

NORTHWEST FISHERIES CENTER  
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Trawl Surveys of Groundfish Resources  
Near Kodiak Island, Alaska  
1973

by

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Prepared by:  
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## CONTENTS

	Page
Introduction . . . . .	1
The resources . . . . .	1
Background . . . . .	2
Methods . . . . .	2
Vessel and fishing gear . . . . .	2
Area and seasonal coverage . . . . .	3
Sampling procedures and effort . . . . .	3
Trawling operations . . . . .	4
Southeast of Kodiak and in Shelikof Strait . . . . .	4
Catches in the Shelikof Gully and Semedi Island areas . . . . .	6
Catches northeast of Kodiak . . . . .	6
Bottom type and water temperature at fishing stations . . . . .	7
Results of echosounding surveys . . . . .	7
Biomass of bottomfish southeast of Kodiak . . . . .	8
Technological characteristics of pollock . . . . .	8
Summary and discussion . . . . .	9
References . . . . .	11

## FIGURES

- Figure 1.--Regions of groundfish surveys in waters adjacent to Kodiak Island, 1973.
- Figure 2.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 3.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 4.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 5.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 6.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 7.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 8.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 9.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 10.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

- Figure 11--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 12--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 13--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 14--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 15--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 16--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall seasons in the Semedi Island-Shelikof Gully area. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 17--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall seasons in the Semedi Island-Shelikof Gully area. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 18--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall seasons in the shaded portion of northeast Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 19--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall seasons in the shaded portion of northeast Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 20--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall season in the shaded portion of northeast Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.
- Figure 21--Size of pollock and biomass estimates in various areas off S.E. Kodiak during the summer-fall of 1973.

## TABLES

Table 1.--Description of trawls used in bottomfish surveys off Kodiak Island, 1973.

Table 2.--Number of successful trawl stations off different regions of Kodiak Island, May-June and July-October periods, 1973.

Table 3.--Estimates of fishable biomass (in 1,000 tons) of bottomfish southeast of Kodiak Island, 1973.

Table 4.--Incidence of parasites in pollock fillets.

## INTRODUCTION

In 1972 and 1973 the National Marine Fisheries Service conducted bottom trawl surveys to assess the fishery potential and condition of walleye (Pacific) pollock, Theragra chalcogramma, and other bottomfish resources in waters adjacent to Kodiak Island in the Gulf of Alaska. These surveys were prompted by the anticipation that (1) U.S. fisheries on Alaska bottomfish resources would develop in the near future, and hence knowledge about the extent of these resources would be needed for industry planning; (2) foreign fishing pressure on bottomfish resources other than those (mainly sablefish [blackcod], Anoplopoma fimbria, and rockfish, Sebastes spp.) now under heavy exploitation in the Gulf would increase substantially and necessitate the need to determine the condition of these resources as early as possible; and (3) there is the need to document the character of living resources in order to resolve multiple use conflicts on the continental shelf and slope areas.

This report is primarily aimed at answering some of the needs of the U.S. fishing industry which is evaluating potentials for a groundfishery around Kodiak.

While our surveys in the Gulf are presently being conducted in other regions, the Kodiak area was surveyed first due to processing capabilities and previous knowledge indicating high groundfish abundance relative to most other regions in the Gulf (Hughes, in press).

## THE RESOURCES

Major groundfishes occurring in the Kodiak area include two species of roundfish and five species of flatfish. The roundfish are walleye pollock and Pacific cod, Gadus macrocephalus. Major flatfish species are rock sole, Lepidopsetta bilineata; flathead sole, Hippoglossoides elassodon; rex sole, Glyptocephalus zachirus; Dover sole, Microstomus pacificus; and arrowtooth flounder (turbot), Atheresthes stomias. Other desirable, but less abundant species in the survey area include Pacific ocean perch, S. alutus; sablefish; yellowfin sole, Limanda aspera; starry flounder, Platichthys stellatus; and sand sole, Psettichthys melanostictus. Of these latter species, Pacific ocean perch and sablefish were much more abundant in the Kodiak area during the early 1960's than now (Hughes, in press).

Resources presently supporting domestic fisheries in and around Kodiak are king crab, Paralithodes camtschatica; snow (Tanner) crab, Chionoecetes spp.; Pacific halibut, Hippoglossus stenolepis; and shrimp. Because crab and halibut are susceptible to fish trawls, data on their catch rates were collected and are presented to better determine what effect a U.S. trawl fishery might have on existing fisheries for these species.

Information on the groundfish resources in other areas and biological conditions of the stocks will be presented later in other reports.

## BACKGROUND

Indications of a favorable climate for the development of a U.S. fishery on walleye pollock came from the increasing demand for frozen blocks of pollock in this country and the rising price of fish blocks in general. Most of the demand for frozen blocks on the U.S. market is being met by foreign producers. Although cod constitutes the bulk of the frozen fish block imports, the rising cost and the decreasing availability of cod blocks have made U.S. processors look for less costly species; walleye pollock appear to be an adequate, but far from a perfect, substitute for cod. Prior to 1971 very little walleye pollock entered the U.S., but in 1971 some 2 million pounds were imported from Japan and, in 1972, imports of this species rose to 32 million pounds and were over 40 million pounds in 1973. Prices in 1973 for the two biggest blocksellers cod and pollock, were priced 34% and 20% higher than for 1972 (Beauchemin, Bosin, and Surdi, 1973). If demand and price of pollock continue to increase, market conditions may eventually be favorable for a U.S. fishery on this species.

The effect of foreign fishing on Gulf of Alaska pollock and other groundfish is poorly known. The Japanese have an intermittent fishery on pollock just south of Unimak Pass and take pollock and other groundfish species in their ocean perch fishery throughout the Gulf of Alaska. Soviet vessels have been observed taking large catches of pollock and flatfishes in waters south of Kodiak Island in recent years. Fisheries statistics provided by Japan and the Soviet Union are insufficient for an adequate appraisal of the effect of their fisheries on pollock and other bottomfish stocks. There has, therefore, arisen a need to measure the impact of foreign fishing on pollock and other groundfish of potential interest to the United States by means of resource surveys.

This report describes the results of NMFS trawl surveys in the Kodiak Island area during the spring and late summer-fall periods of 1973. Results from the 1972 summer survey in Kodiak waters have been summarized by Alton and Nicholl (1973)--only some of the more pertinent findings from the 1972 survey are included in this report. Information is given on the availability of bottomfish by area, season, and depth and in terms of catch rates, fishable amounts or biomass, and size of fish. For pollock the degree of parasite infestation in the fillets and fillet yield is also presented.

## METHODS

### VESSEL AND FISHING GEAR

The NOAA research vessel, John N. Cobb, was used during the 1973 survey cruises. The John N. Cobb has a basic hull design of a West Coast purse seiner and is

93 ft in overall length. She is equipped with a Simrad Scientific Sounder<sup>1/</sup> (frequency of 38 Kh) for the detection of fish schools. During the late summer survey a netsonde system equipped with upward and downward-looking headrope transducers were used to determine the vertical mouth opening of the trawl and the position of the footrope relative to the sea bottom. When fishing trawls off the sea bottom, the netsonde was also used to vertically position the trawl relative to echo signs of fish.

Three types of trawls were used: A 400-mesh Eastern bottom trawl, a modified 400-mesh Eastern bottom trawl, and a Mark II Universal trawl that could be fished both on and off the sea bottom (Table 1). The 400-mesh Eastern trawl is similar to trawls used by many West Coast commercial draggers. The modified 400-mesh Eastern differs from the standard 400-mesh Eastern in having slightly larger meshes in the wings and body and having a greater vertical opening when fished. Catch data for these bottom trawls were used to determine the relative abundance and biomass estimates of the groundfish encountered. Most catch data were obtained using the standard 400-mesh Eastern trawl. The Mark II trawl was used only to fish concentrations located off bottom. All three types of trawls had a 1-1/4 inch mesh web, lining the codend for the retention of small fish.

#### AREA AND SEASONAL COVERAGE

The 1973 surveys took place in four regions adjacent to Kodiak as shown in Figure 1. Regions II and III were investigated during the spring survey in May and June; all four regions were surveyed during the late summer cruise. Each region has been subdivided into smaller areas based on bottom depth (Figs. 2 to 21).

#### SAMPLING PROCEDURES AND EFFORT

A trawl-echosounding survey was conducted during daylight hours at depths of 30-210 fm to determine the distribution and abundance of groundfish species. Fishing effort was primarily devoted to bottom trawling at predetermined stations which were randomly selected in each major sampling area. The amount of sampling in each area ranged from one station per 100-175 square nautical miles in areas of high fish abundance to one station per 350-500 square nautical miles in areas of low fish abundance.

A total of 97 successful bottom trawl hauls were made during the 1973 spring and summer-fall survey periods. Most of this fishing effort was expended southeast of Kodiak and in Shelikof Strait (Table 2).

Trawling duration at each station was usually 30 minutes. A profile of water temperature with depth was determined during each tow by means of an XBT (Expendable Bathythermograph); the bottom type was estimated from sediment retained on the trawl doors and from bottom echo returns.

Catches were sorted by species and weighed to determine the species composition and their catch rates for each area. Fish were measured to determine the percentage of species in each area that were of a marketable size (11-1/2 inches for flatfishes and 12 inches for roundfish). Other data were collected to

estimate stock sizes, growth rates, mortality, and harvesting potentials or yield. Samples of whole pollock were collected for examination of parasite infections and for fillet yield.

## TRAWLING OPERATIONS

### SOUTHEAST OF KODIAK AND IN SHELIKOF STRAIT

Results of catches, catch rates, and sizes of fish obtained during the spring and summer-fall periods are presented in Figures 2-15. The figures and text are organized to compare seasonal differences in each sampling area as well as differences noted at comparable depths between southeast Kodiak and Shelikof Strait. Because catch rates are averages for the areas shown, they are not indicative of commercial potentials which could be achieved during production fishing.

Areas surveyed at depths less than 50 fm along southeast Kodiak and catch data for those areas are shown in Figures 2 and 3. Figure 4 shows comparable data at depths less than 50 fm for Shelikof Strait. Catch rates in these three areas were generally poor, especially in Shelikof. Rock sole dominated catches southeast of Kodiak and their abundance was higher in the summer than spring. While over 1,000 pounds of rock sole per hour (from Fig. 2) is a respectable average catch rate, only 31% by weight were larger than 11-1/2 inches and considered marketable. Species taken in the Shelikof area (Fig. 4) were small as well as very low in abundance during both spring and summer-fall.

King and snow crab catches were considerably higher during the spring than summer in these shallow water areas. Halibut catches were low and showed no consistent trend.

Trawlability of areas shown in Figures 2 and 3, southeast of Kodiak, were generally good with the exception of rocky grounds within 10 miles of the shoreline. Figure 4 area in Shelikof is composed of mud bottom which is characteristically hilly and irregular.

Figures 5-8 show areas and catch data from 50-100 fm depths along the southeast side of Kodiak, and Figures 9-10 show comparable data from Shelikof Strait. Information presented in the above figures includes most of the best areas for groundfish around Kodiak.

Along the southeast side of Kodiak, particularly during the summer, good catches of pollock were taken in Chiniak Gully (Fig. 5), Barnabas (Fig. 6), Twoheaded Gully (Fig. 7), and along the edge of the shelf outside the gullies (Fig. 8). Average catch rates of pollock in these areas were much higher in the summer than spring periods with the exception of the edge southwest of Chiniak Gully (Fig. 8). Within the three gullies, summer-fall catch rates generally improved from Chiniak west toward Twoheaded, however, the largest single pollock catch was made inside Cape Barnabas on the Ghost Rock shrimp grounds (6,000 lbs 1-2 hr).

Pollock taken during the summer in the gullies and along the edge of the shelf were large fish, at least 95% of which were marketable. Pacific cod was usually the second most abundant species during the summer in these areas. Like the pollock, cod taken in these waters were large and nearly 100% marketable. Good catch rates of cod were also taken in Barnabas Gully, particularly the offshore portion, during the spring period.

Average halibut catches in the three gully areas and along the edge of the shelf ranged from 114 to 251 lb per hour during the spring and only 0-28 lb per hour during the summer. King crab catches in these areas ranged from 0-12 lb per hour except for Twoheaded Gully where the average catch was 1.4 lb per hour. Being more widely distributed, snow crab were taken in all areas except the edge of the shelf. Highest average snow crab catch rates (405 lb/hr) occurred in Barnabas Gully during the summer.

