SEASONAL COMPOSITION AND ABUNDANCE OF JUVENILE AND ADULT MARINE FINFISH AND CRAB SPECIES IN THE NEARSHORE ZONE OF KODIAK ISLAND'S EASTSIDE DURING APRIL 1978 THROUGH MARCH 1979

by

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SUMMARY OF OBJECTIVES AND RESULTS WITH RESPECT TO OCS OIL AND GAS DEVELOPMENT

This study was one portion of a multiple-part study of the marine ecosystem on the east side of the Kodiak Archipelago, which was conducted in preparation for exploratory drilling for oil and gas on the continental shelf. This study was to determine the seasonal composition, relative abundance, movements and habitat use of principal finfish (and commercial crabs) in the nearshore zone. Associated studies used fish and crabs captured in this study for food habits studies.

Oil exploration in the Kodiak lease area constitutes a potential for environmental degradation and it is a legal requirement of the Bureau of Land Management (BLM) to consider this potential as a part of the cost of leasing.

Important commercial fisheries on the east side of Kodiak include king crab, Tanner crab, Dungeness crab, shrimp, scallops, salmon, herring, halibut and bottomfish. The history, size and distribution of these fisheries are reviewed.

Samples were collected using beach seine, gill net, trammel net, try net, surface tow net and otter trawl. Numerically predominant taxa in the beach seine were Pacific sand lance, juvenile pink salmon, juvenile chum salmon and *Myoxocephalus* spp. sculpins. Numerically predominant species in the gill net were Pacific herring, adult pink salmon and Dolly Varden. Numerically predominant species in the trammel net were masked greenling, rock greenling, whitespotted greenling and rock sole. Pacific sand lance greatly predominated the catches of the surface tow net which also captured many larvae during summer. The predominant (by weight) species in the try net were king crab, rock sole and yellowfin sole, while the predominant taxa (by weight) in the otter trawl were rock sole, yellow Irish Lord, yellowfin sole, *Myoxocephalus* spp. sculpins and flathead sole.

Seasonality consisted primarily of movement of juveniles and adults of benthic species to shallower areas for summer and summer occurrence of larval and juvenile life history stages. During winter most fish resided deeper but king crabs moved to shallower waters. Differences in catch were found to be related to tidal stage.

Differences between bays were not pronounced and were probably associated with specific features such as depth, exposure of the bay, type and amount of each habitat present and hydrography. The only notable differences between areas were a relatively large number of species captured at the mouth of Kiliuda Bay; and in Saposa Bay, which is in inner Izhut, summer try net catches contained few live fish and a few dead and decaying fish, suggestive of an anoxic environment.

Specific features of distribution, abundance, migration, growth and reproduction were presented for important taxa.

INTRODUCTION

General Nature and Scope of Study

This study is a survey of the nearshore finfish and commercial crab resources of the eastside of Kodiak Island. The study was to establish a baseline for prediction of oil development conflicts with natural resources. The study was executed in four bays on the eastside of Kodiak selected as representative of the area and was conducted in all four seasons. This study was part of a large study of the Kodiak area with other projects addressing plankton, birds, food habits of fishes and crabs, fish pathology, marine mammals, transport and other aspects. The food habit samples were taken from catches of this project.

Specific Objectives

A. Determine the seasonal composition and relative abundance of principal finfish species (adult and juvenile) on the Kodiak shelf with emphasis on nearshore areas.

B. Describe the temporal dynamics and habitat use by principal finfish species, including their juvenile stages.

Relevance to problems of Petroleum Development

Oil exploration in the Kodiak lease area constitutes a potential for environmental degradation and it is a legal requirement of the Bureau of Land Management (BLM) to consider this potential as a part of the cost of leasing.

Since the livelihood of the vast majority of the people of this area is based upon the harvest of renewable resources, the study of the living marine resources of Kodiak-is an important portion of the prelease studies.

Acknowledgements

A large number of people contributed to this study, especially the skipper of the M/V YANKEE CLIPPER, Doug Lohse; the R/V COMMANDO skipper Tom Oswald and engineer Olaf Rockness; and the field crew members, Leslie Watson, Mark Buckley, Tom Bledsoe and Kelly Meeusen. Bill Johnson created the computer routines to analyze the data, Larry Holyoke did most of the report preparation and Joan Peterson typed the manuscript. Personnel from associated projects cooperated in the conduct of activities and thus substantially contributed to this study.

This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) office.

CURRENT STATE OF KNOWLEDGE

Knowledge of the marine fishes of Alaska is incomplete. Several undescribed species are known to exist. The distribution of many species is not well known. Keys for identification are not complete. And this situation exists at a time when most of the effort in biology is turning toward ecological problems, with the assumption that taxonomic problems have all been solved. As an example two important genera of sculpins, Myoxocephalus and Gymnocanthus, could not be reliably identified to species at the outset of this study. In addition, a recent summary of pelagic fishes (Macy et al.,1978) includes distributional features of rainbow smelt (Osmerus mordax) in the North Pacific. As far as we have been able to determine, records of rainbow smelt apparently are misidentifications of eulachon and may all be incorrect.

Wilimovsky (1958) published the first key to fishes of Alaska, in which he stated "Although there have been a number of separate lists and descriptive summaries, such as Everman and Goldsborough's Fishes of Alaska, none of these publications contains keys to, or sufficient descriptive data with which to identify, the fish fauna." Wilimovsky continued his work on Alaskan fishes, publishing information on the inshore fish fauna of the Aleutian Archipelago (Wilimovsky, 1963).

Other individuals have continued to add to ichthyological information; McPhail (1965) described a new ronquil from the Aleutians; Hubbard and Reeder (1965) presented new locality records for Alaskan fishes; Quast (1968) published new records for 14 species; and Peden (1970) described a new cottid (this is not a complete list). The knowledge of Alaskan fishes is growing and Wilimovsky's key is becoming out of date. Quast and Hall (1972) updated the distribution information with a list of Alaska fishes.

Forage fish species have received no directed study. Trumble (1973) and Macy et al. (1978) reviewed the available information on underutilized and pelagic species. These reviews cover general aspects, but features of distribution and abundance in the Kodiak area are not known.

Trawl surveys of bottomfish in the Kodiak area have been conducted. Alverson et al. (1964) reported a survey of the Northeastern Pacific Ocean. Ronholt et al. (1978) reviewed all the trawl surveys that have been conducted in the Gulf of Alaska. These surveys were designed to yield information on abundance of commercial species, which they do; however, knowledge of distribution and its seasonal changes is not complete, even for the major commercial species.

Previous OCSEAP (Outer Continental Shelf Environmental Assessment Project) surveys have been completed in the Kodiak area. Two coordinated surveys were simultaneously conducted in Ugak, Alitak and Kaiugnak Bays in 1976-77; one study addressed the nearshore and pelagic fishes (Harris and Hertt, 1977) and the other addressed the demersal fishes (with an otter trawl) (Blackburn, 1979).

A summary of pertinent information on commercially exploited species in the Kodiak area follows.

King Crab

King crab have been taken in virtually all of the lease area east of Kodiak. The area of greatest king crab catches was the southeast district with a mean annual catch of 5.3 million pounds (Figure 1).

King crab was first harvested in the Kodiak management area in 1951. From 1951 to 1965 catches of king crab increased to their historically highest value in 1965 of 95 million pounds, but have since declined. The fishery now depends primarily upon recruit crab and thus catch in any season depends heavily upon the reproductive success of a single year-class. Catches were very low in 1972, 1977 and 1978. The king crab fishery operated during every month of the year through the 1960's. Now, 1981, it opens September 15 and remains open until December 15 in the Kodiak area or until the guideline harvest is taken. Once closed it reopens for larger seven and a half inch crab in the Kodiak area and remains open through January 15.

King crab move into relatively shallow water in winter where their eggs hatch from February through April. This is followed by moulting and mating so that the female carries eggs for about 11 months of the year. During this time the adults are quite concentrated; nearly all of the bays on Kodiak are known or suspected to harbor spawning concentrations and virtually all shallow water is used by crabs during spawning.

Tanner Crab

Tanner crab have been harvested in virtually all of the lease area east of the Kodiak Archipelago. Mean annual Tanner crab catches have been 4.4 million pounds in the northeast district, 4.1 million pounds in the eastern district and 3.4 million pounds in the southeast district(Figure 2).

The Tanner crab fishery has been in existence since 1967. The catches increased in the first few years of the fishery and by the 1971-72 fishing season, the harvest was less than 10 million pounds in the Kodiak Management Area. As king crab abundance declined in the late 1960's and early 70's, markets opened UP, Prices increased, and more vessels participated in the fishery. By the end of the 1972-73 season, Tanner crab had become the predominant winter and spring shellfishery with 30.5 million pounds harvested in the Kodiak area. Since then, the annual landings in Kodiak have varied between about 13.6 and 33.3 million pounds,largely as a result of disputes over price and competition with other fisheries. There are indications at this time that future catches of Tanner crab will be a little below historic levels.

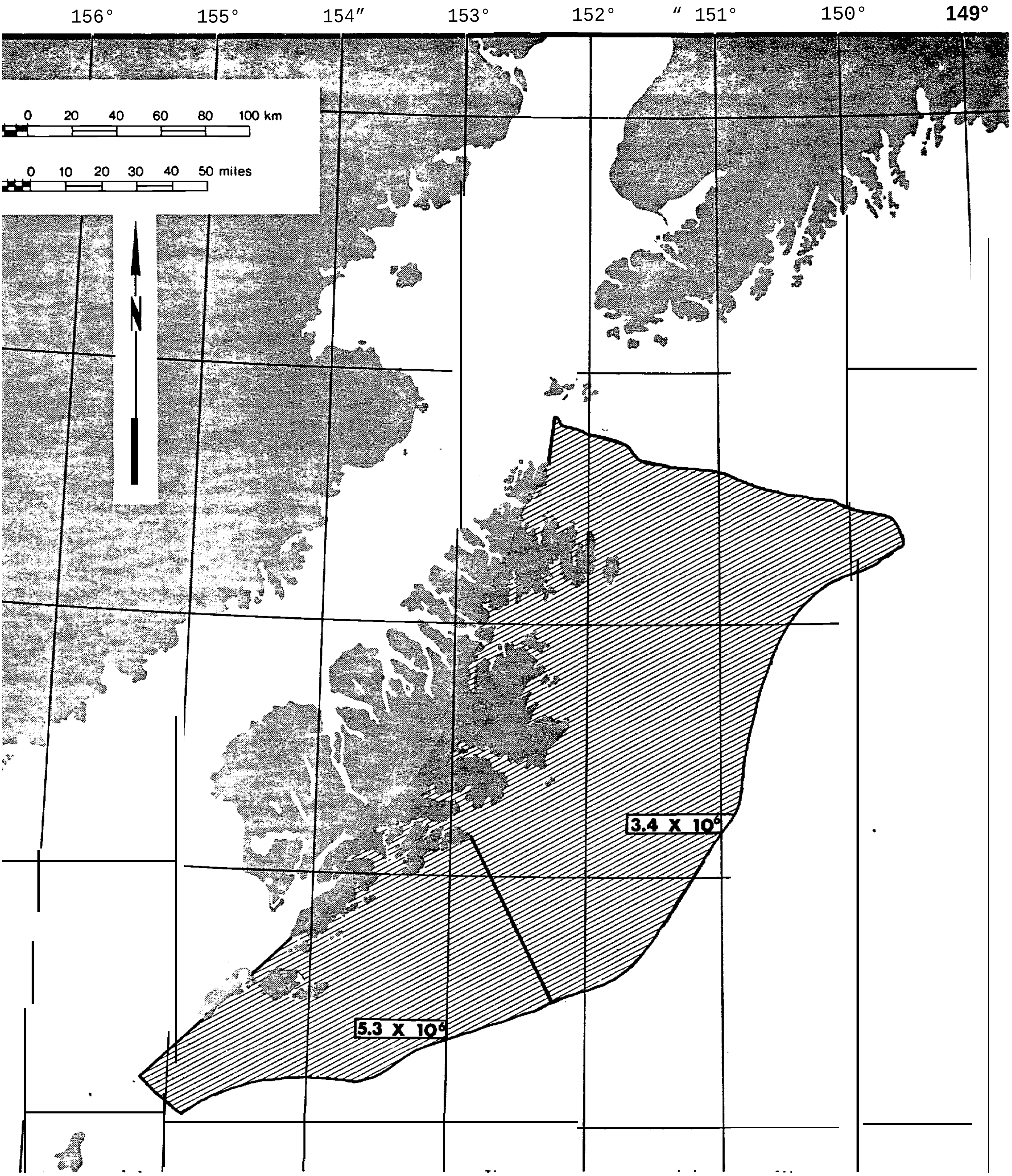

Figure 1. Mean annual catch of king crab in pounds during 1971-72 through 1978-79 fishing seasons by districts on the east side of Kodiak.

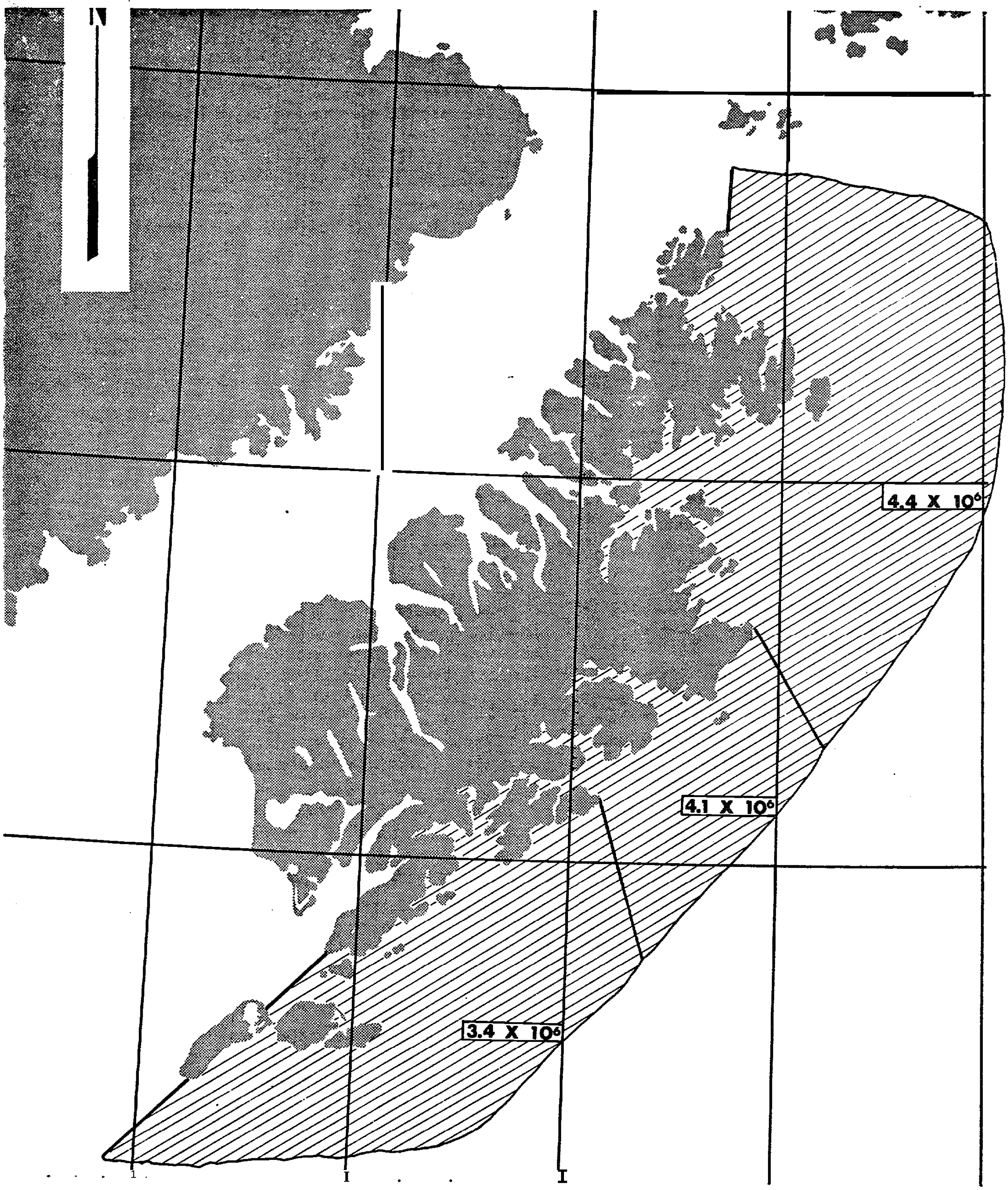

Figure 2. Mean annual catch of Tanner crab in pounds during 1971-72 through 1978-79 fishing seasons by districts on the east side of Kodiak.

The Tanner crab fishing season has included landings in every month of the year. Crab must be delivered alive, and during summer in the early years of the fishery there was a high mortality before delivery. Apparently, Tanner crab could not survive summer surface water temperatures, so the fishery has been restricted to the winter-spring period. In the Kodiak Management Area the season is from February 10 through April 30, with areas being closed earlier if catches reach the guideline harvest level. Seasons may be changed by the Alaska Board of Fisheries.

Little is known about the spawning areas and life history of the Tanner crab. Most bays on the east side of Kodiak are suspected to be spawning areas.

Dungeness Crab

Commercial catches of Dungeness crab have been widespread throughout the lease area. The area of greatest Dungeness crab catches has been the eastern district with a mean annual catch of 366 thousand pounds, followed by the southeastern district with 288 thousand pounds and the northeastern district with 84 thousand pounds (Figure 3).

The Kodiak area Dungeness crab fishery began in 1962 with a harvest of 1.9 million pounds. As a result of favorable market conditions and large virgin stocks in the Kodiak area, commercial harvests increased and peaked in the four year period from 1967-70 with an average annual harvest of 6.3 million pounds. During the early 1970's the fishery in the Kodiak area declined as a result of biological and environmental factors accompanied by adverse marketing conditions. In the mid 1970's low prices and other more lucrative fisheries have kept the Dungeness production at a low level. The outlook for the Dungeness crab fishery is no different from its history. Stock abundance is satisfactory but market conditions will probably continue to fluctuate from year to year.

Dungeness crab spawning areas encompass the entire lease area off the east coast of the Kodiak Archipelago.

Shrimp

Shrimp are commercially harvested in virtually all the lease area on the east side of the Kodiak Archipelago. Mean annual catches have been greater than 8 million pounds in the Outer Marmot and Two Headed districts. The estimated mean annual catches are 4 to 8 million pounds in Alitak and Kiliuda Bays, 1 to 4 million pounds in Inner Marmot Bay, and less than 1 million pounds in Ugak Bay.

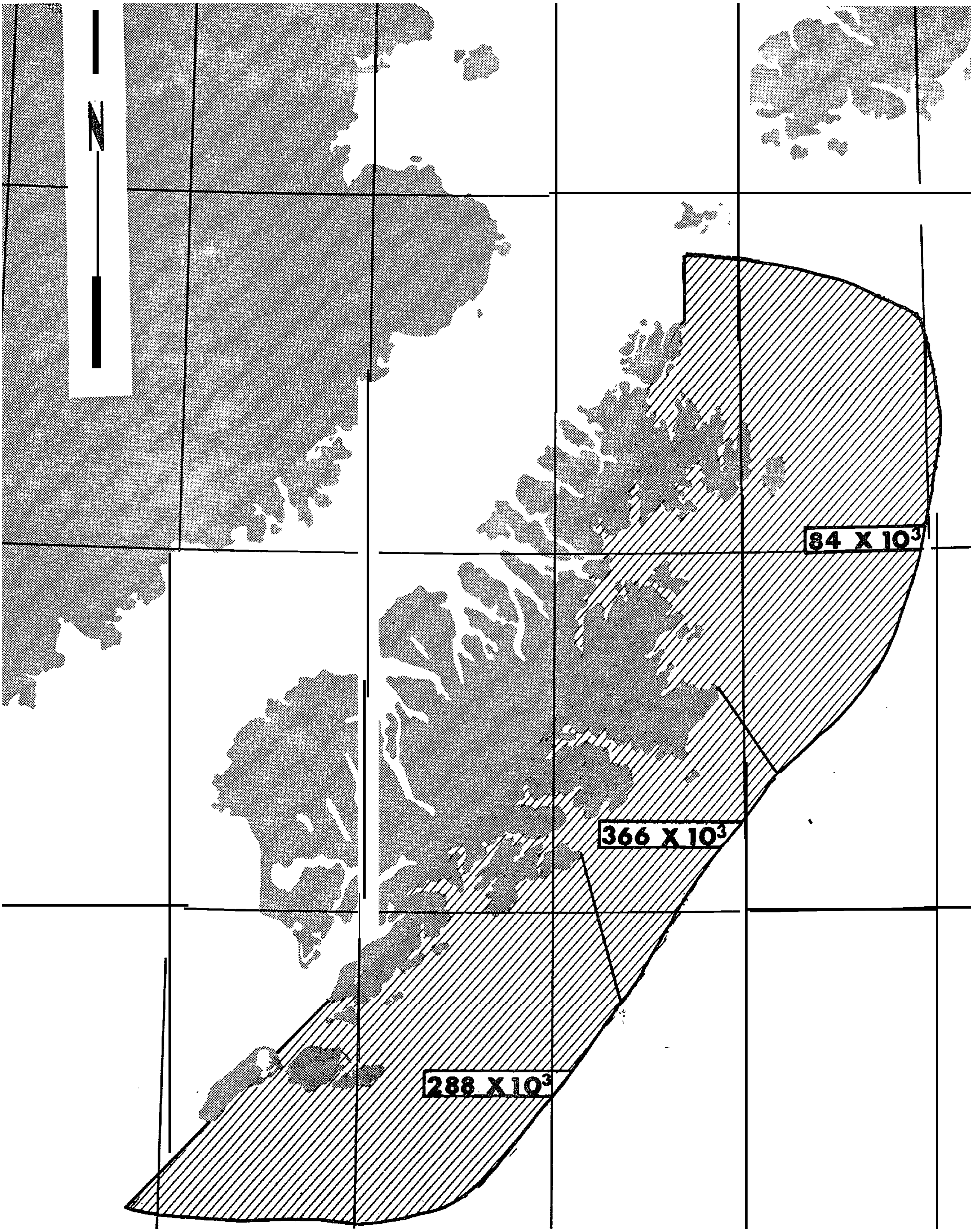

Figure 3. Mean annual catch of Dungeness crab in pounds during 1972 through 1978 fishing seasons by districts on the east side of Kodiak.

The stocks of shrimp have been seriously reduced in areas of historically high production. Stocks in Marmot Bay, the Two Headed area and Kiliuda Bay are especially reduced. Shrimp stocks in Ugak Bay were seriously reduced in the early 70's and the bay was closed for a number of years. The Ugak stocks have slowly grown and in 1979 a short opening there yielded less than a million pounds. The outlook for shrimp harvests on the east side of Kodiak in the immediate future is far below the historic levels. There is, however, some initial activity toward developing a pot fishery for prawns.

Scallops

The fishery for weathervane scallops (*Patinopectin caurinus*) has been conducted primarily on the continental shelf on the east side of Kodiak. The scallop fishery began in 1967 and expanded in the Kodiak area to 1.4 million pounds in 1970 and decreased thereafter, with no "fishery in 1977 and 1978 and modest landings since (Table 1). A considerable amount of exploration was conducted by the fishermen and it is considered likely that all productive areas have been identified. Distribution of catches is presented by Ronholt et al. (1978). The historic catches are in Table 1.

Table 1. Historic commercial catch in pounds of weathervane scallops in the Kodiak area.

Year	Catch	Year	Catch	Year	Catch
1967	7,788	1972	1,038,793	1977	0
1968	872,803	1973	935,705	1978	0
1969	1,012,860	1974	147,945	1979	24,826
1970	1,417,612	1975	294,142	1980	371,018[1]
1971	841,211	1976	'75,245	1981	396,000[2]

[1]353,443 pounds shucked and 17,575 pounds unshucked.
[2]Approximate.

Salmon

All five species of salmon are harvested in the Kodiak area. The 1948-78 average catch was 6.2 million pinks, 709,000 chums, 512,000 red, 42,000 coho and 1,300 chinook or king salmon.

Pink salmon spawn in virtually every stream on Kodiak and there are 23 streams on the east side that have mean 1969-78 escapements of 10,000 or more (Figure 4; Appendix Table 1). These important spawning

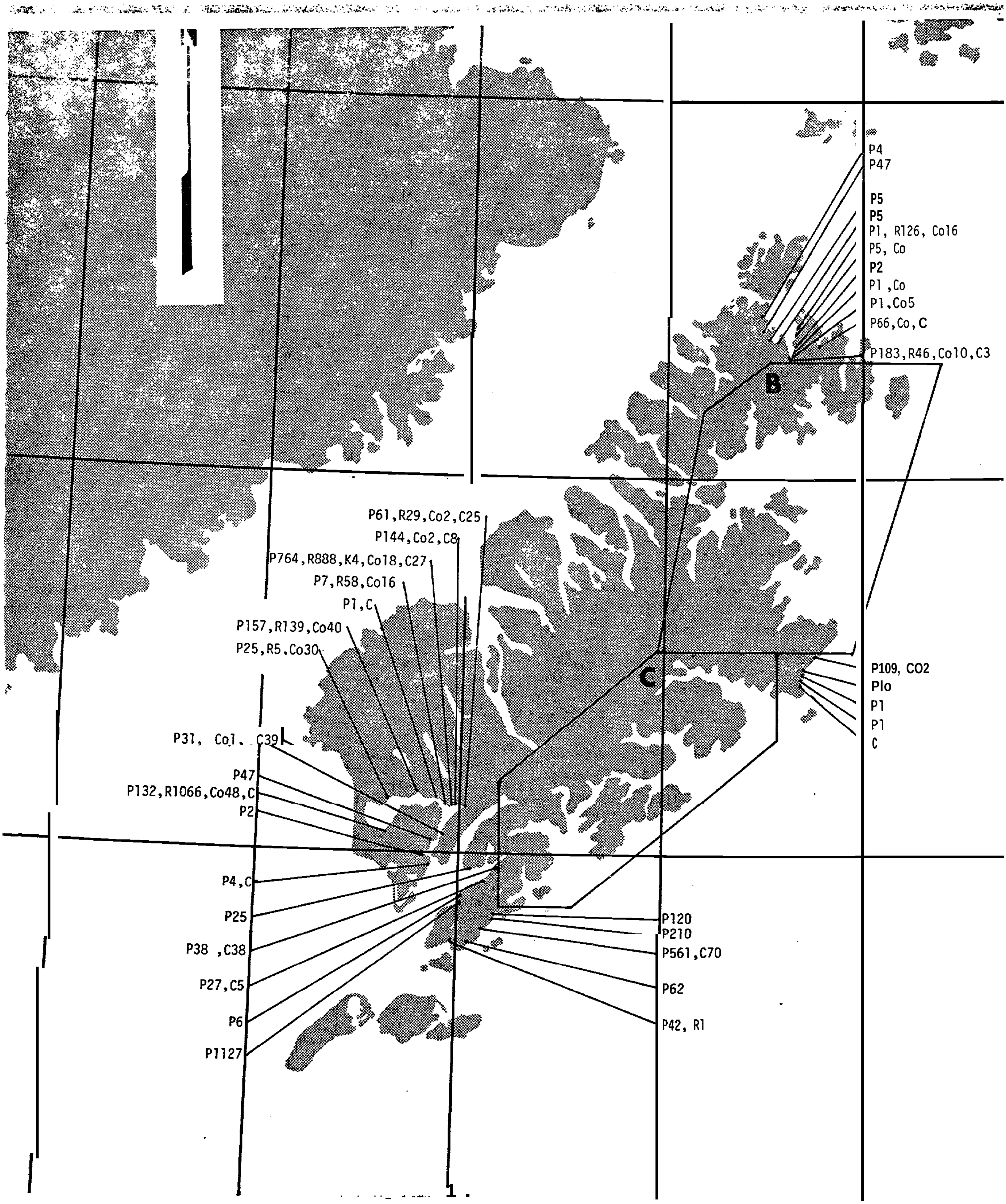

Figure 4A. Salmon spawning streams on the east side of Kodiak Archipelago. The species and run size, shown in hundreds of fish, is based on aerial counts and weir counts from data files maintained by ADF&G as "Peak Counts" for the years 1975 through 1978. The symbols indicate: p - pink salmon, R - red salmon, Co - coho salmon, K - king salmon, C - chum salmon.

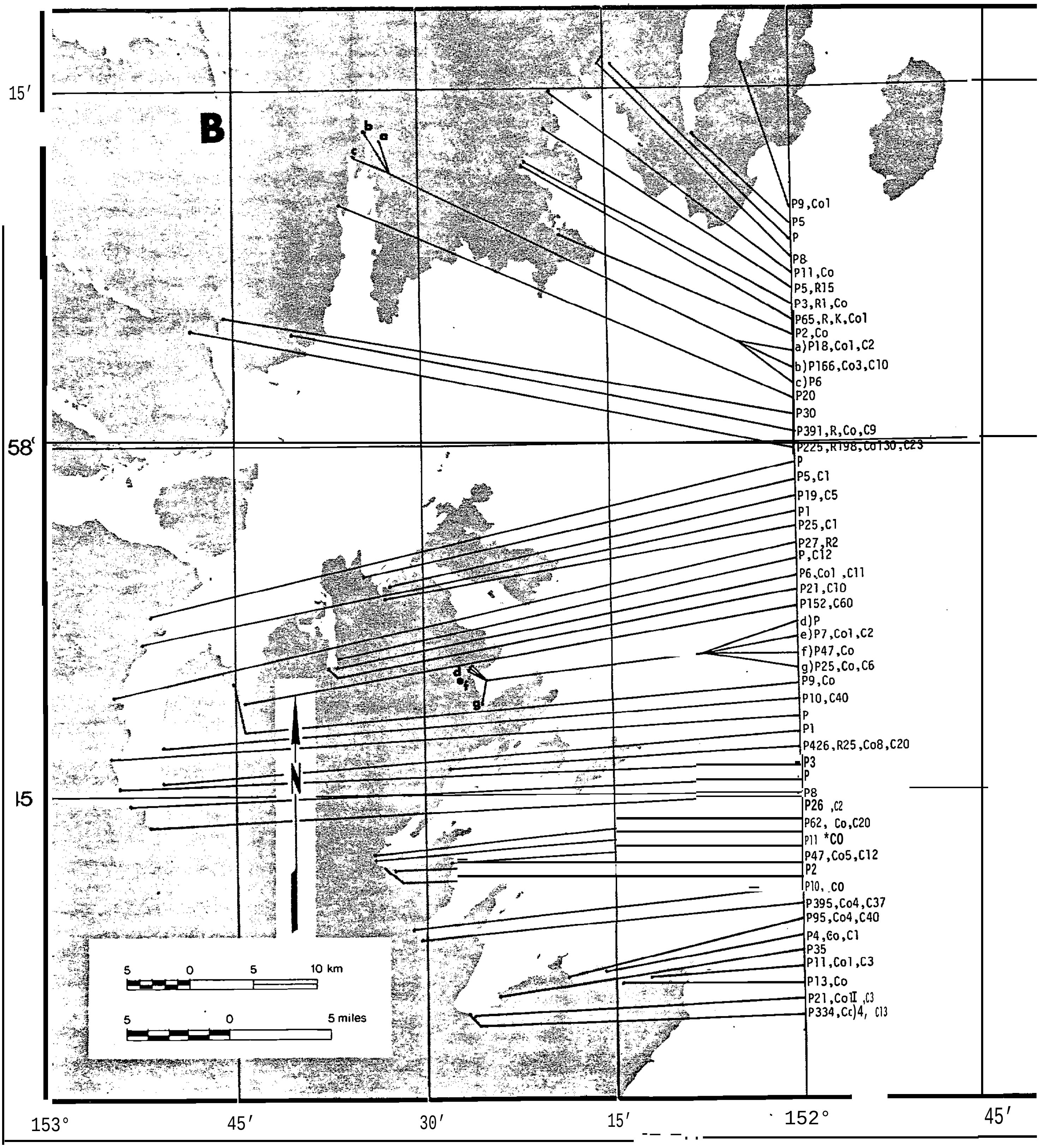

Figure 4B. Salmon spawning streams . . . (cont.).

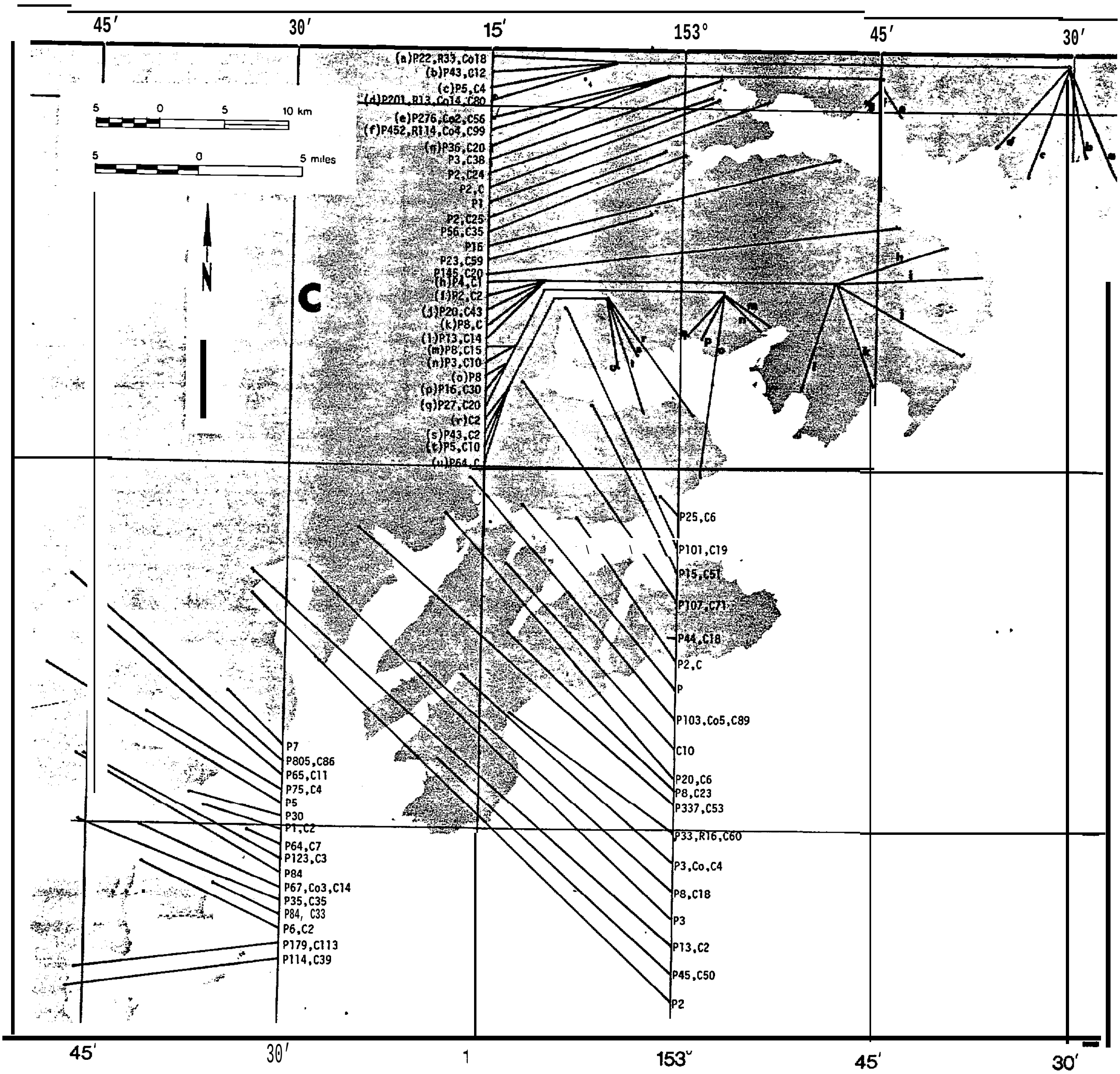

Figure 4C. Salmon spawning streams . . . (cont.).

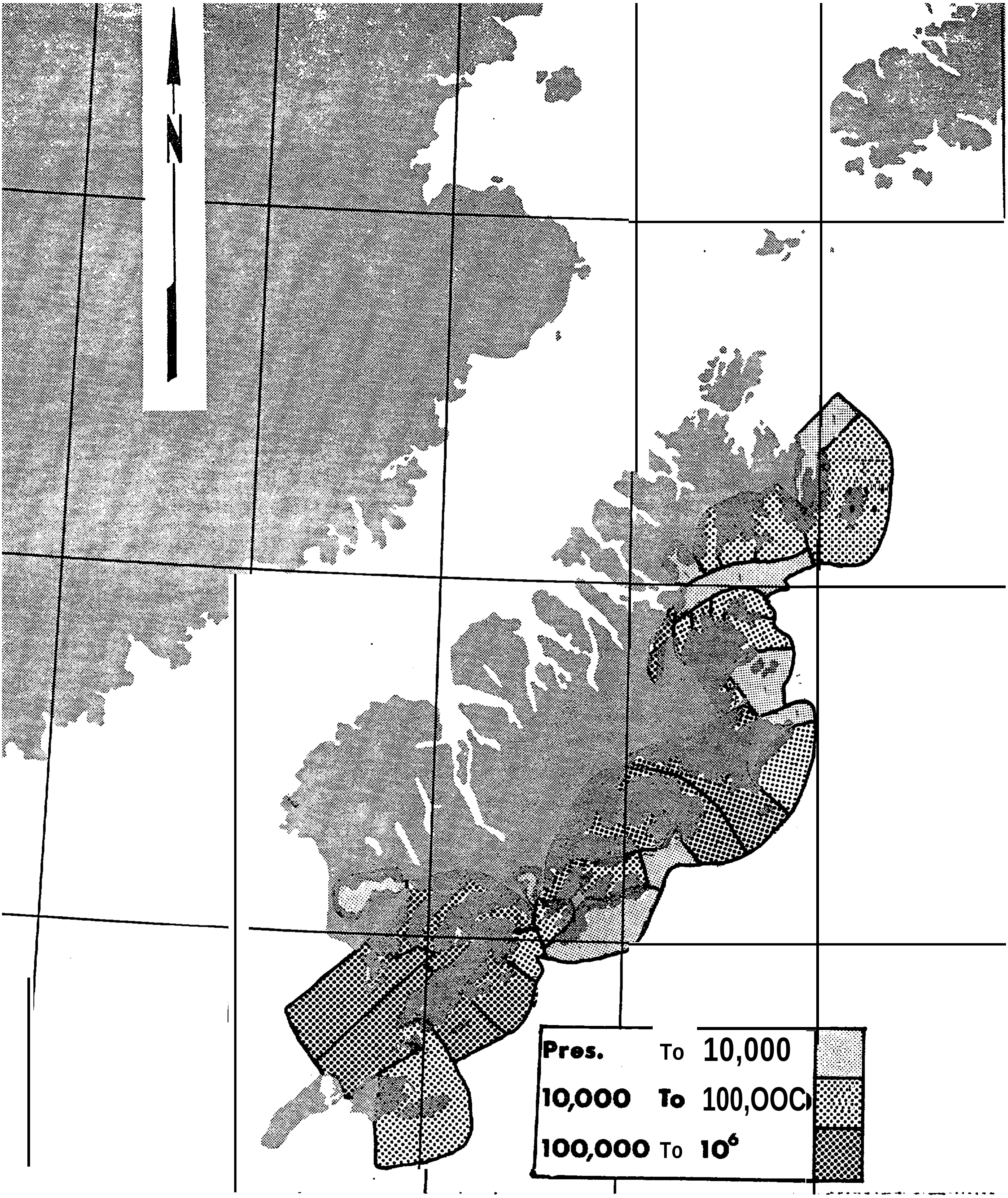

Figure 5. Mean annual pink salmon catch in numbers of fish by statistical area on the east side of Kodiak for the years 1969-1978.

streams are dispersed over the Archipelago, with a concentration of several large runs on the southwest side of Kodiak (Streams on the west side of the Kodiak Archipelago are not included in this report).

Statistical areas on the east side of the Archipelago in which the harvest of pink salmon has averaged more than 100,000 fish per year during 1969-78 are those statistical areas encompassing Kizhuyak Bay, Kalsin Bay, both statistical areas in Ugak Bay, Kiliuda Bay, Sitkalidak Strait at Old Harbor, Kaiugnak Bay, Kaguyak Bay, Geese Islands and all five statistical areas in Alitak Bay (Fig. 5).

The fishery for pink salmon occurs almost entirely during July and August with more than 80%"of the catch between mid-July and mid-August (Figure 6).

Chum salmon use about 105 streams on the east side of the Archipelago of which half have more than 1,000 spawners, 14 have more than 5,000 and one has more than 10,000 (Figure 4). Of the 14 streams with over 5,000 spawners, four flow into Ugak Bay, two flow into Kiliuda Bay and five are between Kiliuda and Kiavak bays (Figure 4).

The catches of chum salmon have averaged between 10,000 and 100,000 fish annually in three statistical areas near Kizhuyak Bay, in Kalsin Bay, in two statistical areas in Ugak Bay, in Kiliuda Bay, in Sitkalidak Straits at Old Harbor and in three of the statistical areas in Alitak Bay (Figure 7).

The harvest of chums has occurred primarily during the last half of July and August (Figure 6).

Red salmon spawn in 20 streams on the east side of the Kodiak Archipelago. Of these streams, 14 have averaged more than 1,000 spawners, six have averaged more than 10,000 and one, Upper Station, has averaged over 100,000 (Figure 4; Appendix Table 1). The average annual catches of red salmon on the east side of the islands have been over 10,000 fish in two adjacent statistical areas of Alitak Bay (Figure 8). Red salmon catches peak in June, thus they are the target species of the early season salmon fishery (Figure 6). Some catch continues through September as different populations return at different times (Figure 6).

The data on coho escapements are incomplete. Since coho return later than the other salmon (Figure 6), the commercial fishery does not fully utilize this species and stream survey information on escapement is incomplete. According to the available data coho salmon spawn *in* about 50 streams on the east side of the Kodiak Archipelago; eleven of these have runs averaging over 1,000 fish (Figure 4; Appendix Table 1). Only two statistical areas have yielded catches averaging over 1,000 cohos, one of which is on Duck Bay on Afognak Island and the other is Moser Bay off Alitak Bay (Figure 9).

King salmon are not common on the east side of the islands. They spawn in one stream flowing into Olga Bay where the largest run was 205 fish (Figure 4). The only statistical area with a historical catch of more than 100 Kings is in Alitak Bay (Figure 10). Most of the catches of king salmon occur during June and July (Figure 6) .

Concerning the offshore migration of juvenile salmon, Stern (1977) stated: " Information available on juvenile salmonids after they enter the marine waters of the total Kodiak region is scarce. The most definitive data are for the Kodiak Island district, and applies mainly to pink salmon. Since 1962, the Fisheries Research Institute (FRI) of the University of Washington has sampled juvenile salmonids in the bays of Kodiak Island by means of tow nets in order to forecast the following year's return of pink salmon "(Tyler 1976 MS). The results of this research are also useful in understanding the timing and movements of juvenile salmonids after they enter the marine environment and are the basis for the following discussion".

"Juvenile pink salmon that leave streams entering bays, fjords, and channels remain in these protected waters for several months. It is suspected that young salmonids that leave streams along unprotected shorelines move directly offshore. Those pinks that do enter protected areas, such as bays, move directly from river mouths to intermediate areas along the the shorelines. Here the juvenile pinks remain in the surface waters and form large schools in the preferred areas. After approximately forty-five days the pinks gradually move to the open water areas in the bays where they remain for approximately another forty-five days. These movements are pictured in Figure 35 (from Tyler 1976 MS), which shows that in the spring and early summer, juvenile pinks are concentrated at the heads of bays. By mid-summer, it can be seen from the figures, that juvenile pinks are distributed throughout the bays and that in August and September they are concentrated near the mouths of the bays. FRI research has also found that young pinks tend to leave from shorter bays earlier (e.g., Kaiugnak and Malina Bays) than from longer bays, especially those that have a network of arms (like Alitak Bay). Departure from these waters is gradual, beginning in late June, peaking in August, and lasting through September. After leaving the open waters of the protected areas, the juvenile pinks move offshore and begin their high seas period of life. There is some evidence to indicate that some pinks, after departing a particular bay, may move back into the open waters of adjacent bays. Small numbers of chum are also included in the catches made by tow-netting in the various bays. Walker (1968 MS) reported that juvenile chum salmon appeared to stay nearshore longer than the pinks, although a small percentage of chums were found in the open water catches of pinks. Chums were seen to remain in or near river mouths for up to several weeks".

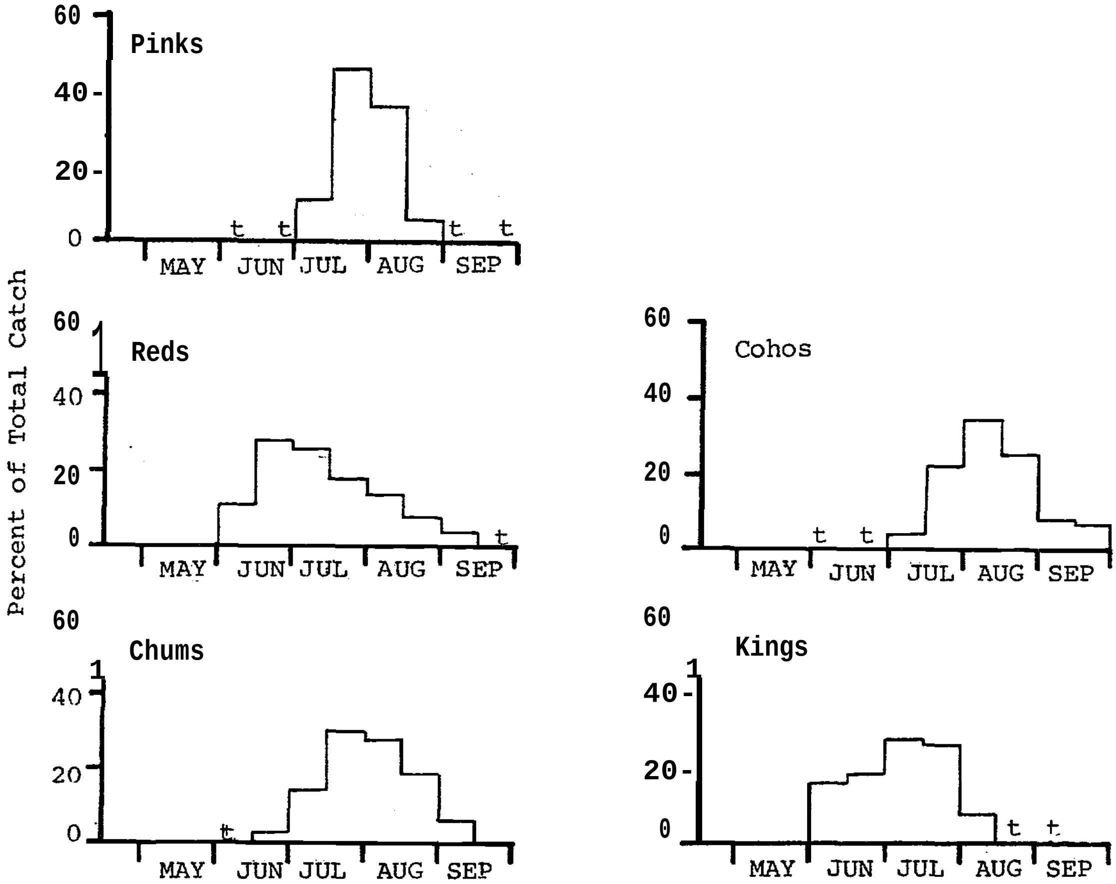

Figure 6. Commercial catch of salmon by species and time in the Kodiak Management Area. Data taken from International North Pacific Fisheries Commission, Statistical Yearbooks for the years 1960-63 and 1970-73.

Fisheries Research Institute has also conducted juvenile studies (using tow-neting) in Chignik Lagoon. The studies, which were conducted from 1961-68, were intended to show various aspects of the distribution and abundance of the post-smelt sockeye salmon in the lagoon (Dahlberg 1968, Phinney 1968). These studies showed that juvenile sockeyes behaved similarly to Kodiak pink salmon juveniles. The young sockeye were seen to delay their offshore migration and remain for a short period of time in the lagoon. Phinney (1968) reported that sockeye post-smelts initially inhabited the littoral areas of the lagoon gradually moving into deeper waters of the lagoon. He also noted that sockeye juveniles remained in the lagoon from four to six weeks before departing for offshore waters.

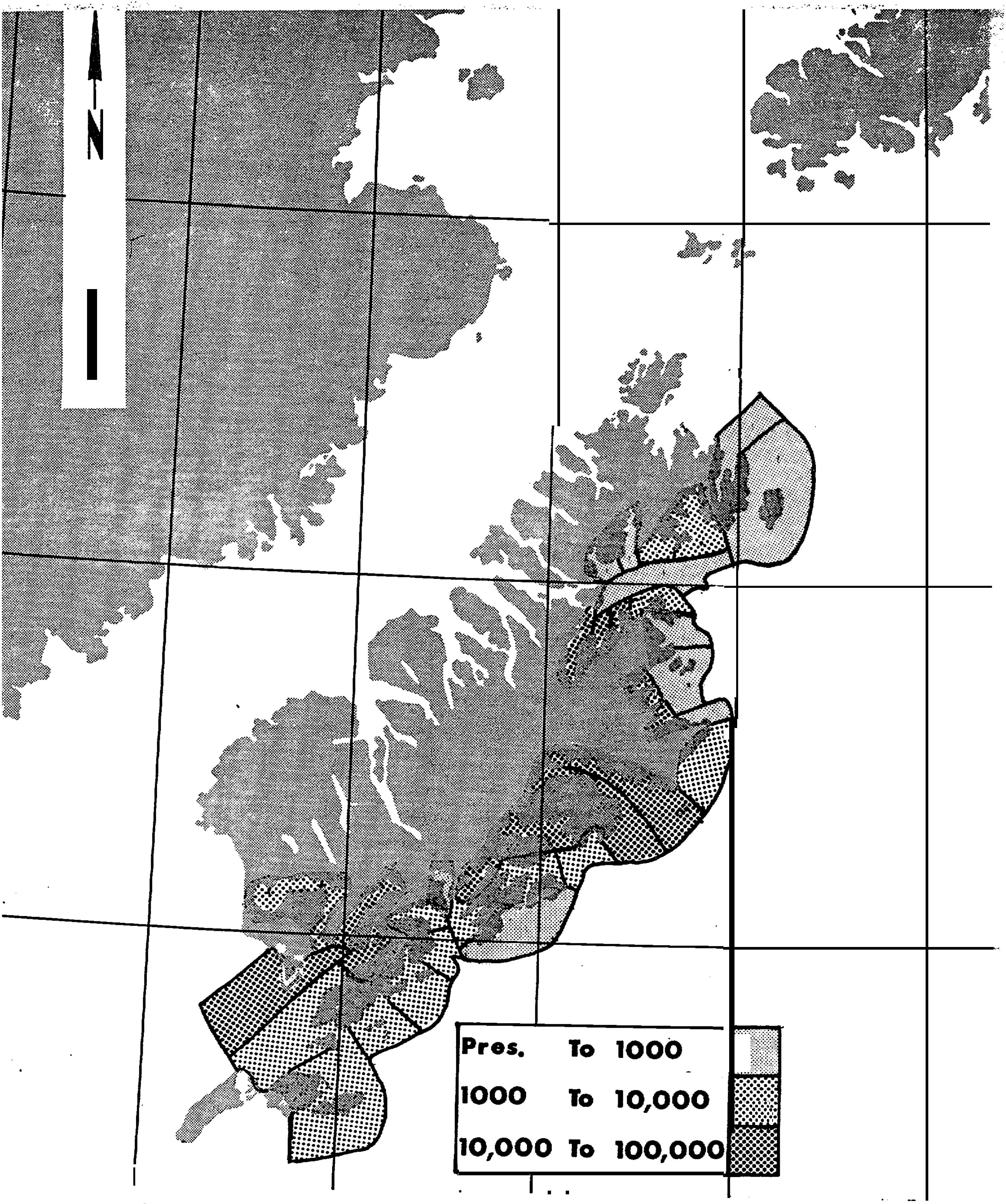

Figure 7. Mean annual chum salmon catch in number of fish by statistical area on the east side of Kodiak for the years 1969-1978.

