KODIAK

SET GILL NET SALMON FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975 [6]
Pounds Landed (in 000's)	~3,099	4,015	2,129	1,508	576	1,499	1,468
Value of Landings	$ 480,000	$ 57s,000	$ 391,000	$ 293,000	$ 187,000	$ 537,000	$ 543,000
Number of Boats	140	134	132	118	120	111	117
Number of Landings[1]	2,747	2,667	1,229	1,320	539'	765	854
Boat Weeks[2]	039	865	628	418	29S	433	482
Man Weeks[3]	1,678	1,730	1,2S6	836	590	866	964
Number of Landings per Boat	19.6	19.9	9.3	11.2	4.5	6.9	7.3
Weeks per Boat	5.99	6.45	4.75	3.54	2.46	3.90	4.12
Pounds per Landing	1,130	I.,510	1,730	1,140	1,070	1,960	1,720
Value of Catch per Landing	$ 1.70	$ 220	$ 320	$ 220	$ 350	$ 700	$ 640
Value of Catch per Boat	$ 3,430	$ 4,290	$ 2,960	$ 2,480	$ 1,560	$ 4,840	$ 4,640
Value of Catch per Boat Week	$ 570	$ 660	$ 620	$ 700	$ 630	$ 1,240	$ 1,130
Price (i.e. value of catch per lbs.)	$ 0.15	$ 0.14	$ 0.18	$ 0.19	$ 0.32	$ 0.36	$ 0.37
Index 1[4]	0.34	0.30	0.27	0.29	0.28	0.29	0.30
Index 2[5]	3.27	3.0s	1.96	3.16	1.83	1.77	1.77

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number Of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all 'coats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus a of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by Commission.

It has been estimated that the *average crew size in* this fishery is 2.

TABLE C. 9
Kodiak
Set Gill Net Salmon Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B								
	L								
April	B								
	L								
May	B								
	L								
June	B	106	70						
	L	656	548						
July	B	124	121	110	115	119	102	109	142
	L	1,618	1,563	593	1,013	533	468	427	1,223
August	B	99	113	111	95		81	98	134
	L	473	556	629	300		290	425	945
September	B			7	7	5	6	2	1
	L			7	7	5	7		
October	B					1			
	L								
November	B								
	L								
December	B								
	L								

Source : Commercial Fisheries Entry Commission Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.10
KODIAK

SET GILL NET SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1.972	1973	1974	1975	1976
0[1]	42	41	33	18	5	2	4	8
1- 25	94	93	94	99	107	106	113	140
26- 35	3		3	1	6	1		4
36- 45			2		2	2		
46- 55	-							1
56- 65	1							
66- 75								
76- 85								
86- 95								
96-105								
106-115								
116-125								
125-								1

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

o

TABLE C.11
KODIAK SALMON FISHERY ALL GEAR TYPES

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Pounds Landed (in 000's)	58,832	56,269	31,231	19,620	5,905	16,107	14,145	55,270	
Value of Landings	7,854,000	7,737,000	5,100,000	3,861,000	2,093,000	6,413,000	4,917,000	19,130,000	
Number of Boats	449	506	565	534	443	389	417	535	
Number of Landings[1]	9,911	10,080	6,899	7,192	2,732	3,772	3,547	9,457	
Boat Weeks[2]	3,201	3,398	2,765	2,437	1,348	2,008	1,926	3,056	
Man Weeks[3]	13,401	14,239	11,803	10,754	5,783	8,627	8,079	12,056	

Source: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A Study of the Socio Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

[1] Number of Landings equals the number of days each boat landed fish. Summed overall boats.

[2] Boat Weeks equals the number of weeks each boat landed fish. Summed over all boats.

[3] Man Weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estimate of the average number of fishermen employed a week times the number of weeks fished.

These statistics do not include the activities of the following boats that participated in this fishery:

1970 one drift gill net boat
1974 one purse seiner

TABLE C.12

KODIAK HALIBUT LANDINGS 1969-1977

(1000 pounds)

1969	6,338	1974	3,742
1970	8,697	1975	4,209
1971	9,217	1976	4,414
1972	8,640	1977	4,665
1973	6,591		

Source: IPHC Annual Report.

TABLE C. 13
KODIAK
SMALL BOAT LONG LINE HALIBUT FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	3.974	1975	1976
Landed)'s)		.		3,22.2	2,709	1,500	1,344	2,118 "'",
of Landings	$	$	$	$ 1,927,000	$ 1,907,000	$ 1,033,000	$ 1,194,000	$ 2,6S0,000 ,.
of Boats				205	2S9	128	1 2 0	176 .
of Landings[1]				702	1,025	361	385, .	519 ,
eeks[2]				604	839	316	31s	4 S 2
eks[3]				.604	839	316	318	452
of Landings ac				3.42	3.55	2.82	3.21	2 . 9 5
per Boat				2.95	2.90	2.47	2.65	2 . S 7
per Lending				4,580	2,640	4,160	3,490	4,080
of Catch ding	$	$	$	$ 2,750	$ 1,860	$ 2,860	$ 3,100	$ 5 , 1 1 0
of Catch at	$	$	$	$ 9,400	$ 6,600	$ 8,070	$ 9,950	$ 15,060
of Catch at Week	$	$ -	$	$ 3,190	$ 2,270	$ 3,270	$ 3,750	$ 5,860 .
value of catch per lbs.)	$.	$	$	$ 0.60	$ 0.70	$ 0.69	$ 0.89	$ 1.25
1[4]				0.3s	0.59	0.44	,0.47	0 . 4 3
2[5]		- -		1.16	1.22	1.14	1.21	1.15 .'

es: Time catch .statistics were derived using data provided from the date files of the State of Alaska Commercial Fisk.cries, Entry Commission. The estimate of the average crew size in this fishery was made by George '.4. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an estimat of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Lended
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Entr Commission.

statistics do not include the activities of the following beets that participated in the Kodiak halibut fishery: 1974, one troller, 1975, one hand troller and one boat with unspecified gear.

3 been estimated that the average crew size in this fishery is 1.

TABLE C.14
Kodiak Small Boat
Halibut Fishery

Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	3								
	L								
March									
	B								
	L								
April									
	B								
	L								
May									
	B				27	36	9	18	33
	L				34	39	9	18	44
June									
	B				103	140	78	40	123
	L				186	268	135	74	221
July									
	E				104	198	88	85	90
	L				210	392	158	163	182
August									
	B				130	150	31	58	56
	L				224	278	47	111	72
September									
	B				37	32	11	18	
	L				48	37	12	19	
October									
	B					11			
	L					11			
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission
Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE c.15
KODIAK

SMALL BOAT HALIBUT FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]				52	38	12	12	13
1- 25				40	81	28	36	53
26- 35				64	105	54	42	48
36- 45				16	29	14	11	19
46- 55				8	13	5	7	15
56- 65				16	14	12	6	17
66- 75				8	7	3	4	8
76- 85				1	2		1	1
86- 95							1	
96-105								1
106-1I.5								
116-125								
125-								1

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.16
KODIAK AREA HERRING HARVEST
1912 - 1976

YEAR	TONS HARVESTED	YEAR	TONS HARVESTED
1912	20.0	1942	16,791.0
191.3	no harvest	1943	35.352.0
1914	" "	1944	26,835.0
1915	" "	1945	31 ,114.0
1916	70.0	1946	47,505.9
1917	137.9	1947	50,743.0
1918	118.4	1948	46,428.0
1919	259.7	1949	no harvest
1920	45.9	1950	44,132.5
1921	944.9	1951	4,299.0
1922	1,482.6	1952	1,389.0
1923	321.5	1953	725.0
1924	4,823.0	1954	no harvest
1925	9,997.0	955	" "
1926	2,680.9	956	13,524.0
1927	2,592.9	957	21 ,818.5
1928	625.0	958	1 ,711.0
1929	no data	959	3,831.0
1930	622.0	960	no harvest
1931	1,000.0	961	" "
1932	3,594.0	1962	no harvest
1933	2,312.5	1963	" "
1934	120,797.0	1964	567.8
1935	no data	1965	657.2
1936	24,748.0	1966	2,769.3
1937	27,659.3	1967	1,662.4
1938	24,522.0	1968	2,000.6
1939	38,600.5	1969	1,130.0
1940	22,677.0	1970	341.6
1941	40,083.5	1971	284.3
		1972	215.0
		1973	831.0
		1974	868.0
		1975	8.0
		1976	4.6

Source: Alaska Department of Fish and Game, Annual Management Report, Kodiak, 1976.

TABLE C.17
KODIAK
PURSE SEINE HERRING FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	1976
nds Landed 000's)	2,21s	685	569	475	1,735	1,755	(	(
ae of Landings	$ 44,000	$ 14,000	$ 11,000	$ 10,000	$ 139,000	$ 88,000	$ (	$ (
oer of Boats	18	15	u	5	17	2s	2	1
oer of Landings[1]	80	42	51	36	99	115	(	(
: Weeks[2]	45	28	25	14	48	61	(	(
'Weeks[3]	255	140	125	70	240	305	(	(
oer of Landings l at	4.4	2.8	4.6	7.2	5.8	4.6	(	(
ks per Boat	2.5	1.87	2.27	2.8	2.82	2.44	(	(
nds per Landing	27,700	16,300	11,200	13,200	17,.500	15,300	(	(
ae of Catch Landing.	$ 550	$ 330	$ 220	$ 2s0	$ 1,400	s 765	$ (	$ (
ae of Catch Boat	$ 2,440	$ 930	$ 1,000	$ 2,000	$ 8,180	$ 3,S20	S (	$ (
ae of Catch Boat Week	$ 980	$ 500	$ 440	$ 710	$ 2,900	$ 1,440	s (	$ (
ce a. value of catch per lbs.)	$ 0.02	$ 0.02	s 0.02	$ 0.02	$ 0.08	s 0.05	s (	$ (
ex 1[4]	0.92	1.00	0.94	0.9s	0.96	0.90	(	(
ex 25	1.78	1.50	2.04	2..57	2.06	1.89	(	(

rces: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed overall boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an estimat of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Entr Commission.

e statistics do not include the activities of the following boats that participated in the Kodiak Herring Fishery: 1969, otter trawler, 1974, one pot gear boat under 50 feet.

as been estimated that the average crew size in this fishery is 5.

TABLE C.18
Kodiak
Seine Herring Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B								
	L								
April	B	5							
	L	9							
May	B	18	14	4	2	9	25	1	1
	L	71	31	13		33	106		
June	B		1	5	3	16	3		
	L			22		60			
July	B			1	1	2	1	1	
	L								
August	B			3	2				
	L								
September	B		1	2					
	L								
October	B		2						
	L								
November	B								
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.19
Kodiak
Purse Seine Herring Fishery
Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
0[1] ft.	4	0	2	1	--	2	--	--
1-25 ft.	0	2	0	0	--	--	--	--
26-35 ft.	9	10	6	3	11	11	1	--
36-45 ft.	3	2	2	1	4	11	1	--
46-55 ft.	2	1	1	--	2	1		1
56-65 ft.								
66-75 ft.								
76-85 ft.								
86-95 ft.								
96-105 ft.								
106-115 ft.								
116-125 ft.								
over 125 ft.								

1 All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.20
KODIAK
OTTER TRAWL BOTTOMFISH FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975
ls Landed)00's)		72	49	50	153	665	22
e of Landings	$ -	$ 3,000	$ 6,000	$ 4,000	$ 15,000	$ 133,000"	$ 4,000 $
er of Boats	1	13	16	6	15	20	4
er of Landings[1]		44	26	7	23	52	7
Weeks [2]		3s	25	7	20	50	7
Veeks [3]		114	75	21	60	1s0	21
er of Landings Boat		3.3a	1.62	1.17	1.53	2.60	1.75
3 per Boat		2.92	1.56	1.17	1.33	2.50	1.75
is per Landing		1,640	1,880	7,140	6,650	12,790	3,140
e of Catch Landing	$ -	$ 70	$ 230	$ 571	$ 652	$ 2,560	$ 570 $
e of Catch Boat	$ -	$ 230	$ 380	$ 670	$ 1,000	$ 6,650	$ 1,000 $
e of Catch Boat Week	$ -	$ 80	$ 240	$ 570	$ 750	$ 2,660	$ 570 $
e . value of catch per lbs.)	$ -	$ 0.04	$ 0.12	$ 0.08	$ 0.10	$ 0.20	$ 0.18 $
x 1[4]		0.92	1.00	0.78	0.96	0.68	0.41
x 2[5]		1.16	1.04	1.00	1.15	1.04	1.00

rces: *The catch statistics were derived using data provided from the data files of the State of Alaska* Commercial Entry Commission. The estimate of the average crew size in this fishery was made by George i?. Rogers in, A the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongo research.

1. Number of Landings equals the number of days each boat landed fish. Summed *over* all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate *of the average crew size in* this fishery; it is thus a of the average number of fishermen employed a week times the number of weeks fished.
4. *Index 1 equals* the number *of* Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by Commission.

se statistics do not include the activities of the following boats that participated in this fishery: 1975, two dou vlers

ıas been estimated that the average crew size in this fishery is 3.

TABLE C.21

Kodiak
Otter Trawl Bottomfish Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]			2	1		3		
	L[2]								
February	B		1	3		4	8		2
	L					5	9		
March	B		1	3		3	6		3
	L						11		
April	B		1	1	2	4	2		4
	L					6			
May	B			3		1	5	2	3
	L						8		
June	B		8	2	1	1	6		1
	L		14				9		
July	B		7	3	2		1		1
	L		10						
August	B		3	1	1	1	3	2	1
	L								
September	B		3	1					7
	L								10
October	B	1						1	12
	L								24
November	B		1			1			11
	L								15
December	B		2			3		1	6
	L								6

Source : Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.22
KODIAK OTTER TRAWL

BOTTOMFISH FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]		1	2		1			
1- 25					1			
26- 35			1		4	1		1
36- 45	1	1	3		1	5		
46- 55		3	2		1	3	2	3
56- 65		3	5	1	2	3		
66- 75		3	2	2	3	4	3	14
76- 85		1	1	2	2	2	1	9
86- 95		1		1	-	1		2
96-105						1		

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TA$~&C.23

WALL SOAT LONG **LINE BOTTOMFISH** FISHERY

CATCH AND **EMPLOYMENT** OATA

	1969	1970	1971	1972	1973	1974	1975	1976
s Landed (00's)				-	17	35	' 91	126
of **Landings**	$	$	$	$ -	$ 3,000	$ 7,000	$ 17,000	S 28,000
r of Boats	.	1		-	12	15	12	21
r of Landings[1]				-	17	17	24	44
Weeks[2]				-	17	17	24	44
eeks[3]				-	17	17	24	44
r of *Landings* oat		-		-	**1.42**	1.13	2.00	2.10
per **Boat**				-	1.42	1.13	2.90	2.10
s per Landing				-	**1,000**	2,060	3,790	**2,860**
of Catch ading	S	$	S	S -	$ 176	S **412**	$ **708**	$ 636
of **Catch** **oat**	S	S	$	S -	$ 250	$ 467	$ 1,420	$ 1,330
of Catch oat *Week*	S	S	S	S -	$ 176	$ 412	S 708	$ 636
value **of catch per lbs.**)	S	S -	$	$ -	$ 0.18	$ 0.20	S 0.19	S 0.22
cl[4]		-		-	1.00	1.00	0.96	0.98
c 2[5]		-		-	1.00	**1.00**	1.00	**1.00**

rces: The **catch statistics** *were* **derived using** data provided from the data **files** of the State ***of* Alaska** Commercial **Fisheries Entry** Commission. The estimate of the average crew *size* in this **fishery** was made by George W. **Rogers** in, A study cf **the** Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, **and** in **ongoing** research.

1. **Number** of Landings **equals** the number **of** days each boat landed fish. **Summed** *over* **all** boats.
2. Boat weeks equals the number of weeks each **boat** landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the **average** *crew size* **in** *this* fishery: it is thus an **estimat of the** *average number of* fishermen **employed** a week times the number of weeks fished.
4. Index 1 equals the number of Landings **divided** by the number of species Landed
5. Index 2 equals the average number **of** Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality **requirements maintained** by the Entr **Commission.**

as been estimated that the average crew size in this fishery is 1.

TABLE C.24

Kodiak Small Boat

Long Line Bottomfish Fishery

Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B								
	L								
April	B								
	L						1	3	6
May	B								6
	L						13	8	11
June	B						14	12	15
	L								
July	B						1	3	5
	L								6
August	B							3	4
	L								A
September	B						1	2	1
	L								
October	B								2
	L								
November	B								2
	L								
December	B								2
	L								

Source: Commercial Fisheries Entry Commission -Data Files

[1]B = Number of Boats

[2]L = Number of Landings

'a

TABLE C.25

KODIAK SMALL BOAT LONG LINE

BOTTOMFISH FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]		1			1	2	1	3
1- 25						2		3
26- 35					7	4	4	6
36- 45					3	4	3	3
46- 55					1	3	3	4
56- 65							1	1
66- 75								
76- 85								
86- 95								1

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.26
KODIAK BOTTOMFISH FISHERY ALL GEAR TYPES

	1969	1970	1971	1972	1973	1974	1975	1976	1577
Pounds Landed (in 000's)	C[4]	72	49	50	170	700	113	384	
Value of Landings	c	$3,000	$6,000	$4,000	$18,000	140,000	21,000	81,000	
Number of Boats	1	13	16	6	27	35	16	33	
Number of Landings[1]	c	44	26	7	40	69	31	75	
Boat Weeks[2]	c	38	25	7	37	67	31	74	
Man Weeks[3]	c	114	75	21	77	167	45	134	

Source: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A Study of the Socio Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

[1]Number of Landings equals the number of days each boat landed fish. Summed over all boats.

[2]Boat Weeks equals the number of weeks each boat landed fish, Summed over all boats.

[3]Man Weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estimate of the average number of fishermen employed a week times the number of weeks fished.

[4]A "c" indicates that the statistic is not available due to confidentiality requirements maintained by the Entry Commission.

These statistics do not include the activities of the following boats that participated in this fishery:

1970 one hand troller and one long liner under 26 feet
1973 one purse seiner and two beam trawlers
1974 one pot gear boat under 50 feet and two. beam trawlers
1975 one pot gear boat under 50 feet, one beam trawler, and two double otter trawlers

TABLE C.27
Kodiak King Crab Fishery
Catch and Effort
1970 - 78

Fishing[1] Year	No. Vessels[4]	Commercial Catch Pounds	Commercial Catch Metric Tons	No. Ldgs.	Avg. Catch per Landing Pounds	Avg. Catch per Landing Metric Tons
1960-61	143	21,064,871	9,554.96			
1961-62	148	28,962,900	13,137.48			
1962-63	195	37,626.703	17,067.36			
1963-64	181	37,716,223	17,107.97			
1964-65	189	41,596,518	18,868.06			
1965-66	175	94,431,026	42.833.63			
1966-67	213	73,812,779	33,483.52			
1967-68	227	43,448,402	19,708.11	3,847	11,294	5.12
1968-69	178	18,211,485	8,260.68	1,839	9,902	4.49
1969-70	136	12,200,571	5,534.14	978	12,475	5.66
1970-71	100	11,719,970	5,316.14	830	14,120	6.40
1971-72	89	10,884,152	4,937.02	507	21,467	9.74
1972-73	88	15,479,916	7,021.64	683	22,664	10.28
1973-74	129	14,397,287"	6,530.57	837	17,201	7.80
1974-75	158	23,582,720[5]	10,697.05	1,195	19,734	8.95
1975-76	169	24,061,651	10,914.29	1,569	19,478	8.84
1976-77	195	17,966,846	8,149.71	1,165	15>422	7.00
1977-78	179	13,503,666	6,125.22	1,186	11,386	5.16
TOTAL	1107	540,672,776	245,247.56	14,636		
AVERAGE	139	30,037,376	13,624.86	1,331	14,037	6.37

[1] Fishing year defined as May 1 - April 30.
[2] July 1 - April 30 season established.
[3] August 15 - January 15 established.
[4] Number of vessels shown are those actually registered through 1969-70 season. Number of vessels fishing is shown from 1970-71 season.
[5] Seasonal harvest includes 551,348 pounds of deadloss documented, but not reflected in computer storage.

Source: ADF&G Westward Region Shellfish Report, 1978.

'TABLE C.28
KODIAK
KING CRAB FISHERY

CATCH AND EMPLOYMENT OATA

	1969	1970	1971	1.972	1973	1974	1975
Pounds Landed (in 000's)	12,956	12,077	11,896	15, 480	14,404	23,031	24,101
Value of Landings	"S 3,498,000	$ 3,382,000	$ 3,569,000	$ 5,882,000	S 9,.S07,000	$10,134,000	$10,84S,000 $12,5
Number of Boats	142	115	07	88	131	161	170
Number of Landings[1]	1,218	915	573	650	787	1,169	1,263
Boat Weeks[2]	1,017	831	482	468	S47	768	897
Man Weeks[3]	3,051	2,493	1,446	1,404	1,641	2,304	2,691
Number of Landings per Boat	8.58	7.96	6.59	7.39	6.01	7.26	7.43
Weeks per Boat	7.16	7.23	5.s4	5.32	4.18	4.77	5.28
Pounds per Landing	10, 640	13,200	20,760	23,S20	18,300	19,700	19,080
Value of Catch per Landing	$ 2,870	$ 3,700	$ 6,230	$ 9,050	s 12,080	$ 8,670	$ 0,s90 $
Value of Catch Per Boat	$ 24,600	$ 29,400	$ 41,000	$ 66,800	$ 72,600	$ 62,900	$ 63,800 S
Value of Catch per Boat Week	$ 3,400	$ 4,100	$ 7,400	$ 12,600	$ 17,400	$ 13,200	$ 12,100 $
Price (i.e. value of catch par lbs.)	$ 0.27	$ 0.28	$ 0.30	s 0.38	$ 0.66	$ 0.44	$ 0.4s $
Index 1[4]	0.94	0.96	0.88	0.92	0.91	0.92	0.80
Index 2[5]	1.20	1.10	1.19	1.39	1.44	1.52	1.41

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial F Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A s the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoi research.

1. Number of Landings equals the number of days each boat landed fish. Summed eve.% all boats.
2. Seat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by Commission.

It haa been estimated that the average crew size in this fishery is 3.

TABLE C. 29
Kodiak
King Crab Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	95	79	63				2	
	L[2]	259	138	90					
February	B	82							
	L	151							
March	B	16							
	L	16							
April	B								
	L								
May	B								
	L								
June	B								
	L								
July	B								
	L								
August	B	50	63	41	69	122	145	20	
	L	147	116	77	207	480	382	42	
September	B	88	81	61	81	76	156	163	166
	L	282	231	214	282	143	693	65 2	509
October	B	84	80	64	42	92	50	145	126
	L	208	170	192	65	164	58	399	294
November	B	43	82		35		15	74	
	L	44	152		-66		28	147	
December	B	78	70		25		7	21	118
	L	111	108		30		8	21	307

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.30
KODIAK

KING CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	29	22	9	3		2	2	4
1- 25	4	1				4	5	6
26- 35	24	15	12	11	17	27	35	40
36- 45	12	11	9"	10	19	29	23	32
46- 55	22	17	16	17	24	26	21	29
56- 65	9	9	7	10	12	11	14	18
66- 75	10	12	10	10	19	23	23	22
76- 85	21	20	16	19	23	20	26	19
86- 95	3	2	3	4	6	10	11	14
96-105	3	2	1	1	4	1	3	2
106-115	3	1	2	1	3	3	4	5
116-125						1		-
125-	2	3	2	2	4	4	3	3

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.31

Kodiak Tanner Crab Fishery
Catch and Effort
1967-1977[1]

Calendar Year	Fishing Year	No. Vessels	Commercial Harvest Pounds	Commercial Harvest Metric Ton	No. Landings	Unweighed mean Catch/Landings Pounds	Unweighed mean Catch/Landings Metric Ton	No. Pot Lifts	Ave. No. Crab/Pot
1967			110,961	50.33	83	1,337	.61		
1968			2,560,687	1,161.51	817	3,134	1.42		
1969		85	6,827,312	3,096.82	955	7,149	3.24	72,748	43
	1969-70[2]	67	8,416>782	3>817.79	833	10,104	4.58	78,266	42
	1970-71	82	6,744,163	3,059.10	453	14,888	6.75	60,967	44
	1971-72	46	9,475,902	4,298.20	505	18,764	8.51	65,907	59
	1972-73	105	30,699,777	13,925.20	1,466	20,941	9.50	188,158	67
	1973-74[3]	123	29,820,899	13,526.55	1,741	17,129	7.77	217,523	59
	1974-75[3]	74	13,649,969	6,191.53	471	28,981	13.15	73,826	85
	1975-76[4]	104	27,336>911	12,399.83	1,168	23,405	10.67	199,304	64
	1976-77[5]	1C2	20.720.079	9.398.57	998	20,762	9.41	164.213	48
TOTAL (FISHING YEARS)			146,864,482	66,617.29	7,635			1.048,164	-
AVERAGE (FISHING YEARS)		88	18,358,060	8,327.16	954	19,243	8.73	131,020	62

[1] Data Source: Alaska Dept. of Fish and Game Annual Board of Fish and Game Reports and Annual Kodiak Area Mgmt. Report.
[2] Fishing year July 1 - June 30.
[3] Legal season November 1 - June. 30. Season terminated May 15 due to onset of mating period.
[4] Legal season November 1 - April 30.
[5] Legal season January 1 - April 30, 1977.

Source: ADF&G, Westward Region Shellfish Report, 1978.

TABLE C.32

KODIAK

TANNER(SNOW) CRAB FISHERY

CATCH AND EMPLOYMENT **DATA**

	1969	1970	1971	1972	1973	**1974**	1975	19
Pounds Landed ***(in 000's)***	6,862	7,710	**7,411**	11 # 907	31,844	26,494	18,197	2
Value of Landings	$ 686,000	$ 771,000	$ 815 ,000	$ 1,429,000	$ 5,732,000	$ 5,S64,000	$ 3,094,000	$ 5,01
Number of Boats	116	81	54	64	126	**12s**	106	
Number of Landings[1]	942	6S6	432	643	1,518	**1,371**	751	
Boat Weeks*	829	577	380	568	1,203"	1,033	582	
Man Weeks[3]	2,487	1,731	1,140	1,704	3,609	3,099	1,746	
Number *of* Landings per **Boat**	8.12	8.10	8.00	10.05	12.05	10.97	**7.08**	
Weeks per Boat	7.15	7.12	7.04	8.88	9.55	8.26	5.49	
Pounds per **Landing**	7,300	11,800	17,200	18 ,500	21,000	19,300	24,200	2(
Value **of** Catch **per** Landing	$ 730	$ **1,180**	$ 1,890	$ 2,220	$ 3,780	$ 4,060	S 4,120	$
Value ***of*** **Catch** ***Per Boat***	$ 5,900	$ 9,S00	$ 15,100	S 22,300	$ 45,.500	$ 44,.500	$ 29,200	$ 4(
Value of Catch **per Boat** Week	$ 830	$ 1,340	$ 2,140	$ 2,520	$ 4,760	$ 5,390	$ 5,320	$
Price (i.e. value of catch per **lbs.**)	$ 0.09	$ 0.10	$ 0.11	$ 0.12	$ 0.18	$ 0.21	$ **0.17**	$
Index 1[4]	0.97	0.98	0.99	0.90	0.95	0.95	0.90	
Index 2[5]	1.14	1.14	1.14	1.13	1.26	1.33	1.29	

Sources: The catch statistics were derived **using** data **provided** from the data files of **the** State of Alaska Commercial Fi **Entry *Commission.*** **The** estimate **of the average** crew size in **this fishery** was made **by George W. Rogers in, A st** the <u>**Socio-Economic Impact** of **Changes** in the Harvesting Labor Force in the Alaska Salmon Fishery</u>, and in ongoir **research.**

1. Number of Landings equals **the** number of days each teat landed **fish.** Summed over **all** boats.
2. 8oat weeks equals the number of weeks each boat landed fish. **Summed** over **all boats.**
3. **Man weeks equals boat** weeks times an estimate of the **average** crew size in this fishery: **it is thus an** of the ***average*** **number of** fishermen employed **a week** times the number of weeks fished.
4. Index 1 equals the number ***of*** Landings divided by the number of species Landed
5. Index 2 equals the **average** number of Landings per week.
6. A "(" indicates that the statistic is not **available** due to confidentiality requirements **maintained by t** Commission.

These statistics do **not** include the activities **of the** following boats that participated in this fishery: **1970, one herri** seiner.

It **has** been estimated **that** the average crew size in this fishery is 3.

TABLE C .33
Kodiak
Tanner (Snow) Crab Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	68	54	33	22	37	93		77
	L[2]	157	116	45	32	83	290		184
February	B	54	41	27	21	49	140	1	81
	L	94	94	42	36	142	104		226
March	B	37	49	30	22	68	110	6	91
	L	117	148	71	46	235	410	8	331
April	B	40	51	24	25	78	108	58	84
	L	128	104	43	89	324	355	213	206
May	B	37	27	26	33	85	14	73	9
	L	107	65	69	116	276	27	285	11
June	B	22	2	20	28	64	6	4	3
	L	61		59	79	127	8	4	
July	B	16	1	11	16	1	1		
	L	58		31	37				
August	B	11		4	2		1		
	L	20		4					
September	B	13	5	1	13	2			
	L	23	8		16				
October	B	49	5	9	27	3			
	L	95	12	10	36				
November	B	24	30	13	36	55		60	
	L	25	51	20.	78	132		124	
December	B	41	33	21	35	73		64	
	L	57	47	37	76	190		116	

Source: Commercial Fisheries Entry Commission
Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.34
KODIAK

TANNER SNOW CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	27	16	2	2	2	2	1	2
1- 25	4	1				1	1	
26- 35	13	7	6	11	19	19	14	16
36- 45	10	8	7	9	19	18	10	14
46- 55	18	16	15	16	21	22	18	20
56- 65	9	7	4	5	10	9	11	12
66- 75	9	5	4	9	17	16	18	14
76- 85	17	16	14	11	25	22	16	10
86- 95	3	1	1		7	8	12	11
96-105	3	2			2	2	3	1
106-115	2	1		1	2	4	2	5
116-125								
125-	1	1	1		2	2		2

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.35

KODIAK DUNGENESS CRAB FISHERY, CATCH AND EFFORT, 1962 - 1977

YEAR	NO. VESSELS	POUNDS	METRIC TONS	NO. LANDINGS	POUNDS	METRIC TONS	NO. POT LIFTS
1962	--	1,904,567	863.9	149	12,782	5.8	
1963	--	2,487,512	1,228.3	354	7,026	3.2	
1964	29	4,162,182	1,888.0	395	10,537	4.8	
1965	25	3,311,571	1,502,1	351	9,434	4.3	
1966	12	1,148,600	521.0	144	7,976	3.6	
1967	18	6,663,668	3,022.6	439	15,179	6.9	
1968	43	6,829,061	3,097.6	536	12,741	5.8	
1969	29	5,834,628	2,646.6	455	12,823	5.8	190,967
1970	33	5,741,438	2,604.3	318	18,055	8.2	249,800
1971	24	1,445,864	655.8	173	8,358	3.8	90,913
1972	34	2,059,536	934.2	316	6,517	3.0	140,921
1973	42	2,000,526	907.4	487	4,108	1.9	251,467
1974	23	750,057	340.2	172	4,361	2.0	104,062
1975	15	639,813	290.2	154	4,154	1.9	76,411
1976	4	87,110	39.5	6	14,518	6.6	4,410
1977	2	113,026	51.3	16	7,064	3.2	3,805
TOTAL		45,179,159	20,493.2	4,465	--	--	1,112,756
AVERAGE	24	2>823,697	1,280.8	279	10,119	4.6	123,639

Source: Alaska Department of Fish and Game Westward Regional Annual Reports, 1978

TABLE C.36

KODIAK

DUNGENESS CRAB FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975
Pounds Landed (in 000's)	5', 83S	5,741	1,460	2,060	1,977	750	640
Value Of Landings	$ 87S,000	$ 861,000	$ 219,000	$ 803,000	S 1,087,000	$ 353,000	$ 384.000
Number of Seats	39	34	24	3s	42	2 3	15 -
Number of Landings[1]	439	346	169	297	461	172	113,
Bost Weeks[2]	362	307	158	244	400	162	111
Man Weeks[3]	905	768	39s	610	1,000	40s	278
Number of Landings per Boat	11.26	10.18	7.04	8.49	10.98	7.48	7.53
Weeks per Boat	9.28	9.03	6.58	6.97	9.52	7.04	7.40
Pounds per Landing	13,300	16,600	8,600	6,900	4,300	4,400	5,700
Value of Catch per Landing	$ 2,000	$ 2,.S00	$ 1,300	$ 2.700	$ 2,400	S 2,100	$ 3,400
Value of Catch Per Boat	$ 22,400	.S 25,300	S 9,100	$ 22,900	S 25,900	$ 15,300	s 25,600
Value of Catch per Boat Week	$ 2,400	$ 2,800	s 1,400	$ 3,300	$ 2,700	$ 2,200	s 3,500
Price (i.e. value of catch per lbs.)	$ 0.15	$ 0.15	S 0.15	s 0.39	s 0.55	$ 0.47	s 0.60
Index 1[4]	0.93	0.S8	0.87	0.77	0.80	0.97	,0.69
Index 2[5]	1.21	1.22	1.07	1.22	1.15	1.06	1.02

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fi Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A st the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoir research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates chat the statistic is not available due to confidentiality requirements maintained by t' Commission.