The areas surveyed in Shelikof Strait in 50-100 fm showed patterns of fish availability similar to those southeast of Kodiak. Catches in general and pollock in particular were low in the spring relative to the summer. Cod abundance in these Shelikof areas was low relative to the gully areas, and in North Shelikof (Fig. 9) the pollock were considerably smaller. Fish size and catch rates in the Shelikof area in Figure 10 compared favorably with or exceeded those from southeast Kodiak. Further comparison with the area southeast of Kodiak indicates halibut catches in Shelikof were relatively low and king crab catches were very low, being similar to Chiniak and Barnabas Gullies. Although snow crab in the Shelikof areas were generally not as abundant as in areas southeast of Kodiak, some substantial catches were made on soft bottom.

Bottom conditions in Chiniak, Barnabas, and Twoheaded Gullies and along the edge of the shelf are generally excellent for trawling. While the edge of the shelf is sometimes steep and the extreme inshore gully areas are hard or rocky, 95% of these areas are flat and the sea bed composed of mud, sand, or gravel. Trawling conditions in north Shelikof (Fig. 9) are poor due to periodic hard bottom and rock pinnacles. Conditions in south Shelikof (Fig. 10) are fair although the area is narrow and bordered by rocky grounds inshore and mud trenches offshore.

The 100-150 fm portion of the continental slope which was surveyed along southeast Kodiak and the catch data are shown in Figure 11; data from comparable depths in Shelikof are shown in Figures 12-14.

Perhaps the most striking factor in comparing the above catches is the extremely low availability of fish in Shelikof relative to the area southeast of Kodiak. Rex sole dominated catches in the spring (1,023 lb per hour) on the southeast side of Kodiak but rarely occurred in the Shelikof areas. Similarly, large pollock which occupied the southeast Kodiak shelf during the summer were not found in Shelikof.

Small amounts of halibut and crab were taken in 100-150 fm depths southeast of Kodiak while substantial amounts of halibut and snow crab were taken at these depths in Shelikof. In Shelikof, halibut catches were restricted to

the spring but snow crab were taken during both seasons and were considerably more abundant in north Shelikof than south Shelikof. The very low abundance of groundfish in 100-150 fm depths in Shelikof may be due to the sea bed conditions. The north Shelikof portion (Fig. 12) is composed of hard bottom where rock pinnacles are common. Areas shown in Figures 13 and 14 are basically mud bottom characterized by deep mud trenches and overhangs. Large beds of basket stars frequent these areas and the bottom is low in oxygen content, producing "dead bottom." Contrary to most of the Kodiak area, fish taken in these south Shelikof areas were of poor quality being highly infected with parasites and commonly having open sores on the skin.

Catch data from 150-210 fm along the slope southeast of Kodiak are shown in Figure 15. While pollock and cod were not encountered during either spring or summer, good catches of Dover sole were taken during both seasons. The Dover were large, being 97-99% marketable. No crab or halibut were taken in this area.

#### CATCHES IN THE SHELIKOF GULLY AND SEMEDI ISLAND AREAS

Grounds were surveyed west of Kodiak and around the Semedi Islands during the late summer-fall period of 1973 only. The locations of surveys in 50-100 fm and catch data are shown in Figure 16; data from 100-150 fm and deeper than 150 fm are shown in Figure 17.

Groundfish catches in these areas were generally low with the exception of pollock in 50-100 fm areas. Like the areas around Kodiak during the summer-fall, halibut catches were low at depths greater than 50 fm. King crab catches were considerably higher west of Kodiak (Alitak) than in other areas except twoheaded Gully and snow crab catch rates were similar to those in the gullies southeast of Kodiak Island. One notable difference in crab catches between southeast Kodiak and Shelikof Gully was substantial catches of snow crab and some king crab at depths greater than 150 fm (Figs. 16 and 17) in the latter area.

Bottom conditions are generally well suited for trawling in areas around the Semedis and are excellent in Shelikof Gully.

#### CATCHES NORTHEAST OF KODIAK

Grounds were also surveyed in and around Marmot Gully during the fall of 1973 (Figs. 18-20). Because surveys in these waters occurred in October, catch results should not be compared with those during the summer-fall season in other regions. For example, in nearby Chiniak Gully, pollock concentrations encountered in August and September (Fig. 5) were not encountered when rechecked in October. Catch data in Figures 18-20 show that pollock catches in 60-100 fm were very low but fair catch rates were achieved in depths of 100-150 fm. Thus it seems probable that pollock in Marmot and the other gullies may move offshore and into deeper waters during late September or October.

Catches of other groundfish and crab were generally very low in and around Marmot Gully. Small flatfishes constituted the bulk of catches. Halibut catch rates in these areas ranged from 112 lb per hour at depths less than 60 fm to 15 lb per hour in 100-150 fm waters.

#### BOTTOM TYPE AND WATER TEMPERATURE AT FISHING STATIONS

Both the composition of the sea bed and temperature conditions near bottom appeared to be important factors which either directly or indirectly influence pollock abundance in particular and groundfish in general. Along southeast Kodiak and in Shelikof Strait, all pollock catches except one, which exceeded 1,200 lb per 30 minutes, were taken on soft bottom (sand, mud, or gravel) where bottom temperatures were between 4.4° and 6.2°C. Fish signs and catches were almost always poor in areas of favorable depths (50-150 fm) where hard bottom existed or where near bottom water temperatures exceeded 6.0°C. In areas of warm water near bottom, the entire water column was of uniform temperature rather than being divided into relative warm waters down to 100 feet (10°C for example) and cold waters at greater depths (5°C for example).

#### RESULTS OF ECHOSOUNDING SURVEYS

During the spring survey, off-bottom echo signs indicative of pollock schools were not encountered southeast of Kodiak. However, in much of the northern part of Shelikof Strait, a dense concentration of echo sign was found over bottom depths of 80 to 130 fathoms. The sign extended from a midwater depth of 50 or 60 fathoms to the bottom and was apparently composed of both animal plankton and fish. The Universal-type trawl was set on the sign twice, each haul being half-hour in duration. A total of only 122 pounds of small pollock and less than a pound of smelt were caught. Hauls made with a small midwater trawl and plankton net in the sign caught large quantities of animal plankton.

In the late summer survey, midwater aggregations of pollock, other fishes, and layers of plankton, were more numerous in Shelikof Strait and off the Semidi Islands than southeast of Kodiak. Small quantities of pollock in their first year of life were encountered well off the seabottom in Shelikof Strait. At locations where both bottom and midwater trawling took place, the catches of pollock from midwater were distinctly less and composed of smaller fish than those obtained from the bottom.

The results from the 1973 surveys confirms the findings from the 1972 summer survey in which midwater schools of pollock always consisted of small fish. However, during the 1972 survey, extensive off-bottom signs were found in the gullies southeast of Kodiak. When these signs were fished, catches of 1,200 to 2,000 pounds of small, mostly 2-year old fish were taken.

## BIOMASS OF BOTTOMFISH SOUTHEAST OF KODIAK

The amount of fish available to the bottom trawl in the various depth zones southeast of Kodiak was estimated for each survey period (Table 3). These estimates are based on the bottom area covered by the trawl and the catch rate and the number of square miles in each area.

Of the total region involved (4,350 square nautical miles) most of it lies at depths less than 50 fm (49%) and at depths of 50 to 100 fm (41%). The remainder (10%) lies along the continental slope at depths of 100 to 200 fm.

Most of the fishable biomass of pollock (some 117,000 tons) during the late summer resided at 50 to 150 fm or in roughly 45% of the region. Flatfishes were abundant in all depth zones, and surprisingly the estimates of total fishable biomass for this group were quite similar for each survey period (about 104,000 tons).

Based upon our estimates of groundfish stocks southeast of Kodiak, about 40,000 tons of pollock, 12,000 tons of cod, and 30,000 tons of sole could be removed from this area each year and sustain the present population sizes.

## TECHNOLOGICAL CHARACTERISTICS OF POLLOCK

Most of the pollock encountered southeast of Kodiak were larger than 12 inches or of a filletable size; however, some fish processors require a finer size breakdown. Therefore, the estimated amount of available pollock during the late summer in areas of pollock abundance were placed into four size groups: fish less than 13 inches in length; fish between 12 and 16 inches which may be more suitable for deboning than filleting; fish between 16 and 19 inches for machine filleting; and fish larger than 19 inches for hand filleting.

From examining Figure 21, one can see some major differences in the proportions of fish in these size groupings among areas. These differences can be attributable to a general trend of increasing size of fish with increased distance from shore.

The gully that lies south of Twoheaded Island is closer to the shore than the gully off Cape Barnabas which has a greater extension seaward (Figs. 6 and 7). Twoheaded Gully contained fish of which the majority was estimated to be in the 12 to 16 inch size category. For the Cape Barnabas Gully, there was a high proportion of fish measuring 16 to 19 inches long. For the deepest and furthest of the subregions from the shore, there were no fish less than 13 inches long and a preponderance of 16 to 19 inch fish. It should be noted, however, that there were less fish available in the deeper water.

Samples of pollock were examined for fillet yield and parasite infestation. The yield from hand filleting ranged from 35% of total fish weight in fish less than 14 inches in length to 33% in larger fish.

Two kinds of infestation were found in the fillets - nematodes which are small thread-like white worms and cysts which are larval forms of a parasite and appear as minute thick capsules.

Fillets were examined from three samples of fish. One was obtained from both Shelikof Strait and southeast Kodiak during the 1972 summer survey. The other two were obtained during the late summer survey in 1973 - one from the Semidi Island areas and the other from waters southeast of Kodiak. All three samples showed an increasing incidence of infection with increasing fish size (Table 4). The sample from the 1972 survey had a high occurrence of cysts, whereas only one such incidence was found in the other samples. The presence of fish from Shelikof Strait in the 1972 sample may have accounted for this difference. As previously noted, south Shelikof pollock obtained in all areas except that shown in Figure 10 were of exceptionally poor quality and often heavily infested with parasites.

The occurrence of nematode worms was slightly greater in the 1973 sample from the southeast side of Kodiak Island than in the other samples.

#### SUMMARY AND DISCUSSION

In the spring and late summer of 1973, the National Marine Fisheries Service conducted bottom trawl surveys of pollock and other groundfish near Kodiak Island, Alaska. The spring survey took place in Shelikof Strait and southeast Kodiak. These same regions plus areas west and northeast of the Island were investigated in the late summer-fall period.

During both survey periods the availability of bottomfish was highest from the region southeast of Kodiak. There was also a greater amount of fish in this region during the late summer survey than during the spring survey. This was due mainly to the abundance of pollock during the late summer period. The greater proportion of the pollock resided in gullies, 50-100 fm in depth, that extend from bays and nearshore areas to the edge of the shelf. Pollock were also available along the upper slope of the shelf (100 to 150 fm) but were virtually absent in deeper water.

Prior to the trawl surveys there was some belief that a significant proportion of the adult pollock population would be found off the seabottom during the day, a situation that we had found with Pacific hake off Washington and Oregon. However, this was not the case since the only sizable catches of pollock were obtained from bottom hauls, and pollock catches off the seabottom were of small magnitude and usually consisted of small fish. These observations, of course, hold for daylight hours only. At night adult pollock move off the seabottom.

The estimated biomass of flatfish southeast of Kodiak remained about the same for both sampling periods, but there was some major change in the amounts of

specific species, such as flathead sole, rex sole, and arrowtooth flounder, between periods - due probably to movements in and out of the region. There were also some major shifts by depth in the availability of flatfish and other species, such as cod, between the two survey periods.

Except for rock sole and yellowfin sole, a high proportion of bottomfish were of filletable size. The average size of pollock generally increased with increased distance from shore.

Parasite infestation in pollock may vary between some regions, but further studies are needed. Shelikof Strait fish appear to be more heavily infested than fish from other regions around Kodiak Island.

Waters southeast of Kodiak, Shelikof Gully, and some areas in south Shelikof Strait are potentially the most promising site for a U.S. bottomfish fishery near Kodiak. In addition to high abundance of bottomfish in these waters, the grounds are generally readily trawlable and close to processing facilities. Pollock would be a potential target species because of its abundance.

The absence of known appreciable concentrations of pollock during the spring does not mean that fisheries on these species would be restricted to the summer months. Pollock are numerous during the spring but would have to be located. Since pollock at this time would probably be concentrated in spawning schools, catch rates would be expected to be high. It should be noted that a sizable Soviet trawl fishery has developed during the late winter and spring of 1972-73 along the Portlock bank and outer Chiniak Gully and along the 100 fm edge between Chiniak and Barnabas Gullies. It was along this edge that our catch rates were best during the spring.

Results showing incidental catch rates of halibut and crab in the trawl gear suggest several trends. Halibut were rarely taken during the summer-fall period when fishing at depths greater than 50 fm. However, they were susceptible at these depths during the spring period. King crab catches were spotty and generally restricted to areas in parts of Towheaded Gully and west of Alitak. Snow crab were more widely distributed and taken in most areas and depths. King crab and particularly snow crab were rarely killed in the trawl during one-half hour tows; however, their mortality could increase substantially during 1-2 hour tows.

