

FRI-UW-7906  
May 1979

FISHERIES RESEARCH INSTITUTE  
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Seattle, Washington 98195

SEASONAL COMPOSITION AND FOOD WEB RELATIONSHIPS OF MARINE ORGANISMS  
IN THE NEARSHORE ZONE OF KODIAK ISLAND--INCLUDING ICHTHYOPLANKTON,  
MEROPLANKTON (SHELLFISH), ZOOPLANKTON, AND FISH

by

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ANNUAL REPORT

Contract: #03-5-022-67  
Task Order: #15  
Res. Unit: #553  
Reporting Period: April 1, 1978 -  
March 31, 1979

Approved



Submitted May 7, 1979

Associate Director  
Fisheries Research Institute

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## PART A: ICHTHYOPLANKTON

### I. SUMMARY OF OBJECTIVES, CONCLUSIONS AND IMPLICATION WITH RESPECT TO OCS OIL AND GAS DEVELOPMENT

Objectives of this program are to provide information on the spatial and temporal relationships of zooplankton in four bays of the Kodiak Archipelago. The Fisheries Research Institute (FRI) is studying the ichthyoplankton and euphausiids, whereas the National Marine Fisheries Service (NMFS) is studying the decapod larvae.

Larval forms of species of both commercial and ecological significance feed and mature in marine waters of Kodiak and nearby islands. For many species these life processes are regulated by both local and natural abiotic and biotic phenomena such as changes in water characteristics and seasonal abundances of zooplankton food resources.

Management of the exploration for and production of offshore petroleum and gas reserves necessitates complementary management of those larval forms and life processes that may be adversely affected by industrial developments in contiguous waters. This study, in coordination with related and concurrent studies within the same area, is intended to create a basis for the required management.

### II. INTRODUCTION

#### General Nature and Scope of Study

The general nature of this study relates to an examination of zooplankton populations in the nearshore waters of the Kodiak Archipelago. The scope of the study consisted of intensive spring and summer sampling followed by less intensive autumn and winter sampling. Gear types included a neuston sampler, bongo-arrayed plankton nets, a mechanical opening-closing Tucker trawl, and an epibenthic plankton sled. This array of sampling devices enabled both discrete and complete sampling of the water column. Sampling design, zooplankton sorting procedures, and laboratory analysis focused on the collection and identification of fish larvae, euphausiids, and other zooplankton taxa. A final report discussing all (12) cruise results will be submitted in September 1979.

#### Specific Objectives

The specific objectives of this study are to:

- 1) Describe seasonal composition, distribution, and relative abundance of major life stages of selected holo- and mero-plankton forms in four bays of the Kodiak Archipelago. Emphasis will be placed on planktonic stages of fishes and euphausiids (by FRI) and decapod larvae (by NMFS).
- 2) Determine seasonal development and succession of selected commercially and ecologically important fish and invertebrate species.
- 3) Correlate observed biological distributions with local hydrographic regimes and bathymetry.

### Relevance to Problems of Petroleum Development

The development of petroleum in Kodiak's marine environment may directly or indirectly affect the life processes of animals. Under natural conditions most animals are constrained, or limited to, for example, the time of year they may reproduce, the area over which the young may be distributed, and/or the depth(s) at which the larvae may feed.

These constraints of time, space, and depth determine to a certain extent the mortality rate of larval forms of many fish species. It is also assumed that one of the problems of petroleum development is the potential introduction of a pollutant that may accentuate those natural constraints already in force.

This study addresses the seasonal composition, spatial and temporal distribution of fish larvae to define the natural environmental limitations. With this information, we should be able to recognize whether the developmental processes of a species are likely to be put under further constraint by an oil spill incident.

### III. CURRENT STATE OF KNOWLEDGE

Aside from the 1978-79 Kodiak-OCS studies, very little descriptive literature exists for ichthyoplankton in the nearshore waters of Kodiak. A general reference to this information is made below. The pertinent data, however, will be incorporated with the discussion of our results.

The egg and larval development, abundance, and distribution of the Pacific halibut, Hippoglossus stenolepis, were examined from 1926-34 by Thompson and Van Cleve (1934). Their study included stations in areas east and southwest of Kodiak Island. Survey results indicated a relatively high concentration of late-stage halibut larvae in the Kodiak region.

Pacific ocean perch, Sebastes alutus, larvae were sampled by Lisovenko (1964) in response to the (past) importance of this rockfish to Soviet commercial fisheries. In comparison to other Gulf of Alaska regions, he found a relatively high abundance of rockfish larvae over Kodiak's continental slope during the spring.

Salmon feeding studies were conducted in 1971 in Alitak and Kiliuda bays of Kodiak Island (Gosho 1977). In several instances fish larvae were found to be an important dietary component of outmigrating juvenile salmon. Unfortunately, no information was obtained on species composition of those larval fishes.

Ichthyoplankton research was carried out in the spring of 1972 over an extensive area of Kodiak shelf waters (Dunn and Naplin 1974). Walleye pollock, Theragra chalcogramma, eggs and larvae were dominant components of the April-May samples.

A composite study of juvenile and adult fishes in three Kodiak Island bays was conducted in 1976 (Harris and Hartt 1977). Large incidental catches of fish larvae were taken with gear types, e.g., beach seine and surface townet, designed to sample larger fishes. Larval forms of capelin, greenling, herring, ronquils, sandfish, sandlance, and pricklebacks, were reported from the inshore survey.

In comparison to the studies above, this program constitutes a much more comprehensive sampling of the abundance, spatial, and temporal characteristics of ichthyoplankton in Kodiak waters. In addition, this study has been complemented by concurrent offshore ichthyoplankton and inshore juvenile and adult fish sampling. Integration of this information should significantly enhance the knowledge of fish populations in this area.

#### IV. STUDY AREA

The study area includes the Izhut, Kalsin-Chiniak, Kiliuda, and Kaiugnak bays of the Kodiak Archipelago (Figs. 1, 2, and 3; Table A). These inshore waters are largely influenced by oceanic water conditions, mixed tides, and prevailing weather patterns. In addition, relatively deep troughs approach all bays and permit additional inflow and/or outflow of waters as dictated by oceanic and atmospheric conditions. Water temperatures range from approximately 1°C to 15°C and salinities up to 34 ‰, depending upon season, depth monitored, and degree of freshwater influence. Bottom substrates vary considerably and include both homogeneous and heterogeneous rock, sand, and mud bottom types. Depths at the selected sampling stations ranged from approximately 30 m to 170 m.

#### V. SOURCES, METHODS, AND RATIONALE OF DATA COLLECTION

Zooplankton were collected from the 20.4 m University of Washington fisheries research vessel Commando. Each bay was sampled once every 2 weeks from late March through August 1978 and once in November 1978 and March 1979. A total of 12 cruises (five spring, five summer, one fall, and one winter) were completed (Table 1).

Station locations were linearly arranged along the main axis of each bay and in front of the respective headlands. Several of the seaward stations were in close proximity to those of the NMFS offshore survey (RU 551). Additional sample locations were added in May 1978 along the edges and inner reaches of Izhut and Kiliuda bays. The inshore sampling program included a total of 26 standard stations.

Capture techniques included the use of four types of gear (Table 2). A Sameoto neuston sampler collected fish eggs and larvae at the air-sea interface. Bongo-arrayed plankton nets sampled the water column from near bottom to the surface. The opening-closing mechanical Tucker trawl sampled discrete depths during light and dark periods, and the epibenthic plankton sled--a Tucker trawl mounted on skis--took discrete samples close to the sea floor. Field procedures generally followed MARMAP survey guidelines (Smith and Richardson 1977).

Samples were preserved with 50 ml of formaldehyde and buffered with 20 ml of saturated sodium borate solution. They were then inventoried and shipped to a commercial sorting center for separation and enumeration of specified zooplankton components (Table 3). Settled plankton volumes were determined for all samples following Kramer et al. (1972), and weighing procedures for euphausiids followed Weibe et al. (1975).

To integrate this program with the offshore ichthyoplankton research (RU 551), various degrees of homogeneity were incorporated into the sampling periods, station locations, gear-use procedures, and sorting options. Project leaders collaborated to insure agreement in the identification and/or typing of captured larval fishes. The closely spaced sample periods should permit descriptive accounts of the appearance, residence time, and growth of selected larval fish species in the inshore zooplankton community.

## VI. RESULTS

Density and kinds of fish eggs and larvae caught during the spring and summer cruises are listed (Tables 4-35). These data will be discussed by life history stage - eggs and larvae; by gear type - neuston and bongo; and by bay - Izhut, Chiniak, Kiliuda, and Kaiugnak. Various elements of the tabularized results and discussion will treat stations 6, 7, and 8, in Izhut and Kiliuda bays separately from other stations within the respective bays because the initiation of sampling at those stations was delayed and they are located close to the margins and heads of the bays.

Station-group comparisons are based primarily on an examination of means of ichthyoplankton densities.

This report does not review results from Tucker trawl or epibenthic sled samples. Nor will there be an examination of other major zooplankton groups sorted from Bongo (333  $\mu$ ) samples. These will be examined in the final report, along with a more integrated review of the findings of the present report.

### Eggs from Neuston Samples

Izhut Bay. Samples were taken at five stations from April through August, and three additional stations were sampled from May through August for a total of 71 plankton hauls. Data from two hauls, station 7, cruise 9 and station 8, cruise 10, were missing; however, these egg densities were estimated, using methods from Snedecor and Cochran (1971), and then were used to calculate mean densities for stations and cruises.

Densities of fish eggs varied between stations and over time (Table 4). No eggs were caught during late March and no eggs were caught from March to May at two stations.

Egg densities were greater at the nearshore stations, 6-8, than at bay stations 1-5. High mean densities of eggs at stations 6-8 occurred in late June and again in early August, whereas mean egg density at stations

1-5 was greatest in late July. Densities decreased for both groups of stations in mid-August.