These statistics do not include the activities of the following boats that participated in this fishery: 1973, one boat w unspecified gear.

It has been estimated that the average crew size in this fishery is 2.S.

TABLE C.37

Kodiak Dungeness Crab Fishery

Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	6	2	3	4	2	7		1
	L[2]	6			5		8		
February	B	1			1	2	1	2	1
	L								
March	B	1		2		3	2	1	
	L								
April	B	1				6	2		
	L					9			
May	B	12	9	1	2	15	6	3	
	L	22	23			36	8		
June	B	18	21	8	9	22	13	8	1
	L	44	51	16	27	68	33	16	
July	B	27	25	14	16	26	15	12	
	L	117	83	34	67	104	46	29	
August	B	31	25	16	18	28	13	13	2
	L	106	67	35	67	102	19	25	
September	B	22	24	15	16	24	7	6	
	L	79	62	29	49	71	10	10	
October	B	17	17	12	15	19	11	7	
	L	43	35	35	42	32	20	18	
November	B	9	10	6	11	20	8	6	1
	L	12	21	7	21	33	15	8	
December	B	6	2	3	8	15	6	1	
	L	6			14	19	7		

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.38
KODIAK

DUNGENESS CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	12	6	2	2				
1- 25	3	1	2	1	2			
26- 35	7	4	4	7	12	5	1	
36- 45	5	3	3	7	8	5	3	1
46- 55	8	8	6	8	9	7	3	1
56- 65	-	1	1	2		1	1	1
66- 75	2	5	2	5	8	5	6	
76- 85	1	5	2	2	3		1	1
86- 95	1	1	1	1				
96-105								
106-115			1					

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.39
Kodiak Shrimp Fishery
Catch and Effort
1960-1978

CALENDAR YEAR	FISHING YEAR	NO. VESSELS[4]	NO. LANDINGS	COMMERCIAL HARVEST POUNDS	COMMERCIAL HARVEST METRIC TONS
1960		11	94	3,197,985	1,450.6
1961		12	203	11,083,500	5,027.4
1962		11	204	12,654,027	S,739.8
1963		--	---	10,118,472	4,S89.7
1964		6	---	4,339,114	1,968.2
1965		11	320	13,823,061	6,270.1
1966		17	5s1	24,097,141	10,930.4
1967		23	---	38,267,856	17,3S8.2
1968		16	---	34,468,713	15>634.9
1969		26	935	41,353,461	18,757.8
1970		18	1,024	62,181,204	28,205.2
1971[1]		49	1,746	82,153,724	37,264.7
1972[2]		63	1,398	58,352,319	26,468.4
1973		50	1,283	70,511,477	31,983.8
	1973-74[3]	63	1,029	56,203,992	2S,494.0
	1974-7s	7s	1,100	58,235,982	26,418.2
	197S-76	58	844	49,086,591	22,265.5
	1976-77	62	762	46,712,083	21,188.S
	1977-78	58	653	26,409,366	11,979.2
TOTAL				703,250,068	318,992.1
AVERAGE (fishing year)		63	878	47,529,603	21,468.6

[1] First egg hatch closures announced for a portion of the Kodiak district shrimp fishery during March and April, 1971.
[2] First year quotas established.
[3] Beginning in the 1973-74 fishing season, a complete egg hatch closure for the entire fishing district was in effect during March and April. Fishing year beqan Mayl, and continued through February 28.
[4] Represents beam trawl and single and double otter trawl.

Source: ADF&G, Westward Region Shellfish Report, 1978

TABLE C.40

KODIAK

OTTER TRAWL SHRIMP FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972.	1973	1974	1975	1
Pounds Landed (in 000's)	41,349	62,169	82,098	57,788	71,343	47,266	46,927	4
Value of Landings	$ 1,654,000	$ 2,487,000	S 3,284,000	$ 3,005,000	$ 5,707,000	$ 4,727,000	$ 3,755,000	$ 4,96
Number of Boats "	24	29	48	55	58	64	67	
Number of Landings[1]	751	989	1,753	1,098	974	806	748	
Boat Weeks[2]	633	779	1,186	823	755	676	660"	
Man Weeks[3]	1,899	2,337	3,558	2,469	2,265	2,028	1,980	
Number of Landings per Boat	31.3	34.1	36.5	20.0	16.8	12.6	11.2	
Weeks per Soat	26.4	26.9	24.7	15.0	13.0	10.6	9.9	
Pounds per Landing	:55,100	62,900	46,800	52,600	73,200	58,600	62.700	6
Value of Catch per Landing	$ 2,200	$ 2,500	$ 1,900	$ 2,700	$ 5,900	$ 5,900	$ 5,000	s
Value of Catch per Boat	$ 68,900	$ 85,000	$ 68,400	$ S4,600	$ 98,400	$ 73,900	s 56,000	$ 7
Value of Catch per Boat Week	$ 2,600	$ 3,200	$ 2,800	$ 3,700	$ 7,600	$ 7,000	$ 5,700	$
Price (i.e. value of catch par lbs.)	$ 0.04	$ 0.04	s 0.04	$ 0.05	$ 0.08	$ 0.10	$ 0.08	$
Index 1[4]	0.80	0.93	0.86	0.86	0.84	0.90	0.90	
Index 2[5]	1.19	1.27	1.48	1.33	1.29	1.19	1.13	

Sources: The catch statistics were derived using data provided from the date files of the State of Alaska Commercial F: Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A st the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoi: research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: 'it is thus an of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained b t Commission.

It has been estimated that the average crew size in this fishery is 3.

TABLE C.41
Kodiak Otter Trawl Shrimp Fishery

Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]	16	17	24	39	33	22	38	32
	L[2]	57	71	91	149	138	36	94	101
February									
	B	16	18	25	15	34	7	45	31
	L	57	66	97	88	126	12	116	109
March									
	B	17	18	32	18	--	4	7	--
	L	67	80	119	41	--	4	11	--
April									
	B	17	19	17	4	--	1	--	--
	L	65	85	50	9	--	--	--	--
May									
	B	15	19	32	5	5	8	1	4
	L	58	57	171	7	14	19	--	--
June									
	B	16	19	34	31	14	8	11	1
	L	65	93	181	128	31	17	17	--
July									
	B	14	19	34	34	8	5	17	5
	L	70	115	197	188	21	10	34	--
August									
	B	14	18	29	33	29	32	39	3
	L	75	103	190	118	130	128	134	--
September									
	B	14	18	31	16	34	31	30	45
	L	72	93	190	32	168	98	102	176
October									
	B	14	18	29	31	32	45	28	52
	L	52	78	161	149	117	183	87	182
November									
	B	15	21	35	30	31	49	31	44
	L	62	72	174	116	121	191	78	123
December									
	B	16	22	36	30	34	44	29	14
	L	61	76	132	73	108	107	74	24

Source: Commercial Fisheries Entry Commission Data Files.

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.42
KODIAK OTTER TRAWL

SHRIMP FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	4	2	3	1				1
1- 25		1		1	2			-
26- 35		1	3	3	5			
36- 45	2	4	4	5	4	3	2	
46- 55	4	5	9	11	6	7	7	5
56- 65	7	6	10	10	8	6	7	4
66- 75	5	7	10	12	17	20	24	31
76- 85	1	2	7	9	13	21	20	22
86- 95	1	1	2	2	3	5	5	3
96-105						1	1	1
106-115						1	1	-
116-125								
125-				1				-

1. All boats unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.43
KODIAK
BEAM TRAWL SHRIMP FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	197s	1976
's Landed OO'&)		-	(	853	3,141	2,590	2,022″	2,017
of Landings	$ -	$ -	$ (	$ 44,000	$ 251,000	$ 2S9,000	$ 162,000	$ 201,000
r of Boats		-	(	15	32	1 9	14	10
r of Landings[1]		-	(	114′	312	161	127	105
Weeks [2]	-	-	(	84	272	142	108	82
eeks [3]	-	-	(	168	544	284	216	164
r of Landings o_c		-	(	7.60	9.75	8.47	9.07	10.50
per Boat		-		5.60	8.50	7.47	7.71	8.20
ls per Landing	-	-	(	7,500	10,100	16,100	15,900	19,200
of Catch anding	$ -	$ -	$ (	S 390	$ 800	$ 1,610	$ 1,280	$ 1,910
of Catch loat	$ -	$ -	$ (	$ 2,900	$ 7,800	$ 13,600	$ 11,600	$ 20,100
of Catch loat Week	$ -	$ -	$ (	$ 520	$ 920	$\ 1,820	S 1,500	S 2,450
value of catch per lbs.)	$	$ -	$ (	$ 0.05	$ 0.08	$ 0.10	$ 0.08	$ 0.10
c 1[4]		-	(	0.95	0.98	0.98	0.97	0.91
c 25		-	(	1.36	1.15	1.13	1.18	1.28

r.s: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Nan weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an estimat of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Entr Commission.

has been estimated that the average crew size in this fishey is 2.

TABLE C.44
Kodiak
Beam Trawl Shrimp Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]					14	5	8	5
	L[2]					42	10	13	13
February									
	B				2	13	6	10	7
	L					51	13	19	18
March									
	B				4		3		3
	L				21				
April									
	B				5				
	L				10				
May									
	B				5	2	2	1	
	L				9				
June									
	B			1	1	3	6		2
	L						16		
July									
	B			1	1		5	2	4
	L						11		13
August									
	B				1	9	4	2.	2
	L					24	16		
September									
	B					15	5	4	3
	L					46	18	18	
October									
	B				4	19	10	3	5
	L				18	51	26		19
November									
	B			1	9	17	11	9	2
	L				19	47	26	25	
December									
	B			1	7	17	10	8	
	L				15	42	18	14	

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.45

KODIAK BEAM TRAWL

SHRIMP FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	-				1			
1- 25	-				1	1		
26- 35				5	12	5	4	2
36- 45			1	6	15	11	9	7
46- 55				1	2	1	1	1
56- 65				1		1		
66- 75								
76- 85					1			
86- 95				1				
96-105	-							
106-L15	-							
116-125	-			1				

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.46

KODIAK
POT SHRIMP FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972,	1973	1974	1975
Pounds Landed (in 000'3)	(	12		(	(	7	13
Value of Landings	$ (	$ 5,000	$	$ (	$ (	$ 3,000	s 29,000 $
Number of Boats	1	5		1	2	8	7
Number of Landings[1]	f	20		(	(	65	66
Boat Weeks[2]	(	20		(	(	4a	4 5 "
Man Weeks'	(	40		(	(	96	90
Number of Landings per Boat	(	4.00		(	(	8.13	9.43
Weeke per Boat		4.00				6.00	6.43
Pounds per Landing	(	600		(	(	110	200
Value of Catch per Landing	S (	$ 250	$	$ (	$ (	$ 50	s 440 s
Value of Catch per Boat	S (	$ 1,000	$	S (	$ (	$ 3$0	s 4,140 S
Value of Catch per Seat Week	S (	$ 250	$	$ (	$ (	$ 60	S 640 $
?r ice (i.e. value of catch per lbs.)	S (	S 0.42	S	$ (	S (	$ 0.43	s 2.23 $
Index 1[4]	(	1.00		(	(	0.64	0.85
Index 2[5]	(	1.00		(	(	1.35	1.47

Sources: *The* catch **statistics were** derived using data provided *from the* data **files** *of the* State of **Alaska Commercial** *Entry* **Commission.** The estimate of the average crew size in this fishery was **made** by George W. Rogers in, A s the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoi research.

1. Number of Landings equals **the** number of days each boat landed fish. Summed **over all** boats..
2. Seat weeks equals *the* **number** *of* weeks each boat landed fish. Summed over all boats.
3. *Man* weeks equals **boat** weeks *times an estimate* of the average *crew size in* this fishery: it is thus an of the *average* number *of fishermen employed a* week times the *number* of weeks fished.
4. Index 1 **equals the** number of Landings divided by **the** number of species Landed
5. index 2 equals the average number of Landings per week.
6. A "(" indicates that.the statistic is not **available due to** *confidentiality requirements* maintained by Commission.

It bee **been estimated** that the average crew sise *in* **this** fishery is 2.

TABLE C.47
Kodiak
Pot Shrimp Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]					2	1	2	
	L[2]								
February									
	B		1			1	3	4	1
	L							9	
March									
	B		2		1		3	4	2
	L							16	
April									
	B		2		1		4	5	2
	L						22	25	
May									
	B	1	1					4	
	L						3	8	
June									
	B	1					2	2	
	L								
July									
	B						2	1	
	L								
August									
	B								
	L								
September									
	B								
	L								
October									
	B	1	2						
	L								
November									
	B		3						
	L								
December									
	B		2						
	L						5		

Source : Commercial Fisheries Entry Commission
Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.48
KODIAK

POT SHRIMP FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]		1				1		
1- 25						6	2	2
26- 35		1			2		4	
36- 45		2			1	1		
46- 55	1	1		1				
56- 65								
66- 75			-				1	

1. All boats of unspecified length are included in this catagory

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.49
KODIAK SHRIMP FISHERY ALL GEAR TYPES:
CATCH, GROSS EARNINGS, AND NUMBER OF BOATS, 1969 - 1976

YEAR	CATCH (pounds)	GROSS EARNINGS	NUMBER OF BOATS
1969	41,353,461	$1,656,086	25
1970	62,181,204	2,491,677	34
1971	82,153,724	3,286,149	48
1972	58,645,349	3,057,925	71
1973	74,484,291	5,958,822	92
1974	49,862,278	4,988,360	91
1975	48,962,019	3,944,698	88
1976	51,850,508	5,168,171	72
1977			

Source: Alaska Commercial Fisheries Entry Commission, Alaska Shellfish Bio-Economic Data Base, 1978

TABLE C.50
KODIAK SCALLOP FISHERY, CATCH AND EFFORT, 1967 - 1976

YEAR	NO. VESSELS	POUNDS	METRIC TONS	NO. LANDINGS	POUNDS	METRIC TONS
1967	2	7,788[1]	3.53	6[1]	1,298	.59
1968	8	872,803[2]	395.89	89[3]	8,983[3]	4.07[3]
1969	11	1,012,860	459.43	86	11,777	5.34
1970	7	1,417,612	643.02	102	13,898	6.30
?971	5	841,211	381.75	48	17,525	7.95
1972	5	1,038,793	471.19	68	15,276	6.93
1973	4	935,705	67.11	42	22,279	10.11
1974	3	147,945	133.42	14	10,568	4.79
1975	3	294,142	42.92	29	10,143	4.60
1976	1	75,245	34.13	6	12,541	5.69
TOTAL[4]	46	6,482,184	2,940.30	475[5]		
AVERAGE[4]	5	720,243	326.70	52	13,647	6.19'

[1] Unshucked scallops only.

[2] 718,671 pounds scallops shucked; 154,132 pounds unshucked.

[3] 80 landings of shucked scallops; 9 landings unshucked. Average pounds/landing based on shucked weight and landings.

[4] 1968-1976 total and average, shucked scallop weight only.

[5] Shucked scallop landings.

Source: ADF&G, Westward Region Shellfish Report, April, 1978.

TABLE C.51
Kodiak Scallop Dredge Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	1976
.s Landed 100's)	1,013	1,418	841	1,039	936	C	C	C
of Landings	$881,000	$1,488,000	$900,000	$1,247,000	$1,123,000	C	C	C
r of Boats	11	7	5	5	4	3	3	1
r of Landings[1]	92	94	49	59	41	C	C	C
Weeks[2]	89	94	49	59	39	C	C	C
Weeks[3]	890	940	490	590	390	C	C	C
r of Landings ... t	8.36	13.43	9.80	11.80	10.25	C	C	C
3 per Boat	8.09	13,43	9.80	11.80	9.75	C	C	C
s per Landing	11,000	15,100	17,200	17,600	22,800	C	C	C
of Catch Landing	$9,600	$15,800	$18,400	$21,100	$27,400	C	C	C
of Catch Boat	$80,100	$23.3,600	$180,000	$249,400	$280,800	C	C	C
of Catch Boat Week	$9,900	$15,800	$18,400	$21,100	$28,900	C	C	C
value of catch per lbs.)	$0.87	$1.05	$1.07	$1.20	$1.20	C	C	C
x 1[4]	0.67	0.63.	0.74	0.80	0.55	C	C	C
x 2[5]	1.03	1.00	1.00	1.00	1.05	C	C	C

Notes: The catch statistics ware derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was mada by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.

2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.

3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estimate of the average number of fishermen employed a week times the number of weeks fished.

4. Index 1 equals the number of Landings divided by the number of species Landed

5. Index 2 equals the average number of Landings par week.

6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by the Entry commission.

7. It has bean estimated that the average crew size in this fishery is ten.

TABLE C.52
KODIAK SCALLOP DREDGE FISHERY
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]	1			1			1	
	L[2]								
February									
	B	5	2	2	2	2	1	1	
	L	5							
March									
	B	4	2	2	4	2	3	1	1
	L	5			7				
April									
	B	7	6		4	2			
	L	12	11		5				
May									
	B	6	6		1				
	L	12	11						
June									
	B	4	7	5	4	2		3	
	L	6	12	11	8				
July									
	B	5	7	5	4	4		3	1
	L	8	18	7	9	10			
August									
	B	6	7	4	4	4	1	2	1
	L	10	11	7	7	5			
September									
	B	6	7	4	4	4	2	2	1
	L	12	12	5	7	5			
October									
	B	4	2	4	3	4	1	1	
	L	8		6		6			
November									
	B	3	2	2	2	2	2	2	
	L								
December									
	B	2	2	2	2	1	2	2	
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

*L = Number of Landings

TABLE C.53
KODIAK SCALLOP DREDGE FISHERY
Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	4	3						
26 - 35 feet	1							
66 - 75 feet	1	1	1	1		1		
76 - 85 feet	4	3	3	3	3	2	3	1
86 - 95 feet	1		1	1	1			

[1]All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission, Data Files.

TABLE C.54
ANNUAL KODIAK RAZOR CLAM CATCH, 1960 - 1977
(in thousands of pounds, shell weight)

YEAR	CATCH	YEAR	CATCH	YEAR	CATCH
1960	420.6	1966	14.8	1972	152.1
1961	382.0	1967	2.2	1973	165.3
1962	297.5	1968	6.4	1974	198.4
1963	323.8	1969	12.0	1975	6.2
1964	0	1970	132.3	1976	0
1965	20.0	1971	190.4	1977	0.4

Source: ADF&G, Westward Region, Shellfish Report, April, 1978.

TABLE C.55
KODIAK RAZOR CLAM CATCH BY MONTH, 1967 - 1977
(in thousands of pounds, shell weight)

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
1967					2.2								2.2
1968					6.4								6.4
1969					5.5	3.6	3.0						12.0
1970				1.7	49.9	65.7	15.0						132.3
1971				4.5	14.8	83.8	50.6	36.8					190.4
1972					23.5	92.2	23.9		1.4	2.4			152.1
1973				2.4	12.8	46.3	44.9	58.4	0.5				165.3
1974				1.4	40.0	59.4	44.9	52.7					198.4
1975					1.9	4.0	0.2						6.2
1976													--
1977						0.4							0.4

Source: Alaska Department of Fish and Game, Statistical Leaflets, various years.

TABLE C .56
KODIAK
RAZOR CLAM FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	1976
; Landed 0'$)	(	132	190	152	165	(	(	
of Landings	$ (	$ 33,000	S 57,000	$ 52,000	$ 56,000	$ (	-$ (	$
" of Boats	3	8	10	13	9	2	3	
· of Landings[1]	(	31	70	85	72	(	(	... ...
'eeks[2]	(	26	37	48	36	(	(	
:eks[3]	(					(	(	
. of Landings	(	3.88	7.00	6.54	8.00	(	(	
per Boat		3.25	3.70	3.69	4.00			
s per Landing	(	4,260	2,710	1,790	2,290	(	(	
of Catch nding	$ (	$ 1,060	$ 810	$ 610	$ 780	$ (	$ (	$
of Catch oat	$ (	$ 4,130	$ 5,700	$ 4,000	$ 6,220	$ (	$ (	$
of Catch oat Week	$.(	$ 1,270	$ 1,540	$ 1,080	$ 1,560	$ (	$ (	$
value of catch per lbs.)	$ (	$ 0.25	S 0.30	$ 0.34	S 0.34	$ (	$ (	S
1[4]	(	0.97	0.85	0.66	0.53.	(	(	
2[5]	(	1.19	1.89	1.77	2.00	(	(	

es: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W.Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.

2. Seat weeks equals the number of weeks each boat landed fish. Summed over all boats.

3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estimat of the average number of fishermen employed a week times the number of weeks fished.

4. Index 1 equals the number of Landings divided by the number of species Landed

5. Index 2 equals the average number of Landings per week.

6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Entr Commission.

e statistics do not include the activities of the following boats that participated in this fishery: 1974, one boat with ecified gear.

TABLE C.57
Kodiak
Razor Clam Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B		1	1		1	1		
	L								
May									
	B	2	5	2	5	2	1	1	
	L		14		17				
June									
	B	1	5	4	6	3	1	2	
	L		13	20	37				
July									
	B	1	2	5	4	3	2	1	
	L			20	14				
August									
	B		3	5	6	6	1		
	L			19	12	23			
September									
	B				1	1			
	L								
October									
	B				1				
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.58
KODIAK

RAZOR CLAM FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	1	2	3	5	1	2	2	
1- 25	-		1		1			
26- 35	1	3	4	2	4			
36- 45	-	1	2	2	2			
46- 55	-	1		1			1	
56- 65	1	1			1			
66- 75	-			1				
76- 85	-			1				
86- 95				1				

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.59

A MEASURE OF DOUBLE COUNTING IN THE KODIAK SHELLFISH AND SALMON FISHERIES, 1975-1977

	1975	1970	1977
Sum of boats in the individual shellfish fisheries	409	387	370
Total boats in the shellfish fishery as a whole	240	268	261
Ratio	1.704	1.444	1.418
Sum of boats in the individual salmon fisheries	416	502	512
Total boats in the salmon fishery as a whole	401	494	507
Ratio	1.037	1.016	1.010

Source: ADF&G data files, 1975-1977.

TABLE C.60

NUMBER OF KODIAK AND STATEWIDE GEAR PERMITS ISSUED TO RESIDENTS OF KODIAK*

1974 - 1978

"SPECIES AND GEAR	1974	1975	1976	1977	1978
KODIAK					
Herring, Purse Seine				29	
Herring, Set Gill Net				1	
King Crab, Small Boat Pots[1]	90	78	108	163	90
King Crab, Large Boat Pots	100	99	101	130	
Salmon, Purse Seine	164	192	194	195	1:?
Salmon, Beach Seine		12	11	23	16
Salmon, Set Gill Net	1::	110	116	107	92
STATEWIDE					
Halibut, Hand Troll		2		1	
"Halibut, Small Boat Long Line[2]	137	53	103	123	121
Halibut, Large Boat Long Line	4	41	43	86	51
Sablefish, Large Boat Long Line				1	
Dungeness Crab, Small Boat Pots	64	11	7	12	10
Dungeness Crab, Large Boat Pots		15	13	9	4
Herring, Pound[3]					1
Herring, Purse Seine	66	25	27		
Herring, Beach Seine	2				
Herring, Drift Gill Net			1		
Herring, Set Gill Net	2	1	3		
Herring, Pound	2				
Herring Roe on Kelp	2	19	9	9	3
Bottomfish, Hand Troll		1			
Bottomfish, Small Boat Long Line	1	4	2	6	6
Bottomfish, Otter Trawl		9	16	21	, 18
Bottomfish, Small Boat Pots	4				
Bottomfish, Beam Trawl					4
Bottomfish, Large Boat Longline		1	3	4	5
Bottomfish, Other		1	1	1	2
Shrimp, Otter Trawl	108	83	86	97	53
Shrimp, Small Boat Pots	32	15	7	27	10
Shrimp, Beam Trawl	62	31	23	24	9
Shrimp, Large Boat Pots		4	8	7	2
Razor Clams, Shovel		12	8	7	
Razor Clams, Dredge				1	
Razor Clams, Other					1
Salmon, Hand Troll	1		2	1	1
Salmon, Power Troll	1	1	2	1	2
Tanner Crab, Small Boat Pots	87	57	62	85	94
Tanner Crab, Large Boat Pots	105	91	92	111	138
Scallops, Dredge	2	2			

[1] A small pot boat has a keel length of not more than 50 feet.

[2] A small long line boat has a keel length of not more than 26 feet.

[3] Indicates a limited entry herring fishery.

*A resident of Kodiak is anyone who used a Kodiak, Alaska address when applying for a gear permit.

Source: Commercial Fisheries Entry Commission, Permit Files.

TABLE C.61
NUMBER OF KODIAK PROCESSING PLANTS[1] BY PRODUCT 1962 - 1972

YEAR	SALMON	HALIBUT	HERRING	KING CRAB	TANNER CRAB	DUNGENESS CRAB	SHRIMP	SCALLOPS	RAZOR CLAMS	TOTAL[2]
1962	1	1	0	7	0	3	1	0	1	9
1963	3	2	0	6	0	2	3	0	1	9
1964	2	1	1	8	0	1	1	0	0	10
1965	5	1	2	9	0	5	3	0	1	14
1966	9	1	3	13	0	3	3	0	1	20
1967	5	2	3	17	4	8	5	3	1	19
1968	5	2	4	17	10	9	6	4	1	21
1969	8	1	3	14	9	8	6	2	1	17
1970	6	3	1	8	7	7	6	5	2	11
1971	7	1	4	11	7	8	5	2	2	13
1972	6	2	3	9	8	9	6	1	2	15

[1] Floating processor plants are included.

[2] The total is not the sum of the columns since most plants produce more than one product.

Source: ADF&G Commercial Operator Reports 1962 - 1972.

TABLE C.62
KODIAK SALMON
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT		1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)						1,278		
	Plants					2		
Frozen (000's lbs)		87	183		344	98	697	357
	Pl ants	3	2		3	3	3	2
Canned (000's lbs)		1,692	1,207		1,897	4,991	5,315	9,94.4
	Plants	3	2		4	3	3	3
Roe (000's lbs)					159	345	270	418
	Plants				4	4	3	4
Bait (000's lbs)								
	Pl ants							
Reduction 000's lbs)								
	Pl ants							
Other (000 s lbs)								
	Plants				1			1
Total (000's lbs)		1,779	1,390		2,400	6,712	6,282	1,769
	Plants	6	4		5	7	5	6

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.63

KODIAK HALIBUT

PROCESSING BY PRODUCT, 1956 - 58 ANO 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)				2,368	3,7(J6	4,140	4,132
Plants				5	4	4	2
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				2,368	3,706	4,140	4,132
Plants				5	4	4	2

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.64
KODIAK HERRING
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)							
Plants							
Canned (000's lbs)							
Plants							
Roe (000's lbs)				32	27	265	
Plants				2	2	3	1
Bait (000's lbs)							
Plants				1	1		
Reduction (000's lbs)							
Plants	1						
Other (000's lbs)							
Plants							
Total (000's lbs)				32	27	265	
Plants	1			2	3	3	1

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.65
KODIAK KING CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT		1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)								
	Plants				1			
Frozen (000's lbs)		158			3,697	4,053	4,920	4,556
	Plants	2	1		18	16	13	13
Canned (000's lbs)		334	445		297	354	446	527
	Plants	2	2		3	3	3	4
Roe (000's lbs)								
	Plants							
Bait (000's lbs)								
	Plants							
Reduction (000's lbs)								
	Plants							
Other (000's lbs)								
	Plants							
Total (000's lbs)		592	445		3,994	4,407	5,366	5,083
	Plants	3	2		18	16	13	13

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will *not* include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.66
KODIAK TANNER CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)				2,961	2,110	2,165	3,248
Plants				14	14	13	11
Canned (000's lbs)				680	736	549	993
Plants				4	4	4	5
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				3,641	2,846	2,714	4,241
Plants				14	14	13	11

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department. of Fish and Game, Processor Reports with 1978 revisions.