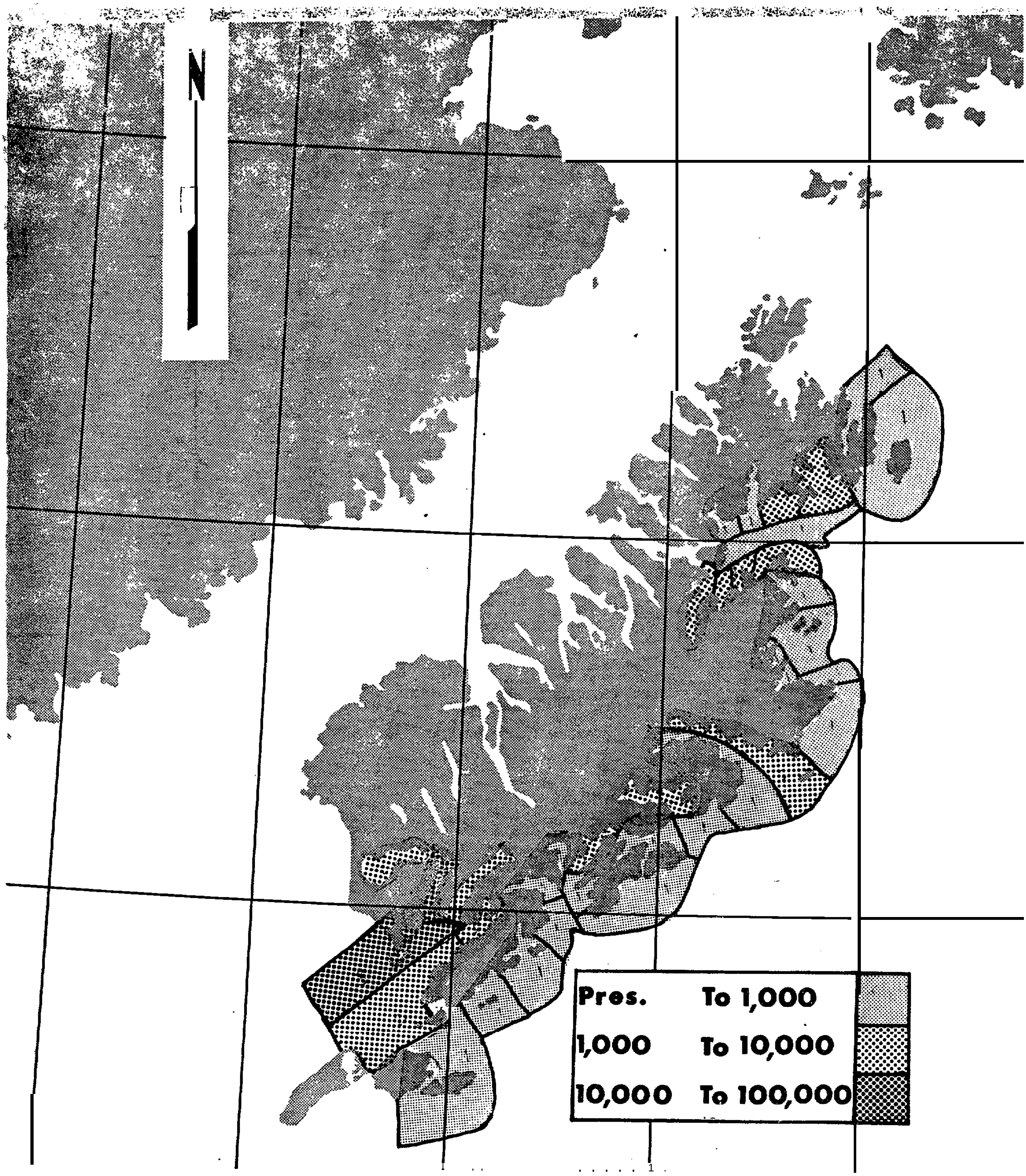

Figure 8. Mean annual red salmon catch in numbers of fish by statistical area on the east side of Kodiak for the years 1969-1978.

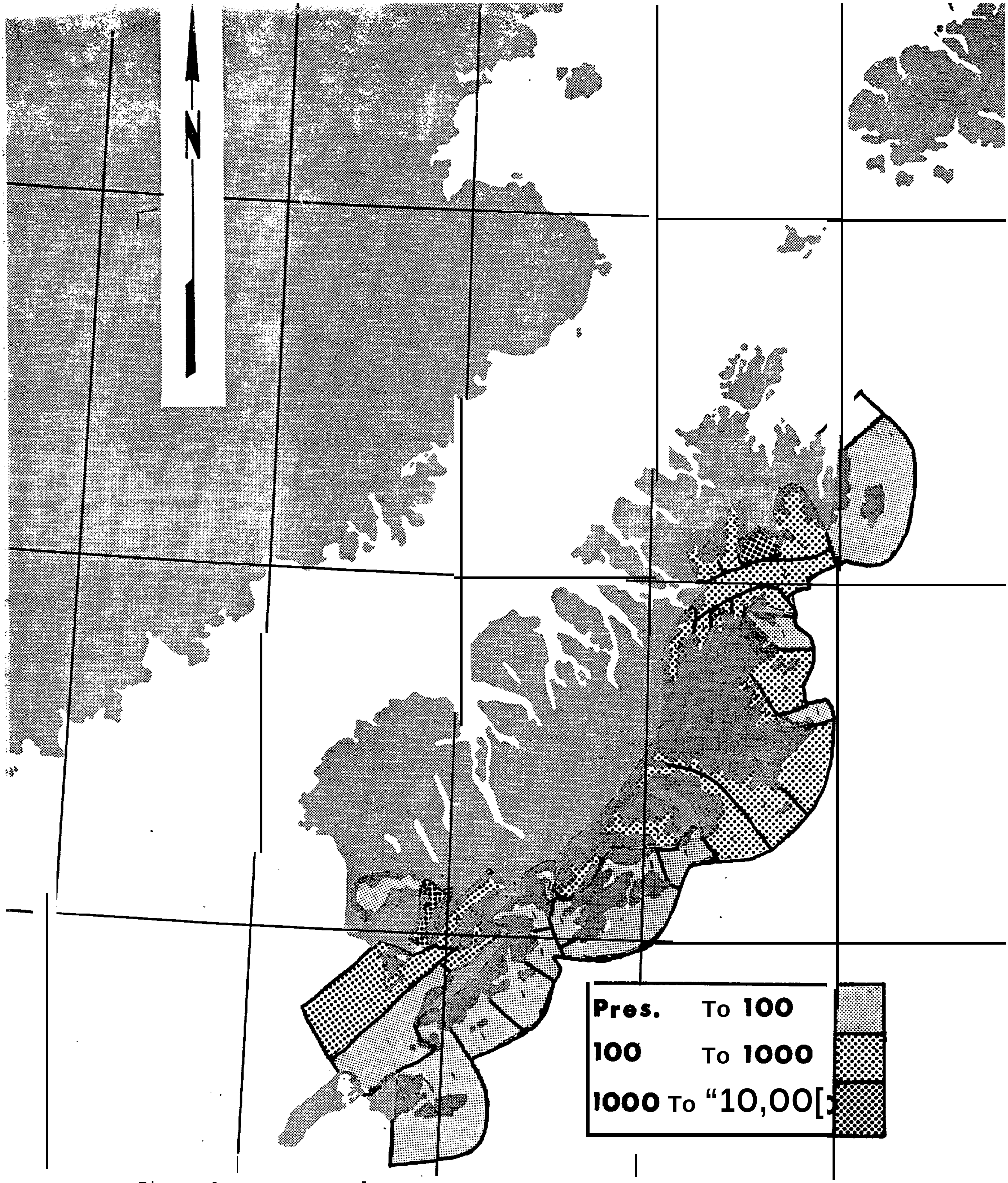

Figure 9. Mean annual coho salmon catch in numbers of fish by statistical area on the east side of Kodiak for the years 1969-1978.

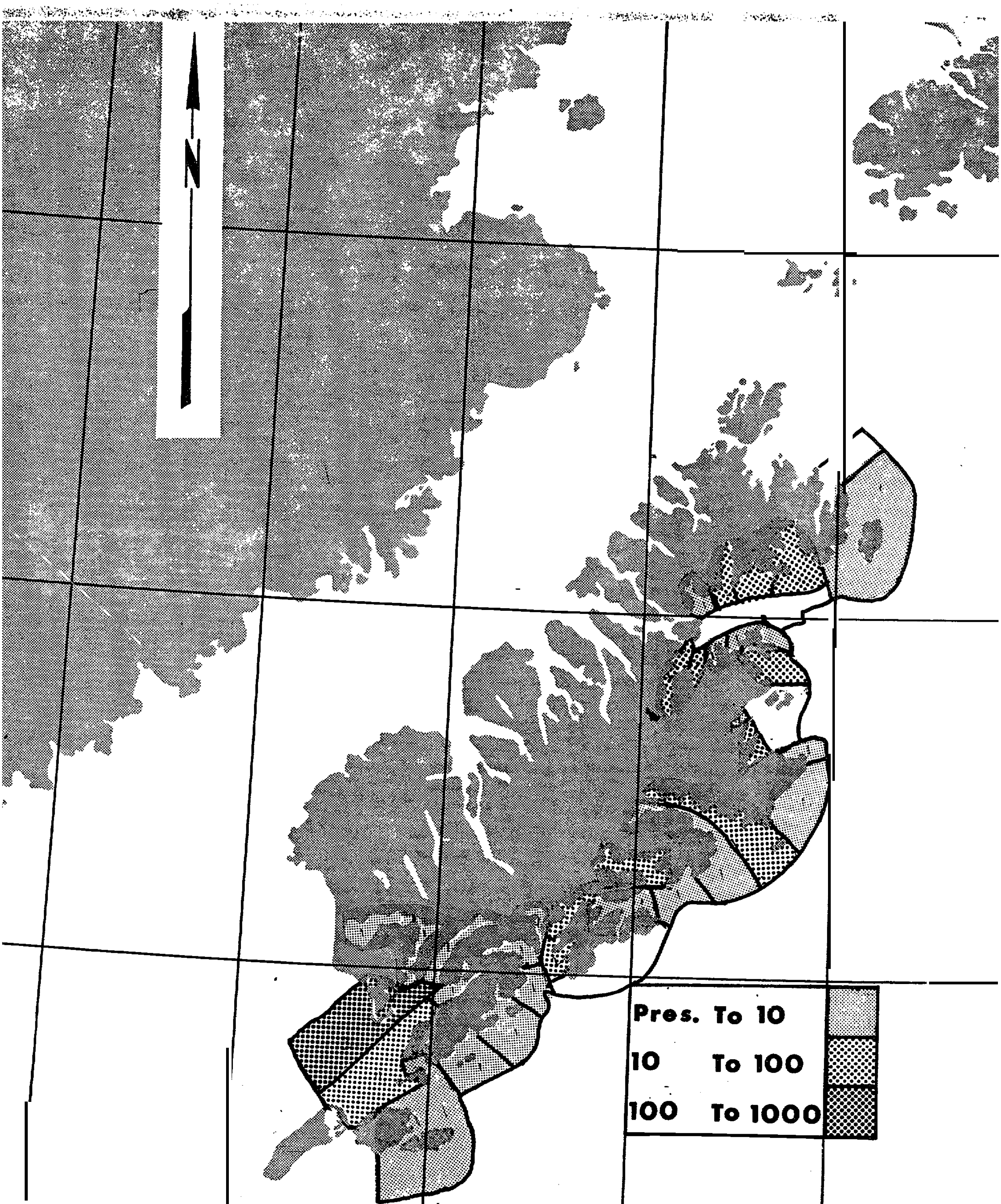

Figure 10. Mean annual king salmon catch in numbers of fish by statistical area on the east side of Kodiak for the years of 1969-1978.

Herring

The Kodiak area herring fishery has existed since 1912 with a sustained harvest reported between 1916 and 1954. Between 1934 and 1950 an average of 40,000 short tons were harvested annually. During the peak year of 1934, 120,797 short tons were processed. This fishery' occurred primarily on summer and fall herring by large seiners, but gillnets and herring pounds were also used.

Previous to the development of large processing plants for herring reduction operations, several small operators put up salted and bait herring. During the height of the fishery, herring were utilized for meal, oil, pickling, dry salting and halibut bait. Market conditions for meal and oil became unprofitable, and no herring were processed between 1960 and 1963. The Japanese market for roe herring has sparked new interest and a limited roe herring fishery has developed since 1963. Herring is also being utilized for halibut and crab bait.

During the years of high herring harvest, fishing effort encompassed the entire island. Total catches on the east side of the island between 1936-1959 exceeded 10,000 tons only in one area, south Sitkalidak Strait, and were between 1,000 - 10,000 tons in two areas, Chiniak Bay and Kiliuda Bay to north Sitkalidak (Reid, 1971).

More recently the harvest of herring has been for roe. It has been concentrated primarily on the west side of the Archipelago with herring purse seiners taking most of the catch while gillnet gear takes a small portion of the catch. Bait herring caught by trawl in winter were delivered for the first time in 1978.

There currently is a 2,400 ton area-wide quota on herring during the roe season of March 1 to June 30. Due to the erratic spawning behavior the past few years, it has not been possible to take this amount of herring in the desirable mature condition, and consequently the average harvest for the last five years has only been 424.7 tons.

Herring are found all around the North Pacific rim. In North America they have been found north as far as the Beaufort Sea and south to San Diego, California. The maximum length is 38 cm, but a 23-25 cm individual is about average and will weigh about 150 g. Few survive to the age of 9 or 10 years, but a rare individual will live for 15 years. Herring will spawn when 3-4 years old (more commonly 4 in Alaska). A female will lay 10,000 - 59,000 eggs each year depending upon age. Herring feed primarily on planktonic crustaceans (copepods and euphausiids) and are in turn fed upon by gulls, seals, sea lions, ling cod and king and silver salmon.

The time of herring spawning around the Kodiak Archipelago varies from late April until mid-July. Herring spawn in comparatively shallow water along the shore in protected bays around Kodiak and Afognak islands. Spawning probably occurs in every bay but the most important spawning bays are Perenosa, Tonki, Izhut/Kitoi, Duck, Kazakof, Afognak, Monashka, Womens, Ugak (the extreme inner portion), Shearwater, Sitkalidka Straits (both north and south), Sulua, and Moser/ Olga Bays. The females lay their eggs in rows most commonly on kelp. The males swim about among the spawning females releasing milt. The eggs are fertilized by a "hit and miss" arrangement and the waters around a spawning population will turn whitish as a result of the milt. Although Pacific herring prefer to spawn on kelp, they will spawn on just about anything when their numbers are dense. Kodiak herring commonly use eelgrass (Zostera), hair kelp (Desmarestia) and rockweed (Fucus). Macrocystis, which is responsible. for much of the roe kelp fishery in S. E. Alaska, grows only rarely in Kodiak. The eggs take from 12 to 20 days to hatch depending upon temperature and exposure, with longer exposure resulting in shorter incubation time. The most robust (heaviest) larval herring come from eggs that are exposed by the tides from 4-6 hours per day (Jones, 1972). Egg mortality may vary from 50% to 99% as a result of predation by fishes, snails, crabs and birds; and eggs in dense spawning areas may be suffocated if the mass is too thick;and exceptionally warm or cold weather or dry conditions increase mortality, and waves may cause kelp to be torn up and cast upon the beach, causing severe mortality.

The larval herring bear little resemblance to the adult. They are about 6 mm in length and are nearly transparent. Their swimming ability is feeble; therefore, this period is one of the more critical stages for the larvae. They rely upon the little remaining egg yolk for the first few days before they begin to feed on minute planktonic organisms. They are at the mercy of water currents, local food supplies and predators, such as comb jellies, arrow worms, jelly fish and others. Larval mortality may exceed 99% during this time. Optimum temperature and salinity for larval survival is 8.5° C and 17% salinity (Alderdice and Velsen, 1971) .

By early September at a size of 30 mm the larval herring begins to look like a small adult. The juveniles then move in large schools and frequent kelp beds. By late fall they move into deep or offshore waters (ADF&G, 1978).

Halibut

The halibut catch has been widely distributed throughout the lease area and a large share of the shelf on the east side of Kodiak Island is considered to be a major fishing ground (IPHC, 1978a, Figure 2) . There has been a seasonal trend in the location of the fishing activity. As halibut migrate from deeper water in winter to shallow water in summer, the fishery follows. In the early season, about May, the fishery is most active in deeper areas and in midsummer some of the activity is as shallow as 10 fm. Some of the fishermen have reported that halibut seem to follow the salmon into the bays and halibut have been found with salmon in their stomachs (R. Myhre, personal communication) .

The halibut fishery has a long history of consistent production, but it declined in the last decade. The total annual catch reached 69 million pounds in 1915 and fell to 44 million pounds in 1931. Thereafter, the annual catch generally increased and exceeded 70 million pounds in 1962 but fell below 25 million pounds in 1974 (IPHC, 1978a). Incidental catch of juvenile halibut by foreign trawlers was identified as part of the cause of the recent decline. The halibut commission has conducted surveys of the abundance of juvenile halibut in the Bering Sea and Gulf of Alaska. In the Bering Sea the abundance of juveniles declined from about 45 per hour of trawling in 1963 to less than 5 in 1972, and it has since increased to nearly 20 in 1977. In the Gulf of Alaska a similar catch rate in 1963 declined to about 20 per hour in 1975-76 and increased somewhat in 1977 (IPHC, 1978b). Since there is wide migration, the abundance of juveniles in the Bering Sea directly affects abundance of adult halibut in the Kodiak area several years later. The outlook is, therefore, for increased catches in the 1980's but not as great as historic levels (IPHC, 1978b).

"Mature halibut concentrate on spawning grounds along the edge of the continental shelf at depths from 182 m to 455 m during November to March. Major spawning sites in the vicinity of Kodiak include Portlock Banks and Chirikof Island. In addition to these major spawning grounds, there is reason to believe that spawning is widespread and occurs in many areas, although not in concentrations as dense as those mentioned above. Evidence to support this conclusion is based on the widespread distribution of mature halibut during the winter months as indicated by research and commercial fishing (IPHC, 1978a).

Spawning of halibut on the Cape St. James spawning ground occurs from December through March with a peak in mid-January (Van Cleve and Seymour, 1953).

Bottomfish

The bottomfish fishery has been dominated by foreign fleets, primarily Japan and U.S.S.R. These fisheries have been generally most active along the Continental Shelf edge. Ronholt et al. (1978) presented a detailed discussion of this fishery. The Japanese catches during 1969-74 were Pacific Ocean Perch (45%), sablefish (27%), pollock (15%) and arrowtooth flounder (3%) (Ronholt et al., 1978).

The domestic bottomfish fishery has been expanding in recent years, and it has targeted upon pollock and Pacific cod. This fishery has occurred primarily in the south Sitkalidak Straits - Two Headed Island area, outer Barnabas trough and in Shelikof Strait.

STUDY AREA

The Kodiak Archipelago lies just off the northwestern perimeter of the Gulf of Alaska and is an extension of the Kenai Peninsula. Most of the islands are mountainous terrain, surrounded by numerous estuarine bays and rugged coast.

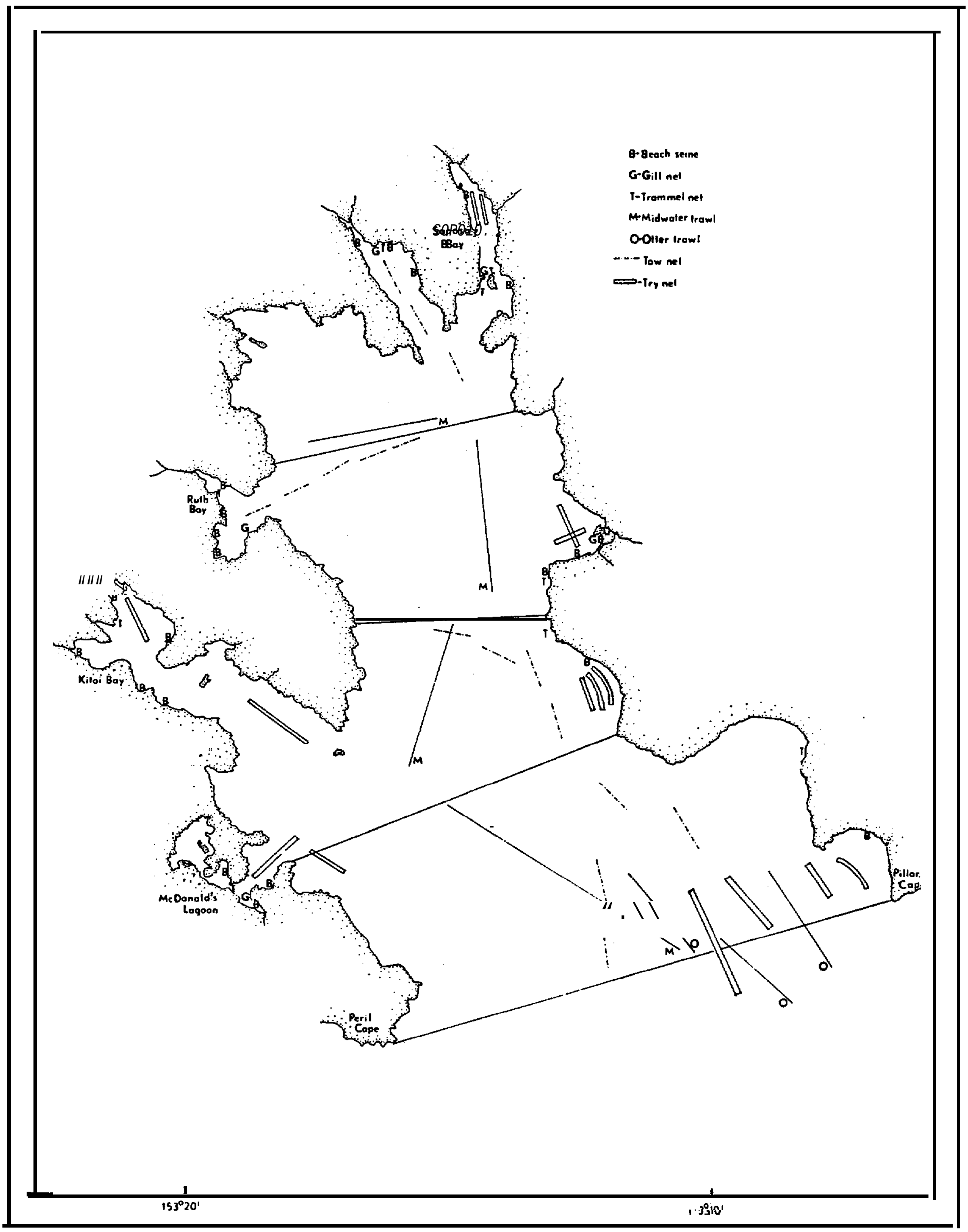

Figure 11A. Izhut Bay sampling region with sampling strata and station locations by gear type, 1978-79.

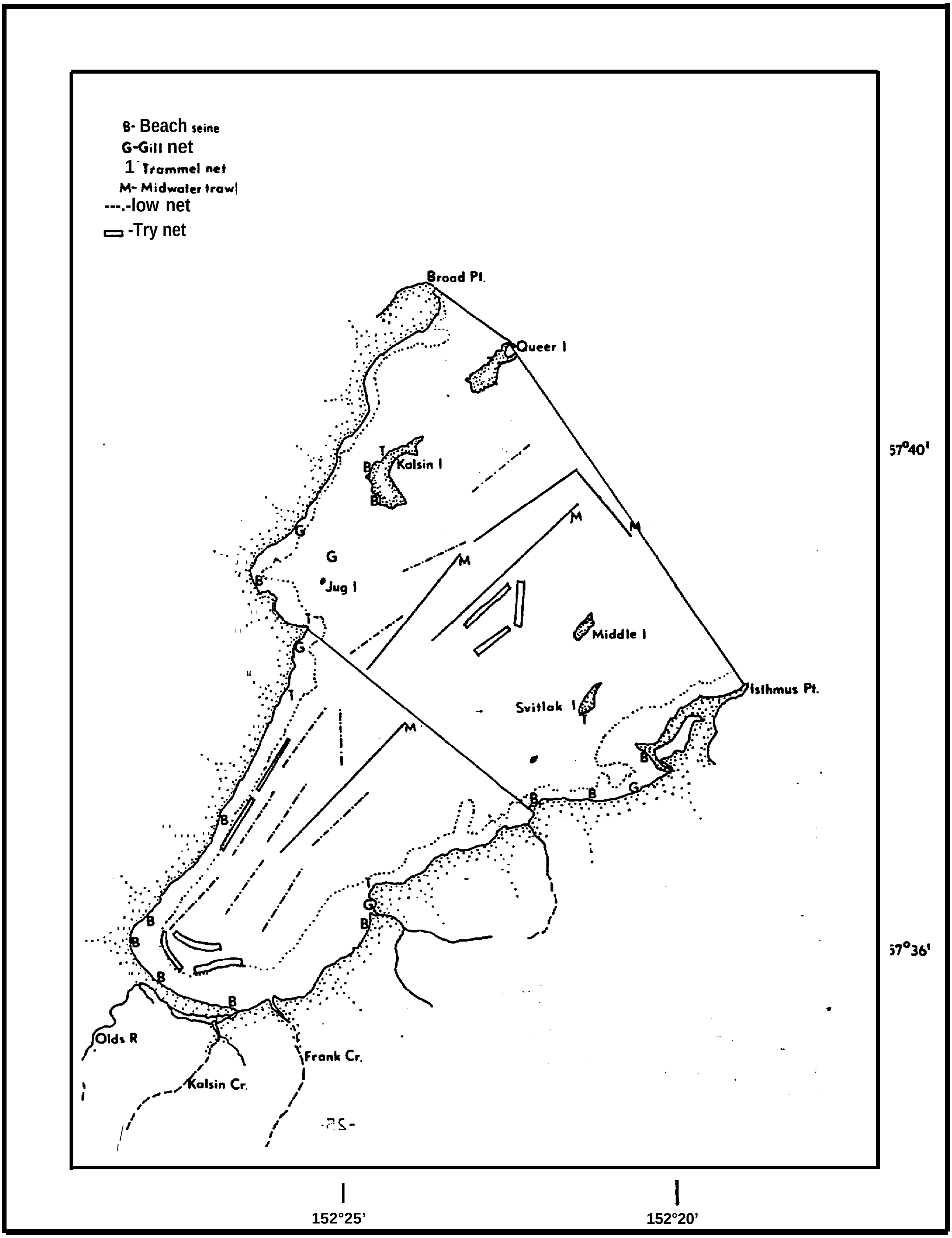

Figure 11B. **Kalsin Bay sampling region with sampling strata and station locations by gear type, 1978-79.**

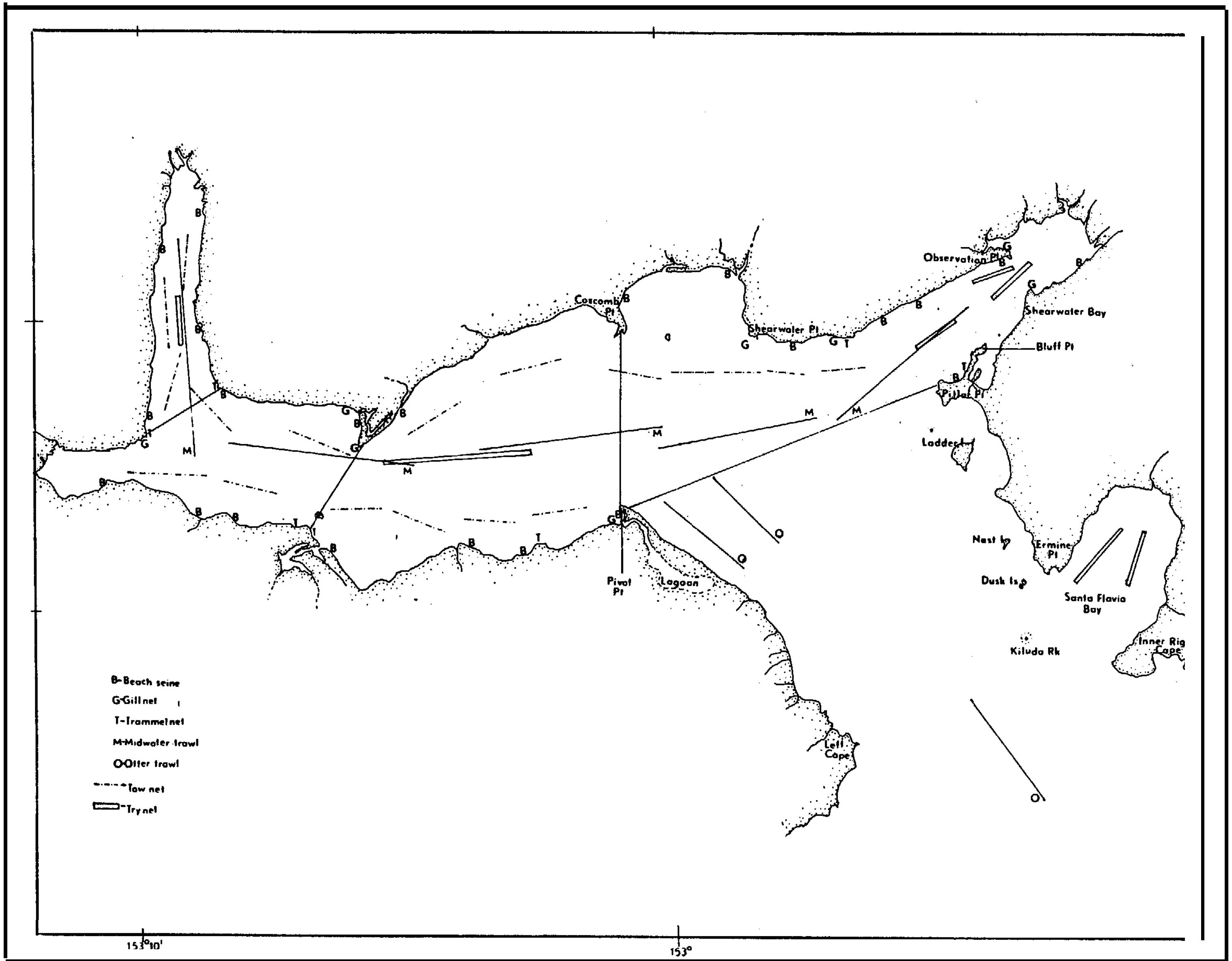

Figure 11C. Kiliuda Bay sampling region with sampling strata and station locations by gear type, 1978-79.

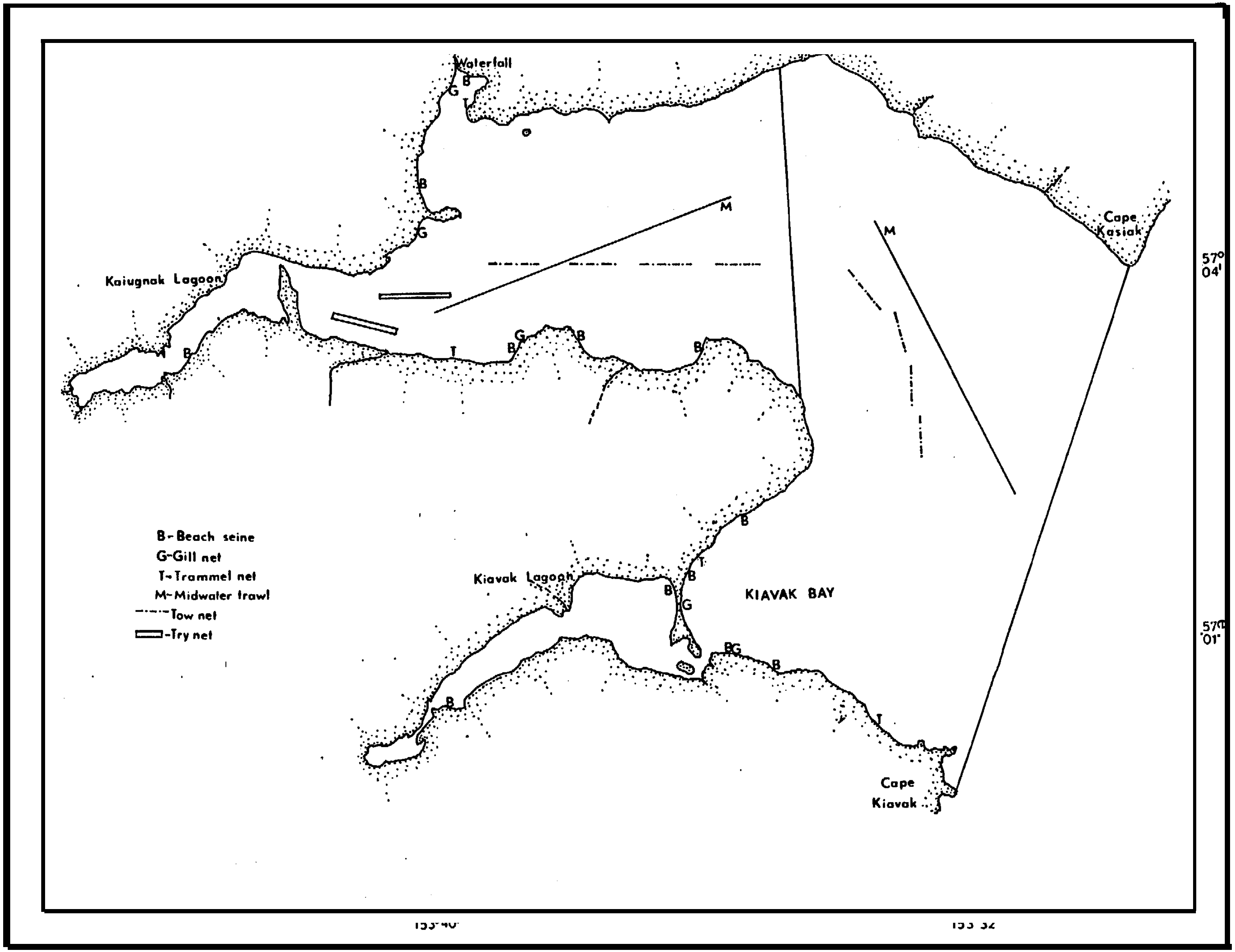

Figure 11D. Kaiugnak Bay sampling region with sampling strata and station locations by gear type, 1978-79.

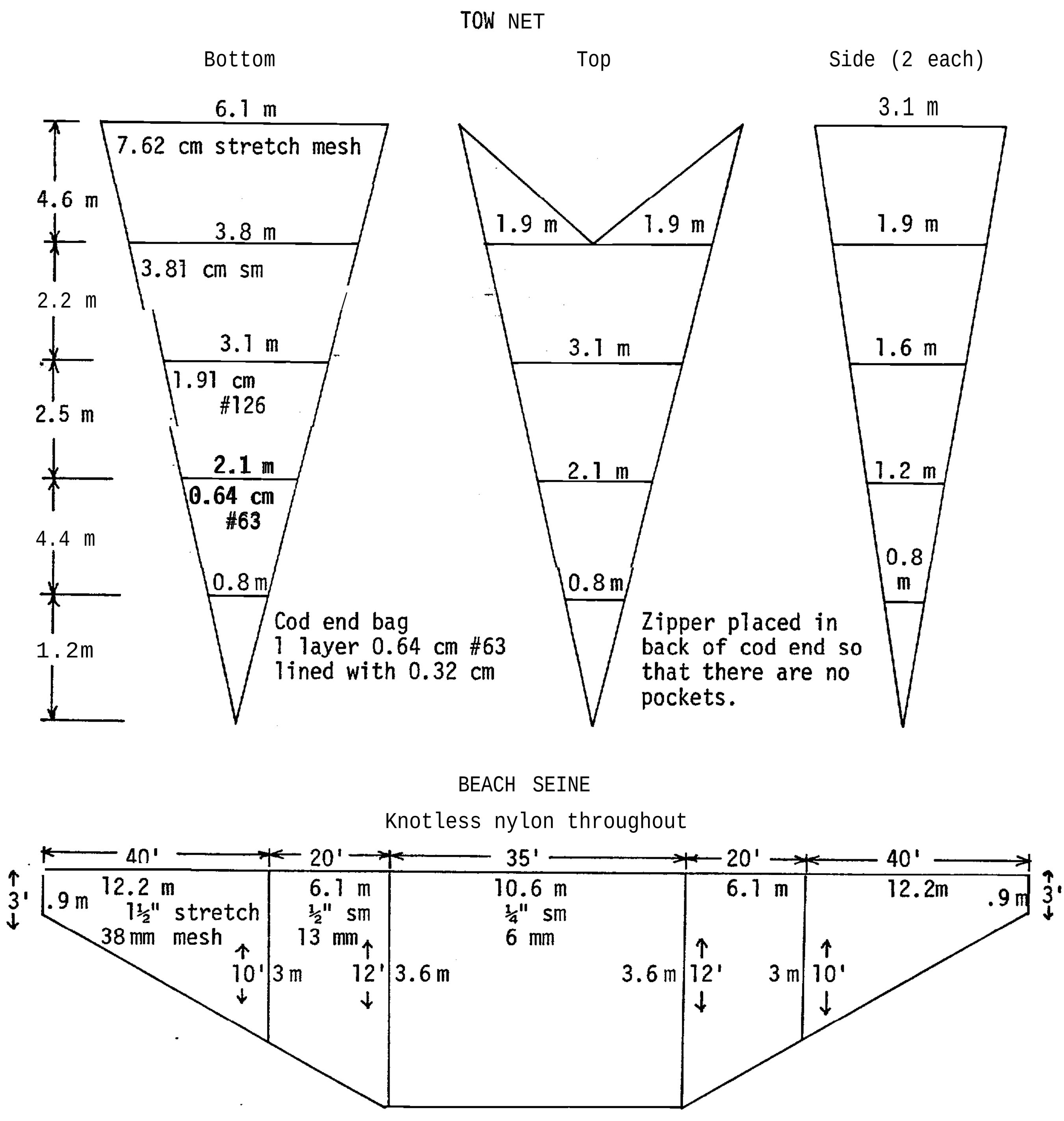

Figure 12. Specifications of the tow net and beach seine, diagrammatically shown.

The broad shelf on the east side of the island is 50 to 100 fathoms deep in most areas. Even along the shore very little area is less than 50 fathoms deep. Weak and variable currents are found over the Continental Shelf, while the much stronger Alaskan Current is concentrated along the shelf edge (sAI, 1979). Areas of fresh water influence occur mainly in the local coastal waters.

This study was conducted in four bays on the east side of the Kodiak Archipelago. The bays, Izhut, Kalsin, Kiliuda, and Kaiugnak, were deemed representative of the area and were considered logistically suitable.

Izhut Bay has steep rocky shores and cobble beaches exposed to surf with extensive kelp beds and little intertidal area. The bay is predominantly 50-115 fathoms deep with a trough extending to just past Ruth Bay where the bottom shoals sharply to a small area around the shoreline less than 10 fm deep. Five small, shallow enclosed inlets can be found around Izhut Bay, one of which, Saposa Bay, is about 10 fm deep with a 3 to 4 fm sill at its mouth. No other sills occur in Izhut Bay.

Kalsin Bay exhibits a large sandy shoreline with intermittent rocky outcrops. Two major creeks flow into the head of the bay. The mouth of the bay has numerous islands and submarine reefs that extend almost into the middle of the bay and at low tide considerable intertidal areas are exposed. About half of the bay is sandy bottomed and shallow (11-44 fro), the remainder is 10 fm or less.

Kiliuda Bay is relatively shallow (12-48 fm) with a 16 fm deep sill in the outer-mid region which isolates a 58 fm mud bottom hole in the middle of the bay from the 57 fm deep outer bay. Most of the shoreline is protected sandy beach with small islands, reefs and rocky outcropping occurring at the mouth. There are numerous small lagoons and one small estuary. Kiliuda receives a considerable quantity of melt water runoff.

Kaiugnak Bay is similar to Izhut in its exposed rocky shoreline, but has small sand bights and two large lagoons with dense eelgrass beds located at the head of Kaiugnak and Kiavak Bays. Several reefs occur near both the northern shore and the head of the bay. Moderate portions of the bay are 10 fm or less in depth, while most of the bottom is precipitous, resulting in depths ranging from 13-62 fathoms.

SOURCES, METHODS AND RATIONALE OF DATA COLLECTION

Kalsin and Kaiugnak Bays were each divided into two regions and Izhut and Kiliuda into four regions. The intention was to sample each approximately equal sized region with about the same number of hauls of each gear. Izhut and Kiliuda Bays are much larger than Kalsin and Kaiugnak Bays. The otter trawl was used only in outer Izhut and outer Kiliuda Bays to sample depths and areas that were intermediate between the nearshore zone sampled with the other gear and the offshore zone sampled by previous surveys. The otter trawl was added as an afterthought by the contractor on the advice of program reviewers. Local conditions dictated minor variations from this scheme; for example, there was very little bottom in Kaiugnak Bay on which try netting was possible. The sampling locations are illustrated in Figure 11.

The sampling gears employed were beach seine, gill net, trammel net, tow net, try net and otter trawl. These are described in detail below. A midwater trawl was unsuccessfully used and results are not presented. Surface temperature and salinity were measured with a Yellow Springs Instrument Co., Model 33 Temperature/Salinity Meter.

Sampling was conducted during- April, May, June, July, August and November of 1978 and March of 1979. During the first five cruises, Kalsin Bay was sampled from the 1st to 7th, Izhut from the 8th to 15th, Kiliuda from the 16th to 23rd, and Kaiugnak from the 24th through the end of the month. During November and March, the sequence did not change, but the time of month varied. The basic sampling crew consisted of four. people, two from the University of Washington (U of W) representing Research Unit 553, and two from the Alaska Department of Fish and Game (ADF&G). These four people worked together to accomplish the objectives of the two different projects. The U of W was responsible for determining food habits of the fishes captured. A representative from the University of Alaska, Institute of Marine Science (IMS) representing Research Unit 5, was present during sampling in Izhut and Kiliuda Bays to take stomachs of crabs for food habits studies. When the sampling designed for this study provided insufficient crabs for R. U. 5, additional effort was devoted to collecting crabs. The fish catch of these samples was not enumerated; however, stomachs were occasionally taken for food habits analysis. A representative of National Marine Fisheries Service (NMFS), representing Research Unit 332, was present during several of the summer cruises to study pathology of fish, crab and shrimp.

During the months of April through August, the sampling crew lived aboard and worked from the chartered vessel M/V YANKEE CLIPPER, which was 65 ft. (19.8 m) long and had a relatively large unobstructed aft deck. A 19 ft. (5.7 m) Boston Whaler with a 70 hp outboard was stored on deck when traveling and was used to pull one side of the tow net and conduct other sampling. A 14 ft (4.3 m) aluminum skiff was sometimes used for beach seining. The R/V COMMANDO was made available one or two days per month in both Izhut and Kiliuda Bays for otter trawling. During November and March the crew lived aboard and worked from the R/V COMMANDO, which was also used for plankton sampling.

Beach Seine

The beach seine was constructed as shown in Figure 12. Approximately 50 ft. (15 m) lines of rope with anchors were attached to each end. The net was set in an arc such that each end of the net was usually within 10 ft. (3 m) of the beach and the net was immediately retrieved. Each set covered approximately 370 m^2. Sampling stations were informally selected on suitable beaches so as to evenly cover the study area. Once stations were selected, they were visited on each successive cruise.

Sampling was conducted during the day. Depth sampled did not exceed the depth of the net, 3.7m (12 ft.)

Gill Net

Gill nets were 6 ft. (1.8 m) deep and 100 ft. (30.4 m) long and each consisted of 25 ft. (7.6 m) long panels of 1",1½", 2" and 2½" (2?5 mm, 38 mm, 51 mm, and 64 mm) stretch mesh knotted nylon. The nets were hung to float, were anchored at selected locations and retrieved after a 2.5 hour soak. They were placed near shore much as were the trammel nets and were fished only during the day. Depths' fished were estimated and ranged from 2 m to 20 m with 62% of the sets at less than 7 m and 83% of the sets at less than 10 m.

Trammel Net

The trammel nets were constructed of three adjacent panels (two outer and one inner) each 150 ft. (45.7 m) by 6 ft. (1.8 m). The two outer panels were made with 20" (0.5 m) stretch mesh of #9 twine 8 mesh deep by 68 mesh long. The single inner panel was 2" (51 mm) stretch mesh of #139 twine, 68 mesh deep by 2016 mesh long. All panels were white knotted nylon. The lead line was 75 lb. lead core rope and the floatline was 1/2" (13 mm) polyfoam core line.

The trammel nets were hung to sink and were fished on the bottom. Two nets were fastened together; one end was fastened on the beach and the other end was anchored offshore, with the set perpendicular to the beach. Sets were generally 2.5 hours long and during the day. Depths fished were estimated and ranged from 2 m to 20 m with 14% of the sets at 2 to 3 m, 60% of the sets at less than 7 m and 80% of the sets at less than 10 m.

Tow Net

The tow net was constructed as illustrated in Figure 12. It was held open vertically by spreader bars of 2" (51 mm) galvanized steel pipe and was held open horizontally by a towing vessel on each side. It opened approximately 10 ft. (3 m) vertically and 20 ft. (6.1 m) horizontally when fishing. It was towed at the surface between a skiff and the charter vessel on approximately 100 ft. (30.4 m) of line for 10 minutes at approximately 3.5 kph so that about 0.6 km were covered *in* one tow or 0.0036 km. Vessel speed and distance covered *were* estimated by eye. Depths at locations fished ranged from 14 m to 183 m with 1% of the hauls in water less than 20 m deep, 35% of the hauls in water less than 40 m deep, 62% of the hauls in water less than 60 m deep, 78% of the hauls in water less than 80 m deep and 93% of the hauls in water less than 100 m deep. All sampling was conducted during daylight.

Try Net

The try net was a standard 20 ft. (6.1 m) try net purchased from McNeir Net and Supply Co. It had a 22 ft. (7 m) footrope, a 20 ft.

(6.1 m) headrope, and was made with 1-1/2" (38 mm) #9 webbing throughout with a 1-1/2" (38 mm) #18 bag and was dipped in green gard. Otter boards were 15" x 30" (38 cm x 76 cm). It was equipped with a tickler of 3/8" (9.5 mm) chain which was slightly shorter than the footrope so that it preceeded the footrope when the net was in operation. It was pulled at about 3.5 kph so that about 0.6 km were covered in one tow. The net was considered to open about 5.3 m horizontally and 0.7 m vertically so that one tow covered about 3200 m of bottom. Sampling stations were selected in the field. Vessel speed and distance covered were estimated by eye. Depths fished ranged from 8 m to 81 m with 32% of the hauls at less than 20 m, 69% of the hauls at less than 30 m, 86% of the hauls at less than 40 m, and 96% of the hauls at less than 50 m.

Otter Trawl

Sampling was conducted with a 400 mesh eastern otter trawl with a 30 m footrope and 27 m headrope. It was 26 m in total length, with a 4 m long cod end. The net was constructed with 4 inch mesh at the mouth and 3-1/2 inch mesh in the body and cod end and had a 1-1/4 inch mesh cod end liner. There were 15 floats 20 cm in diameter on the headrope, and no tickler or rollers. The bridles were 9 m long and the doors were 2.7 m (9 ft.) by 1.8 m (7 ft.) Astoria V design. This net is considered to open 1.5 m high by 12.2 m wide. The net was pulled with a 3 to 1 scope for 1 nautical mile (1.85 km), and 0.02261 km were covered in each haul. The data are reported in catch per km however. Stations were chosen at depths of approximately 30 fm, 40 fm and 50 fm in Izhut and Kiliuda bays. Distance covered was measured by Loran C. Depths trawled ranged from 43 to 110 m with 53% of the hauls between 70 and 89 m and 85% of the hauls between 60 m and 99 m.

Sample Handling

Immediately after capture, catches were sorted to species when possible, counted, weighed and recorded. Life history stage was recorded when it was possible to determine;and for some species the catches were sorted by life history state, i.e. adult, juvenile and larval. Length frequencies were taken. Samples were taken for food habits analysis by R.U. 553. The stomachs were removed from large fish after they were weighed, measured and the data recorded. Small fish were preserved whole for food habit analysis and in some cases lengths of these fishes were not taken in the field. Lengths were recorded from the majority of fish that were not used for food habit analysis. Catches of the otter trawl were subsampled before sorting was initiated,and some specimens were taken for food habit analysis from the unsorted portion of the catch.

Sorting of beach seine, trammel net and gill net catches was occassionaly delayed for several hours after capture. When this occurred, specimens were injected with 10% formaldehyde solution to arrest digestion if they were to be kept for food habit analysis.

Stages of Maturity

Sexual maturity was determined according to the following National Oceanographic Data Center (NODC) Sex Maturity Codes:

Immature - Gonads small (barely determine sex), apparently has not spawned for the first time.

Maturing - Ovaries small to large, eggs all opaque or mixture of opaque and transparent eggs or mostly transparent eggs, testes swelling.

Spawning - Eggs and milt running.

Spent - Ovaries and testes flacid.

Sexually inactive - Adults with gonads firm and shaped.

These descriptions were inadequate. Small gonads may be found in immature, maturing and sexually inactive fish. These stages appear differently in different species of fish and without descriptions of the sexual cycle, staging of fish with these criteria was subjective, with the exception of the spawning category. Fish with freely flowing eggs or milt are distinctive. Fish with fully developed ovaries or testes which are not yet running are also distinctive, but the criteria above do not distinguish them from early maturing fish.

The personnel that made the sexual maturity determinations were inexperienced at the outset of the project, but one person was involved with the entire collection of data so there was some continuity of classification.

The results should be considered with the above qualifications in mind.

Sample Analysis

All species identified are listed, with their scientific names, in Table 2. The tables presenting catch per unit of effort for each gear contain every taxomonic group captured while those tables presenting relative abundance for each gear contain only those taxa comprising more than a trace (more than 0.05% of total) of the seven month mean.

The number of individuals captured is presented from beach seine, gill net, trammel net and surface tow net. Weight of individuals caught is presented for the try net and otter trawl. Weight has been used to report the results of trawl effort by other investigators (Hughes and Alton 1974, Ronholt et.al., 1978), thus its use here serves to make results comparable. Many of the fish caught by the beach seine and surface-tow net were too small to be appropriately represented in terms of weight, given the accuracy attainable in the field.

All lengths measured were fork lengths. All age references are based on length frequency interpretations.