Unidentified pleuronectid eggs were most abundant in the catches from April to August (Table 5). Flathead sole eggs were second in mean abundance and occurred from late April to August. Species of other eggs included walleye pollock which occurred only during April and two demersal spawners, sandfish and greenling.

Chiniak Bay. Densities for fish eggs were determined from 50 hauls (Table 6). Eggs were found at all stations and during all cruises, except for one station in early April. Mean abundances for all stations fluctuated over the months sampled, but a substantial increase in eggs occurred in June-July. Egg densities remained relatively high through August.

Station 1 was located closest to shore and had the highest mean number of eggs for March-August. Stations 4 and 5 were located in the outermost part of the bay and had the lowest mean number of eggs.

As in Izhut Bay, unidentified pleuronectid eggs were most abundant and occurred in all spring and summer months (Table 7). Flathead sole eggs and walleye pollock eggs also occurred, but were not as abundant.

Kiliuda Bay. Fish eggs occurred in most of the 70 hauls taken from March-August (Table 8). One missing value was estimated with methods from Snedecor and Cochran (1971).

Mean abundances between the nearshore stations, 6-8, and the other stations, 1-5, were not appreciably different. For all stations, mean egg densities were low from April through early June, with a substantial increase in numbers in mid-June. Densities remained high through July and began to decrease in August.

Unidentified flatfish eggs were again most abundant in the plankton from March-August, and peak abundances occurred in June-July (Table 9). Walleye pollock eggs were second in abundance and were present from March-June. Flatfish eggs from flathead sole, Alaska plaice, and rex sole occurred in low abundance.

Kaiugnak Bay. Fish eggs were caught in all months except during May when egg densities were lowest (Table 10). Mean egg densities increased during June and early July and peaked in late July-early August. Overall, more eggs were found at the stations (1, 2) closest to the head of the bay.

Unidentified flatfish eggs occurred in all months sampled except May, and densities were greatest during late July (Table 11). Walleye pollock eggs were caught in April and June, but were absent in May catches. Flathead sole eggs occurred April-August and were the only eggs taken from the neuston during May.

Summary. More eggs were collected in Chiniak, stations 1-5, than from the same station group in any other bay.

Although the nearshore stations, 6-8, in Izhut Bay had substantially more eggs than stations 1-5, there was not a significant difference between stations 6-8 and 1-5 in Kiliuda Bay.

Unidentified pleuronectid eggs dominated the egg catches in all four bays and were present from April-August. Overall egg densities were low during the early spring for all bays. In June and July, egg densities increased in each bay primarily from large increases in unidentified flatfish eggs. Egg abundances remained high through late July and early August, with a slight decrease in numbers in most bays during late August.

Walleye pollock eggs also occurred in all bays and were found predominantly during April-June. Flathead sole eggs were also collected from each bay and were present during all months sampled, although no flathead sole eggs were taken in Kiliuda Bay after June.

#### Larvae from Neuston Samples.

Izhut Bay. Fish larvae were caught in 55 of the 69 hauls taken from March-August (Table 12). Two missing values were estimated by methods in Snedecor and Cochran (1971), and the numbers were used in the following discussion.

Mean densities of larvae varied between stations, with more larvae caught at stations 6-8 than at 1-5. The mean density was highest during late July, although only three of the eight stations contained larvae. Station 8 yielded the greatest mean number of larvae per station.

Approximately 19 different species and types from 12 families were identified (Tables 13 and 36). The preponderant larval fish were smelts which occurred from June-August. Two greenling species, Hexagrammos type I and whitespotted greenling, were relatively abundant in the neuston samples and occurred from March-June. Ronquils were less abundant but were present in every month sampled, except March. Juvenile pink salmon were caught during April and May.

Chiniak Bay. Larval fish were present in 76% of the April-August hauls and densities were low; e.g., no larvae were caught at several stations (Table 14). Densities increased in May primarily because of Hexagrammos type I which was most abundant in May and present until July (Table 15). Larval fish densities decreased during June and again increased in July from the appearance of larval smelts. Densities remained high through August with the appearance of two other greenling species--types D and E. Ronquils were present in low abundance from May-August. Eight other larval fish species, including juvenile pink salmon occurred, but were not as abundant.

Kiliuda Bay. Fish larvae occurred in 55 of the 70 hauls. One sample could not be taken but the missing value was estimated. Kiliuda Bay had a

greater number of species, types, and families than the other bays (Table 36).

No significant difference in mean densities was apparent between station groups 6-8 and 1-5, and numbers of larvae were greatest during March-May (Table 16). Lyconectes aleutensis, dwarf wrymouth, was the most abundant larval fish and occurred only in March-April (Table 17). Hexagrammos type I and members of the family Stichaeidae were also abundant during this time. Other larvae occurring in early spring were Myoxocephalus types A and B, whitespotted greenling, sandlance, and rock sole. Abundances of these species decreased in May-June. Larval fish densities increased in late June-July when smelts appeared in the samples.

Kaiugnak Bay. Two-thirds of the hauls in March-August contained fish larvae (Table 18). Two main peaks in mean density were apparent. The first occurred in late April and species contributing to this abundance were Hexagrammos type I, Myoxocephalus types A and B, and whitespotted greenling (Table 19). Abundance of these larvae decreased in May and June, but densities were relatively high again in late June-July primarily because of the presence of smelt and ronquill larvae. Other species abundant at this time included sand sole and unidentified rockfish. Densities decreased in August when larvae present included smelts and Hexagrammos types D and E.

Summary. Smelt were the most abundant larval fish caught in the neuston from all four bays; however, they were only present from June-August. They comprised 79% of the larvae caught in Izhut Bay, 47% in Kaiugnak Bay, 13% in Kiliuda Bay, and 7% in Chiniak Bay.

Greenlings were also important components in the neuston samples. Three greenling types, Hexagrammos types I, D, and E and whitespotted greenling were caught. Although specific identification of the greenling types I, D, and E, cannot yet be made, it is relatively certain that these types include the kelp, masked and rock greenlings.

Hexagrammos type I occurred in all four bays and was the second most abundant larval fish caught in the neuston. It occurred from late March to June and was most abundant in late April-May. Whitespotted greenling, also occurred in all four bays, but only during March and April. The remaining greenlings, types D and E, occurred in most of the bays but were caught only during July and August. Greenlings as a family comprised 83% of the neuston larvae in Chiniak Bay, 39% in Kaiugnak Bay, 24% in Kiliuda Bay, and 14% in Izhut Bay.

More larval fish were caught in Izhut Bay than in any other bay. Kiliuda Bay, however, contained the greatest number of species, types, and families. Fish larvae from the neuston in each bay appeared on a seasonal basis. Hexagrammos type I, whitespotted greenling, Myoxocephalus types A and B, and dwarf wrymouth were preponderant in the surface plankton from late March to late May. In June, densities of fish larvae dropped to the lowest values, then increased in July-August due to the appearance of

large numbers of smelts. Hexagrammos types D and E also occurred at this time and ronquils contributed to catches in all months sampled.

#### Eggs from Bongo Samples (Fig. 4).

Izhut Bay. Fish eggs occurred in Izhut Bay bongo samples from mid-April through August (Table 20). Mean egg abundance peaked at stations 6-8 in late June and at stations 1-5 in late July. Stations 6-8 had significantly more eggs than stations more distant from shore. Flatfish eggs were the preponderant type from May through August (Table 21). Walleye pollock and flathead sole eggs were less abundant but occurred in the plankton in 7 and 8 of the 10 cruises, respectively.

Chiniak Bay. Fish eggs occurred in all 10 cruises in Chiniak Bay with a major peak in abundance in early July (Table 22). The station closest to shore had both the greatest station total and mean abundance. Flatfish eggs were most abundant and occurred throughout the spring and summer with a seasonal peak in July (Table 23). Walleye pollock eggs occurred from April through July and flathead sole eggs from April through August, with peaks in abundance for both species occurring in early May.

Kiliuda Bay. Fish eggs were caught from April through August in Kiliuda Bay (Table 24). Peaks in mean abundance occurred in mid-July at both groups of stations. As in Izhut Bay, stations 6-8 contained a greater mean number of eggs than stations 1-5. Pleuronectid eggs were preponderant in all cruises (Table 25). Walleye pollock eggs occurred from April through early July with the greatest mean number present in late April.

Kaiugnak Bay. In Kaiugnak Bay fish eggs were present from April through August (Table 26). Seasonal peaks of abundance occurred in mid-July and early August, and stations in the central and head portions of the bay contained the greatest mean totals of eggs. Pleuronectid eggs were slightly less abundant than walleye pollock eggs in early April whereas flatfish eggs were most abundant later. A relatively large number of flathead sole eggs appeared in a single cruise in late April (Table 27).

#### Larvae from Bongo Samples (Fig. 5).

Izhut Bay. Larval fishes occurred in all cruises and in 70 of the 71 samples from Izhut Bay (Table 28). Peaks in abundance occurred in late June and again in August, whereas the relative abundance of larvae from late March through early June remained relatively constant for stations 1-5. In this bay as in Chiniak and Kiliuda bays smelt larvae were primarily responsible for a marked increase in the mean density of fish larvae in late June and early July. The inner and marginal bay stations 1, 6, and 7, contained the highest densities while stations 2 and 3 had the lowest. A temporary dip in abundance occurred in late July at all stations and no larvae were caught in cruise 8, station 5.

Smelt larvae in this and the other three bays clearly outnumbered all other larval fish taxa in mean abundance (Table 29). Their spawning period began in early to mid-June in all bays, with a peak in larval abundance in the first half of July. Ronquil and sand lance larvae were second and third in abundance, respectively.