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TABLE C.67
KODIAK DUNGENESS CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)				372	171	109	17
Plants				8	8	5	3
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				372	171	109	17
Plants				8	8	5	3

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.68
KODIAK SHRIMP
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)				3,345	3,942	4,449	5,209
Plants				5	6	7	5
Canned (000's lbs)				579	1,820	3,786	3,700
Plants				4	5	3	4
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				3,942	5,762	8,235	8,909
Plants				6	8	7	6

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.69
KODIAK FISH PROCESSING, QUARTERLY WAGE AND EMPLOYMENT DATA 1970 - 1977

YEAR	QUARTER	NUMBER OF FIRMS	AVERAGE MONTHLY EMPLOYMENT	AVERAGE PAY	TOTAL QUARTERLY WAGES
1970	1	2	1	1	1
	2	2	1	1	1
	3	11	534	651	1,043,320
	4	2	1	1	1
1971	1	14	471	624	881,929
	2	14	3 7 1	691	769,893
	3	14	587	776	1,365,860
	4	16	490	636	935,367
1972	1	2	1	1	1
	2	2	1	1	1
	3	2	1	1	1
	4	2	1	1	1
1973	1	17	1,064	532	1,699,390
	2	19	1,127	690	2,333,990
	3	19	1,245	794	2,964,800
	4	20	1,148	757	2,607,790
1974	1	20	929	663	1,847,640
	2	26	877	801	2,105,730
	3	23	1,147	864	2,973,380
	4	20	1,052	934	2,947,750
1975	1	19	639	1,149	2,200,650
	2	20	894	794	2,128,460
	3	23	1,407	971	4,097,910
	4	20	1,141	931	3,187,740
1976	1	22	984	958	2,828,120
	2	2	1	1	
	3	16	1,673	1,098	5,509%43:
	4	20	1,470	974	4,295,240
1977	1	22	1,269	927	3,529,460
	2	20	1,170	1,029	3,612,470
	3	20	1>697	1,119	5,695,540
	4				

A "l" indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data Files

TABLE C. 70

KODIAK FISH PROCESSING, EMPLOYMENT BY MONTH 1970 - 1977

	1970	1971	1972	1973	1974	1975	1976	1977
January	1	473	1	1,187	8 9 0	607	872	1,201
February	1	452	1	1,033	875	805	1,048	1,397
March	1	488	1	973	1,021	504	1,033	1,209
April	1	188	1	966	910	755	1	1,014
May	1	393	1	1,058	813	1,055	1	904
June	1	533	1	1,358	907	871	1	1,591
July	582	578	1	1,236	1,230	1,255	1,468	1,688
August	558	582	1	1,287	1,137	1,478	1,749	1,701
September	462	600	1	1,212	1,073	1,487	1,802	1,703
October	1	617	1	1,110	1,162	1,343	1,760	
November	1	432	1	1,268	1,091	1,199	1,402	
December	1	421	1	1,065	904	881	1,249	
Total Man Months	1	5,757	1	13,753	12,013	12,240	1	

A "1" indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data Files

TABLE C. 71

KODIAK FISH PROCESSING, ESTIMATED MONTHLY WAGES 1970 - 1977

	1970	1971	1972	1973	1974	1975	1976	1977
January	1	295,152	1	631,484	590,070	697,443	835,376	1,113,330
February	1	282,048	1	549,556	580,125	924,945	1>003,980	1,295,020
March	1	304,512	1	517,636	676,923	579,096	589,614	1,120,740
April	1	129,908	1	666,540	728,910	599,470	1	1,043,410
May	1	271,563	1	730,020	651,213	837,670	1	930,216
June	1	368,303	1	937,020	726,507	691,574	1	1,637,140
July	378,882	448,528	1	981,384	1,062,720	1,218,610	161,186	1,888,870
August	363,258	451,632	1	1,021,880	982,368	1,435,140	192,040	1,903,420
September	300,762	465,600	1	962,328	927,072	1,443,880	197,860	1,905,660
October	1	392,412	1	840,270	1,085,310	1,250,330	171,424	
November	1	274,752	1	959,876	1>018,990	1,116,270	136,555	
December	1	267,756	1	806,205	844,336	820,211	121,653	
Total Man Months	1	3,953,045	1	9,605,970	9,874,496	11,614,726	1	1

A "l" indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data Files

PUBLIC SERVICES

TABLE C.72
Electricity Use, by User Groups
Kodiak, Alaska 1965-1977

(000's of KWH)

	Residential & Small Commercial	Large Commercial	Total[1]	Residential & Small Commercial	Large Commercial	Total[1]
		1965			1966	
Jan.	735	316	1065	904	600	1521
Feb.	698	328	1040	797	610	1425
Mar.	730	352	1098	927	557	1507
Apr.	670	360	1047	853	503	1377
May	940	317	1001	797	478	1298
June	676	344	1037	822	502	1348
July	685	316	1017	698	634	1355
Aug.	708	457	1181	842	694	1557
Sept.	747	436	1198	860	553	1436
Oct.	811	435	1262	992	564	1509
Nov.	926	484	1425	1043	635	1701
Dec.	NA	NA	NA	1136	733	1891
Total	--	--	--	10601	7063	17925
		1967			1968	
Jan.	1106	718	1846	1310	770	2108
Feb.	953	628	1603	1195	744	1968
Mar.	972	703	1697	1095	677	1804
Apr.	863	628	1514	1162	645	1843
May	879	652	1552	1030	669	1735
June	856	664	1521	886	746	1670
July	827	780	1629	976	919	1931
Aug.	932	790	1744	991	979	2007
Sept.	985	777	1783	1064	941	2043
Oct.	1009	759	1790	1234	974	2247
Nov.	1169	771	1965	1194	646	1880
Dec.	1237	708	1972	1386	832	2260
Total	11788	8558	20616	13523	9542	23496
		1969			1970	
Jan.	1307	708	2059	1134	748	2126
Feb.	1173	636	1856	1172	720	1948
Mar.	1165	702	1913	1312	884	2252
Apr.	1201	772	2024	1152	908	2114
May	1056	827	1933	1046	988	2090
June	1030	810	1890	1075	1083	2214
July	995	1091	2136	1097	1324	2478
Aug.	945	1085	2090	1101	1313	2470
Sept	1191	1218	2459	1219	1329	2608
Oct.	1211	979	2234	1268	1101	2430
Nov.	1206	874	2136	1266	962	2309
Dec.	1414	763	2235	1466	982	2510
Total	13894	10465	24966	14498	12342	27549

[1] "Total" includes use of electricity for streetlights, power plant, and other items not included within categories listed.

TABLE C.72

(Continued)
(000's of KWH)

	Residential & Small Commercial	Large Commercial	Total[1]	Residential & Small Commercial	Large Commercial	Tota
		1971			1972	
Jan.	1310	951	2323	1429	1142	263
Feb.	1242	1063	2365	1355	855	227
Mar.	1318	1150	2528	1409	960	245
Apr.	1139	835	2033	1134	874	206
May	1080	1123	2262	1352	1311	272
June	1187	1314	2500	1155	1192	240
July	1020	1409	2488.	1087	1655	280
Aug.	1142	1577	2799	1233	1598	289
Sept.	1171	1596	2828	1211	1361	263
Oct.	1184	1310	2556	1368	1424	285
Nov.	1419	1313	2795	1431	1289	278
Dec.	1425	1106	2595	1482	1128	267
Total	14637	14747	30052	15646	14789	3119
		1973			1974	
Jan.	1622	1314	2989	1630	1416	310
Feb.	1392	1287	2741	1512	1366	293
Mar.	1413	1199	2674	1497	1359	290
Apr.	1418	1584	3013	1479	1766	338
May	1420	1350	2830	1388	1168	260
June	1214	1517	2791	1185	1108	2[illegible]4
July	1295	1759	3114	1256	1297	260
Aug.	1374	1868	3302	1298	1932	328
Sept.	1347	1841	3148	1331	2023	341,
Ott .	1694	1756	3513	1549	1865	346
Nov.	1603	1514	3178	1410	1624	309
Dec.	1507	1568	3111	1722	1601	3[illegible]7
Total	16999	18557	36404	17257	18525	3652
		1975			1976	
Jan.	1678	1403	3136	1801	2171	402
Feb.	1464	1432	2950	1635	1986	3[illegible]7
Mar.	1469	1227	2749	1931	2245	423
Apr.	1527	1595	3275	1701	2051	380
May	1470	1767	3290	1466	1832	335
June	1349	1527	2929	1611	2245	391′
July	1397	1960	3409	1490	2357	390
Aug.	1328	2097	3478	1652	2219	3[illegible]2
Sept.	1569	2433	4055	1793	2583	443′
Oct.	1604	2132	3790	1855	2531	444′-
Nov.	1794	1843	3692	2061	1950	406
Dec.	2022	1841	3920	1981	1802	384
Tot al	18671	21256	40573	20977	25972	4763

TABLE C. 72
(Continued)
(000's of KWH)

	Residential & Small Commercial	Large Commercial	Total [1]	Residential & Small Commercial	Large Commercial	Total [1]
		1977			1978	
Jan.	2111	2559	4534	2331	2132	4540
Feb.	1816	1947	3827	2184	2255	4506
Mar.	1914	2083	4061	2125	2209	4399
Apr.	1806	1747	3570	2182	2017	4264
May	1676	2091	3864			
June	1713	2539	4337			
July	1569	2632	4266			
Aug.	1888	2421	4372			
Sept.	1791	2714	4569			
Oct.	1898	2127	4089			
Nov.	2240	2132	4438			
Dec.	2263	2003	4331			
Total	22685	26995	50258			

Source: Kodiak utilities records

[1] "Total" includes use of electricity for streetlights, power plant, and other items not included within-categories listed.

Figure Cl, Annual Electricity Consumption, Kodiak, Alaska
1966 - 1977

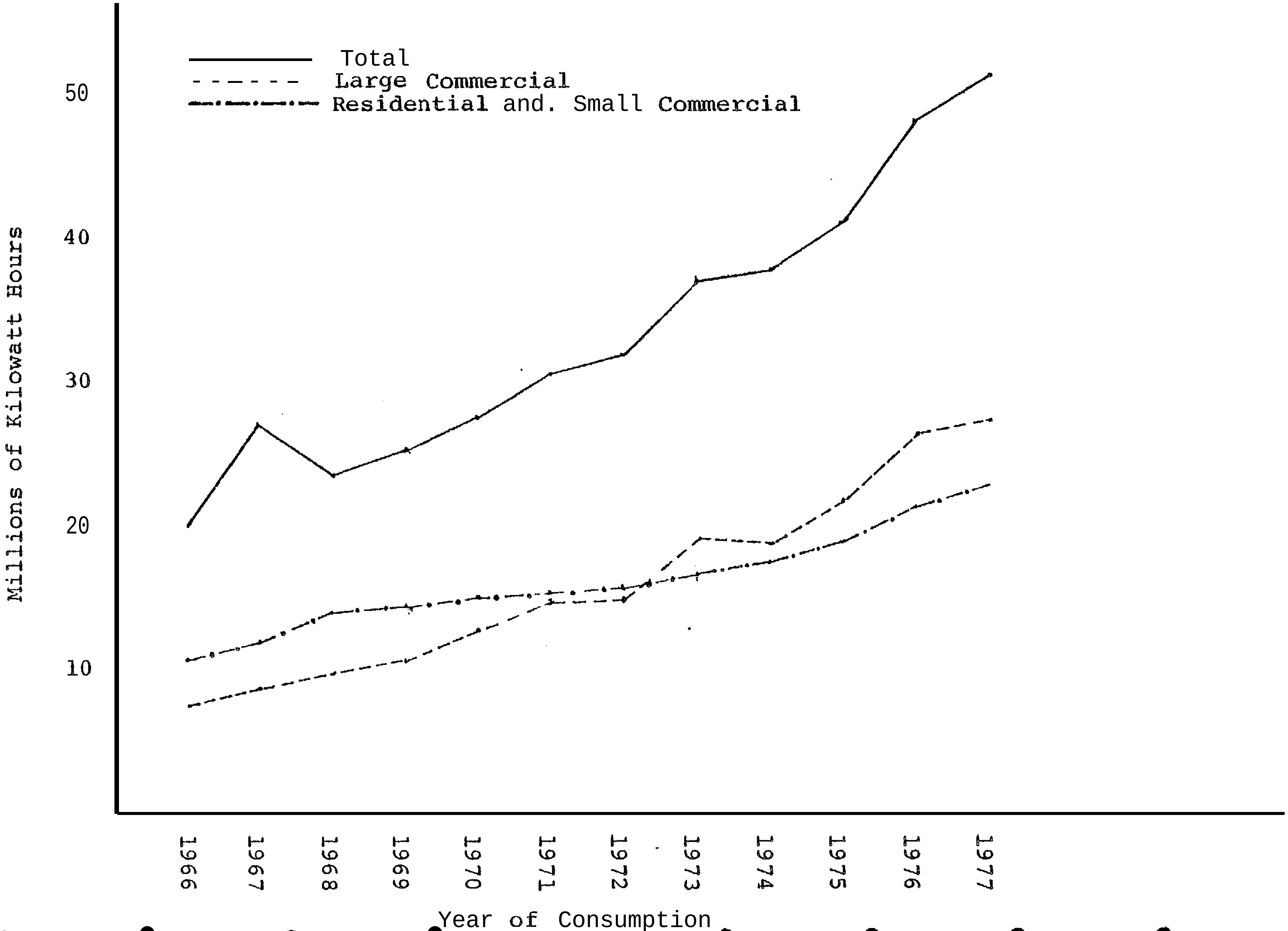

Figure C.2 Monthly Electricity Consumption, Kodiak, Alaska
June, 1975, to December, 1977

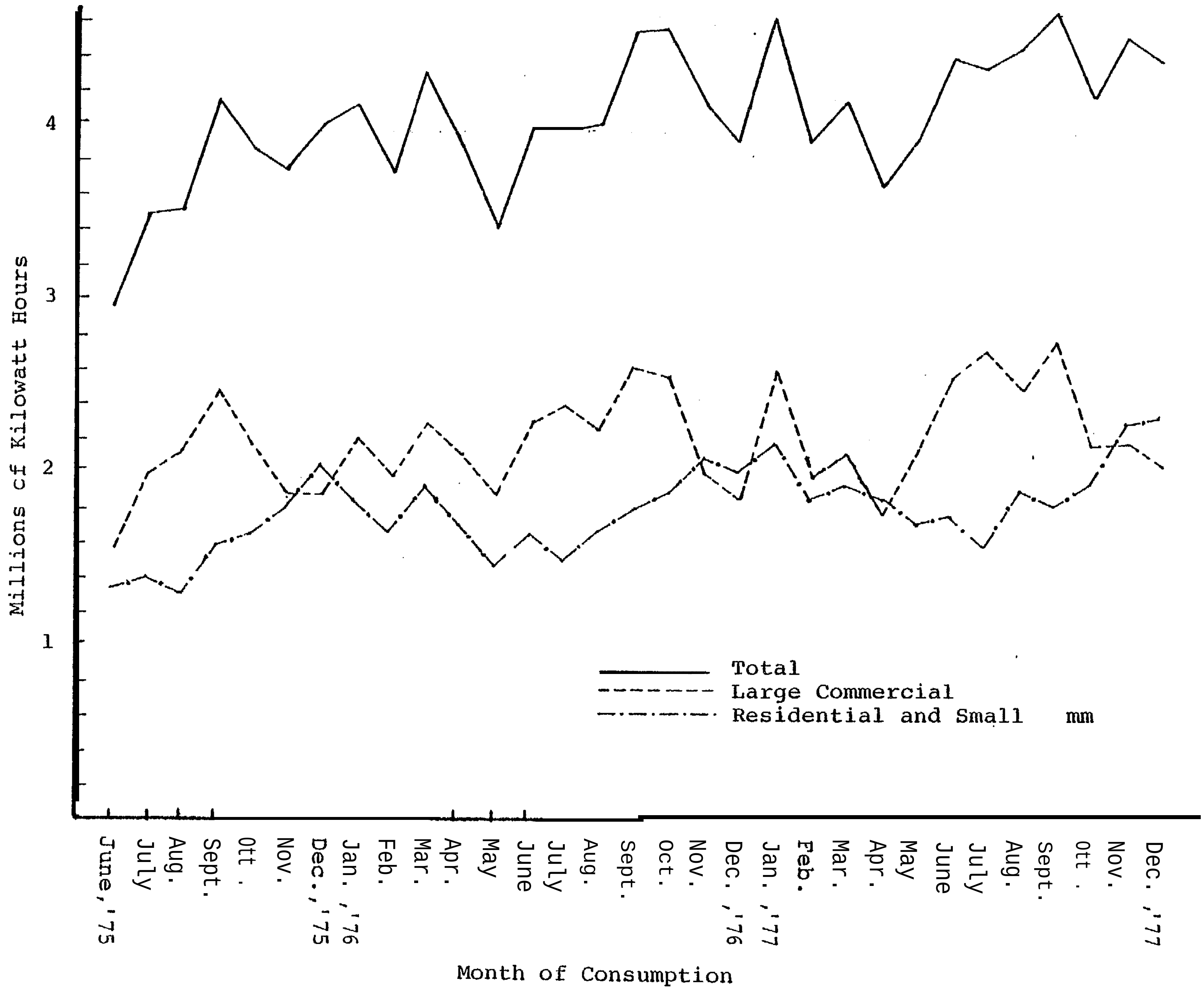

Figure C.3 Annual Water Consumption, Kodiak, Alaska
1964 - 1977

TABLE c.73
Industrial and Domestic Water Use
Kodiak, Alaska 1963-1978

(Millions of Gallons)

	Industrial	Domestic	Industrial	Domestic	Industrial	Domestic
	1963		1964		1965	
Jan.	--	--	13.5	19.7	11.9	28.0
Feb.	--	--	15.4	25,4	22.9	48.0
Mar.	--	--	13.9	46.6	16.9	61.4
Apr.	12.3	13.7	6.2	24.9	11.4	51.0
May	12.6	13.7	8.2	26.8	6.7	42.6
June	15.7	15.6	8.9	41.0	15.5	33.8
July	21.1	13.3	10.8	39.4	21.8	42.1
Aug.	15.9	14.9	8.8	37.1	29.6	35.9
Sept.	13.1	17.1	12.2	33.8	36.7	30.1
Oct.	11.3	17.4	13*9	32.1	36.0	37.3
Nov.	12.3	19.6	14.1	32.5	46.7	44.9
Dec.	5.9	22.5	18.4	56.2	48.0	46.4
Total	—	—	144.3	425.5	304.1	501.5
	1966		1967		1968	
Jan.	49.2	49.5	48.3	41.7	41.5	47.5
Feb.	58.4	58.6	36.6	39.8	33.8	58.3
Mar.	39.9	40.0	48.4	47.8	41.3	47.3
Apr.	36.7	36.8	34.0	47.2	33.0	60.2
May	38.4	38.5	31.4	32.4	35.5	70.1
June	17.5	17.7	43.5	26.0	42.3	38.8
July	52.3	41.6	55.4	.40.7	65.7	41.5
Aug.	49.6	55.7	58.3	39.7	88.1	39.0
Sept.	46.3	56.8	42.7	47.9	68.2	35.0
Oct.	35.3	38.0	49.0	38.3	58.3	34*9
Nov.	46.5	31.2	41.5	35.6	44.8	26.2
Dec.	50.3	45.7	41.2	36.7	33.9	40.1
Total	520.4	510.1	530.3	473.8	586.4	528.9
	1969		1970		1971	
Jan.	42.0	41.2	63.0	39.4	66.9	50.6
Feb.	42.7	34.6	59.5	39.1	77.0	46.0
Mar.	47.7	43.1	73.0	42.2	77.3	51.3
Apr.	56.5	39.0	77.6	43.3	9.4	54.3
May	60.5	44.4	35.7	35.2	67.4	47.0
June	50.2	26.2	62.5	15.9	79.8	39.4
July	63.6	33.7	108.9	38.0	100.4	45.0
Aug.	76.1	34.0	116.8	34.7	117.2	35.8
Sept.	67.6	31.5	92.5	32.6	118.9	35.3
Oct.	51.5	55.6	78.5	32.0	99.7	40.9
Nov.	46.6	31.3	67.1	31.1	84.7	37.6
Dec.	38.7	43.4	54.5	37.6	72.8	53.2
Total	643.7	458.0	889.6	421.1	971.5	536.4

ABLE C.73
(Continued)

(Millions of Gallons)

	Industrial	Domestic	Industrial	Domestic	Industrial	Domestic
	1972		1973		1974	
Jan.	56.3	51.1	81.5	55.8	62.1	55.7
Feb.	3.1	49.7	68.1	39.9	37.9	42.1
Mar.	2.4	49.6	40.0	47.6	52.3	61.3
Apr.	1.2	49.7	61.1	51.4	68.8	60.9
May	15.0	50.3	46.4	47.8	20.6	42.7
June	73.4	49.4	61.6	40.9	15.3	40.9
July	126.8	50.8	77.4	43.5	24.4	45.8
Aug.	100.3	40.5	135.7	42.3	140.5	42.8
Sept.	66.3	34.3	129.8	43.4	139.9	61.4
Oct.	104.3	35.9	1.00.6	42.3	127.5	49.3
Nov.	63.7	29.8	94.3	52.9	100.6	51.4
Dec.	42.2	40.5	92.7	51.2	76.5	52.7
Total	655.0	527.6	989.2	559.0	866.4	607.0
	1975		1976		1977	
Jan.	46.8	72.4	120.4	63.1	144.8	52.7
Feb.	84.0	44.3	142.8	62.0	103.5	44.0"
Mar.	19.4	48.9	85.4	57.7	71.9	77.5
Apr.	54.0	59.0	89.2	55.0	62.7	44.0
May	62.1	56.7	105.9	61.6	70.0	49.8
June	57.4	46.8	100.3	48.6	132.2	69.6
July	117.9	48.2	148.2	50.4	148.2	66.2
Aug.	150.7	46.1	141.1	46.1	147.0	63.0
Sept.	150.1	56.4	209.7	44.6	180.5	52.0.
Ott .	107.5	58.3	200.1	46.2	104.2	52.5
Nov.	87.3	54.1	94.1	71.8	98.3	64.8
Dec.	73.8	56.8	56.9	63.1	52.4	51.0
Total	1016.0	648.0	1494.1	670.2	1315.7	676.1
	1978					
Jan.	124.5	51.2				
Feb.	94.7	57.2				
Mar .	118.2	47.6				
Apr.	70.4	52.7				
May	38.7	49.7				
June	97.2	50.4				

Source: Kodiak utilities records

Figure C.4 Monthly Water Consumption, Kodiak, Alaska
January, 1976, to June, 1978

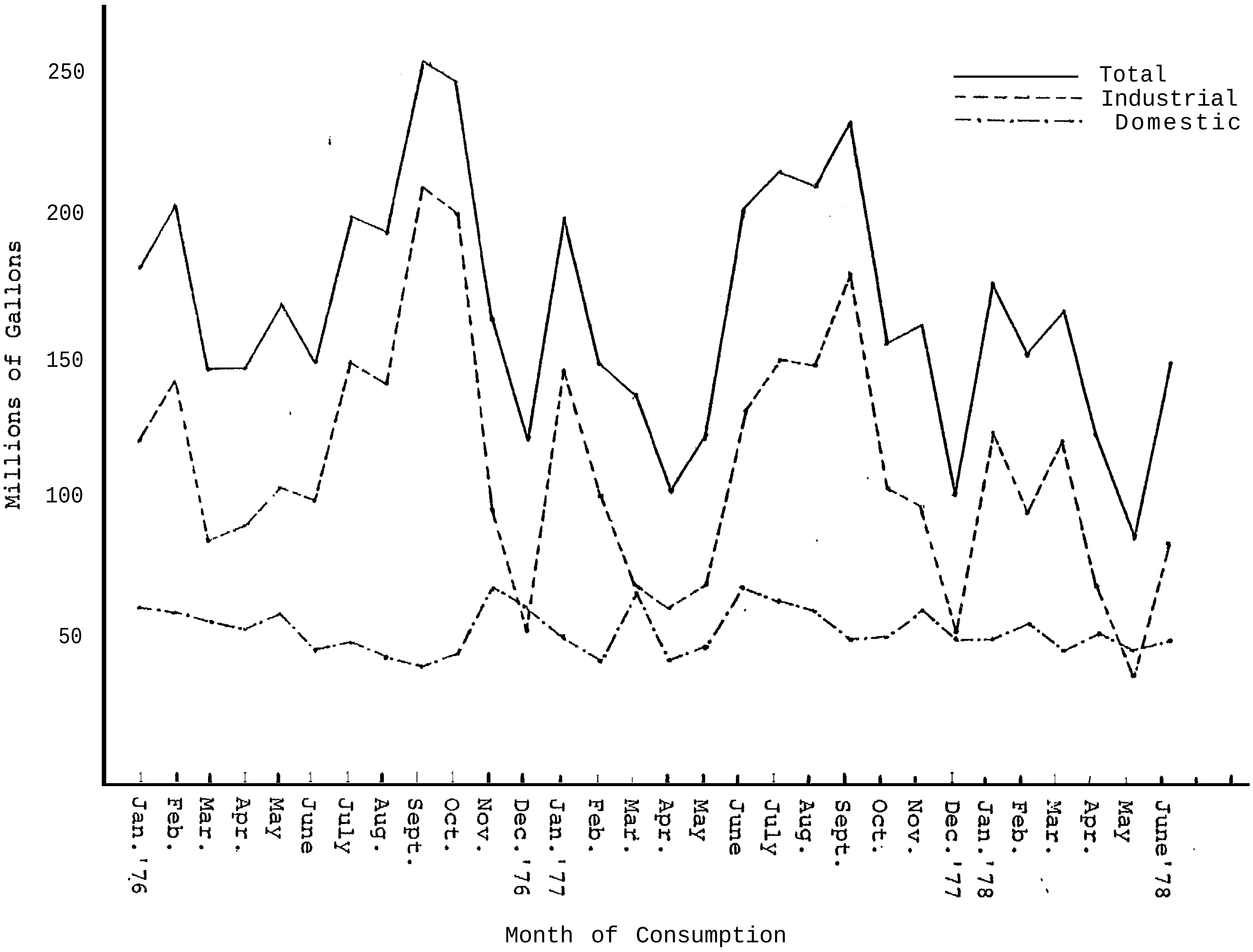

TABLE C.13a

DOCKAGES AT PIERS 1, 2, AND 3. PORT OF KODIAK, ALASKA
OCTOBER, 1974 - JULY, 1978

Date	Pier 1 (Ferry and Oil Dock)		Pier 2	Pier 3 (Container Pier)	
	Ferry	Others[1]	(City Dock)	Sea-Land Service Co.	Other
10/1/74 - 9/30/75	NA	NA	NA	85	NA
10/1/75 - 9/30/76	101	1	64	92	5
10/1/76 - 9/30/77	92	1	44	121	5
10/1/77 - 7/'07/78	71	1	23	99	0

SOURCE: Kodiak Port Operations records

[1] No record available of number of tankers delivering petroleum products

TABLE C. 74

PORT USAGE
KODIAK, ALASKA, 1960 - 1976[1]

Year	Total Cargo[2] Short Tons	FISH AND FISH PRODUCTS Short Tons	% of Total Cargo	No. of Vessels Using Port[3]
1960	38,289	9,807	25.6	826
1961	39,623	14,830	37.4	1,709
1962	80,267	16,817	21.0	936
1963	73,775	20,861	28.3	1,652
1964	62,285	15,455	24.8	1,461
1965	127,584	23,552	18.5	NA
1966	212,675	58,041	27.3	NA
1967	133,247	36,647	27.5	NA
1968	109,645	24,316	22.2	NA
1969	115,863	20,453	17.7	1,914
1970	124,479	42,128	33.8	3,994
1971	148,444	49,833	33.6	2,699
1972	192,963	48,433	25.1	1,606
1973	236,612	99,952	42.2	8,317
1974	217,024	86,960	40.1	4,379
1975	329,639	104,433	31.7	1,885
1976	388,125	178,122	45.9	321

Source: Department of the Army Corps of Engineers, Waterborne Commerce of the United States, Annual issues, 1960-1976.

[1] Includes all waterborne cargo entering and leaving the port.
[2] Includes raw fish and any other fish product form entering and leaving the port.
[3] Includes commercial fishing vessels, except 1976.

Seward

HARVESTING

TABLE C.75
COOK IN'LET TOTAL SALMON CATCH
BY SPECIES, 19S4-1977
(Number of Fish)

YEAR	KINGS	REDS	COHOS	PINKS	CHUMS	TOTAL
19s4	65,32S	1,246,672	336,685	2,4.60,051	77S,659	4,884,392
1955	46,499	1,064,128	180,452	1,286,008	317,053	2,894,140
1956	65,310	1,295,095	207,534	1,803,29S	870,269	4,241,503
1957	42,767	670,629	"127,199	,841	1,207,920	2,3S5,356
1958	22,484	496,842	241,561	2,598,314	596,179	3,955,743
1959	32,783	634,313	112,664	137,2.55	411,157	1,328,172
1960	27,539	948,040	314,153	2,023,2S2	766,079	4,089,063
1961	19,778	1,185,079	119,397	337,394	40s.221	2,066,869
1962	20,270	1,172,8S9	3.S8,051	4,960,030	1,149,841	7,661,051
1963	17,632	9S8,101	203,876	234,052	525,s37	1,939,198
1964	4,622	990,709	462,114	4,287,378	1,402,419	7,147,242
1965	9,7s1	1,426,352	154,363	139,561	344,0S2	2,074,079
1966	8,	1,867,372	295,042	2,585,616	661,883	5,418,499
1967	8,035	1,409,107	180,455	407,717	382,282	'2,387,596
1968	4,600	1,200',138	473,64S	2,862,939	1,183,037	s,724,359
1969	12,462	81S,050	111,s7s	235,866	331,058	1,496',011
1970	8,0S4	7s0,111	276,770	1,352,389	999,005	3,386,329
1971	19,838	658,537	10s,197	428,49S	47S,631	1,687',698
1972	16,174	937,721	83,167	657,243	70.5,691	2,399,9%
1973	S,347	699,277	106,104	633,498	783>080	2,227,506
1974	6,785	S24,762	205,767	534,520	41S,983	1,688,334
1975	4,933	713,960	233,S83	1,399,791	973,442	3,32S,709
1976'	10,660	1,700,763	220,149	1,394,148	523,304	3,849,02
1977*	13,532	2,134,S03	188,672	1,892,	1, ,845	5,626,052

*Preliminary data

Sources: Alaska Department of Fish and Game, 1974 Cook Inlet Salmon Report, December 1974

________, Annual Management Report, Lower k Inlet, 1977

________, Salmon Management Report 1977 Upper Cook Inlet

TABLE C.76
Lower Cook Inlet
Purse Seine **Salmon** Fishery

CATCH AND **EMPLOYMENT** DATA

	1969	3.970	1971	1972	1973	1974	1975	1
Pounds Landed **(in 000's)**	1,260	3,560	2,402	831	2,059	321	3,885	1,
Value of Landings	$154,000	508,000	427,000	202,000	752,000	167,000	1,419,000	526,
Number of Boats	47	73	" 43	47	49	49	63	
Number **of** Landings[1]	484	870	329	245	450	129	632	
Boat Weeks[2]	216	336	1.35	1.20	185	88	233	
Man Weeks[3]	864	1,344	540	480	740	352	932	
Number of Landings per **Boat**	10.3	11.9	7.7	5.2	9.2	2.6	10.0	
Weeks *per* **Boat**	4.60	4.60	3.14	2.55	3.78	1.80	3.70	2
Pounds per Landing	2,600	4,090	7,300	3,390	4,580	2,490	6,150	3,
Value of Catch **per** Landing	$ 320	580	1,300	820	1,670	1,290	2,250	1,
Value of Catch per Boat	$ 3,280	6,960	9,930	4,300	15,350	3,410	22,520	7,
Value *of* Catch **per Boat** Week	$ 710	1,510	3,160	1,680	4,060	1,900	6,090	2,
Price **(i.e. value** of catch per **lbs.)**	$ 0.12	0.14	0.13	0.24	0.37	0.52	0.37	0
Index 1[4]	0.43	0.42	0.40	0.48	0.43	0.48	0.49	0
Index 2[5]	2.24	2.59	2.44	2.04	2.43	1.47	2.71	1

sources : The catch **statistics** were derived **using** data **provided from** the data **files of** the State of Alaska Commercial Fi **Entry Commission.** The estimate of the-average crew size in this fishery was made by *George* **W. Rogers in, Ast** the <u>**Socio-Economic** Impact of Changes in the Harvesting Labor Force in **the** Alaska **Salmon Fishery**</u>, and in **ongoin** research.