Area Comparisons

Dendrograms of percent similarity of the 12 subareas were constructed for each gear. The first step was converting the mean catch in numbers for all cruises to percent composition by subareas. Then, the percent composition figures were compared, each area with all other areas, one at a time in the following manner. For a given gear, two areas were compared by summing the smaller percent composition for each species.

This procedure resulted in 66 numbers, each representing percent similarity between two subareas. "From these, the largest number was found and the two areas which had yielded that number were combined. This formed the first junction of two areas in the dendrogram. A percent similarity was then generated for this new group of areas with" each other area by calculating weighted means of the uncombined values. The weighting was based on the number of areas which were in each group so that recalculated percent similarities were always simple means of the original percent similarities.

Once the new table of percent similarities was completed, the largest number was again chosen and the above process was repeated until all areas had been combined.

Diversity

All diversities were calculated using Shannon diversity and were divided by total catch to standardize the resulting diversities. Such an approach yields values commonly termed diversity per individual (Clifford and Stephenson, 1975). The basic formula for this measure is:

$$\text{Diversity} = \frac{1}{N} (N \text{ Log } N - \Sigma\, n \log n)$$

Diversity was partitioned to within-area and between-area components, within species and between species components, total diversity and interaction (Clifford and Stephenson, 1975). For a given gear, the diversity within areas is the species diversity of each subarea (12 . separate values) while the diversity between areas is calculated using total catch in each of the 12 subareas (this is the diversity of the 12 subareas ignoring species). For a given gear the within-species diversity was calculated for each species using its catch in each of the 12 subareas, while the between-species diversity was calculated using species totals for all 12 subareas. For a given gear the total diversity was calculated using every number in the table (every species in every area but no totals). The interaction was calculated by summing the diversity between species and the diversity between areas and subtracting total diversity.

The basic tables upon which this diversity partitioning was per formed were summaries of mean catch in numbers of individuals per set or haul by subarea and taxon for all cruises combined for each gear and are presented in their entirety as Appendix Tables.

Pielou (1972 and 1977) proposed a method of calculating niche width and niche overlap from diversities partitioned as these were. In the terms presented above, niche width was calculated by' subtracting between-species diversity from total diversity and dividing the result by between-area diversity. This is essentially a weighted mean of the within-species diversities. The niche overlap was calculated by subtracting between-area diversity from total diversity and dividing the result by the between species diversity.

Species Associations

The same tables that were used for diversity calculations were used for species association analyses. The measure of association that was used was the correlation coefficient from linear regression. This measure has several advantages. It is commonly used for other purposes and thus is easily understood by many, it is directly relatable to a probability of significance, the resulting value is the same regardless of the choice of which species is x and which is y, and it ranges from -1 to +1 indicating both positive and negative association. Dendrograms were constructed in the same manner as described for percent similarities.

Note that species distinctions made in the field were maintained in this analysis. Several species of *Myoxocephalus* as well as terpug (Hexagrammidae) occur in the analysis but nowhere else in this report.

Data Limitations

The community of fishes observed during faunal surveys and the relative importance of species or species groups within the community is largely a function of the sampling tools employed. Try nets, otter trawls, beach seines, tow nets and especially trammel nets and gill nets are selective. Sizes and even species of fish captured are influenced by such features as mesh size used, gear configuration, towing speed and method of employment (beach seine may be set far from the beach and pulled to shore or set with the ends nearly ashore, as it was in this study). Passive gear such as the trammel net and gill net depends upon the activity of the fish to become entangled, and catches are affected by the sensitivity of the fish to the presence of the net, body size and shape, presence of spines, behavior and other features. Even species within the size range which theoretically would be retained if engulfed by a towed net may differ in their ability to avoid the mouth of the net. The selective feature of all gears thus alters the species composition and sizes and quantities of species captured from that which occur in its path. The degree to which "apparent" distribution and relative abundance differs from the actual is unknown. Thus, it is important to note that subsequent discussions of distribution and relative abundance of species reflect the results obtained with the sampling gear employed.

The beach seine and tow net each yielded large numbers of age O fish, including larval, post larval and early juvenile stages. The early stages were difficult to identify and too numerous for field crews to include in the data. However, samples were routinely taken, identifications made and estimates of abundance (1, 10, 100 or 1,000) entered in the data.

[1]This section is adapted from a similar discussion for trawls by Alverson et al. (1964).

RESULTS

Identified in this study on the east side of Kodiak were 22 families and 89 species of fish (Table 2). Three of the records constitute range extensions. One longfin gunnel was collected and the identity confirmed by Norman Wilimovsky. This constitutes an extension of the known range from British Columbia and is the first Alaskan record of this species. A modest number of warthead sculpins were captured, and these have not been reported south of the Bering Sea in Alaska. One longnose skate was reported; its identity was not confirmed with a specimen, however. This record constitutes an extension of the range from Southeast Alaska.

There were two species captured that were previously undescribed and remain undescribed, one Myoxocephalus and one Bathymaster. There were four species captured that are recorded in Kodiak only by Harris and Hartt (1977). These were the tube-snout, the plain sculpin, manacled sculpin and Bering poacher. Four species that were captured have a range limit at Kodiak. The slim sculpin, buffalo sculpin and penpoint gunnel are known to occur from Kodiak to the east, and the scissortail sculpin is recorded from Kodiak to the west.

At the beginning of this study considerable confusion existed in the taxonomy of Myoxocephalus and Gymnocanthus, which was partially clarified during the study. Myoxocephalus were found to consist of four types. The great sculpin, which was abundant in the extreme nearshore zone (at beach seine depth); the plain sculpin, which was common just off the beaches beyond beach seine depth; the warthead sculpin, which was less common and also occurred at try net depth and beyond; and an undescribed species of which 2 or 3 specimens were captured. Further changes seem likely as more collections are examined. The Gymnocanthus were identified as armorhead and threaded sculpin on the basis of total fin ray counts of both dorsal, anal, and both pectorals; the threaded sculpin had less than 82 and the armorhead sculpin more than 82 rays. Once the fish are separated thus, consistent differences in body shape, coloration and distribution are apparent. Unfortunately, separation within Myoxocephalus and Gymnocanthus was not consistent through this study.

Some problems were also encountered with the sea poacher genus Occella. Between lower Cook Inlet (Blackburn et al., 1979) and Kodiak (this study) two types of Occella were encountered that could not be separated by existing fish identification guides. Based on drawings only, the Cook Inlet specimens were identified as warty poacher and the Kodiak specimens as Bering poacher. It is possible that both types occurred in Kodiak but were not noticed since they are very similar. The existing distribution information indicates the warty poacher occurs as far north as Shelikof Bay in Southeast Alaska (Gruchy, 1970) and Hart (1973) contains an incorrect citation indicating this species has been reported in Bristol Bay. The Bering poacher has been reported south of the Bering Sea by Phinney (1972) in Chignik Bay and by Harris and Hartt (1977) who found it near Kodiak.

Table 2. Fish species captured on the east side of Kodiak during sampling in April through August and November, 1978 and in March, 1979 and gear in which they were captured. B = Beach Seine, G = Gill Net, T = Trammel Net, TN = Tow Net, TY = Try Net and OT = Otter Trawl.

Squalidae		
Spiny dogfish	*Squalus acanthias*	OT
Rajidae		
Big skate	*Raja binoculata*	OT
Longnose skate	*Raja rhina*	OT
Clupeidae		
Pacific herring	*Clupea harengus pallasii*	B,G,T,TY,OT
Salmonidae		
Pink salmon	*Oncorhynchus gorbuscha*	B,G,T,TN
Chum salmon	*Oncorhynchus keta*	B,G,TN
Coho salmon	*Oncorhynchus kisutch*	B,G
Sockeye salmon	*Oncorhynchus nerka*	G
Dolly Varden	*Salvelinus malma*	B,G,T
Osmeridae		
Surf smelt	*Hypomesus pretiosus*	B,G
Cape lin	*Mallotus villosus*	B,G,TN,TY,OT
Eulachon	*Thaleichthys pacificus*	OT
Gadidae		
Pacific cod	*Gadus macrocephalus*	B,G,T,TN,TY,OT
Pacific tomcod	*Microgadus proximus*	B,G,T,TY,OT
Walleye pollock	*Theragra chalcogramma*	B,G,T,TY,OT
Zoarcidae		
Shortfin eelpout	*Lycodes brevipes*	TY,OT
Wattled eelpout	*Lycodes palearis*	OT
Gasterosteidae		
Threespine sticklebacks	*Gasterosteus aculeatus*	B,TN
Tube-snout	*Aulorhynchus flavidus*	B
Scorpaenidae		
Dusky rockfish	*Sebastes ciliatus*	G,T,TY
Darkblotched rockfish	*Sebastes crameri*	OT
Black rockfish	*Sebastes melanops*	G,T

Table 2. (continued)

Hexagrammidae		
Kelp greenling	*Hexagrammos decagrammus*	B,T,TN,TY,OT
Rock greenling	*Hexagrammos lagocephalus*	B,G,T,TY,OT
Masked greenling	*Hexagrammos octogrammus*	B,G,T,TY,OT
Whitespotted greenling	*Hexagrammos stelleri*	B,G,T,TN,TY,OT
Lingcod	*Ophiodon elongatus*	B,TN,TY,OT
Anoplopomatidae		
Sablefish	*Anoplopoma fimbria*	TY, OT
Cottidae		
Padded sculpin	*Artedius fenestralis*	B,TY
Crested sculpin	*Blepsias bilobus*	T,TY
Silverspotted sculpin	*Blepsias cirrhosus*	B,T,TN,TY
Sharpnose sculpin	*Clinocottus acuticeps*	B
Spinyhead sculpin	*Dasycottus setiger*	TY, OT
Buffalo sculpin	*Enophrys bison*	B,T,TY
Antlered sculpin	*Enophrys diceraus*	
Armorhead sculpin	*Gymnocanthus galeatus*	T,TY,OT
Threaded sculpin	*Gymnocanthus pistilliger*	T,TY,OT
Red Irish Lord	*Hemilepidotus hemilepidotus*	B,T,TY,OT
Yellow Irish Lord	*Hemilepidotus jordani*	B,T,TY,OT
Bigmouth sculpin	*Hemitripterus bolini*	TY, OT
Northern sculpin	*Icelinus borealis*	TY, OT
Pacific staghorn sculpin	*Leptocottus armatus*	B,G,T,TY,OT
Plain sculpin	*Myoxocephalus jaok.*	B,T,TY,OT
Warthead sculpin	*M. niger*	1
Great sculpin	*M. polyacanthocephalus*	B,G,T,TY,OT
Sailfin sculpin	*Nautichthys oculofasciatus*	T,TY
Tidepool sculpin	*Oligocottus maculosus*	B
Slim sculpin	*Radulinus asprellus*	TY
Manacled sculpin	*Synchirus gilli*	B
Scissortail sculpin	*Triglops forficata*	TY
Roughspine sculpin	*Triglops macellus*	TY
Ribbed sculpin	*Triglops pingelii*	TY, OT
Tadpole sculpin	*Psychrolutes paradoxus*	TN
Agonidae		
Smooth alligatorfish	*Anoplagonus inermis*	TY, OT
Sturgeon poacher	*Agonus acipenserinus*	T,TY,OT
Bering poacher	*Occella dodecaedron*	TY
Tubenose poacher	*Pallasina barbata*	B,TN,TY
Cyclopteridae		
Spotted snailfish	*Liparis callyodon*	B
Marbled snailfish	*Liparis dennyi*	TY

Table 2. (continued)

Trichodontidae		
Pacific sandfish	*Trichodon trichodon*	B,TY,OT
Bathymasteridae		
Alaskan ronquil	*Bathymaster caeruleofasciatus*	T
Searcher	*Bathymaster signatus*	B,T,TY,OT
Northern ronquil	*Ronquilus jordani*	OT
Anarhichadidae		
Wolf eel	*Anarrhichthys ocellatus*	T
Stichaeidae		
High cockscomb	*Anoplarchus purpurescens*	B,TY
Snake prickleback	*Lumpenus sagitta*	B,G,TY,OT
Daubed shanny	*Lumpenus maculatus*	TY,OT
Stout eelblenny	*Lumpenus medius*	TY,OT
Whitebarred blenny	*Poroclinus rothrocki*	B,OT
Arctic shanny	*Stichaeus punctatus*	B,TY
Cryptacanthodidae		
Giant wrymouth	*Delolepis gigantea*	2
Dwarf wrymouth	*Lyconectes aleutensis*	2
Pholididae		
Penpoint gunnel	*Apodichthys flavidus*	B
Longfin gunnel	*Pholis clemensi*	TY
Crescent gunnel	*Pholis laeta*	B,TY
Zaproridae		
Prowfish	*Zaprora silenus*	B,TN
Ammodytidae		
Pacific sand lance	*Ammodytes hexapterus*	B,TN
Pleuronectidae		
Arrowtooth flounder	*Atheresthes stomias*	TY, OT
Rex sole	*Glyptocephalus zachirus*	TY, OT
Flathead sole	*Hippoglossoides elassodon*	T,TY,OT
Butter sole	*Isopsetta isolepis*	B,TY,OT
Rock sole	*Lepidopsetta bilineata*	B,T,TY,OT
Yellowfin sole	*Limanda aspera*	B,T,TY,OT
Dover sole	*Microstomus pacificus*	TY,OT
English sole	*Parophrys vetulus*	B,TY,OT
Starry flounder	*Platichthys stellatus*	B,G,T,TY,OT
Alaska plaice	*Pleuronectes quadrituberculatus*	B,TY
Sand sole	*Psettichthys melanostictus*	B,TY,OT
Pacific halibut	*Hippoglossus stenolepis*	B,T,TY,OT

[1]Specimen identified, gear not recorded.
[2]Larvae captured in tow net.

Some confusion also exists in the genus *Hexagrammos*. We report four species. Rock greenling and terpug were separated in the field, based on the length of a pair of cirri on the head, at the urging of field personnel from the University of Washington. At the end of the study none of the field crew believed that the separation was valid, and further work has shown that male and female rock greenling are very different which appears to account for the separation. Data on terpug have been combined with that on rock greenling.

Relative Abundance

The numerically predominant taxa in the beach seine catches in order of greatest abundance were Pacific sand lance, juvenile pink salmon, juvenile *Myoxocephalus* sculpins, juvenile chum salmon, juvenile Pacific cod, masked greenling and whitespotted greenling (Table 3). A considerable share of the beach seine catches were larvae, primarily *Myoxocephalus* sp. larvae in March; April, May and June, capelin larvae in November and Pacific sandfish larvae in March 1979.

When ranked by biomass the beach seine catches appear quite different. The beach seine catches by weight were 74% pink salmon, 15% sandlance, 3.3% Dolly Varden, 1.9% *Myoxocephalus* spp. and 1.0% masked greenling.

The numerically predominant taxa in the gill net catches in order of greatest abundance were Pacific herring, adult pink salmon, Dolly Varden, masked greenling, rock greenling, whitespotted greenling, one-year-old Pacific cod and surf smelt. (Table 4).

The numerically predominant taxa in the trammel net catches in order of greatest abundance were masked greenling, rock greenling, whitespotted greenling, rock sole, *Myoxocephalus* sculpins, Pacific herring, and Pacific cod, which were nearly all one year old (Table 5).

The numerically predominant taxa in the tow net catches, excluding larvae, were overwhelmingly Pacific sand lance followed by juvenile chum salmon and juvenile pink salmon (Table 6)-. A large share of the tow net catch were larvae, including capelin, pricklebacks, *Myoxocephalus* spp. , cod spp., sculpin spp., flounder spp., ronquil spp., snailfish spp. and yellow Irish Lord (Table 7).

The predominant taxa in the try net by weight in order of greatest abundance were king crab, rock sole, yellowfin sole, *Myoxocephalus* spp., Tanner crab, *Gymnocanthus* spp., yellow Irish Lord, flathead sole, butter sole, starry flounder and Dungeness crab (Table 8) .

The predominant taxa in the otter trawl by weight in order of greatest abundance were rock sole, yellow Irish Lord, yellowfin sole, *Myoxocephalus* spp., flathead sole, Pacific cod, Pacific halibut, sablefish walleye pollock and Pacific tomcod (Table 9).

Table 3. Relative abundance in percent of total catch in numbers by month for beach seine on the east side of Kodiak Island, April 1978 through March 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	RANK	MEAN
Pacific sand lance	1.6	13.9	27.3	87.4	97.1	24.0	32.1	1	84.2
Pink salmon	67.0	62.9	41.3	2.7	0.9	0	1.2	2	9.0
Chum salmon	19.3	20.1	16.3	1.3	T	0.2	1.2	3	2.9
<u>Myoxocephalus</u> spp.	1.2	0.7	4.7	1.2	0.3	24.7	26.2	4	0.8
Pacific cod	0.1	T	T	1.8	0.5	3.1	0	5	0.6
Masked greenling	4.7	0.5	1.4	1.0	0.3	19.2	14.3	6	0.6
Whitespotted greenling	0	0.1	0.8	1.5	0.4	2.0	1.2	7	0.5
Silverspotted sculpin	1.4	0.4	1.7	0.6	0.1	1.5	2.4	8	0.2
Tubenose poacher	0.1	0.2	1.2	0.3	0.1	3.5	2.4	9	0.2
Dolly Varden	1.3	0.1	0.4	0.4	T	3.3	0	10	0.1
Pacific tomcod	0	0	1.8	0	0	0	1.2	11	0.1
Crescent gunnel	0.6	0.1	0.2	0.1	0.1	0.2	1.2	12	0.1
Rock sole	0.4	0.1	0.4	0.2	T	6.2	3.6	13	0.1
Coho salmon	0	0	1.6	T	0	0	0	14	0.1
Rock greenling	0.5	0.1	0.2	0.1	T	3.1	2.4	15	0.1
<u>Gymnocanthus</u> spp.	0	T	0.1	0.1	0.1	0.2	0	16	0.1
Snake prickleback	0	0.3	T	0.2	T	0	0	17	0.1
Threespine sticklebacks	0.1	0.1	0.4	0.1	T	0	0	18	0.1
Total Catch	1,481	15,150	9,083	22,537	129,098	547	84		177,980

T = Trace

Table 4. Relative abundance in percent of total catch in numbers by month for gill net on the east side of Kodiak, April 1978 through March 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	RANK	MEAN
Pacific herring	100.0	81.6	93.2	40.5	2.1	0	0	1	70.0
Pink salmon	0	0	0	14.7	27.1	0	0	2	6.1
Dolly Varden	0	2.8	1.7	20.7	6.3	0	0	3	5.6
Masked greenling	0	1.4	0.3	2.6	18.8	0	0	4	3.4
Rock greenling	0	2.1	0.3	9.4	5.2	0	0	5	2.8
Whitespotted greenling	0	0	0	0.9	16.7	0	0	6	2.4
Pacific cod	0	3.6	0.3	3.5	3.1	0	0	7	1.8
Surf smelt	0	2.1	1.4	0.[illegible]	0	0	0	8	1.3
Myoxocephalus spp.	0	2.8		0.[illegible]	3.1	0	0	9	1.1
Pacific staghorn sculpin	0	0	0.3	1.7	4.2	0		10	1.0
Chum salmon	0	0	0.3	0.9	4.2		0	11	0.8
Dusky rockfish	0	0	1.1	1.7	0	0	0	12	0.8
Sockeye salmon	0	0	0.3	1.7	2.1	0	0	13	0.7
Snake prickleback	0	0	0.6	0	2.1	0	0	14	0.6
Capelin	0	1.4	0.3	0	0	0	0	15	0.4
Coho salmon	0	0	0	0	2.1	0	0	16	0.3
Walleye pollock	0	0	0	0	2.1	0	0	17	0.3
Black rockfish	0	1.4	0	0	0	0	0	18	0.3
Pacific tomcod	0	0.7	0	0	0	0	0	19	0.1
Starry flounder	0	0	0	0	1.0	0	0	20	0.1
Total Catch	2	141	354	116	96				709

Table 5. Relative abundance in percent of total catch in numbers by month for trammel net on the east side of Kodiak, April 1978 through March 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	RANK	MEAN
Masked greenling	21.3	20.7	34.5	58.9	61.2	28.9	4.3	1	50.0
Rock greenling	44.5	46.1	42.1	25.1	20.1	35.3	55.3	2	28.9
Whitespotted greenling	2.1	3.7	6.4	5.0	8.0	9.8	0	3	6.1
Rock sole	12.8	11.3	7.7	4.4	2.2	10.2	27.7	4	5.4
Myoxocephalus spp.	8.5	3.5	1.5	1.1	1.1	7.7	4.3	5	1.8
Pacific herring	0	10.3	2.6	0	0.3	0	0	6	1.6
Pacific cod	0	0	1.2	1.9	0.8	3.0	0	7	1.2
Yellowfin sole	0	1.1	1.7	.9	0.5	0	0	8	0.9
Kelp greenling	5.3	1.1	0.7	0.3	0.7	2.6	0	9	0.8
Dolly Varden	0	0.2	0	0.8	0.9	0.9	0	10	0.6
Black rockfish	2.1	1.1	0	0	1.6	0	0	11	0.6
Red Irish Lord	0	0	0.4	0.3	0.4	0.4	0	12	0.3
Pacific staghorn sculpin	1.1	0.3	0.6	0.3	0.3	0.4	0	13	0.3
Pacific tomcod	0	0	0	0	0.6	0	6.4	14	0.2
Dusky rockfish	0	0	0.1	0.5	0	0	0	15	0.2
Gymnocanthus spp.	0	0	- 0.1	0.1	0.3	0	2.1	16	0.2
Starry flounder	2.1	0.3	0.1	T	0.2	0	0	17	0.2
Pink salmon	0	0	0	T	0.3	0	0	18	0.1
Sturgeon poacher	0	0	0	T	0.3	0	0	19	0.1
Walleye pollock	0	0	0	T	0.2	0	0	20	0.1
Silverspotted sculpin	0	0.2	0	T	0.1	0	0	21	0.1
Yellow Irish Lord	0	0	0	0.1	0	0	0	22	0.1
Pacific halibut	0	0	0.1	T	0.1	0	0	23	0.1
Total Catch	94	653	817	2,233	1,922	235	47		6,001

T = Trace

Table 6. Relative abundance in percent of total catch in numbers, excluding larvae, by month for tow net on the east side of Kodiak, April 1978 through March 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH [1]	RANK	MEAN
Pacific sand lance	45.4	0.5	0	99.3	98.1	10.0	0	1	96.5
Chum salmon	9.1	25.8	84.9	0.1	0	0	0	2	1.8
Pink salmon	18.2	63.8	4.0	0.6	1.1	0	0	3	1.1
Capelin	9.1	0	10.7	T	0	90.0	0	4	0.3
Threespine sticklebacks	18.2	6.6	0.2	0	0.2	0	20.0	5	0.1
Lingcod	0	0	0	0	0.5	0	0	6	0.1
Total Catch	11	213	674	29,243	5,261	30	5		35,437

[1] Kelp greenling - 60%, greenling sp. 20%.

Table 7. Relative abundance in percent of total catch in numbers, including larvae, by month for tow net on the east side of Kodiak, April 1978 through March 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	RANK	MEAN
Pacific sand lance	37.7	96.1	18.1	99.3	93.2	1.4	0	1	75.5
Capelin	42.4	2.3	0.4	T	5.0	90.6	93.5	2	3.4
Pricklebacks	10.9	T	12.5	0	0	0	5.3	3	3.3
Myoxocephalus spp.	8.5	0.5	11.1	0	0	0	0	4	3.0
Cod family	0	T	11.4	0	0	0	0	5	2.8
Sculpin family	T	0	10.8	0	T	0	0.1	6	2.6
Flounder family	0	0	10.8	0	0	0	0	7	2.6
Ronquil family	0	0	10.8	0	0	0	0	8	2.6
Snailfish spp.	0	0	5.4	0	0	0	0	9	1.3
Yellow Irish Lord	0	0	5.4	0	0	0	0	10	1.3
Chum salmon	0.1	.3	3.1	0.1	0	0	0	11	0.9
Pink salmon	0.2	.7	.2	0.6	1.1	0	0	12	0.5
Threespine sticklebacks	0.2	.1	T	0	0.2	0	0.1	13	T
Greenling sp.	0	T	0	0	0	8.0	0.1	14	T
Total Catch	1,211	20,122	18,521	29,272	5,549	211	1,150		76,036

T = Trace

Table 8. Relative abundance in percent of total catch in weight by month for try net on the east side of Kodiak, April 1978 through March 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	RANK	MEAN
King crab	0[1]	34.9	31.7	29.8	9.3	53.5	83.0	1	33.6
Rock sole	86.1	29.1	23.0	25.4	21.1	17.5	4.2	2	22.7
Yellowfin sole	1.2	17.4	27.2	21.5	36.6	9.2	1.0	3	21.6
Myoxocephalus spp.	3.4	2.4	4.3	6.0	9.9	4.2	2.4	4	5.5
Tanner crab	0[1]	5.6	3.2	4.3	2.3	7.2	4.8	5	4.1
Gymnocanthus spp.	4.5	3.8	2.1	2.1	2.2	1.9	1.6	6	2.3
Yellow Irish Lord	0.1	0.5	1.5	1.9	4.9	T	T	7	1.9
Flathead sole	0.1	0.3	1.0	2.6	3.7	0.8	0.4	8	1.8
Butter sole	0	1.4	1.9	1.7	1.4	1.3	0	9	1.4
Starry flounder	0.5	2.3	1.0	0.4	2.1	0.4	0.5	10	1.1
Dungeness crab	0	0.3	0	1.7	1.4	2.1	1.3	11	1.1
Whitespotted greenling	0.4	0.6	1.0	0.7	1.1	0.3	0.2	12	0.8
Pacific halibut	0.1	0.3	0.2	0.5	1.2	0.5	0	13	0.5
Sand sole	0	0.6	0.5	0.5	0.5	0.1	0	14	0.4
Arrowtooth flounder	0	0.2	0.3	0.2	0.5	0.1	0	15	0.2
Pacific staghorn sculpin	0.2	0.1	0.2	0.1	0.5	T	0.1	16	0.2
Alaska plaice	0.1	0	0.1	0	0.3	0.3	0	17	0.1
Ribbed sculpin	0	T	T	0	0.4	0.1	0.1	18	0.1
Pacific cod	1.3	0.1	0.1	0.2	0.1	T	T	19	0.1
Searcher	0	0.1	T	0.2	0.2	T	0	20	0.1
Pacific tomcod	0	0	0.2	0.2	T	0	0	21	0.1
Walleye pollock	0.2	0.1	0.2	T	T	T	0	22	0.1
Masked greenling	0.8	0	T	0	0.1	0	0	23	0.1
Sablefish	0	0	0	0.1	0	0	0	24	T
Total Catch, kg	51.7	240.29	489.25	472.61	518.14	318.69	208.4		2299.08

[1]King and Tanner crab were nOt recorded during the first cruise.
T<0.05

Table 9. Relative abundance in percent of total catch in weight by month for otter trawl on the east side of Kodiak, April 1978 through March 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	RANK	MEAN
Rock sole	32.5	33.4	25.0	9.6	6.0	15.6	21.8	1	20.0
Yellow Irish Lord	0.4	20.2	15.0	40.1	17.3	14.4	1.9	2	18.5
Yellowfin sole	19.8	7.3	11.1	8.4	12.5	19.7	19.0	3	12.3
Myoxocephalus spp.	6.3	14.6	6.4	9.3	7.0	5.6	19.4	4	8.8
Flathead sole	1.9	3.4	12.1	11.1	17.4	2.1	2.7	5	8.7
Pacific cod	5.6	3.9	2.8	1.5	7.3	4.4	0.4	6	4.1
Pacific halibut	1.6	1.8	3.2	2.3	9.1	2.6	8.6	7	3.9
Sablefish	T	1.1	12.9	0.8	0.7	0.8	0	8	3.3
Walleye pollock	1.6	0.5	0.4	2.4	8.7	4.2	5.5	9	3.1
Pacific tomcod	3.4	0.2	0.2	4.5	0.5	13.0	2.9	10	3.0
Gymnocanthus spp.	1.3	5.1	2.8	3.0	2.8	0.2	1.8	11	2.8
Tanner crab	8.4	2.2	1.2	1.4	3.5	0.7	5.8	12	2.5
Arrowtooth flounder	1.2	2.3	1.3	1.2	2.0	3.4	2.5	13	1.9
King crab	2.9	1.5	2.5	1.6	1.5	1.5	1.1	14	1.8
Big skate	3.4	0.2	0.5	0.6	1.5	0	0	15	0.8
Starry flounder	1.2	0.6	1.2	0.3	0.4	1.0	1.7	16	0.8
Butter sole	1.5	0.9	0.2	0.4	0.5	1.5	0.1	17	0.7
Pacific staghorn sculpin	0.7	0.2	0.1	0	0	3.4	0.4	18	0.6
Sculpin spp.	2.7	0	0	0	0	2.7	0	19	0.6
Dungeness crab	0.5	0.2	0.1	0.9	0.5	1.0	0.7	20	0.5
Sand sole	T	0	0.1	0	0	0.5	2.5	21	0.2
English sole	0.2	T	0.3	0	0	0.4	T	22	0.1
Searcher	0.2	0.1	0.1	0.1	0.1	0.2	T	23	0.1
Whitespotted greenling	0.1	0	0.1	0.1	0.1	T	0.3	24	0.1
Sturgeon poacher	0.1	0.2	T	0	0.1	T	T	25	0.1
Eulachon	T	0.2	0	0	0	0.1	T	26	0.1
Spinyhead sculpin	0.1	T	T	T	0.1	T	0.2	27	0.1
Re : sole	T	T	T	T	0.1	0.1	T	28	0.1
Total Catch, kg	2274.06	5633.02	5878.86	4059.87	5449.10	3871.82	992.42		28,159.15

Seasonality by Habitat

Nearshore Habitat

The nearshore is probably the most complex habitat encountered in this study and it yielded more species than the pelagic habitat. The nearshore habitat was sampled primarily by the beach seine, gill net and trammel net (Tables 10, 11 and 12). This zone provided an important nursery for many of the fish fauna.

In spring, juvenile pink and chum salmon were the most abundant taxa while larva of several species, especially Myoxocephalus and greenling were common. Dolly Varden are an important predator of this zone. The first Dollies were captured in April and they increased in abundance until July. Dollies are generally restricted to the immediate nearshore zone, but they enter streams during the summer for intermittent periods. Dollies occurred in abundance in all three types of nearshore gear. Sand lance were the numerically predominant species in the beach seine catches. They are primarily a pelagic species that also occurs nearshore. During March and April they tended to occur singly, but in May they first occurred in abundance. Pacific herring used the nearshore zone from mid-April through early June for spawning, with greatest catches in the gill net in May and June.

During June through August the nearshore zone was utilized more than at any other time period. This is associated with movement to shallower water during summer by virtually every fish species (Blackburn, 1978 and 1979) and with the metamorphosis of larvae into juveniles and shallow water residence of juveniles which is a summer occurrence for most fish. Sand lance occurred in modest numbers through most of this time, being more abundant in early June and much more abundant in August as the pelagic juveniles moved into bays. As in the spring, juvenile chum and pink salmon continued to be abundant in the nearshore zone through the summer. Chum were present in abundance a little later than the pinks and during July and August adults were present. Dolly Varden continued to be common in the summer and juvenile Pacific cod about 6 to 8 cm were commonly found in July and August. This species was found in greatest numbers in eelgrass and lagoon areas in Kiliuda and Kaiugnak Bays.

Juvenile Gymnocanthus' 2-3 cm in length appeared in June and grew to sizes of 4-5 cm in August, and juvenile Myoxocephalus were abundant, n growing from 2 cm in May 30 3-5 cm in August. Staghorn sculpin were less abundant than they have been in other areas such as Cook Inlet and Chignik (Blackburn et al., 1979; Phinney, 1972). This is probably associated with their preference for muddy-bottomed estuarine areas. Starry flounder, a common summer nearshore resident, also prefer muddy bottomed estuarine areas and were more abundant in Cook Inlet. Rock sole were common in the nearshore all summer but were more abundant in the demersal zone.

Rockfish were not frequently captured with any of the sampling gear, but they are a well known nearshore rocky or kelp habitat resident, especially black rockfish. The greenings are very important summer residents of the nearshore zone and were captured *in* abundance, especially in the trammel nets. They spawn in the nearshore zone during summer and fall, larvae are

Table 10. Beach seine catch in numbers of individuals[1] per haul and standard error, by taxon and cruise on the east side of Kodiak, 1978 and 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	MEAN
King crab		0.1±0.1						T±T[2]
Dungeness crab		0.2±0.2		0.4±0.3	0.3±0.2			0.1±0.1
Pacific herring					0.1±0.1			T±T
Pink salmon	19.5±9.4	156.1±48.4	60.5±17.5	10.0±3.9	17.4±9.1		T±T	38.4±8.1
Chum salmon	5.6±2.5	50.0±17.1	23.8±8.4	4.6±1.5	0.2±0.1	T±T	T±T	12.3±2.9
Coho salmon			2.3±2.3	T±T				0.4±0.3
Dolly Varden	0.4±0.3	0.2±0.1	0.6±0.3	1.5±1.1	0.3±0.2	0.3±0.2		0.5±0.2
Surf smelt				T±T	T±T	T±T		T±T
Capelin			T±T		T±T	T±T		T±T
Pacific cod	T±T	0.1±0.1	T±T	6.6±2.7	9.5±4.1	0.3±0.2		2.5±0.8
Pacific tomcod			2.6±1.7				T±T	0.4±0.3
Walleye pollock			T±T			T±T		T±T
Threespine stickleback	T±T	0.3±0.1	0.6±0.3	0.3±0.1	0.2±0.1			0.2±0.1
Tube-snout							T±T	T±T
Hexagrammos sp.	T±T	T±T	T±T	0.1±0.1				T±T
Kelp greenling			T±T					T±T
Rock greenling	0.2±0.1	0.3±0.1	0.3±0.2	0.3±0.1	0.7±0.2	0.3±0.1	T±T	0.3±0.1
Masked greenling	1.4±0.5	1.2±0.4	2.1±0.8	3.6±1.2	6.3±1.9	1.7±0.9	0.2±0.1	2.4±0.4
Whitespotted greenling		0.3±0.1	1.2±0.4	5.5±1.2	7.4±1.4	0.2±0.1	T±T	2.2±0.3
Lingcod				T±T	0.6±0.3			0.1±0.1
Sculpin spp.	0.1±0.1	T±T		1.2±0.7	T±T	T±T		0.2±0.1
Padded sculpin		0.1±T	T±T	T±T	T±T	T±T		T±T
Silverspotted sculpin	0.4±0.2	1.1±0.6	2.5±1.8	2.1±1.3	1.0±0.4	0.1±0.1	T±T	1.1±0.4
Sharpnose sculpin				0.1±0.1		T±T	T±T	T±T
Buffalo sculpin	0.1±0.1	0.2±0.1	0.1±T	0.1±T	0.2±0.1	T±T	T±T	0.1±T
Gymnocanthus spp.		T±T	0.1±0.1	0.4±0.3	1.2±0.6	T±T		0.3±0.1
Hemilepidotus spp.	0.1±0.1							T±T
Red Irish Lord					T±T			T±T
Yellow Irish Lord	T±T		T±T	T±T	0.2±0.1	T±T	T±T	0.1±T
Pacific staghorn sculpin			0.1±0.1	0.2±0.1	0.2±0.1	T±T	T±T	0.1±T

(continued)

[1]Juvenile and adult fish combined
[2]T<0.05

Table 10. (continued)

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	MEAN
Myoxocephalus spp.	0.4±0.1	0.5*0.1	6.9±1.9	4.6±1.4	6.8±1.7	2.1±0.4	0.4*0.2	3.2±0.5
Tidepool sculpin						T±T		T±T
Manacled sculpin		T±T		T±T	0.1±0.1	0.1±T		T±T
Tubenose poacher	T±T	0.5*0.3	1.7*1.3	1.2±0.4	2.4±1.6	0.3±0.1	T±T	0.9±0.3
Snailfish spp.		T±T					T±T	T±T
Liparis spp.						0.2±0.2		T±T
Spotted snailfish					0.2±0.1			T±T
Pacific sandfish					T±T			T±T
Searcher					T±T			T±T
High cockscomb					T±T			T*T
Snake prickleback		0.7*0.7	0.1±0.1	0.8*0.8	0.1±0.1			0.2*0.2
Whitebarred prickleback		T±T						T±T
Arctic shanny	T±T	T±T	T±T		T±T	T±T	T±T	T±T
Penpoint gunnel		T±T			T*T	T±T		T±T
Crescent gunnel	0.2±0.1	0.3±0.1	0.3*0.1	0.2*0.2	1.6±0.6	T±T	T±T	0.4±0.1
Prowfish					T±T			T±T
Pacific sand lance	0.5±0.2	34.4±18.3	40.0*32.4	317.8*221.9	1959.4±706.7	2.1*1.1	0.5±0.3	359.4*117.7
Flounder spp.	0.1±T							T±T
Butter sole		T±T						T±T
Rock sole	0.1±0.1	0.3*0.1	0.5±0.2	0.7±0.3	0.4±0.1	0.5±0.2	0.1±T	0.4*0.1
Yellowfin sole		0.1±0.1		T±T				T±T
English sole				0.3*0.3	0.1±T			0.1±T
Starry flounder	0.1±T	0. 1±T	0.1±0.1	0.3±0.2	0.1±0.1	0.1±0.1	T±T	0.1±T
Alaska plaice			T±T	T±T				T±T
Sand sole		T±T	T±T	0.3±0.2				0.1±T
Pacific halibut					0.1±0.1			T±T
Number of hauls	51	61	62	62	64	63	54	417

Table 11. Gill net catch in numbers of individuals per set and standard error, by taxon and cruise on the east side of Kodiak, 1978 and 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	MEAN
Pacific herring[1]	0.3±0.3	4.6±2.6	14.3*12.6	2.0±0.9	0.1±0.1			4.9±2.9
Pink salmon[1]				0.7±0.6	1.1±0.4			0.4±0.2
Chum salmon[1]			T±T[2]	T±T	0.2±0.1			0-1±T
Coho salmon[1]					0.1±0.1			T±T
Sockeye salmon[1]			T±T	0.1±0.1	0.1±0.1			T*T
Dolly Varden		0.2*0.1	0.3*0.1	1.0*0.4	0.2*0.2			0.4*0.1
Surf smelt		0.1±0.1	0.2±0.2	T*T				0.1±0.1
Capelin		0.1±0.1	T±T	0.2±0.1				T±T
Pacific cod		0.2±0.2	T±T	0.2±0.1	0.1±0.1			0.2±0.1
Pacific tomcod		T±T						T±T
Walleye pollock					0.1±0.1			T±T
Dusky rockfish			0.2±0.2	0.1±0.1				0.1±T
Black rockfish		0.1±0.1						T±T
Rock greenling[1]		0.1±0.1	T±T	0.5±0.4	0.2±0.2			0.3*0.1
Masked greenling[1]		0.1±0.1	T±T	0.1±0.1	0.7*0.4			1.7±1.5
Whitespotted greenling[1]				T±T	0.7±0.6			0.2±0.2
Pacific staghorn sculpin			T±T	0.1±0.1	0.2*0.2			0.1±T
Myoxocephalus spp.		0.2±0.1		0.1±0.1	0.1±0.1			0.1±T
Snake prickleback			0.1±0.1		0.1±0.1			T±T
Starry flounder					T±T			T±T
Number **of sets**	7	25	23	23	24	0	0	102

[1]Adults
[2]T<0.05

Table 12. Trammel net catch in numbers of individuals per set and standard error, by taxon and cruise on the **east** side of Kodiak, 1978 and 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	MEAN
Pacific herring		3.3?2.7	1.1±1.0		**0.2*0.1**			**0.7*0.4**
Pink salmon				0.1± 0.1	0.3±0.2			0.1±T
Dolly Varden		0.1±0.1		**0.9* 0.4**	0.9±0.6	0.1±0.1		**0.3*0.1**
Pacific cod			**0.5*0.3**	2.0± **0.7**	0.7±0.3	**0.3*0.3**		0.6±0.1
Pacific tomcod					0.6±0.5		0.2±0.1	0.1±0.1
Walleye pollock				0.1± 0.1	**0.2*0.2**			T±T
Dusky rockfish			0.1±0.1	0.6± **0.6**				0.1±0.1
Black rockfish	0.1±0.1	0.3±0.4			1.4±1.0			0.3±0.2
Hexagrammos **sp.**				0.1± 0.1				T±T
Kelp greenling	0.3±0.2	**0.310.2**	0.3±0.2	0.3± 0.2	0.7±0.4	**0.3*0.1**		0.3±0.1
Rock greenling	2.8±0.9	**15.1?3.8**	18.1±4.2	26.7± **6.8**	18.4±4.3	4.2±1.0	**1.7*0.7**	13.4±1.7
Masked greenling	1.3±0.6	**6.8?2.3**	**14.8?3.3**	62.6±14.4	56.0±8.3	**3.4*1.1**	0.1±0.1	**22.923.5**
Whitespotted greenling	0.1±0.1	1.2±0.3	**2.730.6**	5.3± **1.6**	7.3±1.6	1.1±0.6		2.8±0.4
Sculpin spp.						0.1±0.1		T±T
Crested sculpin				0.1± 0.1				T±T
Silverspotted sculpin		0.1±0.1		0.1± 0.1	0.1±0.1			T±T
Buffalo sculpin						0.1±0.1		T±T
Gymnocanthus spp			0.1±0.1	0.2± 0.2	0.2±0.2		0.1±0.1	0.1±0.1
Red Irish Lord			0.2±0.1	0.3± 0.2	0.3±0.2	0.1±0.1		0.1±T
Yellow **Irish Lord**				0.2± 0.1				T± T
Pacific staghorn sculpin	0.1±0.1	0.1±0.1	0.3±0.2	**0.3* 0.3**	0.1±0.1			0.1±0.1
Myoxocephalus **spp.**	0.5±0.2	1.2±0.3	0.6±0.2	1.1± **0.4**	**1.1*0.3**	(3.9*().3	0.1±0.1	0.8±0.1
Sailfin sculpin		0.1±0.1						T±T
Sturgeon poacher				0.1± 0.1	0.2±0.2			T±T
Alaska ronquil			**0.130.1**					T±T
Searcher		0.1±0.1						T±T
Wolf eel					0.1±0.1			T±T
Rock sole	0.8±0.2	3.7±1.0	3.3±1.1	4.7± **1.9**	2.0±0.9	1.2±0.3	0.9±0.3	2.5±0.3
Yellowfin **sole**		0.3±0.2	0.7±0.7	1.0± **0.9**	0.5±0.3			0.4±0.2
Starry flounder	0.1±0.1	0.1±0.1	0.1±0.1	0.1± 0.1	0.1±0.1			0.1±T
Pacific halibut			0.1±0.1	0.1± 0.1	0.1±0.1			T±T
Number of sets	15	20	**19**	**20**	**21**	**20**	**15**	**130**

T<0.05

present, primarily in the pelagic zone, in late fall, winter and spring; and juveniles take up demersal residence in the nearshore zone in mid-summer, as can be seen by the increased catch rates of greenling in the beach seine in July and August. A number of other species are common in the nearshore zone in summer such as tubenose poacher and silverspotted sculpin, which were occasionally captured in considerable abundance.

During August Pacific sand lance and Pacific cod were in far greater numbers than earlier. Most of the juvenile salmonid species had already migrated out of the nearshore zone in August while Dolly Varden were still abundant.

During winter the most important feature of the nearshore zone is the reduced abundance of all species and reduced number of species present. Both total catch and number of species in November were considerably less than in summer and in March were at the lowest point of the study. During this period the beach seine catches were predominated by sand lance, Myoxocephalus, masked greenling, rock sole, tubenose poacher and rock greenling, in order of abundance. Dolly Varden were present in November but not in March. Trammel net catches were predominantly rock greenling, rock sole, masked greenling and Myoxocephalus in winter. Whitespotted greenling ranked 4th in November but were absent in March, and Pacific tomcod were absent in November and ranked 3rd in March. Tomcod may have been coming inshore to spawn. Sand lance were at much lower abundance than during summer, which may be due to their habit of taking refuge by burying in sand. The Myoxocephalus were almost exclusively young of the year great sculpins and were the predominant species along with sand lance, although their abundance was as low as one seventeenth of the summer abundance. The greenings were at a much lower abundance than in summer but remained important.

An important feature of the nearshore habitat is its relationship to tides. The beach seine catches were summarized for the entire study by the tidal stage at which they were made: high tide plus or minus one hour, low tide plus or minus one hour, flood tide and ebb tide. Catches were considerably lower on ebb tide (172 fish per set), intermediate on low tide (510 fish per set) and flood tide (601 fish per set) and greatest on high tide (784 fish per set).

For the different species there are a number of apparent trends, some of which may be spurious, but the same trends were observed in identical samples in Cook Inlet (Blackburn et al., 1979). Pink salmon (mostly juvenile) catches were much greater on flood tide (50.7 per haul) , least on high (10.5 per haul) and low (13.9 per haul) and intermediate on ebb (37.3 per haul). Chum salmon juveniles basically showed the same trend, except the lowest was the low tide (4.6 per haul) and intermediate was the high and ebb tide. Dolly Varden were more abundant on flood tide (0.8 per haul) than on the other tides (0.1 to 0.4 per haul). Myoxocephalus spp. catches were 44.1 per haul on ebb tide, 15.1 on flood tide, 7.7 per haul on low tide and 7.2 per haul on high tide. Pacific sand lance catches were 739.2 per haul on high tide, 501.8 on flood, 454.1 on low and 65.9 on ebb tide. The greatest beach seine catch of flounders occurred during low tide, and the next highest catch was during ebb tide. Rock sole was the only flounder encountered in all four tidal stages.

Pelagic Habitat

The pelagic habitat, sampled by the surface tow net and gill net (Tables 11 and 13), is simpler than either the nearshore or the demersal habitat and contains primarily three groups of fish taxa. These are the forage species, salmonid species and the larval/juvenile stages of many demersal and nearshore fish. The forage species consist mainly of sand lance, herring and capelin. Although surf smelt may be abundant locally, they were not captured in abundance in this study.

Pacific sand lance spawn in mid-winter and their larvae are generally found all across the shelf during spring and early summer. Age 1 and older sand lance distribution is not clear during spring-early summer, but they appear to be dispersed when captured in nets and to be common in sand where they take refuge. Capelin of age 1 are about 50 to 70 mm during April and begin metamorphosis to their juvenile stage when about 65 mm in length. Older capelin, mostly age 2, aggregate prior to their late May spawning, as they appear in the otter trawl catches at this time in greater abundance than at any other time. Their spawning seems to be continous from late May through June and into July. During April-May adult herring enter the surface waters in mass just prior to their spawning and juvenile pink and chum salmon begin to enter shallow fringes of the pelagic zone. By late April a large number of larval taxa enter the pelagic environment and subsequently grow to juveniles and then most settle to the demersal. or nearshore zone by early June.

During June through August juvenile pink and chum salmon moved from the nearshore zone into the pelagic and dispersed from the bays. Adult capelin were captured in greatest numbers in the surface waters during June as their beach or demersal spawning apparently continued. In late summer sand lance moved inshore, becoming very abundant within the bays where they probably take refuge during the winter. The pelagic juvenile stages of greenings persist through part of the summer; the whitespotted greenling, the most common species found, apparently settled to the bottom during July and August. Juvenile lingcod, another member of the greenling family, appeared only in July and August, apparently as they were metamorphosing into juvenile fish and were . preparing to settle to the bottom.

During November only capelin were captured in the tow net. The surface waters were sparsely populated until March when greenings began to hatch. Threespine sticklebacks were captured in the pelagic zone throughout the year, except during November. Their movements are not known well enough to interpret.

Demersal Habitat

The demersal habitat was sampled primarily by the try net and otter trawl (Tables 14 and 15). During March and April large catches of rock and yellowfin sole were encountered in the try net and otter trawl. Large catches of Pacific cod, tomcod, walleye pollock, Myoxocephalus spp. and flathead sole were observed in the otter trawl. Rock sole and yellowfin sole were the predominant fish found during spring. A larger number of sculpin species were observed than in either the pelagic or nearshore habitat.

Table 13. Tow net catch in numbers of individuals per km and standard *error* by taxon and cruise on the east side of Kodiak, 1978 and 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	MEAN
Pink salmon	0.2*0.2	10.6*5.6	2.3±2.0	7.7±6.9	2.5±2.1			2.9±1.4
Chum salmon	0.1±0.1	4.3±2.9	47.7*39.6	0.9±0.9				3.8±2.8
Capel in	0.1±0.1		6.0±4.4	0.2±0.2		1.0±1.0		(3.7553.4
Pacific cod				0.5*0.4	T±T			0.1±0.1
Threespine sticklebacks	0.3±0.2	1.1±0.8	0.1±0.1		0.3±0.2		0.1±0.1	0.2±0.1
Hexagrammos sp.		0.3±0.3					0.1±0.1	T±T
Kelp greenling							0.3±0.2	T±T
Whitespotted greenling		0.2±0.2	0.2±0.1		0.2±0.1			0.1±T
Lingcod				T±T	1.0*0.7			0.2±0.2
Silverspotted sculpin					T±T			T±T
Tadpole sculpin				T±T				T±T
Tubenose poacher					T±T			T±T
Prowfish				0.2*0.1	T±T			T±T
Pacific sand lance	0.7±0.6	0.1±0.1		1395*1004	215±164	0.1±0.1		289.5*178.9
Number of tows	18	'16	15	37	48	53	27	214

T< 0.05

Table 14. Try net catch in kilograms per 10 minute tow and standard error by taxon and cruise on the east side of Kodiak, 1978 and 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	MEAN
King *crab*	[1]	2.9±0.8	5.7±1.9	5.0*1.5	1.7±0.6	6.8±5.4	7.9±3.2	4.2±0.9
Tanner crab		0.5±0.2	0.6±0.2	0.7±0.2	0.4±0.2	0.9±0.5	0.5±0.2	0.5±0.1
Dungeness crab		T±T		0.3*0.1	0.2±0.1	0.2*0.2	0.1±0.1	0.1±T
Capel in			T±T				T±T	T±T
Pacific cod	T±T	T±T	T±T	T±T	T±T	T±T	T±T	T±T
Pacific tomcod			T±T	T±T	T±T	T±T		T±T
Walleye pollock	T±T	T±T	T±T	T±T	T±T	T±T		T±T
Shortfin eelpout					T±T			T±T
Dusky rockfish					T±T			T±T
Darkblotched rockfish		T±T						T±T
Kelp greenling					T±T			T±T
Rock greenling					T±T	T±T		T±T
Masked greenling	T±T		T±T		T±T	T±T		T±T
Whitespotted greenling	T±T	T±T	0.2±0.1	0.1±T	0.2±0.1	0.1±T	T±T	0.1±T
Lingcod					T±T	T±T		T±T
Sablefish				T±T	T±T			T±T
Sculpin sp.		T±T	T±T					T±T
Crested sculpin			T±T			T±T		T±T
Silverspotted sculpin	T±T					T±T	T±T	T±T
Spinyhead sculpin	T±T	T±T	T±T	T±T	T±T			T±T
Buffalo sculpin	T±T							T±T
Gymnocanthus spp.	0.1±T	0.2*0.1	0.5*0.3	0.3±0.2	0.5±0.3	0.2±0.1	0.1±0.1	0.3±0.1
Red Irish Lord	T±T					T±T		T±T
Yellow Irish Lord	T±T	T±T	0.3±0.2	0.3*0.1	().9*().5	T±T	T±T	0.2±0.1
Bigmouth sculpin	T±T							T±T
Northern sculpin		T±T						T±T
Pacific staghorn sculpin	T±T	T±T	T±T	T±T	0.1±0.1	T±T	T±T	T±T
Myoxocephalus sp.	0.1±0.1	0.2*0.1	0.8±0.3	1.0±0.3	1.8±0.5	0.5*0.3	0.2±0.2	0.7±0.1
Sailfin sculpin				T±T				T±T

T<0.05

[1]King crab caught, but not recorded.