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1973. Food fish--market review and outlook. U.S. Dept. Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., Current Economic Analysis F-16. 56p.

Hughes, Steven E.

In press. Groundfish and crab resources in the Gulf of Alaska--based on International Pacific Halibut Commission trawl surveys, May 1961-March 1963. U.S. Dept. Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., Data Rep.

**Footnote**

1/ Reference to trade name(s) in this publication does not imply endorsement of commercial product(s) by the National Marine Fisheries Service, NOAA.

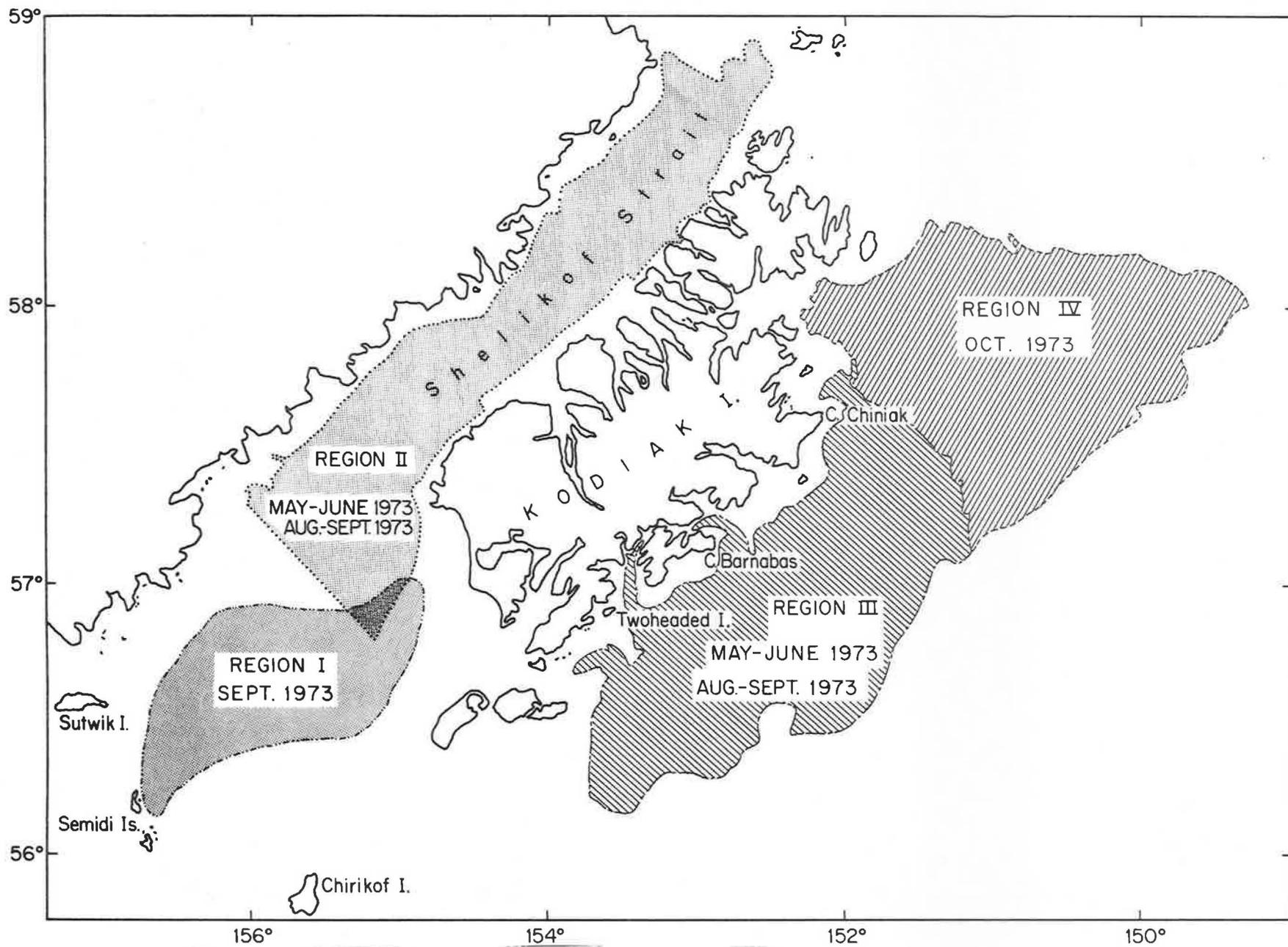


Figure 1.--Regions of groundfish surveys in waters adjacent to Kodiak Island, 1973.



**ROCK SOLE**  
 573 lbs/hr  
 9 inches  
 37 % Marketable

**YELLOWFIN**  
 260 lbs/hr  
 12 inches  
 82 %

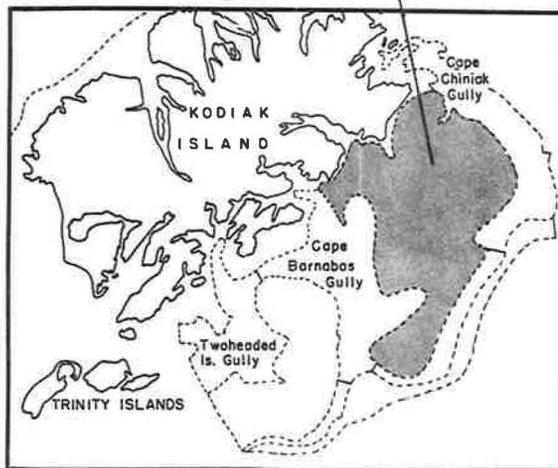
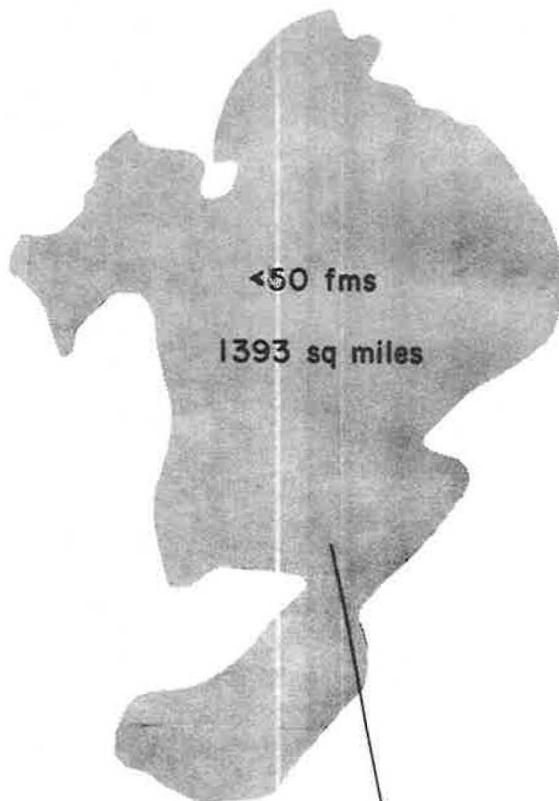
**COD**  
 94 lbs/hr  
 22 inches  
 99 %

**FLATHEAD**  
 74 lbs/hr  
 10 inches  
 51 %

**HALIBUT**  
 4 lbs/hr

**KING CRAB**  
 211 lbs/hr

**TANNER CRAB**  
 356 lbs/hr



**ROCK SOLE**  
 1084 lbs/hr  
 9 inches  
 31 % Marketable

**COD**  
 759 lbs/hr  
 12 inches  
 59 %

**POLLOCK**  
 158 lbs/hr  
 12 inches  
 84 %

**HALIBUT**  
 148 lbs/hr

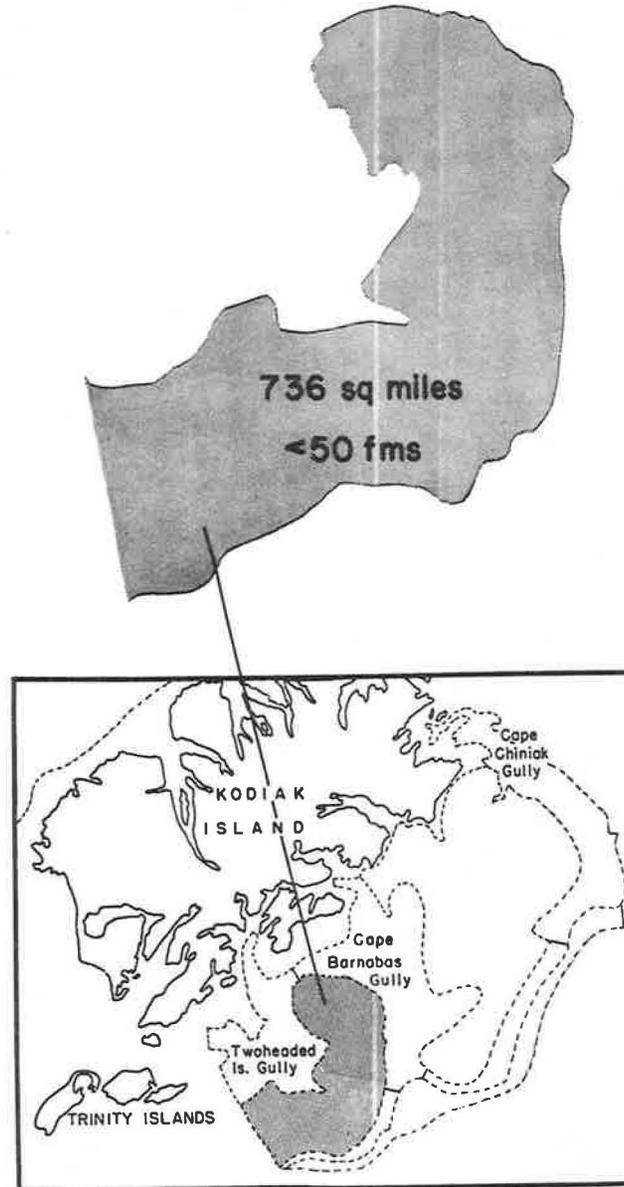
**KING CRAB**  
 16 lbs/hr

**TANNER CRAB**  
 54 lbs/hr

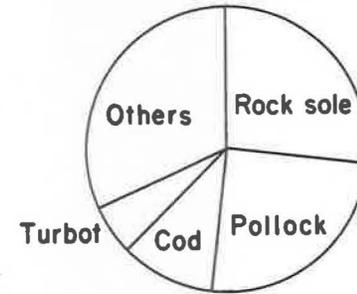
Figure 2--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

SPRING

No data available



SUMMER - FALL



ROCK SOLE

690 lbs/hr  
9 inches  
16 % Marketable

POLLOCK

635 lbs/hr  
13 inches  
87 %

COD

277 lbs/hr  
15 inches  
98 %

TURBOT

127 lbs/hr  
No data

HALIBUT

14 lbs/hr

KING CRAB

271 lbs/hr

TANNER CRAB

22 lbs/hr

Figure 3.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicated the average length and percentage of marketable-sized fish by weight, 1973.