1. *Number of Landings equals the number* **of** days each boat landed fish. Summed over **all boats.**
2. **Boat** weeks equals the number of weeks each boat landed **fish.** Summed over all boats.
3. **Man** weeks equals boat weeks times an estimate of the average crew size *in* this **fishery;** it is **thus** an of the average number of fishermen employed a week times **the** number of weeks fished.
4. **Index 1 equals** the **number** of Landings divided by the number of species Landed
5. Index 2 **equals** the **average** number of Landings per week.
6. A **"C"** indicates that the statistic is not available due to confidentiality **requirements maintained by t** Commission.
7. It has been estimated that the *average crew size in this* fishery is four.

TABLE C.77
Lower Cook Inlet
Purse Seine Salmon Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								1
	L								
March	B								
	L								
April	B								
	L								
May	B								
	L								
June	B	16	16	26					7
	L	42	29	46					8
July	B	42	60	42	39	43	20	56	53
	L	224	508	279	128	285	33	416	, 199
August	B	34	63	3	35	38	42	52	45
	L	215	332		114	165	96	210	157
September	B	3	1		3			4	
	L							6	
October	B								
	L								
November	B								
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.78
LOWER COOK INLET

PURSE SEINE SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	12	14	4	1	2	1	3	20
1- 25	5	11	7	8	6	5	7	8
26- 35	28	40	28	36	36	39	43	35
36- 45	1	7	3	1	4	4	9	8
46- 55	1	1	1	1	1			-
56- 65		-						
66- 75							1	

9

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.79
Cook Inlet
Drift Gill Net Salmon Fishery
CATCH AWD Employment OATA

		1969	1970	1971	1972	1973	1974	197s	1976
ds Landed ' 000's)		5,169	9,827	4,686	7,639	8,057 .	5,440	9,599.	3.3,611
e of Landings	,	$1,144,000	1,836,000	1,224,000	1,996,000	4,023,000	3,636,000	4,501,000	8,654,000
er of Boats		508	55s	, 432	401	462	550	541	577
e of Landings[1]		4,417	5,424	1,914	3,330	4,527	3,959	'4,533	5,350
Weeks[2]		2,233	2:,622	1,612	1,720	2,151	2,254	2,395	2,769
Weeks[3]		4,466	5,244	3,224	3,440	4,302	4,508" -	5,790	5,538
er of Landings Boat		8.69	9.77	4.43	8.30	9.80	7.20	8.38	9.27
.s per Boat		4.40	4.72	3.73	4.29	4.66	4.10	4.43	4.80
ds par Landing		1,170	1,810	2,450	2,290	1,780	1,370	2,120	2,540
.e of Catch Landing	$	260	340	580	600	890	920	990	1,620
.e of Catch Boat	$	2,250	3,310	2,580	4,980	8,710	6,610	8,320	15,000
e of Catch Boat Week	$	510	700	690	1,160	1,870	1,610	1,880	3,130
e . value of catch perlbs.)	$	0.22	0.19	0.24	0.26	0.50	0.67	0.47	0.64
x l[4]		0.34	0.28	0.33	0.28	0.29	0.29	0.28	0.26
:x 2[5]		1.98	2.07	1.19	1.94	2.10	1.76	1:89	1.93

c :: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate *of the* average craw size in this fishery was made by George W. Rogers in, A study. of the Socio-Economic Impact of Changes in the Harvesting Labor Forcc in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Seat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of tha average crew size in this fishery? it is thus an estimate! of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average *number of* Landings per week.
6. A "C" indicates that the statistic is not available due *to* confidentiality requirements maintained by the Entry Commission.
7. It has been estimated that the average crew size in this fishery is two.

TABLE C.80
Cook Inlet
Drift Gill Net Salmon Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B								
	L								
May									
	B	31			1				
	L	60							
June									
	B	185	92	50	39	18	24	29	47
	L	765	134	134	60	23	24	32	64
July									
	B	474	547	420	391	448	530	515	555
	L	3,218	4,565	1,305	2,7'10	3,499	3,058	3,289	4,380
August									
	B	174	253	277	193	344	324	389	365
	L	374	724	473	557	1,005	876	1,200	998
September									
	B		1	1	1		1	8	4
	L							12	i'
October									
	B								
	L								1
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.81
Cook Inlet
Drift Gill Net Salmon Fishery

Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
0[1] ft.	101	97	53	24	9	62	59	63
1-25 ft.	28	25	20	24	47	57	56	74
26-35 ft.	355	404	340	336	377	385	380	398
36-45 ft.	22	27	19	16	27	42	39	39
46-55 ft.	1	1		--		0	2	2
56-65 ft.	--	1		--		2	3	1
66-75 ft.	1			1	1	1	1	
76-85 ft.						1	1	
86-95 ft.								
96-105 ft.								
106-115 ft.								
116-125 ft.								
over 125 ft.								

1 All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.82

Cook Inlet
Set Gill Net Salmon Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	
Pounds Landed (in 000'*)	3,260	5,520	2,767	5,755	4,300	4,577	4,561	8
Value of Landings	$835,000	1,184,000	756,000	1,616,000	2,282,000	3,132,000	2,395,000	5,203
Number of Boats	394	457	398	454	488	558	567	
Number of Landings[1]	4,617	6,652	3,640	5,X24	4,568	5,009	4,856	5
Boat Weeks[2]	2,223	2,890	2,469	2,668	2,364	2,861	2,815	3
Man Weeks[3]	2,223	2,890	2,469	2,668	2,364	2,861	2,815	3
Number of Landings per Boat	11.7	14.6	9.1	11.3	9.4	9.0	8.6	
Weeks per Boat	5.64	6.33	6.20	5.87	4.84	5.13	4.96	
Pounds per Landing	710	830	760	1,120	940	910	940	1
Value of Catch per Landing.	$ 180	180	210	320	500	630	490	
Value of Catch per Boat	$ 2,120	2,590	1,900	3,560	4,680	5,610	4,220	8
Value of Catch per Boat Week	$ 380	'410	310	610	970	1,090	850	1.
Price (i.e. value of catch per lbs.)	$ 0.26	0.21	0.27	0.28	0.53	0.68	0.53	(
Index 1[4]	0.36	0.33	0.37	0.29	0.30	0.32	0.33	(
Index 2[5]	2.08	2.30	1.47	1.92	1.93	1.75	1.73	]

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A stu the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoin research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an e of the average number of fishermen employed a week times the number of weeka fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.
7. It has been estimated that the average crew size in this fishery is one.

TABLE C.83
Cook Inlet
Set Gill Net Salmon Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B				1				
	L								
April	B								
	L								
May	B		1						
	L								
June	B	271	279	280	307	184	169	209	236
	L	1,206	1,097	1,021	989	506	415	469	509
July	B	304	401	344	396	439	508	502	548
	L	2,350	3,354	1,472	2,661	2,735	2,716	2,583	3,490
August	B	268	355	282	295	324	410	388	422
	L	1,052	1,878	946	1,327	1,122	1,565	1,427	1,570
September	B	6	76	47	55	64	84	91	73
	L	9	317	200	146	204	313	361	204
October	B		3	1				12	7
	L							16	11
November	B								
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.84

COOK INLET

SET GILL NET SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	390	453	396	453	487	558	567	599
1- 25	2	4	2		1		-	1
26- 35	2			1			-	1

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.85
COOK INLET HAND TROLL SALMON FISHERY
CATCH AND EMPLOYMENT OATA

	1969	1970	1971	1972	1973	1974	197s	1976
ls Landed)00's)	0	6	12	c	6	C	C	C
s of' Landings	0	$3,000	$s,000	C	$1, 000	C	C	C
er of Boats	0	6	4	3	S	1	1	2
er of Landings[1]		8	6	c	8	C	C	C
weed		7	5	c	8	C	C	C
Weeks[3]		7	5	c	8	C	C	C
er of Landings Boat		1,33	1,s0'	c	1.60	C	C	C
s per Boat		1.17	1.2s	c	1.60	c	c	C
ls per Landing		7s0	2,000	c	7s0	C	C	c
e of Catch Landing		$ 380	$ 830	C	$ 880	C	C	C
e of Catch Boat		$ 500	$1,250	C	$1,400	C	C	C
e of Catch Boat Week		$ 430	$1,000	C	$ 880	c	C	C
e Value of catch per lbs.)		$0.50	$ 0.42	c	$1.17	C	c	C
x 1[4]		0.47	0.62	c	0.s0	C	C	C
x 2[5]		1.14	1.20	c	1.00	C	C	C

:ces: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in. this fishery was made lay George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing. research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats+,

2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.

3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estima of the average number of fishermen employed a week times the number of weeks f i shad.

4. Index 1 equals the number of Landings divided by the number of species Landed

S. Index 2 equals the average number of Landings per week.

60 A "~ indicates that the statistic Is not available due to conf identiality requirements maintained by the Ent Commission.

TABLE C. 86
COOK INLET HAND TROLL SALMON FISHERY
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B								
	L								
May									
	B								
	L								
June									
	B								
	L								
July									
	B		3	2	2	2			1
	L								
August									
	B		3	3	1	3	1	1	1
	L								
September									
	B					1			
	L								
October									
	B								
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission
Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.87
COOK INLET

HAND TROLL SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	-	3	3	1	2	1		
1- 25	-	1			2			1
26- 35		1						
36- 45		1	1	2	1			
46- 55								
56- 65								
66- 75								
76- 85								-
86-95							1	1

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.88

COOK INLET SALMON FISHERY ALL GEAR TYPES

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Pounds Landed (in 000's)	9,869	18,913	9,867	14,225	14,422	10,338	18,045	23,297	
Value of Landings	2,133,000	3,531 >000	2,302,000	3,814,000	7,064,000	6,935,000	8,315,000	14,138,000	
Number of Boats	949	1,091	877	905	1,004	1,158	1,172	1,256	
Number of Landings[1]	9,518	12,954	5,889	8,699	9,553	9,097	10,021	11,505	
Boat Weeks[2]	4,672	5,855	4,221	4,508	4,708	5,203	5,443	6,139	
Man Weeks[3]	7,553	9,485	6,238	6,588	7,414	7,721	8,537	9,471	

Source: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission- The estimate of the average crew size in this fishery was made by George W. Rogers in, A Study of the Socio Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

[1]Number of Landings equals the number of days each boat landed fish. Summed over all boats.

[2]Boat Weeks equals the number of weeks each boat landed fish. Summed over all boats.

[3]Man Weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estimate of the average number of fishermen employed a week times the number of weeks fished.

TABLE C.89

SEWARD HALIBUT LANDINGS 1969-1976

(1000 pounds)

1969	294	1973	3,972
1970	4,046	1974	1,930
1971	3,611	1975	3,936
1972	5,056	1976	3,418

Source: IPHC, Annual Reports 1969-1976.

TABLE C.90

Cook Inlet
Small Boat Long Line Halibut Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	197S	
Pounds Landed (in 000's)	0	C	0	4,806	4,596	3,328	3,S.37	3,
Value of Landings	0	C	0	$ 2,895	3,251	2,289	3,145	4,
Number of Boats	0	1	0	313	364	296	210	
Number of Landings[1]	0	C	0	1,159	1,3s5	951	792	
Boat Weeks[2]	0	C	0	964	1,179	819	676	
Man Weeks[3]	0	C	0	964	1,179	819'	676	
Number of Landings per Boat	0	C	0	3.70	3.80	3.21	3.77	3
Weeks per Boat	0	C	0	3.08	3.24	2.77	3.22	2
Pounds per Landing	0	C	0	4,150	3,320	3,500	4,470	3,
Value of Catch per Landing	0	C	0	$2,500	2,350	2,41.0	3,970	4,
Value of Catch par Boat	0	C	0	$ 9,250	8,930	7,730	14,980	16,
Value of Catch per Boat Week	0	C	0	$ 3,000	2,760	2,790	4,650	5,
Price (i.e. value of catch per lbs.)	0	C	0	$ 0.60	0.71	0.69	0.89	1
Index 1[4]	0	C	0	0.44	0.56	0.58	0.51	0
Index 2[5]	0	C	0	1.20	1.17	1.16	1.17	1

Sources: The catch statistics were derived using data provided from the data files of the Stata of Alaska Commercial i: Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A st the <u>Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery,</u> and in ongoi research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.
7. It has been estimated that the average crew size in this fishery is one.
8. These statistics do not include the activities of the following boats that participated in the Cook Inle halibut fishery:

   1972-76, one hand troller.

TABLE C.91
Cook Inlet Small Boat
Halibut Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B								
	L								
May									
	B				60	110	44	50	60
	L				78	166	66	67	76
June									
	B				139	244	191.	123	180
	L				299	531	38%	229	394
July									
	B				189	194	158	126	150
	L				402	390	277	255	348
August									
	B				176	135	105	106	66
	L				306	221	176	193	106
September									
	B				57	52	37	42	1
	L				74	71	44	48	
October									
	B					6			
	L					6			
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission
Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.92
COOK INLET

SMALL BOAT HALIBUT FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]				52	33	28	11	12
1- 25				46	71	52	41	73
26- 35		1		140	174	136	92	93
36- 45		-		32	38	41	33	34
46- 55		-		12	14	15	11	12
56- 65		-		22	21	18	15	17
66- 75		-		8	10	5	6	10
76- 85		-		1	2	1		-
86- 95		-			1	-		1
96-105						-		
106-115						-		
116-125						-		
125-						-	1	

[1] All Boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE [illegible]
SEWARD HALIBUT LANDINGS 1969-1977
(000 pounds)

YEAR	LANDING	YEAR	LANDING
1969	294	1974	1,930
1970	4,046	1975	3,936
1971	3,611	1976	3,418
1972	5,056	1977	3,249
1973	3,972		

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.93
COOK INLET HISTORICAL HERRING CATCH

Kachemak Bay

Year	Millions of Pounds	Tons
1914	0.3	150
1915	0.03	15
1916	0.1	50
1917	1.9	950
1918	4.0	2,000
1919	5.3	2,650
1920	1.9	950
1921	5.2	2,600
1922	1.0	500
1923	7.6	3,800
1924	14.1	7,050
1925	19.2	9,600
1926	14.3	7,150
1927	7.2	3,600
1928	4.3	2,150

Day Harbor - Resurrection Bay

Year	Millions of Pounds	Tons
1939	0.2	100
1940	---	
1941	3.2	1,600
1942	0.4	200
1943	5.2	2,600
? 944	31.9	15,450
1945	29.2	14,600
? 946	37.5	18,750
1947	1.2	600
1948	12.2	6,100
1949	---	
1950	7.7	3 ,850
1951	4.3	2,150
1952	0.8	400
1953	0.3	150
1954	0.4	200
1955	14.9	7,450
1956	3.3	1,650
1957	4.5	2,250
1958	---	
1959	0.1	50

Source: Alaska Department of Fish and Game, Cook Inlet Herring Report, December, 1974.

TABLE C.94
LOWER COOK INLET HERRING CATCHES 1969 - 1976.

		Tons	Landings	Vessels
1969	Southern	551.5	41	5
	Outer	38.0	1	1
	Eastern	757*9	32	7
	Total	1 ,347*4	74	11
1970	Southern	2,708.7	104	11
	Eastern	2,100.2	81	11
	Total	4,808.9	185	18
1971	Southern	12.5	4	3
	Eastern	974.0	129	20
	Total	986.5	133	23
1972	Southern	1.0	1	1
	Eastern	95.0	14	5
	Total	96.0	15	6
1973	Southern	203.8	20	12
	Outer	300.5	19	7
	Eastern	830.8	53	22
	Kamishak	243.1	33	9
	Total	1,578.2	125	30
1974	Southern	110.2	20	7
	Outer	39001	91	22
	Eastern	47.4	18	10
	Kamishak	2,108.0	127	26
	Total	2,655.7	256	42
1975	Southern	24.0	9	5
	Kamishak	4,119.0	294	39
	Total	4,143.0	304	44
1976	Kamishak	4,836.6	422	72 (purse seine)
	Kamishak	6.1	1	1 (set net)
	Total	4,842.7	427	72
1977	Kamishak	2,881.0	337	53 (purse seine
	Southern	276.0	21	16 (purse seine1
	Total	3,157.0	547	

Source: ADF&G Annual Management Report 1977, Upper Cook Inlet Area, May, 1978

TABLE C.95

Cook Inlet

Purse Seine Herring **Fishery**

CATCH AND **EMPLOYMENT** DATA

	1969	1970	1971	1972	1973	1974	1975	1976
is Landed 000's)	2,693	9,618	1,678	C	3,111	5,309	8,286	9,671
e of Landings	$54, 000	S192,000	$268,000	C	$249,000	$478,000	$331,000	$948, 000
er of Boats	11	23	20	2	31	4s	41	66
er of Landings[1]	64	145	73	C	91	178	170	239
Weeks[2]	29	59	40	C	59	98	77	129
Weeks[3]	116	236	160	C	236	392	308	516
er of Landings Boat	5.82	6.30	3.65	C	2.94	3.96	4.15	3.62
s per Boat	2.64	2.56	2.00	C	1.90	2.18	1.88	1.95
ds per Landing	.42,100	66,300	23,000	C	34,200	29,800	4a, 700	40,500
e of Catch Landing	840	1,320	3,670	C	2,740	2,690	1,950	3,970
e of Catch Boat	4,910	8,3S0	13,400	C	8,030	10,620	8,070	14,360
e of Catch Boat Week	1,860	3,250	6,700	C	4,220	4,880	4,300	7,350
e (. value of catch per lbs.)	$0.02	$0.02	.$0.16	C	$0.08	SO. 09	$0.04	$0. 10
x 1[4]	0.85	0.74	0.63	C	0.74	0.70	0.56	0.57
x 2[5]	2.21	2.46	1.83	C	3..54	1.82	2.21	1.85

ces: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Seat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew siza in this fishery: it is thus an esthete of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of specias Landed
5. Index 2 equals the average number of Landings per week.
6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by the Entry Commission.
7. It has been estimated that the average crew size in this fishery is four.
8. These statistics do not include the activities of the following boats that participated in this fishery: 1971 one herring seiner; 1973 two boats with unspecified gear; 1974 one pot 9ear boat.

TABLE C.96
Lower Cook Inlet
Seine Herring Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B	1	6				7		
	L		17				8		
May									
	B	11	22	21		18	44	40	62
	L	62	127	71		28	147	129	203
June									
	B	1	1	4	1	22	10	12	36
	L			5		62	23	41	36
July									
	B				1				
	L								
August									
	B								
	L								
September									
	B								
	L								
October									
	B								
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.97

Lower Cook Inlet
Purse Seine Herring Fishery

Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
0[1] ft.		4	1		5	4	1	.-
1-25 ft.	1	2	3		2	2	1	1
26-35 ft.	5	12	11	1	12	19	16	23
36-45 ft.	3	3	5	1	10	17	22	35
46-55 ft.	2	1	1		1	2	1	7
56-65 ft.		1			--	--		
66-75 ft.					1	1		
76-85 ft.								
86-95 ft.								
96-105 ft.								
106-115 ft.								
116-125 ft.								
over 125 ft.								

1 All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.98
Cook Inlet
Small Boat Long Line Bottomfish Fishery
CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975
Pounds Landed (in 000'S)	0	36	58	64	59 "	98	" 6
Value of Landings	0	$6,000	9,000	115	14,000	15,000	1,000
Number of Boats	0	19	40	5	46	47	9
Number of Landings[1]	0	38	82	5	119	128	11
Boat Weeks[2]	0	34	70	5	110	1.20	u
Man Weeks[3]	0	34	70	.5	110	120	11
Number of Landings per Seat	0	2.00	2.05	1.00	2.59	2.72	1.22
Weeks per Boat	0	1.79	I*75	1.00	2.39	2.55	1.22
Pounds per Landing	0	950	710	200	500	770	550
Value of Catch per Landing"	0	$ 160	110	23	120	120	90
Value of Catch par Boat	0	$ 320	230	23	300	320	110
Value of Catch per Boat Week	0	$ 180	130	23	130	125	9 0
Price (i.e. value of catch per lbs.)	0	$ 0.17	0.16	0.18	0.24	0.2.5	0.17
Index 1[4]	0	1.00	0.99	0.71	0.93	0.97	0.92
Index 25	0	1.12	1.17	1.00	1.08	1.07	1.00

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fi Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A st the Socio-Economic Impact of Changes in the *Harvesting* Labor Force in the Alaska Salmon Fishery, and in ongoin research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all *boats.*

2. Boat weeks equals the number of weeks each boat landed fish. Summed over *all* boats.-

3. Man weeks equals boat weeks *times an estimate* of the average crew size in this fishery; it is thus an of the average number of fishermen employed a week times the number of weeks fished.

4. Index 1 *equals the* number of Landings divided by the *number* of species Landed

5. Index 2 equals the average number of Landings per week.

6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.

7. It hae been estimated that the average crew size in this fishery is one.

8. These statistics do not include the activities of the following boats that participated in the Cook Inle bottomfish fishery:

1969 - *one* beam trawler
1969-1974 - one to three otter *trawlers*
1973-1974 - *one to two* pot boats
1971 - one purse siener and six hand trollers
1974 - 14 boats with unspecified gear, 36 set gill net boats
1975 - one hand troller

TABLE C.99
Cook inlet Small Boat
Long Line Bottomfish Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B								
	L								
April	B								1
	L								
May	B					9	10	2	
	L					10	11		
June	B		18	27	1	26	26	4	2
	L		32	53		38	46	5	
July	B		6	6	1	16	24	2	2
	L		6	7		30	40		
August	B			13	1	15	16	2	
	L			21		23	24		
September	B			1	1	8	5		
	L					16	7		
October	B					2			
	L								
November	B								
	L				1				
December	B								
	L								

Source : Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.100

LOWER COOK INLET SMALL BOAT LONG LINE

BOTTOMFISH FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]		7	6	1	2	1	1	
1- 25			5	2	4	5		1
26- 35		10	21	2	30	24	5	1
36- 45		1	7		6	9		2
46- 55					2	4	1	
56- 65		1			1	3	1	1
66- 75						1		
76- 85			1		1			
86- 95								
96-105								
106-115								
116-125							-	
125-							1	

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.101

COOK INLET OTTER TRAWL BOTTOMFISH FISHERY

Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B								
	L								
April	B					1			
	L								
May	B								
	L								
June	B						1		
	L								
July	B								
	L								
August	B			1					
	L								
September	B								
	L								
October	B								
	L								
November	B		2		2				
	L								
December	B						2		
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.102

LOWER COOK INLET OTTER TRAWL

BOTTOMFISH FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]						-		
1- 25						-		
26- 35						-		
36- 45	1		2	2		1		
46- 55						-	-	
56- 65								
66- 75					1	1		
76- 85					-	1		

1. All boats of unspecified length are included in this category

Source : Commercial Fisheries Entry Commission Data Files

TABLE C.103
COOK INLET KING CRAB CATCH IN POUNDS
BY CALENDAR YEAR 1951 - 1971

YEAR	CATCH	YEAR	CATCH
1951	6,619	1962	6,851,621
1952	2,900	1963	8,381,163
1953	1,359,854	1964	6,772,392
1954	1,275,852	1965	2,776,547
1955	1,915,821	1966	3,900,163
1956	2,129,035	1967	3,124,509
1957	620,858	1968	4,009,453
1958	752,990	1969	2,852,507
1959	2,191,437	1970	3,882,802
1960	4,287,432	1971	4,157,639
1961	4,256,396		

COOK INLET KING CRAB CATCH IN POUNDS BY FISHING YEAR, 1960-61 - 1977-78

YEAR	CATCH	YEAR	CATCH
1960-61	3,804,000	1969-70	3,228,000
1961-62	5,631,000	1970-71	3,665,000
1962-63	8,617,000	1971-72	4,873,000
1963-64	6,935,000	1972-73	4,149,000
1964-65	3,744,000	?973-74	4,203,000
1965-66	3,646,000	1974-75	4,778,000
1966-67	2,873,000	1975-76	3,559,000
1967-68	3,246,000	1976-77*	4,156,000
1968-69	2,550,000	1977-78*	1,672,000

*preliminary data

Sources: Alaska Department of Fish and Game, Shellfish Report Lower Cook Inlet, 1978; Alaska Department of Fish and Game, Cook Inlet Management Area Shellfish Report, 1972.

TABLE C.104
Lower Cook Inlet
King Crab Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975
Pounds Landed (in 000's)	2,855	3,888	4,258	4,572	4,349	4,602	2,886
Value of Landings	$ 731	1,089	1,247	1,509	2,870	2,163	1,183
Number of Boats	46	53	54	51	66	81	67
Number of Landings[1]	729	795	955	1,056	1,207	1,340	642
Boat Weeks[2]	336	402	521	591	665	785	461
Man Weeks[3]	1,176	1,407	1,824	2,069	2,328	2,748	1,614
Number of Landings per Boat	25.8	15.0	17.7	20.7	18.3	16.5	9.6
Weeks per Boat	7.30	7..$9	9.65	11.6	10.1	9.69	6.88
Pounds per Landing	3,920	4,890	4,350	4,330	3,600	3,430	4,500
Value of Catch per Landing	$1,000	1,370	1,310	1,420	2,380	1,610	1,840
Value of Catch per Boat	$15,900	20,500	23,100	29,600	43,500	26,700	17,700
Value of Catch per Boat Week	$ 2,180	2,710	2,390	2,550	4,320	2,760	2,570
Price (i.e. value of catch per lbs.)	$ 0.26	0.28	0.30	0.33	0.66	0.47	0.41
Index 1[4]	0.98	0.96	0.98	0.97	0.97	0.99	0.95
Index 2[5]	2.17	1.98	1.83	1.79	1.82	1.71	1.39

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Entry Commission. The estimate of the average craw size in this fishery was made by George W. Rogers in, A st the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoin research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.

2. 8oat weeks equals the number of weeks each boat landed fish. Summed over all boats.

3. Man weeks equals boat weeks times' an estimate of the average crew size in this fishery; it is thus an of the average number of fisherman employed a week times the number of weeks fished.

4. Index 1 equals the number of Landings divided by the number of species Landed

5. Index 2 equals the average number of Landings per week.

6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.

7. It is estimated that the average crew size in this fishery is 3.5.

8. These statistics do not include the activities of the following boats that participated in this fishery:

   1972 - two boats of unspecified gear.

TABLE C.105
Lower Cook Inlet
King Crab Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	19	17	24	26	25	40	16	46
	L[2]	50	34	61	106	73	153	53	133
February	B	21	22	25	32	28	37	28	45
	L	135	128	132	137	158	142	81	171
March	B			17	31	27	43	30	44
	L			24	128	130	137	44	131
April	B					1	3		
	L								
May	B								
	L								
June	B								
	L								
July	B								
	L								
August	B	26	33	42	38	42	66	3	48
	L	250	361	346	287	355	490		430
September	B	26	34	36	32	38	52	49	40
	L	192	166	209	145	153	250	150	79
October	B	20	25	27	20	31	36	48	2
	L	71	42	77	44	69	88	148	
November	B	1	15	17	21	41	15	32	2
	L		34	40	84	147	35	78	
December	B	11	16	19	23	37	17	37	34
	L	22	30	66	124	121	42	83	103

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.106

LOWER COOK INLET

KING CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	10	9	9	4	6	4	3	7
1- 25	1	1	1	2	3		4	3
26- 35	11	15	13	13	24	26	18	17
36- 45	11	17	17	17	19	24	18	23
46- 55	1	1	2	2	2	7	5	5
56- 65	-	2	4	4	4	6	7	8
66- 75	2	3	3	4	4	6	6	8
76- 85	4	5	4	4	3	6	6	5
86- 95	-		-	-	-	1		3
96-105	-		-	-	-	1		
106-115	-							
116-125	-							
125-	-		1	1	1	-		

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.107

Cook Inlet Tanner Crab Catch
by District
1968-1969 to 1977-1978

YEAR	SOUTHERN DISTRICT	KAMISHAK/BARREN IS.	OUTER/EASTERN DIS.	TOTAL
1968-69	1,388,282	12,398	816	1,401,496
1969-70	1,147,154 .	71,196	104,191	1,322,541
1970-71	1,046,803	541,212	3,000	1,s91,015
1971-72	2,462,956	974,962	804,765	4,242,683
1972-73	2,935,662	3,361,023	1,266,937	7,563,622
1973-74	1,387,535	4,689,251	1,891,021	7,967,807
1974-7s	967,762	3,150,462	656,660	4,774,884
1975-76	1,339,245	3,281,084	850,964	5,471,293
1976-77	2,016,501[1]	1,805,918[1]	823,851[1]	4,646,270
1977-78	2,700,000[1]	220,0001	120,000	3,040,000
AVERAGE	1,739,190	1,810,715	652,221	'4,202,161

1/Preliminary Data

Source: Alaska Department of Fish and Game, Shellfish Report, Lower Cook Inlet, 1978

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TABLE C.108
Lower Cook Inlet
Tanner (Snow) Crab Fishery

CATCH AND **EMPLOYMENT** DATA

	1969	1970	1971	1972	1973	1974	197s	
Pounds **Landed** **(in 000's)**	1,433	1,329	2,117	4,779	8,509	7,661	4,952	5
Value of Landings	$158,000	133,000	212,000	717,000	1,447,000	1,532,000	**693,000**	**1,246**
Number of Boats "	29	27	**44**	**54**	108	90	51	
Number of **Landings**[1]	520	313	603	1,080	1,S26	1,139	508	
Boat Weeks*	238	207	33s	**554**	766	666	350	
Man **Weeks**[3]	833	725	1,172	1,939	2,681	2,331.	**1,225**	1
Number of **Landings** *per* Boat	17.9	**11.6**	13.7	20.0	14.1	**12.7**	10.0	
Weeks per Boat	8.2	7.67	**7.61**	10.3	7.09	7.4	6.86	
Pounds **per** Landing	2,760	4,250	3,510	**4,430**	5,580	6,730	**9,750**	6
Value **of** Catch *per* Landing	$ 300	**420**	350	660	950	1,350	**1,360**	
Value of catch per **Boat**	$ 5,450	4,930	4,820	13,280	13,400	17,020	**13,590**	17
Value of **Catch** per **Seat Week**	**$** 660	640	630	1,290	**1,890**	2,300	**1,980**	2
Price (i.e. value **of** catch **per lbs.**)	$ **0.11**	**0.10**	0.10	**0.15**	0.17	0.20	**0.14**	
Index 1[4]	0.98	**0.98**	0.98	0.99	0.98	0.97	**0.98**	
Index 25	2.18	1.51	**1.80**	**1.95**	**1.99**	**1.71**	**1.45**	

Sources: The **catch statistics** were **derived using** data provided from the data files of the State of Alaska **Commercial** i **Entry** Commission. The estimate of the **average crew** size in this **fishery** was **made by George W. Rogers in**, A st the <u>**Socio-Economic Impact of Changes in the Harvesting Labor Force** in **the** Alaska **Salmon Fishery**,</u> and in **ongoin** research.