Other larval forms of species of relative importance that ranked among the top 15 in abundance included sand sole, rock sole, (great) sculpin types, walleye pollock and rockfishes.

Chiniak Bay. In Chiniak Bay larval fish were present at all stations during all cruises (Table 30). As in Izhut Bay, mean abundance remained relatively low until smelt larvae appeared in mid-June. Peak mean abundance occurred in early July, and the station furthest inside the bay had significantly more larvae than the remaining stations. Species of relative importance and among the most abundant in Chiniak Bay were smelts, sand lance, rock sole, pricklebacks, sand sole, flathead sole, rockfish and cod (Table 31). Of these, rock sole were present in the greatest number of cruises.

Kiliuda Bay. In Kiliuda Bay larval fishes occurred during all cruises and at all stations (Table 32). As in Chiniak Bay lowest mean densities occurred in May and early June followed by peaks in abundance in mid-July and August. Mean abundance for stations 1-5 was approximately half of that found at marginal stations 6-8. Larval fish species of importance that occurred in relative abundance were smelts, pricklebacks, sand lance, rock sole, walleye pollock, sand sole, and Myoxocephalus types (Table 33). As with those species mentioned for Izhut and Chiniak bays, particular patterns of seasonality and periods of relative abundance can be noted. The principle example is the synchronous disappearance of sand lance larvae in early June and the appearance of smelt larvae in late June (Figs 6 and 7).

Kaiugnak Bay. In Kaiugnak Bay fish larvae were found in all cruises and in 49 of 50 station-samples (Table 34). A minor peak in spring abundance occurred in late April with the higher summer densities occurring in late August. Minimum mean larval fish densities were in early June. Mean densities for stations 1, 2, 3 and 5 were relatively similar to one another and low when compared to station 4. Commercially and economically important fishes for which larval forms were relatively abundant were smelts, sand lance, rock sole, pricklebacks, sand sole, Pacific cod, and flathead sole (Table 35). These fishes, excluding the Pacific cod, occurred in at least half of the cruise periods.

#### Environmental Data

Salinity and temperature data were compiled for the various cruises, bays and depths (Tables 39-42). Ranges in mean temperatures for all bays and all cruises were 3.5-12.3°C at 1 meter depth, 3.4-9.7 at 25 m, 3.5-8.7 at 50 m, and 3.5-7.6°C at 100 m. Ranges in mean salinities for all bays and all cruises were 30.5-34.3 at 1 m, 33.5-34.4 at 25 m, 33.6-34.4 at

50 m, and 33.5-34.5 at 100 m. A slight cooling trend appeared in late August at the surface in three bays and in deeper water in Kaiugnak Bay.

## VII. DISCUSSION

Several fish taxa used the nearshore regime as a nursery area for various segments of the spring and summer sampling periods. In general, cod fish, sand lance, pricklebacks, Myoxocephalus spp., rock sole, and Hexagrammos type I larvae were the primary spring spawners. Smelts, yellowfin sole, sand sole, and Hexagrammos types D and E were the most important species of the summer ichthyoplankton populations. Ronquil larvae were relatively abundant during the spring and summer periods.

Smelt larvae were clearly preponderant in the summer samples. Their abundance remained relatively high in relationship to other species, when sampling was recessed in August. Other species, such as rock sole, Myoxocephalus spp., and sand lance and pricklebacks were both reaching a size for transformation to existence in their juvenile habitat and/or occurring in relatively fewer numbers by early summer. Relationships between fish length, time, and abundance will be discussed in the final report.

Fish larvae were distributed throughout the nearshore zone while patterns of distribution within and between bays varied. In many but not all cases larval densities were higher for stations closest to shore. Analysis of distribution by family, genera, and species (versus cruise and station) has not yet been completed. This is intended for the final report, along with an analysis of their vertical distributions in Izhut and Kiliuda bays.

Several references were made to the occurrence and abundance of eggs of the family Pleuronectidae and larvae of the families Osmeridae, Cottidae (types I and L), and the genus Myoxocephalus (types A and B). These families and generic types could not be identified at a lower taxonomic level. However, listed below are the genera and species they most likely represent.

Many pleuronectid eggs are extremely difficult to identify to genus (or species) except when fully developed. We consider captured flatfish eggs to be composed of one or more of the following species: butter sole, yellowfin sole, english sole, starry flounder and/or sand sole. Yellowfin sole, starry flounder and sand sole probably accounted for the majority of eggs found. Rock sole eggs are demersal and adhesive and are not included among the planktonic pleuronectid eggs.

Osmerid larvae are also difficult to identify to a sub-family level. Capelin probably accounted for the majority of the smelt larvae, but other possible species include surf smelt, eulachon, and longfin smelt.

Cottidae type I is presently considered to contain the sculpin genera Icelinus and Icelus. Cottidae type L may be composed of larvae from the genera Artedius, Clinocottus and/or Oligocottus.

Myoxocephalus types A and B may represent two or more of the 4(?) local species within the genus. The great sculpin is the most abundant and ecologically important of the group and probably composes the greatest part of the type A group.

Larvae of many fish species did not appear in density tables 29, 31, 33, and 35, but did occur in relatively low numbers in at least one of the bays (Table 37). Several of these species occurred in relatively low numbers in all four bays. The most notable is the yellowfin sole. Adults are caught in relatively large numbers in bottom trawls in Kodiak Island bays (Blackburn 1978; Harris and Hartt 1977). However, the larvae were not found to be proportionately abundant. Rockfish larvae were also caught in low numbers in all four bays, as were juveniles/adults by investigators of RUs 485 and 552.

Species considered commercially and/or economically important and which did not appear in the bongo and neuston plankton samples, included Pacific herring, Clupea harengus pallasii, sablefish, Anoplopoma fimbria, sandfish, Trichodon trichodon, and arrowtooth flounder, Atheresthes stomias. We suspect that one or more factors were responsible for their absence. Foremost is that they did not spawn or have larvae in the study area. Secondly, their larvae may be large enough or close enough to the bottom to avoid the nets. Finally, their appearance in the plankton may not occur except in the fall and winter periods.

#### VIII. SUMMARY - CONCLUSIONS

Ichthyoplankton in four bays of the Kodiak Archipelago were sampled from late March through August, 1978. Larval fishes and fish eggs from bongo and neuston plankton samples were identified to the lowest taxonomic level possible; 20 families, 49 genera, and 31 species were identified.

Planktonic fish eggs and larvae were present during all cruise periods and in all bays in both surface and sub-surface samples. Seasonal trends in abundance of taxa of commercial and ecological importance were also evident. These taxa included cod fish, (great) sculpins, greenlings, sand lance, pricklebacks and flatfish. Most notable, perhaps, were the large numbers of flatfish eggs and smelt larvae present in the late spring and summer months.

Several aspects of the sampling will be reported in the final report. These include an examination of the epibenthic (sled) samples, vertical distributions, and variation in day and night catches in both neuston and tucker trawl samples.

From the data presented in this report, it is apparent that OCS development activities may interact with the early life history stages of many fishes of the nearshore zone. Species in the neuston are, of course, more susceptible to floating pollutants. Diel migrations to the surface at night of larval fishes normally found at depth could further complicate such an interaction. Many of those stations closest to shore had relatively higher mean densities of fish eggs and larvae and are subject

to possible pooling effects of pollutants along or close to the shore and in small bays. Most of the larval fish species reviewed had distinct seasonal occurrences and may only be indirectly affected by the possible effects of petroleum developments in alternate seasonal periods.

#### IX. NEEDS FOR FURTHER STUDY

This will be discussed subsequent to the May 1979 Kodiak synthesis meeting.

#### X. SUMMARY OF JANUARY-MARCH QUARTER

##### A. Ship or laboratory activities

1. Ship or field trip schedule
  - a. Dates: March 4-16, 1979
  - b. Name of vessel: R/V COMMANDO
2. Scientific party
  - a. Names: Doug Rabin; Biff Bermingham
  - b. Affiliation: Fisheries Research Institute, Univ. Washington
  - c. Roles: Project leader; Cruise leader, respectively
3. Methods
  - a. Field sampling: Refer to methods section of this report
  - b. Laboratory analysis: Refer to methods section of this report
4. Sample localities: refer to methods section of this report
5. Data collected or analyzed
  - a. Number and types of samples: See Table 43.
  - b. Number and types of analysis: completed identification of fish eggs and larvae from November 1978 cruise.