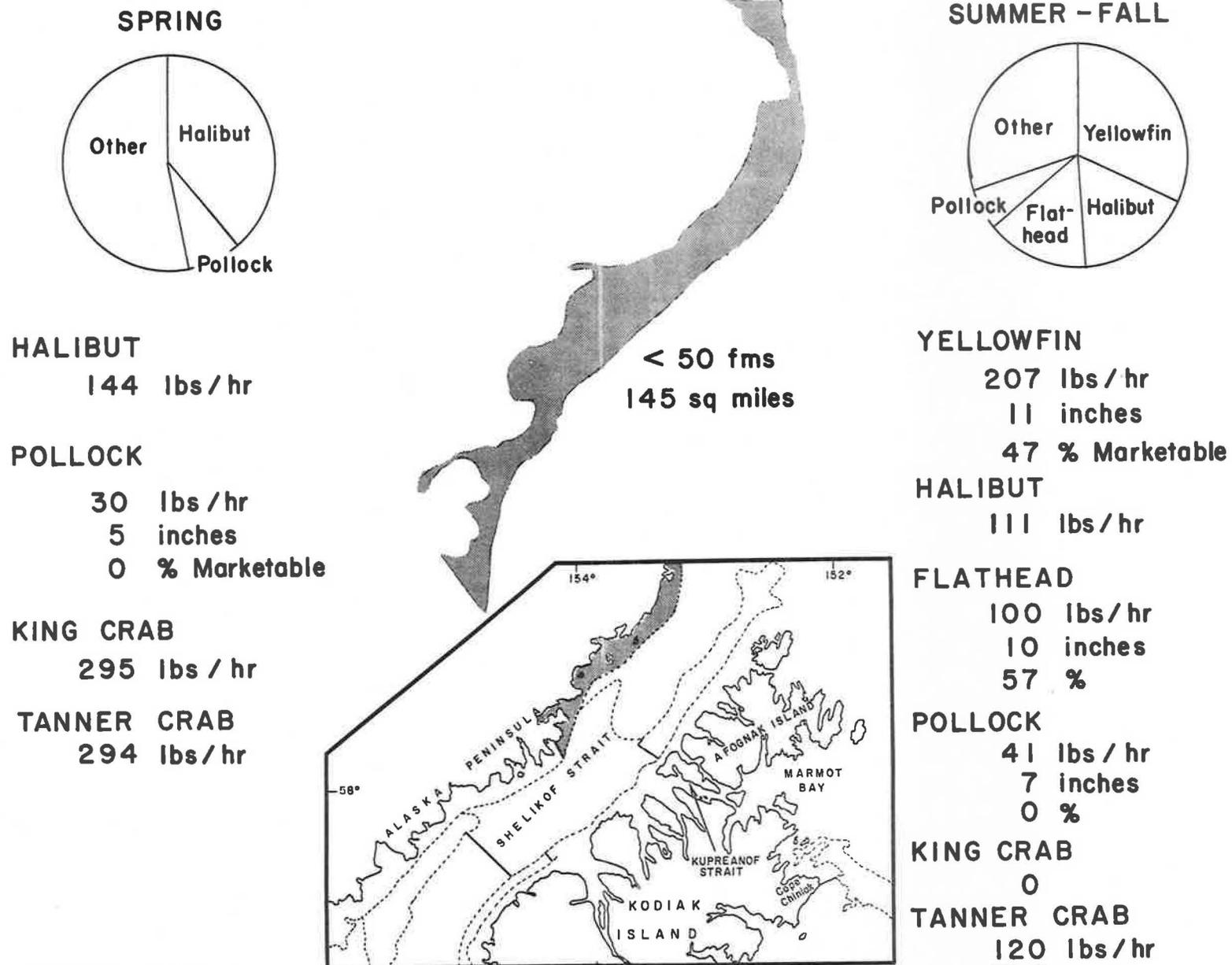
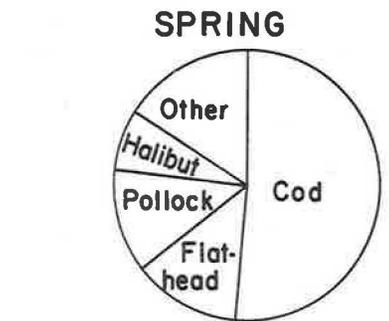


Figure 4.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.



**COD**  
 800 lbs/hr  
 19 inches  
 100 % Marketable

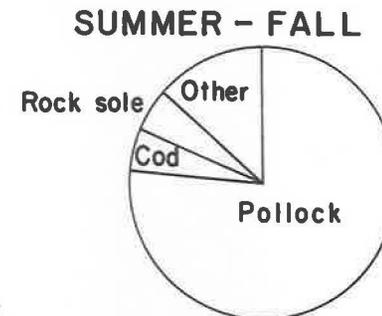
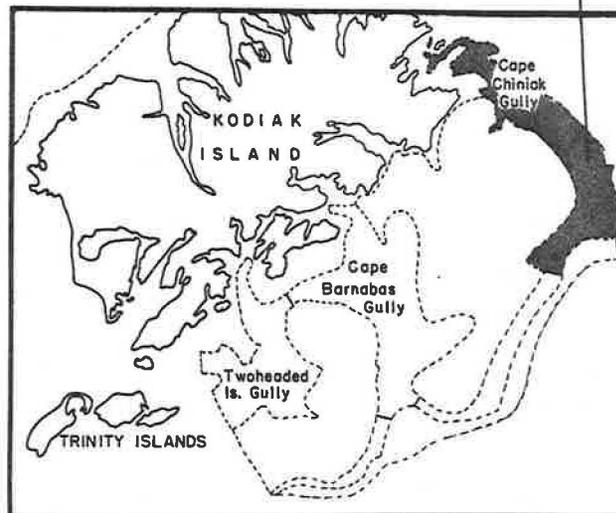
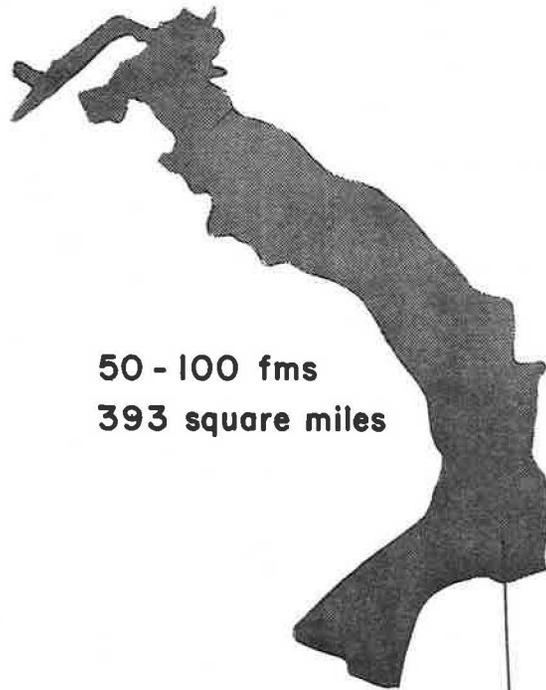
**FLATHEAD**  
 225 lbs/hr  
 11 inches  
 65 %

**POLLOCK**  
 216 lbs/hr

**HALIBUT**  
 114 lbs/hr

**KING CRAB**  
 0

**TANNER CRAB**  
 284 lbs/hr



**POLLOCK**  
 1941 lbs/hr  
 13 inches  
 95 % Marketable

**COD**  
 96 lbs/hr  
 16 inches  
 100 %

**ROCK SOLE**  
 115 lbs/hr  
 11 inches  
 70 %

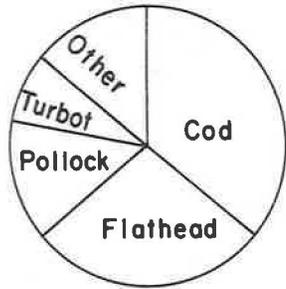
**HALIBUT**  
 0

**KING CRAB**  
 12 lbs/hr

**TANNER CRAB**  
 79 lbs/hr

Figure 5.—Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

**SPRING**



**COD**

1433 lbs/hr  
21 inches  
99 % Marketable

**FLATHEAD**

1133 lbs/hr  
10 inches  
23 %

**POLLOCK**

549 lbs/hr  
13 inches  
69 %

**TURBOT**

330 lbs/hr  
10 inches  
14 %

**HALIBUT**

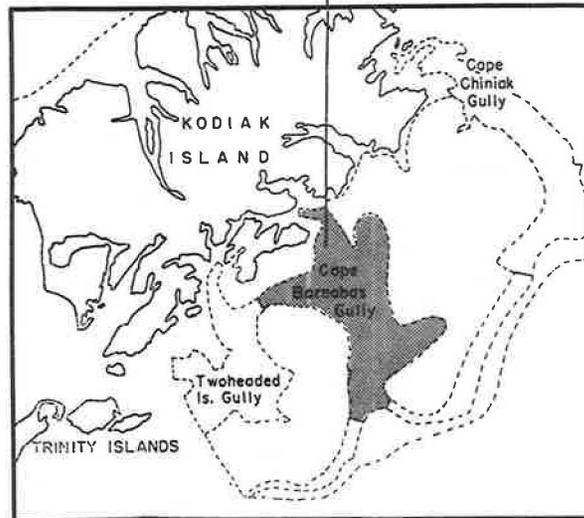
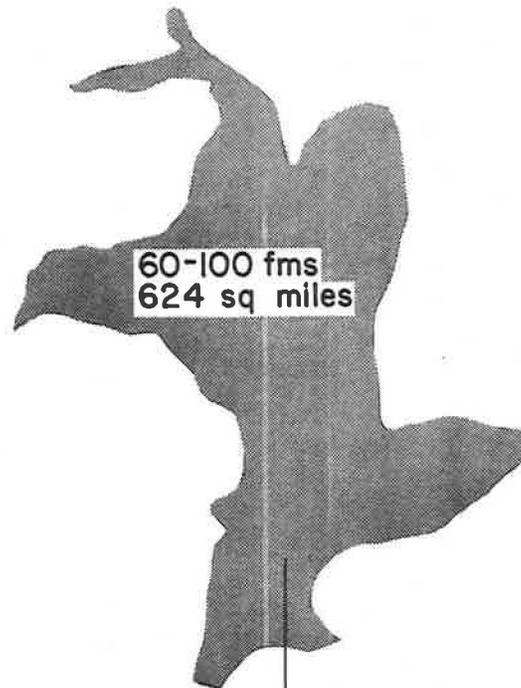
251 lbs/hr

**KING CRAB**

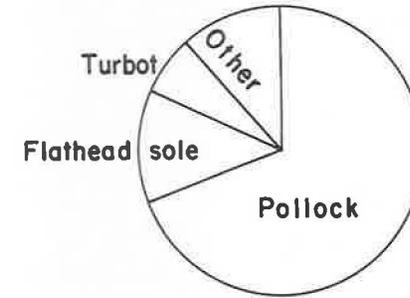
1.3 lbs/hr

**TANNER CRAB**

131 lbs/hr



**SUMMER - FALL**



**POLLOCK**

3050 lbs/hr  
16 inches  
99 % Marketable

**FLATHEAD SOLE**

626 lbs/hr  
11 inches  
45 %

**TURBOT**

393 lbs/hr  
16 inches  
96 %

**HALIBUT**

28 lbs/hr

**KING CRAB**

3 lbs/hr

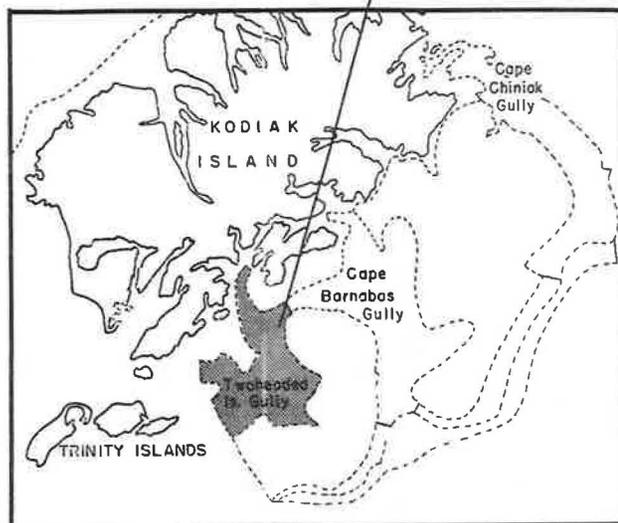
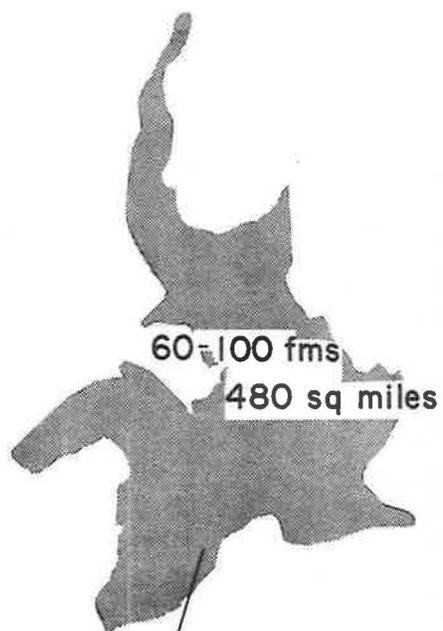
**TANNER CRAB**

405 lbs/hr

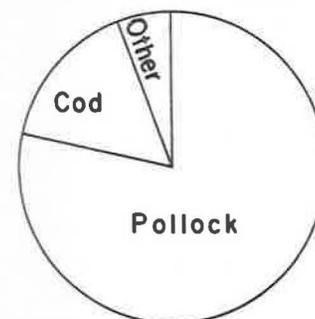
Figure 6.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

SPRING

No data available



SUMMER - FALL



POLLOCK

3931 lbs/hr  
14 inches  
96 % Marketable

COD

781 lbs/hr  
21 inches  
100 %

HALIBUT

19 lbs/hr

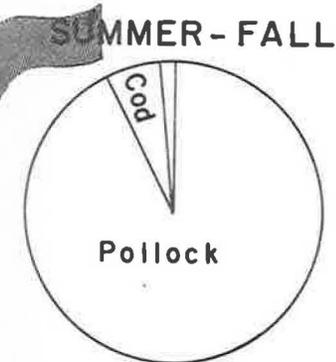
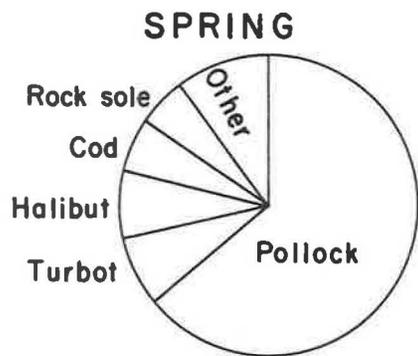
KING CRAB

1358 lbs/hr

TANNER CRAB

447 lbs/hr

Figure 7.—Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.