1. **Number** of Landings equals the number of days each boat landed fish. **Summed** ***over all*** beats.

2. **Boat** weeks **equals** the number of weeks each boat landed fish. Summed over all boats. . .

3. **Man** weeks equals boat weeks times an estimate of the average **crew** size **in** this fishery: it is thus an of the average ***number*** of fishermen employed a week times the number of weeks fished.

4. Index 1 equals the number of Landings divided by the number of **species** Landed

5. **Index** 2 equals the average number **of** Landings per week.

6. A **"C"** indicates that the statistic is not available due to confidentiality requirements maintained **by t** Commission.

7. It has been estimated that the **average** ***crew size in*** this fishery is 3.5.

8. These statistics do not include the activities of the following boats that participated in this fishery:

   1969 and 1972 - two **boats** with **unspecified** *gear.*

TABLE C.109
Lower Cook Inlet
Tanner (Snow) Crab Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	17	11	18	24	26	49	14	37
	L[2]	41	21	42	76	85	191	33	97
February	B	20	16	22	30	34	50	17	41
	L	130	68	119	125	194	164	35	148
March	B	16	12	15	43	38	60	27	45
	L	111	36	84	221	267	254	80	142
April	" B	14	14	16	22	36	59	30	32
	L	87	94	106	162	191	298	137	159
May	B	8	13	18	21	33	63	30	27
	L	33	56	91	144	3.22	199	140	101
June	B	7	9	14	19	23	3	18	
	L	76	13	51	77	84		34	
July	B	7		5"	9	3			
	L	16		9	11				
August	B				8	1			
	L				19				
September	B			2	5	1			
	L				5				
October	B	U	1	4	12			1	
	L	18		5	24				
November	B		2	9	20	55			
	L			31	93	383			
December	B	6	12	17	22	44	12	24	40
	L	8	20	63	123	170	29	48	205

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.I10

LOWER COOK INLET

TANNER (SNOW) CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	5	3	7	7	15	4	-	5
1- 25	1			2	2	2	2	2
26- 35	7	5	9	13	33	23	11	16
36- 45	9	12	16	15	20	22	13	20
46- 55	1		1	2	2	7	6	4
56- 65	1	1	2	4	5	8	7	8
66- 75	1	1	3	4	7	8	3	7
76- 85	4	4	5	6	7	8	8	7
86- 95	-				1	,5	1	3
96-105	-					1	-	
106-115	-							
116-125	-		-					
125-		1	1	1		2		

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.111

COOK INLET DUNGENESS CRAB CATCH, 1961 - 1977

YEAR	CATCH
1961	193,683
1962	530,770
1963	1,677,204
1964	423,041
1965	74,211
1966	129,560
1967	7,168
1968	487,859
1969	49,894
1970	209,819
1971	97,161
1972	38,930
1973	310,048
1974	721,243
1975	358,256
1976	119,000
1977-78	74,300

Source: McClean, et al, 1977, ADF&G Cook Inlet Shellfish Reports, 1976 - 1978.

TABLE C.112
Lower Cook Inlet
Dungeness Crab Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975
Pounds Landed (in 000's)	50	210	97	39	330	721	· 363
Value of Landings	$7,000	27,000	24,000	15,000	198,000	397,000	171,000
Number of Seats	9	10	22	24	55	37	34
Number of Landings[1]	40	48	1.35	228	612	610	387
Boat Weeks[2]	33	41	8S	152	352	360	276
Man Weeks[3]	66	82	170	304	704	720.	552
Number of Landings per Boat	4.44	4.80	6.14	9.50	11.12	16.49	11.38
Weeks per Boat	3.67	4.10	3.86	6.33	6.40	9.73	8.11
Pounds per Landing	1,250	4,380	720	170	540	1,180	940
Value of Catch per Landing	$ 180	560	180	70	320	650	440
Value of Catch per Boat	$ 780	2,700	1,090	630	3,600	10,730	5,030
value of Catch per Boat Week	$ 210	660	280	100	560	1,100	620
Price (i.e. value of catch per lbs.)	$ 0.14	0.13	0.25	0.38	0.60	0.55	0.47
Index 1[4]	1.00	0.96	0.99	Loo	0.98	0.99	0.96
Index 2[5]	1.21	1.17	1.59	1.50	1.74	1.69	i.40

63 ,

1

3

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fi Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A st the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoin research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by : commission.
7. It is estimated that the average crew size in this fishery is two.
8. These statistics do not include the activities of the following boats that participated in this fishery

   1969 - one boat with unspecified gear.

   1973 - two boats with unspecified gear.

TABLE C.113
Lower Cook Inlet
Dungeness Crab Fishery

Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]	1			1	16	14	3	1
	L[2]					47	25		
February									
	B	1			2	15	6	4	
	L					58	7	5	
March									
	B	2			3 “	9	6	1	1
	L					15	a		
April									
	B	2				6	2		1
	L					21			
May									
	B	3		1		9	8	4	1
	L					54	25	8	
June									
	B	2	1	4	3	6	9	7	2
	L			17		40	33	18	
July									
	B	2	1	6	6	7	13	14	1
	L			29	19	25	77	39	
August									
	B	2	4	7	5	8	21	23	10
	L		8	18	8	30	131	115	31
September									
	B	5	6	7	4	9	24	26	13
	L	10	15	19	13	35	139	95	43
October									
	B		6	6	5	25	20	20	10
	L		13	22	14	125	96	68	17
November									
	B		1	9	16	30	14	14	5
	L			18	59	106	49	.29	7
December									
	B			5	17	12	9	5	
	L			10	92	56	14	5	

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.114
LOWER COOK INLET

DUNGENESS CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	4	2	3		6		3	3
1- 25	1	1	-	-	4	1	2	1
26- 35	1	3	9	12	23	21	17	12
36- 45	2	2	9	9	15	10	6	2
46- 55	1	1		1	2	2	5	
56- 65	-		-	1	2	2	1	1
66- 75	-	1	1	1	1	-		-
76- 85	-		-	-	2	1		-

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.115
Cook Inlet
Otter Trawl Shrimp Fishery
Catch and Effort
1962-1976

Year	Boats	Deliveries	Thou. lbs. Catch	Thou. lbs. Catch/Delivery
1962	2	39	403	10.3
1963	7	169	1,898	11.2
1964	5	48	600	12.5
1965	2	38	61	1.6
1966	2	54	286	5.3
1967	3	70	733	10.5
1968	1	20	25	1.2
1969	5	2s2	1,8.S0	7.3
1970	3	537	5,808	10.8
1971	7	559	5,395	9.7
1972	7	428	5,377	12.6
1973	13	324	4,s50	14.0
1974	9	354	5,063	14.3
1975	4	421	4,526	8.7
1976	4	473	5,769	12.2

Source: ADF&G, Cook Inlet Shellfish Report.

TABLE C.116
Cook inlet
Shrimp Fishery Catch
by Gear Type
1969-70 through 1977-78

	Trawl Shrimp Catches		Pot Shrimp Catches	
Year	June 1-Oct. 31	Nov. 1-Mar. 31	June 1-Sept. 30 (100,000 lbs.)	Oct. 1-May 31 (500,000 lbs.)
69-70[1]	1,292,651	1,692,854		
70-71[1]	3,211,924	2,076,228	3,606	7,602
71-72[1]	2,618,630	1,761,569	8,836	70,601
72-73[1]	2,722,422	2,109,660	75,247	184,230
73-74	2,502,154	2,323,780	63,181	738,165
74-75	2,512,764	2,519,148	43,650	126,472
75-76	1,997,563	2,421,456	100,765	273,758
76-77	2,545,885	2,453,101[2]	52,115	199,929[2]
77-78	2,490,967[2]	2,537,259,[2]	89,986[2]	506,124[2]

[1]Catches do not include April and May landings

[2]Preliminary data

Source: ADF&G, Lower Cook Inlet Shellfish Report, 1978.

TABLE C.117

Lower Cook Inlet
Pot Shrimp Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	1976
s Landed OO's)	30	9	56	171	347	685	226	438
of Landings	$13,000	4,000	20,000	103,000	111,000	1,542,000	679,000	189,000
r of Seats	4	8	13	23	51	44	27	34
r of Landings[1]	8	39	171	352	740	1,139	495	877
Weeks[2]	7	33	74	3.36	296	365	203	308
Weeks[3]	14	66	148	272	592	730	406	63.6
r of Landings Boat	2.0	4.9	13.2	15.3	14.5	25.9	18.3	25.8
s per Boat	10.9	0	19*4	17.3	8.75	12.2	27.S	15.6
is par Landing	3,750	230	330	490	470	600	460	500
e of Catch Landing	$ 1,630	100	120	290	150	1,350	1,370	220
e of Catch Boat	$ 3,250	500	1,540	4,480	2,180	35,050	25, 150	5,560
e of Catch Boat Week	$ 1,860	120	270	760	380	4,220	3,340	610
e (value of catch per lbs.)	$ 0.43	0.44	0.36	0.60	0.32	2.25	3.00	0.43
x 1[4]	1.00	0.98	0.91	0.98	0.97	0.91	0.97	0.97
x 25	1.14	1.18	2.31	2.59	2.50	3.12	2.44	2.85

es : The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisherie Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an estim of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals tile number of Landings divided by the number of species Landed
5. Index 2 equals tile average number of Landings per week.
6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by the En Commission.
7. It has been estimated that the eaverage crew size in this fishery is two.

TABLE C.118
Lower Cook Inlet
Pot Shrimp Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]		1		1	8	17	4	8
	L[2]					39	114	20	55
February	B		2		1	8	14	5	10
	L					66	76	28	84
March	B		2		11	9	23	9	9
	L				26	47	235	60	112
April	B		2	2	3	10	27	7	12
	L					77	390	44	102
May	B		3	5	4	11	28	7	5
	L			8	11	70	81	55	38
June	B	3	1	5	6	10	4	8	3
	L			11	43	37	52	55	
July	B		1	2	3	2	6	7	2
	L						48	44	
August	B	2	1	3	5	5	4	8	4
	L				26	8	22	61	41
September	B	2	2	5	6	12	5	5	6
	L			10	35	52	18	47	59
October	B		2	57	3	18	5	6	19
	L			20		95	34	34	109
November	B		1	66	6	19	5	6	21
	L			16	69	157	30	33	175
December	B			3	10	16	6	3	8
	L				82	84	39		30

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.119

LOWER COOK INLET

POT SHRIMP FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]		1	5	2	7		4	3
1- 25		1	1		2	2	-	9
26- 35	1	5	3	12	26	31	16	17
36- 45	3	1	4	7	11	10	3	5
46- 55				1		1	-	
56- 65							1	
66- 75				1	2		1	
76- 85					2		1	
86- 95					1		-	
96-105								
106-115								
116-125								
125-							1	

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.120
Cook Inlet Otter Trawl

Shrimp Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972,	1973	1974	1975	
Pounds Landed (in 000's)	1,754	C	5,395	5,24a	4,457	5,064	.4,526	5,
Value of Landings	$53,000	C	$270,000	$31S,000	$267,000	$1,266,000	$407,000	$663,
Number"of Seats "	7	3	8	7	12	9	4	
Number of Landings[L]	263	C	557	434	32S	353	403	
Boat Weeks[2]	76	C	155	121	105	110	1 1 0	
Man Weeks[3]	228	C	465	363	33.S	330	330	
Number of Landings per Boat	37.6	C	69.6	62.0	27.1	39.2	100 .8	
Weeks per Boat	10.9	C	19.4	17.3	8.75	12.2	27.5	
Pounds per Landing	6,670	C	9,690	12,090	13,710	14,350	11,230	12,
Value of Catch per Landing.	200	C	480	730	820	3,s90	1,010	1,
Value of Catch per Boat	7,600	C	33,800	4s,000	22,300	140,600	101,800	82,
Value of Catch per Boat *Week*	700	C	1,740	2,600	2,540	11,510	3,700	5,
Price (i.e. value of catch per lbs.)	$0.03	C	$0.05	$0.06	50.06	$0.25	$0.09	
Index 1[4]	0.99	C	0.98	1.00	0.98	0.99	0.96	
Index 2[5]	3.46	C	3.59	3.59	3.10	3.21	' 3.66	

sources : The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fi. Entry Commission. The estimate of the average crew size in this fisherv was mada bv George W. Rogers in, A st the Socio-Economic Impact Of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoin research.

1. Number of Landings equals the number of daye each beat landed fish. Summed over all boats.
2. Seat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an of the average number of fishermen employed a week *times* the *number* of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings *per week.*
6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.
7. It has been estimated that the average crew size in this fishery is three.

TABLE C.121
COOK INLET OTTER TRAWL SHRIMP FISHERY,
NUMBER OF BOATS IN FISHERY BY MONTH

		1969	1970	1971	1972	1973	1974	1975	1976
JAN	B	1	2	3	3	5	6	4	3
	L					44	39	48	
FEB	B	1	2	4	4	6	3	4	4
	L			44	42	33		50	50
MAR	B	1	2	4	3	1	4	4	4
	L			67			16	44	13
APR	B	1	2	4	3	2			
	L			48					
MAY	B	1	3	3	5				
	L				12				
JUNE	B	2	3	4	4	4	3	3	3
	L			66	45	43			
JULY	B	3	3	4	4	6	3	2	3
	L			64	57	79			
AUG	B	4	3	4	2	4	3	3	5
	L	38		54		46			74
SEPT	B	4	3	5	2	2	4	3	3
	L	41		57			55		
OCT	B	3	3	3	3		3	3	"5
	L								41
NOV	B	2	3	3	3	3	4	3	4
	L						41		58
DEC	B	2	3	4	3	3	4	4	4
	L			24			35	40	60

Source: Commercial Fisheries Entry Commission Data Files

B = Number of Boats

L = Number of Landings

TABLE C.122

LOWER COOK INLET OTTER TRAWL

SHRIMP FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	2		2		1			-
1- 25	2							1
26- 35	1				1	1		1
36- 45	2	2	3	3	3	2	2	2
46- 55			1	1	2	1		1
56- 65				1	1			
66- 75		1	2	1	4	2	1	2
76- 85				1		2	1	1
86- 95				-		1		

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.123
COOK INLET SHRIMP FISHERY ALL GEAR TYPES:
CATCH, GROSS EARNINGS, AND NUMBEROF BOATS, 1969 - 1976

	YEAR	CATCH	GROSS EARNINGS	NUMBER OF BOATS
	1969	1,849,710	$ 67,678	16
	1970	5,817,633	236,589	11
*	1971	5,451,340	289,334	19
	1972	5,548,567	425,462	33
	1973	4,897,054	383,970	68
	1974	5,748,874	2,807,539	53
	1975	4,752,139	1,085,876	31
	1976	6,207,672	852,002	42
	1977			

Source: Alaska Commercial Fisheries Entry Commission, Alaska Shellfish Bio-Economic Data Base, 1978

TABLE C.125
NUMBER OF SEWARD
PROCESSING PLANTS[1] BY PRODUCT 1962 - 1972

YEAR	SALMON	HALIBUT	HERRING	KING CRAB	TANNER CRAB	DUNGENESS CRAB	SHRIMP	SCALLOPS	RAZOR CLAMS	TOTAL[2]
1962	1	0	0	1	0	0	2	0	0	3
1963	2	0	0	1	0	0	1	0	0	3
1964	1	1	0	0	0	0	0	0	0	1
1965	2	2	0	0	0	0	0	0	0	2
1966	2	2	0	0	0	0	0	0	0	2
1967	2	1	0	0	0	0	0	0	0	2
1968	3	3	0	0	0	0	0	1	0	3
1969	2	1	0	0	0	0	0	2	0	3
1970	1	0	2	1	1	0	0	2	1	3
1971	0	0	1	0	0	0	0	1	0	3
1972	2	1	2	1	0	0	0	1	0	5

[1] Floating processor plants are included.

[2] The total is not the sum of the columns since most plants produce more than one product.

Source: ADF&G Commercial Operator Reports 1962 - 1972.

PROCESSING

TABLE C.125
NUMBER OF SEWARD
PROCESSING PLANTS[1] BY PRODUCT 962 - 972

YEAR	SALMON	HALIBUT	HERRING	KING CRAB	TANNER CRAB	DUNGENESS CRAB	SHRIMP	SCALLOPS	RAZOR CLAMS	TOTAL[2]
1962		0	0	1	0	0	2	0	0	3
1963	2	0	0	1	0	0	1	0	0	3
1964		1	0	0	0	0	0	0	0	1
1965	2	2	0	0	0	0	0	0	0	2
966	2	2	0	0	0	0	0	0	0	2
1967	2	1	0	0	0	0	0	0	0	2
1968	3	3	0	0	0	0	0		0	3
1969	2	1	0	0	0	0	0	2	0	3
19 0	1	0	2	1	1	0	0	2	1	3
197	0	0	1	0	0	0	0	1	0	3
1972	2	1	2	1	0	0	0	1	0	5

Floating processor plants are included.

[2] he tota is not the sum of the columns s nce most plants produce more than one product.

Source: ADF&G Commercial Operator Reports 962 - 1972.

TABLE C.126
SEWARD SALMON
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT		1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)								
	Plants							
Frozen (000's lbs)					638			
	Plants				2	1	1	1
Canned (000's lbs)								
	Plants				1	1	1	1
Roe (000's lbs)								
	Plants				1	1	1	1
Bait (000's lbs)								
	Plants					1		
Reduction (000's lbs)								
	Plants							1
Other (000's lbs)								
	Plants							
Total (000's lbs)					638			
	Plants				2	1	1	1

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.127
SEWARD HALIBUT
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)				3,910	1,755		
Plants				2	2	1	1
Frozen (000's lbs)							
Plants							
Canned. (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				3,910	1,755		
Plants				2	2		1

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.128
SEWARD HEWING
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)							
Plants				1	1	1	1
Canned (000's lbs)							
Plants							
Roe (000's lbs)				391	290	548	
Plants				2	2	2	1
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							1
Other (000's lbs)							
Plants							
Total (000's lbs)				391	290	548	
Plants				2	2	2	2

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.129
SEWARD KING CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)							312
Plants				1	1	1	2
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)							312
Plants				1	1	1	2

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.130
SEWARD TANNER CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's 10S)							
Plants							
Frozen (000's lbs)							549
Plants				1	1	1	2
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)							549
Plants				1	1	1	2

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, *Processor Reports* with 1978 revisions.

TABLE C.131
SEWARD DUNGENESS CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)							5
Plants					1	1	2
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)							5
Plants				1	1	1	2

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.132
SEWARD SHRIMP
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT		1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)								
	Plants					1		
Frozen (000's bs)					37			34
	Plants				2	1		3
#anneal (000's bs)								
	Plants							
Roe (000's lbs)								
	Plants							
Bait (000's lbs)								
	Plants							
Reduction (000's Its)								
	Plants							
Other (000's lbs)								
	Plants							
Total (000's lbs)					37	40		34
	Plants				2	2		3

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will *not* include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.133

SEWARD FISH PROCESSING, QUARTERLY WAGE AND EMPLOYMENT DATA 1970 - 1977

YEAR	QUARTER	NUMBER OF FIRMS	AVERAGE MONTHLY EMPLOYMENT	AVERAGE PAY	TOTAL QUARTERLY WAGES
1970	1	2	1	1	1
	2	2	1	1	1
	3	2	1	1	1
	4	2	1	1	1
1971	1	2	1	1	1
	2	2	1	1	1
	3	2	1	1	1
	4	2	1	1	1
1972	1	2	1	1	1
	2	2	1	1	1
	3	2	1	1	1
	4	2	1	1	1
1973	1	1	1	1	
	2	3	297	522	464,59:
	3	3	1'90	776	442,852
	4	3	161	663	319,706
1974	1	2	1	1	1
	2	2	1	1	1
	3	2	1	1	1
	4	2	1	1	1
1975	1	2	1	1	1
	2	2	1	1	1
	3	2	1	1	
	4	3	97	600	174,56:
1976	1	3	111	678	226,527
	2	2	1	1	1
	3	3	368	896	989,746
	4	3	111	632	210,351
1977	1	3	88	876	230,458
	2	4	561	518	872,311
	3	4	499	899	1,344,480
	4				

A "l" indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data Files

TABLE C.134

SEWARD FISH PROCESSING, EMPLOYMENT BY MONTH 1970 - 1977

	1970	1971	1972	1973	1974	1975	1976	1977
January	1	1	1	1	1	1	75	59
February	1	1	1	1	1	1	77	81
March	1	1	1	1	1	1	182	123
April	1	1	1	336	1	1	1	467
May	1	1	1	313	1	1	1	602
June	1	1	1	239	1	1	1	614
July	1	1	1	186	1	1	399	645
August	1	1	1	236	1	1	491	538
September	1	1	1	149	1	1	215	313
October	1	1	1	95	1	153	160	
November	1	1	1	196	1	66	80	
December	1	1	1	191	1	72	93	
Total Man Months	1	1	1	1	1	1	1	1

A “l” indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data Files

TABLE C.135
SEWARD FISH PROCESSING, ESTIMATED MONTHLY WAGES 1970 - 1977

	1970	1971	1972	1973	1974	1975	1976	1977
January	1		1	1	1		50,850	51,684
February	1			1	1	1	52,206	70,956
March	1			1	1	1	23,396	107,748
April	1		1	76,436	1	1		24[illegible],906
May	1		1	63,386	1	1		31[illegible],836
June	1		1	24,758	1	1	1	3[illegible]8,052
July	1		1	144,336	1	1	357,504	579,855
August	1	1	1	183,136	1	1	439,936	483,662
September			1	115,624	1	1	192,640	281,387
October			1	62,985	1	91,800	101,120	
November	1			29,948	1	39,600	50,560	
December			1	126,633	1	43,200	58,776	
Total Man Months			1		1	1	1	

A "1" indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data Files

PUBLIC SERVICES

TABLE C.136

TOTAL COMMUNITY ELECTRICITY CONSUMPTION, AND CONSUMPTION FOR FISH PROCESSING SEWARD, ALASKA, 1975 - 1978

Date	ELECTRICITY CONSUMPTION (KILOWATT HOURS) Total Consumption for Community (000's)	Consumption for Fish Processing[1] (000's)	% of Total Consumption by Fish Processing
6/75	1,677		
7/75	1,457		
8,/75	1,473		
9/75	1,403		
10/75	1,315		
11/75	1,558		
12/75	1,433		
1/7 6	1,538		
2/76	1,443		
3/76	1,501		
4/76	1,534		
5/76	1,499		
6/76	1,498		
7/76	1,617		
8/76	1,652		
9/76	1,656		
10/76	1,478		
11/76	1,312		
12/76	1,254		
1/77	1,366	68	4.9
2/77	1,242	73	5.9
3/77	1,215	70	5.8
4/77	1,466	175	11.9
5/77	1,357	128	9.4
6/'77	1,552	276	17.8
7/77	1,665	322	19.4
8/77	1,705	293	17.2
9/77	1,476	58	3.9
10/77	1,405	16	1.1
11/77	1,405	64	4.5
12/77	1,422	73	5.1
1/78	1,522	61	4.0
2/'78	1,528	64	4.2
3/78	1,321	77	5.9
4/78	1,375	76	5.5
5/78	1,699	145	8.5
6/78	1,490		
7/78	1,621		

[1]Data does not include two minor processors located in Seward

Source: City of Seward electricity records

Figure C.5 Monthly Electricity Consumption, Seward, Alaska
January, 1977, to May, 1978

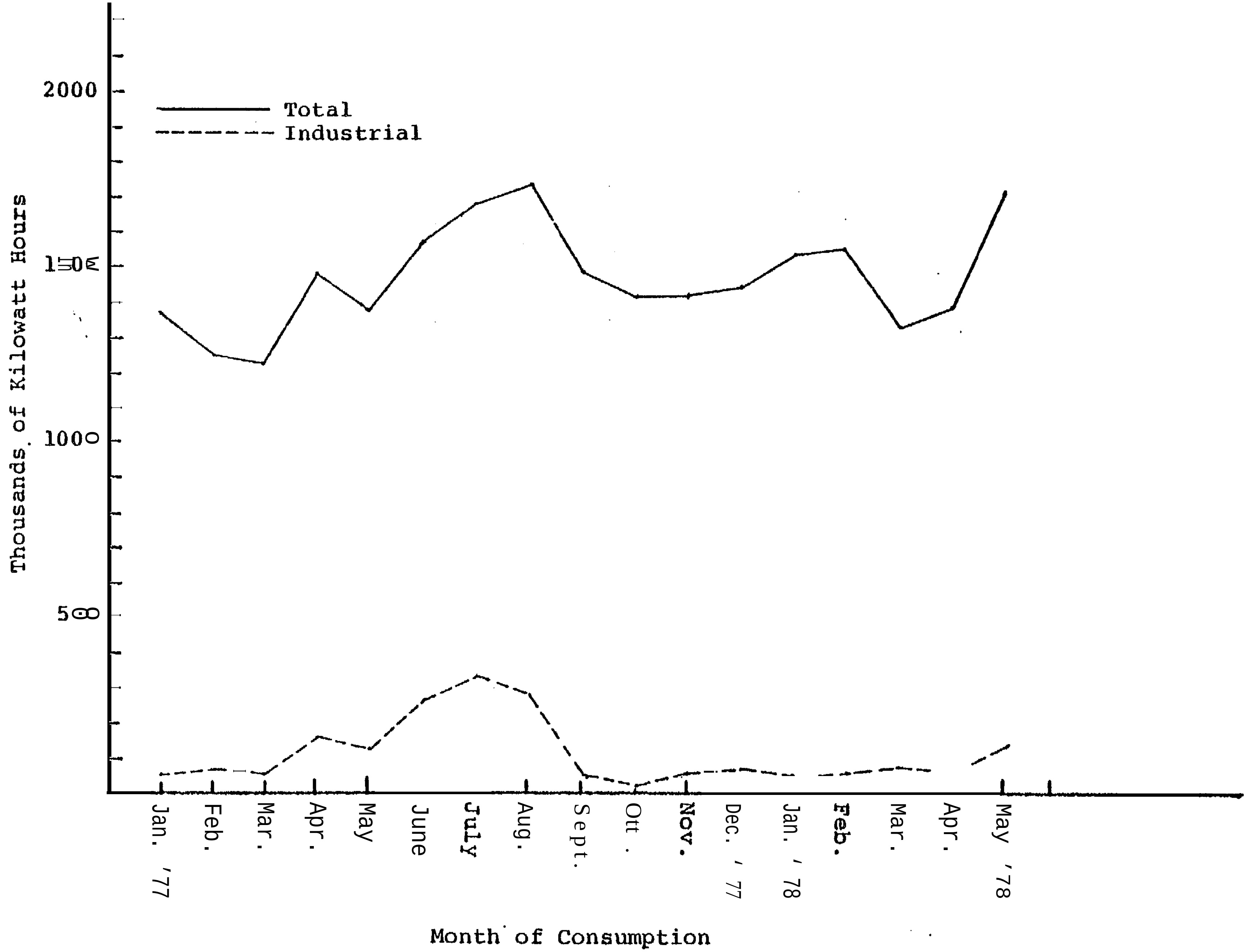
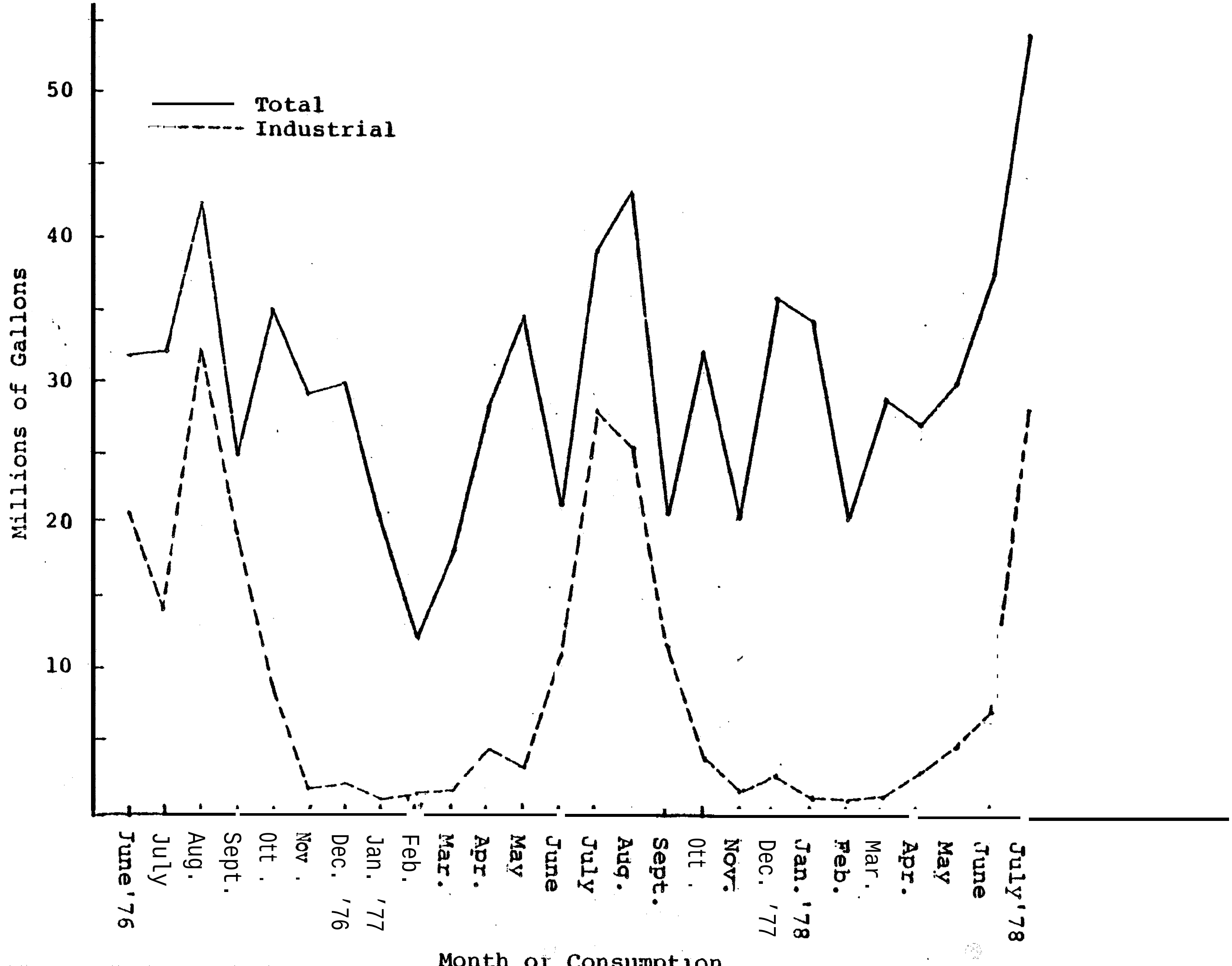


Figure C.6 Monthly Water Consumption, Seward, Alaska
June, 1976, to June, 1978



TOTAL COMMUNITY WATER CONSUMPTION, AND CONSUMPTION FOR FISH PROCESSING[1]
SEWARD, ALASKA, 1976 - 1978

Date Pumped	# of Days Pumped	Total Gallons Pumped (000)	Average Gallons Pumped per Day (000)	WATER CONSUMPTION FOR FISH PROCESSING		
				Gallons (000)	Average Gallons per Day for Month	% of Total Gallons Pumped Utilized for Fish Processing
1/76				2,063		
2/76				4,648		
3/76				9,704		
4/76				19,441		
5/76				29,927		
6/'76	26	31,551	1,213	20,892	696,400	66.2
7/76	21	32,160	1,531	14,074	454,000	43.8
8/76	21	42,605	2,029	32,092	1,035,226	75.3
9/76	22	24,626	1,119	19,157	638,567	77.8
10/76	26	33,843	1,302	8,771	282,935	25.9
11/76	24	28,402	1,183	1,772	59,067	6.2
12/76	27	29,207	1,082	2,766	89,226	9.5
1/77	28	20,144	719	1,284	41,419	6.4
2/77	20	12,281	614	1,530	54,643	12.5
3/77	20	17,794	890	1,663	53,645	9.3
4/77	25	27,696	1,108	4,385	146,167	15.9
5/77	29	34,361	1,185	3,232	104,258	9.4
6/77	25	21,154	846	10,887	362,900	51.5
7/77	21	38,642	1,840	27,799	896,742	71.9
8/77	28	42,557	1,520	25,362	818,129	59.6
9/77	20	20,486	1,024	11,849	394,967	57.8
10/77	28	28,946	1,034	3,749	120,935	13.0
11/77	19	20,303	1,069	1,657	55,233	8.2
12/77	28	35,335	1,262	2,447	78,935	6.9
1/78	27	33,781	1,251	1,291	41,645	3.8
2/78	19	20,503	1,079	1,000	35,714	4.9
3/78	27	28,169	1,043	1,194	38,516	4.2
4/78	21	27,039	1,288	2,614	87,133	9.7
5/78	29	29,045	1,002	4,740	152,903	16.3
6/78	24	37,485	1,562	7,154	238,467	19.1
7/78	28	53,062	1,895	27,942	901,355	52.7

[1]Data does not include two minor seafood processors located in Seward.