## XI. AUXILIARY MATERIAL

References Used

- Blackburn, J. E. 1978. Demersal fish and shellfish assessment in selected estuary systems of Kodiak Island. Alaska Dep. Fish Game, Final Rep. 120 pp. + appendices.
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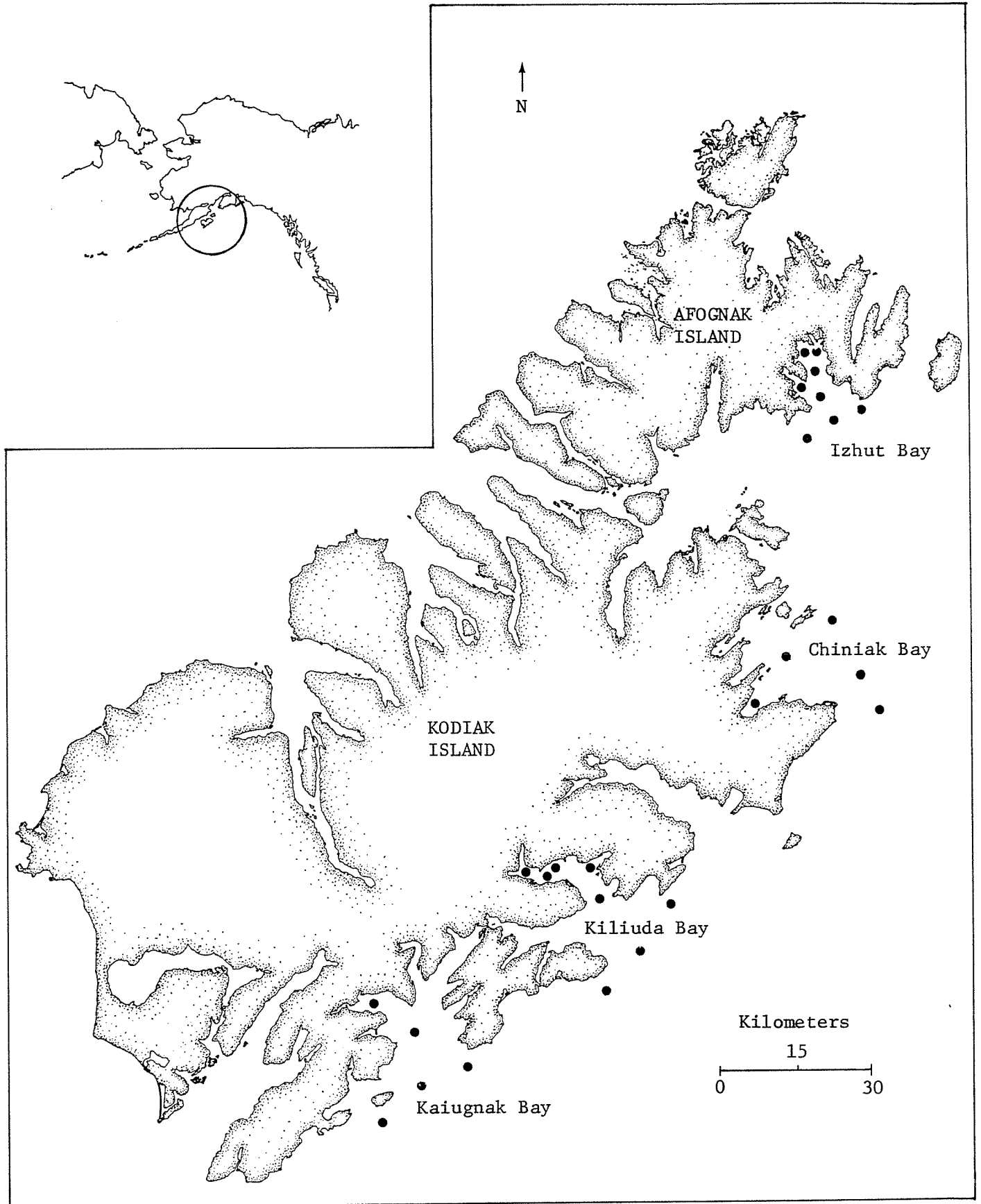


Fig. 1. Locations of bays and stations, Kodiak Archipelago nearshore zooplankton research, 1978.

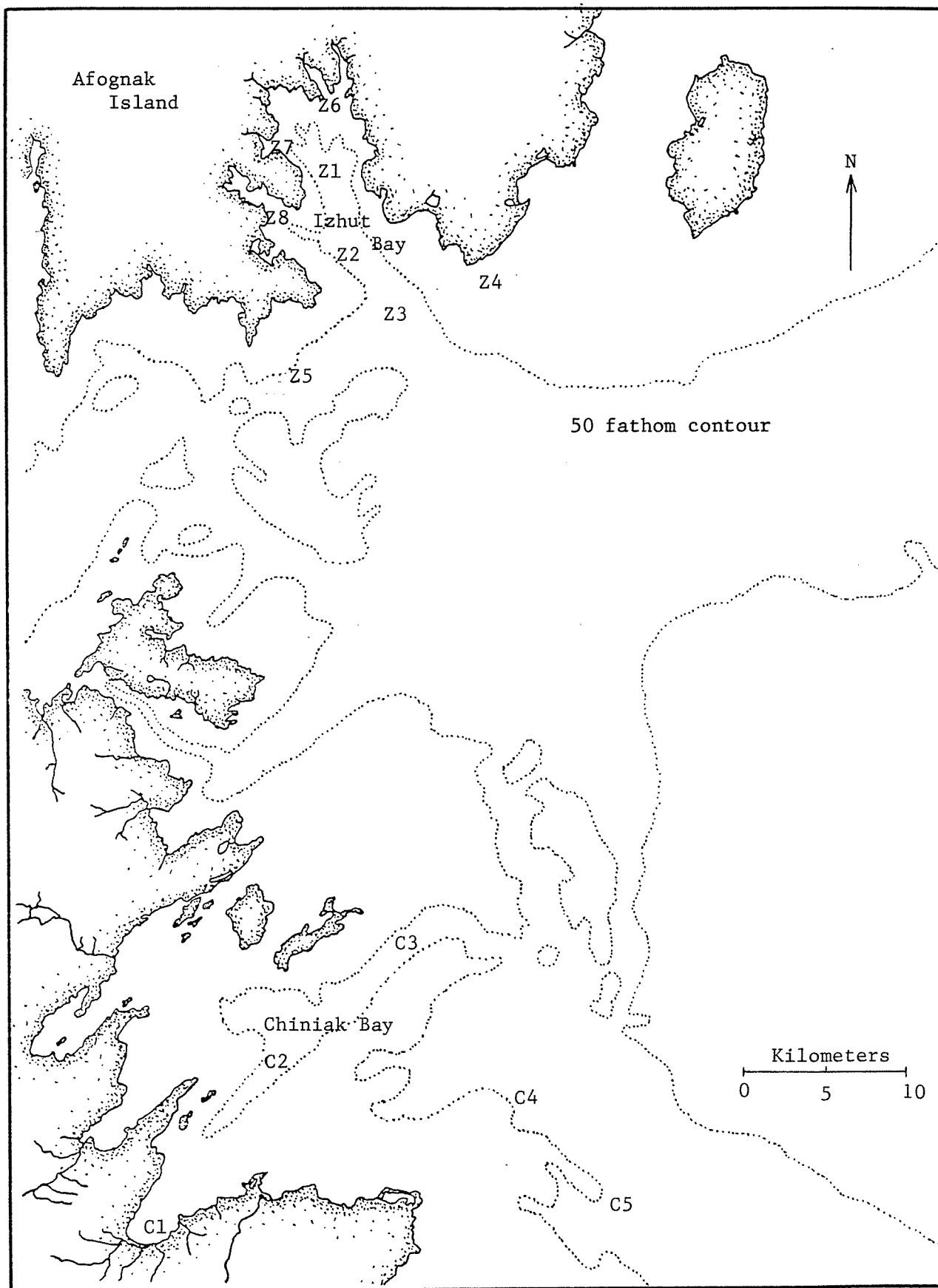


Fig. 2 . Station locations for Kodiak Island nearshore zooplankton research, 1978.

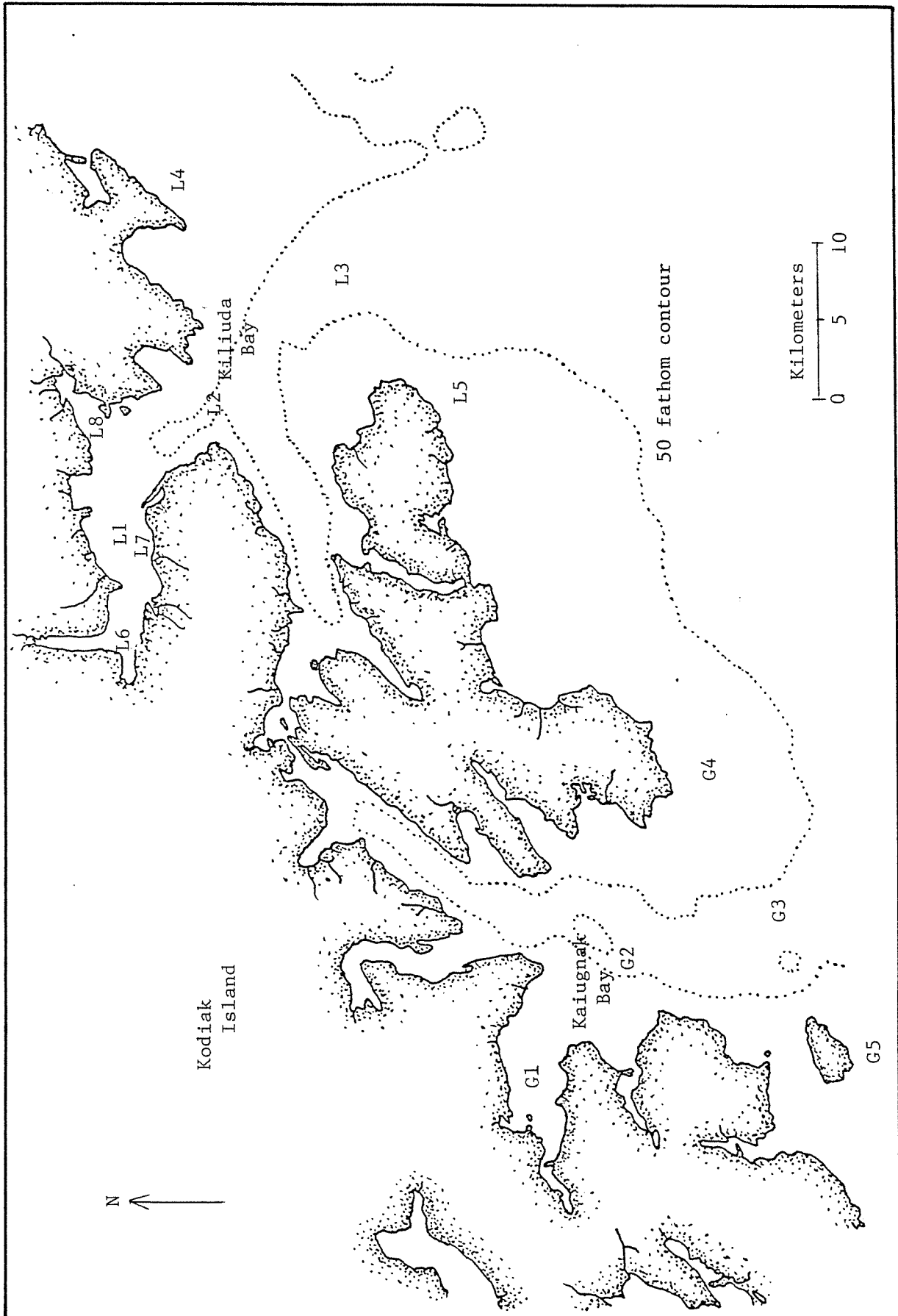


Fig. 3. Station locations for Kodiak Island nearshore zooplankton research, 1978.