**POLLOCK**  
 1604 lbs/hr  
 13 inches  
 77 % Marketable

**TURBOT**  
 200 lbs/hr  
 11 inches  
 35 %

**HALIBUT**  
 161 lbs/hr

**COD**  
 137 lbs/hr  
 19 inches  
 100 %

**ROCK SOLE**  
 122 lbs/hr  
 11 inches  
 43 %

**KING CRAB**  
 0

**TANNER CRAB**  
 0

60 - 100 fms  
 294 square miles

**POLLOCK**  
 1211 lbs/hr  
 No data available

**COD**  
 784 lbs/hr  
 No data

**HALIBUT**  
 0

**KING CRAB**  
 0

**TANNER CRAB**  
 0

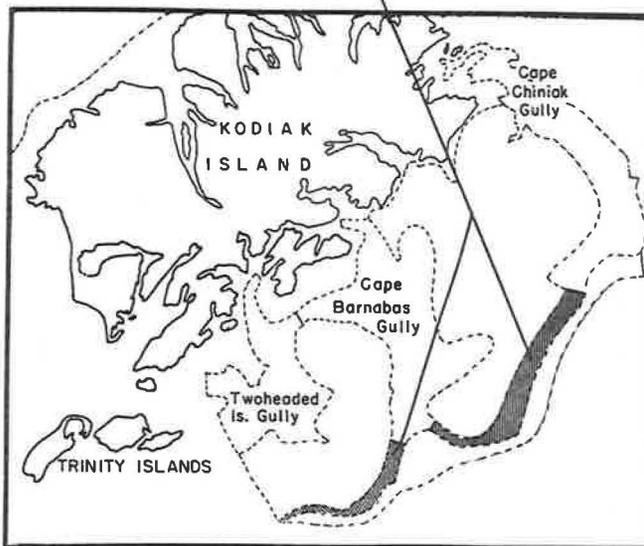
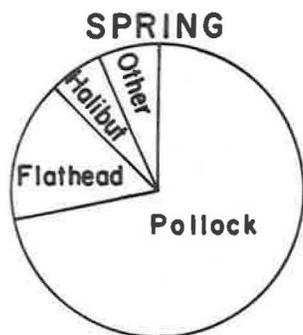


Figure 8--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.



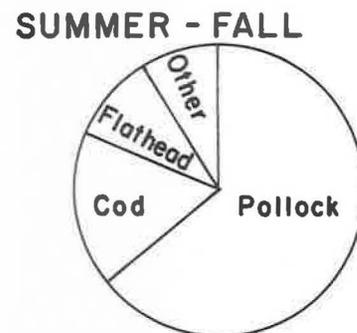
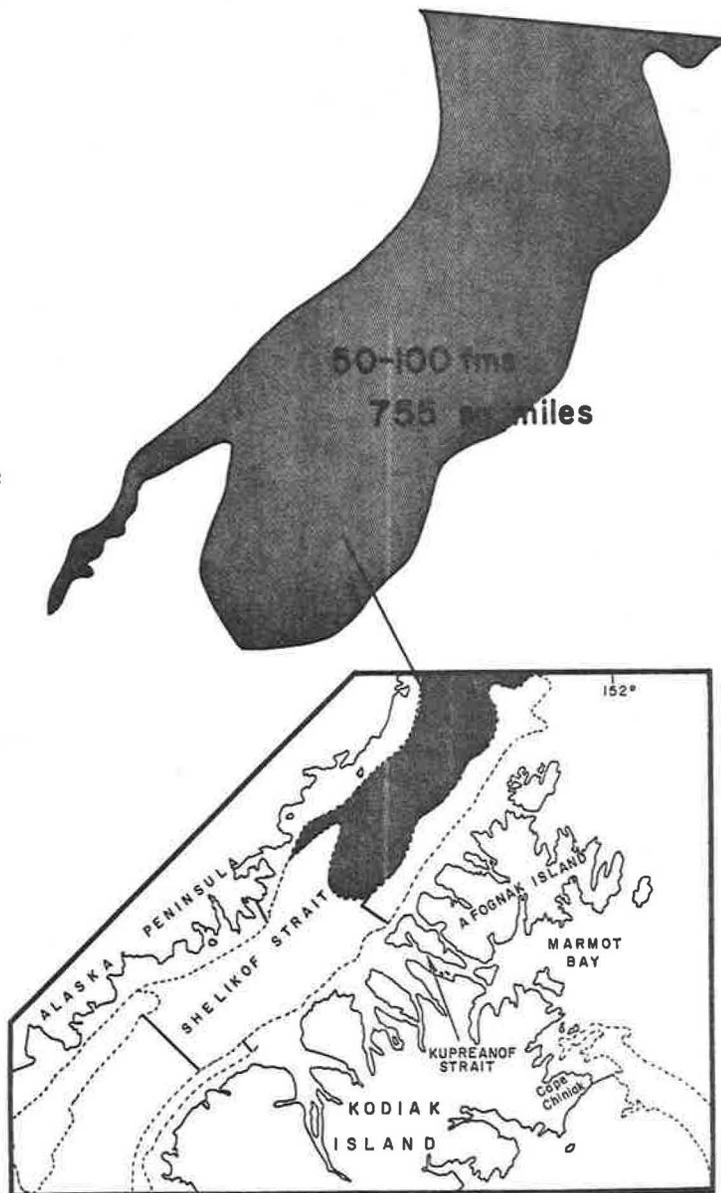
**POLLOCK**  
 819 lbs/hr  
 11 inches  
 54 % Marketable

**FLATHEAD**  
 190 lbs/hr  
 10 inches  
 45 %

**HALIBUT**  
 72 lbs/hr

**KING CRAB**  
 22 lbs/hr

**TANNER CRAB**  
 179 lbs/hr



**POLLOCK**  
 1110 lbs/hr  
 13 inches  
 88 % Marketable

**COD**  
 323 lbs/hr  
 21 inches  
 100 %

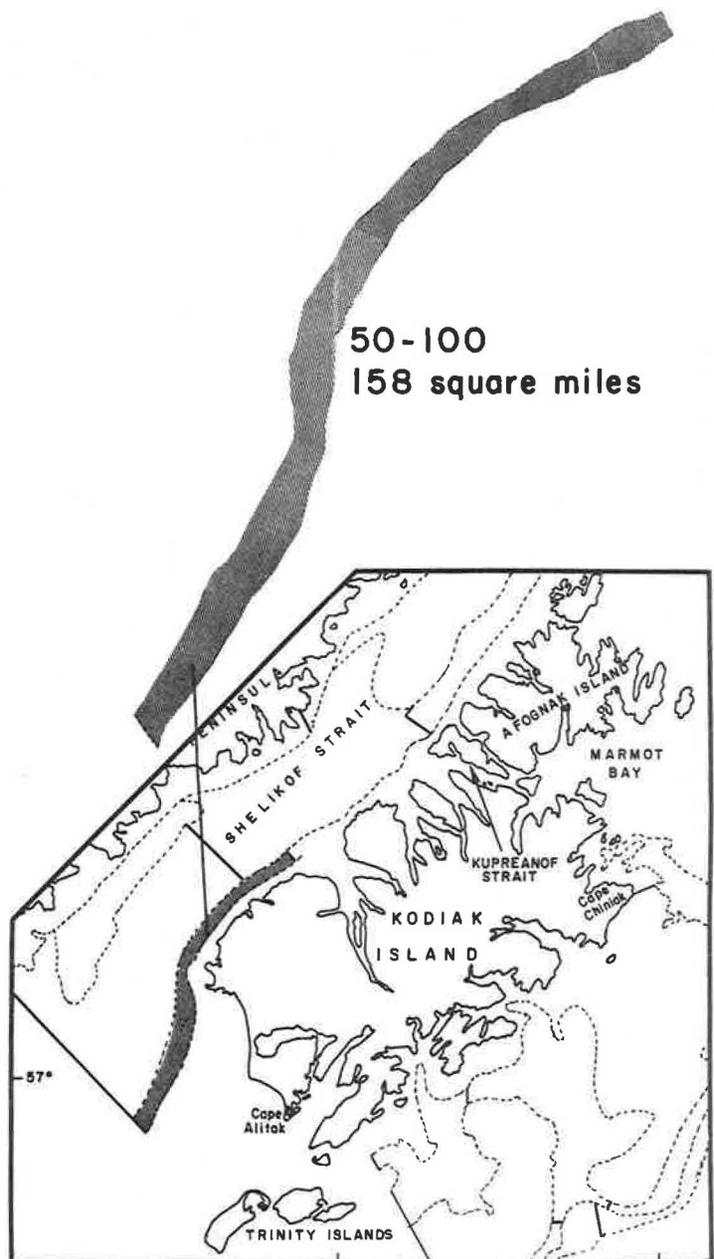
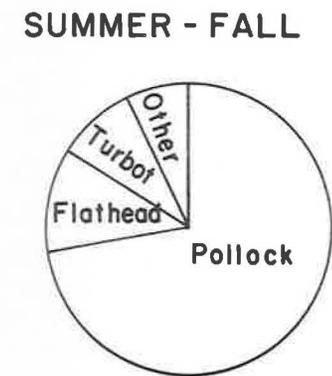
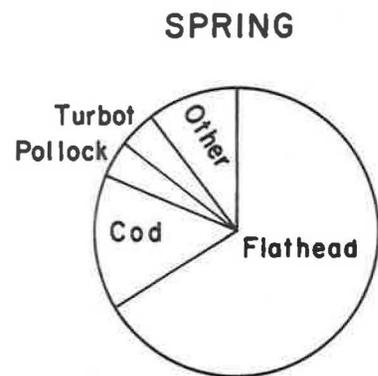
**FLATHEAD**  
 177 lbs/hr  
 11 inches  
 59 %

**HALIBUT**  
 22 lbs/hr

**KING CRAB**  
 0

**TANNER CRAB**  
 126 lbs/hr

Figure 9.—Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.