Source: Schaefermeyer, 1978, and City of Seward utilities records

C.153

SEWARD SMALL BOAT HARBOR
BOAT REGISTER
AUGUST 8, 1977

Slip Length	Number of Slips Filled	Commercial Boats in Slips	Pleasure Boats on Waiting List	commercial Vessels on Waiting List	Number of Transient pleasure Boats Using Harbor	Number of Commercial Transient Boats Using Harbor (Could be in Seward Permanently)
17'	148	2	27	0	169	0
23'	106*	12	91	1	178	5
32'	162	26	128	11	68	81
40'	62	10	20	5	14	21
42'	58	17	10	6	9	15
50'	46	8'	12	3	6	25
75'	16	9	2	1	0	117
Totals	598	86	290	27	444	264

317 Total Boats on Waiting List
708 Total Transient Boats
350 Total Commercial Vessels
1306 Total Vessels Registered in the Harbor

*Twenty-nine 50' slips are split and filled with two vessels.

Source: Seward Harbormaster .

TABLE C.139

PORT USAGE
SEWARD, ALASKA, 1960 - 1976[1]

Year	Total Cargo[2] Short Tons	FISH AND FISH PRODUCTS Short Tons	% of Total Cargo	No. of Vessels Using Port[3]
1960	628,422	2,916	0.46	611
1961	631,209	4,819	0.76	1,504
1962	670,037	13,999	2.09	761
1963	622,017	9,322	1.50	1,226
1964	185,730	54	0.03	135
1965	37,462	0	0.00	NA
1966	49,326	4,340	8.80	NA
1967	90,857	3,337	3.67	NA
1968	117,329	7,103	6.05	NA
1969	60,084	1,318	2.19	274
1970	29,309	643	2.19	160
1971	126,664	44,821	35*39	715
1972	61,726	11,777	19.08	1,233
1973	51,913	9,691	18.67	743
1974	71,844	1,279	1.78	152
1975	NA	NA	NA	NA
1976	236,722	12,188	5.15	213

Source: Department of the Army Corps of Engineers, Waterborne Commerce of the United States, Annual issues, 1960-1976.

[1] Includes all waterborne cargo entering and leaving the port.
[2] Includes raw fish and any other fish product form entering and leaving the port.
[3] Includes commercial fishing vessels, except 1976.

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Cordova

HARVESTING

TABLE C.140

PRINCE WILLIAM SOUND ANNUAL SALNON CATCH BY SPECIES, 1950 - 1977[1]

(Number of Fish)

YEAR	KINGS	REDS	PINKS	CHUMS	COHOS	TOTAL
1950	558	74,585	1,850,731	455,900	74,445	2,456,219
951[2]	4,407	119,976	1,051,798	467,007	37,065	1,680,253
952		80,467	2,339,500	458,880	41,356	2,920,203
953	126	54,712	2,016,894	314,423	28,595	2,414,750
9543		6,213	12,309	6,047	543	25,112
9553		12,921	26,925	4,785	592	45,223
956[2]	111	172,950	4,827,264	497,474	27,498	5,525,297
957	599	61,966	616,499	524,841	19,761	1,223,656
958	54	13,821	6,289,435	687,263	8,196	6,998,769
959			C L O S E D			
1 960	1,580	35,176	1,841,899	381,858	30,722	2,291,235
1 961	406	55,551	2,287,766	221,951	3,335	2,569,009
1962	1,834	44,679	6,543,081	871,858	17,888	7,479,340
1963	449	39,746	5,248,773	933,133	30,998	6,253,099
1964	65	37,517	4,189,505	521,711	30,914	4,779,712
1965	1,095	118,563	2,387,131	198,824	13,863	2,719,476
1966	174	100,752	2,719,236	429,653	17,218	3,267,033
1967	411	21,118	2,606,315	262.385	14,634	2,904,863
1968	1 .523	121,804	2,452,168	. 342 ; 939	11,693	2,930,127
1969	3; 340	285,584	4,828,579	320,977	12,866	5,451,346
1970	1,031	104,169	2,809,996	230 661	11,485	3,157,342
1971	3,551	88,368	7,310,964	574,265	30,551	8,007,699
19724	547	197,526	54,783	45,370	1,634	299,860
1973	2,405	124,802	2,056,878	729,839	1,399	2,915,323
19744	1,590	129,366	448,773	88,544	801	669,074
1975	2,519	189,613	4,452,805	100,479	6,142	4,751,558
1976	1,044	112,809	3,018,991	370,478	6,171	3,509,493
1977	632	310,147	4,528,675	571,397	804	5,411,655

[1] Catch by all gear from all districts of Prince William Sound.

‘Estimated catch using conversion of case pack.

[3] Eshamy district catch only. General season closed.

[4] General purse seine season closed.

Sources: Alaska Department of Fish and Game, Area Management Reports, Prince William Sound, 1972 and 1977.

TABLE C.141
Prince William Sound
Purse Seine Salmon Fishery

CATCH AND EMPLOYMENT OATA

	1969	1970	1971	1972	1973	1974	1975	'1,
Pounds Landed (in 000'$)	22,971	13,145	30,856	0	13,808	317	16,083	1(
Value of Landings	$3,143,000	2,106,000	4,882,000	0	4,796,000	139,000	4,838,000	6,14(
Number of Boats	233	257	251	0	231	37	2.55	
Number of Landings[1]	3,667	2,942	4,707	0	2,342	224	3,071	
Boat Weeks[2]	979	928	1,366	0	723	70	880	
Man Weeks[3]	3,916	3,712	5,464	0	2,892	280	3,520	
Number of Landings per Boat	15.7	11.4	18.8	0	10.1	6.05	23.6	
Weeks per Seat	4.20	3,61	5.44	0	3.13	1.89	3.91	
Pounds per Landing	6,260	4,470	6,560	0	5,900	1,420	5,240	
Value of Catch per Landing	$ 860	720	1,040	0	2,050	620	1,580	
Value of Catch per Boat	$ 3.3,500	8,200	19,500	0	20,800	3,800	21,500	2(
Value of Catch per Boat Week	$ 3,210	2,270	3,570	0	6,630	1,990	5,500	
Price (i.e. value of catch per lbs.)	$ 0.3,4	0.16	0.16	0	0.35	0.44	0.30	
Index 1[4]	0.31	0.32	0.30	0	0.37	0.33	,0.33	
Index 2[5]	3.75	3.17	3.45	0	3.24	3.20	3.49	

SOURCES: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fi Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A st. the Socio-Economic Impact of Charges in the HerVesting Labor Force in the Alaska Salmon Fishery, and in ongoin research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.

It has been estimated that the average crew size in this fishery is 4.

TABLE C.142
Prince William Sound
Purse Seine Salmon Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B	1	1						
	L								
March	B		1						
	L								
April	B								
	L								
May	B								2
	L								
June	B	68	40	37		6	4	7	30
	L	255	156	85		14	6	9	104
July	B	219	237	246		228	36	223	287
	L	2,448	2,201	2,735		1,487	218	2,362	3,100
August	B	198	206	242		224		211	186
	L	962	583	1,887		841		700	373
September	B	1							
	L								
October	B								
	L								
November	B								
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.143

PRINCE WILLIAM SOUND

PURSE SEINE SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	42	36	21	-	2		3	5
1- 25	28	43	22	-	27	3	17	28
26- 35	121	129	147		149	21	146	173
36- 45	40	43	52		48	11	53	68
46- 55	2	5	8		4	2	5	22
56- 65								
66- 75			1	-	1	-	1	
76- 85								
86- 95		1						

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.144

Prince William Sound
Drift Gill Net Salmon Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	1976
Landed 0's)	6,368	10,079	7,865	8,138	7,289	8,701	6,0S9	10,952
of Landings	$1,943,000	2,999,000	2,232,000	2,758,000	3,728,000	5,488,000	2,957,000	9,174,000
f Boats	503	637	551	527	548	501	444	550
of Landings[1]	8,798	1.3,295	9,830	11,459	12,233	12,438	8,909	12,601
leeks[2]	3,328	4,976	3,694	4,227	4,285	4,204	3,382	4,497
eks[3]	3,328	4,976	3,694	4,227	4; 285	4,204	3,382	4,497
f Landings oat	17.5	20.9	17.8	21.7	22.3	24.9	20.1	22.9
per Boat	6.62	7.81	6.70	8.02	7.82	8.39	7.62	8.18
s per Landing	720	760	800	710	600	700	680	870
of Catch ing	$ 220	230	230	240	300	440	330	730
of Catch oat	$ 3,860	4,710	4,050	5,230	6,800	10,950	6,660	16,680
of Catch oat Week	$ 580	600	600	650	870	1,310	870	2,040
value of catch per lbs.)	$ 0.31	0.30	0.28	0.34	0.51	0.63	0.49	0.84
1[4]	0.s4	0.56	0.59	0.52	0.47	0.42	0.43	0.44
2[5]	2.64	2.67	2.66	2.71	2.85	2.96	2.63	2.80

ces: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisherie Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Seat weeks equals the number of weeks each boat landed fish. Summed over all beats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estima of the average number of fishermen employed a week times the number of weeka fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Ent Commission.

as been estimated that the average crew size in this fishery is 1.

TABLE C. 145
Prince William Sound
Drift Gill Net Salmon Fishery
Number of Boats and Landings in the Fishery by Month

		1,969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B	1	6						1
	L		7						
March									
	B	1							
	L								
April									
	B	1							1
	L								
May									
	B	378	438	63	389	417	430	363	438
	L	1,880	2,895	64	832	912	2,221	1,498	2,520
June									
	B	435	508	521	493	511	474	418	481
	L	4,384	4,681	4,883	4,786	4,747	4,823	3,782	4,792
July									
	B	291	322	340	412	434	442	368	390
	L	1,260	1,394	1,623	3,234	3,038	4,626	2,427	3,038
August									
	B	159	366	237	331	317	65	209	298
	L	479	2,031	1,213	1,637	2,119	106	658	1,268
September									
	B	238	348	254	261	267	149	173	274
	L	792	2,287	2,047	970	1,417	662	544	978
October									
	B								1
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.146

Prince William Sound

Drift Gill Net Salmon Fishery

Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
0[1] ft.	118	173	90	40	16	25	14	30
1-25 ft.	273	326	315	317	343	279	226	262
26-35 ft.	92	114	122	151	161	168	117	225
36-45 ft.	20	19	22	19	27	28	25	26
46-55 ft.		2	0		1	1	1	5
56-65 ft.		1	1					--
66-75 ft.		--	1					1
76-85 ft.		--						--
86-95 ft.		--						1
96-105 ft.		2						
106-115 ft.								
116-125 ft.							1	
over 125 ft.								

[1] All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C. 147
Prince William Sound
Set Gill Net Salmon Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975
Pounds Landed (in 000's)	555	335	0	465	218	427	0
Value of Landings	$139,999	68,000	0	124,000	83,000	185,000	0
Number of Boats	30	41	0	21	19	15	0
Number of Landings[1]	533	292	0	104	65	63	0
Boat Weeks[2]	140	109	0	104	65	63	0
Man Weeks[3]	140	109	0	104	65	63	0
Number of Landings per Boat	17.8	7.12	0	22.5	14.4	16.7	0
Weeks per Boat	4.67	2.66	0	4.95	3.42	4.2	0
Pounds per Landing	1,040	1,150	0	980	.800	1,700	0
Value of Catch per Landing	$ 260	230	0	260	300	,740	0
Value of Catch per Boat	$ 4,630	1,660	0	5,900	4,370	12,330	0
Value of Catch per Boat Week	$ 990	620	0	1,190	1,280	2,940	0
Price (i.e. value of catch per lbs.)	$ 0.25	0.20	0	0.27	0.38	0.43	0
Index 1[4]	0.32	0.27	0	0.27	0.28	0.21	.0
Index 25	3.81	2.68	0	4.55	4.20	3.98	0

Sources: The catch statistics were derived using date provided from the data files of the State of Alaska Commercial F Entry Commission. The estimate of the average crew size in #is fishery was made by George W. Rogers in, A s the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoi research.

1. Number of Landings equals the number of daye each boat landed fish. Summed over all beats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Men weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings par week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by commission.

It has been estimated that the average crew size in this fishery is 1.

TABLE C. 148
Prince William Sound
Set Gill Net Salmon Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B								
	L								
April	B								
	L								
May	B		1						
	L								
June	B		1						
	L								
July	B	25	33		18	19	15		1
	L	270	181		250	240	251		
August	B	26	24		21	12			1
	L	263	109		223	33			
September	B								
	L								
October	B								
	L								
November	B								
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.149

PRINCE WILLIAM SOUND

SET GILL NET SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	13	20		1	2	1		
1- 25	15	17		19	17	11		
26- 35	1	4		1		3		2
36- 45	1							

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.150

Prince William Sound
Eland Troll Salmon Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972.	1973	1974	1975	1976
s Landed 00'3)	43	19	32	11	24	(	0	0
of Landings	$20,000	13,000	18,000	9,000	28,000	(	0	0
r of Boats "	12	10	7	7	a	1	0	0
r of Landings[1]	28	12	24	23	18	(	0	0
Weeks[2]	27	11	16	21	17	(	0	0
eeks[3]	27	11	16	21	17	(	0	0
r of Landings	2.33	1.20	3.43	3.29 .	2.25	(	0	0
i per Boat	2.25	1.10	2.29	3.00	2.13	0	0	0
s per Landing	1,540	1,580	1,330	480	1,330	(	0	0
! of Catch anding	$ 710	1,080	750	390	1,560	(	0	0
of Catch oat	$ 1,670	1,300	2,570	1,290	3,500	(	0	0
of catch oat Week	$ 740	1,180	1,130	430	1,650	(	0	0"
alue of catch per lbs.)	$ 0.47	0.68	0.56	0.82	1.17	(	0	0
: 1[4]	0.55	0.40	0.57	0.82	0.86	(	,0	0
; *5	1.04	1.09	1.50	1.10	1.06	(	0	0

: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisherie Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact Of Changes in the Harvesting Labor Fores in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Seat weeks equals the number of weeks each beat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estima of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Ent Commission.

as been estimated that the average crew size in this fishery is 1.

TABLE C.151
Prince William Sound
Troll Salmon Fishery

Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B	1							
	L								
March									
	B	1	1						
	L								
April									
	B	1							
	L								
May									
	B	1			1	1			
	L								
June									
	B	3			2	2	1		
	L								
July									
	B	4	3	4	2	1	1		
	L	4		10					
August									
	B	4	7	5	6	5	1		
	L	7	a	11	10	a			
September									
	B	4		2	3	3	1		
	L	5							
October									
	B				1				
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.152

PRINCE WILLIAM SOUND

HAND TROLL SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	4	3	3	1				
1- 25	2		1	2	4			
26- 35	3		1	1	2			
36- 45	3	6	2	3	1	1		
* 46- 55	-	1			1			

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.153

PR[illegible]NCE WILLIAM SOUND SALMON FISHERY ALL GEAR TYPES

	1969	1970	1971	1972	1973	1974	975	1976	1977
Pounds Landed (in 000's)	29,937	23,578	38,753	8,614	21,339	9,445	22,172	25,651	
Value of Landings	5,245,000	5,186,000	7,132,000	2,891,000	8,635,000	5,812,000	7,795,000	5,3[illegible]4,000	
Number of Boats	778	945	809	555	806	553	669	846	
Number of Landings	13,026	16,541	14,561	11,955	14,	12,913	11,980	16,180	
Boat Weeks[2]	4,474	6,024	5,076	4.352	5,090	4,337	4,262	5,748	
Man Weeks[3]	7,411	8,808	9,174	4.352	7,259	4,547	6,902	9,5[illegible]	

Source: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A Study of the Socio Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

[1]Number of Landings equals the number of days each boat landed fish. Summed over al boats.

[2]Boat Weeks equals the number of weeks each boat landed fish. Summed over all boats.

[3]Man Weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estimate of the average number of fishermen employed a week times the number of weeks f shed.

These statistics do not include the activit es of the following boats that participated in this fishery:

1974 one hand troller
1975 one boat with unspecified gear
1976 two set gill net boats, one power troller, and two boats with unspec f ed gear

Table C.154

Prince William Sound Halibut Landings

1969 - 1976

1969	13,497	1973	236,546
1970	15,596	1974	87,651
1971	24,269	1975	?48,176
1972	165,949	1976	204,051

TABLE C.155
PRINCE WILLIAM SOUND
SMALL BOAT LONG LINE HALIBUT FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	3.972	1973	1974	1975	1
Pounds Landed (in 000's)				899	890	750	1,473	
Value of Landings	$ -	$	$	$ 540,000	$ 629,000	$ 517,006	$ 1,309,000	$ 1,51
Number of Boats				111	130	52	63	
Number of Landings[1]				325	431	140	173	
Boat Weeks[2]			-	267	359	129	167	
Man Weeks[3]				267	359	129	167	
Number of Landings per Boat				2.93	3.32	2.69	2.75	
Weeks per Boat		-		2.41	2.76	2.48	2.65	
Pounds per Landing				2,770	2,060	5,360	8,53.0	
Value of Catch per Landing	$	$	$	$ 1,660	$ 1,460	$ 3,690	$ 7,570	$
Value of Catch per Boat	$	$	$	$ 4,860	$ 4,840	$ 9,940	$ 20,780	$ 1
Value of Catch per Boat Weak	$	$	$	$ 2,020	s 1,750	$ 4,010	$ 7,840	$
Price (i.e. value of catch per lbs.)	$	$	$	$ 0.60	$ 0.71	$ 0.69	$ 0.89	$
Index 1[4]				0.59	0.63	0.51	0.37	
Index 2[5]				1.22	1.20	1.09	1.04	

sources: The catch statistics were derived using date provided from the data files of the State of Alaska Commercial Fi Entry Commission. The estimate of the-average crew size in this fishery was made by George W. *Rogers* in, A st the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, *and* in ongoir research.

1. **Number of Landings** equals the number **of days each boat** landed fish. Summed over all **boats.**
2. Boat *weeks* **equals** the *number* **of** *weeks* **each boat** *landed* **fish.** Summed **over all boats.**
3. Men weeks equals beat weeks times an estimate of the average crew size in this fishery; **it is** thus an of the average number of fishermen employed a week times the number *of* weeks fished.
4. Index 1 equals the number of Landings divided by the number **of** species **Landed**
5. **Index 2 equals** the average number *of* Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by " commission.

These statistics do not include the activities of the following boats that participated in the Prince William **Halibut** Fi 1972, three hand *trollers,* **1973, one hand troller.**

It has been estimated that the average crew size in this fishery is 1.

TABLE C.156
Prince William Sound Small Boat
Halibut Fishery
Number Of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B								
	L								
April	B								
	L								
May	B				16	37	7	14	25
	L				16	51	10	16	27
June	B				37	84	35	34	59
	L				55	175	55	42	91
July	B				58	65	30	39	49
	L				132	136	50	59	74
August	B				56	35	15	31	22
	L				93	57	23	43	26
September	B				22	8	2	13	
	L				29	12		13	
October	B								
	L								
November	B								
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.157
PRINCE WILLIAM SOUND

SMALL BOAT HALIBUT FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]				15	12	2	7	8
1- 25				22	35	8	3	27
26- 35				39	43	18	24	15
36- 45				17	23	9	11	16
46- 55				12	10	8	11	15
56- 65				5	6	6	5	8
66- 75				1	1	1	2	3

1. All boats unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.158

Herring catch and production from Prince William Sound From Inception of the Fishery 1914 - 1971. 1/ 2/ 3/ 4/

Year	Barrels Cured	Gallons Oil	Tons Meal	Pounds Of Herring For Roe	Pounds Kippered, etc.	Pounds Bait	Spawn on Kelp	Total catch in Barrels
1914	214							
1918	22,263							
1919	18,075							
1920	1S,275							
1921	37,353							
1922	72,608							
1923	37,966							
1924	18,989							
1925	9,689							
1926	4,643							
1927	12,707							
1928	8,513							
1929	477							
1930	4,006							
1931	6,498	226,153	773					
1932	6,753	363,058	1,256		410			
1933	9,973	468,528	1,720					
1934	8,073	811,033	2,564					
1935	20,982	1,283,225	5,087					
1936		1,426,323	5,546					
1937	2,366	2,164,207	6,998					384,000
1938	2,415	2,386,822	8,860					
1939	4,205	2,227,343	7,864		190,445			422,179
1940	3,323	1,262,207	432		16,750			255,723
1941	1,062	1,166,459	503					272,377
1942		60,000	26					13,893
1943	REPORTS NOT COMPLETE							8,008
1944								83,965
1945	697	395,015	1,487					79,952
1946	203	453,700	2,100					103,469
1947								NONE
1948		907,166	2,862			300,000est.		163,278

TABLE C.158, Continued

Herring catch and production from Prince William Sound from inception of the fishery 1971. 1/ 2/ 3/ 4/

Year	Barrels Cured	Gallons Oil	Tons Meal	Pounds of Herring For Roe	Pounds Kippered, etc.	Pounds Bait.	Pounds Spawn On Kelp	Total Catch In Barrels
1949	NO PRICE SETTLEMENT							
1950								190,634
1951						305,350		178,468
1952								26,488
1953								4,268
1954								75,339
1955								80,811
1956								119,734
1957								100,677
1958								31,136
1959								682
1960								NONE
1961						27,625		
1962						124,000 est.		
1963								
1964								
1965								
1966								
1967						60,000		
1968								
1969				711,305			5,449	
1970						20,000	190.370	
1971				1,838,470		40,053	769,481	
1972				3,536,503		17,920	599,481	

1/ Data from 1914 - 1930 from Pacific Fisherman Yearbook. Barrels of cured herring only separated by area. Catches reported do not include herring reduced to oil and meal.

2/ Data from 1931- 1959 from U. S. Bureau of Commerical Fisheries Annual Management Reports. Refer to "Annual Report for 1952", Alaska Department of Fisheries, Juneau, Alaska for additional data.

3/ Data from 1960 - 1971 from Alaska Department of Fish and Game records.

4 / For additonal data on catch refer to, "Fluctuations in the Supply of Herring Clupea Pallasii in Prince William Sound, Alaska", By George A. Rounsefell and Edwin H. Dalhgren. Bull. No. 9 U. S. Bureau of Fisheries, 1932; and, Statistics of the Alaska Herring Fishery, 1878 - 1956, Statistical Digest No. 48, By Bernard E. Skud, Henry M. Sakuda and Gerald M. Reid, U.S. Fish & Wildlife Service, Bureau of Commercial Fisheries.

Source: Alaska Department of Fish and Game, Status of Prince William Sound Herring Fisheries, 1972

TABLE C.159

Herring and Herring Roe on kelp in Tons from Prince William sound, 1966-1977

Year	Bait	Used for Roe	No. Boats 1/	Roe on Kelp	No. Permits Issued
1967	30				
1969		355.7	6	2.7	3
1970	10		1	9S.2	58
1971	20.03	919.2	14	384.7	487
1972	8.96	1,768.3	1s	299.7	1,100
1973		6,983	28	153.2	S04
1974		6,371	75 2	276.1	295
197s	226.7	S,853.8	76	458.5	765
1976		2,584.1	66	242.1	622
1977*		2,283.1	S6	208. S	251

1/ Number of herring fishing boats making actual deliveries.

2/ Three drift gill net boats also fished.

3/ One drift gill net boat fished.

* Prelimary.

source: Alaska Department of Fish and Game, Annual Management Report, Prince William Sound, May 8, 1978.

TABLE C.160

Prince William Sound
Purse Seine Herring Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1.973	1974	1975	
Pounds Landed (in 000's)	**711**	c	1,838	3,554	13,984	**12,734**	12,161	
Value of Landings	**$14,000**	c	110 ,000	71,000	1,119,000	891,000"	**486,000**	4
Number **of** Boats	6	1	12	18	31	**72**	**76**	
Number of Landings[1]	24	c	49	120	174	**181**	**144**	
Boat Weeks[2]	10	c	23	34	66.	**116**	**128**	
Man Weeks[3]	40	**c**	92	136	264	**464**	512	
Number of Landings **per** Boat	**4**	c	4.08	6.67	5.61	**2.51**	1.89	
Weeks per **Boat**	**1.67**	c	1.92	**1.89**	2.13	**1.61**	**1.68**	
Pounds per Landing	29,600	c	37,500	29,600	80,400	**?0 ,400**	**84,500**	7
Value of Catch **per** Landing	$ 580	c	2,240	590	6,430	4,920	3,380	
Value of **Catch** per Boat	$ 2,330	c	9,170	3,940	**36,100**	12,400	6,390	
Value of Catch **per Boat Week**	**$ 1,400**	c	4,780	2,100	17,000	7,700	3,800	
Price (i.e. value of catch **per lbs.**)	$ 0.02	c	0.06	0.02	0.08	0*07	0.04	
Index 1[4]	0.86	c	0.79	0.63	0.59	0.69	0.77	
Index 2[5]	2.40	c	2.13	3.53	2.64	1.S6	' 1.13	

Sources: The **catch** statistics were derived using data provided **from** the **data files of** the State **of** Alaska Commercial Fi Entry Commission. The estimate *of the* average **crew** size **in this fishery** was made by **George W.** Rogers in, **A st the** Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in **ongoi** research.

1. Number of Landings equals the number of days each **boat** landed fish. **Summed *over*** all **boats.**

2. **Boat** weeks equals **the** number of weeks each boat landed fish. Summed over all beats. -

3. **Man** weeks equals **boat** weeks times **an** estimate of the average crew size in this **fishery;** it is thus an of the average number of fishermen employed a week times **the** number of weeks fished.

4. Index 1 equals the number *of* Landings divided by the number of species Landed

5. Index 2 **equals** the average number of Landings per week.

6. A "c" indicates that the statistic is not available due to confidentiality **requirements** maintained by t **Commission.**

7. **It** has been estimated that the average crew size in this **fishery** is **four.**

8. **These** statistics do not include the activities of the following boats that **participated** in the Prince William Sound herring fishery:

   1971 - two herring **seiners.**
   1974 - three drift gill netters.
   1975 - **eleven** boats with unspecified gear (**landed** 7,000 **pounds**).
   1976 - one drist gill netter.

TABLE C.161
Prince William Sound
Seine Herring Fishery

Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B								
	L								
March	B		1						
	L								
April	B	4	10		14	27	72	73	
	L	19	39		66	103	181	131	
May	B	2	6		16	24	2	63	
	L		10		49	70		63	
June	B						4	9	
	L						14	9	
July	B								
	L								
August	B								
	L								
September	B								
	L								
October	B			1					
	L								
November	B			2					
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission
Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C. 162
Prince William Sound
Purse Seine Herring Fishery

Number of Boats by Length

	1969	1970	1971	1972	1973	1974	?975	1976
0[1] ft.			--	1	0	1	--	5
1-25 ft.			.-	0	2	1	1	--
26-35 ft.	3	1	7	11	14	35	33	33
36-45 ft.	2		5	6	13	30	38	27
46-'55 ft.	1		1		.-	3	2	'2
56-65 ft.			1		--	--	--	
66-75 ft.					1	2	1	
76-85 ft.					. .		1	
86-95 ft.					--			
96-105 ft.					--			
106-115 ft.					--			
116-125 ft.					1			
over 125 ft.								

1 All boats of unspecified length are included in this category.

Source: commercial Fisheries Entry Commission Data Files

TABLE C.163
Prince William Souna
Herring Roe on Kelp Fishery

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	i976
1s Landed)00's)	(	190	773	600	306	581	909	485
ɛ of Landings	(	$95,000	386,000	300,000	153,000	395,000	600,000	320,000
ɛr of Boats	3	34	159	397	176	143	333	279
ɛr of Landings[1]	(	103	73a	1,291	330	623	1,799	881
Weeks [2]	(	54	319	565	192	225	734	440
Weeks[3] '8								
ɛr of Landings 3oat	(	3.03	4.64	3.25	1.88	4.36	5.40	3.16
s per Boat	(	1.59	2.01	1.42	1.09	1.57	2.20	1.58
ls per Landing	(	1,840	1,050	460	930	930	510	550
ɛ of Catch Landing	(	$ 920	520	230	460	630	330	360
ɛ of Catch Boat	(	$ 2,790	2>430	760	870	2,760	1,800	1 ,150
ɛ of Catch Boat Week	"(	$ 1,760	1,210	530	800	1,760	820	730
value of catch per lbs.)	(	$0.50	0.50	0.50	0.50	0.68	0.66	0.66
‹ 1[4]	(	0.86	0.80	0.80	0.80	0.66	0.71	0.67
‹ 2[5]	(	1.91	2.31	2.28	1.72	2.77	2.45	2.00

:es: 'N-e catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisherie Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting LaborForceintheAlaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over ail boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man *weeks equals boat* weeks times an estimate of the average crew size in this fishery; it is thus an estima of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A '*(" indicates that the statistic is not available due to confidentiality requirements maintained by the Ent Commission.

TABLE C.164
Prince William Sound
Herring Roe on Kelp Fishery

Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B		22	135	397	168	137	320	266
	L		50	498	1,291	309	557	1,416	769
May									
	B		23	104			58	175	69
	L		48	240		21	66	383	111
June									
	B		5						
	L		5						
July									
	B								1
	L								
August									
	B								
	L								
September									
	B								
	L								
October									
	B								
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C. 165
PRINCE WILLIAM SOUND HERRING ROE ON KELP FISHERY
Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	1	8	30	104	7	6	19	23
1 - 25 feet	1	8	45	144	95	74	164	136
26 - 35 feet	1	14	53	102	58	52	109	92
36 - 45 feet		3	21	35	12	9	32	21
46 - 55 feet		1	5	5	4		6	6
56 - 65 feet			4	6		1	1	1
66 - 75 feet			1		1	1	1	
76 - 85 feet								
86 - 95 feet								
96 -105 feet				1				
106 -115 feet								
116 -125 feet								
over 125 feet							1	

[1]All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission, Data Files.