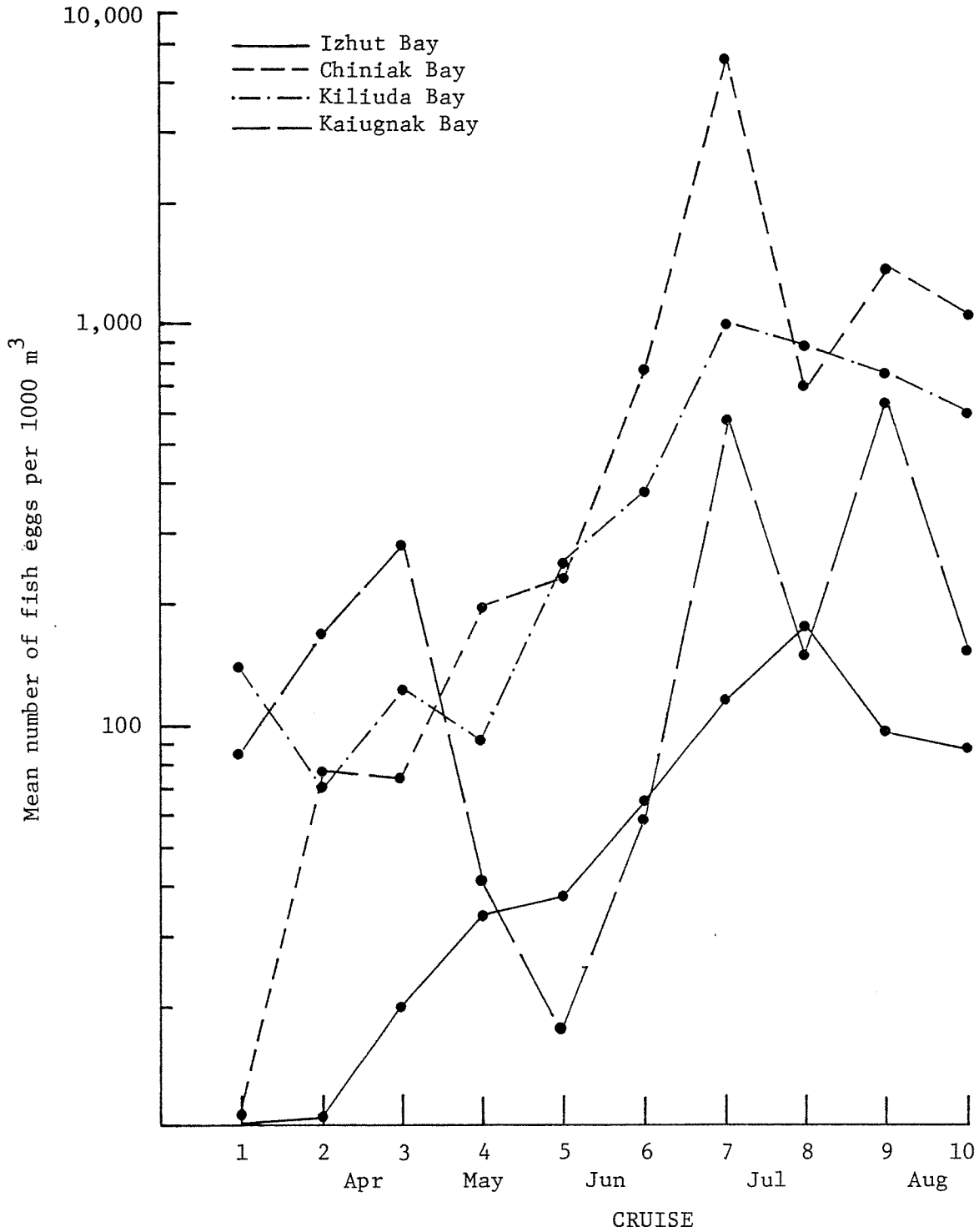


Fig. 4. Mean number of fish eggs per 1000 m<sup>3</sup> from bongo (505 $\mu$ ) samples, stations 1-5, by bay and cruise, Kodiak Archipelago, Alaska, 1978.

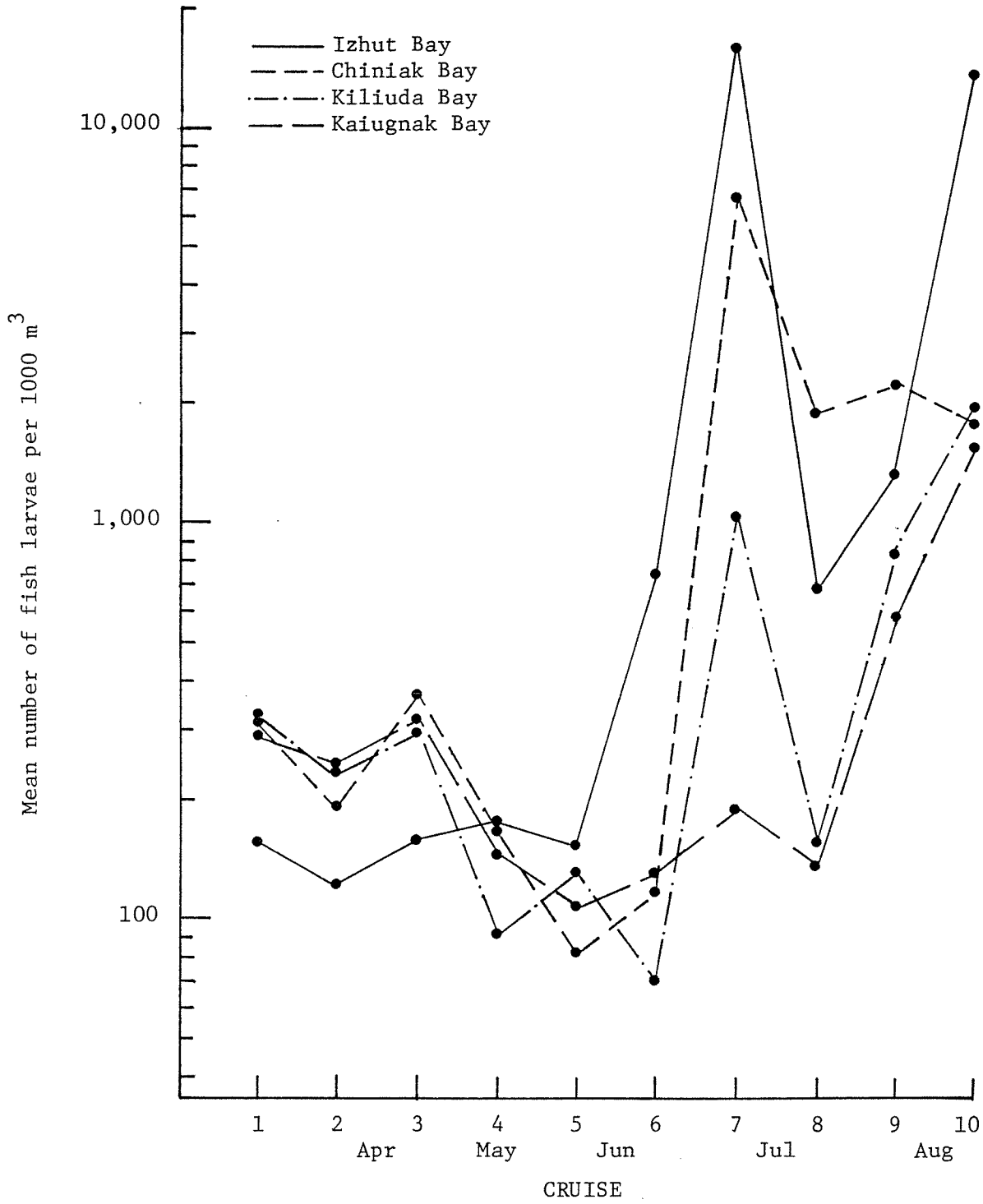


Fig. 5. Mean number of fish larvae per 1000 m<sup>3</sup> from bongo (505µ) samples, stations 1-5, by bay and cruise, Kodiak Archipelago, Alaska, 1978.