Table 14. continued

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	MEAN
Slim sculpin			T±T					T±T
Triglops sp.				T±T				T±T
Scissortail sculpin	T±T		T±T					T±T
Roughspine sculpin				T±T		T±T		T±T
Ribbed sculpin		T±T	T±T		0.1±0.1	T±T	T±T	T±T
Smooth alligatorfish		T±T						T±T
Sturgeon poacher	T±T	T±T	T±T	T±T	T±T	T±T	T±T	T±T
Bering poacher					T±T			T±T
Tubenose poacher	T±T		T±T					T±T
Snailfish sp.	T±T					T±T	T±T	T±T
Liparis sp.	T±T		T±T					T±T
Marbled snailfish	T±T							T±T
Pacific sandfish			T±T	T±T			T±T	T±T
Searcher		T±T	T±T	T±T	T±T	T±T		T±T
High cockscomb	T±T							T±T
Snake prickleback		T±T	T±T	T±T	T±T			T±T
Daubed shanny		T±T		T±T	T±T		T±T	T±T
Stout eelblenny			T±T	T±T	T±T			T±T
Arctic shanny		T±T			T±T			T±T
Crescent gunnel	T±T	T±T					T±T	T±T
Arrowtooth flounder		T±T	0.1±T	T±T	0.1±0.1	T±T		T±T
Rex sole					T±T			T±T
Flathead sole		T±T	0.2±0.1	0.4±0.2	0.7±0.2	0.1±T	T±T	0.2±T
Butter sole		0.1±0.1	0.4±0.2	0.3±0.1	0.3±0.1	0.2±0.1		0.2±T
Rock sole	1.8±0.6	2.1±0.5	4.2±1.5	4.3±1.3	3.9±1.1	2.2±0.5	0.4±0.1	2.8±0.4
Yellowfin sole	T±T	1.4±0.3	4.9±1.4	3.7±0.8	6.7±1.7	1.2±0.4	0.1±0.1	2.7±0.4
Dover sole			T±T	T±T	T±T			T±T
English sole			T±T		T±T	T±T		T±T
Starry flounder	T±T	0.2±0.1	0.2±0.1	0.1±0.1	0.4±0.3	0.1±0.1	T±T	0.1±0.1
Alaska plaice	T±T		T±T		T±T	T±T		T±T
Sand sole		T±T	0.1±T	0.1±0.1	0.1±0.1	T±T		T±T
Pacific halibut	T±T	T±T	T±T	0.1±T	0.2±0.1	0.1±T	T±T	0.1±T
Number of tows	25	31	27	28	28	25	22	186

Table 15. Otter trawl catch in kilograms per km trawled and standard error, by taxon cruise on the east side of Kodiak, 1978 and 1979.

Taxon	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH	MEAN
Scallop	0.2±0.2							T±T
Hermit crab	0.2±0.2							T±T
King crab	5.2±2.0	8.7±4.4	1[illegible].6±9.[illegible]	7.0±4.2	7.3±5.4	9.4±9.4	0.8±0.8	7.3±2.1
Hyas crab	T±T							T±T
Tanner crab	14.3±2.1	13.2±5.0	6.5±5.0	5.6±2.4	17.3±1[illegible].9	4.1±2.5	5.9±2.4	9.7±2.0
Dungeness crab	0.9±0.8	1.0±0.9	0.7±0.5	3.6±1.4	2.5±1.4	4.5±2.5	0.7±0.3	1.9±0.5
Spiny dogfish				0.2±0.2				T±T
Big skate	6.1±6.1	1.3±0.8	2.7±2.2	2.6±2.6	7.4±6.0			3.1±1.4
Longnose skate					0.6±0.6			0.1±0.1
Pacific herring	T±T	T±T	0.1±0.1	0.1±0.1	0.1±0.1	0.3±0.2	T±T	0.1±T
Capelin	0.1±0.1	0.1±0.1	T±T	T±T	T±T		0.3±0.3	0.1±0.1
Eulachon	T±T	1.3±1.2				0.5±0.4	T±T	0.2±0.2
Pacific cod	9.6±8.1	23.2±6.7	15.1±8.2	6.5±4.5	36.0±31.3	27.3±23.5	0.4±0.2	16.3±5.7
Pacific tomcod	5.5±3.4	1.2±0.9	0.8±0.7	16.8±12.4	2.7±1.1	55.7±50.9	3.2±2.8	11.3±6.5
Walleye pollock	2.7±1.2	2.7±1.4	2.3±1.5	9.3±3.6	43.2±37.3	24.1±11.2	6.2±6.1	12.7±5.8
Shortfin eelpout			0.4±0.3	0.1±0.1	0.1±0.[illegible]			0.1±0.1
Wattled eelpout				T±T	0.3±0.[illegible]			T±T
Sebastes sp.	T±T	T±T			T±T			T±T
Darkblotched rockfish						0.1±0.1		T±T
Hexagrammos sp.	0.1±0.1							T±T
Kelp greenling	0.1±0.1							T±T
Rock greenling	0.1±0.1							T±T
Masked greenling	0.4±0.4							0.1±0.1
Whitespotted greenling	0.1±0.1		0.7±0.6	0.5±0.4	0.5±0.5	0.3±0.3	0.3±0.2	0.3±0.1
Lingcod	T±T	0.1±0.1						T±T
Sablefish	0.1±0.1	6.6±4.4	69.8±58.9	3.2±2.0	3.3±1.6	5.0±4.9		12.6±8.8
Sculpin sp.	4.8±2.7					12.1±10.1		2.3±1.5
Spinyhead sculpin	0.1±0.1	0.1±0.1	0.1±0.1	0.1±0.1	0.6±0.6	0.2±0.2	0.2±0.2	0.2±0.1
Gymnocanthus spp.	2.2±1.6	30.1±24.5	1[illegible].0±3.7	12.0±3.8	14.1±7.9	1.4±1.4	1.5±0.7	10.5±4.7
Red Irish Lord						0.9±0.6		0.1±0.1
Yellow Irish Lord	0.7±0.5	119.6±100.4	81.5±45.3	169.8±111.3	85.5±65.9	90.2±77.2	2.1±2.0	75.3±25.0
Bigmouth sculpin					0.1±0.1			T±T

(continued)

Table 15. **continued**

Taxon	April	May	June	July	August	November	March	Mean
Northern sculpin	T±T							T±T
Pacific staghorn sculpin	1.1±0.7	1.0±1.0	0.3±0.2			22.1?16.2	0.4±0.3	3.1±2.1
Myoxocephalus sp.	10.2±5.9	89.9?67.9	34.4*13.4	39.0±21.4	34.4±28.0	31.4*13.17	19.657.8	36.2±13.2
Triglops sp.		0.1±0.6			T±T			T±T
Ribbed sculpin	T±T	T±T		T±T	T±T			T±T
Smooth alligatorfish	T±T							T±T
Sturgeon poacher	0.1±T	1.3±1.3	0.2±0.2		0.3±0.3	0.210.2		0.3±0.3
Snailfish sp.		0.1±0.1						T±T
Pacific sandfish	T±T	0.2±0.2		0.3±0.1	0.1±0.2	0.1±0.1	0.1±0.1	0.1±T
Searcher	0.4±0.3	0.6±0.4	0.6±0.5	(3.5*().4	0.6±0.5	0.8±0.6	T±T	0.5±0.2
Northern ronquil	0.3±0.3							0.0±0.1
Pricklebacks	T±T							T±T
Snake prickleback	T±T	0.1±0.1	0.1±0.1	0.1±0.1	T±T		T±T	0.1±T
Daubed shanny				0.1±T	T±T			T±T
stout eelblenny					T±T			T±T
Whitebarred blenny	T±T							T±T
Arrowtooth flounder	1.9±1.1	13.9±10.8	7.1±4.3	4.4±2.1	9.9±3.2	17.924.2	2.9±1.6	7.8?1.7
Rex sole	T±T	0.1±0.1	0.2±0.2	0.1±0.1	0.4±0.4	0.6±0.6	T±T	0.2±0.1
Flathead sole	3.2±1.3	19.9*7*9	65.9?39.5	46.0±24.5	86.0±36.6	11.4±6.1	3.0±1.9	33.8?9.4
Butter sole	2.6±2.1	5.2±3.3	1.3±1.0	1.5±0.7	2.4?1.3	9.3±4.3	0.1±0.1	3.0±0.8
Rock sole	55.0±32.2	198.1±170.6	129.8117.0	36.8219.8	29.8?14.5	66.9±56.4	22.2±12.8	73.7?24.7
Yellowfin sole	33.2?8.4	44.0±9.0	60.4±24.3	33.0±11.6	61.7±18.6	109.7±35.6	20.2±9.0	50.037.6
Dover sole			0.2±0.2	T±T	0.1±0.1	0.3±0.1		0.1±T
English sole	0.3±0.3	0.2*0.2	1.5±1.5			1.7±1.4	T±T	0.5±0.3
starry flounder	2.1±0.6	3.7±1.7	6.6±3.4	1.2±0.7	2.1±0.6	4.9±2.1	1.4±0.9	3.1±0.7
Sand sole	T±T		0.3±0.3			2.8±1.9	2.4±1.0	0.7±0.3
Pacific halibut	2.8±1.8	10.5*3.7	17.5±8.9	9.3±4.2	45.1?14.3	13.5?4.4	9.6±8.6	15.3?3.3
Number of trawls	7	5	6	6	6	5	6	41

Area Comparisons

The percent similarity comparison of the different subareas serves to illustrate the degree of similarity in the catches between areas (Figure 13). One of the advantages of the percent similarity is that it shows directly how much of the catch (in terms of percent composition) is identical between areas. However, the percent similarity is also affected most by the predominant species. Thus, with the very high predominance of sandlance in the beach seine and tow net catches, it was necessary to exclude sandlance when calculating this index. As presented, the percent similarity index is affected most by three or four predominant species.

In the beach seine there were two main groupings of areas which combined at 45 percent similarity (Figure 13). One group of areas (inner Kalsin, outer Kiliuda, outer middle Kiliuda, and inner Kiliuda) had catches that were predominantly chum salmon (mostly juveniles) or nearly so,with pink salmon (mostly juveniles) of an equal or lesser proportion of the catch. The other group of areas (inner Izhut, outer middle Izhut, inner middle Izhut, outer Kaiugnak, inner Kaiugnak, outer Kalsin and inner middle Kiliuda) had predominantly pinks with chums absent or in low proportions (Table 16).

In the gill net the last areas combined at 29 percent similarity, eight areas combined at 36 percent similarity and seven areas combined at 53 per cent similarity (Figure 13). The gill net had very small catches that were greatly predominated by herring overall and in different proportions in different areas (Table 17). The distribution of herring was important in the area similarity of gill net catches.

In the trammel net all areas combined at 40 percent similarity while 10 areas combined at 58% similarity (Figure 13).

The various species of greenling greatly predominated the trammel net catches and occurred in varying proportions in different areas, dictating area similarities (Table 1?3).

The tow net catches were very dissimilar between areas (Figure 13). Three areas, outer middle Izhut, outer Izhut and inner middle Kiliuda, yielded capelin almost exclusively and no other area had more than four percent capelin (Table 19; note that sandlance were excluded from this analysis). Capelin never occurred more than once in any subarea in the tow net, which indicates their distribution is probably not accurately reflected by the data presented here. Four areas, inner Izhut, outer middle Kiliuda, outer Kiliuda and inner Kalsin,combined at 75 percent similarity, which is due to a predominance of juvenile pink salmon in these areas (Table 19).

In the try net catches, all areas combined at 28 percent similarity and nine areas combined at 50 percent similarity (Figure 13) . The outer middle Izhut and outer Izhut areas had a great predominance of rock sole causing their dissimilarity with the other areas (Table 20) .

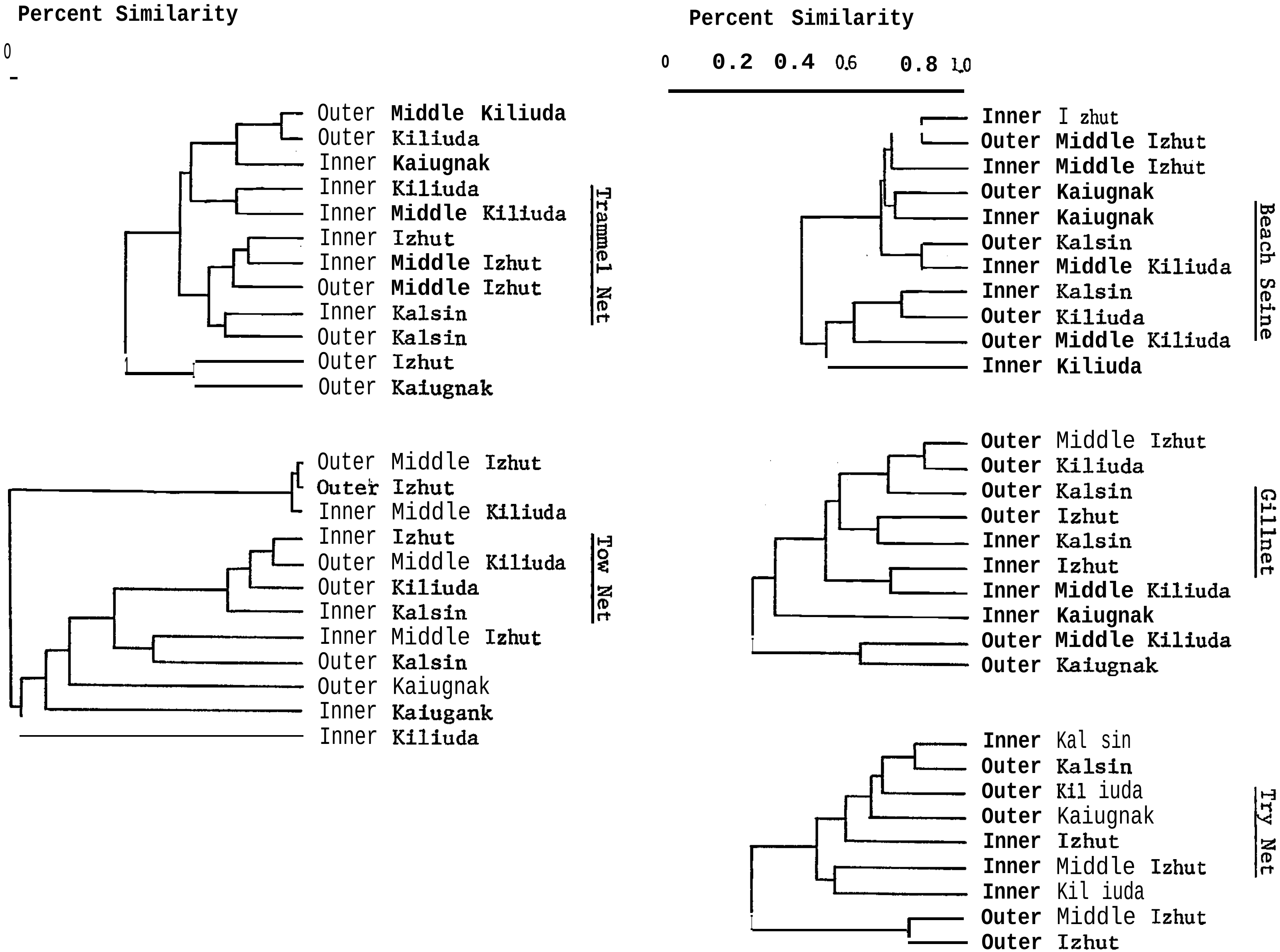

Figure 13. Dendrograms of percent similarity of the catches in the areas sampled by each gear type.

Table 16. Mean beach seine catch in numbers of fish per set by subarea and taxon for all cruises combined.

	IZHUT				KALSIN		KILIUDA				KAIUGNAK	
	Inner	Inner Middle	Outer Middle	Outer.	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
King crab										.1		
Dungeness crab	.2				.4					.8		T
Pacific herring		.1	.2			.1						
Pink salmon	22.3	15.1	20.7		17.6	28.8	3.9	23.1	3.6	22.8	165.9	126.5
Chum salmon					12.3	8.9	52.1	8.1	9.3	24.6	18.6	2.0
Coho salmon			2.9		T					T		.1
Dolly Varden	T	.2	.6		.1	.5	.1	.1	.6	.2	.5	2.6
Surf smelt			T							.1		
Capelin					T				T			
Pacific cod juv.	T	1.8	.1		.4		5.7	.5	3.2	1:9	.3	16.7
Pacific tomcod					T						.6	4.5
Walleye pollock	T				T							
Threespine sticklebacks			.1		T	.1	.3	.2	.8	.1	.3	.7
Tube-snout			T			T						
Hexagrammos spp.		T	T		T	.1	T	T		.1		
Kelp greenling			T									
Rock greenling	.2	.4′	.1		T	T		.3	.6	.1	.7	.9
Masked greenling	3.0	2.6	1.5		.6	1.7	1:5	3.7	1.0	3.6	3.7	4.2
Whitespotted greenling	3.5	1.4	3.0		3.4	3.5	1.3	1.2	1.0	.7	1.4	4.3
Lingcod	.2	.1	T		T		.6	.1		T	.1	T
Sculpin spp.		.1			.9		T		.2	.1	.9	
Padded sculpin	T	T	T		.1	.1				T		
Silverspotted sculpin	.1	.1	.1		.1	.3	4.2	1.2	.2	.3	.7	5.8
Sharpnose sculpin		.1	T					.1				
Buffalo sculpin	.1	.1	.1		T	.1	.1	.1	.1	.3	.1	T
Gymnocanthus spp.						T	.3	.1	.9	T	1.7	
Hemilepidotus spp.		.1										
Red Irish Lord												T
Yellow Irish Lord	T	.1			.1		.2	.1		T	.2	T
Pacific staghorn sculpin	T		.1		.2			.2		.2	.2	
Myoxocephalus spp.	1.0	2.2	.1		2.9	1:6	4.1	2.1	2.6	1.2	5.8	4.1
Plain sculpin												
Great sculpin	1.6	.6	.2		.5	1:2	.4	2.5	1.1	.4	3.2	.3

Table 16 . (continued)

	IZHUT				N		KILIUDA				KAIUGNAK	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
Tidepool sculpin		T										
Manacled sculpin	.1	.3										
Tubenose poacher	T	.1			.1	.2	.7	.2	.1	.9	.8	8.5
Snailfish spp.					T	T			.4			
Spotted snailfish						.1					.2	
Pacific sandfish	.1											
Searcher		T										
High cockscomb	.1											
Snake prickleback								.1		T		3.2
Whitebarred blenny		T										
Arctic shanny		.2	T		.1						T	
Penpoint gunnel		T	T			T						
Cresent gunnel	.6	.2	.3		.2	1.1	.8	.2	.1	.1	.1	.6
Prowfish	T	T										
Pacific sand lance	862.1	38.3	109.7		895.2	117.8	.8	63.1	36.6	27.0	974.9	735.0
Flounder spp.		T						T		T		
Butter sole										T		
Rock sole	.1	.7	.1		.6	.3		.2	.5	1.3	.1	
Yellowfin sole	.1				T							
English sole	T					T				.4	.1	
Starry flounder					.3	.1		T	.1	.4	.3	
Alaska plaice						T				T		
Sand sole					.1					.4	.1	
Pacific halibut										.1		

T = Trace

Table 17. Mean gill net catch in numbers of fish per set by subarea and taxon for al cruises combined.

	IZHUT				KALSIN		KILIUDA				KAIUGNAK	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
Pacific herring	[illegible]		9.7	3.0	.2	5.2		.9	[illegible]	20.2	1.0	.2
Pink salmon adult	[illegible]					.2		.6	[illegible]	.4	.7	1.2
Chum salmon adult			.1		.2					.2		
Coho salmon adult						.1						.1
Sockeye salmon adult						.3		[illegible]			.1	
Dolly Varden			.2	1.0	.6	.6		[illegible]	.2	.8	.2	1.2
Surf smelt				2.0	.1	.7					.1	
Capelin			.2									
Pacific cod juv.			.4						.2	.3	.2	
Pacific tomcod			.1									
Walleye pollock										.1		
Dusky rockfish											.5	
Black rockfish											.2	
Rock greenling										[illegible]	1.0	
Masked greenling	.1		.2		.2	.1				[illegible]	.2	
Whitespotted greenling						.1				1		
Pacific staghorn sculpin								.1		[illegible]		.1
Great sculpin					[illegible]	.2				[illegible]		
Snake prickleback										[illegible]		
Starry flounder										[illegible]		

Table 18. Mean trammel net catch in numbers of individuals per set by subarea and taxon for all cruises combined.

	IZHUT				KASLIN		KILIUDA				KAIUGNAK	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
Pacific herring	.2		.1		2.6	4.3						.1
Pink salmon adult									.1			.5
Dolly Varden					.7	1.2			.5	.2	.4	
Pacific cod juvenile	.2		1.1		.1	.7	.7	.6	1.4	.9	.2	.1
Pacific tomcod	.8		.1				.1	.1	.1			
Walleye pollock	.1						.1		.2			
Dusky rockfish			.1	3.7								
Black rockfish		1.6	.6	5.7								
Hexagrammos spp.		.1										
Kelp greenling	.3	1.4	.7	.7			.2	.1	.1	.1		1.1
Rock greenling	13.0	10.8	10.8	15.7	10.1	12.1	1.7	1.7	7.1	11.6	25.6	37.8
Masked greenling	12.6	9.5	6.1	4.3	15.2	20.8	9.8	28.6	48.6	50.2	44.5	6.9
Whitespotted greenling	1.7	1.9	3.1	.3	3.4	1.0	5.8	7,9	3.2	2.4	2.4	0.6
Sculpin spp.		.2										
Crested sculpin	.1											
Silverspotted sculpin	.1			.7							.1	
Buffalo sculpin										.1		
Gymnocanthus spp.							.1	.1				
Armorhead sculpin								.1				
Threaded sculpin			.1				.5					
Red Irish Lord	.2		.1			.1			.1	.2	.1	.8
Yellow Irish Lord									.1		.1	
Pacific staghorn sculpin			.1		.9	.1				.1		
Myoxocephalus spp.	.2		.1		.8	1.6	.2	.1	.1	.2	.6	.1
Plain sculpin												.1
Great sculpin	.1		.2	.3	.9	.5	1.0	.6	.8	.5	.2	.2
Sailfin sculpin			.1									
Sturgeon poacher					.1	.4						
Alaska ronquil						.1						
Searcher		.1										
Wolf eel									.1			

Table 18. (continued)

	IZHUT				KALSIN		KILIUDA				KAIUGNAK	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
Flathead sole			.1									
Rock sole	1.8	3.0	4.3	1.0	6.9	2.6	2.6	5.7	.6	.2	.7	
Yellowfin sole			.2		2.4		.9	.7	.1			
Starry flounder					.4	.1			.1		.1	
Pacific halibut	.1			.3	.1							

Table 9. Mean tow net catch in numbers of individuals per km towed by subarea and [illegible] for all cruises combined.

	IZHUT				KALSIN		KILIUDA				KAIUGNAK	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
Pink salmon juv.	2.5	.2			8.8	1.2	1.0		14.7	1.1		.4
Chum salmon juv.					2.3	.3	≤4.1	.1				
Capelin			3.1	7.0				3.3	4	.1		
Pacific cod juv.		.1							.7	.1		.1
Threespine stick		.2			.1	1.4	.1		.1		.1	.9
Hexagrammos spp.	.1				.2							
Kelp greenling		.2										
Whitespotted greenling		.1		.1	.2							.5
Lingcod	.2				.2	.			.1			2.5
Silverspotted sculpin											.1	
Tadpole sculpin									.1			
Tubenose poacher					.1							
Prowfish									.1	.1		.3
Pacific sand lance	102.9	.5			.2	.1	26.6	195.7	1697.3	.1	488.0	

Table 20. Mean try net catch in numbers of fish per 10 minutes towed by subarea and taxon for all cruises combined.

	IZHUT				KALSIN		KILIUDA				KAIUGNAK	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
King crab					86.7	24.1				26.8	2.3	
Tanner crab	7.3	25.5	20.8	3.0	35.8	67.1	112.0			161.3	.5	
Dungeness crab		.6	1.6	.6	.2		7.0			5.6		
Pacific herring					.2							
Capelin					1.4	.9						
Pacific cod		.6			1.0	.6				6.0	1.8	
Pacific tomcod				.2						7.8		
Walleye pollock	1.3	2.3			5.4	3.6				1.8	.5	
Shortfin eelpout	.7											
Dusky rockfish										.2		
Kelp greenling										.2		
Rock greenling										.2	1.4	
Masked greenling										.7	4.2	
Whitespotted greenling	1.3	2.8	2.0	.4	5.4	3.6	3.0,			9.0	11.1	
Lingcod		.6	.2		.2	.9				.5	.5	
Sablefish										.2		
Sculpin spp.		.6			1.0					.2		
Padded sculpin					.2					.4		
Crested sculpin										.4		
Silverspotted sculpin										1.1	.9	
Spinyhead sculpin		5.7	.9			.3				1.2	.5	
Buffalo sculpin						.6						
Gymnocanthus spp.		1.1	1.8	2.3	24.2	27.3	8.0			7.6	1.8	
Armorhead sculpin		3.4	12.2	14.7	2.1	2.7	5.0			9.4	.5	
Threaded sculpin			1.1	.4	44.5	32.7	190.0			17.1	15.7	
Red Irish Lord										.2	.9	
Yellow Irish Lord	.7	7.4		2.3	1.5	2.1	3.0			35.6	13.8	
Bigmouth sculpin			.2									
Northern sculpin				.4								
Pacific staghorn sculpin			.4		.4	.3	1.0			2.8		
Myoxocephalus spp.		6.2	1.4	.2	.2	3.0	4.0			1.9	4.6	
Plain sculpin					7.5	1.8				11.1	1.4	
Great sculpin	.7	1.7	.4	.6	.6	.9				5.3	3.2	

Table 20. (continued)

	IZHUT				KALSIN		KILIUDA				KAIUGNAK	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
Shorthorn sculpin	.7				.2					.4		
Sailfin sculpin		.6										
Slim sculpin							2.0					
Triglops spp.											3.7	
Scissortail sculpin										.2	.5	
Roughspine sculpin				.2						.2		
Ribbed sculpin			.4	1.5		.9	13.0			3.7	7.4	
Smooth alligatorfish				.2								
Sturgeon poacher		1.1	.7	2.6	4.1	.6				3.5		
Bering poacher										.2		
Tubenose poacher					.2					.2	.5	
Snailfish spp.					1.5						.5	
Liparis spp.										.9		
Marbled snailfish			.4									
Pacific sandfish				.4						.2		
Searcher		22.6	.5	.4	.4	1.2	1.0			3.7		
Prickleback spp.										.2	.5	
High cockscomb		.6			.2							
Lumpenus spp.							1.0					
Snake prickleback	4.0	.6	.2	.2	1.7		2.0			1.8	.9	
Daubed shanny		2.8					1.0			1.8		
Stout eelblenny	1.3	2.3					2.0			6.0		
Arctic shanny										.4	1.4	
Longfin gunnel										.2		
Crescent gunnel										.7	1.8	
Arrowtooth flounder		27.2	3.7	5.6	.8	39.5				4.6		
Rex sole					.4							
Flathead sole	4.7	103.6	20.4	6.4	93.1	93.9	126.0			60.7	7.8	
Butter sole		3.4	6.2	9.4	1.4	5.6				17.8		
Rock sole	10.0	8.5	254.2	426.6	169.4	220.1	11.0			157.9	60.0	
Yellowfin sole	9.3	76.4	23.1	6.6	282.0	451.0	220.0			269.5	167.5	
Dover sole		.6			.2	5.6				.5		
English sole		1.1	.2	.2						1.8		
Starry flounder	.7			1.5	2.1	.3	2.0			.2		
Alaska plaice					1.0	.6				.2		
Sand sole			1.6	1.1	.6					.7		
Pacific halibut											8	

The otter trawl was used only in two areas so this analysis was not performed. The otter trawl catch by area is presented in Table 21.

Izhut Bay was physically unique; it is the deepest bay and has the most rocky shoreline of any of the bays, as discussed under Study Area. There were no juvenile chum salmon captured in Izhut Bay (Table 16 and 19) . Izhut is the only bay among the four sampled in which there are no streams in which chum salmon spawn (Figure 4) . The total try net catch in inner Izhut Bay (Table 20) was much lower than in any other area. In July and August try net catches in this area contained very few live fish and a few dead and decaying fish. This situation is suggestive of an anoxic environment and this bay has the elements necessary for such an environment to develop. The bay has a maximum depth of 13 fm with a narrow mouth of 2 to 4 fm depth and is protected. Typically, in such conditions deeper waters have no opportunity to exchange with oxygenated waters due to summer" stratification. Surface waters can exchange, bringing in plankton which will settle to the deeper waters and decay, consuming oxygen. Due to the relatively small volume of the deeper portion of this bay it can contain little oxygen.

The inner portion of Kiliuda Bay also had evidence of reduced fish catch in summer, with evidence that anoxia may have occurred. Inner Kiliuda does not have a sill preventing deep water exchange.

Kalsin Bay displayed only one outstanding characteristic in terms of catch. The try net yielded greater catches of king crab and yellowfin sole than in any other area (Table 20).

Kiliuda Bay was unique in several respects; the outer area yielded the greatest number of species captured by the beach seine, gill net and also by the try net (Figure 14). Juvenile chum salmon catches in both the beach seine and tow net were far higher in inner Kiliuda than in any other area. In three of the areas of Kiliuda Bay, chum salmon were more abundant than pink salmon in the beach seine collection (Table 16), a feature that occurred in no other area. The catches of sandlance in the beach seine were lower in every area of Kiliuda Bay than in any other area (Table 16) while tow net catches of sandlance were highest within the inner middle and outer middle Kiliuda Bay area (Table 19). The trammel net yielded higher proportions of masked greenling from all areas of Kiliuda than in any other area;and in the inner Kiliuda and inner middle Kiliuda areas catches of rock greenling were lower than in any other area while catches of whitespotted greenling were higher than in any other area (Table 18). The try net yielded higher catches of Tanner crab and Dungeness crab in two Kiliuda Bay areas sampled than any other areas (Table 20).

Kaiugnak Bay yielded far higher catch rates of pink salmon from both its areas than occurred in any other area (Table 16). The outer Kaiugnak Bay area consisted primarily of a large shallow lagoon.

Table 21. **Otter trawl catch in kilograms per kilometer trawled and number of trawls, by taxon and area. T represents trace, less than 0.05 kg/ion.**

Taxon	Outer Izhut	Outer Kiliuda
Scallops	0.1	
Hermit crab		0.1
King crab	0.3	13.7
Hyas crab		T
Tanner crab	8.3	11.3
Dungeness crab	3.8	0.3
Spiny dogfish		0.1
Big skate	T	6.2
Longnose skate		0.2
Pacific herring	0.1	T
Capelin	T	0.2
Eulachon	T	0.4
Pacific cod	8.9	22.7
Pacific tomcod	23.4	0.3
Walleye pollock	6.7	17.2
Shortfin eelpout	0.1	T
Wattled eelpout	0.1	T
Sebastes sp.	T	T
Darkblotched rockfish	T	
Hexagrammos sp.	T	
Kelp greenling	T	T
Rock greenling		T
Masked greenling		0.1
Whitespotted greenling	0.1	0.6
Lingcod		T
Sablefish	21.5	4.5
Sculpin sp.	3.1	1.7
Spinyhead sculpin	0.4	0.1
Gymnocanthus spp.	15.9	6.0
Red Irish Lord	0.2	
Yellow Irish Lord	4.2	138.1
Bigmouth sculpin	T	
Northern sculpin	T	
Pacific staghorn sculpin	0.9	3.8
Myoxocephalus spp.	17.4	50.8
Triglops sp.	T	T
Ribbed sculpin	T	T
Smooth alligatorfish		T
Sturgeon poacher	T	0.6
Snailfish sp.		T
Pacific sandfish	0.2	0.1
Searcher	0.8	0.3
Northern ronquil	0.1	
Pricklebacks	T	
Snake prickleback	0.1	T
Daubed shanny	T	T

Table 21. Continued

Taxon	Outer Izhut	Outer Kiliuda
Stout eelblenny		T
Whitebarred blenny		T
Arrowtooth flounder	11.6	3.7
Rex sole	0.3	0.1
Flathead sole	26.3	41.6
Butter sole	2.3	3.3
Rock sole	148.9	9.4
Yellowfin sole	48.6	47.6
Dover sole	0.2	
English sole	1.1	T
Starry flounder	2.5	3.7
Sand sole	0.6	0.6
Pacific halibut	8.9	21.0
Number of trawls	20	21

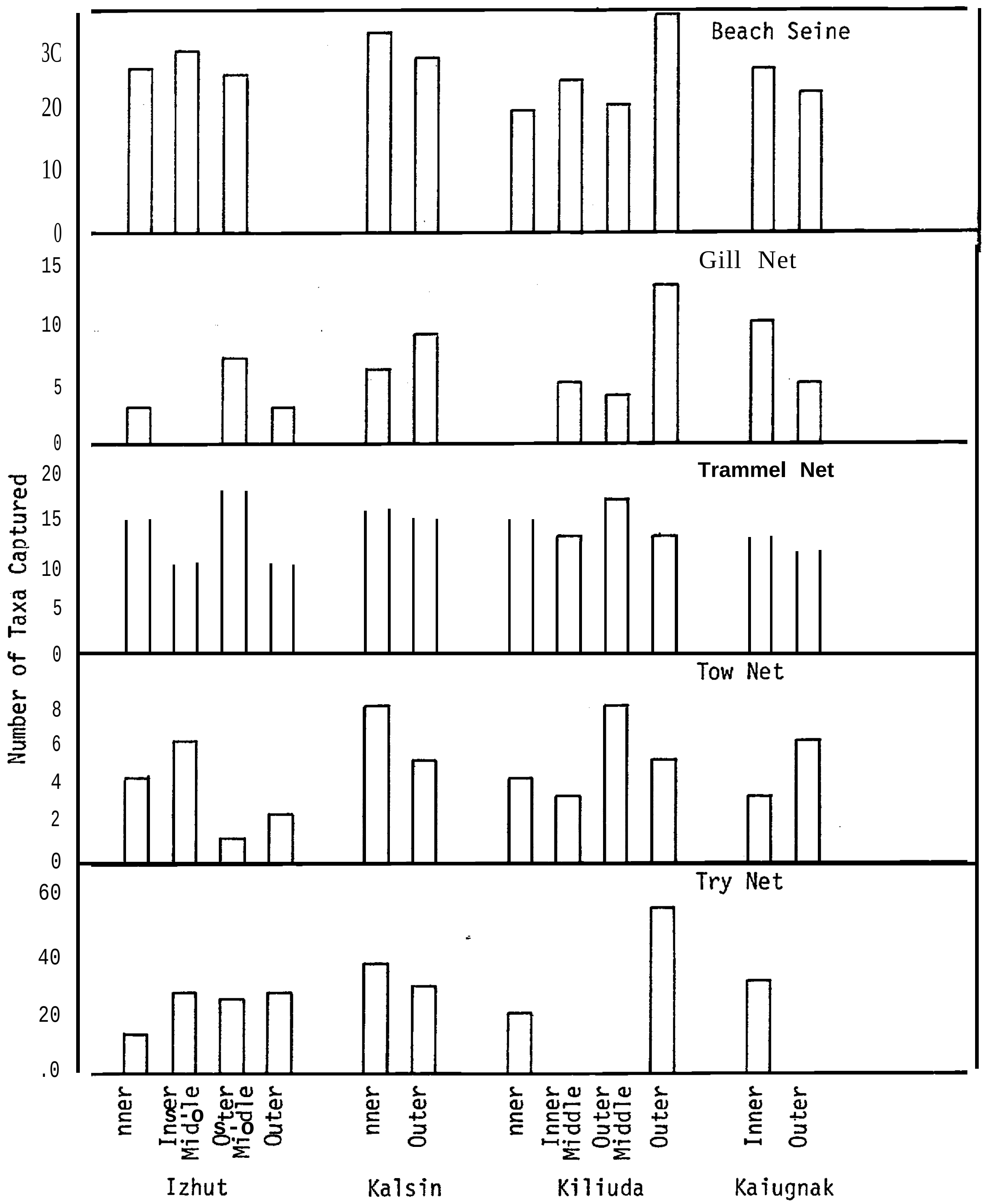

Figure 14. Number of taxa captured **in each sampling** gear and subarea on the east side of the Kodiak Archipelago, 1978-1979. The otter trawl was not included because it was used in only two subareas.

The beach seine yielded much higher catch rates in this outer Kaiugnak area than in any other area sampled for Dolly Varden, juvenile Pacific cod, Pacific tomcod, tubenose poacher and snake prickleback. Silver-spotted sculpin catches in the beach seine were also very high in outer Kaiugnak, and the catch of this species was also very high in inner Kiliuda (Table 16). The trammel net yielded the highest catch rates of rock greenling and some of the lowest catch rates of whitespotted greenling in Kaiugnak Bay.

Species Associations

The results of the species association analyses both depend upon and reveal the relative abilities of the different sampling gear to catch a variety of fish species. As will be shown, the try net, beach seine, and trammel net caught a considerably greater variety of species than the gill net or tow net. The gill net catch was greatly predominated by three species while the tow net catch was so highly variable that the distribution features are probably due to chance.

There were 18 species in the beach seine catches that were judged to be sufficiently frequent and abundant that their correlation with other species would have meaning. A number of highly significant correlations occurred. After grouping the larger correlations there were five groups remaining at a correlation coefficient of .35 (Figure 15). One of these consisted mainly of the predominant species, sand lance, pink salmon, masked greenling, great sculpin and Myoxocephalus Spp. Weakly associated with this was another group composed of Pacific cod, tubenose poacher, Dolly Varden, silverspotted sculpin, threespine sticklebacks, and rock greenling. The other three groups were not associated with any other group and two were negatively associated with all others. (Note that negative association did not appear at as large a. value as positive association partly because species were grouped before negative values were encountered.)

The group composed of lingcod juveniles and chum salmon had large catches in inner Kiliuda in common; and when this area is eliminated the relationship between them vanishes. This grouping is probably spurious.

There were only six species in the gill net catches that were sufficiently frequent that their correlation with other species would have meaning. Among these species there was only one significant correlation, between Pacific cod and Pacific herring (Figure 15).

In the trammel net catches there were 17 species sufficiently frequent to include in interspecies correlations. There were a number of significant correlations; and after grouping the larger correlations there were six groups remaining at a correlation coefficient of .35 (Figure 15). In one group were staghorn sculpin, starry flounder, yellowfin sole, rock-sole and terpug. Associated with this group was a group composed of white-spotted greenling and great sculpin. These two were related to a third group composed of Dolly Varden, herring, Myoxocephalus spp., and shorthorn sculpin (note that shorthorn sculpin is not necessarily a valid identification but for the purposes of this analysis distinctions made in the field

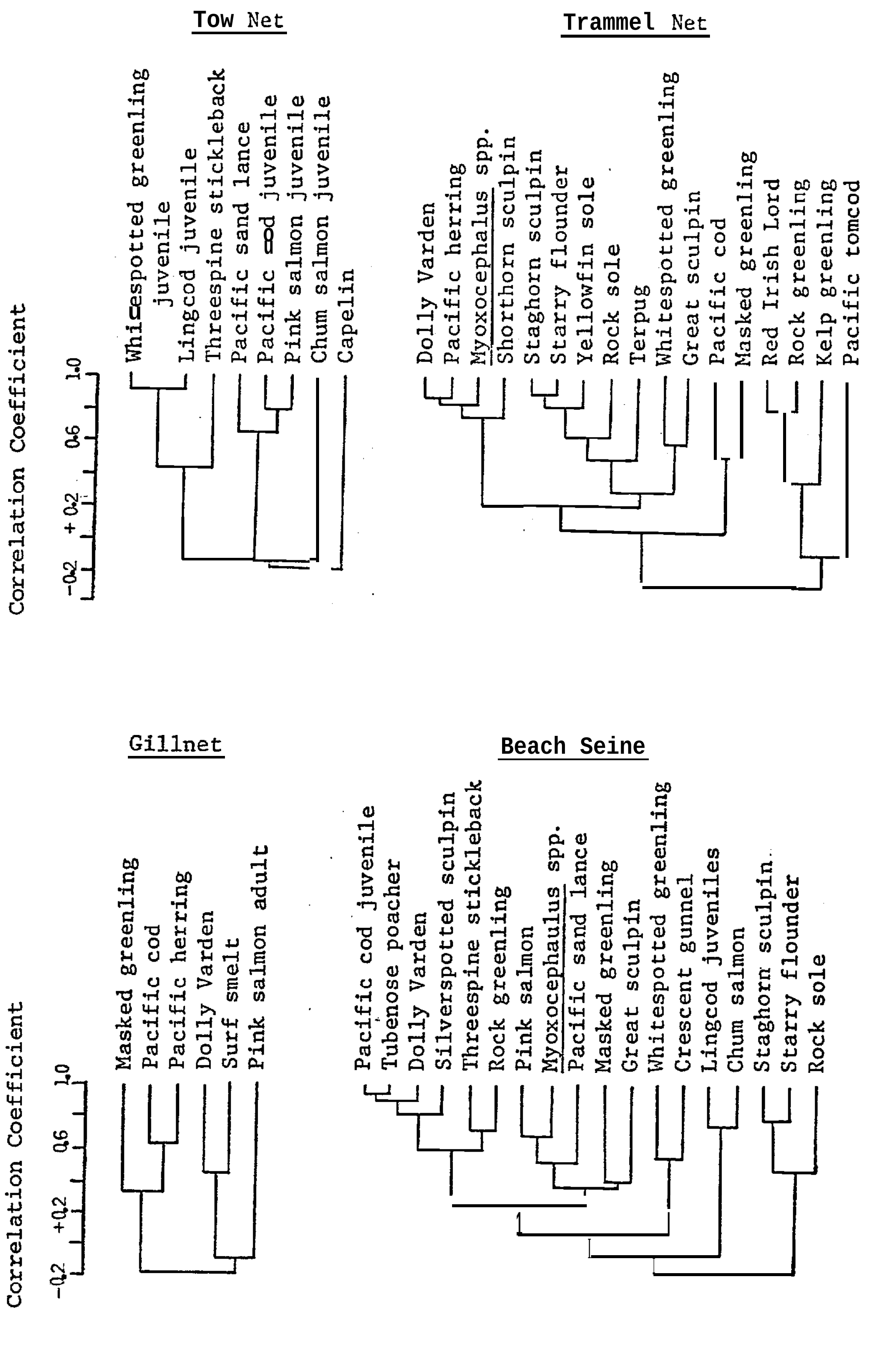

Figure 15. Dendrograms of the correlation coefficients among species from mean catches by area, for four gear types.

were maintained) . The remaining three groups were not associated or were negatively associated with all other groups. Red Irish lord, rock greenling and kelp greenling comprised one group; Pacific tomcod comprised a group,while Pacific cod and masked greenling comprised the remaining group (Figure 15).

There were eight species in the tow net catches that were sufficiently frequent to include in interspecific correlations. After larger correlation coefficients were combined there were four groups remaining at a correlation coefficient of .35 (Figure 15). Each of these groups was negatively associated with all others. The groups were, 1. whitespotted greenling juveniles, lingcod juveniles and threespine sticklebacks juveniles; 2. sand lance, Pacific cod juveniles, and pink salmon juveniles: 3. chum salmon juveniles and 4. capelin (Figure 15).

In the try net catches there were 31 species sufficiently frequent to include in interspecific correlations. A number of significant correlation coefficients occurred,and after grouping species with high correlations there were six groups remaining at a correlation coefficient of .35 (Figure 16). Of these groups, one contained 13 species, one contained eight species, three groups contained three species and one contained a single species (Figure 16).

Diversity

The diversity measure employed (Shannon index divided by total catch, in which form it is termed diversity per individual; Clifford and Stephenson, 1975) is largest when all the numbers greater than zero are most similiar. It also increases as the total number of separate numbers increases.

The diversity between species was highest for the try net and lowest for the tow net (Table 22). Since this index uses the total catch of each species (Table 16,17,18,19 and 20) this result indicates that the differences among the tow net species totals were greater than for any other gear and the differences among the try net species totals were less than for any other gear.

Table 22. Shannon diversity per individual (times 100 to remove decimals) between species, area, total and interaction for each sampling gear.

	Between Species	Between Subareas	Total	Interaction
Beach Seine	71	91	149	14
Gill Net	61	79	122	18
Trammel Net	69	105	160	14
Tow Net	54	70	83	41
Try Net	93	88	164	16

Try Net

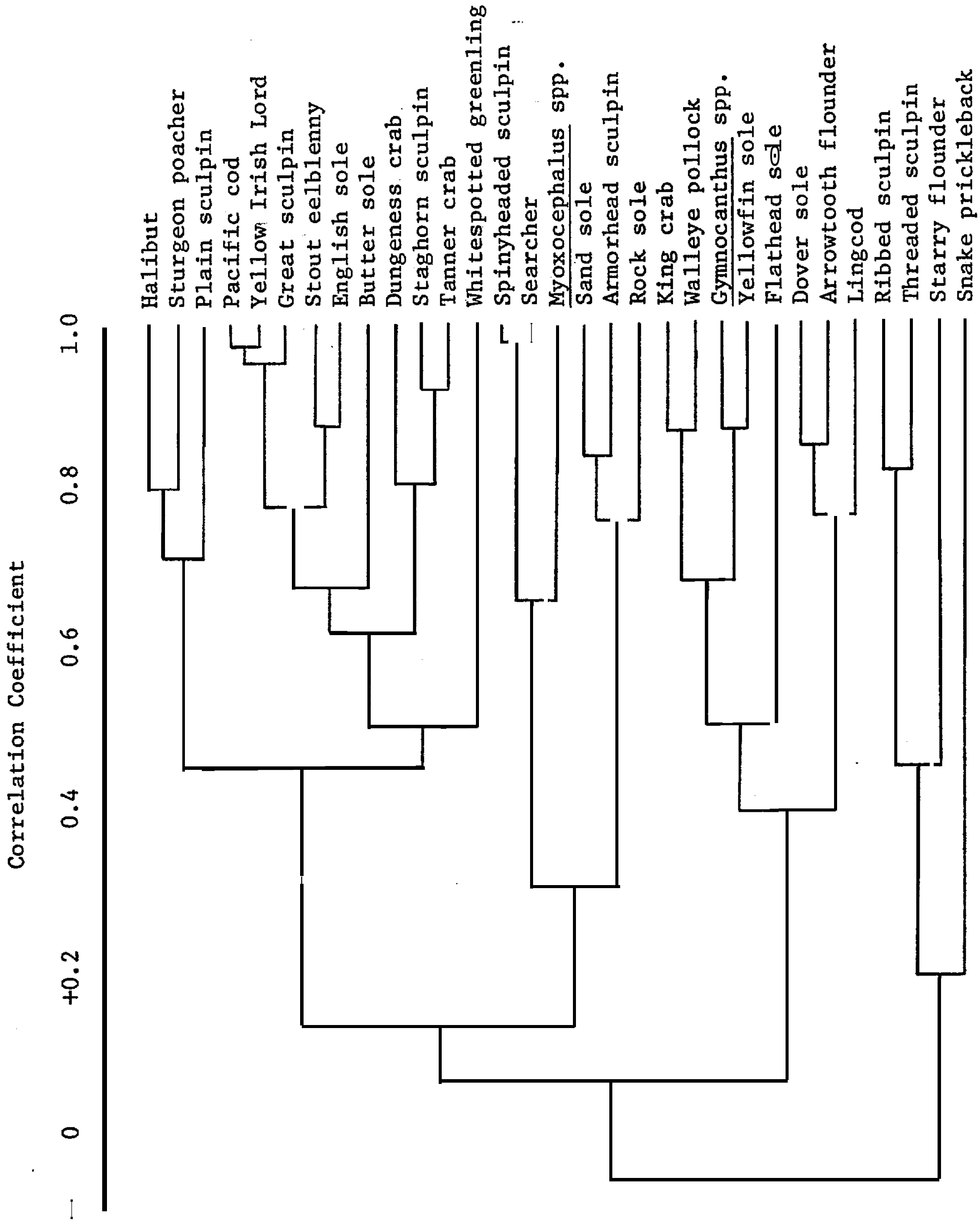

Figure 16. Dendrogram of the correlation coefficients among species from mean catches by area in the try net.

The diversity between areas was highest for the trammel net and lowest for the tow net (Table 22). Since this index uses the total catch in each subarea (Table 16, 17, 18, 19, and 20), this result indicates that the differences among areas was least for the trammel net and greatest for the tow net catches.

The total diversity was highest for the try net, trammel net and beach seine and least for the gill net and tow net (Table 22). Since this index uses all numbers in each table of species by area (Tables 16, 17, 18, 19 and 20) the result indicates that the variation among these numbers is least in the try net, trammel net and beach seine and greatest for the gill net and tow net.

The interactive diversity was about 9 to 14 percent of the total diversity for all sampling gear except the tow net, for which it was nearly 50 percent of the total diversity (Table 22). This index reflects the fidelity of species to areas. Thus, the high interactive diversity for the tow net indicates greater fidelity between species and areas in this gear. However, this is probably due in part to inadequate sampling.

The diversity of species catches within each subarea (Table 23) is a reflectionof the equitability of species numbers, greater diversity indicating greater equitability. From the beach seine catches the greatest diversity was found in outer middle Kiliuda (Table 23). Greatest diversity was found in inner Kaiugnak with the gill net, inner Kalsin with the trammel net, inner middle Izhut with the tow net and outer Kiliuda with the try net (Table 23).

The diversity of each species between subareas (Table 24) for each gear type is an indication of the equitability of the catch, higher diversity indicating greater equitability. Only two species, Pacific cod and whitespotted greenling had significant differences between area diversities from all five gear types (Table 24). A total of six species had significant difference between area diversities from four gear types: Pacific herring, pink salmon, rock greenling, masked greenling, staghorn sculpin and great sculpin.

The species with greatest diversity in the beach seine catches were masked greenling, whitespotted greenling, Myoxocephalus spp., buffalo sculpin, crescent gunnel and great- sculpin (Table 24). The species with greatest diversity in the gill net catches were Dolly Varden, adult pink salmon and masked greenling (Table 24). The species with greatest diversity in the trammel net catches were whitespotted greenling, rock greenling, masked greenling, great sculpin and rock sole (Table 24). The species with greatest diversity in the tow net catches were juvenile pink salmon, threespine sticklebacks and capelin (Table 24). The species with greatest diversity in the try net catches were whitespotted greenling, flathead sole, yellowfin sole, rock sole, Myoxocephalus spp., snake prickleback, and Pacific halibut (Table 24).

Table 23. Shannon diversity per individual (times 100 to remove decimals) within each subarea by sampling gear.