TABLE C. 166
PRINCE WILLIAN SOUND
SMALL BOAT LONG LINE BOTTOMFISH FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	197s
Pounds Landed (in 000's)	(	51	9	11	53	43	19
Value of Landings	$ (	$ 8,000	S 1,000	s 2,000	S ,9,000	S 20,000	S 3,000 $
Number of Boats	1	23	12	30	51	30	17
Number of Landings[1]	(	58	17	66	114	72	46
Boat Weeks[2]	(	4a	17	62	107	66	43
Man Weeks[3]	(	48	17	62	107	66	43
Number of Landings per Boat	(	2.52	1.42	2.20	2.24	2.40	2.71
Weeks per Boat	(	2.09	1.42	2.07	2.10	2.20	2.S3
Pounds per Landing	(	880	S30	170	460	600	410
Value of catch per Landing	s (	$ 140	$ 60	$ 30	$ 80	S 2s0	$ 6S $
Value of Catch per Boat	s (	$ 350	s 8s	$ 65	$ 180	$ 670	S 100 S
Value of Catch per Boat Week	s .(	s 170	.S "60	$ 32	S 8s	S 300	s 70 $
Price (i.e. value of catch per lbs.)	$ (	s 0.16	S 0.11	$ 0.18	$ 0.17	s 0.47	s 0.16 $
Index 1[4]	(	0.95	0.89	0.96	0*80	0.95	0.98
Index 2[5]	(	1.21	1.00	1.06	1.07	1.09	1.07

Sources : The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A st the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoin research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.

2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.

3. Nan weeks equals boat weeks times an estimate of the average crew size in this fishery: it is thus an of the average number of fishermen employed a week times the number of weeks fished.

4. Index 1 equals the number of Landings divided by the number of species Landed

5. Index 2 equals the average number of Landings per week.

6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained b, t Commission.

It has been estimated that the average crew size in this fishery is 1.

TABLE C. 167
Prince William Sound Small Boat
Long Line Bottomfish Fishery
Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]								
	L[2]								
February	B					1			
	L								
March	B					1			
	L								
April	B								
	L								
May	B		8	1	1	9	7	2	8
	L		12			10	10		11
June	B	1	8	2	8	26	22	9	13
	L		11		8	43	35	u	19
July	B			7	21	25	12	10	9
	L			9	31	43	19	17	. 17
August	B		18	2	15	11	5	9	7
	L		31		20	11	8	15	8
September	B		3	1	5	1			
	L				5				
October	B								
	L								
November	B			1					
	L								
December	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.168

PRINCE WILLIAM SOUND SMALL BOAT LONG LINE

BOTTOMFISH FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]		6		3	2	1		1
1- 25		1		2	12	3		10
26- 35	1	11	9	17	23	17	14	10
36- 45		4	2	7	11	7	2	2 *
46- 55			1	1	3	1	1	
56- 65		1				1		

1. All boats of unspecified length are included in this category.

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.169

PRINCE WILLIAM SOUND
OTTER TRAWL BOTTOMFISH FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	1976
s Landed 00's)	-			(	4a	(	(	(
of Landings	$ -	$ -	$ -	$ (	$ 8,000	S (	$ (	$ (
r of Boats	-			1	5	3	2 “	3
r of Landings[1]	-			(	12 .	(	(	(
Weeks[2]	- .			(	9	(.	(	(
eks[3]	-			(	27	(	(	(
r of Landings oat				(	2.4	(	(	(
s per Boat		.			1.80			
ls per Landing		-		(	4,000	(	(	(
f Catch Landing	$	$ -	$ -	$ (	$ 670	$ (	$ (	$ (
e of Catch Boat	$	$ -	$ -	$ (	$ 1,600	$ (	$ (	$ (
e of Catch Boat Week	$ -	$ -	$ -	$ (	$ 890	$ (	$ (	$ (
e . value of catch per lbs.)	S	$ -	s -	$ (	$ 0.16	S (	s (.	s (
% 1[4]				(	1	(	(	(
x 2[5]				(	1.33	(	(	(

ces: The catch statistics were derived using data Provided from the data files of the State of Alaska Commercial Fisherie Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estima of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Ent Commission.

as been estimated that the average crew size in this fishery is 3.

*

TABLE C.170
PRINCE WILLIAM SOUND OTTER TRAWL BOTTOMFISH FISHERY
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]					1	2		2
	L[2]								
February									
	B					1	2		2
	L								
March									
	B					1	3	1	2
	L								
April									
	B					2	2	2	2
	L								
May									
	B							1	1
	L								
June									
	B						1		
	L								
July									
	B								
	L								
August									
	B								
	L								
September									
	B								
	L								
October									
	B					1			
	L								
November									
	B								
	L								
December									
	B					1		1	
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.171

PRINCE WILLIAM SOUND OTTER TRAWL

BOTTOMFISH FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
-.1	_							1
1- 25	-				1			
26- 35	-				1	2	2	2
36- 45	-			1	1	1		
46- 55	-							
56- 65	-				1			
66- 75	-				1			

1. All boats of unspecified length are included in this category.

Source : Commercial Fisheries Entry Commission Data Files

TABLE C.172
PRINCE WILLIAM SOUND BOTTOMFISH FISHERY ALL GEAR TYPES

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Pounds Landed (in 000's)	C[4]	51	9	11	101	43	19	26	
Value of Landings	C	8,000	1,000	2,000	17,000	20,000	3,000	8,000	
Number of Boats	1	23	12	30	56	30	17	23	
Number of Landings[1]	C	58	17	66	126	72	46	55	
Boat Weeks[2]	C	48	17	62	116	66	43	52	
Man Weeks[3]	C "	48	17	62	134	66	43	52	

Source: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A Study of the Socio Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

[1] Number of Landings equals the number of days each boat landed fish. Summed over all boats.

[2] Boat Weeks equals the number of weeks each boat landed fish, Summed over all boats.

[3] Man Weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estimate of the average number of fishermen employed a week times the number of weeks fished.

[4] A "C" indicates that the statistic is not available due to confidentiality requirements maintained by the Entry Commission.

These statistics do not include the activities of the following boats that participated in this fishery:

1971 one hand troller
1972 one otter trawler
1973 one drift gill net boat and one hand troller
1974 three otter trawlers
1975 two otter trawlers
1976 three otter trawlers

TABLE C.173

King Crab Catch In Pounds, Prince William Sound Area.
1960 - 1977 - 78 Season

Year	Pounds	Year	Pounds
1960	246,965	1969	48,100
1961	236,081	1970	94,300
1962	31,478	1971	144,200
1963	43,569	1972	296,200
1964	14,028	1973	207,916
1965	5,500	1974	85,379
1966	11,000	1975	53,423
1967	41,800	1976-77 1/	17,087
1968	200,000	1977-78 1/	86,595

1/ Season.

Source: Alaska Department. of Fish and Game, Annual Management Report Prince William Sound May, 1978.

TABLE C.174
PRINCE WILLIAM SOUND
KING CRAB FISHERY

CATCH AND EMPLOYMENT DATA

		1969		1970		1971		1972		1973		1974		1975	
Pounds Landed (in 000's)		48		94		1,44		296		208		85		53	
Value of Landings	S	3.3,000	S	26,000	$	43,000	$	121,000	S	135,000	S	41,000	$	24,000	S
Number of Boats		19		12		20		25		22		21		10	
Number of Landings[1]		80		52		74		192		133		63		75	
Boat Weeks[2]		73		41		53		141		93		58		47	
Man Weeks[3]		292		164		212		564		372		232		188	
Number of Landings per Boat		4.21		4.33		3.70		7.68		6.05		3.00		7.50	
Weeks per Boat		3.84		3.42		2.65		S.64		4.23		2.76		4.70	
Pounds per Landing		600		1,800		1,950		1,540		1,560		1,350		710	
Value of Catch per Landing	S	160	S	500	$	580	$	630	S	1,020	S	650	S	320	S
Value of Catch per Boat	S	680	$	2,170	$	2,1.50	S	4,840	S	6,140	S	1,950	S	2,400	S
Value of Catch per Boat Week	S	180	S	630	$	810	$	860	S	1,450	$	no	$	510	$
Price (i.e. value of catch per lbs.)	$	0.27	$	0.28	$	0.30	$	0.41	$	0.65	$	0.48	S	0.45	$
Index 1[4]		1.00		1.00		1.00		0.98		0.99		1.00		0.95	
Index 2[5]		1.10		1.27		1.40		1.36		1.43		1.09		'1.60	

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial.! Entry Commission. The estimate of the average craw size in this fishery was made by George W. Rogers in, A s the Socio-Economic impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoi research.

1. Number of Landings equals the number of days each boat Landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Ladings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained t. Commission.

It has been estimated that the average crew size in this fishery is 4.

TABLE C. 175
Prince William Sound
King Crab Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	15	5	2	6	13	4	2	12
	L[2]	35	20		17	51	6		52
February	B	13	5	2	8	8	12	3	9
	L	24	12		21	24	18		23
March	B	9			5	2	6	1	3
	L	16			6		9		
April	B								
	L								
May	B								
	L								
June	B								
	L								
July	B								
	L								
August	B			1	4	4	1	1	
	L				10	7			
September	B		1	4	5	7	5	1	
	L			10	11	12	8		
October	B	1	5	3	6	6	7		
	L		11		10	9	15		
November	B	1	3	11	16	6	4	8	
	L			21	56	12	5	29	
December	B	1	2	11	16	3		8	
	L			22	61			37	

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.176
PRINCE WILLIAM SOUND

KING CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	2	2	4	4		1		
1- 25	1	2	2			-		
26- 35	10	5	6	5	7	5	1	1
36- 45	5	3	4	11	9	7	5	8
46- 55	1	-	2	2	2	4	2	3
56- 65			2	2	3	3	2	1
66- 75						-	-	-
76- 85			-	1	1	-	-	-
86- 95						-		
96-105						-		
106-115						-		
116-125						1		

1. All boats of unspecified length are included in this category.

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.177

Prince William Sound Area Historical Tanner Crab Catch in Pounds by Season.

Season	Inside	Outside	Total
1968-69			1,235,613
1969-70			1,284,597
1970-71			4,1s9
1971-72			7,788,498
1972-73			13,927,868
1973-74	1,658,000	8,500,000	10,158,000
1974-75[1]	1,187,000	2,667,000	3,854,000
1975-76	3,322,482	3,810,262	7,132,744

	Northern	Hinchinbrook	Western	Eastern		Vessels
1976-77[2]	782,048	766,650	701,725	70,925	2,321,348	23
1977-78[3]	774,929	897,768	717,739	56,214	2,446,6S0	37

[1]No concentrated effort. until February 1975.
[2]New districts established.
[3]As of March 18, 1978.

Source: Alaska Department of Fish and Game, Annual Management Report, Prince William Sound, May, 1978.

TABLE C. 178

PRINCE WILLIAM SOUND
TANNER (SNOW) CRAB FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975
Pounds Lended (in 000's)	945	1,292	642	8,551	12,697	9,598	, 5,017
Value of Landings	$ 104,000	$ 129,000	$ 71,000	$ 1,026,000	$ 2,158,000	$ 1,920,000	S 702,000 $ 1,2
Number of Boats	19	13	20	47	51	54	33
Number of Landings[1]	244	267	129	836	1,012	628	384
Boat Weeks[2]	156	129	70	S18	668"	472	268
Man Weeks[3]	624	516	280	2,072	2,672	1,888 "	1,072
Number of Landings per Boat	12.8	20.5	6.5	17.8	19.8	11.6	11.6
Weeks per Seat	8.21	9.92	3.50	11.0	13.1	8.74	8.12
Pounds per Landing	3,900	4,800	5,000	10,200	12,500	15,300	13,100
Value of Catch per Landing	$ 430	$ 480	$ 550	$ 1,230	$ 2,130	$ 3,060	$ 1,830 $,
Value of Catch per Boat	$ 5,470	s 9,920	$ 3,550	$ 21,830	$ 42,310	$ 3S,560	$ 21,270 $
Value of Catch per Boat Week	$ 670	$ 1,000	$ 1,010	$ 1,980	$ 3,230	$ 4,070	$ 2,620 $
Price (i.e. value of catch per lbs.)	S 0.11	$ 0.10	s 0.11	$ 0.12	$ 0.17	$ 0.20	s 0.14 $
Index 1[4]	1.00	0.99	0.99	0.97	0.98	0.97	0.97
Index 2[5]	1.56	2.07	1.84	1.61	1.51	1.33	1.43

Sources: Tine catch statistics were derived usinq data provided from the data files of the State of Alaska Commercia. F Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A s the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoi. research.

1. Number of Landings equals the number of days each beat landed fish. Summed over all boats.

2. Boat weeks equals the number of weeks each boat landed fish. Summed OVer all boats.

3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an of the average number of fishermen employed a week times the number of weeks fished.

4. Index 1 equals the number of Landings divided by the number of species Landed

S. Index 2 equals the average number of Landings per week.

6. A '*(" indicates that the statistic is not available due to confidentiality requirements maintained by Commission.

It has been estimated that the average crew size in this fishery is 4.

TABLE C.179
Prince William Sound
Tanner (Snow) Crab Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	14	8	1	11	33	10	2	28
	L[2]	63	60		62	143	13		130
February	B	16	8		13	39	31	14	29
	L	48	59		75	235	67	36	118
March	B	15	12		16	44	50	17	27
	L	66	88		72	243	243	95	101
April	B	9	10		18	44	50	18	23
	L	51	56		6.5	220	166	68	75
May	B	5			20	37	39	9	19
	L	16			129	114	139	34	58
June	B				17	20		1	
	L				91	54			
July	B				11				
	L				30				
August	B				1				
	L								
September	B				2			1	
	L								
October	B		2	4	5				
	L			26	8				
November	B		1	18	26	1		15	
	L			59	134			51	
December	B			12	36	2		23	
	L			43	163			96	

Source: Commercial Fisheries Entry Commission Data Files

[1] B = Number of Boats

[2] L = Number of Landings

TABLE C.180

PRINCE WILLIAM SOUND

TANNER (SNOW) CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	3	1	3	5	2	1	1	2
1- 25	1	2	1	2	2	1	1	1
26- 35	9	7	7	9	9	6	2	3
36- 45	4	2	3	12	14	18	12	12
46- 55	1	1	4	6	9	11	8	9
56- 65	-		2	4	5	5	5	6
66- 75	-			2	3	4	1	2
76- 85	1			7	7	3	1	2
86- 95	-					4	2	1
96-105	-					-		-
106-115	-					-		-
116-125						1		

1. All boats of unspecified length are included in this category.

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.181
Prince William Sound Area Dungeness Crab Catch, 1960 - 1977

Year	Copper River Pounds	Vessels	Orca Inlet Pounds	Vessels	Total Catch Pounds
1960			1,524,326		
1961			990,242		
1962			1,353,190		
1963	no data available		1,216,846		incomplete data
1964			1,290,929		
1965			1,240,372		
1966			999,341		
1967			No data available		
1968			579,279		
1969	336,696		541,822		878,696
1970	78,223		660,411		738,634
1971	78,848		430,976		509,824
1972	437,865		286,808		724,673
1973	458,613		347>764		806,377
1974	290,149		269,015		559,164
1975	654,410		163,631		818,041
1976	%54,933	4	35,399	3	290,332
1977	506,751	4	228,8S8	23	735,609

Source: Alaska Department of Fish and Game, Annual Management Report, Prince William Sound, May 8, 1978

TABLE C. 182

PRINCE WILLIAM SOUND
DUNGENESS CRAB FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	197s
Pounds Landed (in 000's)	879	739	510	725	806	559	818
Value of Landings	$ 123,000	$ 103,000	$ 87,000	s 268,000	$ 421,000	$ 268,000	$ 466,000 S
Number of Boats	41	38	26	47	45	50	37
Number of Landings[1]	589	389	438	510	634	4s9	331
Boat Weeks[2]	234	145	164	233	3s9	219	204
Man Weeks[3]	468	290	328	466	718	438	408
Number of Landings per Boat	14.4	10.2	16.8	10.9	14.1	·9.2	8.9
Weeks per Boat	5.71	3.82	6.31	4.96	7.4a	"4.38	5.s1
Pounds per Landing	1,490	1,900	1,160	1,420	1,270	1,220	2.470
Value of Catch per Landing	$ 22.0	$ 265	$ 200	$ 525	S 6S0	$ 585	$ 1,410 s
Value of Catch per Boat	$ 3,000	$ 2,700-	$ 3,300	$ 5,700	$ 9,100	s 5,400	s 12,600 S
Value of Catch per Scat Week	$ S30	$ 710	S '330	$ 1,150	$ '1,140	$ 1,220	$ 2,280 S
Price (i.e. value of catch per lbs.)	$ 0.14	s 0.14	S 0.17	s 0.37	$ 0.51	s 0.48	$ 0.57 s
Index 1[4]	0.83	0.87	0.98	0.99	1.00	0.98	, 0.95
Index 25	2.52	2.6a	2.67	2.19	1.77	2.10	1.62

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A, the Socio-Economic Impact of Changes in the EarVesting Labor Force in the Alaska Salmon Fishery, and in ongo research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals heat weeks times an estimate of the average crew size in this fishery: it is thus a of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of handings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by Commission.

It has been estimated that the average crew size in this fishery is 2.

TABLE C.183
Prince William Sound Dungeness Crab
Fishery

Number of Boats and Landings in the Fishery by Month

Month		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]	7				14	1		1
	L[2]	26				47			
February	B	11	1			10	1	1	1
	L	30				42			
March	B	5	2			6	3		1
	L	27				30			
April	B	5				5	2		
	L	13				21			
May	B	1				7	3	1	
	L					24			
June	B	3				7	4	2	1
	L					22	8		
July	B	4		1	6	5	3	4	
	L	31			32	22		19	
August	B	6	2	2	11	4	3	4	4
	L	28			51	19		22	11
September	B	28	32	22	38	29	46	35	5
	L	337	159	261	278	256	345	197	18
October	B	19	32	20	2	23	19	19	
	L	79	215	145		106	70	60	
November	B		4	6	14	13		7	
	L		8	20	87	44		23	
December	B				13	1		2	
	L				52				

Source: Commercial Fisheries Entry Commission
Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.184

PRINCE WILLIAM SOUND

DUNGENESS CRAB FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	16	13	5	2	2			-
1- 25	6	5	3	8	7	3	6	1
26- 35	12	12	12	24	20	27	18	2
36- 45	6	8	4	9	9	12	6	1
46- 55	1		2	4	4	6	4	1
56- 65					1	2	2	2
66- 75					1			
76- 85					1		-	
86- 95							1	1

1. All boats of unspecified length are included in this category.

Source : Commercial Fisheries Entry Commission Data Files

TABLE C.185

Shrimp Harvest in Pounds, Prince William Sound Area, 1960 - 1977

Year	Pots	Year	Pots	Trawl	Total
1960	2,494	1969	2,S73		
1961		1970	9,888		
1962	1,788	1971	6,537		
1963	.SS0	1972	3,474	5,153	8,627
1964	2,124	1973	3,185	4,243	7,428
196.S	2,178	1974	12,489	1,345	13,854
1966		1975	2,07S	26,961	29,036
1967	374	1976	1,20s	134,115	135,320
1968	3,433	1977	3,7S8	170,7s7	174,515

Source: Alaska Department of Fish and Game, Annual Management Report, Prince William Sound, May 8, 1978.

TABLE C.186
PRINCE WILLIAM SOUND SHRIMP FISHERY ALL GEAR TYPES:
CATCH, GROSS EARNINGS, AND NUMBER OF BOATS, 1969 - 1976

YEAR	CATCH (POUNDS)	GROSS EARNINGS	NUMBER OF BOATS
1969	2,573	$1,158	3
1970	9,888	3,955	7
1971	6,537	2,288	7
1972	8,627	2,394	6
1973	7,428	2,548	5
1974	13,834	36,372	5
1975	29,036	35,882	4
1976	C	C	C
1977			

A "C" indicates that the statistic is not available due to confidentiality requirements.

Source: Alaska Commercial Fisheries Entry Commission, Alaska Shellfish Bio-Economic Data Base, 1978

TABLE C. 187

PRINCE WILLIAM SOUND POT SHRIMP FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	1976
s Landed 00's)	(	Lo	7	(	(	12	(	(
of Landings	(	$4,000	$ 2,000	(	(	$35,000	(	(
r of Boats	3	7	7	3	2	4	2	I
r of Landings[1]	(	37	13	(	(	25	(	(
'Weeks[2]	(	27	13	(	(	25	(	(
'eeks[3]	(	54	26	(	(	50	(	(
r of Landings oat	(	5.29	1.86	(	(	6.25	(	(
per Boat	(	3.86	1.86	(	(	6.25	(	(
is per Landing	(	270	538	(	(	.480	(	(
of Catch anding	(	$ 108	$ 154	(	(	$1,400	(	(
of Catch oat	(	$ 571	$ 286	(	(	$8,750	(	(
of Catch lost Week	(	$ 148	$ 154	(	(	$1,400	(	(
value of catch per lbs.)	(	$ 0.40	$ 0.29	(	(	$ 2.92	(	(
c 1[4]	(	1.0	1.0	(	(	1.0	(	(
c 2[5]	(	1.37	1.0	(	(	1.0	(	(

ces: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisherie Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in tile Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each teat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estima of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Ent Commission.

TABLE C.188

Prince William Sound

Pot Shrimp Fishery

Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]	1	1	1	1	2	1		
	L[2]								
February									
	B		1	2	2		1		
	L								
March									
	B		3	3	1		1	1	
	L								
April									
	B		4	3		1	3	1	
	L		1 0						
May									
	B	2	5		1		3		
	L		7						
June									
	B		1				1		
	L								
Ju ly									
	B						1		
	L								
August									
	B						2		
	L								
September									
	B						2	1	
	L								
October									
	B						2		
	L								
November									
	B		1	2					1
	L								
December									
	B		1		1				1
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

2L = Number of Landings

TABLE C.189

PRINCE WILLIAM SOUND

POT SHRIMP FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	-	2						
1- 25	-							
26- 35	1	1		1	2	2	1	
36- 45	2	3	5	2		2	1	1
46- 55			2					
56- 65		1						

1. All boats of unspecified length are included in this category.

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.190
ANNUAL PRINCE WILLIAM SOUND RAZOR CLAM CATCH, 1960 - 1977
(in thousands of pounds, shell weight)

YEAR	CATCH	YEAR	CATCH	YEAR	CATCH
1960	433.9	1966	27.1	1972	30.3
1961	261.6	1967	114.9	1973	31.5
1962	208.7	1968	72.9	1974	29.7
1963	86.3	1969	26.8	1975	15.4
1964	39.3	1970	27.9	1976	1.5
1965	86.5	1971	38.0	1977	2.2

Source: ADF&G, Status of Prince William Sound Shellfish, 1976.

TABLE C.191
PRINCE WILLIAM SOUND RAZOR CLAM CATCH BY MONTH 1967 - 1977
(in thousands of pounds, shell weight)

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
1967			14.2	47.7	24.4	12.0	12.3	3.8	0.3	0.2			114.9
1968			4.1	16.6	18.6	17.6	10.0	6.0					72.9
1969			0.2	2.8	2.2	15.0	5.0	1.3	0.3				26.8
1970			?.3	2.1	6.6	8.8	7.0	1.9		0.2			27.9
1971		0.6	2.3	3.0	3.6	8.9	7.4	1.8	0.2				38.0
1972	0.2	0.1	0.3	3.0	7.9	2.1	8.2	7.3	1.4				30.3
1973		0.4	0.1	2.1	7.9	10.1	8.3	2.2	0.2	0.2		.1	31.5
1974			0.1	2.2	8.1	10.8	6.7	1.8					29.7
1975				0.5	1.9	4.1	7.0	1.9					15.4
1976				0.3	0.9	0.2	0.1						1.5
1977					0.5	1.0	0.5	0.2					2.2

Source: Alaska Department of Fish and Game, Statistical Leaflets, various years.

TABLE C.192
PRINCE WILLIAM SOUND
RAZOR CLAM FISHERY

CATCH AND EMPLOYMENT DATA

		1969	1970	1971	1972	1973	1974	1975	1976
s Landed)0's)		27	28	38	30	31	30	15	2
of Landings	$	7,000 $	7,000 $	9,000 $	12,000 $	15,000 $	19,000 S	8,000 S	1,000
r of Boats		33	15	39	54	48	37	22	9
r of Landings[1]		144	133	186	191	240	174	164	22
Weeks[2]		87	59	103	121	1.59	113	70	16
eeks[3]									
r of Landings oat		4.36	"-a. 89	4.77	3.54	5.00	4.70	7.45	2.44
per Boat		2.64	3.93	2.64	2.24	3.31	3.05	3.19	1.78
s per Landing		190	210	200	160	130	170	90	90
of Catch anding	$	49 $	53 $	48 $	63 $	63 $	110 S	49 S	45
of Catch oat	$	210 $	470 $	230 $	220 $	310 $	510 S	360 $	110
of Catch oat Week	s	80 $	118 $	87 $	99 $	94 $	168 $	114 $	63
value of catch per lbs.)	$	0.26 $	0.25 $	0.24 $	0.40 $	0.48 S	0.63 S	0.53 $	0.50
x 1[4]		0.96	0.87	0.91	0.93	0.98	0.99	0.72	0.88
x 2[5]		1.66	2.25	1.81	1.58	1.51	1.54	2.34	1.38

es: The catch "statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheri Entry Commission. The estimate of the average crew size in 'his fishery was made by George W. Rogers in, A study o the Socio-2cor.omit Impact of Chan es in the Harvestin Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Seat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of 'the average crew size in this fishery; it ia thus an estim of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the En Commission.

as been estimated that the average crew size in this fishery is

TABLE C.193
Prince William Sound
Razor Clam Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January	B[1]				1				
	L[2]								
February	B			1	1	3			
	L								
March	B	1	2	6	1	1	1		
	L			16					
April	B	8	3	6	5	12	7	4	3
	L	24		16	17	32	17	5	
May	B	5	9	17	20	30	14	11	5
	L	11	35	57	40	70	40	18	12
June	B	18	7	18	6	26	23	9	2
	L	60	40	48	11	67	5-7	40	
July	B	13	5	10	22	11	17	15	1
	L	31	37	31	50	43	48	79	
August	B	8	4	4	26	7	4	6	1
	L	14	7	10	53	17	11	22	
September	B	1		1	5	2			
	L				10				
October	B		2			2			
	L								
November	B								
	L								
December	B					1			
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.194
THE NUMBER OF PRINCE WILLIAM SOUND AND STATEWIDE GEAR PERMITS
ISSUED TO RESIDENTS OF CORDOVA 1974 - 1977*

SPECIES AND GEAR	1974	1975	1976	1977	1978
PRINCE WILLIAM SOUND					
Herring, Purse Seine[1]				31	29
Herring, Drift Gill Net[1]					52
King Crab, Small Boat Pots[2]	44	16	16	27	12
King Crab, Large Boat Pots	6	5	4		
Salmon, Purse Seine	202	181	192	17;	14:
Salmon, Drift Gill Net	370	348	378	374	341
Salmon, Set Gill Net	32	18	17	19	11
STATEWIDE					
Halibut, Small Boat Long Line[3]	47	19	31	51	23
Halibut, Hand Troll			1	1	
Halibut, Large Boat Long Line		8	16	25	26
Sablefish, Small Boat Long Line		2	1	1	1
Sablefish, Large Boat Long Line					1
Dungeness Crab, Small Boat Pots	105	45	34	46	38
Dungeness Crab, Large Boat Pots		8	8	2	1
Herring, Purse Seine	43	26	37		
Herring, Set Gill Net	31				
Herring, Pound	1				
Herring Roe on Kelp	239	508	523	220	106
Bottomfish, Small Boat Long Line		3	5	3	6
Bottomfish, Otter Trawl		5	4	2	2
Bottomfish, Small Boat Pots	3	1		1	
Bottomfish, Beam Trawl				1	1
Bottomfish, Large Boat Long Line			1	1	3
Shrimp, Otter Trawl	10	1	1	1	1
Shrimp, Small Boat Pots	22	2	4	9	7
Shrimp, Beam Trawl	10	2	2	3	
Shrimp, Large Boat Pots		1			
Razor Clams, Shovel		84	64	65′	
Razor Clams, Dredge		1	2	3	1
Razor Clams, Other		4			
Salmon, Hand Troll	2		1	2	4
Salmon, Power Troll	3	2	1	2	
Tanner Crab, Small Boat Pots	61	31	29	38	36
Tanner Crab, Large Boat Pots	20	16	13	15	14
Other, Other	125	2	2	1	2

[1] Indicates a limited entry herring fishery,

[2] A small pot boat has a keel length of not more than 50 feet.

3A small long line boat has a keel length of not more than 26 feet.

*A resident of Cordova is anyone using a Cordova address when applying for a gear permit.

Source: Commercial Fisheries Entry Commission, Permit Files.

PROCESSING

TABLE C.195
NUMBER OF CORDOVA
PROCESSING PLANTS[1] BY PRODUCT 1962 - 1972

YEAR	SALMON	HALIBUT	HERRING	KING CRAB	TANNER CRAB	DUNGENESS CRAB	SHRIMP	SCALLOPS	RAZOR CLAMS	TOTAL[2]
1962	4	0	0	1	0	2	0	0	2	5
1963	8	0	0	1	1	2	0	0	2	9
1964	8	3	0	0	0	0	0	0	3	9
1965	7	0	0	0	0	1	0	0	2	7
1966	4	0	0	1	0	1	0	0	2	6
1967	11	0	0	3	0	3	0	0	2	13
1968	8	1	0	2	2	2	0	0	2	10
1969	8	0	0	2	1	3	0	0	1	8
1970	4	1	0	1	0	2	0	0	1	4
1971	5	1	1	2	1	4	0	0	2	5
1972	5	1	1	2	3	2	0	0	2	8

[1]Floating processor plants are included. .

[2]The total is not the sum of the columns since most plants produce more than one product.

Source: ADF&G Commercial Operator Reports 1962 - 1972.