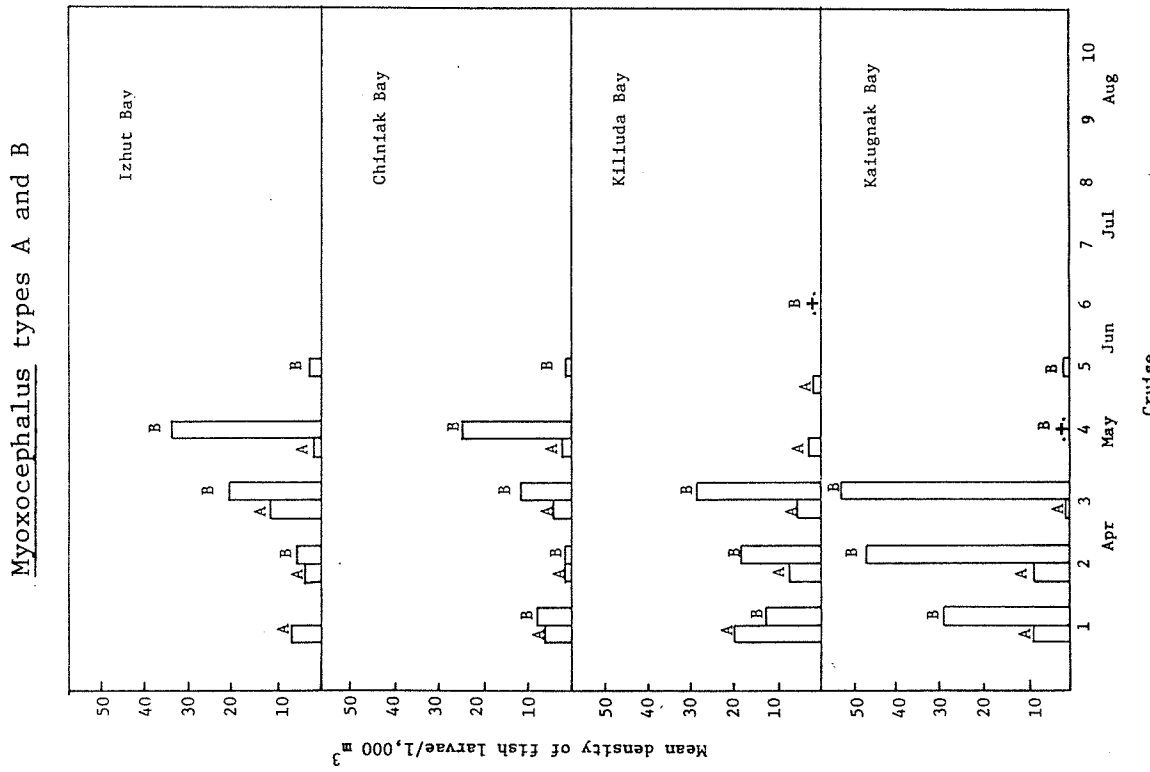
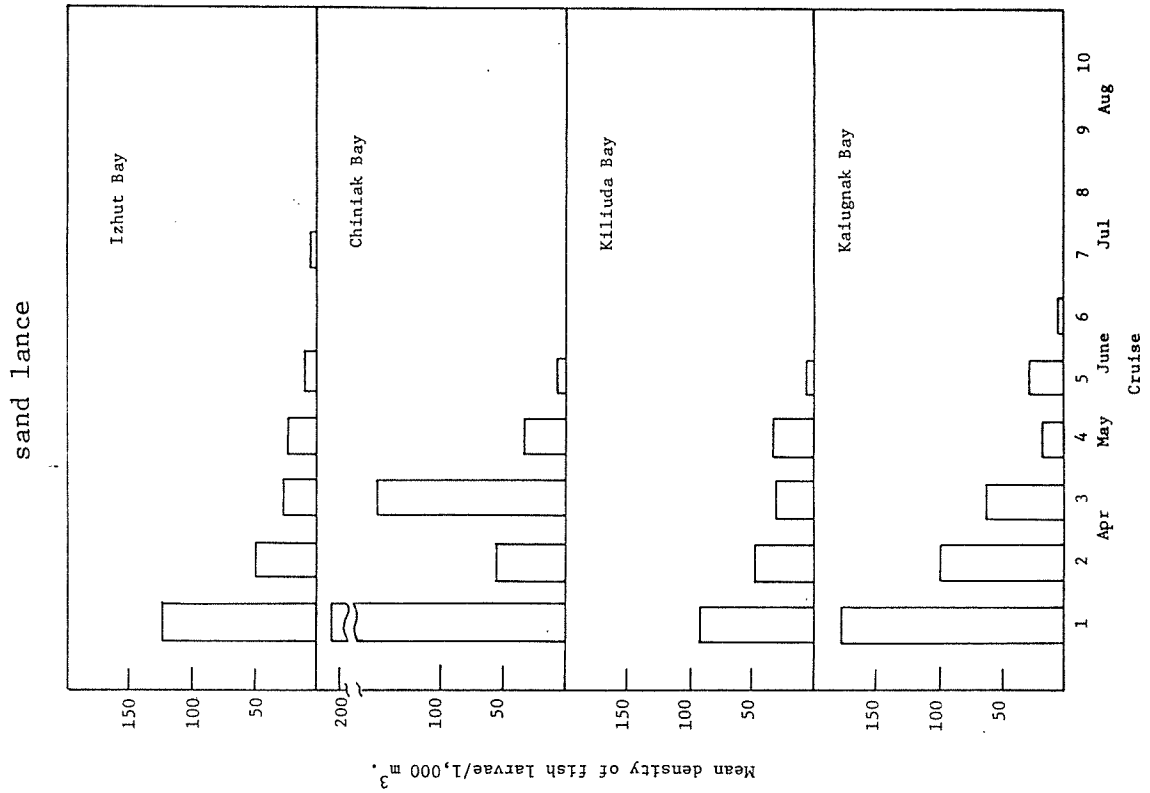


Fig. 6. Seasonal occurrence and mean density of Myoxocephalus types A and B and sand lance larvae in four bays of the Kodiak Archipelago, Alaska, 1978.

smelt



rock sole

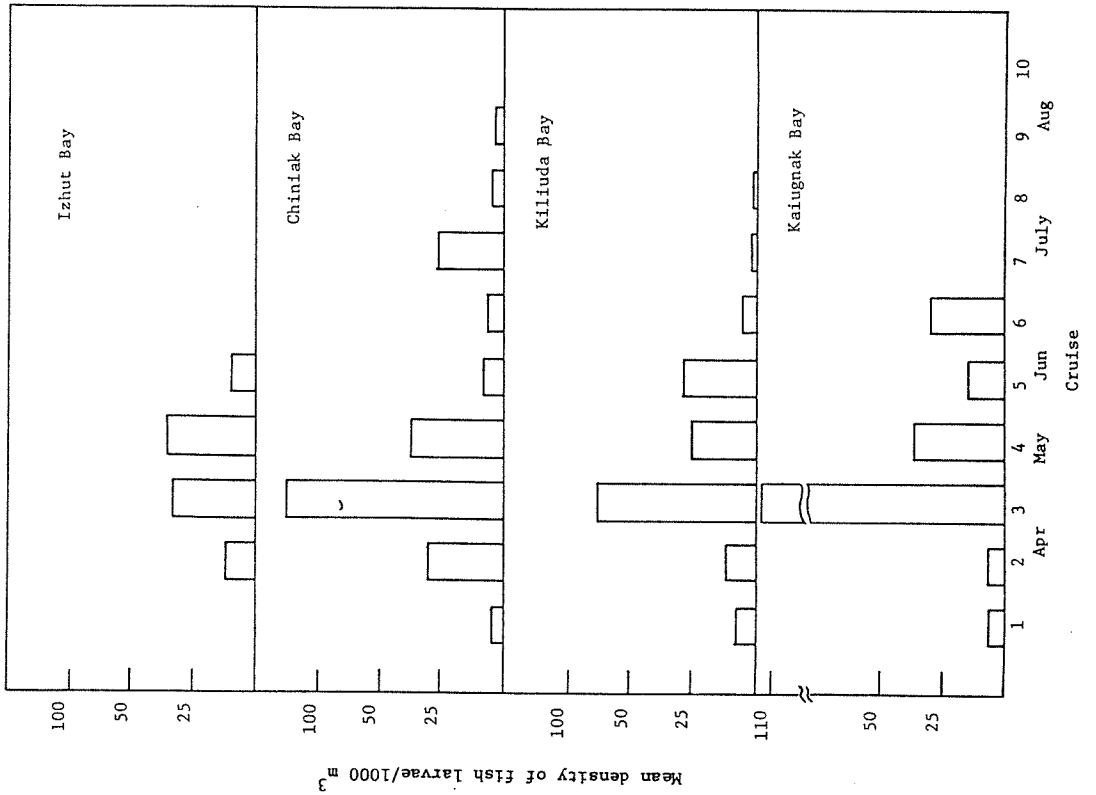


Fig. 7. Seasonal occurrence and mean density of rock sole and smelt larvae in four bays of the Kodiak Archipelago, Alaska, 1978.

Table A. Station locations for Kodiak Island nearshore zooplankton research, 1978-79.

Bay	Station	Latitude	Longitude	Gear used*
Izhut	Z1	58 13	152 17	N,B
	Z2 (day-night)	58 10	152 14	N,B,T,S
	Z3	58 06	152 10	N,B,S
	Z4	58 08	152 03	N,B
	Z5	58 05	152 18	N,B
	Z6**	58 15	152 16	N,B
	Z7**	58 13	152 18	N,B
	Z8**	58 11	152 20	N,B
Kalsin-Chiniak	C1	57 37	152 25	N,B
	C2	57 41	152 19	N,B,S
	C3	57 44	152 14	N,B,S
	C4	57 42	152 04	N,B
	C5	57 38	151 55	N,B
Kiliuda	L1	57 19	153 02	N,B
	L2 (day-night)	57 16	152 55	N,B,T,S
	L3	57 12	152 45	N,B,S
	L4	57 16	152 37	N,B
	L5	57 36	152 54	N,B
	L6**	57 20	153 09	N,B
	L7**	57 18	153 06	N,B
	L8**	57 20	152 55	N,B
Kaiugnak	G1	57 04	153 36	N,B
	G2	57 01	153 29	N,B,S
	G3	56 56	153 27	N,B,S
	G4	56 58	153 14	N,B
	G5	56 52	153 35	N,B

\* N = neuston, B = bongo, T = Tucker trawl, S = epibenthic sled

\*\* Stations added 5/78

Table 1. Frequency of gear use by bay, station, and cruise for inshore zooplankton research, Kodiak Archipelago, Alaska, 1978-79.<sup>1, 2</sup>

Gear	Neuston (505 $\mu$ )	Bongo (505 $\mu$ & 333 $\mu$ )	Tucker (505 $\mu$ )	Tucker (3 mm)	Epibenthic sled (505 $\mu$ )							
Bay/Station												
Izhut												
1	I-XII	I-XII										
2	"	"	II-XII II-XII	II-X II-X	II-X II-VI							
2 (night)	II-XII											
3	I-XII	I-XII										
4	"	"										
5	"	"										
6	IV-XII	IV-XII			I							
7	"	"										
8	"	"										
Chiniak												
1	I-XII	I-XII			I							
2	"	"			I-X							
3	"	"			I-V							
4	"	"										
5	I-X	I-X										
Cruise-month reference												
Cruise	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Month	Mar '78	Apr	May	Jun	Jul	Aug	Nov	Mar '79				

<sup>1</sup>All stations were occupied during daylight hours except when noted.