	Izhut				Kalsin		Kiliuda				Kaiugnak	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
Beach seine	54	74	53		73	63	57	73	95	72	39	58
Gill Net	45		23	44	60	51		52	52	38	87	50
Trammel Net	61	68	78	68	85	71	76	53	40	38	42	35
Tow Net	18	68	0	3	36	46	4	6	19	33	30	60
Try Net	91	91	53	32	84	76	75			98	79	

The number of taxa captured is an indication of diversity (Figure 14). The amount of effort affects the number of taxa captured (Table 25) but there is no way to completely remove the effect of varying effort. If it is assumed that the subareas were sampled approximately equally, the number of taxa in each subarea in each sampling gear provides a direct indication of species richness. The most taxa were caught in the try net and the greatest number of species in the try net were captured in outer Kiliuda (Figure 14). The beach seine yielded generally the second greatest number of taxa and the greatest number of taxa were taken in outer Kiliuda also (Figure 14).

The trammel net yielded the third greatest number of taxa and the greatest number of taxa were taken with this gear in outer middle Izhut (Figure 14). The greatest number of taxa in the gill net were taken in outer Kiliuda (Figure 14). The greatest number of taxa in the tow net were taken in inner Kalsin and outer middle Kiliuda (Figure 14).

The diversity by sampling date does not show clear trends in all gear types (Figure 17). The diversity of beach seine and tow net samples was depressed considerably in July and August by the high abundance of sand lance. All gear showed highest species counts during August, with the exception of the otter trawl (Figure 17).

Table 24. Shannon diversity per individual (times 100 to remove decimals) among subareas for each species and each sampling gear. A few species were omitted when all entries were zero (one occurrence in any one gear). Otter trawl was omitted because it was used in only two areas while the other sampling gears were used in nine or more of the areas.

	Beach Seine	Gill Net	Trammel Net	Tow Net	Try Net
King crab	0				43
Tanner crab					71
Dungeness crab	43				55
Pacific herring	45	65	39		0
Pink salmon	79	76	20	60	
Chum salmon	76	46		8	
Coho salmon	8	30			
Sockeye salmon		41			
Dolly Varden	76	85	63		
Surf smelt	13	36			
Capelin	48	0		50	29
Pacific cod	61	58	88	41	51
Pacific tomcod	16	0	48		5
Walleye pollock	30	0	45		69
Threespine sticklebacks	78			59	
Tube-snout	30				
Dusky rockfish		0	5		0
Black rockfish			33		
Hexagrammos spp.	60		0	28	
Kelp greenling	0		79	0	0
Rock greenling	82	28	96		16
Masked greenling		75	96		18

Table 24. Continued...

	Beach Seine	Gill Net	Trammel Net	Tow Net	Try Net
Whitespotted greenling	98	12	97	45	82
Terpug			58		
Ling cod	63			33	72
Sculpin spp.	54		0		41
Padded sculpin	55				28
Crested sculpin			0		0
Silverspotted sculpin	65		30	0	30
Sharpnose sculpin	37				
Spinyhead sculpin					46
Buffalo' sculpin	94		0		0
Gymnocanthus spp.	46		30		68
Armorhead sculpin			0		77
Threaded sculpin			20		50
Red Irish Lord	0		68		21
Yellow Irish Lord	79		30		61
Staghorn sculpin	72	41	36		5 3
Myoxocephalus spp.	95		76		76
Plain sculpin	0		0		47
Great sculpin	90	4 4	96		73
Shorthorn sculpin	60		59		43
Slim sculpin					0
Manacled sculpin	24				
Scissortail sculpin					26
Roughspine sculpin					30
Ribbed sculpin					57
Sturgeon poacher			22		68
Tubenose poacher	46"			0	43
Snailfish spp.	10				24
Spotted Snailfish	28				
Sandfish	0				28
Searcher	0		0		39
Prickleback spp.					26
High cockscomb	0				24
Snake prickleback	7	0			76
Daubed shanny					44
Stout eelblenny					53
Arctic shanny	38				23
Penpoint gunnel	48				
Crescent gunnel	91				26
Prowfish	30			41	
Pacific sand lance	80			49	
Arrowtooth flounder					54
Rex sole					0
Flathead sole			0		79.
Butter sole	0				67
Rock sole	81		91		76
Yellowfin sole	13		51		77
Dover sole					29
English sole	29				45
Starry Flounder	71	0	50		67
Alaska plaice	30				41
Sand sole	38				57
Pacific halibut	0		41		75

Table 25. Number of hauls or sets of each gear type in each subarea for all cruises combined.

	Izhut				Kalsin		Kiliuda				Kaiugnak	
	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer	Inner	Inner Middle	Outer Middle	Outer	Inner	Outer
Beach Seine	36	37	48	0	37	37	35	36	38	47	35	31
Gill Net	8	6	11	1	8	9	0	20	4	15	12	8
Trammel Net	13	8	15	3	14	12	10	7	14	11	12	11
Tow Net	18	26	12	14	30	13	16	15	23	15	16	16
Try Net	9	11	34	27	31	21	6	0	0	34	13	0
Otter Trawl[1]	0	0	0	20	0	0	0	0	0	21	0	0

[1]The otter trawl was not used in all areas because this study was designed as a nearshore survey and some otter trawling was added as an afterthought to provide some link with existing information on otter trawl catches.

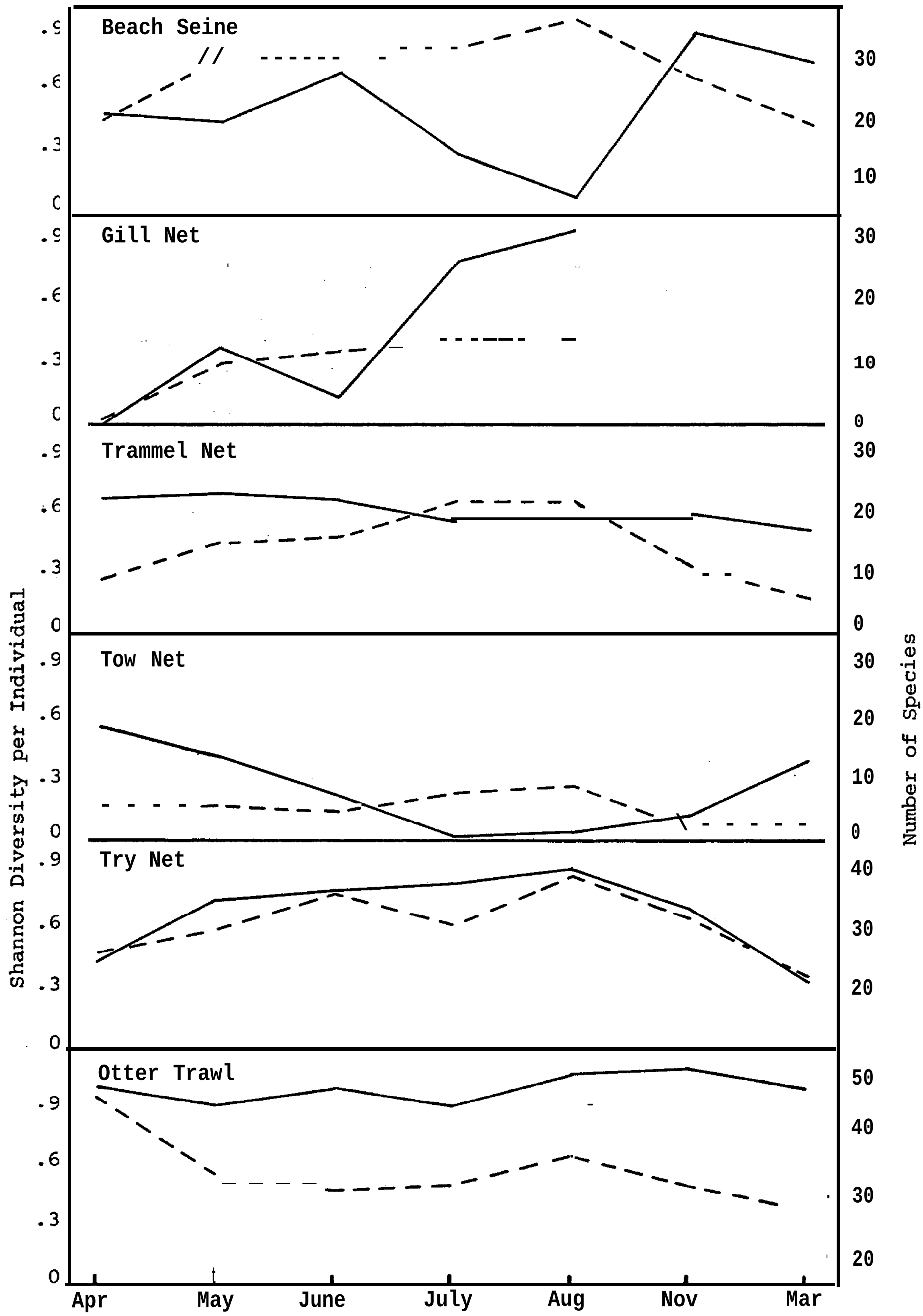

Figure 17. Shannon diversity per individual (solid line) and number of species (dashed line) by gear and month.

Features of Distribution, Abundance, Migration, Growth and Reproduction of Prominent Taxa

King Crab

Although they occurred in every cruise, known seasonal migration features, described earlier, were not clearly displayed (Tables 10,14, 15) .

King crab were captured in outer Izhut in the trawl (Table 21), inner and outer Kalsin in the try net (Table 20) , outer Kiliuda in the beach seine, try net and otter trawl (Tables 16, 20 and 21) and inner Kaiugnak in the try net (Table 20).

Tanner Crab

Seasonal features of Tanner crab catches are not consistent in the try net and otter trawl but the two types of gear captured Tanner crab of considerably different sizes. The otter trawl, which sampled 30 to 50 fathoms deep, captured larger crab, with mean weights ranging from 0.36 to 0.67 kg/crab by cruise. The try net sampled 10 fathoms and shallower and captured crab 0.02 kg to 0.37 kg/crab by cruise. The mean catch of crab in the otter trawl in June was strongly biased downward due to failure to record weights or counts, partly due to the soft shell of the recently molted crab.

Tanner crab are known to occur in shallower waters in April and May and this is reflected in the higher otter trawl catches at this time. Lower otter trawl catches during the other portions of the year are due to movement into deeper waters. Tanner crab were captured in all areas in the try net (Table 20).

Pacific Herring

Seasonality was apparent, with greatest gill and trammel net catches in May and June. Catch variability was quite high for herring, and differences between bays cannot be stated with any degree of confidence; however, the highest catches in the gill net were obtained in outer Kiliuda, outer Kalsin and the two outer areas of Izhut (Table 17). Herring in spawning condition were captured in April, May and June (Table 26).

Age O herring were 3 to 4 cm in August and a few captured in November were 6 to 7 cm. Older age classes cannot be identified from the existing length frequencies (Figure 18).

Pink Salmon

Pink salmon occurred from March to August, with greatest abundance in June and July. Pinks were present in all areas sampled, and the greatest juvenile pink salmon catches were in the beach seine in

Table 26. Stage of maturity by date for each species examined. Data were collected on the eastside of the Kodiak Archipelago during April through November of 1978 and March of 1979. The criteria used to classify gonads did not clearly separate spent, inactive, and maturing;thus these results should be used with caution. The values are numbers of fish.

	APRIL		MAY		JUNE		JULY		AUGUST		NOVEMBER		MARCH	
	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-8	12-18	3-10	15-18
Pacific Herring														
Maturing		2	3		3									
Spawning		1	95	1	5									
Spent			3		8	1	8							
Pink Salmon														
Maturing								7	13	2				
Chum Salmon														
Maturing										2				
Coho Salmon														
Maturing										1				
Sockeye Salmon														
Maturing					1			1						
Dolly Varden														
Maturing		9	2	1		3	2	6	2	1		2		
Spawning					1						1			
Spent					8						13			
Inactive			4	1	1									
Surf Smelt														
Maturing			1		3						2			
Spawning			2											

Table 26. Stage of maturity by date for each species examined. (CONTINUED)

	APRIL		MAY		JUNE		JULY		AUGUST		NOVEMBER		MARCH	
	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-8	12-18	3-10	15-18
Capelin														
Maturing		1			3	3								20
Spawning			1		4	1							3	
Spent					4									
Inactive					2									
Eulachon														
Maturing												13		
Spawning		2												
Pacific Cod														
Maturing	5				14	14		6				9	5	
Spawning		1												
Inactive				1	6	2		10		13		5	2	
Pacific Tomcod														
Maturing									1		1		15	
Spawning													3	2
Inactive									5		5			
Walleye Pollock														
Maturing							3	6	9	8	2	1		3
Spawning	3													
Spent										1				
Inactive										5	1	8		
Threespine Stickleback														
Maturing				1		3		1						

Table 26. Stage of maturity by date for each species examined. (CONTINUED)

	APRIL		MAY		JUNE		JULY		AUGUST		NOVEMBER		MARCH	
	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-8	12-18	3-10	15-18
<u>Black Rockfish</u>														
Maturing	2								4					
<u>Kelp Greenling</u>														
Maturing	2		2				2				4			
Spawning							1				2			
Spent									1					
Inactive	3					2			5					
<u>Rock Greenling</u>														
Maturing	1	27	76	44	95	67	48	28	15	1			15	[illegible]
Spawning					1	38	31	26	36	14				
Spent						18	15	6	19	29				4
Inactive	2			4	1	3	2		4	3	36	34	10	3
<u>Masked Greenling</u>														
Maturing	1	29	18	80	47	146	70	58	65	38	4			3
Spawning						7	40	41	27	46				
Spent						1	2	4	5	8				
Inactive	2		1	2		1	1	1		1	34	38		1
<u>Whitespotted Greenling</u>														
Maturing		2	5	25	32	46	33	63	38	28	1	1	3	5
Spawning					1	5	1	5	16	54				
Spent										1				
Inactive				10	3	8	3	2	3		19	14	3	
<u>Terpug</u>														
Maturing			2	2	9									

Table 26. Stage of maturity by date for each species examined. (CONTINUED)

	APRIL		MAY		JUNE		JULY		AUGUST		NOVEMBER		MARCH	
	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-8	12-18	3-10	15-18
Silverspotted Sculpin														
Maturing					1									
Threaded Sculpin														
Maturing														
Spawning													2	
Red Irish Lord														
Maturing						2	3	3	1	3	1			
Inactive						1						1		
Yellow Irish Lord														
Maturing			28	19	12	45	19	26	12	5			11	
Spawning						7			5	4				
Spent										1				
Inactive				19	1			16	2	29	22	19	9	
Staghorn Sculpin														
Maturing	1				2	2	6	2	2			2		
Inactive						4								
Plain Sculpin														
Maturing						1	1				2			
Great Sculpin														
Maturing	1	1	12	19	2	23	8	15	8	17	4			
Spent				2		1		3	4					
Inactive	1		1	28	4	3		14	1	9	3			

Table 26. Stage of maturity by date for each species examined. (CONTINUED)

	APRIL		MAY		JUNE		JULY		AUGUST		NOVEMBER		MARCH	
	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-8	12-18	3-10	15-18
Manacled Sculpin														
Maturing	4		1											
Spawning							1							
Ribbed Sculpin														
Maturing											1			
Spawning											1			
Tubenose Poacher														
Maturing											3	4		
Spawning				1										
Pacific Sandfish														
Maturing	1		1	1			21	9	18			2	1	
Spawning													5	
Spent				4	1				1					
Inactive				4				3						
Alaska Ronquil														
Spawning					1									
Searcher														
Maturing	2													
Snake Prickleback														
Maturing			1		14	1	13	10	1	2				2
Inactive								6	2	2				

Table 26. Stage of maturity by date for each species examined. **(CONTINUED)**

	APRIL		MAY		JUNE		JULY		AUGUST		NOVEMBER		MARCH	
	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-8	12-18	3-10	15-18
Arctic Shanny														
Maturing				1										
Crescent Gunnel														
Maturing					1	1	7	5	6	4				
Spent														1
Inactive	1			3					5	1				
Pacific Sandlance														
Maturing								1	1	18		1		
Spawning										1	10	48		
Spent										2		2		
Inactive								6	3					
Arrowtooth Flounder														
Maturing			1											
Flathead Sole														
Maturing			3	17	21	34	18	14	22	16	23	6	7	1
Spawning				1		2	7		2	1	2			
Spent						1		3						
Inactive				1	27				1	3	1	1		
Buttersole														
Maturing			9	5	1						10			
Spawning			1											
Rocksole														
Maturing	78	14	146	71	157	53	99	43	54	19	130	17	42	5
Spawning			2		10	1	2		1			1		
Spent	1					2	6	10	8		3		4	
Inactive			4	1	57	1		10	52	21	21	2	22	24

Table 26. Stage of maturity by date for each species examined. (CONTINUED)

	APRIL		MAY		JUNE		JULY		AUGUST		NOVEMBER		MARCH	
	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-8	12-18	3-10	15-18
Yellowfin Sole														
Maturing		3	105	41	122	47	31	44	47	15	74	40	51	36
Spawning			1		76	69	61	17	24	54	"4			
Spent							3	12	5	7	5,			
Inactive					1			2	4	2	1			1
Starry Flounder														
Maturing		1	5		3					1				
Inactive											5			
Alaska Plaice														
Maturing											2			
Sandsole														
Maturing			2			1								
Pacific Halibut														
Maturing							6							

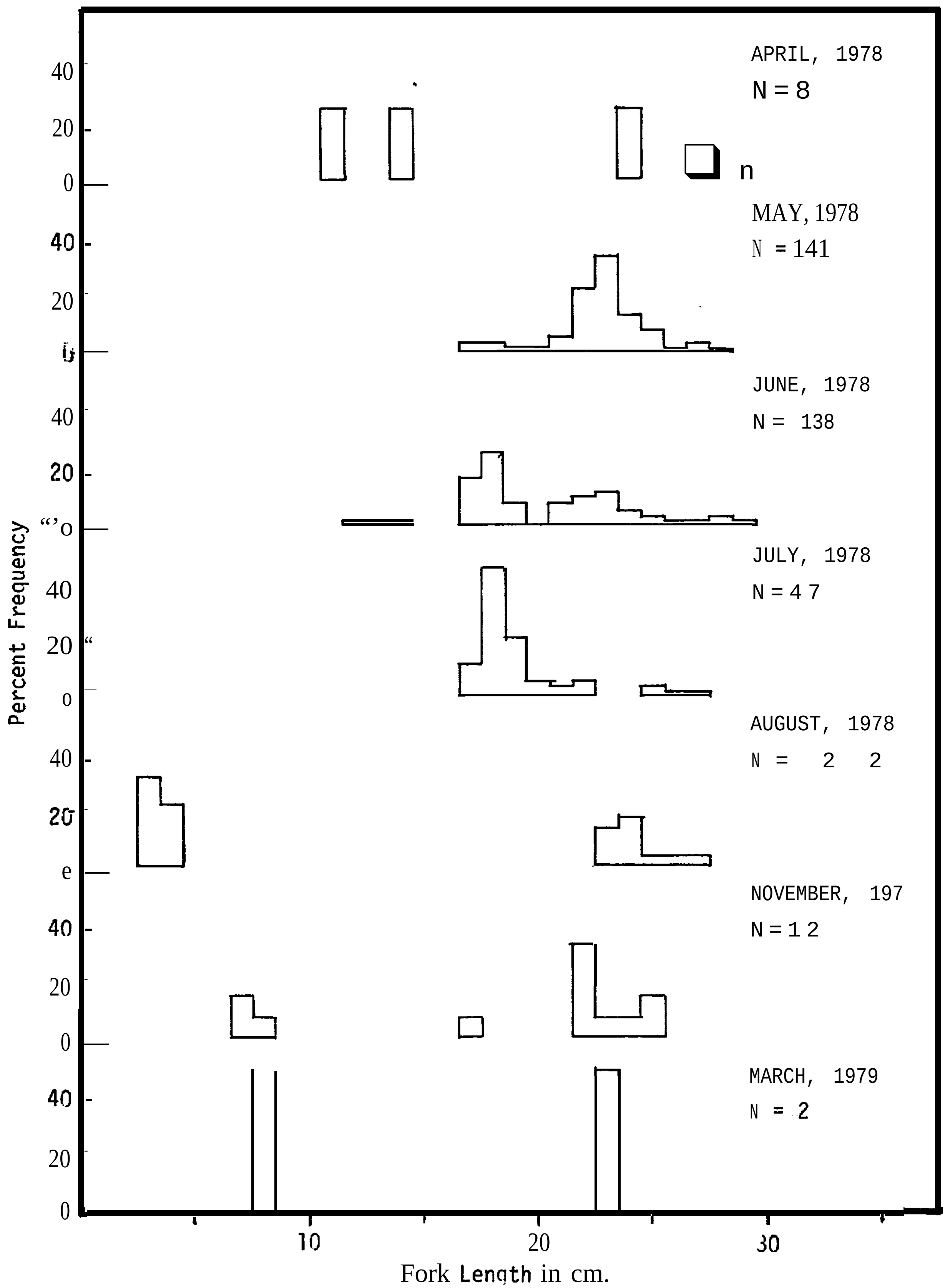

Figure 18. Relative length frequency of Pacific herring by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

Kaiugnak Bay (Table 16). Tow net catches were larger in Kalsin and Kiliuda Bays (Table 19). Adult pink salmon occurred in trace amounts in July and greater numbers in August in the beach seine, trammel net and gill net. Adult pink salmon were captured from late July through late August (Table 26).

The degree of exposure of each bay, or size of the bay, probably affected catches, as young pinks tend to leave shorter bays earlier than longer bays, especially those with a series of arms (Stern, 1977). In addition, catches of juveniles in any bay would be affected by the number of fish spawning in streams near the bay in question, as there is evidence that some pinks, after departing a particular bay, may move back into the open water of adjacent bays (Stern, 1977).

The age O pink salmon followed a definite pattern of growth. The first catch of a 3 cm juvenile occurred in March, and the mean length of fish caught in August was 10 cm (Figure 19). Pinks 3 cm in length occurred from March into June: This is the size at which they descend from freshwater.

Chum Salmon

Juvenile chum salmon occurred throughout the year with greatest abundance in May and June. Adults were captured from June to August, with the greatest catch in August (Table il.). Largest beach seine catches of juvenile chum salmon were in inner and outer Kiliuda, inner Kaiugnak and inner Kalsin Bays (Table 16).

No chums were caught in Izhut. There are no chum salmon streams in Izhut and there are much larger total runs to Kiliuda than Kalsin or Kaiugnak, which compares favorably with catches. Only two adult chum salmon were captured, in late August (Table 26).

Growth of juvenile chum salmon was not clear. Immigration and *emigration* probably had a strong effect on the length frequency (Figure 20).

Coho Salmon

Distribution or seasonal features of coho salmon distribution are not apparent although one large catch of juveniles occurred in Izhut Bay in June (Tables 10 and 16).

The juvenile coho salmon caught during June to August ranged in size from 8 cm to 17 cm, with a mean length of 14 cm (Figure 21). One adult coho was captured in late August (Table 26).

Dolly Varden

Dolly Varden were present from April through November and catches were greatest in July. Beach seine catches were greatest in outer

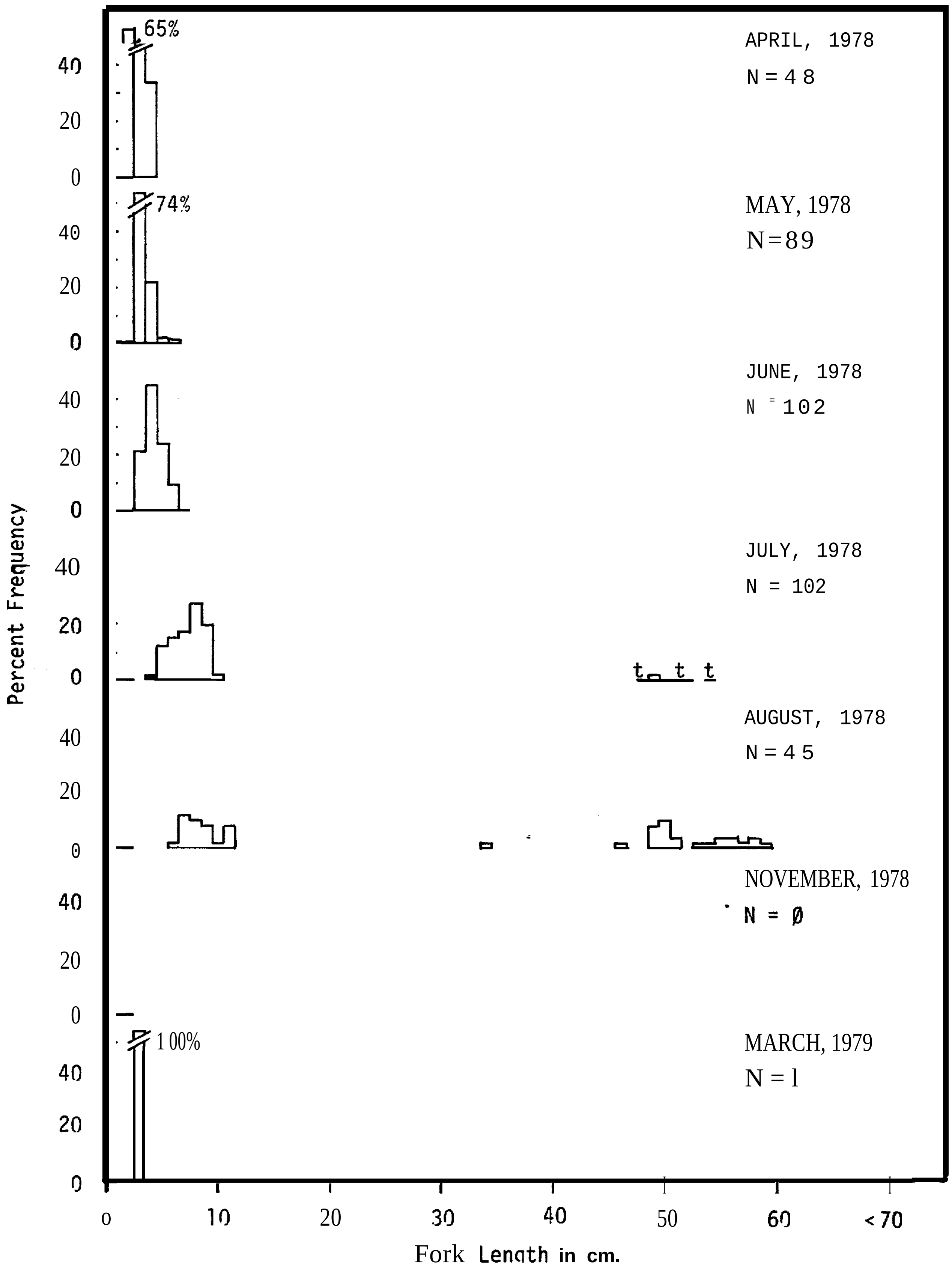

Figure 19. **Relative length-frequency of pink salmon by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak. t refers to trace amounts.**

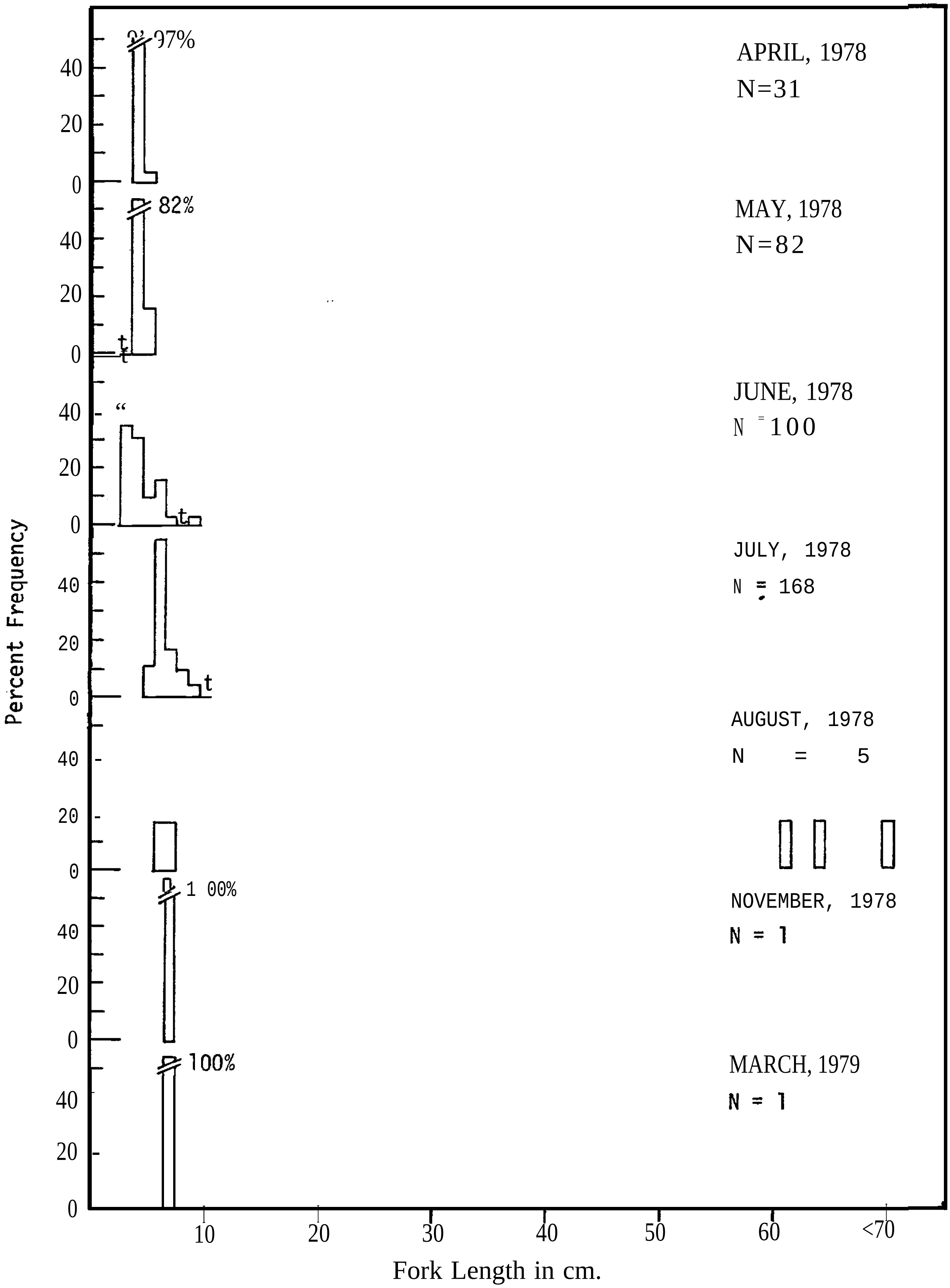

Figure 20. Relative length-frequency of chum salmon by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak. t refers to trace amounts.

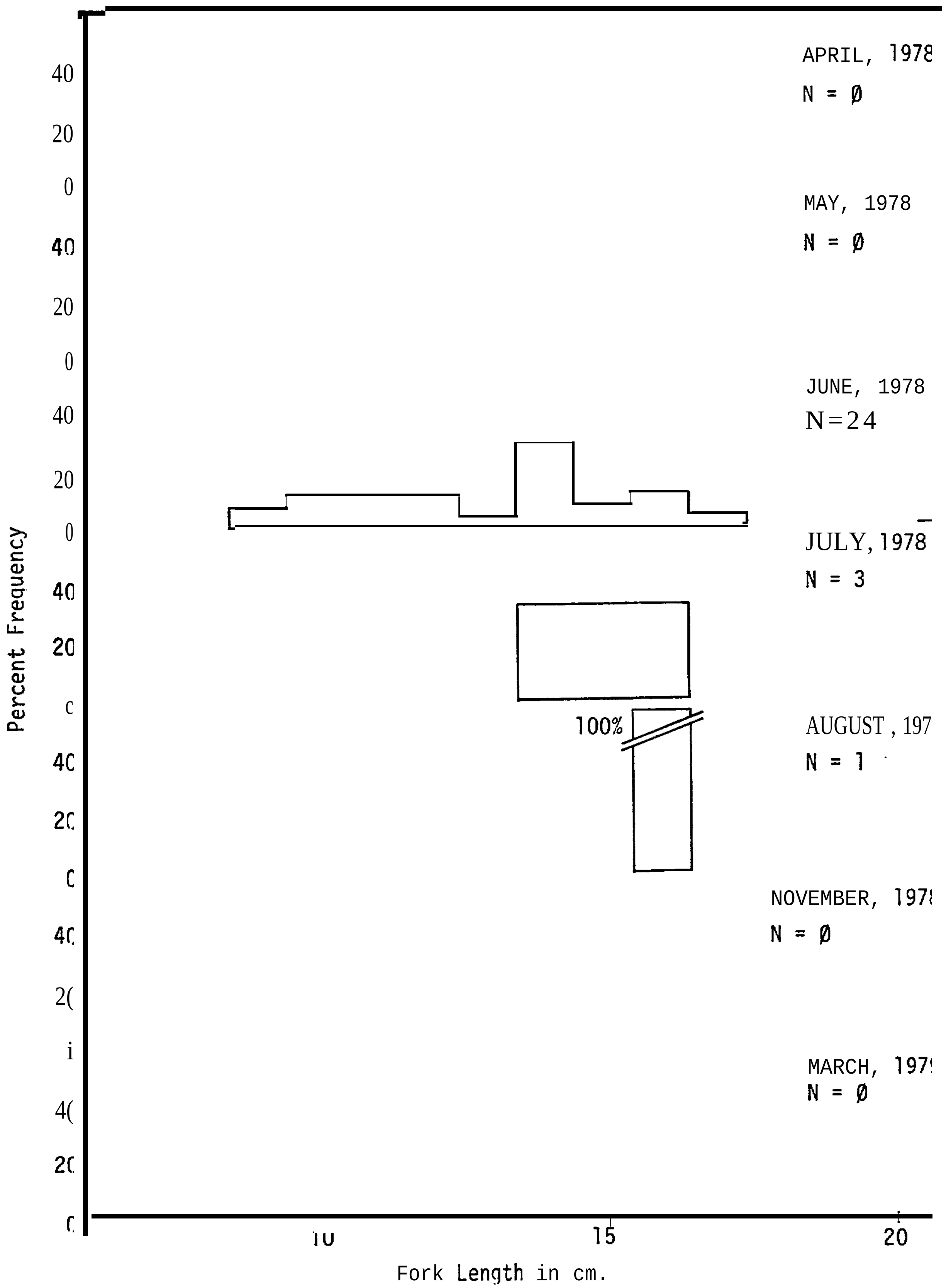

Figure 21. Relative length-frequency of coho salmon by month of capture. The catch by all **types** of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

Kaiugnak Bay; however, much of this is due to two large catches: 13 Dollies were taken in one of 4 sets in April and 65 Dollies were taken in one set in June (Table 16). Dolly Varden were present in the beach seine in all other areas at a fairly uniform abundance (Table 16) . Dolly Varden also were caught by the gill net and trammel net in most areas (Table 17 and 18).

The length frequency data provided no insight to the growth of Dolly Varden (Figure 22). Most Dollies were 26 to 38 cm in length. Dolly Varden were judged to be in spawning condition in early June and in early November (Table 26).

Capelin '

Capelin catches were highly variable and juveniles and adults were captured only in Izhut and Kiliuda Bays in the tow net (Table 19) and in Kalsin in the beach seine (Table 16). Larvae were captured in all bays but it was not possible to quantify their catch.

Three age classes can be distinguished in the length frequency data. Age O capelin were 3 cm in August and 4 cm in November. Age 1 capelin appeared abundantly in March at 5 cm and grew to 10 cm by November. Age 2 capelin were 11 cm in March and 11 to 12 cm by June. No age 2 capelin were caught after June [Figure 23). Adult capelin were judged to be in spawning condition in early May, early and late June and in early March (Table 26).

Pacific Cod

The beach seine catches of Pacific cod were almost exclusively age O fish with lengths of 5 to 9 cm in July and August while about six age 1 fish, 13 to 20 cm were captured in April-June. The gill net and trammel net catches were all age 1 cod, mostly 21 to 25 cm, taken primarily in June through August. The otter trawl captured all age classes, including age O in November. The try net captured a few small age 1 cod in summer and very few age O cod. Apparently cod are present their first two summers in the shallows (about 10 fm or less) , the second year somewhat deeper than the first, but it cannot be said that they are absent deeper based on our data. At age 2 and greater, they reside deeper than about 10 fathoms (18 m). Commercial concentrations usually occur between 80 and 260 m (Pereyra et al., 1976) . They demonstrate seasonal migration to shallower water in summer (Table 10, 11, 12 and 15).

Beach seine catches (age O) tended to be greater in Kiliuda Bay and Kaiugnak Bay (Table 16) and tow net catch (also age O) was greatest in outer middle Kiliuda. Gill and trammel net catches did not reveal a difference between bays, but the otter trawl yielded more Pacific cod in Kiliuda than in Izhut Bay.

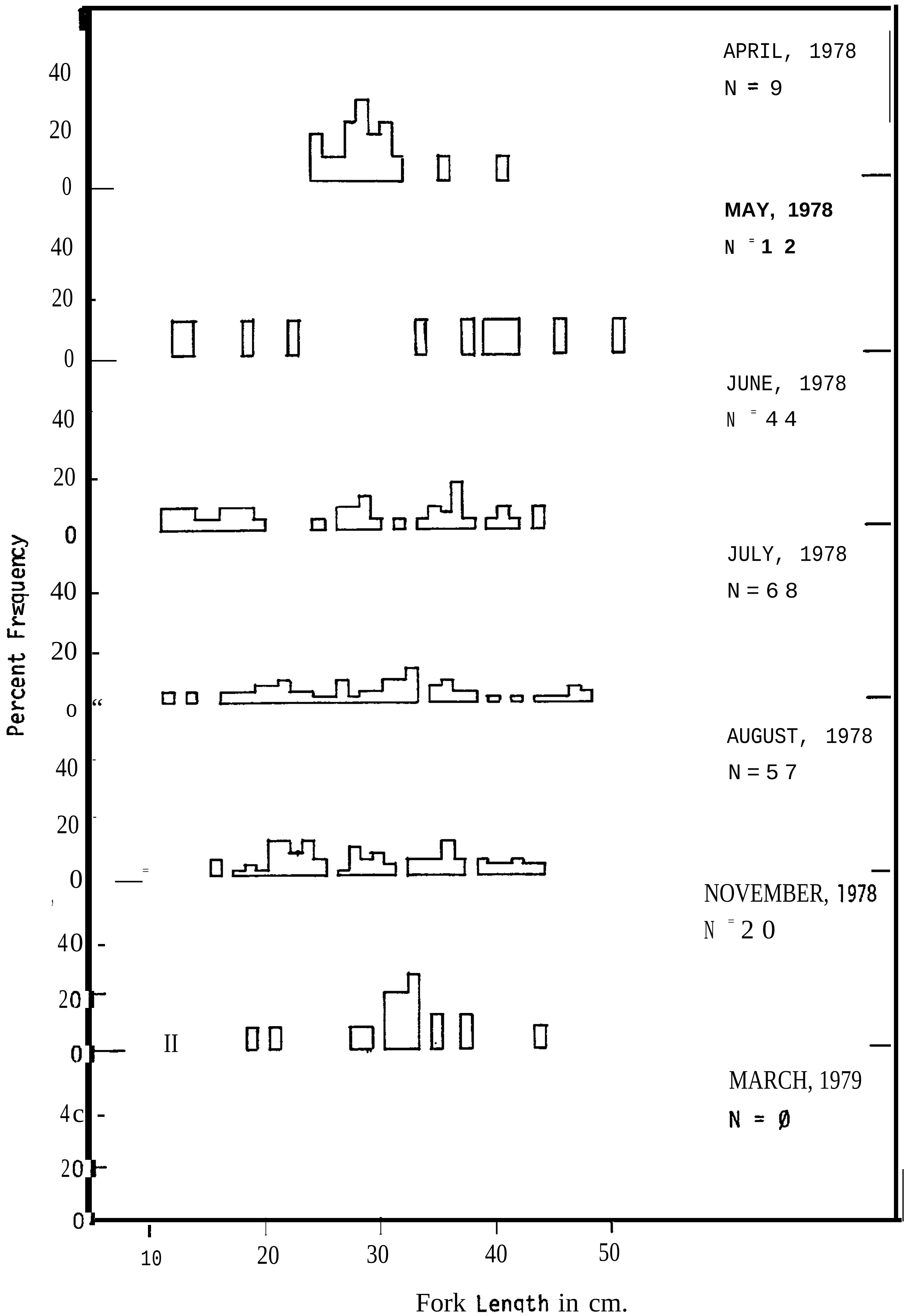

Figure 22. Relative length-frequency of Dolly Varden by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

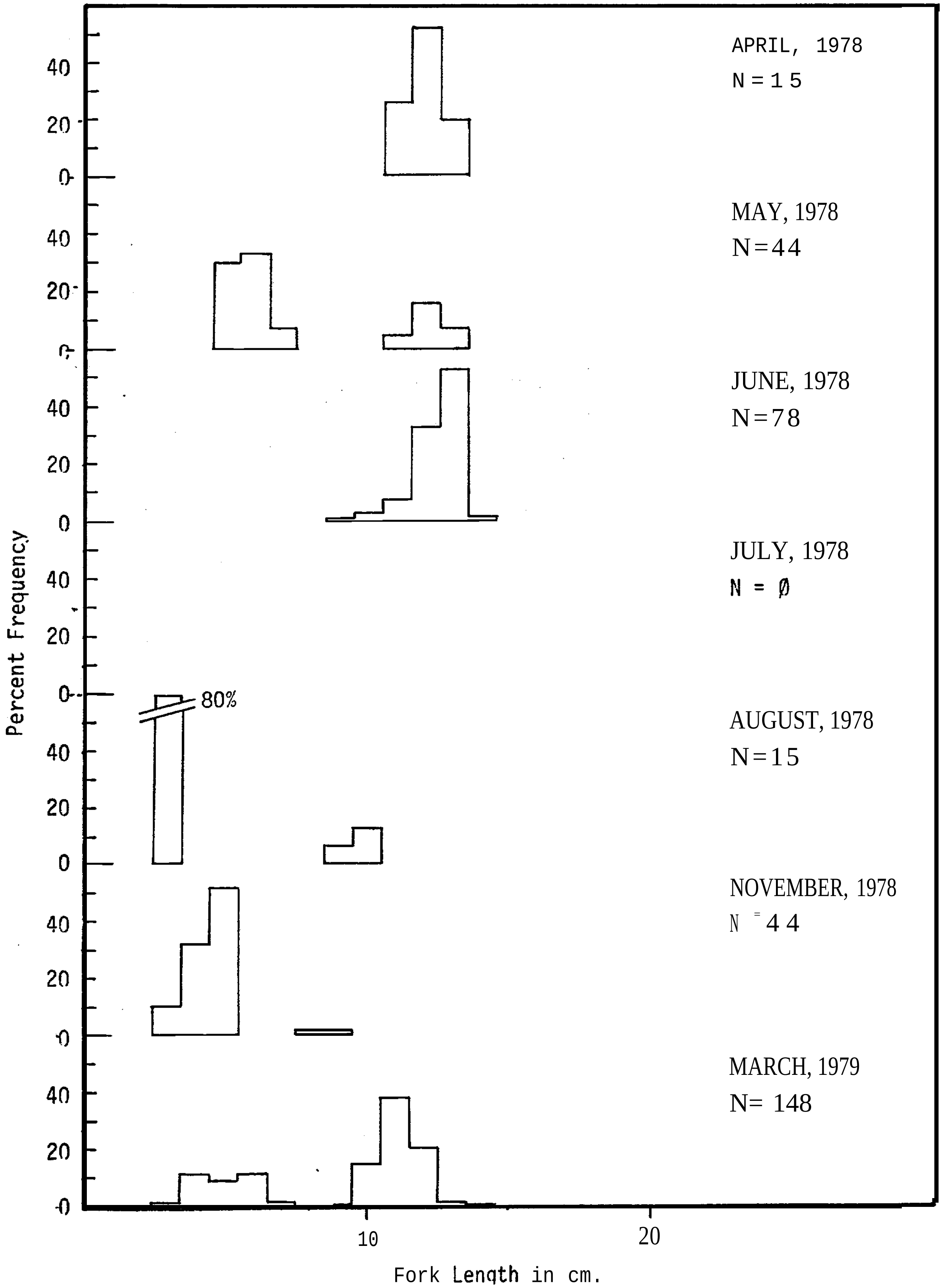

Figure 23. Relative length-frequency of capelin by month of capture. The catch by all types of gear combined, April 1978 through March 1979 on the east side of Kodiak.

Age O Pacific cod grew from 6 cm in July to about 12 cm in November. Age 1 fish were 15 cm in March and grew to about 32 cm in November (Figure 24). Greater ages cannot be assigned based on length frequency. One Pacific cod captured in late April was in spawning condition (Table 26).

Pacific Tomcod

The Pacific tomcod occurred in all four bays throughout the year, but the greatest catch was made by the otter trawl, in which catches were greater in Izhut than Kiliuda Bays (Table 10, 15, 16, 17,18, 20, and 21). No bay had more tomcod than any other as each gear showed different relative catches between bays.

Age O Pacific tomcod grew from about 3 to 5 cm in June to 11 to 12 cm in November. Age 1 fish were about 15 cm in June and 17 to 18 cm in July and what appears to be age 3 tomcod grew from about 24 cm in May to about 25 to 28 cm in November (Figure 25). This apparent size at age is essentially identical to that similarly interpreted from figures published from Puget Sound by Stober and Solo (1973). Pacific tomcod in spawning condition were captured in March (Table 26).

Walleye Pollock

Walleye pollock were relatively abundant in otter trawl catches in both Izhut and Kiliuda Bays (Table 21). Walleye pollock were caught throughout the year by the otter trawl and the catch was greatest in July, August and November. Pollock were caught by other gear types, but the catches were much less than in the otter trawl (Tables 10, 11, 12, 14 and 15).

Age O pollock first appeared in November at 12 cm and grew from 12 cm in March to 24 cm in November. The first two age groups made up the majority of the total catch (Figure 26). Pollock in spawning condition were captured only in early April (Table 26).

Rockfish

Rockfish composed a relatively minor portion of the catches, which is a little surprising since they are very common and in certain areas undoubtedly a major taxon. It is possible that the nearshore species of rockfish are not very susceptible to the sampling gear used.

Rockfish were 3.5% of the weight and 0.85% of the number caught in the trammel net, and 0.7% of the weight and 1.1% of the numbers caught in the gill net. The gill net catches were predominantly dusky rockfish with a few black rockfish while trammel net catches were predominantly black rockfish with a few dusky. The try net yielded only dusky rockfish while the otter trawl yielded darkblotched rockfish.