50-100  
158 square miles

**FLATHEAD SOLE**  
1060 lbs/hr  
10 inches  
41 % Marketable

**COD**  
247 lbs/hr  
14 inches  
95 %

**POLLOCK**  
67 lbs/hr  
8 inches  
55 %

**HALIBUT**  
28 lbs/hr

**KING CRAB**  
0

**TANNER CRAB**  
82 lbs/hr

**POLLOCK**  
4118 lbs/hr  
15 inches  
99 % Marketable

**FLATHEAD SOLE**  
641 lbs/hr  
No data available

**TURBOT**  
501 lbs/hr  
No data available

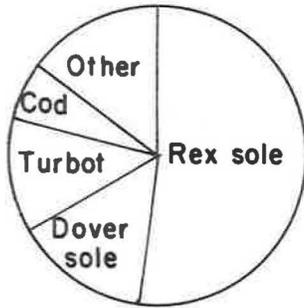
**HALIBUT**  
39 lbs/hr

**KING CRAB**  
2 lbs/hr

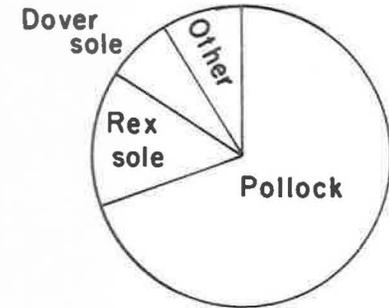
**TANNER CRAB**  
181 lbs/hr

Figure 10.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

**SPRING**



**SUMMER - FALL**



100-150 fms  
113 square miles

**REX SOLE**

1023 lbs/hr  
13 inches  
95 % Marketable

**DOVER SOLE**

300 lbs/hr  
12 inches  
88 %

**TURBOT**

238 lbs/hr  
No data

**COD**

129 lbs/hr  
22 inches  
100 %

**HALIBUT**

21 lbs/hr

**KING CRAB**

0

**TANNER CRAB**

0

**POLLOCK**

3103 lbs/hr  
17 inches  
100 % Marketable

**REX SOLE**

677 lbs/hr  
13 inches  
93 %

**DOVER SOLE**

311 lbs/hr  
13 inches  
92 %

**HALIBUT**

0

**KING CRAB**

0

**TANNER CRAB**

0

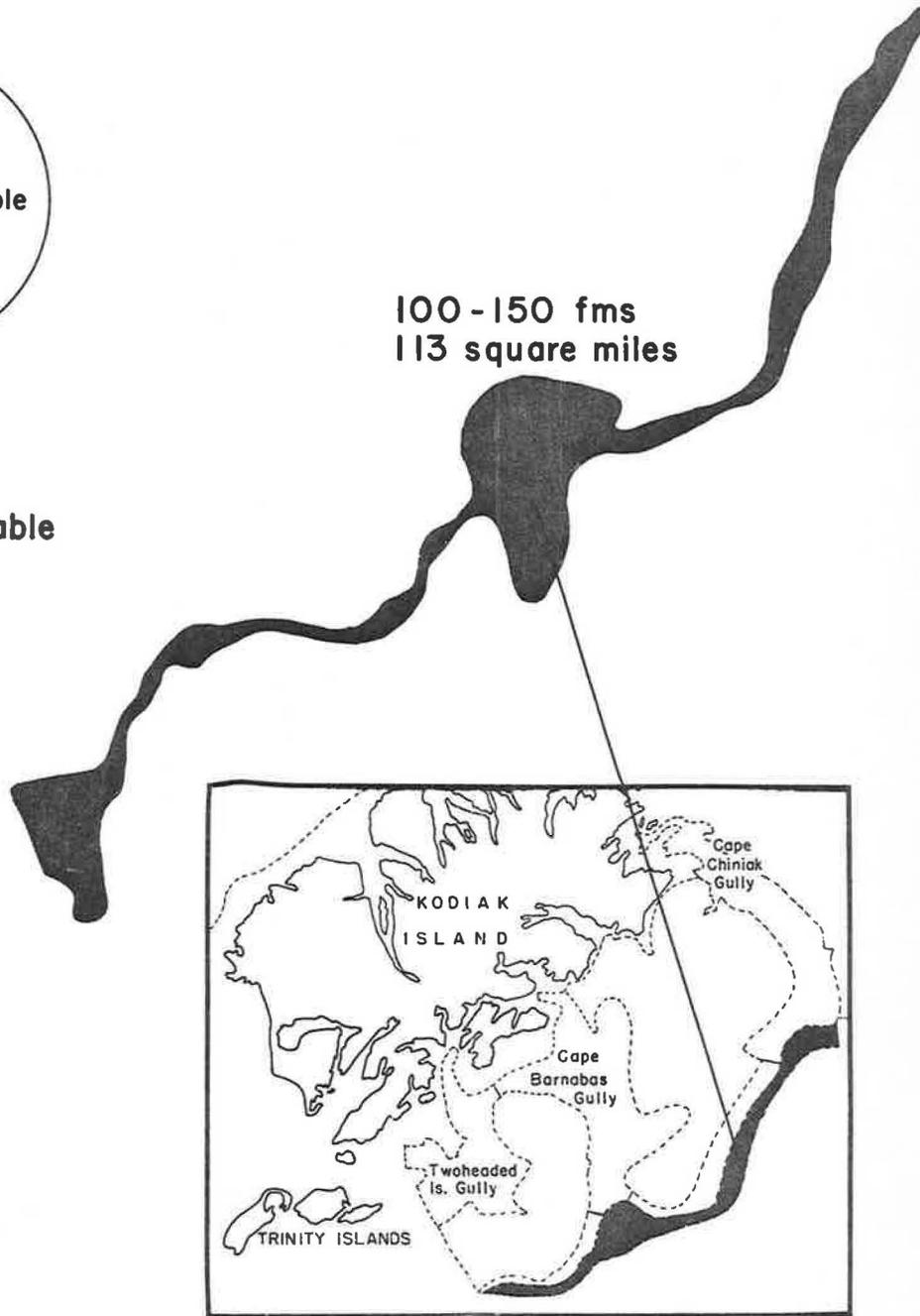


Figure 11--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

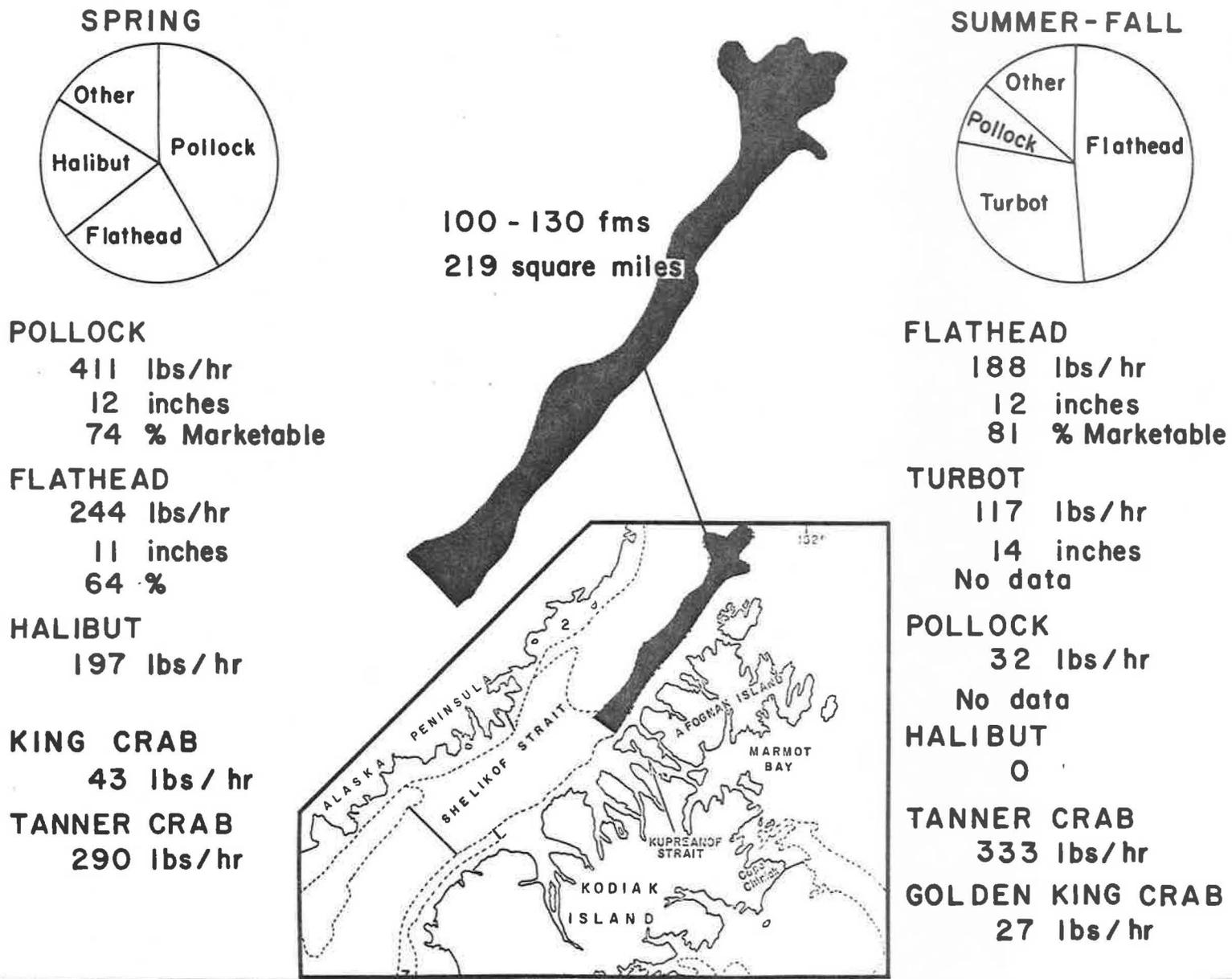


Figure 12.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

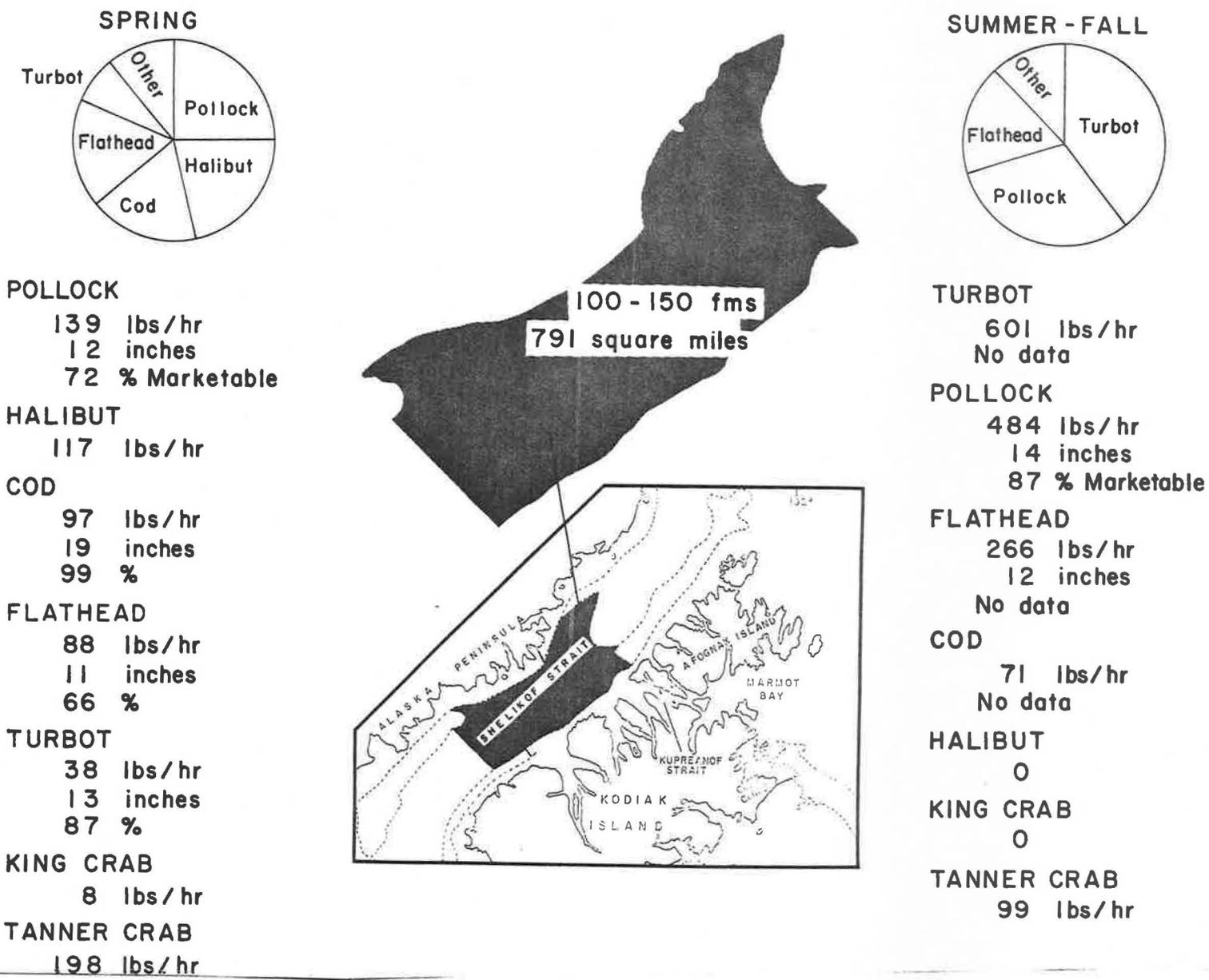


Figure 13.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

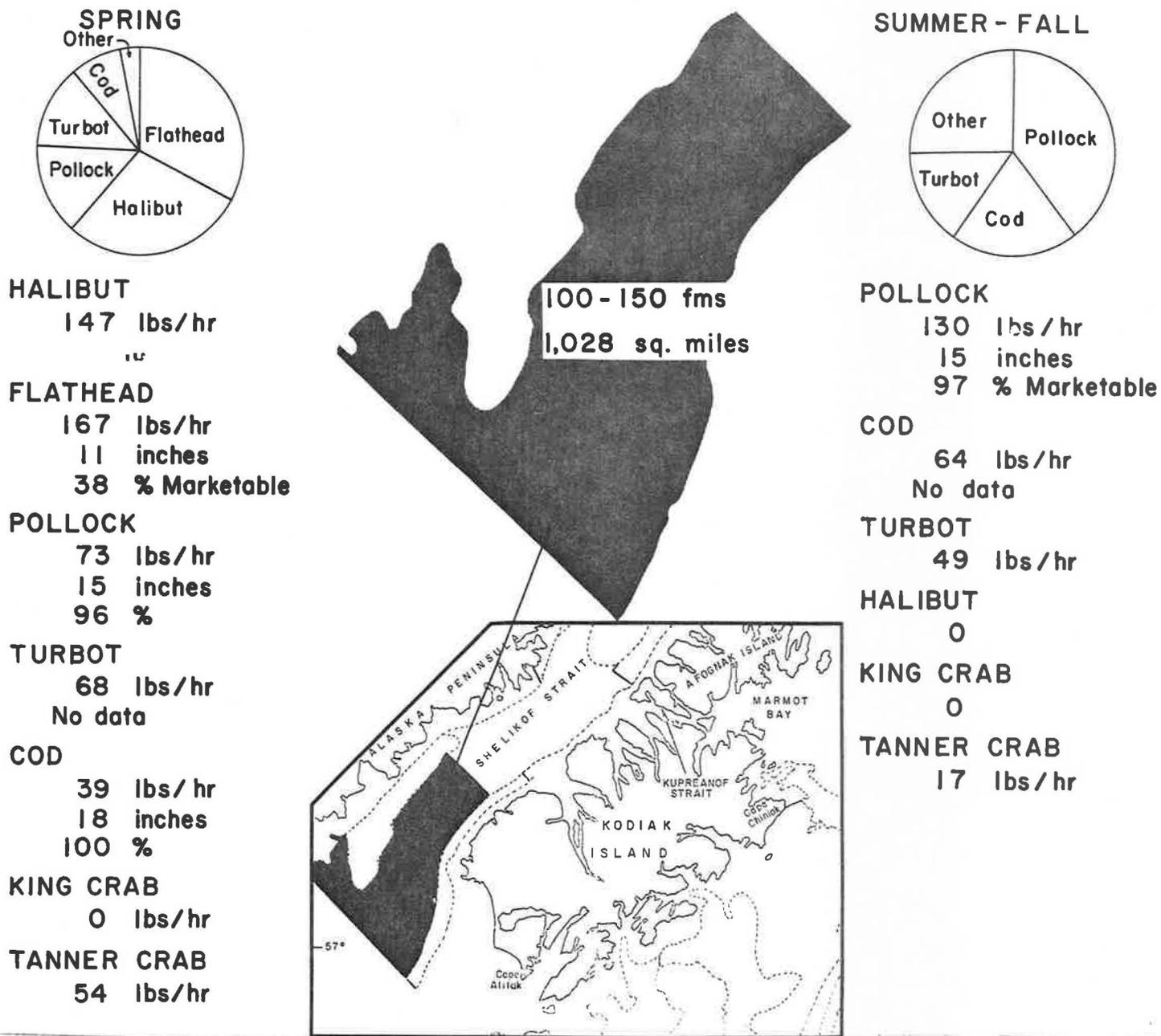


Figure 14.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of Shelikof Strait. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

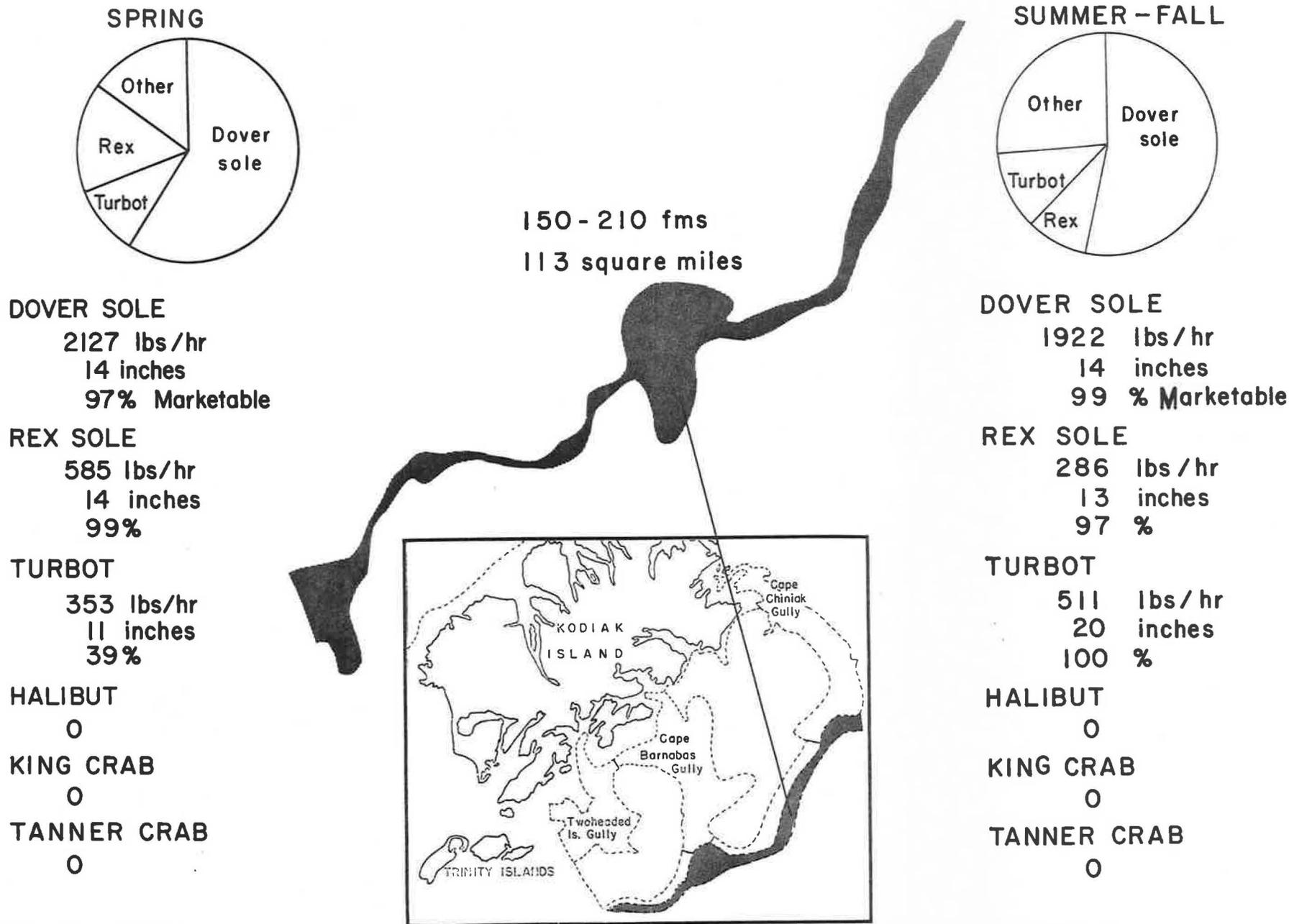