TABLE C.196

CORDOVA SALMON

PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							1
Frozen (000's lbs)				1,999	493	1,346	1,229
Plants				5	6	4	4
Canned (000's lbs)	9,864	6,333		9,005	6,178	8,111	10,050
Plants	3	4	1	6	7	5	6
Roe (000's lbs)				606	273		467
Plants				4	4	1	5
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants					1		
Other (000's lbs)							
Plants							
Total (000's lbs)	9,864	6,333		11,610	6,944	9,457	11,746
Plants	3	4	1	7	8	6	7

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source : Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.197
CORDOVA HALIBUT
Processing BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT		1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)								
	Plants							1
Frozen (000's lbs)					74	43	135	
	Plants	1			3	2	3	1
Canned (000's lbs)								
	Plants							
Roe (000's lbs)								
	Plants							
Bait (000's lbs)								
	Plants							
Reduction (000's lbs)								
	Plants							
Other (000's lbs)								
	Plants							
Total (000's lbs)					74	43		
	Plants				3	2		2

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C. 198
CORDOVA HERRING
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants					1		1
Frozen (000's lbs)					670		
Plants				1	3	1	
Canned (000's lbs)							
Plants							
Roe (000's lbs)							126
Plants				1		1	3
Bait (000's lbs)				68	29		
Plants				3	2	1	
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							1
Total (000's lbs)				68	699		
Plants				4	3	3	4

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.199

CORDOVA KING CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants		1			1		
Frozen (000's lbs)				46	10	8	8
Plants				3	2	2	2
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				46	10	8	8
Plants		1		3	3	2	2

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 *revisions,*

TABLE C.200
CORDOVA TANNER CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)				1,516	896	575	815
Plants				3	4	3	3
Canned (000's lbs)						330	215
Plants				1	1	2	2
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				1,516	896	905	1,030
Plants				3	4	3	3

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.201
CORDOVA DUNGENESS CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)							
Plants		1					
Frozen (000's lbs)				314	178	190	24
Plants		1		3	3	3	2
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				314	178	190	24
Plants		2		3	3	3	2

The weights are meat equivalent weights. If there are fewer than two processors, the data is net available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.202
CORDOVA SHRIMP
PROCESSING BY PRODUCT, 1'356 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)				1.5			
Plants		i		2	1	1	1
Frozen (000's lbs)							
Plants						1	
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)				1.5		0.5	
Plants		1		2	1	2	1

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weignt will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.203

CORDOVA FISH PROCESSING, QUARTERLY WAGE AND EMPLOYMENT DATA 1970.1977

YEAR	QUARTER	NUMBER OF FIRMS	AVERAGE MONTHLY EMPLOYMENT	AVERAGE PAY	TOTAL QUARTERLY WAGES
1970	1	2	1	1	1
	2	2	1	1	1
	3	9	380	648	738,252
	4	2	1	1	1
1971	1	9		606	36,380
	2	8	1;!	654	246,029
	3	9	282	709	598,698
	4	8	62	503	93,547
1972	1	2	1	1	1
	2	2	1	1	1
	3	2	1	1	1
	4	2	1	1	1
1973	1	7	217	512	333,566
	2	7	366	557	612,444
	3	7	351	705	742,767
	4	6	74	651	143,788
1974	1	6	143	667	285,504
	2	6	313	715	670,916
	3	6	274	664	545,859
	4	7	44	872	116,013
1975	1	7	143	586	251,184
	2	8	254	685	521,208
	3	8	326	959	937,703
	4	10	130	689	269,284
1976	1	9	277	552	458,987
	2	2	1	1	1
	3	10	420	1,058	1,331,830
	4	10	66	1,392	274,166
1977	1	9	157	692	325,220
	2	12	335	962	967,036
	3	12	467	1,486	2,081,690
	4				

A "1" indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data File

TABLE C. 204

CORDOVA FISH PROCESSING, ESTIMATED MONTHLY WAGES 1970 - 1977

	1970	1971	1972	1973	1974	1975	1976	1977
January	1	11,514	1	73,216	47,357	16,994	151,248	113,488
February	1	10,302	1	109,568	83,375	84,384	145,176	98,956
March	1	14,544	1	150,528	154,744	150,016	162,288	112,796
April	1	26,160	1	175,455	255,255	137,685	1	212,602
May	1	56,244	1	221,686	211,940	206,185	1	305,916
June	1	163,500	1	215,002	204,490	177,415	1	448,292
July	346,032	246,023	1	327,825	247,672	362,502	516,304	937,666
August	250,128	219,790	1	279,885	142,096	403,739	522,652	778,664
September	141,912	133,292	1	135,360	156,040	171,661	293,066	365,556
October	1	32,695	1	62,496	62,784	47,541	96,048	
November	1	31,186	1	46,872	29,648	88,192	91,872	
December	1	29,677	1	34,503	23,544	133,666	86,304	
Total Man Months	1	974,654	1	1,832,565	1,618,292	1,979,379	1	

A "1" indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data Files

TABLE C.205

CORDOVA FISH PROCESSING, EMPLOYMENT BY MONTH 1970 - 1977

	1970	1 9 7	1972	1973	1974	1975	1976	1977
January	1	19	1	143	71	29	274	164
February	1	17	1	214	125	144	263	143
March	1	24	1	294	232	256	294	163
April	1	40	1	315	357	201	1	221
May	1	86	1	398	296	301	1	318
June	1	250	1	386	286	259	1	466
July	534	347	1	465	373	378	488	631
August	386	310	1	397	214	421	494	524
September	219	188	1	192	235	179	277	246
October	1	65	1	96	72	69	69	
November	1	62	1	72	34	128	66	
December	1	59	1	53	27	194	62	
Total Man Months	1	1,467	1	3,025	2,322	2,559	1	1

A “1” indicates that the data is not available due to confidentiality requirements

Source: Alaska Department of Labor Data Files

PUBLIC SERVICES

TABLE C.206

PORT USAGE
CORDOVA, ALASKA, 1960 - 1976[1]

Year	Total Cargo[2] Short Tons	FISH AND FISH PRODUCTS Short Tons	FISH AND FISH PRODUCTS % of Total Cargo	No. of Vessels Using Port[3]
1960	34,885	9,024	25.9	1,299
1961	35,945	13,271	36.9	1,794
1962	43,459	16,228	37.3	3,031
1963	46,298	20,270	43.8	5,999
1964	38,673	11,855	30.7	2,361
1965	43,169	11,681	27.1	NA
1966	56,830	14,413	25.4	NA
1967	51,114	8,974	17.6	NA
1968	43,666	10,786	24.7	NA
1969	46,405	13,422	28.9	2,113
1970	34,455	4,659	13.5	1,461
1971	68,553	10,309	15.0	1,156
1972	42,114	4,842	11.5	4,538
1973	46,750	16,157	34.6	7,186
1974	35,218	10,879	30.9	3,779
1975	43,132	11,070	25.7	2,241
1976	65,969	16,850	25.5	176

Source: Department of the Army Corps of Engineers, Waterborne *Commerce* of the United States, Annual issues, 1960-1976

1 Includes all waterborne cargo entering and leaving the port.

2. Includes raw fish and any other fish product form entering and leaving the port.

3 Includes commercial fishing vessels, except 1976.

Yakutat

HARVESTING

TABLE C. 207

YAKUT CATCHES, NUMBER OF FISH BY SPECIES, 1902 - 1977

YEAR	KING	RED	COHO	PINK	CHUM	TOTAL	REMARKS
1902	150	52,900	12,300	35,000		100,350	
1903							No Reported Catch
1904		141,653	96,540	111,100		349,293	
1905		266,664	49,889	45,229		361,782	
1906		296,897	80,786	63,249		440,932	
1907		331,396	100,890	53,862		486,148	
1908	6,890	430,850	46,324	54,073		538,137	
1909		483,095	67,725	18,461		569,281	
1910	2,340	464,963	164,292	41,823	2,111	675,529	
1911	328	508,329	158,049	180,749	3,679	861,134	
1912	4,733	637,519	127,283	31,515	6,418	807,468	
1913	4,066	562,211	112,210	45,437		723,924	
1914	11,500	543,927	116,294	5,620		677,341	
1915	9,176	433,086	156,967	157,367		756,596	
1916	1,317	435,062	126,826	41,434		604,639	
1917	16,871	493,348	188,651	92,757		791,627	
1918	12,821	453,722	224,885	115,931		807,359	
1919	13,363	493,758	244,218	24,123		775,462	
1920	24,299	485,827	211,153	44,431		765,710	
1921	12,720	512,614	197,748	34,967		758,049	
1922	9,457	376,998	179,518	72,562		638,535	
1923	16,093	359,792	190,319	294,425	6,263	866,892	
1924	20,495	395,082	155,278	311,047		881,902	
1925	20,443	200,601	147,685	103,842	2,224	474,795	
1926	18,992	207,396	143,538	245,891	4,156	619,973	
1927	9,974	241,675	292,328	100,262	1,079	645,318	
1928							
1929							
1930	83,044	313,277	83,988	72,365		552,674	
1931		279,623				279,623	Italio, Situk, Ahrnklin catch only included in S.E. catches
1932							
1933	12,760	156,964	132,873	118,366	2,878	423,841	
1934	17,791	355,344	237,694	107,791	3,415	722,035	
1935	7,985	406,648	145,695	87,558	1,574	649,460	
1936	4,408	248,446	206,920	168,954	1,026	629,754	Estimated from case pack
1937	7,164	227,574	177,578	127,292	4,224	543,832	" " " "
1938	7,347	374,800	200,966	128,681	1,326	713,120	
1939	6,934	325,571	84,318	41,024	228	458,075	
1940	1,992	171,278	230,008	107,550	1,291	512,119	
1941	4,658	242,631	340,624	66,958	5,033	659,904	
1942	499	157,933	185,340	58,125	257	402,154	
1943	1,095	137,558	107,231	28,585	116	274,585	
1944	3,152	183,246	91,251	63,732	137	341,518	
1945	11,491	233,474	173,225	15,182	4,399	437,771	
1946	9,189	115,979	123,437	62,334	1,047	311,986	
1947	7,576	129,044	75,011	24,721	3,190	239,542	
1948	9,255	81,836	105,646	99,734	6,629	303,100	
1949	612	77,833	44,633	17,583	385	141,046	
1950							Included in S.E. catch

Table , continued on following page.....

....TABLE C.207, continued. . .

YEAR	KING	RED	COHO	PINK	CHUM	TOTAL	REMARKS
1951	1,260	148,295	127,701	35,222	5,328	317,806	
1952	2,414	110,358	187,990	37,067	12,599	350,428	
1953	1,914	111,733	150,512	8,801	15,605	288,565	
1954	2,246	127,095	267,181	40,043	16,094	452,659	
1955	3,808	111,250	201,842	25,686	23,568	366,154	
1956	6,341	108,303	130,445	17,201	23,533	285,823	
1957	3,680	110,504	63,009	16,475	31,996	225,664	
1958	1,093	42,090	98,772	61,785	17,764	221,509	
1959	1,412	76,790	138,989	12,505	36,694	266,390	
1960	916	48,321	121,320	13,966	12,491	197,014	
1961	2,534	82,929	130,314	65,063	11,520	292,360	
1962	2,748	80,668	189,511	27,692	17,914	318,533	
1963	942	52,711	145,863	79,180	10,679	289,375	
1964	2,005	92,235	169,806	40,392	5,669	310,107	
1965	1,468	122,735	125,421	4,425	4,258	258,307	
1966	2,152	185,361	67,414	1,395	3,395	259,717	
1967	2,190	88,431	120,286	32,532	4,47?	247,910	
1968	656	80,780	122,497	2,317	13,896	220,146	
1969	1,863	117,797	59,623	64,094	14,935	258,012	
1970	1,864	112,169	38,529	3,764	7,110	163,436	Yakataga Closed
1971	1,821	129,212	40,504	80,317	5,019	256,873	"
1972	2,243	132,000	43,161	2,783	8,000	188,197	"
1973	2,344	131,343	41,504	15,556	8,916	199,663	Limited Fishery
1974	2,257	82,820	77,069	4,254	4,227	170,627	"
1975	2,211	73,677	37,423	78,496	3,725	195,532	Closed
1976	1,780	129,377	50,416	28,269	7,748	217,590	Limited Fishery
1977	2,424	186,235	90,989	74,632	8,471	362,751	"

Source: ADF&G, Yakutat District Report, 1977.

TABLE C.208
Yakutat Salmon Fisheries
Catch by Species in Pounds
1966-1977

Year	Troll King	Setnet King	Red	Coho	Pink	Chum	Total
1966	3,091	26,500	1,280,174	660,249	4,760	31,250	2,003,013
1967	12,000	12,540	600,766	970,8S6	110,050	44,300	1,738,512
1968	34,580	13,120	551,303	967,480	7,164	130,528	1,669,595
1969	27,660	37,260	727,110	311,109	224,448	153,190	1,453,837
1970	3S,460	36,420	754,466	293,398	11,109	70,033	1,165,426**
1971	51,7S6	40,820	849,816	377,340	280,672	63,670	1,664,074
1972	24,960	47,520	851,S00	450,704	10,160	82,900	1,467,744
1973	19,992	44,880	853,799	410,504	54,446	89,160	1,472,711
1974	24,948	45,140	583,330	770,069	14,889	42,200	1,480,S75
197s	33,012	44,220	493,635	370,423	274,738	37,250	1>253,266
1976	20,388	35,600	840,825	504,160	98,941	77,480	1,577,394
1977	15,444	50,904	1,303,64S	992,956	298,520	84,740	2,740,209

** Yakutat area closed.

Source: Alaska Department of Fish and Game Memorandum

TABLE C.209
YAKUTAT
SET GILL WET SALMON FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975
Pounds Landed (in 000's)	1,440	1,085	1,543	1,381	1,465	1,404	1,199
Value of Landings	$ 259,000	$ 249,000	$ 331,000	$ 408,000	$ 952,000	$ 812,000	$ 618,000 $ 1,27
Number of Boats	151	142	130	141	200	200	158
Number of Landings[1]	2,761	2,450	2,676	2,349	3, 565	3,030	2,485
Boat Weeks[2]	1,194	1,106	1,132	1,074	1,581	1,568	1,205"
Man Weeks'	1,194	1,106	1,132	1,074	1,581	1,568	1,20s
Number of Landings per Seat	18.3	17.3	20.6	16.7	17.8	15.2	15.7
Weeks per Boat	7.91	7.79	8.71	7.62	7.91	7.84	7.63
Pounds per Landing	520	440	580	590	410	460	480
Value of Catch per Landing	$ 90	$ 100	$ 120	$ 170	$ 270	$ 270	$ 250 $
Value of Catch per Bose	$ 1,720	$ 1,750	$ 2,550	$ 2,890	$ 4,760	$ 4,060	$ 3,910 $
Value of Catch per Boat Week	$ 22s	$ 224	$ 290	$ 380	$ 600	$ 520	$ 515 $
Price (i.e. value of catch per lbs.)	$ 0.1s	$ 0.23	$ 0.21	$ 0.30	$ 0.65	$ 0.58	$ 0.52 $
Index 1[4]	0.5s	0.55	0.54	0.57	0.50	0.55	0.ss
Index 2[5]	2.31	2.22	2.36	2.19	2.25	1.93	2.06

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial i Entry Commission. The estimate of the average crew size in this fishery was made by *George* W. Rogers in, A st the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoir research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat landed fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an of the average number of fishermen employed a *week* times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landsd
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.

It has been estimated that the average *crew size* in this fishery is 1.

TABLE C.210

Yakutat

Set Gill Net Salmon Fishery

Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B								
	L								
May									
	B				5				
	L				7				
June									
	B	124	123	106	110	157	159	108	120
	L	709	767	722	731	750	582	518	575
July									
	B	128	125	101	117	177	178	122	139
	L	984	840	714	802	1,444	903	700	947
August									
	B	103	- 78	98	79	129	109	101	119
	L	494	342	573	347	582	573	580	703
September									
	B	100	89	96	95	149	129	113	104
	L	574	501	667	462	789	972	686	666
October									
	B							1	3
	L								
November									
	B								
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

ʻB = Number of Boats

2L = Number of Landings

TABLE C.211

YAKUTAT

SET GILL NET SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	151	141	130	140	199	200	158	150
1- 25		1			1			11
26- 35				1	-			2
36- 45								-
46- 55								
56- 65								
66- 75								
76- 85								
86- 95								
96-105								-
106-115								1

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.212

YAKUTAT
HAND TROLL SALMON FISHERY

CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	1975	1976
ıds Landed 000's)	202	150	118	112	30	69	4	64
ıe of Landings	$ 101,000	$ 102,000	S 73,000	S 68,000	$ 32,000	$ 65,000	$ 4,000	.$ 97,000
ɔe of Boats	62	72	52	39	17	27	6	4
ɔer of Landings[1]	660	S52	236	191	80	79	18	15
: Weeks [2]	295	302	188	114	61	73	15	14
Weeks [3]	295	302	188	114	61	73	15	14
ɔer of Landings Boat	10.64	7.67	4.54	4.90	4.71	2.93	3.00	3.75
ks per Boat	4.76	4.19	3.62	2.92	3.59	2.70	2.s0	3.50
nds per Landing	310	270	500	590	380	870	220	400
ıe of Catch Landing	S 150	$ 180	$ 310	$ 360	S 400	s 820	$ 220	$ 600
ıe of Catch Boat	$ 1,630	S 1,420	$ 1,400	$ 1,740	$ 1,880	s 2,410	$ 670	S 2,250
ıe of Catch Seat Week	S 340	$ 340	$ 390	s 600	$ 520	$ 890	$ 270	S 640
:e 9. value of catch per lbs.)	$ 0.50	$ 0.68	$ 0.62	S 0.61	$ 1.07	s 0.94	s 1.00	$ 1.50
ex 1[4]	0.59	0.59	0.58	0.57	0.57	0.51	0.90	0.71
ex 2[5]	2.24	1.83	1.26	1.68	1.31	1.08	1.20	1.07

ırces: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the-average crew size in this fishery was made by George W. Rogers in, A study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

1. Number of Landings equals the number of days each beat landed fish. Summed over all boats.

2. 8oat weeks equals the number of weeks each boat landed fish. Summed over all boats.

3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery: it ia thus an estimat of the average number of fishermen employed a week times the number of weeks fished.

4. Index 1 equals the number of Landings divided by the number of species Landed

5. Index 2 equals the average number of Landings per week.

6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by the Entr Commission.

has been estimated that the average crew size in this fishery is 1.

TABLE C.213
Yakutat
Hand Troll Salmon Fishery
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]							1	
	L[2]								
February									
	B								
	L								
March									
	B	1							
	L								
April									
	B	7	8	1					
	L	10	24						
May									
	B	15	9	6	2	4	7	4	
	L	28	20	10		5	10	8	
June									
	B	17	20	26	5	6	11	2	2
	L	36	44	50	5	13	24		
July									
	B	31	38	21	23	8	14	3	2
	L	138	1.06	50	71	16	29		
August									
	B	50	54	31	31	11	9		2
	L	399	297	97	104	36	13		
September									
	B	21	22	10	5	4	2	1	3
	L	48	61	27	8	8			
October									
	B					1	1	1	
	L								
November									
	B				1				
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.214
YAKUTAT

HAND TROLL SALMON FISHERY

NUMBER OF BOATS BY LENGTH

FEET	1969	1970	1971	1972	1973	1974	1975	1976
0[1]	30	28	21	5		2		
1- 25	17	19	11	19	3	4	2	2
26- 35	7	12	8	5	6	7	3	2
36- 45	7	11	9	8	7	10		
46- 55	1	2	2	1	1	4		
56- 65	-		1	1		-		
66- 75							1	

1. All boats of unspecified length are included in this category

Source: Commercial Fisheries Entry Commission Data Files

TABLE C.215
YAKUTAT POWER TROLL SALMON FISHERY
CATCH AND EMPLOYMENT DATA

	1969 "	1970.	1971	1972	1973	1974	1975	
Pounds Landed (in 000's)							34	
Value of Landings							$29,000	$81
Number of Mats							17	
Number of Landings[1]							SO	
suet Weeks[2]							46	
Man Weeks[3]							69	
Number of Landings per Boat							294	
Weeks per Boat							2.71	
Founds per Landing							680	
Value of Catch per Landing							$580	$1
Value of Catch per Boat							$1,710	"5
value of Catch per Seat Weak							$ 630	$1
Price (i.e. value of catch per lbs.)							0.85	$:
Index 1[4]							0.60	
Index 2[5]							1.09	

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fi Entry Commission. The estimate of the average crew size in this fishery waa made by George W. Rogers in, A t the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoir research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all boats.
2. Boat weeks equals the number of weeks each boat leaded fish. Summed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus of the average number of fishermen employed a week times the number of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landings per week.
6. A "(" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.

TABLE C.216
YAKUTAT POWER TROLL SALMON FISHERY
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B								
	L								
March									
	B								
	L								
April									
	B								
	L								
May									
	B							1	3
	L								
June									
	B							3	7
	L								11
July									
	B							6	10
	L							10	16
August									
	B							11	7
	L							24	15
September									
	B							2	2
	L								
October									
	B							1	
	L								
November									
	B							1	
	L								
December									
	B								
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C.217
YAKUTAT POWER TROLL SALMON FISHERY
Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
0[1]							2	2
1 - 25 feet							1	1
26 - 35 feet							1	2
36 - 45 feet							12	10
46 - 55 feet							1	1

[1] All boats of unspecified length are included in this category

Source: Commercial. Fisheries Entry Commission, Data Files.

TABLE C. 218

YAKUTAT SALMON FISHERY ALL GEAR TYPES

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Pounds Landed (in 000's)	1,642	1,235	1,661	1,493	1,495	1,473	1,237	1,673	
Value of Landings	360,000	351,000	404,000	476,000	984,000	877,000	651>000	1,362,000	
Number of Boats	213	214	182	180	217	227	181	184	
Number of Landings[1]	3,421	3,002	2>912	2,540	3,645	3,109	2,553	2,958	
Boat Weeks[2]	1,489	1,408	1,320	1,188	1,642	1,641	1,266	1,404	
Man Weeks[3]	1,489	1,408	1,320	1,188	1,642	1,641	1,289	1,426	

Source: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fisheries Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A Study of the Socio Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoing research.

[1] Number of Landings equals the number of days each boat landed fish. Summed over all boats.

[2] Boat Weeks equals the number of weeks each boat. landed fish. Summed over all boats.

[3] Man Weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an estimate of the average number of fishermen employed a week times the number of weeks fished.

TABLE C.219
YAKUTAT HALIBUT
LANDINGS 1969-1976
(in pounds)

1969	11,845	1973	228,129
1970	18.265	1974	154,881
1971	302 ; 283	1975	127,805
1972	347,351	1976	221,026

Source: IPHC data files

TABLE C.220

YAKUTAT SHELLFISH CATCH, 1960 - 1976

YEAR	LBS. SHRIMP	LBS. DUNGENESS CRAB	LBS. KING CRAB	LBS. TANNER CRAB	LBS. SCALLOP
1960		543,762			
1961		1,023,545	4,366		
1962	488	937,051	2,799		
1963	875	1,383,298	23,879		
1964	68	637,140	3,818		
1965		910,278	261		
1966		538,060			
1967	22,718	2,031,460			
1968		2,096,1?9		708	903,468
1969		1,207,397			836,712
1970	10,080	1,508,561			22,726
1971		1,668,654			84,948
1972		1,992,574	4,503	15,493	128,241
1973		2,347,407		206,948	173,700
1974		1,631,918		1,872,357	357,000
1975		540,803	6,558	2,021,149	139,000
1976		529,330		1,714,192	190,000

Sources: ADF&G Catch and Production Leaflet, 1975
ADF&G Annual Management Report, Yakutat, 1973
ADF&G Al Havens

TABLE C.221
Yakutat Scallop Dredge Fishery
CATCH AND EMPLOYMENT DATA

	1969	1970	1971	1972	1973	1974	197s
Pounds Landed (in 000 '~)	837	C	C	128	174	C	109
Value of Landings	$703,000	C	C	$150,000	$208,000	C	$149,000
Number of Boats	14	2	3	4	4	2	4
Number of Landings[1]	59	C	C	6	4	C	10
Boat Weeks[2]	58	C	C	6	4	C	10
Man Weeks'	530	C	C	60	40	C	100
Number of Landings per Boat	4.2X	C	C	1.50	1.00	C	2.s0
Weeks per Boat	4.14	C	C	1.50	1.00	C	2.s0
Pounds per Landing	14,200	C	C	21,300	43,500	C	10,900
Value of catch per Landing	$11,900	C	C	$25,000	$52,000	C	$14,900
Value of Catch per Seat	$50,200	C	C	$37,500	$52,000	C	$37,300
Value of Catch per Boat Week	$12,100	C	C	$25,000	$s2,000	C	$14,800
Price (i.e. value of catch per lbs.)	$0.84	C	C	$1.17	$1.20	C	51.37
Index 1[4]	0.65	C	C	0.60	0.57	C	1.00
Index 2[5]	1.02	C	C	1.00	1.00	C	1.00

Sources: The catch statistics were derived using data provided from the data files of the State of Alaska Commercial Fi Entry Commission. The estimate of the average crew size in this fishery was made by George W. Rogers in, A st the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Alaska Salmon Fishery, and in ongoin research.

1. Number of Landings equals the number of days each boat landed fish. Summed over all beats.
2. Boat weeks equals the number of weeks each boat landed fish. Sassed over all boats.
3. Man weeks equals boat weeks times an estimate of the average crew size in this fishery; it is thus an of the average number of fishermen employed a week times the number Of weeks fished.
4. Index 1 equals the number of Landings divided by the number of species Landed
5. Index 2 equals the average number of Landinga per week.
6. A "C" indicates that the statistic is not available due to confidentiality requirements maintained by t Commission.
7. It hae been estimated that the average crew size in this fishery is ten.

TABLE C.222
YAKUTAT SCALLOP DREDGE FISHERY
Number of Boats and Landings in the Fishery by Month

		1969	1970	1971	1972	1973	1974	1975	1976
January									
	B[1]								
	L[2]								
February									
	B	1							1
	L								
March									
	B	3						1	
	L								
April									
	B	1		2	1		2	3	1
	L								
May									
	B	8	1	3	4	4	2	2	1
	L	9			5	4			
June									
	B	11					2	1	2
	L	19							
July									
	B	10					2		1
	L	13							
August									
	B	4					1		1
	L	6							
September									
	B	3					1		1
	L								
October									
	B								1
	L								
November									
	B		1				1		
	L								
December									
	B	1							
	L								

Source: Commercial Fisheries Entry Commission Data Files

[1]B = Number of Boats

[2]L = Number of Landings

TABLE C. 223

YAKUTAT SCALLOP DREDGE FISHERY
Number of Boats by Length

	1969	1970	1971	1972	1973	1974	1975	1976
76 - 85 feet	4	2	2	3	3	2	3	2
86 - 95 feet			1	1			1	

Source: commercial Fisheries Entry Commission, Data Files.

TABLE C.224
NUMBEROF YAKUTAT, SOUTHEASTERN, AND STATEWIDE GEAR PERMITS
ISSUED TO RESIDENTS OF YAKUTAT*
1974 - 1978

SPECIES AND GEAR	1974	1975	1976	1977	1978
YAKUTAT					
Salmon, Set Gill Net	183	139	131	144	93
SOUTHEASTERN					
King Crab, Small Boat Pots[1]	5	1		1	.3
King Crab, Large Boat Pots		1		3	1
STATEWIDE					
Halibut, Hand Troll			1		
Halibut, Small Boat Long Line[2]	24	4	15	24	23
Halibut, Large Boat Long Line		1	5	9	7
Dungeness Crab, Small Boat Pots	7	3	2	2	4
Dungeness Crab, Large Boat Pots		1		1	1
Herring, Purse Seine	1				
Herring Roe on Kelp	2	4	2		
Bottomfish Small Boat Long Line				1	2
Shrimp, Small Boat Pots	6	2	3	4	
Shrimp, Beam Trawl	1				
Shrimp, Large Boat Pots			1	1	
Salmon, Hand Troll	28	9	19	44	55
Salmon, Power Troll	9	13	9	10	
Tanner Crab, Small Boat Pots	6	2		1	4
Tanner Crab, Large Boat Pots		1		3	2

[1]A small pot boat has a keel length of not over 50 feet.

[2]A small long line boat has a keel length of not over 26 feet.

*A resident of Yakutat is anyone using a Yakutat address in applying for a gear permit.

Source: Commercial Fisheries Entry Commission, Permit Files.

TABLE C.225
NUMBER OF YAKUTAT PROCESSING PLANTS[1] BY PRODUCT 1962 - 1972

YEAR	SALMON	HALIBUT	HERRING	KING CRAB	TANNER CRAB	DUNGENESS CRAB	SHRIMP	SCALLOPS	RAZOR CLAMS	TOTAL[2]
1962	0	0	0	0	0	1	0	0	0	1
1963	2	0	0	1	0	1	0	0	0	2
1964	3	1	0	1	0	1	0	0	0	3
1965	1	0	0	0	0	1	0	0	0	3
1966	2	0	0	0	0	1	0	0	0	2
1967	1	1	0	0	0	1	0	0	0	1
1968	3	1	0	0	0	1	0	1	0	3
1969	2	1	0	0	0	1	0	0	0	2
1970	0	0	1	0′	0	1	0	0	0	1
1971	1	0	0	0	0	1	0	0	0	1
1972	1	1	0	1	1	1	0	0	0	1

[1] Floating processor plants are included.

[2] The total is not the sum of the columns since most plants produce more than one product.

Source: ADF&G Commercial Operator Reports 1962 - 1972.

TABLE C.226
YAKUTAT SALMON
PROCESSING BY PRODUCT, 1556 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	1973	1974	1975	1376
Fresh (000's lbs)						1,471	
Plants						2	
Fr-zen (000's lbs)				1,209	898		1,936
?1 ants	1			4	2	1	3
Canned (000's lbs)							
Plants							
Roe (000's lbs)				39			
Plants				2	1		
Bait (000's lbs)							
Pl ants							
Reduction (000's lbs)							
Pl ants							
Other (000]s lbs)							
Plants							
Total (000's lbs)				1,248	898	1,471	1,936
Pl ants	1			4	2	3	3

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C. 227
YAKUTAT HALIBUT
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT		1956	1957	1958	1973	1974	1975	1975
Fresh (000's lbs)							131	
	Plants						"2	
Frozen (000's lbs)					265			
	Plants				2	1		
Canned (000's lbs)								
	Plants							
Roe (000's lbs)								
	Plants							
Bait (000's lbs)								
	Plants							
Reduction (000's lbs)								
	Plants							
Other (000's lbs)								
	Plants							
Total (000's lbs)					265		131	
	Plants				2	1	2	

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 *revisions,*

TABLE C.228
YAKUTAT TANNER CRAB
PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT	1956	1957	1958	? 973	1974	1975	1976
Fresh (000's lbs)							
Plants							
Frozen (000's lbs)					209		
PI ants				1	2	1	
Canned (000's lbs)							
Plants							
Roe (000's lbs)							
Plants							
Bait (000's lbs)							
Plants							
Reduction (000's lbs)							
Plants							
Other (000's lbs)							
Plants							
Total (000's lbs)					209		
PI ants				1	2	1	

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.

TABLE C.229

YAKUTAT DUNGENESS CRAB

PROCESSING BY PRODUCT, 1956 - 58 AND 1973 - 76

PRODUCT		1356	1957	1958	1973	1974	1975	1976
Fresh (000's lbs)								
	Plants							
Fr-zen (000's 5s)					276	107	55	
	Plants				2	2	2	
Canned (000's bs)								
	Plants							
Roe (000's lbs)								
	Plants							
Bait (000's lbs)								
	Plants							
Reduction (000's lbs)								
	Plants							
Other (000's lbs)								
	Plants							
Total (000's lbs)					276	107	55	
	Plants				2	2	2	

The weights are meat equivalent weights. If there are fewer than two processors, the data is not available due to confidentiality requirements and the total weight will not include the confidentiality data.

Source: Alaska Department of Fish and Game, Processor Reports with 1978 revisions.