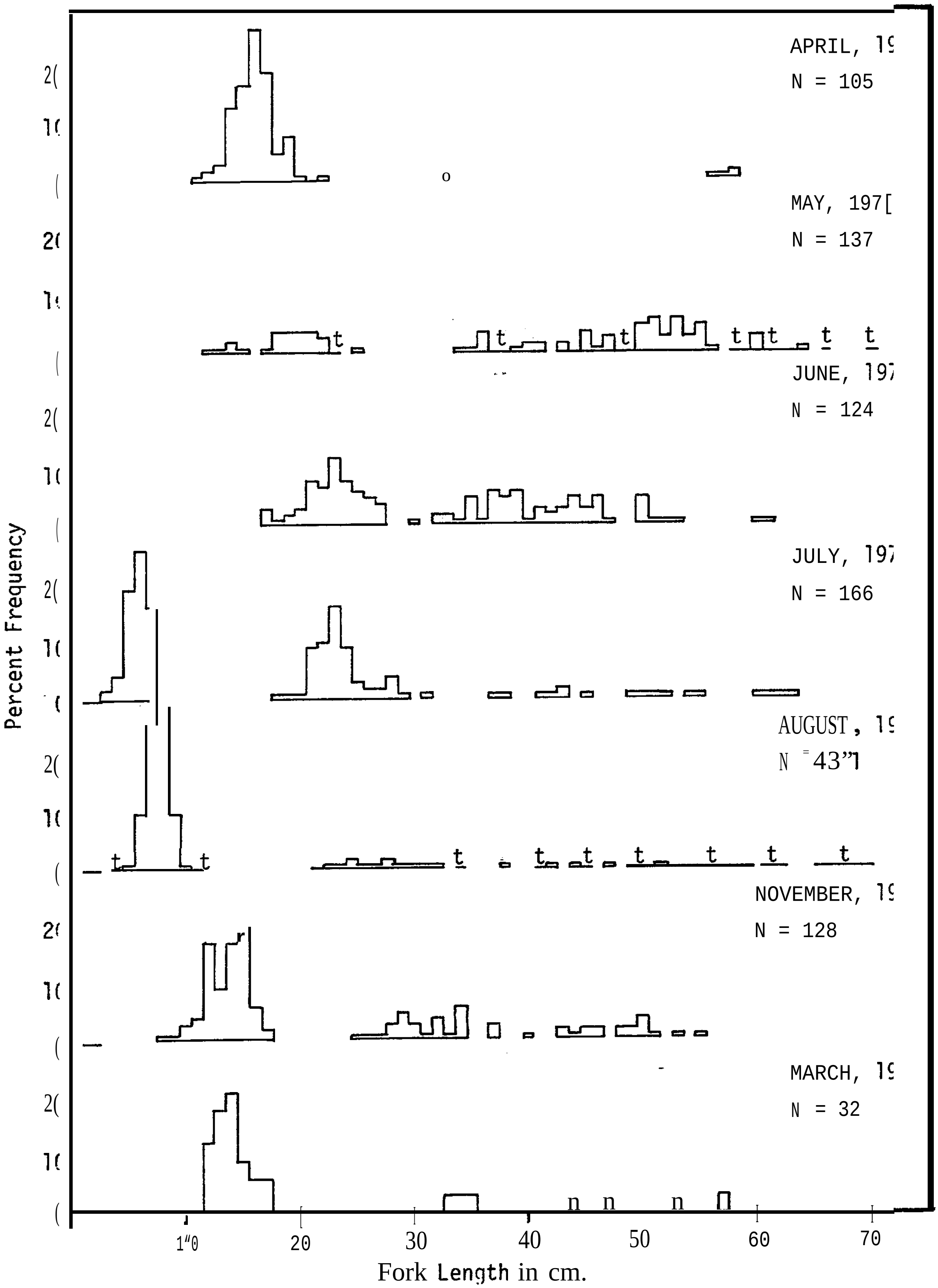

Figure 24. Relative length-frequency of Pacific cod by month of capture. **The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of** Kodiak. t refers **to trace amounts.**

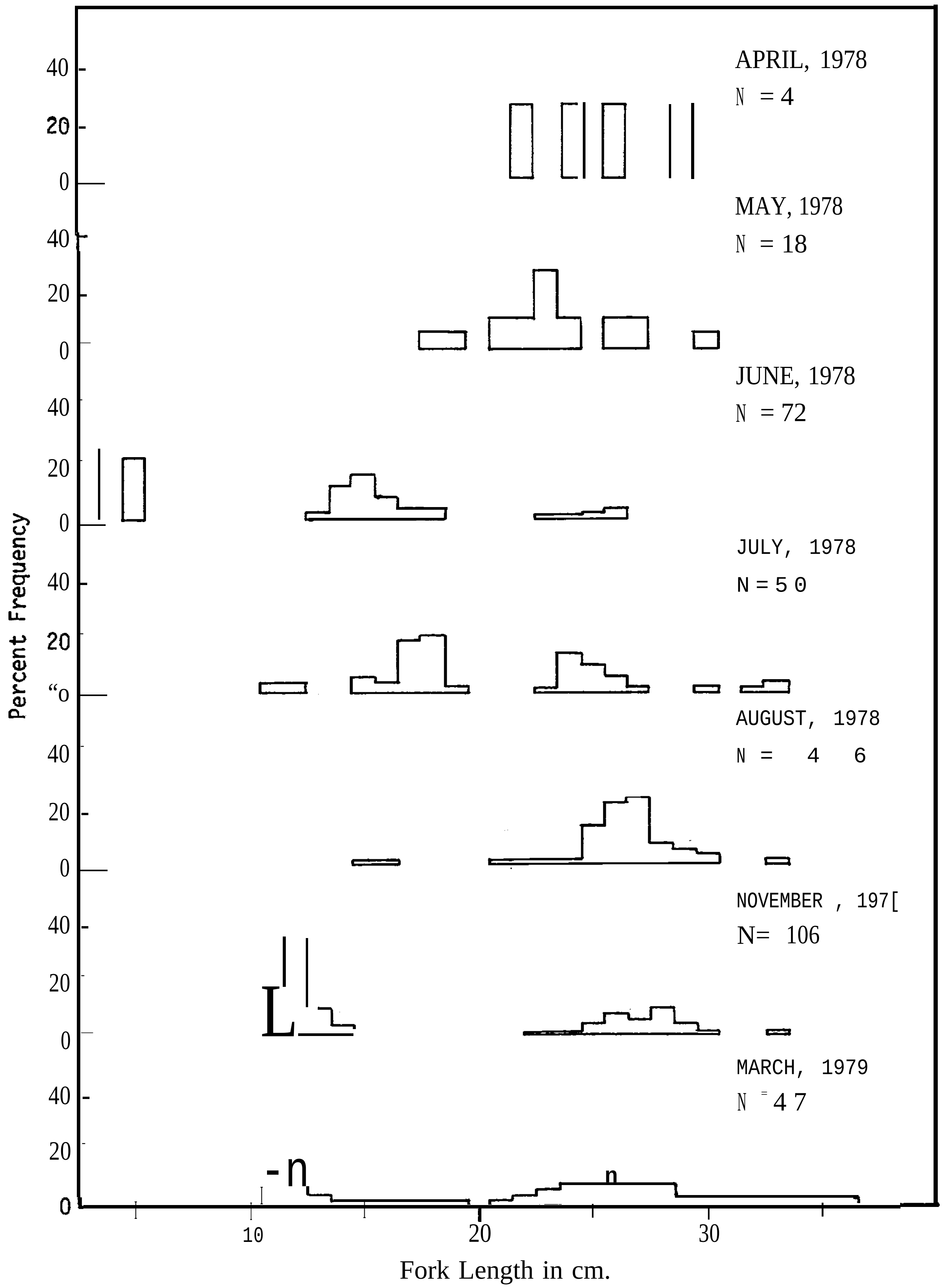

Figure 25. Relative length-frequency of Pacific tomcod by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

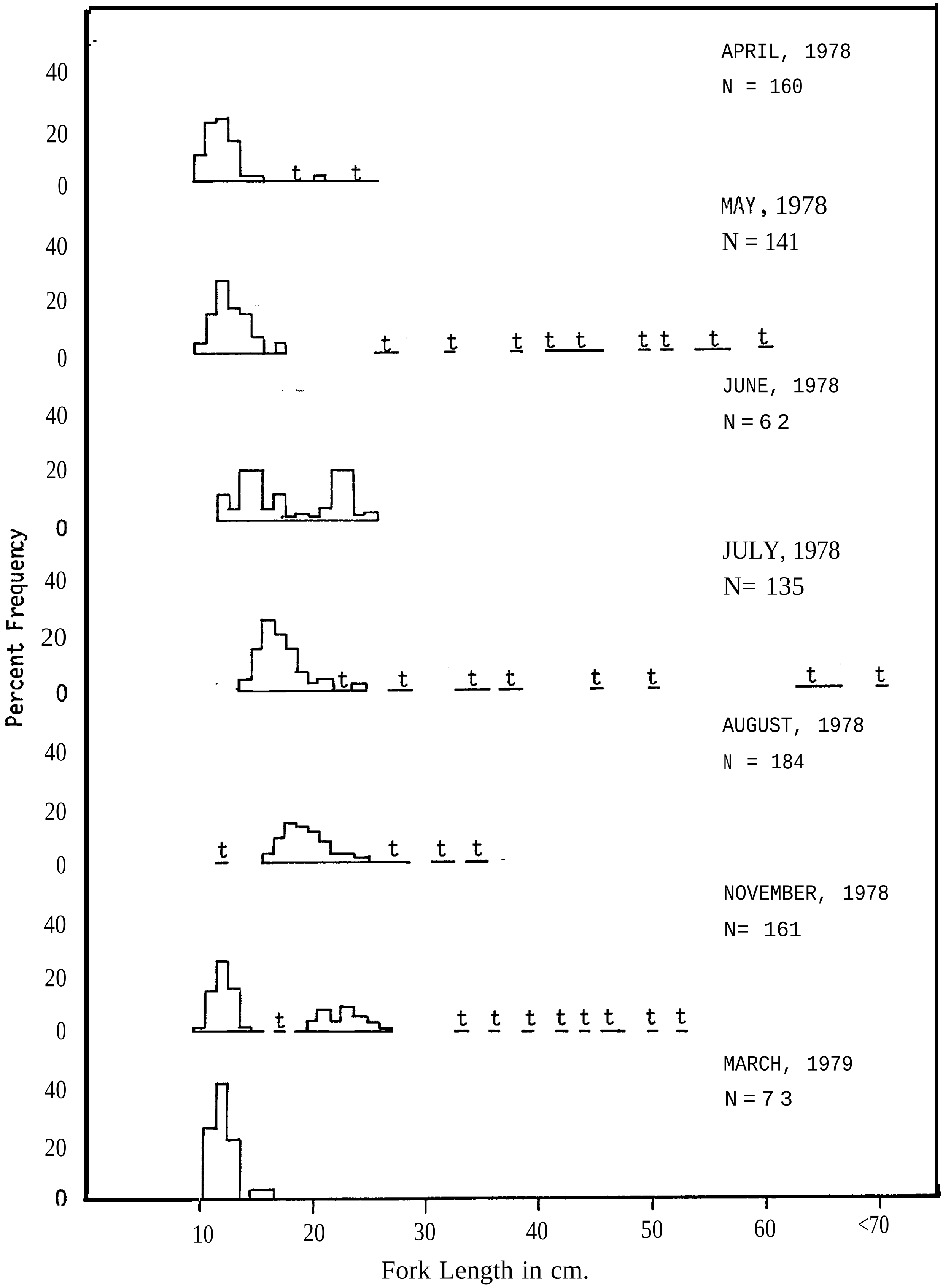

Figure 26. Relative length-frequency of walleye pollock by month of capture. The catch by all types of gear and all bays combined; April 1978 through March 1979 on the east side of Kodiak. t refers to trace amounts.

Rock Greenling

Rock greenling occurred in all cruises with greatest trammel net catches during May through August (Tables 3 and 5). They occurred in all bays with the greatest trammel net catches in Kaiugnak Bay and lowest in Kiliuda (Table 18).

Rock greenling with freely flowing sex products were observed during June, July and August. The greatest spawning activity apparently occurred from mid-June through mid-August (Table 26). They attained substantial spawning activity earlier than either the whitespotted or masked greenling.

Growth of rock greenling was similar to that of other greenling. Age O fish attained about 8-9 cm by July and 12 cm by November. Size of age 1 fish is not clear but a mode at about 19-20 cm in August could represent them (Figure 27).

Masked Greenling

Masked greenling distribution was more restricted than that of whitespotted greenling since only a trace was captured in the try net and otter trawl (Tables 14 and 15). Pelagic juveniles were not captured in the tow net, but they were captured in the beach seine. Masked greenling were captured in all four bays in large quantities on all cruises by beach seine and trammel net (Tables 16 and 18) , and catches of it were greatest in July and August, while the lowest was in March (Tables 10 and 12).

Adults with flowing sex products were captured during June, July and August with greatest frequency in July and August (Table 26). The first such individuals were captured on June 19 and there was no detectable change in the frequency of ripe adults between early July and the end of August when summer sampling ended. The smallest mature fish was 17 cm. Fish smaller than about 15-17 cm were usually preserved whole by F.R.I. personnel for later food habit analysis rather than opened for removal of stomach and maturity determination.

The ovaries of both masked and rock greenling in early summer contained ova of several size classes throughout. Later the largest ova, about 2 to 2.5 mm diameter,were loose within the posterior portion of the ovary. The anterior portion of the ovary contained smaller ova of two size classes which varied in size between fish but were generally about 0.6 to 1.0 mm and 1.2 to 1.5 mm in diameter. Kovtun (1979) described several size modes among the ova of the greenling *Pleurogrammus azonus* and described three successive spawnings at 10 to 13 day intervals.

Growth of masked greenling was similar to that of whitespotted greenling, but masked were smaller at each age. Age O masked greenling

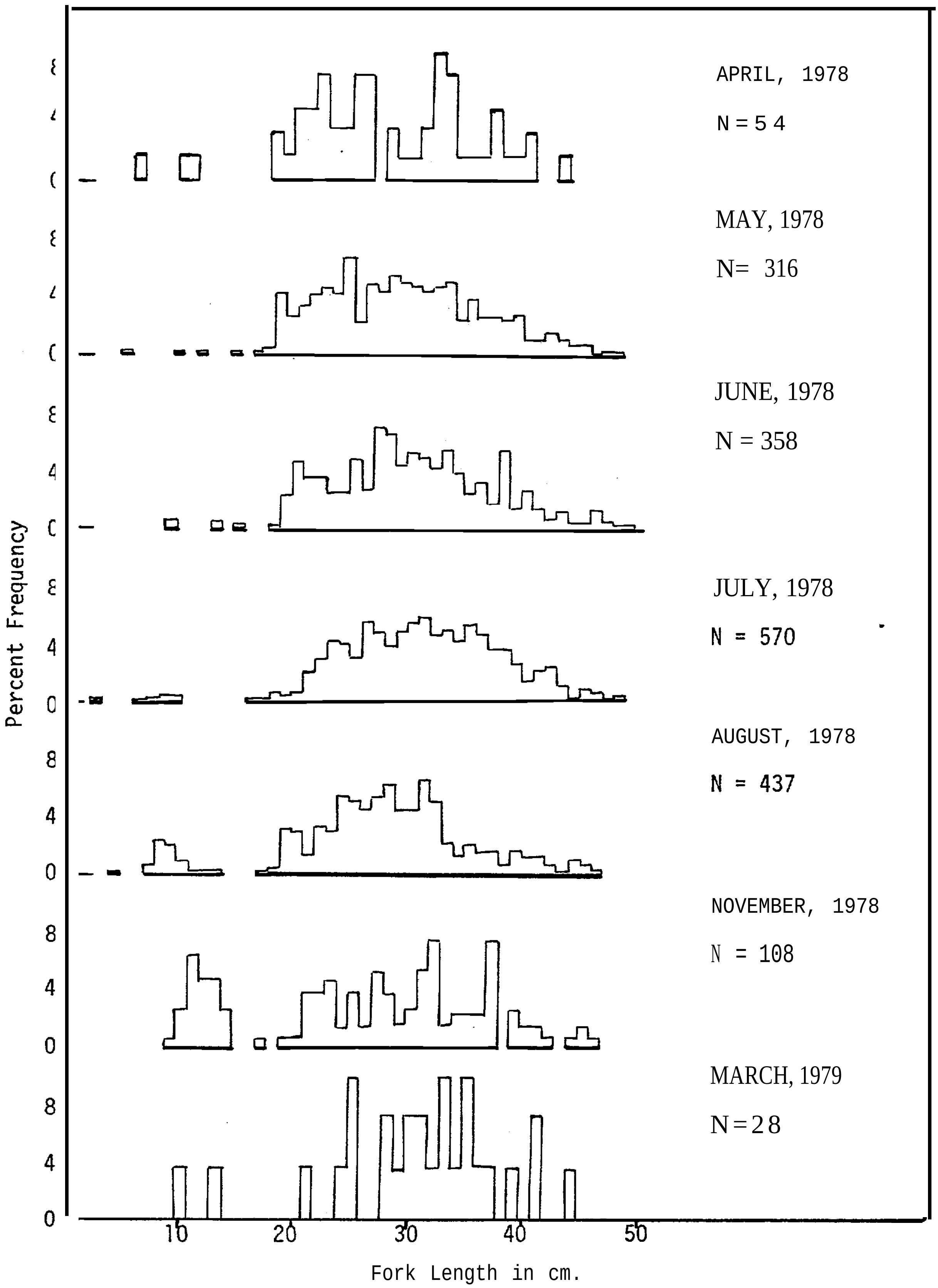

Figure 27. Relative length-frequency of rock greenling by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

were about 5 cm or so in June. The mode of age 1 fish is not separate from larger fish after June but could be interpreted as being 17-18 cm in August (Figure 28).

Whitespotted Greenling

Whitespotted greenling were common in all gear types (Table 3, 4 and 5). Whitespotted greenling catches were lowest in November, March and April and highest in July and August (Tables 10, 11 and 12). Trawling conducted in 1976 and 1977 at depths of 30 to 100 m indicated a high relative abundance of whitespotted greenling in winter (Blackburn, 1979). This information and the data collected in this survey suggest that these greenling undergo a winter migration to deeper water.

Whitespotted greenling of both sexes were observed in spawing condition, with freely flowing sex products, during June, July and August, but they were much more common in August, especially the last half of August . The first individual in spawning condition was captured June 12 and five more were taken June 22 (Table 26).

The smallest individual in spawning condition was 17.3 cm in length but most were over 20 cm. Comparison of length frequencies of running ripe fish with the population length frequency indicates they apparently mature at age 2.

Juvenile whitespotted greenling, less than one year of age, are pelagic in the spring, until about July. They have coloration which is unlike either the larval or juvenile stage. About July, when they are about 6 to 8 cm, they metamorphose to a juvenile form, take up bottom residence and their diet changes (Blackburn et al., 1979).

Age O whitespotted greenling grew from about 5 cm in May to 10 to 15 cm in November (Figure 29). Growth of age 1 fish is not as apparent, but it appears that most are about 20 cm by August.

Sablefish

Sablefish occurred from April through November in the otter trawl and try net, with greatest catch in June (Tables 14 and 15). The majority of the sablefish were caught in the mouth of Izhut and Kiliuda Bays by the otter trawl. The try net yielded one in Kiliuda Bay.

Growth of sablefish is quite clear from the length data but difficult to reconcile with published information. From the first catch in April to the last catch in November the predominant age class grew from 26.6 cm to 37.1 cm and averaged 1.49 cm per month (Figure 30). A length frequency of this same age class was obtained in March 1979 from the commercial fishery by a domestic groundfish observer project funded by the North Pacific Fishery Management Council. These fish

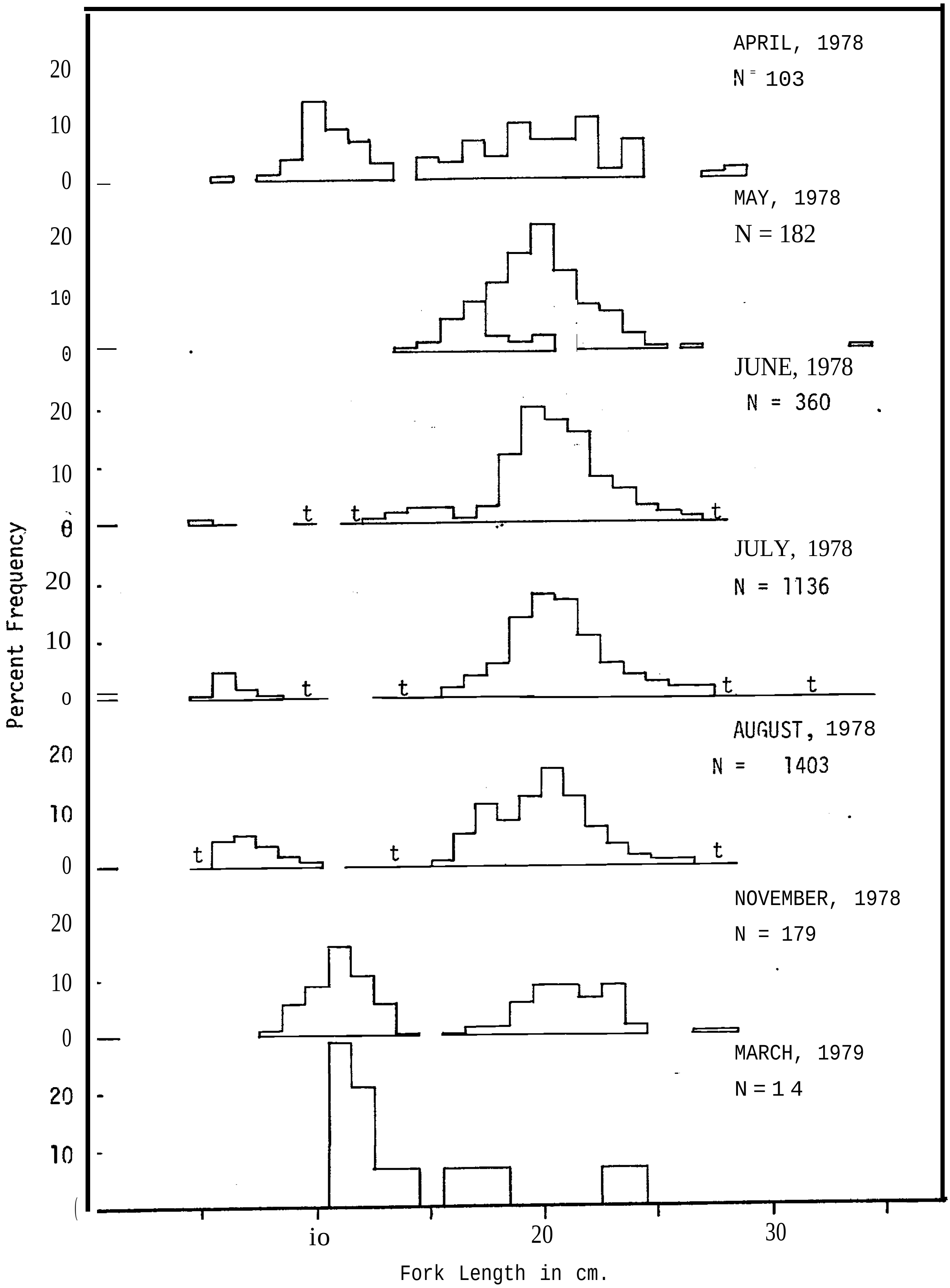

Figure 28. Relative length-frequency of masked greenling by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

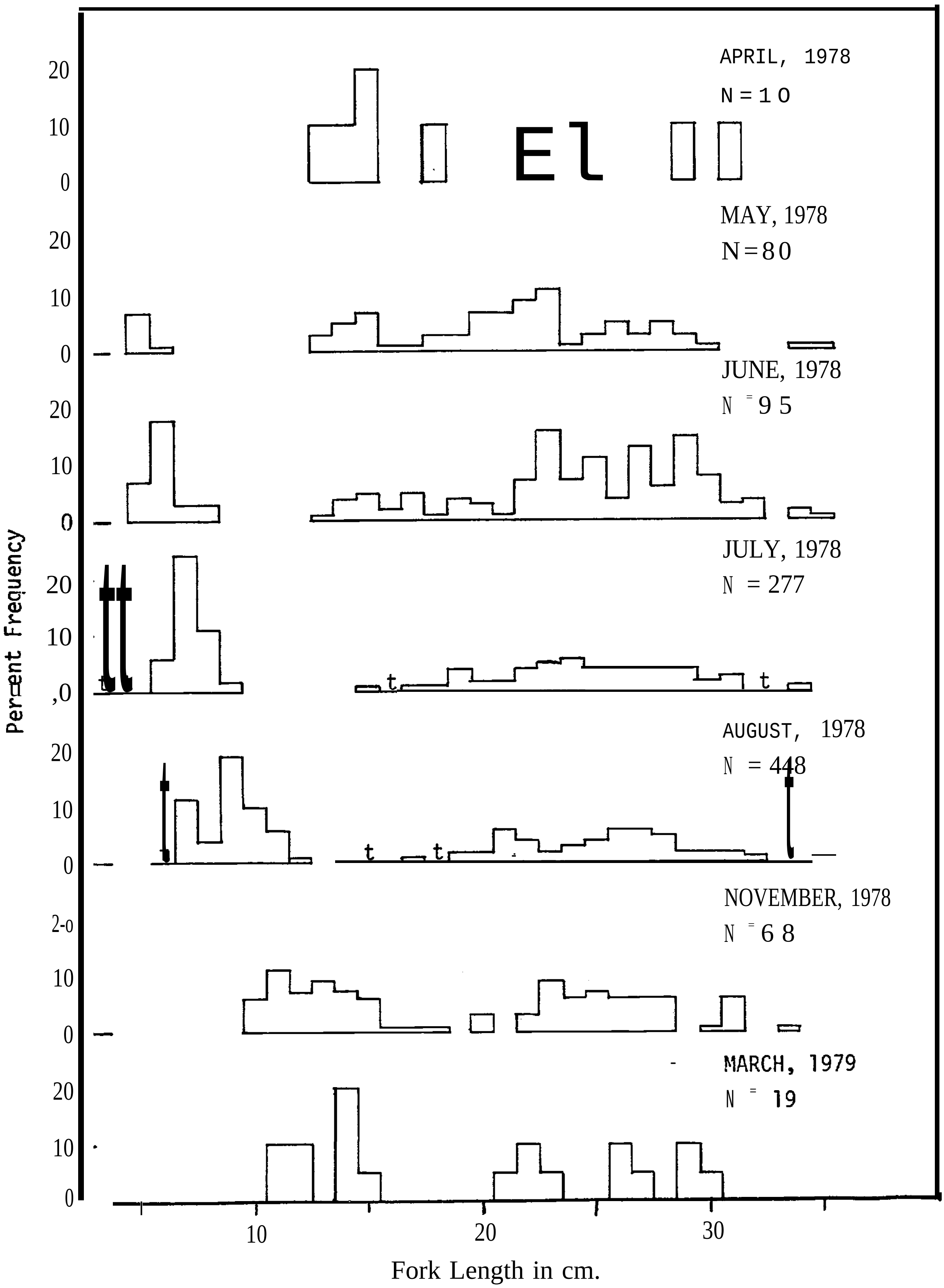

Figure 29. **Relative length-frequency of whitespotted greenling by month of** capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak. t refers to trace amounts.

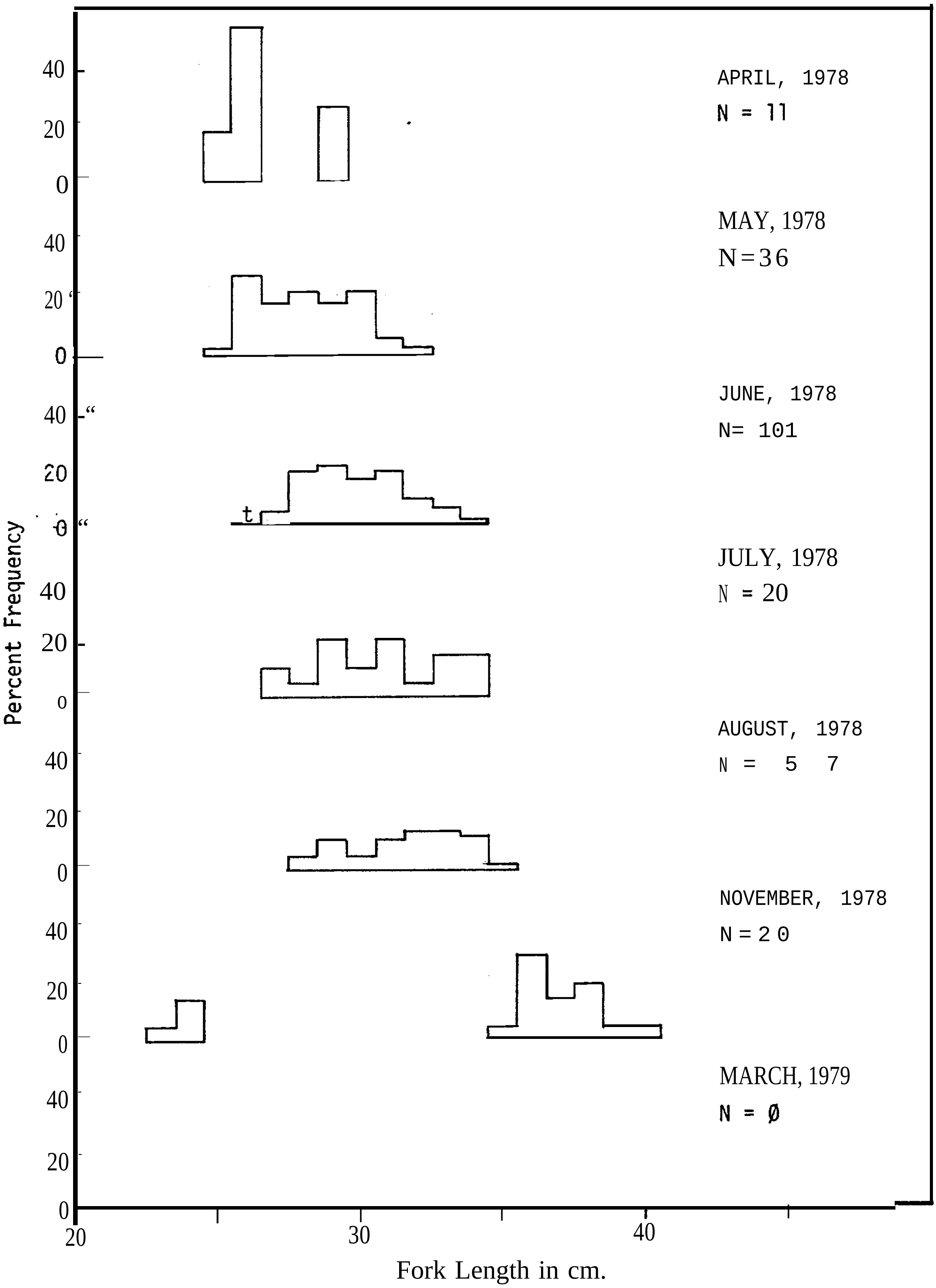

Figure 30. Relative length-frequency of sablefish by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak. t refers to trace amounts.

were 43.7 cm (93 fish) for a growth rate of 1.65 cm\month from November. The growth is remarkably consistent, about 1.55 cm/month, even through the winter, a time when many fish species grow more slowly or stop growing competely. Four individuals of a younger age class appeared in November at 23.8 cm, which is about 3.3 cm larger than the main age class would have been in November, assuming constant growth.

Placing an age on these sablefish is difficult from published information. Low and Marasco (1979) provide size at age information for Gulf of Alaska blackcod, which indicates age 1 fish are 34 cm, age 2 are 42 cm and age 3 are 49 cm. By assuming a constant growth rate of 1.55 cm per month from hatching until they are 26.6 cm in April 1978, the birthdate is about December 1976. The growth rate is probably more rapid during the first year and mid-winter is known to be the spawning time. Thus the main age class captured was probably age 1.

Gymnocanthus

Sculpins of the genus Gymnocanthus were common in all gear that sampled demersal species.

When the two taxa were separated the threaded sculpin was about 3 to 7 times more abundant than the armorhead sculpin in the try net samples, and the otter trawl samples contained exclusively armorhead sculpin, except in March, when threaded sculpin were deeper and yielded a CPUE OF 0.4 kg per km.

Three male threaded sculpin of 16 to 20 cm fork length were found to have freely flowing sex products in March, which constitutes the only indication of spawning time (Table 26). Larvae of Gymnocanthus were abundant during about late April through early June following which time considerable numbers of juveniles were captured. Juveniles were 2 to 3 cm in June, and 3 to 6 cm, with a mode of 4 to 5 cm in August. Another size mode, obviously one year olds, was 7 to 9 cm in June and 9-11 cm in August. Some of the one year olds were identified and armorhead sculpin apparently reached a larger size. The bulk of the adult armorhead sculpins were greater than 23 cm in fork length and the bulk of the adult threaded sculpins were less than 21 cm.

Yellow Irish Lord

The otter trawl and try net catches of Yellow Irish Lords were considerably greater in Kiliuda and Kaiugnak Bays (Tables 20 and 21).

Male yellow Irish Lords of 29 to 34 cm fork length with freely flowing sex products were recorded in June and August (Table 26). Gorbunova (1964) reports that Hemilepidotine sculpins sPawn at the end of summer, August and September, throughout their range, although spring and early summer spawning has been reported. Larvae appear in November and December (Gorbunova, 1964) and, as noted above, larvae or early juveniles appeared in June at about 3 cm and grew to 6 to 8 cm by November. A mode of yearlings at about 8 to 9 cm in April grew to about 11 to 13 cm by August.

The greatest catches in shallow water occurred during June through August with the beach seine and try net catches greatest in August. This suggests that they spawn in shallow water at this time, and Gorbunova (1964) reports that the group generally spawns in 10 to 20 m of water.

Otter trawl catches of this species were much greater in summer (Table 15) suggesting that seasonal migration to deeper water in winter took them out 'of the depths sampled.

Myoxocephalus spp.

Several taxa of Myoxocephalus spp. sculpins were identified and, at times, separately enumerated; but the identifications appear inconsistent, so all identifications have been reduced to the generic level. The prominent species of this taxon are the great sculpin, plain sculpin and to a lesser extent the warthead sculpin. Only a couple individuals of a fourth, unidentified taxon occurred.

Distribution trends are not pronounced but Izhut tended to have the lowest apparent abundance (Tables 15, 18, 20 and 21).

Seasonally low abundance occurred during March and April in all gear types (Tables 10, 12,14 and 15). High abundance occurred during May through August. The period of high abundance was shortest in the shallowest gear; beach seine catches were greatest during June through August. The period of higher abundance in the trammel net, try net and otter trawl included May and November, with the greatest catch in the otter trawl in May (Table 15).

The stage of maturity data does not clearly indicate spawning season (Table 26) but larvae occurred in April, May and June (Appendix Table 1) and transformed to age O juveniles in early summer. The beach seine captured age O Myoxocephalus that grew from 2 cm in May to 3 to 5 cm in August, ana about 5 to 7 cm in March. The other gear captured larger fish (Figure 31).

Pacific Sand Lance

Pacific sand lance are a pelagic species which aggregate highly so that catch variability is extremely large. The larvae were too small to be quantitatively retained by the net in the early summer; they were 2 to 5 cm in May. They grew rapidly; most were 7 to 10 cm in August and were recruited to the samples during the summer. Age 1 sand lance appeared to grow from 9 to 10 cm in April to about 13 cm in November (Figure 32).

The beach seine catch was greatest in July and August, especially August, while the tow net catch was greatest in July (Tables 10 and 13).

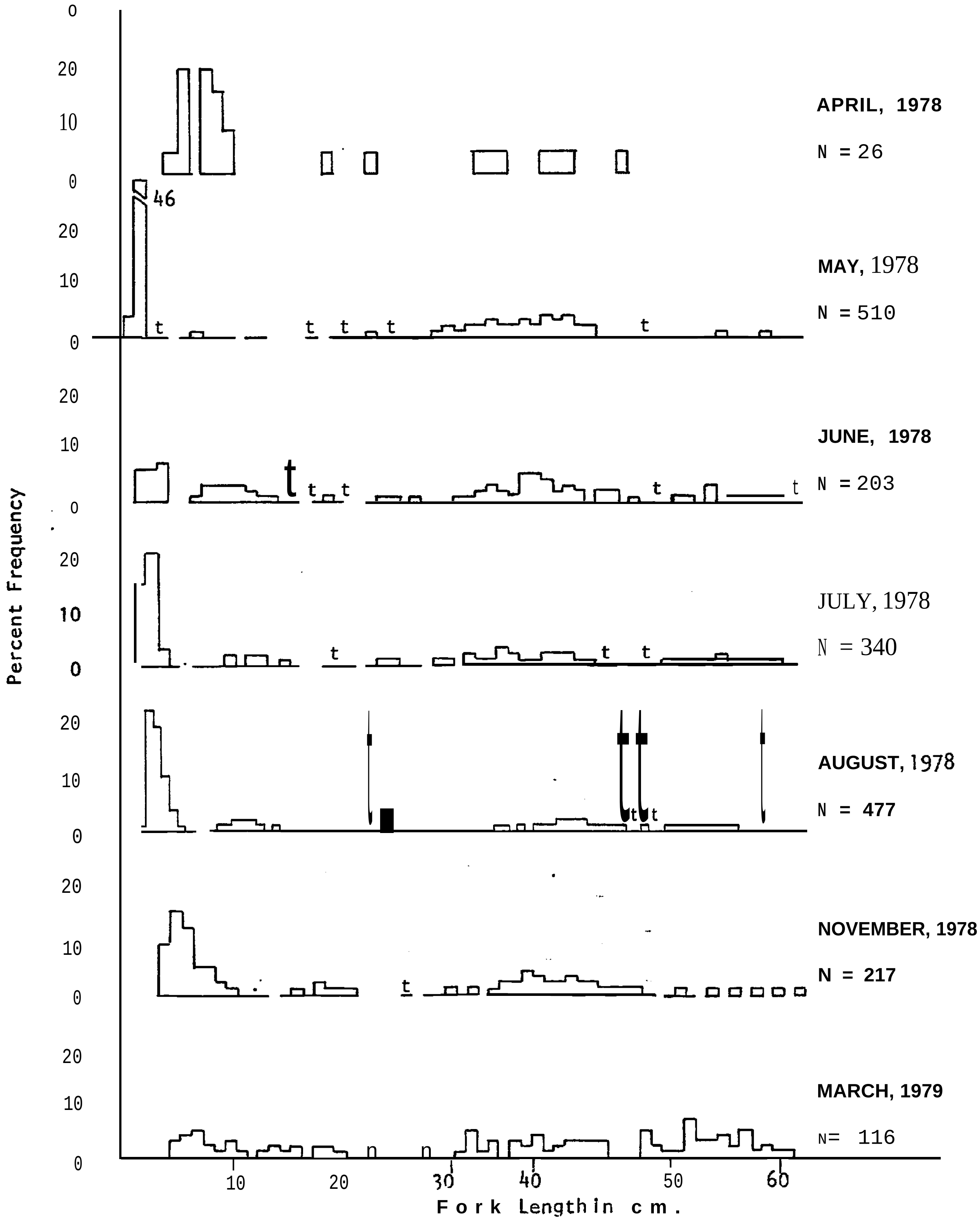

Figure 31. Relative length-frequency of Myoxocephalus spp. by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak. t refers to trace amounts.

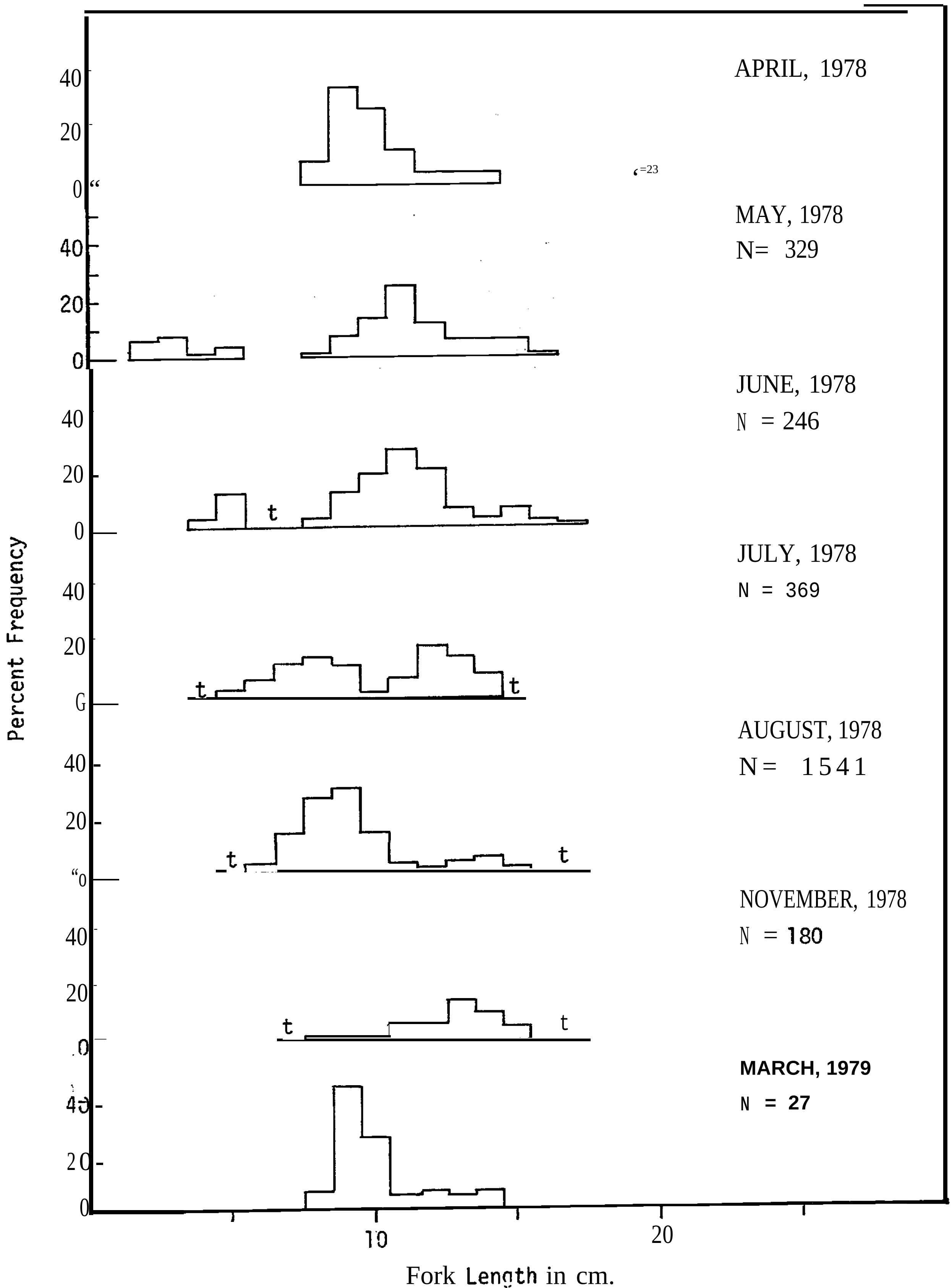

Figure 32. Relative length-frequency of Pacific sand lance by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak. t refers to trace amounts.

Table 27. Beach seine catch of sand lance in numbers of fish per haul by cm size class and month and by age class. Data from east side of Kodiak, 1978-79.

LENGTH CM	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER	MARCH
4			1.6	0.1			
5			1.7	0.4	0.2		
6			0.2	2.4	62		
7			0.1	3.1	339	T[1]	
8	T	0.1	0.1	6.0	513	T	T
9	0.2	0.5	1.8	17.8	577	0.1	0.2
10	0.2	4.3	9.1	6.0	344	0.1	0.1
11	0.1	13.5	10.9	20.6	60	0.2	
12		8.6	9.9	102	8.4	0.2	T
13		3.0	2.5	95	29.5	0.7	T
14	T	3.6	1.0	60	30.1	0.6	T
15		2.8	3.3	0.2	2.2	0.2	
16		0.7	0.9		T	T	
17			0.1		T	T	
Age 0	T	0	3.7	29.2	1896	0.3	0
Age 1[2]	0.4	28.5	34.8	283	70	1.8	0.4
Age 2+	T	8.1	4.8	0.1	0.1	T	0.1

[1] T = less than 0.05 per haul
[2] Birthday is considered to be January 1

Month to month differences in abundance were extremely high and appear to be best explained by mid-summer recrui-tment of age O fish to the samples, movement to inshore areas during late summer and probable winter residence in refuge (buried in sand as protection from predation) .

Recruitment of sand lance to the catches is a natural result of growth and is assumed to be complete by a size of 5 cm. The influx of age O sand lance in the beach seine catches was fairly uniform over the range of 5 to 11 cm and was greatest in August (Table 27). If the late summer increase in sand lance was exclusively due to recruitment, the influx would tend to be in all months over a small range of sizes. An inshore migration of age o sand lance began in July and was more aPParent in August.

An increase in the abundance of age 1 sand lance from April to May and June is quite apparent in Table 27 and a considerably greater abundance occurred in July. This may also represent an inshore migration, but is considerably earlier than that of the age O sand lance.

The catch distribution suggests extreme inshore occurrence in August as the inner most regions of the bays yielded the greatest catches in both the tow net and beach seine (Tables 16 and 19; Appendix Tables)

Adult sand lance with freely flowing sex products were observed in August and November (Table 26). Larval sand lance were captured in April and May (Appendix Table 2).

Winter distribution patterns are not clear, but it is the authors belief they spend much of the winter buried in sand. The growth rate during winter is minimal and sand lance are commonly found in intertidal sand during winter. During spring the catches were frequently single fish which is unusual for a schooling species.

Arrowtooth Flounder

Arrowtooth flounder were slightly more prevaient in the northern bays. Izhut and Kalsin Bays had the greatest catches, Kiliuda had a smaller catch whereas none was captured in Kaiugnak (Tables 20 and 21). Seasonal trends in catch rates include highest try net catches in summer and highest otter trawl catches in May and November (Tables 14 and 15). The try net catches were almost exclusively age O and 1 fish. The large May catch in the otter trawl included a lot of age 2 fish while the August and November catches included large numbers of age 1 fish. Apparently, the low otter trawl catch rates in June and July were due to the depth stratification,with older fish deeper;and during this time the depth trawled fell between the depths occupied by age 1 and age 2 fish which may have moved deeper as they grew.

The length-frequency histograms (Figure 33) clearly illustrate the first two years of the arrowtooth flounder. Age O fish grew from 6 cm in August to about 9 cm in November. Age 1 arrowtooth flounder were 12 cm in March and grew to 19 cm in November. Age 2 were 19 cm in March and grew to 25 cm in August, and greater ages cannot be assigned based on length frequency.

Flathead Sole

Relative abundance of flathead sole was greatest during June through August and least in March and April, a reflection of the seasonal migration to shallower water in summer (Tables 14 and 15). There appears to be no demonstrable differences in catch rates between bays or regions of bays.

The length-frequency histograms (figure 34) indicate that most of the flathead sole were 'juveniles of less than 20 cm. Growth is not clear from length-frequency data (Figure 34). Weak length modes at 7 to 8 cm and 11 cm in April appear to be successive age classes, with the n-cm-mode progressing to about 14 to 15 cm in August and November. Flathead sole in spawning condition were captured in May, June, July, August and November (Table 26).

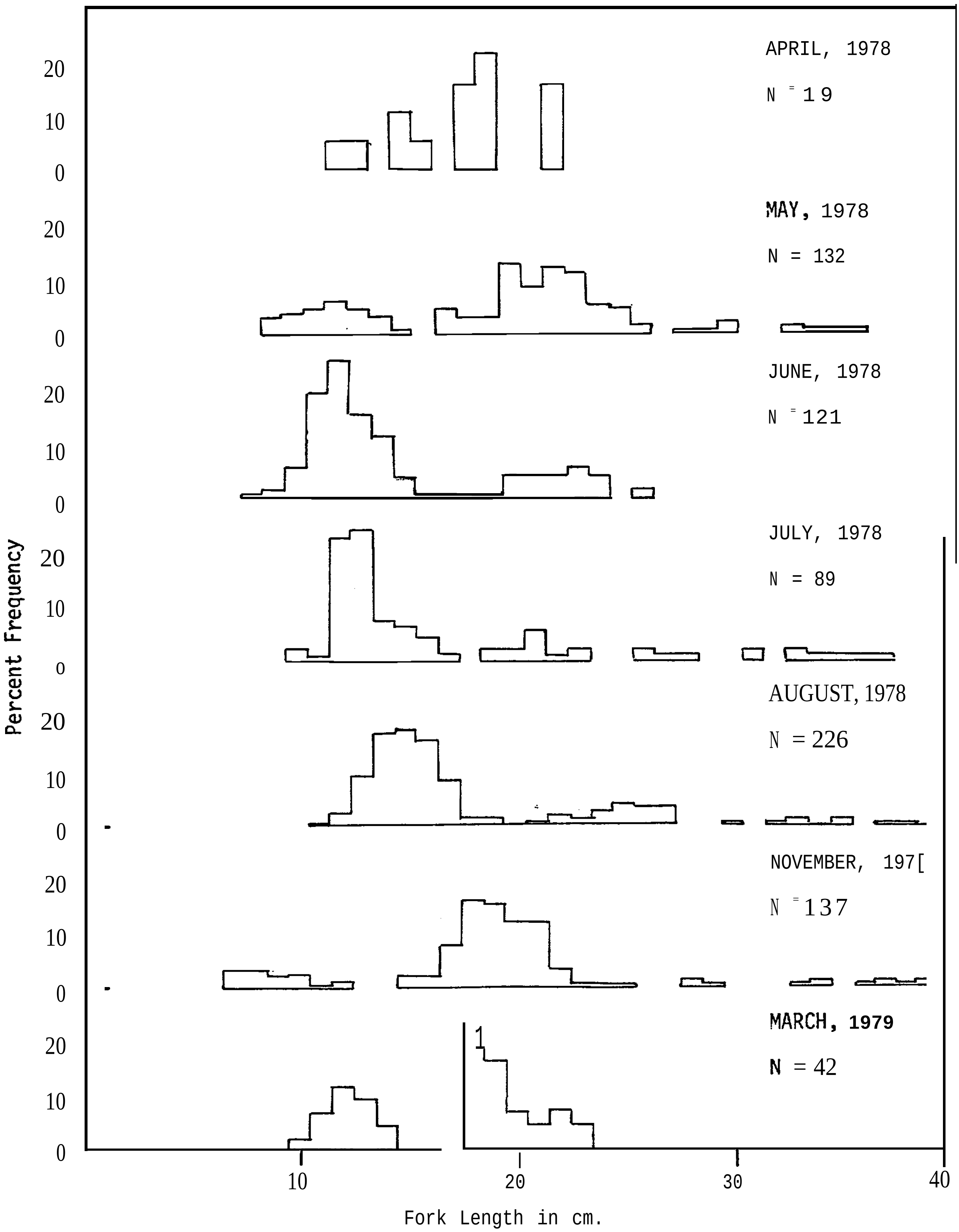

Figure 33. Relative length-frequency of arrowtooth flounder by month of capture. **The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.**

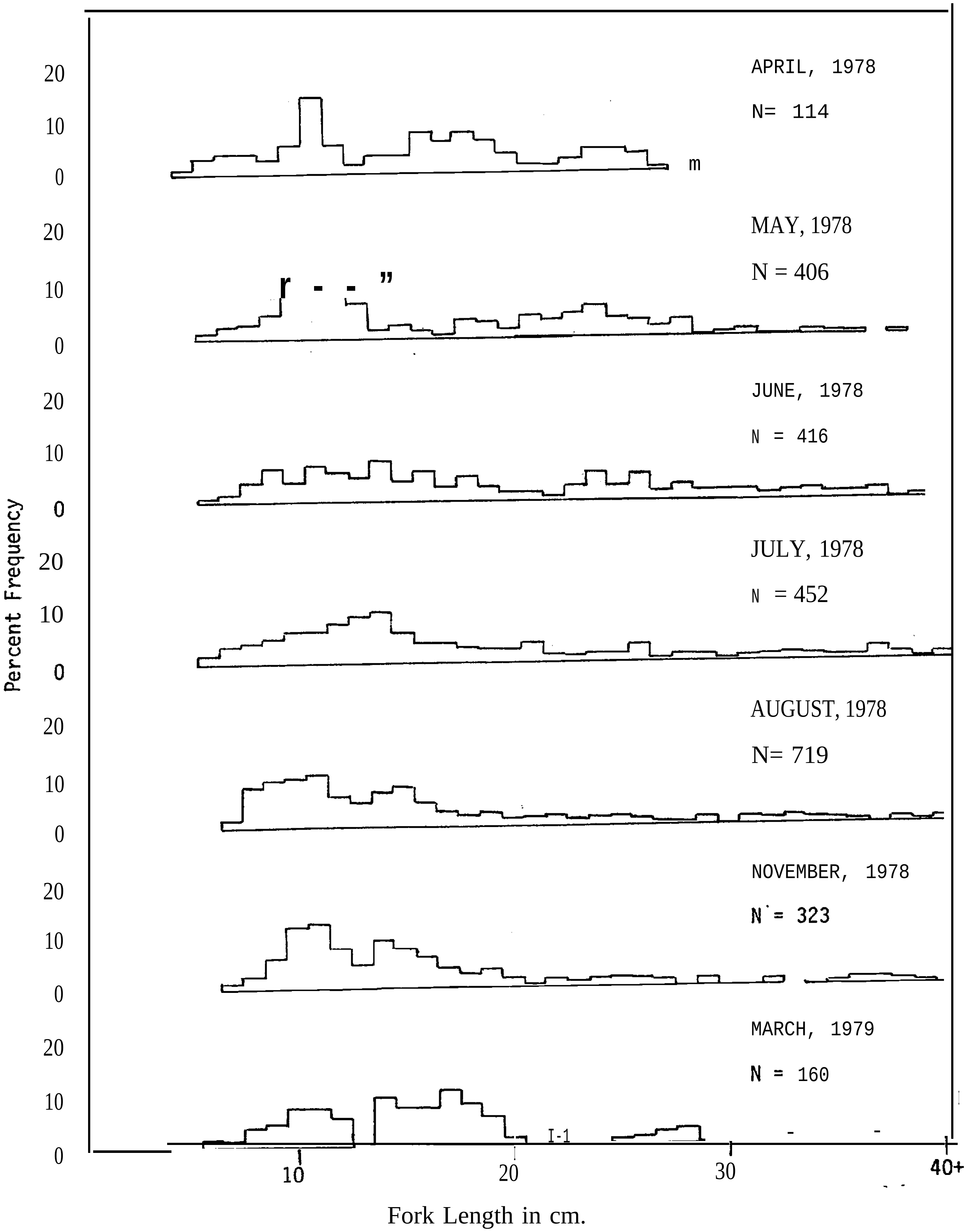

Figure 34. Relative **length-frequency** of flathead sole by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

Butter Sole

The try net catches displayed a distinct seasonal peak abundance during June through August, decreasing in November (Table 14). The otter trawl catches fluctuated widely with greatest catches during May and November (Table 15) , as fish were moving into and out of the shallower try net depths. This species apparently resides in shallow water in summer and at depths greater than those sampled by the otter trawl during winter.

The catches of butter sole did not display strong differences between bays but were slightly greater in Kiliuda Bay in both try net and otter trawl than in any other bay (Tables 20 and 21). Try net catches of butter sole displayed strong distributional features within bays, with largest catches at the mouth of each bayrand catches decreased within the bay to smallest in the innermost subareas (Appendix Tables) . No butter sole were captured in Kaiugnak Bay but try netting was only conducted in the inner region.