<sup>2</sup>Gear use per cruise was limited to one sample per gear type, station, depth interval (and time of day when appropriate).

Table 1. Frequency of gear use by bay, station, and cruise for inshore zooplankton research Kodiak Archipelago, Alaska, 1978-79.<sup>1</sup>, 2 - continued.

Gear	Neuston (505 $\mu$ )	Bongo (505 $\mu$ & 333 $\mu$ )	Tucker (505 $\mu$ )	Tucker (3 mm)	Epibenthic sled (505 $\mu$ )
Bay/Station					
Kiliuda					
1	I-XII	I-XII			I
2	"	"	I-XII	I-X	II-X
2 (night)	"	I-XII	I-XII	I-X	
3	"	"			II-V
4	"	"			
5	"	"			
6	IV-XII*	IV-XII			
7	IV-XII <sup>o</sup>	"			
8	IV-XII+	"			
Kaiugnak					
1	I-XII	I-XII			II-X
2	"	"			II-V
3	"	"			
4	"	"			
5	"	"			
Time-scale reference					
Cruise	I II III IV V VI VII VIII IX X XI XII				
Month	Mar '78	Apr	May	Jun	Jul
					Aug
					Nov
					Mar '79

\*Except cruise VI.

<sup>o</sup> " " IX.

+ " " X.

<sup>1</sup>All stations were occupied during daylight hours except when noted.

<sup>2</sup>Gear use per cruise was limited to one sample per gear type, station, depth interval (and time of day when appropriate).

Table 2. Gear and gear-use characteristics for inshore zooplankton research, Kodiak Archipelago, Alaska, 1978-79.

Gear type	Opening (m <sup>2</sup> )	Mesh (μ)	Tow characteristics	Duration (minutes)	Vessel speed (knots)
Neuston	.14 (= .3 m x .5 m)	505	Horizontal-surface	10	2-2.5
*Bongo	.28 (.6 m dia.)	505 & 333	Double oblique - near bottom to surface	10-25	2-2.5
*Tucker (with opening-closing mechanism)	1 (with 45° side-wire angle)	505	Horizontal at 10, 30, 50, 70, 90 meters	5 per depth	2-2.5
*Tucker	1	505 & 3000	Double oblique - 90 m to surface	10-25	2-2.5 (4 for larger mesh)
Epibenthic sled (with opening-closing mechanism)	1	505	Horizontal-bottom	10	2-2.5

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\*Rate of descent: 50 m of wire/min with 30 second hold at maximum depth. Rate of ascent: 20 m of wire/min.

\*Procedure conducted once during daylight and repeated after dusk.

Table 3. Zooplankton sorting design, by gear type, for inshore zooplankton research, Kodiak Archipelago, Alaska, 1978-79.

Sampling device (mesh size)	Sorted component(s)	Total number or organisms removed or percent of sample sorted
Neuston (505 $\mu$ )	- fish eggs and larvae	100%
Bongo (505 $\mu$ )	- fish eggs and larvae - adult euphausiids <sup>1</sup>	100% 175-225
Bongo (333 $\mu$ )	- major taxa including fish eggs and larvae, crab and shrimp larvae, euphausiids, amphipods, copepods, and chaetognaths	500 $\approx$ 700
Tucker trawl (505 $\mu$ )	- fish eggs and larvae - crab and shrimp larvae - adult euphausiids <sup>1</sup>	100% from 500 $\approx$ 700 organism- aliquot 175-225
Tucker trawl (3 mm)	- fish larvae	100% of those > 20 mm
Epibenthic sled (505 $\mu$ )	- fish eggs and larvae - crab & shrimp larvae	100% from 500 $\approx$ 700 organism- aliquot

<sup>1</sup>Adult euphausiids were removed from Bongo (505 $\mu$ ) samples taken at stations 1 and 3 for all bays and all cruises and from Tucker (505 $\mu$ ) samples taken in Kiliuda Bay during both day and night sampling from depths 10 m and 30 m.

Adult euphausiids were identified, their lengths measured and wet weights taken by the sorting agency.

Table 4. Density of fish eggs per 1000 m<sup>3</sup> from neuston (505μ) samples, by cruise and station, Izhut Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations								$\bar{X}$ (1-5)	$\bar{X}$ (6-8)
		1	2	3	4	5	6	7	8		
1	Mar 29-Apr 8	0	0	0	0	0	-	-	-	0	
2	Apr 10-Apr 17	0	1074	0	0	9	-	-	-	217	
3	Apr 21-May 1	333	14	0	0	15	-	-	-	72	
4	May 3-May 28	140	18	8223	95	64	409	386	0	1708	265
5	May 31-Jun 6	3121	313	0	143	71	3845	8000	18000	730	9948
6	Jun 14-Jun 26	14215	2636	195	360	3525	67647	43368	43238	4186	51418
7	Jun 28-Jul 18	21999	31	754	21	679	53238	29647	187253	4697	90046
8	Jul 21-Jul 29	92617	3940	714	33	525	31875	54564	30533	19566	38991
9	Aug 1-Aug 9	20865	6122	204	40	9055	45484	(28970)	641600	7257	238685
10	Aug 15-Aug 21	13167	323	587	541	774	5579	11489	(144785)	3078	53951
	$\bar{X}$ (1-10)	16646	1447	1068	123	1472					
	$\bar{X}$ (4-10)	23732	1912	1525	176	2099	29725	25203	152201		

( ) = estimate; no sample taken.

Table 5. Kinds and mean numbers per 1000 m<sup>3</sup> of fish eggs from neuston (505μ) samples, Izhut Bay, Kodiak Archipelago, 1978.

Taxa	Month										
	Cruise	1	2	3	4	5	6	7	8	9	10
<u>Pleuronectidae</u>	.	2	25	131	4177	21543	36670	26755	103292	4578	
<u>Hippoglossoides elassodon</u>	.	.	3	992	4	297	22	77	19	10	
<u>Theragra chalcogramma</u>	.	215	.	.	.	.	.	.	.	.	.
Unidentified	.	.	44	18	2	53	12	18	0	49	
<u>Trichodon trichodon</u>	.	.	.	26	.	4	.	.	.	.	.
<u>Hexagrammidae</u>	.	.	.	.	.	.	.	.	27	.	.
<u>Glyptocephalus zachirus</u>	.	.	.	.	4	.	.	.	.	.	.

Table 6. Density of fish eggs per 1000 m<sup>3</sup> from neuston (505μ) samples, by cruise and station, Chiniak Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations					$\bar{X}$ (1-5)
		1	2	3	4	5	
1	Mar 29-Apr 8	23	42	10	0	13	18
2	Apr 10-Apr 17	2414	265	68	457	180	677
3	Apr 21-May 1	21*	29	47	129	222	90
4	May 3-May 28	160	454	579	387	4500	1216
5	May 31-Jun 6	38	179	889	804	81	398
6	Jun 14-Jun 26	10250	12617	2445	2548	1500	5872
7	Jun 28-Jul 18	166909	40604	18310	8109	589	46904
8	Jul 21-Jul 29	16522	91784	77511	180	510	37301
9	Aug 1-Aug 9	33216	10278	6312	590	2821	10643
10	Aug 15-Aug 21	335673	5088	329	262	2796	68830
$\bar{X}$ (1-10)		56523	16134	10650	1347	1321	

\* not identified.

Table 7. Kinds and mean numbers per 1,000 m<sup>3</sup> of fish eggs from neuston(505μ) samples, Chiniak Bay, Kodiak Archipelago, 1978.

Taxa	Month Cruise	1	2	3	4	5	6	7	8	9	10
Pleuronectidae		13	636	11	87	363	5777	46861	37296	10566	68808
<u>Hippoglossoides</u> <u>elassodon</u>		.	.	54	1109	35	20	29	5	72	21
Unidentified		.	.	.	7	.	71	15	.	.	.
<u>Theragra</u> <u>chalcogramma</u>		4	41	20	13	.	3	.	.	5	.

Table 8. Density of fish eggs per 1000 m<sup>3</sup> from neuston (505 $\mu$ ) samples, by cruise and station, Kiliuda Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations								$\bar{x}$ (1-5)	$\bar{x}$ (6-8)
		1	2	3	4	5	6	7	8		
1	Mar 29-Apr 8	686	1896	466	226	167	-	-	-	688	
2	Apr 10-Apr 17	2276	1387	30	86	396	-	-	-	835	
3	Apr 21-May 1	1468	151	84	387	341	-	-	-	486	
4	May 3-May 28	27	784	20	1384	1056	12	0	239	654	84
5	May 31-Jun 6	0	422	417	86	95	0	4796	571	204	1789
6	Jun 14-Jun 26	1029	21389	184	22700	15056 (6320)		128	48340	12072	18263
7	Jun 28-Jul 18	4447	42000	7578	10949	18244	21	1211	30591	15844	10608
8	Jul 21-Jul 29	13853	17705	13943	29192	15436	342	5105	47821	18026	17756
9	Aug 1-Aug 9	27765	14227	24800	7656	4891	1667	1339	8512	15868	3839
10	Aug 15-Aug 21	25182	3521	1702	7000	7395	1432	822	9065	8960	3773
	$\bar{x}$ (1-10)	7673	10348	4922	7967	6308					
	$\bar{x}$ (4-10)	10329	14293	6949	11281	8882	1399	1914	20734		

( ) = estimate; no sample taken.