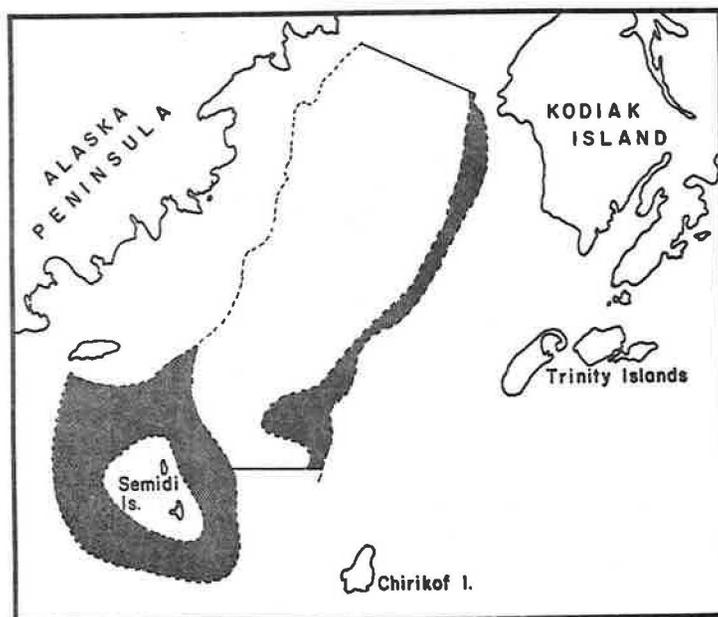
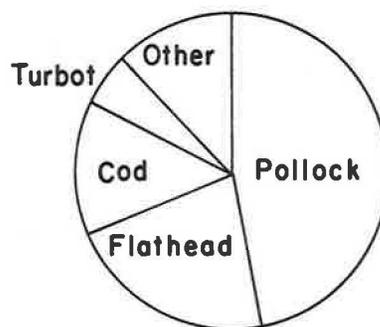


Figure 15.—Groundfish species composition and pounds of fish and crab caught per hour trawled during the spring and summer-fall seasons in the shaded portion of S.E. Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

LATE SUMMER - FALL

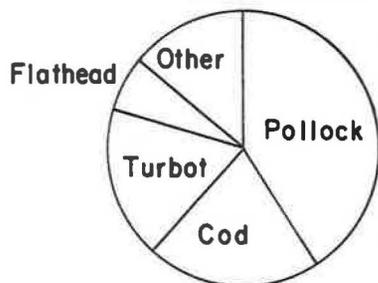
50 - 100 fms  
385 square miles



<b>POLLOCK</b>	
1518	lbs / hr
15	inches
94	% Marketable
<b>FLATHEAD</b>	
678	lbs / hr
10	inches
32	%
<b>COD</b>	
548	lbs / hr
16	inches
96	%
<b>TURBOT</b>	
200	lbs / hr
11	inches
55	%
<b>HALIBUT</b>	
76	lbs / hr
<b>KING CRAB</b>	
654	lbs / hr
<b>TANNER CRAB</b>	
93	lbs / hr

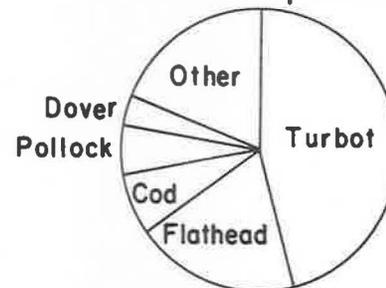
Figure 16.--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall season in the Semedi Island-Shelikof Gully area. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

100-150 fms  
2,090 square miles



LATE SUMMER - FALL

> 150 fms  
100 square miles



**POLLOCK**

634 lbs/hr  
15 inches  
95 % Marketable

**COD**

300 lbs/hr  
20 inches  
86 %

**TURBOT**

276 lbs/hr  
14 inches  
No data

**FLATHEAD**

119 lbs/hr  
12 inches  
32 %

**HALIBUT**

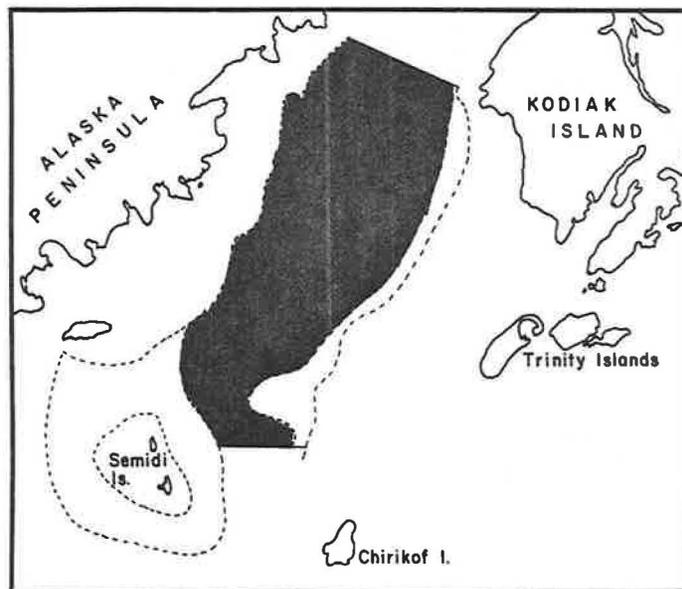
55 lbs/hr

**KING CRAB**

112 lbs/hr

**TANNER CRAB**

105 lbs/hr



**TURBOT**

400 lbs/hr  
18 inches  
99 % Marketable

**FLATHEAD**

155 lbs/hr  
13 inches  
92 %

**COD**

61 lbs/hr  
No data

**POLLOCK**

39 lbs/hr  
17 inches  
98 %

**DOVER SOLE**

27 lbs/hr  
14 inches  
100 %

**KING CRAB**

151 lbs/hr

**TANNER CRAB**

253 lbs/hr

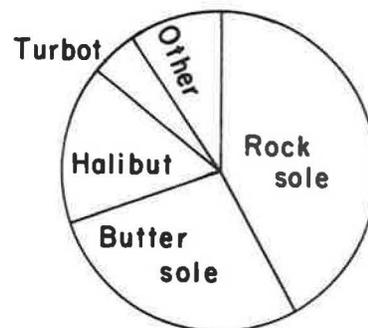
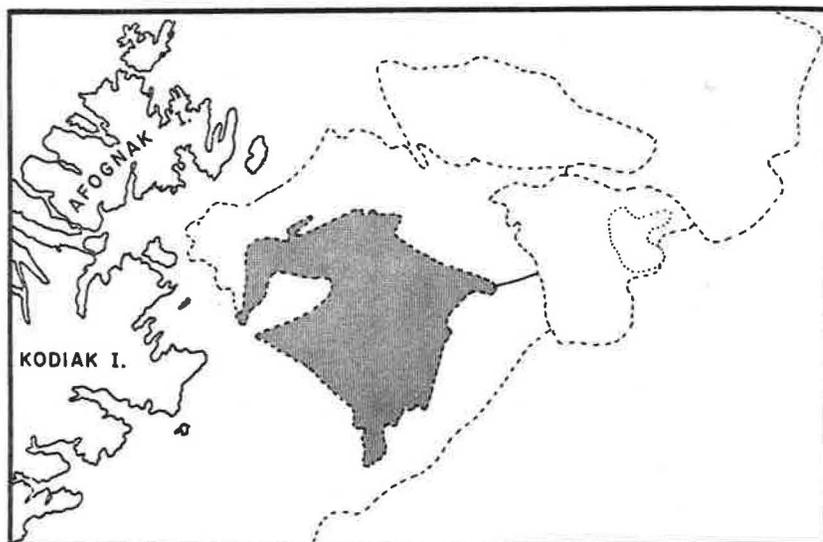
**HALIBUT**