All sizes of butter sole from 7 to 39 cm were captured. Although the length data do not distinctly show growth by a progression of modes through time, there are 3 strong modes in July suggestive of age 1 fish at 13 cm, age 2 at 20-21 cm and age 3 at about 25 cm (Figure 35). One butter sole was captured in spawning condition in early May (Table 26) .

Rock Sole

Rock sole were widely distributed in all bays, but the greatest catch was in Izhut Bay by the try net and otter trawls (Tables 20 and 21) . Higher catches were obtained in the summer and lower catches in the winter with all types of gear, indicative of summer migration inshore (Tables 14 and 15).

The length frequency data provided 'some insight into the growth of young rock sole. Age 1 rock sole were about 6 cm in March and by November they grew to about 10 cm. Greater ages cannot be assigned based on length frequency (Figure 36). Rock sole judged to be in spawning condition were captured in May, June, July, August and November (Table 26).

Yellowfin Sole

Seasonality of yellowfin sole was evident in greater shallow water catches (try net and trammel net) in the summer, but the otter trawl catches, though somewhat seasonally variable, cannot be interpreted (Tables 12, 14 and 15). Yellowfin sole were observed in all bays, but maximum catches by the trammel and try nets were in Kalsin Bay and second highest catches were in Kiliuda Bay (Tables 18 and 20).

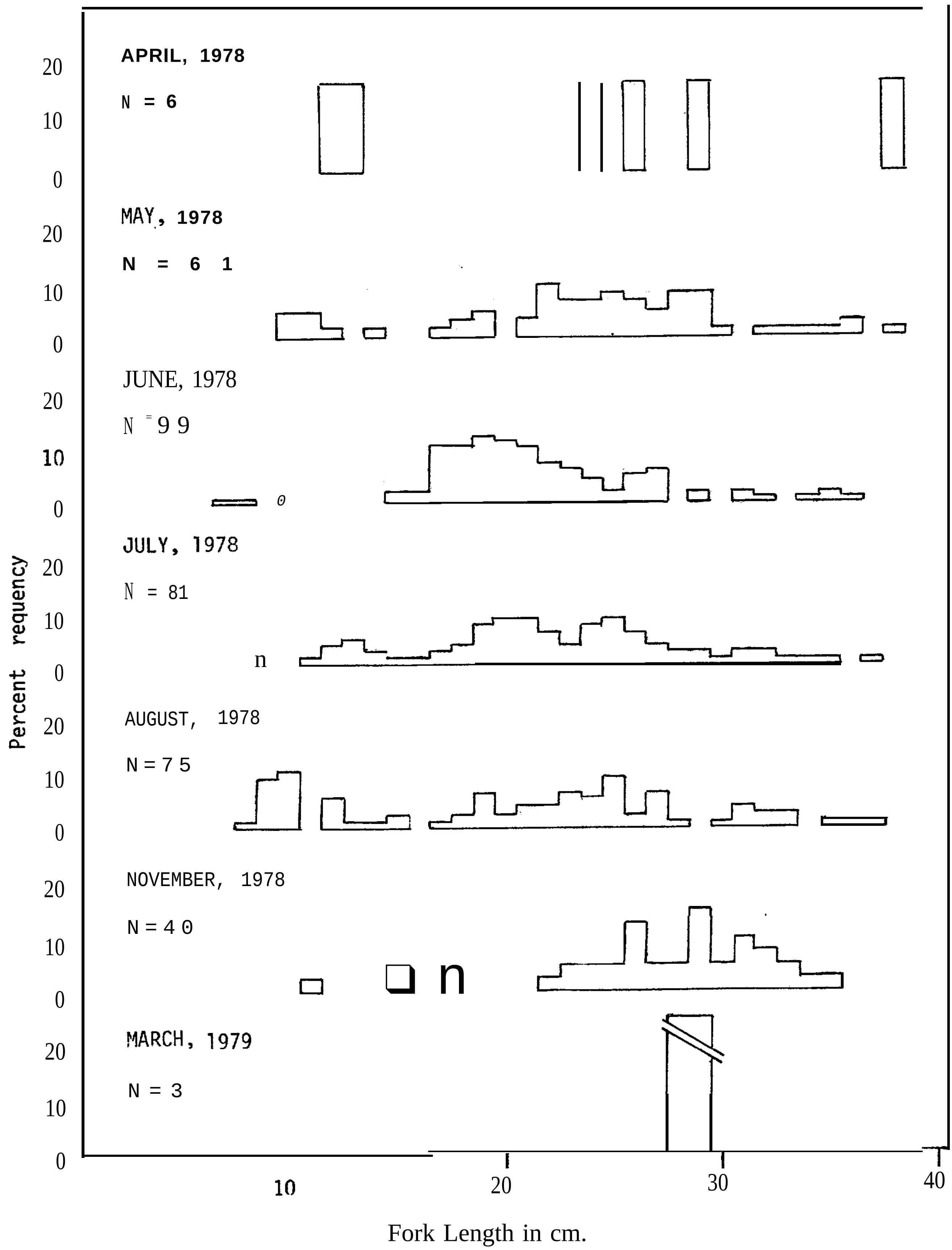

Figure 35. Relative length-frequency of butter sole by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

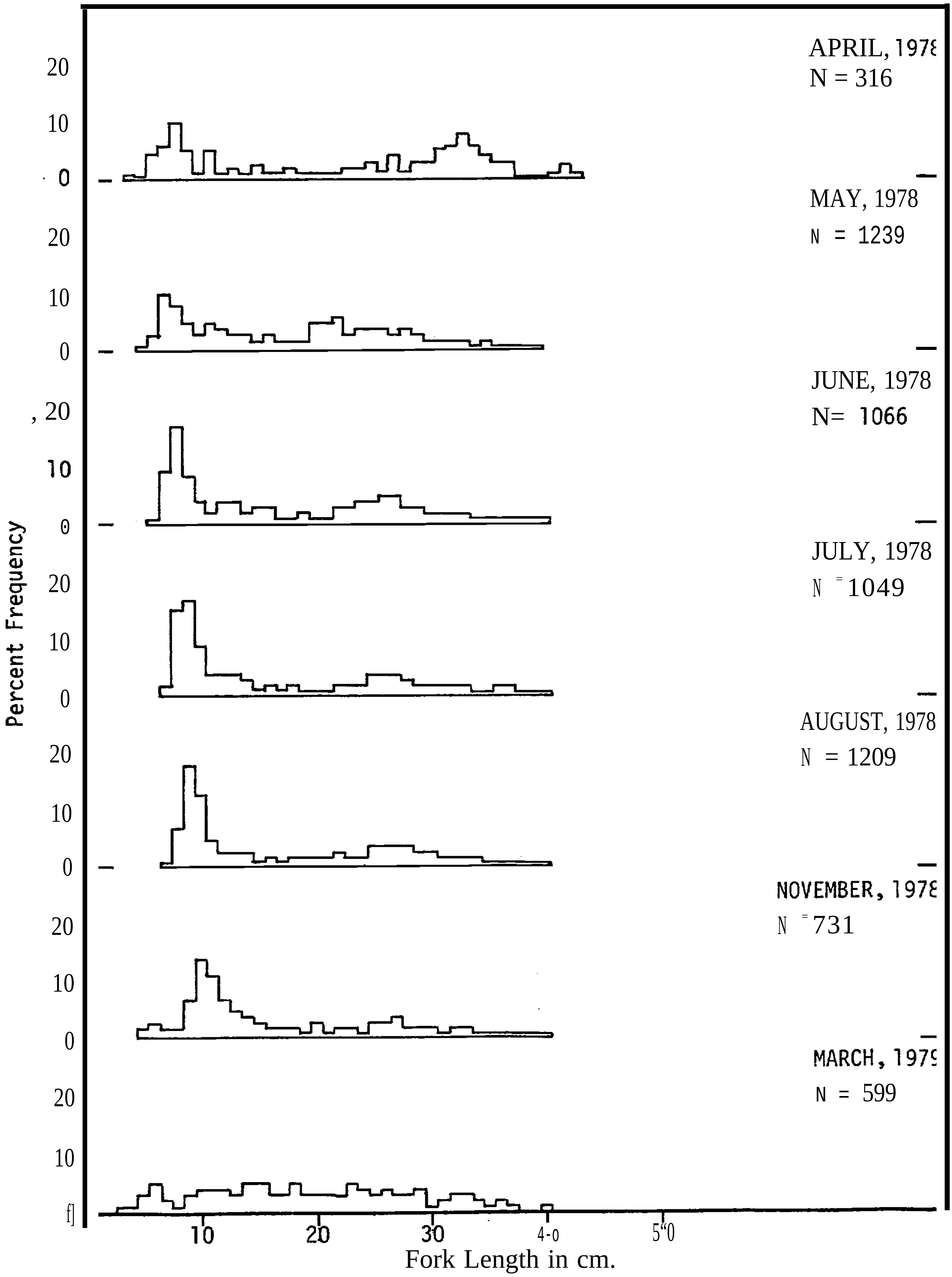

Figure 36. Relative length-frequency of rock sole by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

Growth of young yellowfin sole was evident from the length frequency data. The smallest fish, which are assumed to be age 1, were 4 to 5 cm in April and grew to about 8 to 9 cm by November. The age 2 fish grew to about 12 to 13 cm by August. The SiZe at greater age cannot be interpreted from larger fish (Figure 37). Yellowfin sole judged to be in spawning condition were captured in May, June, July August and November (Table 26).

Starry Flounder

Starry flounder were encountered in all months and bays, although differences in catch between bays were small and not consistent in different gear (Tables 14, 15, 20 and 21). There were consistently higher beach seine catches in some locations near river mouths. A weak trend towards seasonality was apparent, with greatest beach seine and gill net catches during mid-summer, while greatest try net and otter trawl catches were in early summer and fall (Tables 10,11, 13 and 14) .

Sizes captured ranged from 6 to 60 cm and were evenly spread within those extremes so that growth information is very weak. The length frequency data (not presented because no size modes are present) could be interpreted to indicate growth of about 6 to 7 cm per year in the first 3 years so that November sizes are 6 - 7 cm at age O, 13 cm at age 1 and 20 cm at age 2. Starry flounder in spawning condition were not captured (Table 26).

Pacific Halibut

The otter trawl and try net captured halibut throughout the year and in all four bays. The Pacific halibut displayed a very weak tendency towards a seasonal migration with greater abundance in the summer (Tables 10, 12, 14 and 15), the season when they are considered to be farthest inshore.

The length-frequency data show a vague picture of the first three years of the halibut. The mean length for age 1 fish in August was 7 cm and in November 10 cm. In March the age 2 fish averaged 12 cm and by November increased to 20 cm. The third age class was difficult to separate from older age classes, but apparently grew from 23 cm in March to 32 cm in November (Figure 38)). This growth rate corresponds to the published growth information (Southward, 1967).

Water Surface Temperature

The water surface temperature ranged from 1.4 C in early March to 16.7 C in early August (Figure 39). Considerable variation occurred over relatively short time periods due to the wide range of areas sampled, from open water to shallow protected areas to near river mouths.

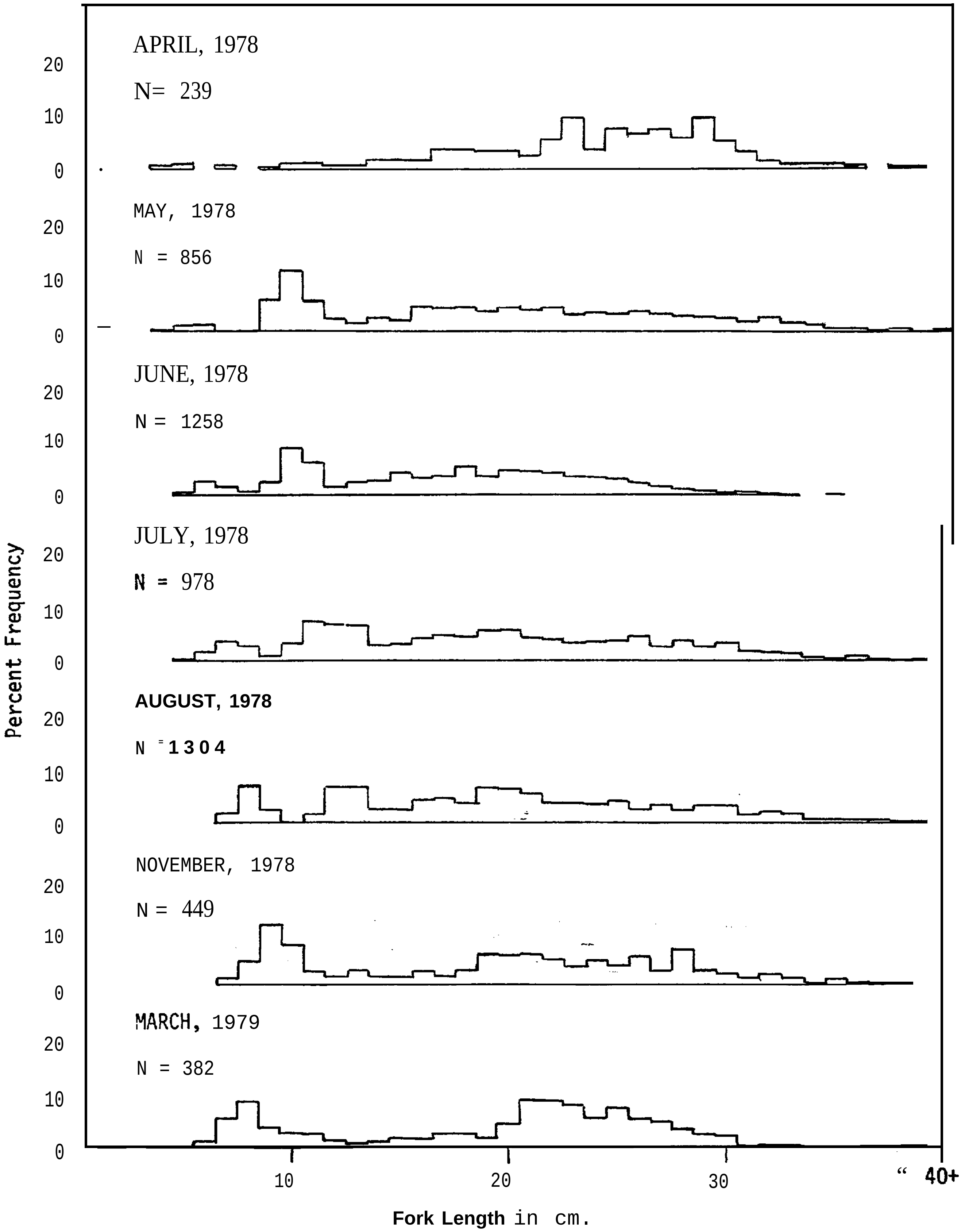

Figure 37. Relative length-frequency of yellowfin sole by month of capture. The catch by all types of gear and all bays combined; April 1978 through March 1979 on the east side of Kodiak.

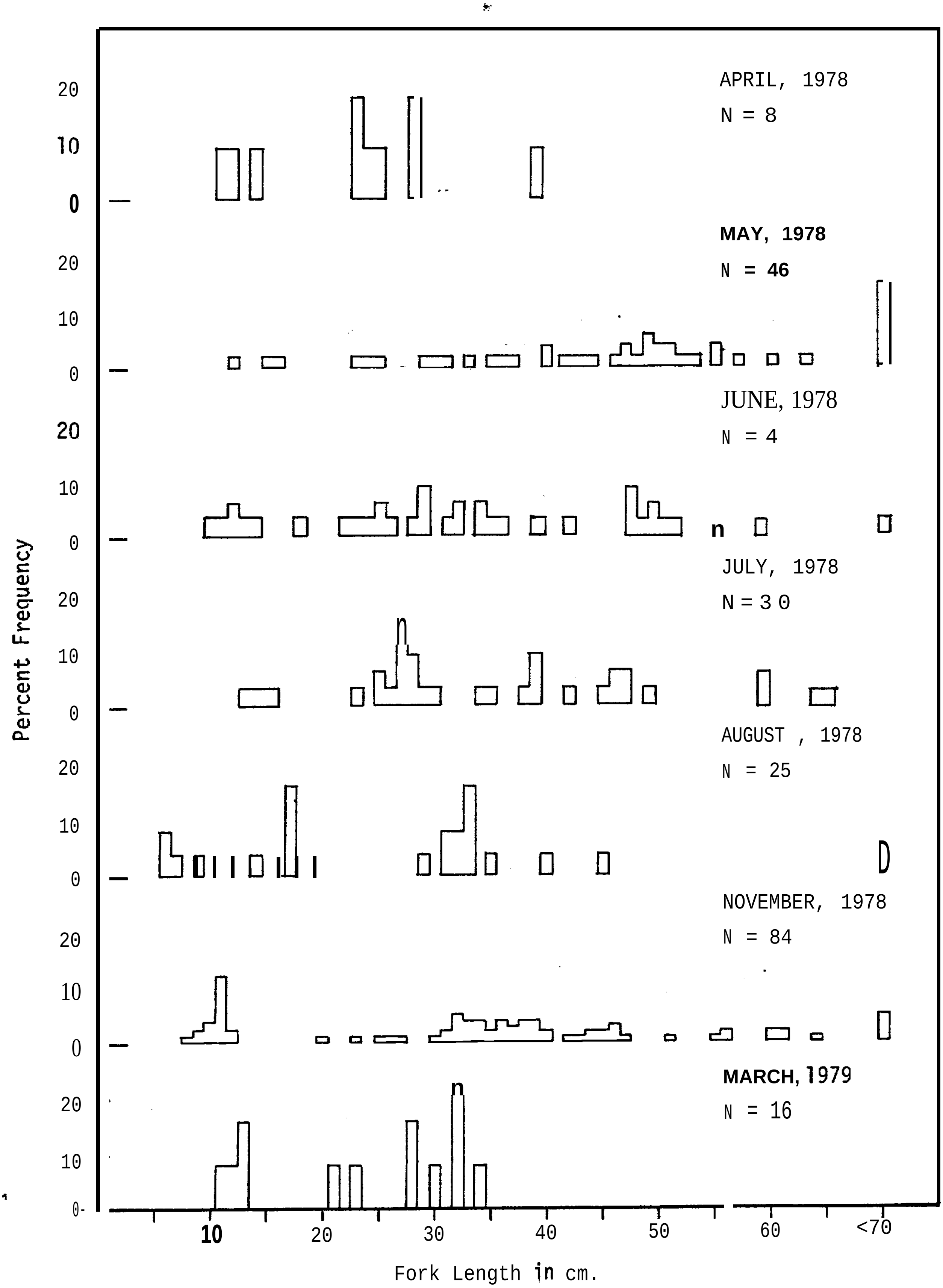

Figure 38. Relative length-frequency of Pacific halibut by month of capture. The catch by all types of gear and all bays combined, April 1978 through March 1979 on the east side of Kodiak.

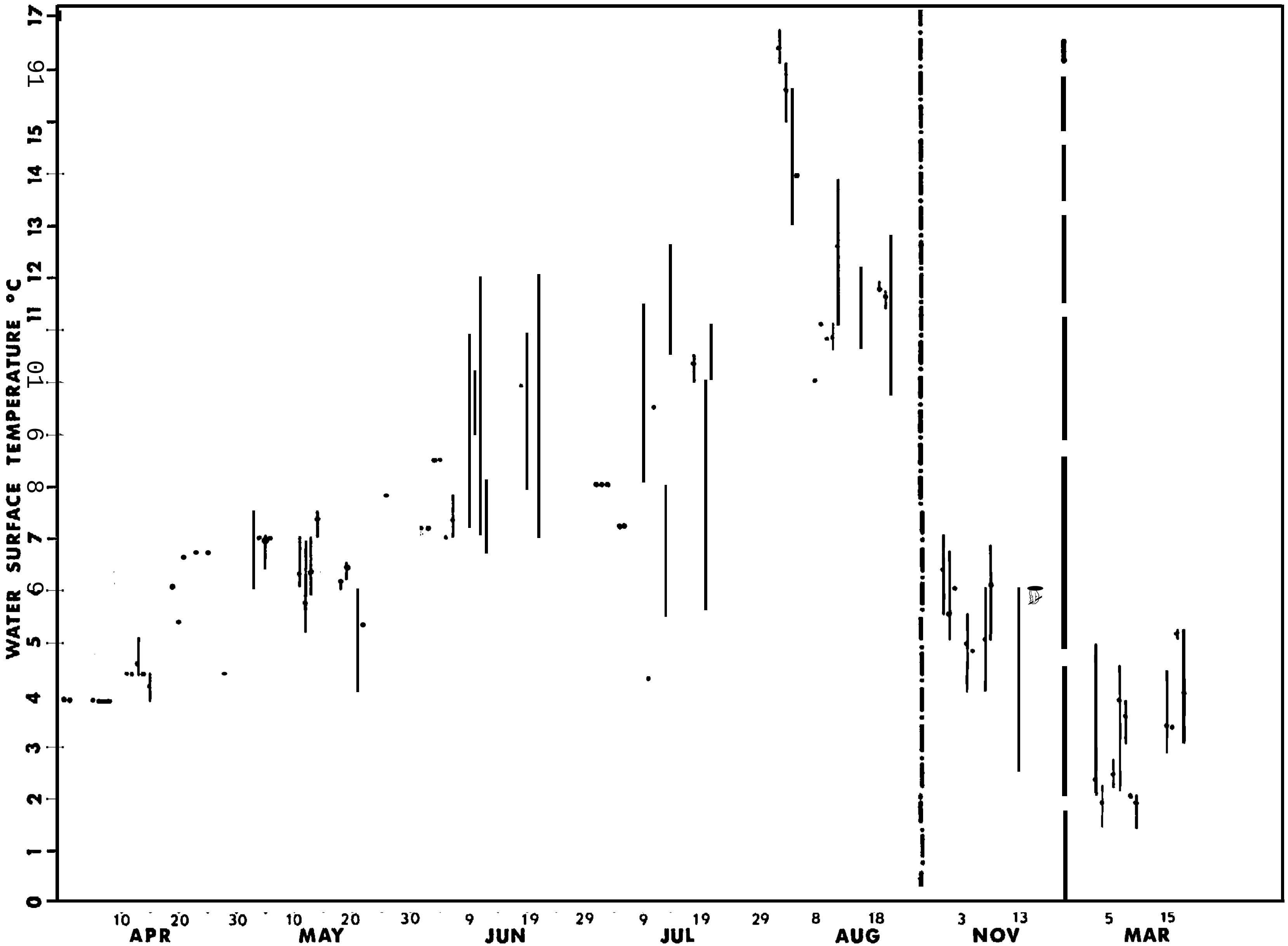

Figure 39. Water surface temperature daily mean and range by date during April through August 1978, November 1978 and March 1979.

Salinity

Salinity was recorded with 186 hauls. There were two records of 5 ppt., two records of 15 ppt, six records (3.2%) were 21 ppt or less and all others were between 26.0 ppt and 36.0 ppt. There were 35 records (18.8%) less than 30 ppt., 94 records (50.5%) less than 31 ppt., 135 records (72.6%) less than 32 ppt., 154 records (82.8%) records less than 33 ppt., and 179 records (96.2%) less than 35 ppt.

The information present in the salinity records does not justify further presentation or analysis. Seasonal or regional differences are not sufficiently documented.

Salinity was recorded with too small a proportion of the samples to justify comparison of catches at different salinities.

With surface salinities of 26 ppt or more on nearly 98% of the records and 30 ppt or more on 80% of the records, it is clear that the area sampled was primarily oceanic.

DISCUSSION

A description of the fish assemblages of the Kodiak area is not complete until certain dependable features of distribution are addressed as well as cyclic features. Most species display increasing size at increasing depth. Little attention was placed on establishing this feature in this report since it has been previously established (Alverson et al., 1964, for flounders; Hughes and Alton, 1974, for pollock; Blackburn, 1978 and 1979, in studies similar to this one). Butter sole seem to be an exception to this rule since the evidence from this study and from Blackburn (1978 and 1979) clearly indicate mixture of all sizes at depths occupied by the species.

An important corollary of this generality is that the smallest individuals of most species are in the shallowest water. Oil spill impact is generally considered greatest in surface waters and along shorelines and egg, larval and juvenile stages are considered most vulnerable to oil pollution. Both the impact and most vulnerable stages of fish are in shallow water.

Another important feature is that different species tend to occupy different depths and different ranges of depths. For example, in summer starry flounder seem to be mostly in the extreme shallows and in rivers; butter sole are mostly in 5 to 30 fathoms or so while arrowtooth flounder and flathead sole juveniles are within the 5 to 30 fathom depth range, but adults are most abundant at well over 100 fathoms.

There was little difference in catches attributable to location within bays in this study. There were generally fewer species farther within bays;and in Saposa Bay, the innermost area in Izhut Bay, there was evidence of reduced catches in late summer apparently due to oxygen depletion in the bottom water. Blackburn (1979) demonstrated some differences in otter trawl catch associated with distance into Ugak Bay.

The otter trawl yielded significantly more rock sole in the Izhut area than in the Kiliuda area and this appears to be a real feature when trawling results from a wider area are compared. From surveys summarized by Ronholt et al. (1978) the Marmot Bay-Albatross Bank area seems to have more rock sole than other areas on the east side of Kodiak.

The only short term cyclic feature investigated was the effect of tide on catches. Considerable differences in beach seine catch were found on different tide stages. The meaning of this relationship to the functioning of the nearshore zone is not clear.

Seasonal features are extremely important, especially in the nearshore zone. Movement to deep water for winter leaves few fish in this area while inshore movement for summer results in considerably higher catches of several fish. The largest component of the seasonal variability is associated with the reproductive cycles of many marine and anadromous species. Juvenile salmon migrate through the nearshore zone mostly during April through July and adults pass through it during May through September. But many marine fish invade the pelagic and nearshore zone first as larvae or eggs and as these fish and invertebrates grow they occupy different habitats; size and vulnerability to sampling gear change so that during the summer period the composition of the nearshore fauna seems to change constantly.

Long term changes and differences between years are known to occur. The year this study was conducted was the third successive relatively warm winter in the Kodiak area. Salmon runs were large due to favorable environment while unusually harsh winters in the early 1970's were considered the cause of low salmon runs which resulted from spawn in those years. As discussed earlier in this report, the herring fishery during the 1930's and 1940's averaged 40,000 short tons catch per year in the Kodiak area while the current harvest is about 2,000 metric tons. The difference is thought to be due to changes in abundance.

During a survey conducted during 1976-77 on the east side of Kodiak, which was very similar to this one, very large catches of age O Pacific sandfish were obtained (Harris and Hartt, 1977; Blackburn, 1979). Similar catches of this species were not taken during this study.

The 1977 year class of sablefish, which constituted nearly all of the sablefish caught in this study, has become recognized as the largest year class of this species seen in a long time.

The numerical taxonomic approaches yielded some interesting results: however, they have a couple weaknesses. There is no way of calculating variance estimates for diversities or area similarities and there is no way of constructing dendrograms that illustrate alternative groupings.

(That is, when two groups were combined there occasionally was a third group that was quite similar to one of the combined groups but not to the other. This situation never occurred at high levels of association.) In short, it is difficult to separate meaningful frOm spurious results. To do so requires comparison of results between gear types, comparison with previous papers, and careful interpretation of data.

The ability of the various sampling gear to obtain a representative (repeatable) sample affects all the results, so a discussion of the relative merits of the catches of each gear is in order.

The greatest number of species were taken with the try net, the beach seine and the trammel net, in that order. The otter trawl is excluded in all numerical taxonomy results because it was not used in all areas. The total diversity was greatest in the try net, trammel net and beach seine, in that order. Since numerical properties dictate that diversity increases as sample size increases and diversity increases with decreasing variability, diversity seems to be a very good indicator of reliability of results. Total diversity indicates that tow net results are least reliable and gill net results are more reliable, but not nearly comparable to try net, trammel net or beach seine results.

The tow net sampled pelagic fish which were usually highly aggregated (schooled as well as concentrated in good feeding areas), and it is necessary to conduct extensive sampling to get highly reliable results. The gill net also sampled pelagic fish (herring, adult salmon, smelt) and a few demersal fish although it was deployed in the littoral zone. Since this gear caught and killed adult salmon its use was restricted by the field crew, which may be partially responsible for low reliability of catches. The trammel net and try net caught almost exclusively demersal species, which are in general much more uniformly distributed than pelagic species and very much less mobile. Thus catches by the try net and trammel net are commonly very repeatable. The beach seine caught both pelagic fish and demersal fish in the nearshore zone; more sets were made than with any other gear and fish were almost always caught. The large amount of effort with the beach seine and the abundance of fish in the nearshore zone combine to provide reliable results.

The area similarity dendrograms illustrate the similarity of the various areas but they are affected by the relative ability of the different gear to obtain representative samples of the predominant species in an area. One would expect geographic affinities (areas of one bay to be most similar with each other) to exist partly because of similarity of habitat within a bay and partly due to dispersio-n of species from specific habitats. Geographic affinities definitely are predominant in the two very nearshore, reliable gear types, beach seine and trammel net (Figure 13) , while some geographic affinity is present in the try net catches (Figure 13). The two less reliable gear types, gill net and tow net, show little geographic affinity (Figure 13).

The geographic affinities that are most prominent are based on the distribution of juvenile pink and chum salmon (beach seine) which is related to the proximity of producing streams, and on the distribution of greenling species (trammel net) which is probably related to specific elements of the kelp habitat or kelp abundance. There does not appear to be a cline of species abundance (gradual change of species with distance) along the archipelago. The differences between areas are due primarily to shifts in relative abundance of predominant species, not to changes of species composition. There is a marked similarity of catches throughout the study area.

Pielou (1972 and 1977) has used components of diversity, partitioned as in this study, as measures of niche width and niche overlap. To do so, however, requires that sampling be conducted by habitat. Since the samples presented here were collected by geographic area, not habitat, it is perhaps inappropriate to use the terms niche width and niche overlap; however, they are used for simplicity.

Pielou (1972 and 1977) presented a method of scaling niche width and niche overlap between O and 1 for minimum to maximum. The indices of niche width and niche overlap thus calculated (Table 28) were markedly lower for the tow net and slightly lower for the gill net than for the other three types of gear. In addition, niche width was greater than niche overlap for all gear except the try net, for which they were about equal.

Table 28. Niche width and niche overlap by gear type. Calculations were by the method of Pielou (1972), using the 12 subareas as sampling sites.

	Niche Width	Niche Overlap
Beach Seine	.86	.82
Gill Net	.77	.70
Trammel Net	.87	.80
Tow Net	.41	.24
Try Net	.81	.82

Low figures for niche width indicate that each species tends to be restricted to a subset of the areas while high values indicate that they tend to occur indifferently in the different areas. Low figures for niche overlap indicate that each area contains a relatively small subset; of low diversity, of the community species complement while high overlap indicates that the species diversity within each area approaches that of the community treated as an undivided whole (Pielou, 1977) .

The niche width and niche overlap figures are both relatively high but niche width is higher for all but one gear (Table 28). Since diversity is higher when all the numbers comprising it are more even (have lower variability) the higher value for niche width indicates that the catch rates between areas and within species are more even than the catch rates within areas and between species. If the areas sampled had been much more widely separated the within species catch rates would be less even and the niche width would be lower.

The numerator of the niche width figure is essentially a weighted mean of all of the site diversities of the various species, from Table 24. The individual site diversities of the various species are also worthy of some attention. They provide an indication of the relative ubiquity of each species, with higher values for those species which are most evenly distributed among areas. For example, the buffalo sculpin had a very high site diversity from the beach seine collections (Table 24) while its mean density was uniformly very low (Table 16). It is the belief of the authors that these values are characteristic of the individual species, but that they are strongly influenced by the collection methods. If a particular species of fish is not expected to occur throughout the range of use of a particular gear then the site diversity of that species will be lowered. For example, the site diversities of all the flounders except starry flounder and rock sole, are greater for the try net than for any other gear. The try net is the gear that most directly samples the habitat of flounders. Rock sole and starry flounder occur at shallower depths than the other flounders, with starry flounder more abundant in the very shallow depths sampled by the beach seine and trammel net than at the slightly greater depths sampled by the try net.

In addition, certain species are more susceptible to capture by certain gear types than by others. Herring are more common and more predominant in the gill net collections although nearly the same zone was sampled with the trammel net and beach seine. Greenling were nearly all most susceptible to capture by the trammel net. The gear to which a species was most susceptible seems to have yielded higher site diversities for that species.

Species Associations

The species dendrograms for each gear are very interesting but very difficult to discuss for several reasons: as presented they are inflexible, without any method of assessing variability and consequently there is no method of assessing validity; there are a number of measures of similarity between taxa that could have been employed; there are a number of ways data may have been handled (lumped by area and time, separated by time, haul by haul, etc.); and there are a number of ways the groups may have been constructed from a matrix of similarity values. All these choices affect the details of the species similarity dendrograms. Thus, it is very difficult to make clear statements of results from the dendrograms and especially difficult to separate the valid details present in the dendrograms from the invalid or spurious details.

Another important characteristic of species association analyses is that they are functions of the survey design. To understand this feature, consider the following example. Within a given area, Area A, species 1 and species 2 are independently distributed while in an adjacent area, Area B, neither species occurrs. Samples taken within Area A would not reflect any relationship between these two species while samples taken in both Area A and Area B considered together would result in a degree of association between the two species. In fact the species are related by both occurring within one area (although they are independent within that area), but the level of association must be considered. If Area A is Hawaii and Area B is Kodiak the species association is based on geographic features,but if Area A is kelp beds on Kodiak Island and Area B is sand bottom then the association could be said to be based on habitat.

One more example of the effect of survey design on association is pertinent. Consider species A and species,B both of which occur at increasing abundance with increasing depth from O m, but abundance of species A reaches a maximum at 25 m and decreases deeper while abundance of species B increases to at least 50 m. Samples taken between O and 25 m will reveal a positive association while a separate study at 25 m to 50 m would reveal a negative association. Since marine fish abundance is strongly associated with depth, any species association is a function of the depths sampled.

With these considerations in mind the dendrograms may be examined for meaningful associations. From the beach seine dendrogram, staghorn sculpin, starry flounder and rock sole were combined while the same three were combined, along with yellowfin sole, from the trammel net. Staghorn sculpin and starry flounder were found to be strongly associated in beach seine catches in Cook Inlet in 1976, so this association is probably valid. The inclusion of rock sole in this group seems valid due to consistency, and the inclusion of yellowfin sole in this group in the trammel net catches is probably meaningful. However, in the try net catches there was no association among any of these four species, undoubtedly due to the different depth and sampling characteristics of the try net.

A very different type of relationship may be seen for Pacific cod. Pacific cod was one of the members-of the highest or second highest correlation in four of the five gear types. In the beach seine it combined with three other species (correlation greater than 0.8) before any other two species combined, and in the try net it combined with two other species at correlation of 0.95 and with four other species at a correlation of 0.78. Pacific cod seems to be always associated strongly with some other species. Also, Pacific cod seems to be a member of the group with the largest number of species. Examination of try net catch data for August revealed that Pacific cod were caught on few hauls but they occurred when the number of species captured were greatest.

It is possible that Pacific cod require high levels of food abundance which is indicated in the samples by positive correlation with high species counts.

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Appendix Table 1. Names and general locations of salmon spawning streams that averaged 10,000 or more spawners of any species as listed in Figure 4. Streams are listed in the sequence they appear on the shoreline from north to south.

	Name	Location
Figure 4A	Perenosa	Drains Portage Lake to Perenosa Bay
	Pauls Lake	Eastside of Perenos Bay
	Sacramento Creek	Between C. Chiniak and Narrow Cape
	Tundra Lakes Creek	Aliulik Peninsula south of Kaguyak
	Sow Creek	Aliulik Peninsula south of Kaguyak
	7 Rivers	Aliulik Peninsula south of Kaguyak
	Humpy River	Aliulik Peninsula opposite Kaguyak
	Talifson's Creek	Northeast Olga Bay
	Dog Salmon River	Drains Frazer Lake to Olga Bay
	Akalura	Drains Akalura Lake to Olga Bay
	Upper Station	Drains Upper Station Lakes to Olga Bay
Figure 4B	Danger River	Danger Bay, north end
	Marka Creek	Between Danger Bay and Afognak Bay
	Afognak River	Drains Afognak Lake to Afognak Bay
	Sheratin River	On Sheratin Bay
	Buskin River	3 miles S.W. of City of Kodiak
	American River	On Middle Bay
	Sid Olds Creek	On Kalsin Bay
Figure 4C	Miam River	On Portage Bay
	Hurst Creek	On Saltery Cove
	Saltery Creek	On Saltery Cove
	Eagle Harbor	On Eagle Harbor
	North Kiliuda	Inner Kiliuda, north arm
	West Kiliuda	Inner Kiliuda, west arm
	Midway Bay	On Midway Bay, north of Old Harbor
	Barling Bay	Barling Bay, south of Old Harbor
	Kaiugnak Lagoon	Inner Kaiugnak Bay
	North Kaguyak	Kaguyak Bay
	West Kaguyak	Kaguyak Bay -
	Deadman River	Head of Deadman Bay

Appendix Table 2. Presence of each life history stage of each taxon by month of collection on the east side of the Kodiak Archipelago during April through November of 1978 and **March of** 1979. The sampling gear caught large larvae (greater than 10-15 nun) **better than small larvae. The larval tomcod and larval pollock probably were very small juveniles. The distinction between juvenile and adult is subjective for many species, however, when stomachs were removed gonads were examined to assist in the distinction. Most flatfish were called juvenile at less than 20 cm. Life history stages are L-1arvae, J-juvenile and A-adult.**

	Stage	Mar	Apr	May	Jun	Jul	Aug	Nov
King Crab	J	J		J	J	J	J	
	A	A	A	A	A	A	A	A
Tanner Crab	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Dungeness Crab	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Dogfish	J							
	A					A		
Big Skate	J			J				
	A		A	A	A	A	A	
Longnose Skate	J							
	A						A	
Pacific herring	L						L	
	J	J	J		J	J	J	J
	A	A	A	A	A	A	A	A
Pink Salmon	J	J	J	J	J	J	J	
	A					A	A	
Chum Salmon	J	J	J	J	J	J	J	J
	A						A	
Coho Salmon	J				J	J	J	
	A						A	
Sockeye Salmon	J							
	A				A	A	A	
Dolly Varden	J			J	J	J	J	J
	A			A	A	A	A	A
Surf Smelt	L							
	J					J	J	
	A			A	A	A		A
Capelin	L	L	L	L	L	L	L	L
	J		J	J			J	J
	A	A	A	A	A	A	A	

Appendix Table 2. Continued...

	Stage	Mar	Apr	May	Jun	Jul	Aug	Nov
Eulachon	L							
	J							
	A	A	A	A				A
Gadidae spp.	L			L	L			L
	J							
	A							
Pacific Cod	L					L		
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Pacific tomcod	L				L			
	J	J	J	J	J	J	J	J
	A	A	A			A	A	A
Walleye pollock	L					L		
	J	J	J	J	J	J	J	J
	A	A	A	A		A	A	A
Shortfin eelpout	J			J		J		
	A				A	A	A	
Wattled eelpout	J						J	
	A					A	A	
Threespine sticklebacks	J	J	J		J	J	J	
	A		A	A	A	A	A	
Tubesnout	J							
	A	A						
Rockfish spp.	J		J	J			J	
	A							
Dusky Rockfish	J				J	J	J	
	A				A	A		
Darkblotched Rockfish	J			J				J
	A							
Black Rockfish	J			J				
	A		A	A			A	
Greenling spp.	L	L	L					L
	J	J	J	J	J	J		
	A		A			A		

Appendix Table 2 Continued . . .

	Stage	Mar	Apr	May	Jun	Jul	Aug	Nov
Kelp greenling	L							
	J	J			J		J	
	A		A	A	A	A	A	A
Rock greenling	L							
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Masked greenling	L							
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Whitespotted Greenling	L							
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Lingcod	L			L	L			
	J	J	J	J		J	J	J
	A							
Sablefish	L							
	J		J	J	J	J	J	J
	A							
Sculpin spp.	L	L	L	L	L	L	L	
	J		J	J	J	J	J	J
	A		A	A				A
Padded sculpin	L							
	J	J		J			J	J
	A			A	A	A		
Crested sculpin	L							
	J							
	A				A	A		A
Silverspotted Sculpin	L			L				
	J	J	J	J	J	J	J	J
	A		A	A	A	A	A	A
Sharpnose sculpin	L				L	L	L	
	J	J				J		J
	A							
Spinyhead sculpin	L							
	J	J	J	J	J	J	J	J
	A	A	A	A		A	A	A

Appendix Table 2 Continued . . .

	Stage	Mar	Apr	May	Jun	Jul	Aug	Nov
Buffalo sculpin	L							
	J	J	J	J	J	J	J	J
	A		A	A	A	A		A
Gymnocanthus spp.	L				L			
	J		J	J	J	J	J	J
	A		A	A	A	A	A	
Armorhead sculpin	L							
	J	J	J	J	J	J	J	J
	A	A		A	A	A	A	A
Threaded sculpin	L							
	J	J			J	J	J	J
	A	A		A	A	A	A	A
Red Irish Lord	L							
	J		J				J	J
	A				A	A	A	A
Yellow Irish Lord	L				L			
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Bigmouth sculpin	L							
	J		J				J	
	A							
Northern sculpin	L							
	J		J	J				
	A							
Pacific staghorn sculpin	L							
	J	J				J	J	J
	A	A	A	A	A	A	A	A
Myoxocephalus spp.	L		L	L	L			
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Plain Sculpin	L							
	J			J	J	J	J	
	A			A	A	A	A	A
Great Sculpin	L							
	J		J	J	J	J	J	J
	A		A	A	A	A	A	A

Appendix Table 2   Continued . . .

	Stage	Mar	Apr	May	Jun	Jul	Aug	Nov
Sailfin sculpin	L							
	J					J		
	A			A				
Tidepool sculpin	L							
	J							J
	A							
slim sculpin	L							
	J				J			
	A							
Manacled sculpin	L							
	J						J	J
	A		A	A		A		A
Scissortail sculpin	L							
	J							
	A		A		A			
Roughspine sculpin	L							
	J					J		J
	A							
Ribbed sculpin	L							
	J	J	J		J		J	J
	A	A	A	A	A	A	A "	A
Tadpole sculpin	L							
	J							
	A					A		
Poacher spp.	L	L		L				
	J							
	A							
Smooth alligator-fish	L							
	J							
	A		A	A				
Sturgeon poacher	L							
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Bering poacher	L							
	J							
	A						A	
Tubenose poacher	L			L	L			
	J			J	J	J	J	J
	A	A	A	A	A	A	A	A

Appendix Table 2 Continued . . .

	Stage	Mar	Apr	May	Jun	Jul	Aug	Nov
Snailfish spp.	L			L	L	L	L	
	J	J	J	J	J			J
	A	A	A	A				A
Spotted snailfish	L			L		L		
	J						J	
	A						A	
Marbled snailfish	L							
	J		J					
	A		A					
Pacific sandfish	L	L	L	L				
	J		J	J			J	
	A	A	A	A	A	A	A	A
Bathymasteridae	L		L		L			
	J							
	A							
Searcher	L							
	J		J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Northern Ronquil	L							
	J		J					
	A		A					
Wolf eel	L							
	J						J	
	A							
Pricklebacks	L	L	L	L	L	L		
	J		J				J	
	A		A					
High cockscomb	L							
	J	J	J				J	
	A						A	
Snake prickle-back	L			L				
	J	J		J	J	J	J	
	A	A	A	A	A	A	A	
Daubed shanny	L							
	J	J			J	J	-J	
	A		A	A		A	A	

Appendix Table 2 continued . . .

	Stage	Mar	Apr	May	Jun	Jul	Aug	Nov
stout eelblenny	L							
	J			J	J	J		
	A			A	A	A	A	
Whitebarred blenny	L							
	J			J				
	A		A	A				
Arctic shanny	L							
	J	J			J		J	J
	A		A	A			A	
Giant wrymouth	L		L	L	L			
	J							
	A							
Dwarf wrymouth	L			L	L			
	J							
	A							
Pholidae spp.	L			L	L			
	J							
	A							
Penpoint gunnel	L							
	J						J	
	A			A			A - -	A
Longfin gunnel	L							
	J							
	A				A			
Crescent gunnel	L					L		
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A -	A	
Prowfish	L							
	J					J	J	
	A							
Sandlance	L		L	L				
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Flounder spp.	L			L	L	L		L
	J		J					
	A							

Appendix Table 2 Continued...

	Stage	Mar	Apr	May	Jun	Jul	Aug	Nov
Arrowtooth	L							
	J	J	J	J	J	J	J	J
	A		A	A	A	A	A	A
Rex sole	L							
	J	J	J		J	J	J	J
	A			A		A	A	
Flathead sole	L							
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Butter sole	L							
	J		J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Rock sole	L							
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Yellowfin sole	L							
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Dover sole	L							
	J				J	J	J	J
	A				A	A	A	
English sole	L							
	J	J		J		J	J	J
	A		A		A			A
Starry flounder	L							
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A
Alaska plaice	L							
	J		J	J	J	J		
	A				A		A	A
Sand sole	L							
	J	J		J	J	J		J
	A	A	A	A	A	A	A	A
Pacific halibut	L					L		
	J	J	J	J	J	J	J	J
	A	A	A	A	A	A	A	A

Appendix Table 3. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in inner Izhut Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Dungeness crab					1.5			0.2
Pink salmon	1.2	1.8	146.4	9.3				22.3
Dolly Varden					0.2			T
Pacific cod	0.2							T
Walleye pollock			0.2					T
Rock greenling	0.5	0.8			0.2	0.2		0.2
Masked greenling	1.8	5.0		3.3	8.3	1.0		3.0
Whitespotted greenling		0.8	0.4	6.0	14.2			3.5
Lingcod					1.3			0.2
Padded sculpin		0.2						T
Silverspotted sculpin		0.4			0.2	0.2		0.1
Buffalo sculpin		0.2	0.2			0.2		0.1
Yellow Irish Lord						0.2		T
Pacific staghorn sculpin					0.2			T
Myoxocephalus spp.		0.8		4.3	9.0	1.6	0.8	2.6
Manacled sculpin				0.2		0.4		0.1
Tubenose poacher						0.2		T
Pacific sandfish					0.3			0.1
High cockscomb					0.5			0.1
Crescent gunnel		0.8			3.0			0.6
Prowfish					0.2			T
Pacific sand lance			9.6	197.3	4967.2	0.2		862.1
Rock sole				0.2		0.8		0.1
Yellowfin sole		0.6						0.1
English sole					0.2			T
Numbers of hauls	4	5	5	6	6	5	5	36

Appendix Table 4. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in inner middle Izhut Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring					0.3			0.1
Pink salmon	1.0	3.0	134.8					15.1
Dolly varden				0.2		0.9		0.2
Pacific cod				0.2	9.4			1.8
Hexagrammos sp.			0.2					T
Rock greenling	0.6	0.8	0.7		0.7	0.1		0.4
Masked greenling	2.0	0.6	4.5	5.4	4.3	1.0		2.6
Whitespotted greenling			0.7	2.0	5.3	0.3		1.4
Lingcod					0.4			0.1
Sculpin spp.	0.4							0.1
Padded sculpin					0.1			T
Silverspotted sculpin	0.2		0.2	0.2				0.1
Sharpnose sculpin				0.2		0.1		0.1
Buffalo sculpin			0.2	0.2			0.2	0.1
Hemilepidotus spp.	0.8							0.1
Yellow Irish Lord			0.5					0.1
Myoxocephalus spp.	0.2	16.2	1.5	0.8	1.1	0.4	0.2	2.8
Tidepool sculpin						0.1		T
Manacled sculpin		0.2			1.1	0.3		0.3
Tubenose poacher	0.2	0.2			0.1	0.3		0.1
Searcher					0.1			T
Whitebarred prickleback		0.2						T
Arctic shanny			0.7			0.4	0.2	0.2
Penpoint gunnel						0.1		T
Crescent gunnel	0.2		0.7.	0.2		0.1		0.2
Prowfish					0.1			T
Pacific sand lance	2.0	1.6	4.8	2595.8	156.7			381.3
Founder spp.	0.2							T
Rock sole		0.6	0.2		1.3	1.6	0.2	0.7
Number of hauls	5	5	4	5	7	7	4	37

Appendix Table 5. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in outer middle Izhut Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring			0.4		0.6			0.2
Pink salmon	62.6	81.8	3.5	10.9	11.6			20.7
Coho salmon			17.5					2.9
Dolly Varden			1.6	0.9		1.0		0.6
Surf smelt						0.2		T
Pacific cod		0.2	0.1	0.1	0.1			0.1
Threespine sticklebacks	0.2		0.1		0.2			0.1
Tube-snout							0.2	T
Hexagrammos sp.		0.3						T
Kelp greenling			0.2					T
Rock greenling	0.2		0.2	0.2	0.2			0.1
Masked greenling	3.6	0.5	2.5	2.1	1.8		0.2	1.5
Whitespotted greenling		0.3	0.4	12.6	4.8		0.2	3.0
Lingcod					0.2			T
Padded sculpin			0.1		0.1			T
Silverspotted sculpin	1.2							0.1
Sharpnose sculpin						0.1		T
Buffalo sculpin	0.6	0.2		0.1				0.1
Pacific staghorn sculpin			0.2		0.1			0.1
Myoxocephalus spp.	0.4		0.1	0.5	0.1	0.7		0.3
Arctic shanny					0.1			T
Penpoint gunnel		0.2			0.1			T
Crescent gunnel	0.6	0.2	1.1	0.1	0.2			0.3
Pacific sand lance		3.7	0.1	668.0	0.1	1.0		109.7
Rock sole		0.2	0.2	0.1		0.2		0.1
Numbers of hauls	5	6	8	8	8	8	5	48

Appendix Table 6. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in inner Kalsin Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Dungeness crab				3.7				0.4
Pink salmon	0.6	22.7	.34.8	72.8	2.4			17.6
Chum salmon	0.9	36.2	37.3	1.8				12.3
Coho salmon				0.2				T
Dolly Varden					1.0			0.1
Capelin			0.2					T
Pacific cod					2.6			0.4
Pacific tomcod							0.2	T
Walleye pollock						0.2		T
Threespine sticklebacks				0.2				T
Hexagrammos sp.				0.2				T
Rock greenling	0.1							T
Masked greenling	0.6	0.2		0.7	2.6			0.6
Whitespotted greenling				17.8	11.0			3.4
Ling cod				0.2				T
Sculpin spp.				8.0				0.9
Padded sculpin				0.7				0.1
Silverspotted sculpin	0.6							0.1
Buffalo sculpin						0.2		T
Yellow Irish Lord	0.1			0.2				0.1
Pacific staghorn sculpin				1.5	0.6			0.2
Myoxocephalus spp.	1.0	0.5	0.5	18.5	4.4	3.4	0.5"	3.4
Tubenose poacher					0.4	0.2		0.1
Snailfish spp.		0.2						T
Arctic Shanny	0.1				0.2			0.1
Crescent gunnel	0.3	0.8						0.2
Pacific sand lance				25.0	6603.8	0.8		895.2
Rock sole	0.6	0.3	0.8	1.8	0.4	0.2		0.6
Yellowfin sole				0.2				T
Starry flounder	0.1	0.5	0.7		0.2	0.2		. 0.3
Sand sole				0.5				0.1
Number of hauls	7	6	6	4	5	5	4	32

Appendix Table 7. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in outer Kalsin Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring						0.5		0.1
Pink salmon	0.5	118.5	50.3	7.7	0.8			28.8
Chum salmon		48.2	6.5	0.2				8.9
Dolly Varden		0.2	1.5	0.7	0.7			0.5
Threespine sticklebacks				0.2	0.5			0.1
Tube-snout							0.2	T
<u>Hexagrammos</u> sp.				0.3				0.1
Rock greenling					0.2			T
Masked greenling		0.3	0.3	1.3	8.5			1.7
Whitespotted greenling			0.5	6.8	14.2			3.5
Padded sculpin		0.2				0.6		0.1
Silverspotted sculpin					1.8		0.2	0.3
Buffalo sculpin		0.2			0.2			0.1
<u>Gymnocanthus</u> spp.					0.2			T
Pacific staghorn sculpin					0.2			T
<u>Myoxocephalus</u> spp.	2.5	0.7	6.7	2.0	1.8	5.5	0.2	2.8
Tubenose poacher			0.3	0.2	0.7	0.2		0.2
Snailfish spp.							0.2	T
Spotted snailfish					0.7			0.1
Penpoint gunnel					0.2			T
Crescent gunnel			0.2		6.8			1.1
Pacific sand lance	0.5	0.5		0.2	725.2	0.2		117.8
Rock sole		0.3	0.3	0.5	0.5	0.2	0.2	0.3
English sole					0.2			T
Starry flounder					0.5		0.2	0.1
Alaska plaice				0.2				T
Number of hauls	2	6	6	6	6	6	5	37

Appendix Table 8. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in inner Kiliuda Bay. T represents trace, less than 0.05 fish/ set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon	2.2	21.8	1.2	0.8	1.4		0.2	3.9
Chum salmon	7.6	188.8	165.0	2.8	0.4			52.1
Dolly Varden		0.2				0.2		0.1
Pacific cod				28.0	11.6			5.7
Threespine sticklebacks		1.0	0.8					0.3
Hexagrammos sp.				0.2				T
Rock greenling		0.2						T
Masked greenling		0.4	1.2	7.4	1.6		0.2	1.5
Whitespotted greenling		1.0	2.2	5.0	1.0			1.3
Ling cod					4.0			0.6
Sculpin spp.	0.2							T
Silverspotted sculpin		2.8	4.2	22.2	0.2			4.2
Buffalo sculpin		0.2			0.2			0.1
Gymnocanthus spp.				0.8	1.0			0.3
Yellow Irish Lord					1.2			0.2
Myoxocephalus spp	0.2	0.4	14.0	2.4	13.6	0.6		4.5
Tubenose poacher		0.4	0.4	3.8		0.2	0.2	0.7
Crescent gunnel		1.2		1.8	2.6			0.8
Pacific sand lance		8.0	1.6	1.4	1.2	0.2		1.8
Number of hauls	5	5	5	5	5	5	5	35

Appendix Table 9. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in inner middle Kiliuda Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon	14.5	11.4	1.0	8.6	128.0			23.1
Chum salmon	1.8	12.2	30.8	12.0	1.0		0.2	8.1
Dolly Varden		0.4		0.2		0.2		0.1
Pacific cod				0.6	2.6	0.6		0.5
Threespine sticklebacks			0.4	0.8	0.2			0.2
Hexagrammos sp.	0.2							T
Rock greenling						1.8	0.4	0.3
Masked greenling	3.8	4.4	1.2	1.4	2.8	10.8	1.6	3.7
Whitespotted greenling			1.2	4.0	2.0	1.4		1.2
Ling cod					0.4			0.1
Silverspotted sculpin	0.7	2.4	1.8	0.2	1.8	1.2	0.2	1.2
Sharpnose sculpin				0.8			0.2	0.1
Buffalo sculpin				0.2	0.2	0.2		0.1
Gymnocanthus spp.				0.4	0.4			0.1
Yellow Irish Lord					0.2	0.2	0.2	0.1
Pacific staghorn sculpin			1.0	0.2	0.4		0.4	0.2
Myoxocephalus spp.		1.2	10.0	4.4	15.6	0.6	0.6	4.6
Tubenose poacher	0.2			0.2	0.2	0.8		0.2
Snake prickleback			0.4					0.1
Crescent gunnel	0.3				0.6		0.2,	0.2
Pacific sand lance	1.3	3.6	3.8	10.0	416.2	15.8	3.2	63.1
Flounder spp.	0.2							T
Rock sole			0.6		0,2	0.2	0.2	0.2
Starry flounder	0.2			0.4	0.2			0.1
Number of Hauls	6	5	5	5	5	5	5	36

Appendix Table 10. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in outer middle Kiliuda Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon	1.3	4.8	6.8	11.2	2.0			3.6.-
Chum salmon	17.3	10.4	10.6	22.8	0.4	0.2		9.3
Dolly Varden	0.9	0.6	0.2	0.4	2.0			0.6
Capelin						0.2		T .
pacific cod				11.0	12.4			3.2
Threespine sticklebacks		0.8	4.2	0.2	0.8			0.8
Rock greenling	0.1	0.6		1.2	2.4			0.6
Masked greenling	0.9	0.2		2.4	3.4		0.4	1.0
Whitespotted greenling				1.4	5.8			1.0
Sculpin spp.				1.8				0.2
Silverspotted sculpin	0.6				0.6			0.2
Buffalo sculpin	0.1	0.2						0.1
Gymnocanthus spp,					6.6	0.2		0.9
Myoxocephalus spp.	0.3	0.6	5.6	5.2	11.6	3.4	0.4	3.7
Tubenose poacher					0.2	0.2	0.2	0.1
Snailfish spp.						2.8		0.4
Crescent gunnel	0.1		0.4					0.1
Pacific sand lance		75.6		6.4	187.2		2.0	36.6
Rock sole		0.2	0.4	0.6	0.2	2.4		0.5
Starry flounder						0.4		0.1
Number of hauls	7	5	5	5	5	5	6	38

Appendix Table 11. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in outer Kiliuda Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
King crab		0.8						0.1
Dungeness crab		2.5		1.6	1.8			0.8
Pink salmon	22.0	20.8	110.6	2.0	1.0			22.8
Chum salmon	13.1	144.3	20.1	8.1				24.6
Coho salmon				0.3				T
Dolly Varden		0.3	0.1	1.0		0.1		0.2
Surf smelt				0.3	0.2	0.1		0.1
Capelin					0.2			T
Pacific cod		0.5		0.9	11.0	2.0		1.9
Threespine sticklebacks			0.3		0.2			0.1
Hexagrammos sp.				0.7				0.1
Rock greenling				0.1	0.3	0.1		0.1
Masked greenling	0.1	0.7	2.6	2.4	21.8			3.6
Whitespotted greenling			1.4	2.3	0.8			0.7
Ling cod					0.3			T
Sculpin spp.				0.7	0.2	0.1		0.1
Padded sculpin		0.3						T
Silverspotted sculpin	0.1			0.7	1.7			0.3
Buffalo sculpin	0.4	0.5	0.3	0.1	1.0			0.3
Gymnocanthus spp.				0.3				T
Yellow Irish Lord					0.3			T
Pacific staghorn sculpin			0.1	0.6	0.2	0.3		0.2
Myoxocephalus spp.		1.2	1.7	2.0	0.8	0.7		0.9
Snake prickleback				0.3				T
Crescent gunnel					0.8			0.1
Pacific sand lance	0.6	0.8	16.1	0.4	188.2	1.9		27.0
Flounder spp	0.1							T
Butter sole		0.2						T
Rock sole	0.3	1.0	2.1	4.3	1.0	0.3		1.3
English sole				2.6	0.3	. -		0.4
Starry flounder	0.1	0.2		1.9	0.7			0.4
Alaska plaice			0.1					T
Sand sole			0.3	2.1				0.4
Pacific halibut					0.7			0.1
Tubenose poacher		1.2	1.7	2.0	0.8	0.7		0.9
Number of hauls	7	6	7	7	6	7	7	47

Appendix Table 12. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in inner Kaiugnak Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon	134.3	722.7		1.2	56.5			165.9
Chum salmon	6.0	83.6	5.0	4.0				18.6
Dolly Varden	4.3	0.1	0.4	0.3		0.2		0.5
Pacific cod				1.3	0.7			0.3
Pacific tomcod			4.2					0.6[1]
Threespine sticklebacks	0.3	0.6	0.2	0.5				0.3
Rock greenling		0.6	0.2	0.3	2.0	0.7		0.7
Masked greenling		0.7	2.8	11.8	0.3	6.5		3.7
Whitespotted greenling		0.4	0.6	1.8	5.3			1.4
Ling cod					0.5			0.1
Sculpin Spp.	1.0	0.3		4.5				0.9
Silverspotted sculpin		0.1	2.2	2.2		0.2		0.7
Buffalo sculpin		0.3		0.2	0.2			0.1
<u>Gymnocanthus</u> spp.		0.1	1.0	3.2	5.5			1.7
Yellow Irish Lord					1.0			0.2
Pacific staghorn sculpin				0.5	0.5			0.2
<u>Myoxocephalus</u> Spp.		0.6	17.0	15.2	18.0	4.5		9.0
Tubenose poacher		0.4	0.6	2.5	0.8	0.3		0.8
Arctic shanny		0.1						T
Crescent gunnel		0.1	0.2	0.2	0.3			0.1
Pacific sand lance		230.1	453.0	0.8	5036.3	3.8		974.9
Rock sole		0.1	0.4		0.3			0.1
English sole				0.5				0.1
Starry flounder		0.1	0.2	0.5		0.7		0.3
Sand sole		0.4						0.1
Spotted snailfish					1.0			0.2
Number of hauls	3	7	5	6	6	6	2	35

[1]Appears to be a misidentification of juvenile Pacific cod.

Appendix Table 13. Beach seine catch in numbers of fish per haul and numbers of hauls by taxon and month in outer Kaiugnak Bay. T represents trace, less than 0.05 fish/set.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Dungeness crab					0.2			T
Pink salmon		557.8	186.5	2.6				126.5
Chum salmon		6.6	2.7	2.2	0.2			2.0
Coho salmon			0.7					0.1
Dolly Varden			2.0	13.4	0.2			2.6
Pacific cod				38.8	64.6			16.7
Pacific tomcod			23.0					4.5[1]
Threespine sticklebacks		1.0	1.0	1.8	0.6			0.7
Rock greenling		0.4	1.8	1.4	1.4	0.2		0.9
Masked greenling		0.8	7.7	1.0	14.8			4.2
Whitespotted greenling		0.7	5.5	0.8	18.2	0.5		4.3
Ling cod					0.2			T
Silverspotted sculpin		7.8	18.7	0.2	5.4			5.8
Buffalo sculpin					0.2			T
Red Irish Lord					0.2			T
Yellow Irish Lord				0.2				T
Myoxocephalus spp.		0.4	17.0	0.6	4.2	1.0	1.2	4.4
Tubenose poacher		3.6	14.5	5.0	26.4	0.2		8.5
Snake prickleback		8.0	0.3	9.8	1.4			3.2
Crescent gunnel			0.3		3.6			0.6
Pacific sand lance		3.0	0.7	0.6	4552.2	0.2	0.2	735.0
Number of hauls	0	5	6	5	5	4	6	31

[1] appears to be a misidentification of juvenile Pacific cod.

Appendix Table 14. Gill net catch in numbers of fish per set and **number of sets, by taxon and month in inner Izhut Bay.**

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring		1.0						0.2
Pink salmon					0.5			0.1
Masked greenling					0.5			0.1
Number of sets	0	2	2	2	2	0	0	8

Appendix Table 15. Gill net catch in numbers of fish per set and numbers of sets, by taxon and month in inner middle Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
			No Catch					
Number of sets	0	1	1	2	2	0	0	6

Appendix Table 16. Gill net catch in numbers of fish per set and numbers of sets, by taxon and month in outer middle Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring		23.5		0.5	1.0			9.7
Chum salmon				0.5				0.1
Dolly Varden		0.2		0.5				0.2
Capelin		0.5						0.2
Pacific cod		1.0						0.4
Pacific tomcod		0.2						0.1
Masked greenling		0.5						0.2
Number of sets	0	4	2	3	2	0	0	11

Appendix Table 17. Gill net catch in numbers of fish. per set and number of sets, by taxon and month in outer Izhut Bay

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring			3.0					3.0
Dolly Varden			1.0					1.0
Surf smelt			2.0					2.0
Number of sets	0		0	1	0	0	0	1

Appendix Table 18. Gill net catch in numbers of fish per set and number of sets, by taxon and month in inner Kalsin Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring			4.5	0.5				1.2
Chum salmon			0.5		0.5			0.2
Dolly Varden				1.0	1.5			0.6
Surf smelt				0.5				0.1
Masked greenling					1.0			0.2
Great sculpin		0.5						0.1
Number of sets	0	2	2	2	2	0	0,	8

Appendix Table 19. Gill net catch in numbers of fish per set and numbers of sets, by taxon and month in outer Kalsin Bay

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring		6.0	7.0	7.5				5.2
Pink salmon					1.0			0.2
Coho salmon					-0.5			1.0
Sockeye salmon			0.5		1.0			0.3
Dolly Varden			0.3		0.4	1.5		0.6
Surf smelt		1.0	1.5					0.7
Masked greenling				0.5'				0.1
Great sculpin		0.7						0.2
Whitespotted greenling				0.5				0.1
Number of sets	0	3	2	2	2	0	0	9

Appendix Table 20. Gill net catch in numbers of fish per set and number of sets, by taxon and month in inner middle Kiliuda.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring	0.7			4.3				0.9
Pink salmon				3.3				0.6
Sockeye salmon				0.2				0.1
Dolly Varden			0.2	0.2				0.1
Pacific staghorn sculpin				0.2				0.1
Number of sets	3	4	5	4	4	0	0	20

Appendix Table 21. Gill net catch in numbers of fish per set and number of sets, by taxon and month in outer middle Kiliuda.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring				1.0				0.2
Pink salmon					3.0			0.7
Dolly Varden		1.0						0.2
Pacific cod					1.0			0.2
Number of sets	1	1	0	1	1	0	0	4

Appendix Table 22. Gill net catch in numbers of fish per set and number of sets, by taxon and month in outer Kiliuda.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring		0.3	99.0	1.7				20.2
Pink salmon					1.5			0.4
Chum salmon					0.7			0.2
Dolly Varden		0.3	1.0	2.7				0.8
Pacific cod				1.0	0.5			0.3
Walleye pollock					ct. 5			0.1
Rock greenling				2.3	0.2			0.5
Masked greenling				0.3	3.5			1.0
Whitespotted greenling					4.0			1.1
Pacific staghorn sculpin			0.3		1.0			0.3
Great sculpin		0.3		0.3	0.7			0.3
Snake prickleback			0.7		0.5			0.3
Starry flounder					0.2			0.1
Number of sets	2	3	3	3	4	0	0	15

Appendix Table 23. **Gill net catch in numbers of fish per set and number of sets, by taxon and month in inner Kaiugnak Bay.**

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring			1.7	3.5				1.0
Pink salmon					2.7			0.7
Sockeye salmon				0.5				0.1
Dolly Varden			0.3	0.5				0.2
Capelin			0.3					0.1
Pacific cod		0.3	0.3	0.5				0.2
Dusky rockfish			1.3	1.0				0.5
Black rockfish		0.7						0.2
Rock greenling		1.0	0.3	2.0	1.3			1.0
Masked greenling			0.3	1.0				0.2
Number of sets	1	3	3	2	3	0	0	12

Appendix Table 24. Gill net catch in numbers of fish per set and number of sets, by taxon and month in outer Kaiugnak Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring			1.0					0.2
Pink salmon				2.0	3.0			1.2
Coho salmon					0.5			0.1
Dolly Varden				5.0				1.2
Pacific staghorn sculpin				0.5				0.1
Number of sets	0	2	2	2	2	0	0	8

Appendix Table 25. Trammel net catch in numbers of fish per set and number of sets by taxon and month in inner Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring					1.0			0.2
Pacific cod					1.0	0.5		0.2
Pacific tomcod					5.5			0.8
Walleye pollock					0.5			0.1
Kelp greenling			1.0			1.0		0.3
Rock greenling	1.0	15.0	16.5	13.5	28.0	4.0	7.0	13.0
Masked greenling	1.0	1.0	10.0	14.5	55.0	1.0		12.6
Whitespotted greenling			1.5	4.5	4.5	0.5		1.7
Crested sculpin				0.5				0.1
Silverspotted sculpin				0.5				0.1
Red Irish Lord				1.0				0.2
Myoxocephalus spp.					0.5	1.0		0.3
Rock sole	2.0	1.0	1.0	1.5	1.5	3.5	2.0	1.8
Pacific halibut				0.5				0.1
Number of sets	1	2	2	2	2	2	2	13

Appendix Table 26. Trammel net catch in numbers of fish per set and numbers of sets by taxon and month in inner middle Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Black rockfish					6.5			1.6
Hexagrammos spp.				1.0				0.1
Kelp greenling		2.0		1.0	4.0			1.4
Rock greenling	1.0	5.0	16.0	15.0	23.5	2.0	1.0	10.8
Masked greenling	1.0	1.0	4.0	32.0	18.5	1.0		9.5
Whitespotted greenling			1.0	1.0	6.5			1.9
Sculpin spp.						2.0		0.2
Searcher		1.0						0.1
Rock sole		10.0	3.0		3.0	4.0	1.0	3.0
Number of sets	1	1	1	1	2	1	1	8

Appendix Table 27. Trammel net catch in numbers of fish per set and number of sets by taxon and month in outer middle Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring					0.5			0.1
Pacific cod			0.5	2.0	1.5	3.0		1.1
Pacific tomcod							0.5	0.1
Dusky rockfish			0.5					0.1
Black rockfish	1.0	3.5						0.6
Kelp greenling	1.5		0.5	1.7	0.5			0.7
Rock greenling	1.0	11.0	13.5	24.3	14.0	5.0		10.8
Masked greenling		4.0	3.5	8.0	25.0	1.0		6.1
Whitespotted greenling		1.0	1.5	2.0	13.0	5.0		3.1
Threaded sculpin							0.5	0.1
Red Irish Lord				0.3				0.1
Pacific staghorn sculpin				0.3				0.1
Myoxocephalus spp.		1.5	1.0					0.3
Sailfin sculpin		0.5						0.1
Flathead sole					0.5			0.1
Rock sole		5.0	10.1	7.7	2.0	1.5	2.0	4.3
Yellowfin sole		1.0		0.3				0.2
Number of sets	2	2	2	3	2	2	2	15

Appendix Table 28. Trammel net catch in numbers of fish per set and number of sets by taxon and month in outer Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Dusky rockfish				11.0				3.7
Black rockfish					17.0			5.7
Kelp greenling	1.0			1.0				0.7
Rock greenling	7.0			22.0	18.0			15.7
Masked greenling				4.0	9.0			4.3
Whitespotted greenling				1.0				0.3
Silverspotted sculpin					2.0			0.7
Myoxocephalus spp.	1.0							0.3
Rock sole				3.0	-			1.0
Pacific halibut					1.0			0.3
Number of sets	1	0	0	1	1	0	0	3

Appendix Table 29. Trammel net catch in numbers of fish per set and number of sets by taxon and month in inner Kalsin Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring		7.5	10.5		0.5			2.6
Dolly Varden				0.5	4.5			0.7
Pacific cod				0.5				0.1
Rock greenling	0.5	3.5	13.5	14.0	33.5	6.0		10.1
Masked greenling			6.0	23.5	67.5	9.5		15.2
Whitespotted greenling		0.5	3.5	6.5	9.5	3.5		3.4
Pacific staghorn sculpin	0.5	0.5	2.0	2.5	1.0			0.9
Myoxocephalus spp.		1.0	2.5	4.5	1.0	2.0	0.5	1.7
Sturgeon poacher					0.5			0.1
Rock sole	1.5	5.0	8.0	20.0	9.5	2.5	1.5	6.0
Yellowfin sole		1.5	7.0	8.5				2.4
Starry flounder		0.5	0.5	0.5	1.5			0.4
Pacific halibut		0.5						0.1
Number of sets	2	2	2	2	2	2	2	14

Appendix Table 30. Trammel net catch in numbers of fish per set and number of sets by taxon and month in outer Kalsin Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring		26.0						4.3
Dolly Varden		0.5		4.0	1.5	0.7		1.2
Pacific cod				4.5				0.7
Rock greenling	2.0	6.5	16.5	30.0	17.0	1.0		12.1
Masked greenling		3.0	5.5	36.0	79.5	0.7		20.8
Whitespotted greenling			2.0	1.0	3.0			1.0
Red Irish Lord					0.5			0.1
Pacific staghorn sculpin		0.5						0.1
Myoxocephalus spp.	2.0	1.5	1.0	3.5	3.0	1.6		2.1
Sturgeon poacher				0.5	2.0			0.4
Alaska ronquil			0.5					0.1
Rock sole		3.0	5.5	3.0	2-.0	1.3		2.6
Starry flounder		0.5						0.1
Number of sets	1	2	2	2	2	3	0	12

Appendix Table 31. Trammel net catch in numbers of fish per set and number of sets by taxon and month in inner Kiliuda Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific cod				4.0	3.0			0.7
Pacific tomcod							0.5	0.1
Walleye pollock					1.0			0.1
Kelp greenling					2.0			0.2
Rock greenling	2.0	1.5	4.0	1.0		3.5		1.7
Masked greenling		5.0	11.0	48.0	22.0	3.5		9.8
Whitespotted greenling		3.0	6.0	27.0	17.0	1.0		5.8
Gymnocanthus spp.				1.0				0.1
Threaded sculpin					5.0			0.5
Myoxocephalus spp.	2.0	2.0		2.0	3.0	0.5		1.2
Rock sole	1.0	10.5		1.0	2.0	0.5		2.6
Yellowfin sole		1.0		1.0	6.0			0.9
Number of sets	1	2	1	1	1	2	2	10

Appendix Table 32. Trammel net catch in numbers of fish per set and number of sets by taxon and month in inner middle Kiliuda Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific cod				3.0	1.0			0.6
Pacific tomcod							1.0	0.1
Kelp greenling	1.0							0.1
Rock greenling		3.0		1.0	6.0	1.0	1.0	1.7
Masked greenling		5.0	16.0	79.0	100.0			28,6
Whitespotted greenling		3.0	9.0	19.0	24.0			7.9
Gymnocanthus spp.			1.0					0.1
Armorhead sculpin					1.0			0.1
Myoxocephalus spp.		2.0		1.0	1.0	1.0		0.7
Rock sole	1.0	8.0	6.0	21.0	4.0			5.7
Yellowfin sole				2.0	3.0			0.7
Number of sets	1	1	1	1	1	1	1	7

Appendix Table 33. Trammel net catch in numbers of fish per set and number of sets by taxon and month in outer middle Kiliuda Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon				0.5	0.5			0.1
Dolly Varden				2.0	1.5			0.5
Pacific cod			3.5	6.0	0.5			1.4
Pacific tomcod					0.5			0.1
Walleye pollock					1.5			0.2
Kelp greenling		0.5				0.5		0.1
Rock greenling	3.5	8.0	11.0	18.0	5.0	2.5	2.0	7.1
Masked greenling	2.5	2.0	21.5	191.0	112.5	10.5	0.5	48.6
Whitespotted greenling			2.0	8.5	10.5	1.5		3.2
Red Irish Lord					0.5			0.1
Yellow Irish Lord				1.0				0.1
Myoxocephalus spp.		2.0		1.0	2.5	0.5		0.9
Wolf eel					0.5			0.1
Rock sole	0.5	1.5	1.0	0.5			0.5	0.6
Yellowfin sole					0.5			0.1
Starry flounder	0.5							0.1
Number of sets	2	2	2	2	2	2	2	14

Appendix Table 34. Trammel net catch in numbers of fish per set and number of sets by taxon and month in outer Kiliuda Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Dolly Varden				0.5	1.0			0.2
Pacific cod				3.5	2.0			0.9
Kelp greenling						0.5		0.1
Rock greenling	3.0	16.0	15.0	16.0	10.5	9.5	2.0	11.6
Masked greenling	2.0	19.0	35.0	143.0	98.0	5.0		50.2
Whitespotted greenling	1.0	2.0	4.0	5.5	2.5			2.4
Buffalo sculpin						0.5		0.1
Red Irish Lord				1.0				0.2
Pacific staghorn sculpin			0.5					0.1
Myoxocephalus spp.	1.0	1.5		1.0	1.0			0.7
Rock sole		1.0						0.2
Number of sets	1	2	2	1	2	2	1	11

Appendix Table 35. Trammel net catch in numbers of fish per set and number of sets by taxon and month in inner Kaiugnak Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Dolly Varden				2.0	0.5			0.4
Pacific cod			1.0					0.2
Rock greenling	8.0	47.0	21.0	66.0	10.0	1.5		25.6
Masked greenling	5.5	27.0	41.5	139.0	53.0	1.0		44.5
Whitespotted greenling	0.5	3.,5	1.5	3.0	6.0			2.4
Silverspotted sculpin		0.5						0.1
Red Irish Lord				0.5				0.1
Yellow Irish Lord				0.5				0.1
Myoxocephalus spp.	1.0	0.5	1.0		1.0	2.0		0.8
Rock sole	2.0	1.0	1.5					0.7
Starry flounder	0.5							0.1
Number of sets	2	2	2	2	2	2	0	12

Appendix Table 36. Trammel net catch in numbers of fish per set and number of sets by taxon and month in outer Kaiugnak Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pacific herring					0.5			0.1
Pink salmon					2.5			0.5
Pacific cod					0.5			0.1
Kelp greenling		2.0	1.5		1.5	2.0		1.1
Rock greenling		38.0	55.0	66.5	40.0	13.0	2.0	37.8
Masked greenling		3.5	2.5	17.0	13.5	2.0	0.5	6.9
Whitespotted greenling		0.5	2.0		1.0			0.6
Red Irish Lord			1.5		2.5	1.0		0.8
Myoxocephalus spp.		0.5	0.5	0.5			0.5	0.4
Number of sets	0	2	2	2	2	1	2	11

Appendix Table 37. Surface tow net catch. in numbers of fish per kilometer towed and number of tows, by taxon and month. in inner Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon	0.5		10.4					2.5
Hexagrammos spp.							0.8	0.1
Ling cod					1.3			0.2
Pacific sand lance					700.0			102.9
Number of tows	3	0	3	3	3	3	3	18

Appendix Table 38. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in inner middle Izhut Bay

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon			0.6					0.2
Pacific cod					0.4			0.1
Threespine sticklebacks	0.5						0.5	0.2
Kelp greenling							1.5	0.2
Whitespotted greenling			0.3					0.1
Pacific sand lance					2.8			0.5
Number of tows	5	0	4	2	5	5	5	26

Appendix Table 39. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in outer middle Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Capelin			23.8					3.1
Number of tows	0	0	1	3	4	4	0	12

Appendix Table 40. Surface tow net catch. in numbers of fish per kilometer towed and number of tows, by taxon and month in outer Izhut Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Capelin			33.1					7.0
Whitespotted greenling			0.6					0.1
Numbers of tows	0	0	2	4	4	4	0	14

Appendix Table 41. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in inner Kalsin Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon		18.4			18.5			8.8
Chum salmon		6.9						2.3
Threespine sticklebacks		0.2						0.1
Hexagrammos spp.		0.6						0.2
Whitespotted greenling		0.5						0.2
Ling cod					1.1			0.2
Tubenose poacher					0.4			0.1
Pacific sand lance		0.2				0.6		0.2
Numbers of tows	0	8	1	0	5	8	8	30

Appendix Table 42. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in outer Kalsin Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon		6.2			0.6			1.2
Chum salmon		1.9						0.3
Threespine sticklebacks		8.1						1.4
Ling cod					0.6			0.1
Pacific sand lance					0.6			0.1
Number of tows	0	2	2	0	3	3	3	13

Appendix Table 43. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in inner Kiliuda Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon		3.3			0.7			1.0
Chum salmon		3.3	357.5	10.7				64.1
Threespine sticklebacks			0.6					0.1
Pacific sand lance					164.7			26.6
Number of tows	2	3	2	3	3	3	0	16

Appendix Table 44. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in inner middle Kiliuda Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Chum salmon	0.8							0.1
Capelin						13.5		3.3
Pacific sand lance				9685.0				1195.7
Number of tows	3	3	0	2	3	4	0	15

Appendix Table 45. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in outer middle Kiliuda Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon	0.6			43.9				14.7
Capelin				1.3				0.4
Pacific cod				2.1				0.7
Threespine sticklebacks	0.6							0.1
Lingcod				0.3				0.1
Tadpole sculpin				0.3				0.1
Prowfish					0.3			0.1
Pacific sand lance	0.6			5091.6				1697.3
Number of tows	4	0	0	7	6	6	0	23

Appendix Table 46. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in outer Kiliuda Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon				1.2	2.5			1.1
Capelin	2.5							0.1
Pacific cod				0.4				0.1
Prowfish				0.4				0.1
Pacific sand lance	10.0 .			1.6				1.1
Number of sets	1	0	0	5	4	5	0	15

Appendix Table 47. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in inner Kaiugnak Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Threespine sticklebacks					0.5			0.1
Silverspotted sculpin					0.5			0.1
Pacific sand lance					1927.5			488.0
Number of sets	0	0	0	4	4	4	4	16

Appendix Table 48. Surface tow net catch in numbers of fish per kilometer towed and number of tows, by taxon and month in outer Kaiugnak Bay.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Pink salmon					1.4			0.4
Pacific cod				0.5				0.1
Threespine sticklebacks					3.3			0.9
Whitespotted greenling					1.9			0.5
Ling cod					9.0			2.5
Prowfish				1.0				0.3
Number of sets	0	0	0	4	4	4	4	16

Appendix Table 49. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in inner Izhut Bay. T represents trace, less than 0.05 kg/hr.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Tanner crab		1.7						0.4
Walleye pollock					T			T
Shortfin eelpout		T						T
Whitespotted greenling		0.1						T
Yellow Irish Lord		T						T
Myoxocephalus spp.	0.1	3.7						0.8
Snake prickleback		0.2		0.2	T			0.1
Stout eelblenny			T					T
Flathead sole		0.1						T
Rock sole	4.4	2.0		1.8				1.3
Yellowfin sole		5.8	0.1		1.3			1.6
Starry flounder		1.1						0.3
Numbers of tows	1	2	2	2	2	0	0	9

Appendix Table 50. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in inner middle Izhut Bay. T represents trace, less than 0.05 kg/hr.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Tanner crab		0.2		2.8	0.1	0.3		0.6
Dungeness crab				1.5				0.3
Pacific cod				0.3				0.1
Walleye pollock		T			0.1	0.1		T
Whitespotted greenling		1.0				2.4		0.6
Ling cod						0.2		T
Sculpin spp		T						T
Spinyhead sculpin		0.1	0.2	0.1	T			0.1
Gymnocanthus spp.		0.4						0.1
Armorhead sculpin			3.0	3.0				0.8
Yellow Irish Lord		0.5		5.2		0.2		1.2
Myoxocephalus spp.	0.1	4.8		14.7	9.6			6.4
Sailfin sculpin				T				T
Sturgeon poacher		T						T
Searcher		0.1	0.6	2.4	1.1			0.8
High cockscomb	0.1							T
Snake prickleback				0.1				T
Daubed shanny				0.1	T			T
Stout eelblenny				0.1				T
Arrowtooth flounder		T	0.2	0.8	1.9	0.9		0.6
Flathead sole		0.3	0.3	14.3	2.5	1.8		3.5
Butter sole				2.8	0.5	0.1		0.6
Rock sole	T	0.5	1.9	0.5		1.2		0.5
Yellowfin sole		7.6	1.4	20.0	22.6	3.0		11,3
Dover sole				T				T
English sole						0.1		T
Number of tows	1	4	1	2	2	1	0	11

Appendix Table 51. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in outer middle Izhut Bay. T represents trace, less than 0.05 kg/hr.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Tanner crab			2.5	0.9		T	5.2	1.3
Dungeness crab				1.6			0.2	0.3
Whitespotted greenling			0.7	0.2	0.4	0.1	T	0.2
Ling cod						T		T
Spinyhead sculpin	0.1		T				T	T
Gymnocanthus spp.	0.1		0.1		T			T
Armorhead sculpin	T		2.2	0.1	0.1	0.3	0.1	0.4
Threaded sculpin				T	0.1	T	0.1	T
Bigmouth sculpin	T							T
Pacific staghorn sculpin			0.2		0.4			0.1
Myoxocephalus spp.			4.6	5.9	2.5		5.4	2.8
Ribbed sculpin			T					T
Sturgeon poacher	0.1		T	T	T			T
Marbled snailfish	0.1							T
Searcher					0.2			T
Snake prickleback			T					T
Arrowtooth flounder		T	T	T	0.3	T		0.1
Flathead sole	T		0.6	0.1	1.4	0.9	0.3	0.5
Butter sole		0.8		1.1	4.5	0.7		1.0
Rock sole	8.6	39.1	24.9	30.4	32.9	19.0	4.1	23.0
Yellowfin sole	T	2.3	3.4	0.4	8.3	2.8	0.1	2.6
English sole					T			T
Sand sole			1.1	0.6	1.5	0.1		0.5
Pacific halibut		0.5	0.2			T		0.1
Number of tows	4	5	5	5	5	5	5	34

Appendix Table 52. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in outer Izhut Bay. T represents trace, less than 0.05 kg/hr.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Tanner crab		0.1	T	T		T		T
Dungeness crab				0.5			T	0.1
Pacific tomcod			0.1					T
Whitespotted greenling						T	T	T
Gymnocanthus spp.	T	6.0			0.1			1.1
Armorhead sculpin			1.1	0.1	0.5	0.9	0.1	0.4
Threaded sculpin				0.1				T
Yellow Irish Lord		0.7		0.1				0.1
Northern sculpin		T						T
Myoxocephalus spp.			0.1	1.7				0.2
Roughspine sculpin				T				T
Ribbed sculpin		T			0.1			T
Smooth alligatorfish		T						T
Sturgeon poacher		T		0.1	T			T
Pacific sandfish			T				0.2	T
Searcher		T						T
Snake prickleback					0.1			T
Arrowtooth flounder		0.6		0.1	0.1	0.1		0.2
Flathead sole		0.1		0.8				0.1
Butter sole		0.1		4.1	0.3	0.2		0.7
Rock sole	53.7	15.8	105.3	109.0	92.4	30.4	3.9	57.3
Yellowfin sole		0.8	1.6	1.6				0.6
English sole						T		T
Starry flounder			2.5	16.1				2.6
Sand sole		2.1				0.2		0.3
Pacific halibut		0.9	1.1	0.8	0.2			0.4
Number of tows	4	3	4	4	4	4	4	27

Appendix Table 53. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in inner Kalsin Bay. T represents trace, less than 0.05 kg/hr.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
King crab		49.4	151.3	111.8	51.8	193.9	102.4	94.8
Tanner crab		10.5	6.9	11.2	6.1	27.4	2.1	9.2
Dungeness crab					1.6			0.2
Pacific herring							T	T
Capelin			0.1				T	T
Pacific cod			0.1				0.1	T
Walleye pollock		T	0.5		0.2			0.1
Whitespotted greenling		0.2	2.1	0.1	1.6		0.1	0.5
Ling cod						T		T
Sculpin spp.			0.1					T
Padded sculpin							T	T
Gymnocanthus spp.	0.3	0.8	2.7	0.5				0.6
Armorhead sculpin							0.2	T
Threaded sculpin				3.0	4.8	0.2	0.2	1.1
Yellow Irish Lord			0.4		T			0.1
Pacific staghorn sculpin			0.3				0.2	0.1
Myoxocephalus spp.		T	5.8	0.5	35.0			5.3
Sturgeon poarcher		T	T			T	0.3	0.1
Tubenose poacher			T					T
Snailfish spp.	T					T	0.3	0.1
Searcher					T			T
High cockscomb							T	T
Snake prickleback			0.1		T			T
Arrowtooth flounder			0.1					T
Rex sole					0.1			T
Flathead sole		0.1	0.9	0.1	11.8	T		1.7
Butter sole			0.3	0.1	0.3	1.5		0.3
Rock sole	3.6	9.8	18.5	7.1	10.6	10.4	2.8	8.6
Yellowfin sole		17.9	97.9	69.4	134.6	7.0	T	42.4
Dover sole			T					T
Starry flounder	0.3	7.6	3.9			1.7		1.8
Alaska plaice	0.1	T	0.1			1.2		0.2
Sand sole		2.0				T		0.3
Pacific halibut				0.1	0.8	0.8	T	0.2
Number of tows	5	4	4	4	4	5	5	31

Appendix Table 54. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in outer Kalsin Bay. T represents trace, less than 0.05 kg/hr .

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
King crab		13.0	63.4	62.6	15.5	19.2		26.1
Tanner crab		6.7	17.6	11.9	5.8		7.8	7.0
Capelin			0.1					T
Pacific cod				0.3				T
Walleye pollock	T	0.2	0.1					0.1
Whitespotted greenling		0.2	0.7		1.3	0.9		0.5
Lingcod						0.2		T
Spinyhead sculpin				T				T
Buffalo sculpin	T							T
Gymnocanthus spp.	1.4	2.0	2.6		3.2			1.5
Armorhead sculpin				2.9				0.4
Threaded sculpin			2.8	1.8	0.2	3.3	0.6	1.2
Yellow Irish Lord			0.2	1.2				0.2
Pacific staghorn sculpin				1.3				0.2
Myoxocephalus spp.			4.8		13.4	11.9	0.9	4.6
Ribbed sculpin					T	0.1		T
Sturgeon poacher		T	T					T
Searcher			0.1	0.1				T
Arrowtooth flounder		T	2.5	1.0	0.8	0.1		0.7
Flathead sole		0.2	4.4	6.7	4.8	T		2.3
Butter sole			2.5	1.1	0.3	4.5		1.2
Rock sole	5.2	8.3	7.2	6.5	4.9	10.8	0,1	6.9
Yellowfin sole	0.1	19.3	86.9	42.5	86.7	22.0		39.2
Dover sole			0.1	0.1	0.3			0.1
Starry flounder			1.0					0.1
Alaska plaice			1.0		1.2			0.3
Pacific halibut	0.1		0.1		1.6	1.5		0.5
Number of tows	3	5	3	3	3	3	1	21

Appendix Table 55. Try net catch. in kilograms per hour of trawling and number of tows, by taxon and month in inner Kiliuda Bay. T represents trace, less than 0.05 kg/hr.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Tanner crab		0.6			1.1	T	8.0	1.6
Dungeness crab					6.6	1.0	10.8	3.1
Whitespotted greenling							1.8	0.3
Gymnocanthus spp.		1.6	0.5					0.3
Armorhead sculpin				0.8				0.1
Threaded sculpin			1.0		0.6	6.9	15.0	3.8
Yellow Irish Lord							0.1	T
Pacific staghorn sculpin							0.1	T
Myoxocephalus spp.						0.1	0.1	T
Slim sculpin			0.2					T
Ribbed sculpin					0.2		1.5	0.3
Searcher						0.2		T
Lumpenus spp.					0.5			0.1
Daubed shanny							0.5	0.1
Stout eelblenny					T			T
Flathead sole		0.5	0.4	1.1	10.2	4.8	3.0	3.3
Rock sole						1.8	0.9	0.5
Yellowfin sole		6.1	12.8	4.1	9.6	9.6	7.8	8.3
Starry flounder			6.9				6.0	2.2
Number of tows	0	1	1	1	1	1	1	6

Appendix Table 56. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in outer Kiliuda Bay. T represents trace, less than 0.05 kg/hr.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
King crab		45.8	25.7	44.5	7.1		105.2	33.6
Tanner crab		0.9	0.3	6.5	5.8	T	1.5	2.2
Dungeness crab		0.8		7.1	5.8	9.8	0.8	3.3
Pacific cod	0.8	0.2	0.4	0.8	0.4	0.1		0.4
Pacific tomcod			1.3	0.8	0.1	T		0.3
Walleye pollock -			0.4	0.1		T		0.1
Dusky rockfish					T			T
Kelp greenling					0.1			T
Rock greenling						T		T
Masked greenling			0.2		0.3			0.1
Whitespotted greenling	0.2	0.3	2.5	2.5	3.6	0.5	0.1	1.4
Ling cod					T	0.1		T
Sablefish				0.3				T
Sculpin spp.		T						T
Padded sculpin					T			T
Crested sculpin			0.3			0.2		0.1
Silverspotted sculpin	T					T	T	T
Spinyhead sculpin	T		T	T	T			T
Gymnocanthus spp.	1.3	1.5	1.3					0.6
Armorhead sculpin		T	1.5	0.7	4.7	2.0		1.2
Threaded sculpin		0.4		2.2	2.0	1.1	0.1	0.8
Red Irish Lord						0.1		T
Yellow Irish Lord	T	0.3	8.5	5.0	28.9	T	T	6.3
Pacific staghorn sculpin	0.1	0.2	0.7		2.6	0.1		0.6
Myoxocephalus spp.	2.1	1.6	11.7	16.8	18.0	3.4	0.5	7.9
Scissortail sculpin			T					T
Roughspine sculpin						0.1		T
Ribbed sculpin			T		2.4	T		0.4
Sturgeon poacher			T	0.1	0.3	T		0.1
Bering poacher					T			T
Tubenose poacher							T	T
Snailfish spp.	0.1		T					T
Pacific sandfish				T				T
Searcher			T	0.1	0.5			0.1
Prickleback spp.					T			T
Snake prickleback		T			0.1		T	T
Daubed shanny"		T			0.2			T
Stout eelblenny			0.1	T	T			T
Arctic shanny					T			T
Longfin gunnel			T					T
Crescent gunnel	T						T	T
Arrowtooth flounder				0.1	1.1	T		0.2

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Appendix Table 56. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in outer Kiliuda Bay. T represents trace, less than 0.05 kg/hr. (Continued)

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Flathead sole		T	1.7	4.2	5.9	0.9	T	1.8
Butter sole		3.3	9.6	3.4	3.6			2.9
Rock sole	3.8	13.7	6.0	14.6	11.2	6.8	0.1	8.1
Yellowfin sole	0.4	6.0	18.4	23.0	42.2	12.1	0.9	14.8
Dover sole			T	T	T			T
English sole			0.1		0.1	0.5		0.1
Starry flounder			1.0					0.2
Alaska plaice					1.0			0.1
Sand sole				2.1	1.6			0.5
Pacific halibut		0.3	0.3	1.4	4.9	T		1.0
Number of tows	5	5	5	5	5	4	5	34

Appendix Table 57. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in inner Kaiugnak Bay. T represents trace, less than 0.05 kg/hr.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
King crab		9.3	3.3	T				1.9
Tanner crab				T				T
Pacific cod		0.1		T		T		T
Walleye pollock	0.1							T
Rock greenling					T	0.1		T
Masked greenling	1.3				1.1	T		0.4
Whitespotted greenling		0.2	0.7	2.2	2.7	0.7		1.0
Lingcod						T		T
Silverspotted sculpin	0.1							T
Spinyhead sculpin			T					T
Gymnocanthus spp.	0.7	0.2	0.2					0.2
Armorhead sculpin					0.2			T
Threaded sculpin			0.7	5.1	0.9	T		1.0
Red Irish Lord	0.2					T		T
Yellow Irish Lord	0.1	0.1		7.3	3.2	0.1		1.7
Myoxocephalus spp.			2.9	8.9	2.4	15.6		4.6
Triglops spp				0.2				T
Scissortail sculpin	T							T
Ribbed sculpin			0.3		T	0.3		0.1
Tubenose poacher	T							T
Snailfish spp.							0.1	T
Prickleback spp.	T							T

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Appendix Table 57. Try net catch in kilograms per hour of trawling and number of tows, by taxon and month in inner Kaiugnak Bay. T represents trace, less than 0.05 kg/hr. (continued)

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Snake prickleback				0.1				T
Arctic shanny		0.1						T
Crescent gunnel	T	0.1						T
Flathead sole	T		0.9	0.1				0.2
Rock sole	4.7	1.1	0.5	4.7	3.6	3.0		2.7
Yellowfin sole	0.5	0.7	7.2	22.8	12.4	0.7		6.8
Pacific halibut		0.1		0.4		T		0.1
Numbers of tows	2	2	2	2	2	2	1	13

Appendix Table 58. Otter trawl catch in kilograms per kilometer trawled and number of trawls, by taxon and month in outer Izhut Bay. T represents trace, less than 0.05 kg/km.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Scallop	0.5							0.1
King crab	1.0		0.8					0.3
Tanner crab	15.9	9.3	2.6	2.0	18.6	0.5	9.3	8.3
Dungeness crab	2.1	2.4	1.5	6.6	4.5	7.6	0.7	3.8
Big skate		T						T
Pacific herring		T	0.2	0.2	0.3	0.1	0.1	0.1
Capelin		0.2	0.1		0.1			T
Eulachon	T						T	T
Pacific cod	20.8	26.7	11.8	0.3	1.2	2.0	0.7	8.9
Pacific tomcod	13.2	2.9	1.6	33.7	4.9	91.1	6.5	23.4
Walleye pollock	4.7	0.8	1.0	11.0	7.6	9.9	12.4	6.7
Shortfin eelpout			0.7		0.2			0.1
Wattled eelpout					0.4			0.1
Sebastes sp.	0.1							T
Darkblotched rockfish						0,2		T
Hexagrammos sp.	0.1							T
Kelp greenling	0.1							T
Whitespotted greenling	0.1		0.2	0.3	T		0.1	0.1
Sablefish		2.0	125.2	5.6	3.1			21.5
Sculpin sp.	T					20.2		3.1
Spinyhead sculpin	0.3	0.1		0.2	1.3	0.3	0.5	0.4
Gymnocanthus spp[1]	4.7	64.2	16.6	14.7	20.8		1.0	15.9
Red Irish Lord						1.5		0.2

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Appendix Table 58. Otter trawl catch in kilograms per kilometer trawled and number of trawls, by taxon and month in outer Izhut Bay. T represents trace, less than 0.05 kg/km. (continued)

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Yellow Irish Lord	1.5	7.1	3.3	1.3	6.6	6.6	4.2	4.2
Bigmouth sculpin					0.2			T
Northern sculpin	T							T
Pacific staghorn sculpin	2.6					2.7	0.7	0.9
Myoxocephalus sp.	21.0	32.2	13.8	5.0	14.6	13.8	29.7	17.4
Triglops sp.					0.1			T
Ribbed sculpin	T			T	T			T
Sturgeon poacher	0.1		T					T
Pacific sandfish	0.1	T		0.4	0.5		0,2	0.2
Searcher	0.5	0.9	1.1	0.2	1.0	1.5	0.1	0.8
Northern ronquil	0.7							0.1
Pricklebacks	T							T
Snake prickleback		T	0.2	0.3	0.1			0.1
Daubed shanny				0.1				T
Arrowtooth flounder	4.4	29.0	11.6	7.7	14.5	11.9	5.8	11.6
Rex sole	T	0.2	0.4	0.2	0.9		T	0.3
Flathead sole	5.4	14.6	8.9	18.1	116.6	7.3	5.5	26.3
Butter sole	5.3	2.6		1.6	3.1	2.6		2.3
Rock sole	119.9	459.9	256.8	63.3	52.5	108.5	34.4	148.9
Yellowfin sole	55.2	39.6	40.8	40.1	67.8	54.4	34.9	48.6
Dover sole			0.4	0.1	0.1	0.4		0.2
English sole	0.6	0.4	3.1			2.9	T	1.1
Starry flounder	1.9	1.1	6.5	0.4	1.0	4.9	0.8	2.5
Sand sole	0.1		0.6			1.5	2.8	0.6
Pacific halibut	2.3	9.2	0.5	6.6	19.7	9.4	19.0	8.9
Number of trawls	3	2	3	3	3	3	3	20

[1] *Gymnocanthus* were not identified in April or May. During the remainder of the survey all individuals taken were armorhead sculpin.

Appendix Table 59. Otter trawl catch in kilograms per kilometer trawled and number of trawls, by taxon and month in outer Kiliuda Bay. T represents trace, less than 0.05 kg/km.

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Hermit crab	0.4							0.1
King crab	8.4	14.6	26.4	14.0	14.6	23.6	1.6	13.7
Hyas crab	T							T
Tanner crab	13.2	16.0	10.3	9.2	16.1	9.7	2.5	11.3
Dungeness crab		0.1		0.5	0.6		0.7	0.3
Spiny dogfish				0.5				0.1
Big skate	10.8	2.1	5.5	5.2	14.9			6.2
Longnose skate					1.2			0.2
Pacific herring	0.1					0.4		T
Capelin	0.2	T	T	T			0.7	0.2
Eulachon	T	2.2				1.3		0.4
Pacific cod	0.8	21.2	18.0	12.7	70.8	65.2	0.1	22.7
Pacific tomcod					0.5	2.6	T	0.3
Walleye pollock	1.3	4.1	3.6	7.7	78.7	45.4	0.1	17.2
Shortfin eelpout			T	0.2				T
Wattled eelpout				0.1	0.2			T
Sebastes sp.		T			T			T
Kelp greenling							T	T
Rock greenling	0.1							T
Masked greenling	0.7							0.1
Whitespotted greenling	T		1.3	0.8	1.0	0.6	0.4	0.6
Lingcod	T	0.2					T	T
Sablefish	0.1	9.9	10.3	0.8	3.5	12.6		4.5
Sculpin sp.	8.3							1.7
Spinyhead sculpin	T	0.1	0.3	T	T		T	0.1
Gymnocanthus spp.[1]	0.3	7.5	13.4	9.2	7.4	3.5	2.1	6.0
Yellow Irish Lord		197.9	159.6	338.3	164.5	215.5	T	138.1
Pacific staghorn sculpin		1.6	0.6			51.2	0.2	3.8
Myoxocephalus sp.	1.5	124.5	54.7	73.1	54.3	57.8	9.6	50.8
Triglops sp.		0.1						T
Ribbed sculpin	T	0.1					T	T
Smooth alligatorfish	T							T
Sturgeon poacher	0.1	2.2	0.4		0.6	0.6	T	0.6
Snailfish		0.1						T
Pacific sandfish	T	0.4		0.2		0.2		0.1
Searcher	0.3	0.3	0.3	0.8	0.1			0.3
Snake prickleback	0.1	0.1			T		T	T
Daubed shanny	T		T	T	T			T
Stout eelblenny					T			T
Whitebarred blenny	T							T
Arrowtooth flounder	T	3.8	2.4	1.1	5.4	26.9	T	3.7
Rex sole		T				1.5		0.1
Flathead sole	1.7	23.8	122.6	73.8	55.4	17.6	0.5	41.6

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Appendix Table 59. Otter trawl catch-in kilograms per kilometer trawled and number of trawls, by taxon and month in outer Kiliuda Bay. T represents trace, less than 0.05 kg/km. (continued)

	Apr	May	Jun	Jul	Aug	Nov	Mar	Mean
Butter sole	0.5	7.0	2.6	1.3	1.8	19.2	0.2	3.3
Rock sole	3.6	23.4	5.6	10.4	7.2	4.1	10.1	9.4
Yellowfin sole	16.9	46.8	78.5	25.9	55.6	"192.6	5.5	47.6
English sole							T	T
Starry flounder	2.3	5.4	6.8	2.0	3.3	4.8	2.0	3.7
Sand sole						4.7	1.9	0.6
Pacific halibut	3.1	11.5	34.5	12.0	70.5	19.8	0.3	21.0
Numbers of trawls	4	3	3	3	3	2	3	21

[1]Gymnocanthus were not identified in April or May. During the remainder of the survey all were armorhead sculpin except four threaded sculpins in March.