0

Figure 17--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall season in the Semedi Island-Shelikof Gully area. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

LATE SUMMER - FALL

< 60 fms  
1,167 square miles



**ROCK SOLE**  
268 lbs/hr  
9 inches  
52 % Marketable

**BUTTER SOLE**  
178 lbs/hr  
No data

**HALIBUT**  
112 lbs/hr  
No data

**TURBOT**  
30 lbs/hr  
6 inches  
6 %

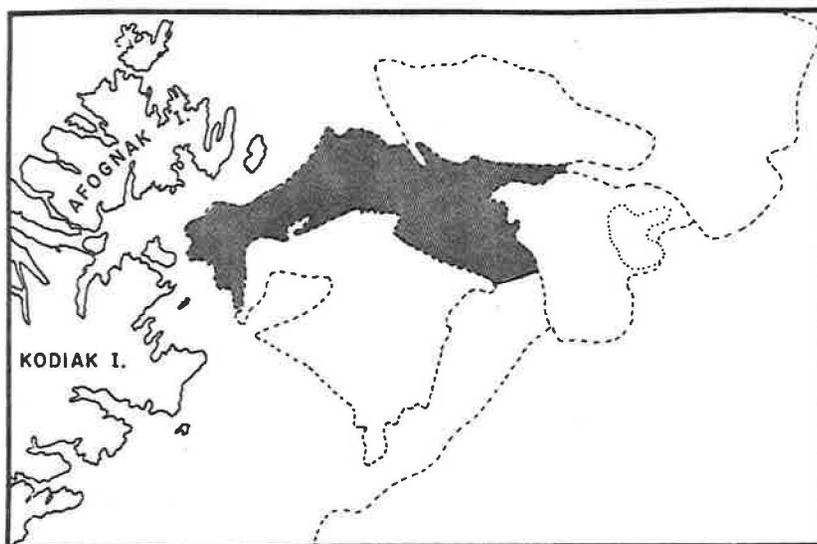
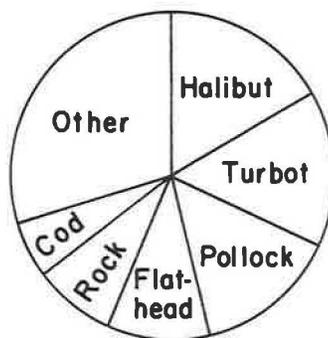
**KING CRAB**  
9 lbs/hr

**TANNER CRAB**  
5 lbs/hr

Figure 18--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall seasons in the shaded portion of northeast Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

LATE SUMMER - FALL

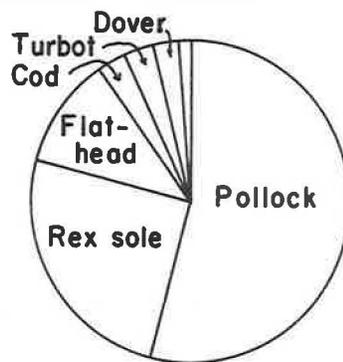
60 - 100 fms  
884 square miles



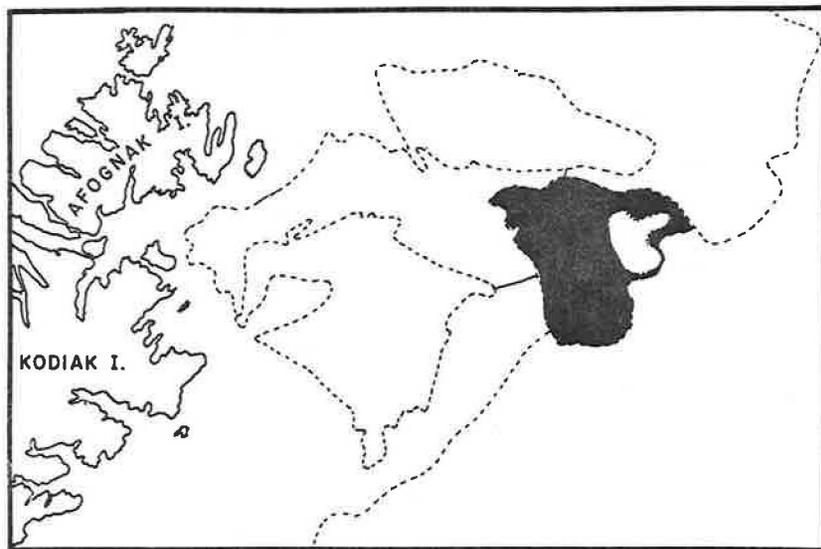
<b>HALIBUT</b>	77 lbs/hr
<b>TURBOT</b>	70 lbs/hr 6 inches 22 % Marketable
<b>POLLOCK</b>	65 lbs/hr 10 inches 59 %
<b>FLATHEAD</b>	49 lbs/hr 12 inches 67 %
<b>ROCK SOLE</b>	40 lbs/hr 13 inches 92 %
<b>COD</b>	25 lbs/hr 14 inches 85 %
<b>KING CRAB</b>	31 lbs/hr
<b>TANNER CRAB</b>	103 lbs/hr

Figure 19--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall season in the shaded portion of northeast Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight, 1973.

LATE SUMMER - FALL



100 - 150 fms  
513 square miles



**POLLOCK**  
1448 lbs/hr  
14 inches  
98 % Marketable

**REX SOLE**  
637 lbs/hr  
12 inches  
79 %

**FLATHEAD**  
270 lbs/hr  
11 inches  
64 %

**COD**  
67 lbs/hr  
18 inches  
100 %

**HALIBUT**  
15 lbs/hr

**KING CRAB**  
0

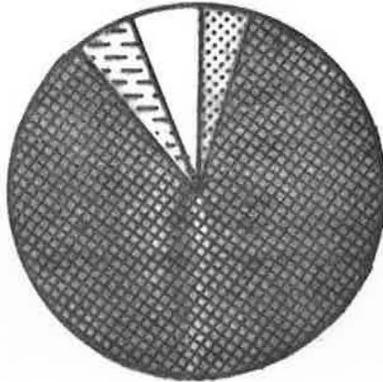
**TANNER CRAB**  
1 lbs/hr

**TURBOT**  
65 lbs/hr  
12 inches  
73 % Marketable

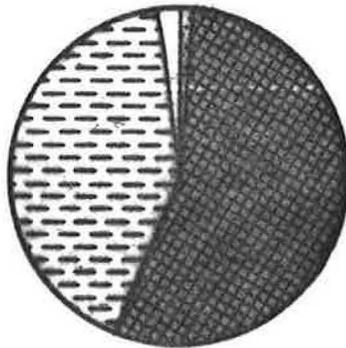
**DOVER SOLE**  
62 lbs/hr  
12 inches  
83 %

Figure 20--Groundfish species composition and pounds of fish and crab caught per hour trawled during the late summer-fall seasons in the shaded portion of northeast Kodiak. Size of fish indicate the average length and percentage of marketable-sized fish by weight.

**GULLY OFF TWOHEADED ISLAND**  
 (50-100 fms.)  
 42,000 tons



**GULLY OFF CAPE BARNABUS**  
 (50-100 fms.)  
 37,000 tons



**UPPER SLOPE OF SHELF**  
 (100-150 fms.)  
 11,000 tons

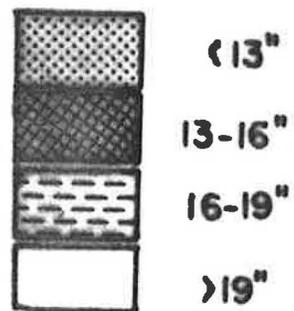
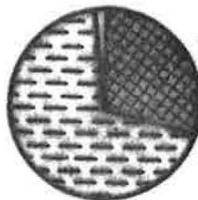


Fig. 21. Size of pollock and biomass estimates in various areas off S.E. Kodiak during the summer-fall of 1973.

Table 1.--Description of trawls used in bottomfish surveys off Kodiak Island, 1973.

Trawl type	Trawl dimensions						No. of floats
	Footrope length (ft)	Headrope length (ft)	Mesh size (inch)				
			Wings	Body	Intermediate	Codend	
Standard 400-mesh Eastern	94	71	4	4	3 1/2	3 1/2	15
Modified 400-mesh Eastern	94	87	5 1/2	5 1/2	3 1/2	3 1/2	21
Mark II Universal	94	94	5 1/2	5 1/2	2 1/2	3	31

Table 2.--Number of successful trawl stations off different regions of Kodiak Island, May-June and July-October periods, 1973.

Region	Survey period	
	May-June	July-September
I. Semedi Islands-Shelikof Gully	0	15
II. Shelikof Strait	21	11
III. Southeast Kodiak	16	23
IV. Northeast Kodiak	0	11
	37	60
Total	37	60

Table 3.—Estimates of fishable biomass (in 1,000 tons) of bottomfish southeast of Kodiak Island, 1973.

Species	Areas surveyed									
	Banks, less than 50 fath.		Gullies and outer shelf, 50-100 fath.		Slope of shelf, 100- 150 fath.		Slope of shelf, 150- 200 fath.		All subregions SE of Kodiak Is.	
	Spring	Late summer	Spring	Late summer	Spring	Late summer	Spring	Late summer	Spring	Late summer
Pollock	2.9	17.5	31.4	105.2	0.3	11.3	0	0.0	34.6	134.1
Cod	4.7	28.4	20.2	11.6	0.5	0.0	0	0	25.5	39.9
Rock sole	28.8	46.8	1.6	2.1	0	0	0	0	30.4	48.9
Flathead sole	6.5	1.7	30.9	13.2	0	0.5	0	0.0	37.4	15.4
Rex sole	0.0	0.3	10.1	1.6	4.3	4.9	2.8	1.2	17.2	8.0
Dover sole	0	0	0.1	3.2	1.3	1.5	9.0	9.6	10.4	14.3
Turbot	1.1	5.2	4.6	9.5	1.0	0.4	1.5	2.5	8.2	17.7
All flatfish <sup>1/</sup>	<u>36.4</u>	<u>54.1</u>	<u>47.4</u>	<u>29.6</u>	<u>6.6</u>	<u>7.4</u>	<u>13.3</u>	<u>13.3</u>	<u>103.6</u>	<u>104.4</u>
All fish	70.9	132.2	123.3	154.1	8.4	19.4	15.7	15.7	218.4	321.5

<sup>1/</sup> Excludes halibut and yellowfin sole

Table 4.—Incidence of parasites in pollock fillets.

Date and location of fishing operation	Size of fish (inch)	No. fillets	No. fillets infected	No. fillets with cysts	No. fillets with nematodes
Summer 1972, S. E. Kodiak & Shelikof	<13"	35	2 (6%)	1 (3%)	1 (3%)
	13-16"	244	43 (18%)	24 (10%)	23 (9%)
	>16"	204	80 (39%)	48 (23%)	44 (22%)
	Total	483	125 (26%)	73 (15%)	68 (14%)
Summer-fall 1973, S. E. Kodiak	<13"	0	0 -----	0 -----	0 -----
	13-16"	50	3 (6%)	1 (2%)	2 (4%)
	>16"	70	30 (43%)	0 -----	30 (43%)
	Total	120	33 (28%)	1	32 (27%)
Summer-fall 1973, Semedi Island	<13"	11	0 -----	0 -----	0 -----
	13-16"	60	7 (12%)	0 -----	7 (12%)
	>16"	42	14 (33%)	0 -----	14 (33%)
	Total	113	21 (19%)	0	21 (19%)