Table 9. Kinds and mean numbers per 1000 m<sup>3</sup> of fish eggs from neuston (505μ) samples, Kiliuda Bay, Kodiak Archipelago, 1978.

Taxa	Month										Total	
	Cruise	1	2	3	4	5	6	7	8	9		10
Pleuronectidae		38	812	417	410	782	15431	14380	17925	11357	7015	
<u>Theragra</u> <u>chalcogramma</u>		286	17	38	17	.	20	.	.	.	.	.
<u>Hippoglossoides</u> <u>elassodon</u>		2	6	20	8	10	96	.	.	.	.	.
Unidentified		20	.	6	5	4	.	.	.	.	.	31
<u>Pleuronectes</u> <u>quadrituberculatus</u>		.	.	5	.	.	.	.	.	.	.	.
<u>Glyptocephalus</u> <u>zachirus</u>		.	.	.	.	2	.	.	.	.	.	.

Table 10. Density of fish eggs per 1000 m<sup>3</sup> from neuston (505 $\mu$ ) samples, by cruise and station, Kaiugnak Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations					$\bar{X}$ (1-5)
		1	2	3	4	5	
1	Mar 29-Apr 8	907	523	1449	678	28	717
2	Apr 10-Apr 17	95	5137	913	32	2193	1674
3	Apr 21-May 1	1846	1553	257	143	1077	975
4	May 3-May 28	0	17	56	0	0	15
5	May 31-Jun 6	113	52	122	68	60	83
6	Jun 14-Jun 26	235	3235	1000	83	590	1029
7	Jun 28-Jul 18	7160	969	886	1179	56	2050
8	Jul 21-Jul 29	37489	43539	2405	29	583	16809
9	Aug 1-Aug 9	9156	39170	776	4828	5880	11962
10	Aug 15-Aug 21	1848	3920	1440	151	1567	1785
$\bar{X}$ (1-10)		5885	9812	930	719	1203	

Table 11. Kinds and mean numbers per 1000 m<sup>3</sup> of fish eggs from neuston (505μ) samples, Kaiognak Bay, Kodiak Archipelago, 1978.

Taxa	Month		Apr		May		Jun		Jul		Aug	
	1	2	3	4	5	6	7	8	9	10		
Pleuronectidae	207	875	602	.	15	912	1631	16788	11945	1785		
<u>Theragra</u> <u>chalcogramma</u>	503	771	118	.	5	.	.	.	.	.	.	.
Unidentified	2	13	36	.	20	.	419	.	.	.	.	.
<u>Hippoglossoides</u> <u>elassodon</u>	5	15	219	15	42	116	.	21	17	.	.	.

Table 12. Density of larval fish per 1000 m<sup>3</sup> from neuston (505μ) samples, by cruise and station, Izhut Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations								$\bar{X}$ (1-5)	$\bar{X}$ (6-8)
		1	2	3	4	5	6	7	8		
1	Mar 29-Apr 8	58	213	60	26	116	-	-	-	95	
2	Apr 10-Apr 17	0	148	131	386	510	-	-	-	235	
3	Apr 21-May 1	1963	285	75	231	154	-	-	-	542	
4	May 3-May 28	0	18	333	95	26	46	544	408	94	333
5	May 31-Jun 6	30	0	683	58	0	0	38	0	154	13
6	Jun 14-Jun 26	1616	36	146	60	450	59	737	0	462	265
7	Jun 28-Jul 18	59	31	33	167	144	2786	59	55	319	967
8	Jul 21-Jul 29	0	0	0	0	3950	31	0	40067	790	13366
9	Aug 1-Aug 9	27	20	68	40	0	0	(0)	50	123	17
10	Aug 15-Aug 21	1778	32	63	65	60	211	327	(6831)	400	2456
	$\bar{X}$ (1-10)	553	78	159	113	541					
	$\bar{X}$ (4-10)	501	20	189	69	661	448	244	6773		

( ) = estimate; no sample taken

Table 13. Kinds and mean numbers per 1000 m<sup>3</sup> of 15 most abundant fish larvae from neuston (505µ) samples, Izhut Bay, Kodiak Archipelago, 1978.

Taxa	Month Cruise	1	2	3	4	5	6	7	8	9	10
Osmeridae		.	.	.	.	.	208	371	5303	20	334
<u>Hexagrammos</u> type I		42	186	506	106	91	65	.	.	.	.
Bathymasteridae		.	.	15	8	6	108	35	61	.	2
<u>Hexagrammos stelleri</u>		50	15	3	2	.	.	.	.	.	.
<u>Icelinus</u> spp.		.	.	.	.	.	.	.	58	.	.
<u>Oncorhynchus gorbuscha</u>		.	.	5	48	.	.	.	.	.	35
Cottidae type L		.	.	.	.	.	.	.	34	.	.
<u>Psettichthys melanostictus</u>		.	.	.	.	.	.	.	28	3	.
Scorpaenidae		.	.	.	.	.	.	4	18	.	.
Cottidae type I		.	15	.	.	.	3	.	.	.	.
<u>Hexagrammos</u> type D		.	.	.	.	.	.	.	.	.	15
Unidentified		.	.	.	9	.	.	4	.	.	.
<u>Myoxocephalus</u> type B		.	.	7	3	.	3	.	.	.	.
<u>Myoxocephalus</u> type A		.	12	.	+	.	.	.	.	.	.
<u>Ammodytes hexapterus</u>		3	.	3	.	.	.	.	.	.	3

+ = <.5 larvae/1000 m<sup>3</sup>

Table 14. Density of larval fish per 1000 m<sup>3</sup> from neuston (505 $\mu$ ) samples, by cruise and station, Chiniak Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations					$\bar{X}$ (1-5)
		1	2	3	4	5	
1	Mar 29-Apr 8	0	11	0	256	363	126
2	Apr 10-Apr 17	0	0	0	86	154	48
3	Apr 21-May 1	1	14	0	51	28	19
4	May 3-May 28	186	46	1895	1387	548	812
5	May 31-Jun 6	0	141	1978	0	122	448
6	Jun 14-Jun 26	15	0	0	0	210	45
7	Jun 28-Jul 18	440	226	144	65	26	180
8	Jul 21-Jul 29	11	189	22	26	20	54
9	Aug 1-Aug 9	0	14	1557	26	129	345
10	Aug 15-Aug 21	163	662	63	130	633	330
$\bar{X}$ (1-10)		82	130	566	203	223	

Table 15. Kinds and mean numbers per 1000 m<sup>3</sup> of 15 most abundant fish larvae from neuston (505µ) samples, Chiniak Bay, Kodiak Archipelago, 1978.

Taxa	Month										
	Cruise	1	2	3	4	5	6	7	8	9	10
<u>Hexagrammos</u> type I	116	38	3	757	448	.	23	.	.	.	.
<u>Hexagrammos</u> type D	.	.	.	.	.	.	.	.	.	305	140
Osmeridae	.	.	.	.	.	3	123	44	.	.	5
<u>Hexagrammos</u> type E	.	.	.	.	.	.	.	.	.	6	151
Bathymasteridae	.	.	.	3	.	37	13	5	26	3	.
<u>Oncorhynchus gorbuscha</u>	.	.	.	35	.	.	.	.	.	.	.
Unidentified	.	.	16	.	.	5	12	.	.	.	37
<u>Gasterosteus aculeatus</u>	.	.	.	.	.	.	.	.	.	5	20
<u>Hexagrammos stelleri</u>	10	10	.	.	.	.	.	.	.	.	.
Scorpaenidae	.	.	.	.	.	.	10	.	.	.	.
<u>Myoxocephalus</u> type A	.	.	.	10	.	.	.	.	.	.	.
<u>Leptocottus armatus</u>	.	.	.	.	.	.	.	.	.	.	8
Hexagrammidae	.	.	.	5	.	.	.	.	.	.	.
<u>Myoxocephalus</u> type B	.	.	.	4	.	.	.	.	.	.	.
<u>Hemilepidotus jordani</u>	.	.	.	.	.	.	.	4	.	.	.

Table 16. Density of larval fish per 1000 m<sup>3</sup> from neuston (505 $\mu$ ) samples, by cruise and station, Kiliuda Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations								$\bar{X}$ (1-5)	$\bar{X}$ (6-8)
		1	2	3	4	5	6	7	8		
1	Mar 29-Apr 8	0	163	0	386	4711	-	-	-	1052	
2	Apr 10-Apr 17	69	0	1152	4715	1023	-	-	-	1392	
3	Apr 21-May 1	85	416	639	806	537	-	-	-	497	
4	May 3-May 28	54	27	180	845	362	109	11	11	294	44
5	May 31-Jun 6	0	0	28	28	24	11	23	0	16	11
6	Jun 14-Jun 26	0	0	0	33	0	(0)	12	0	7	4
7	Jun 28-Jul 18	158	17	0	26	975	43	131	682	235	285
8	Jul 21-Jul 29	264	0	114	42	0	0	79	30	84	36
9	Aug 1-Aug 9	88	23	22	344	73	0	51	48	110	33
10	Aug 15-Aug 21	636	342	85	406	69	12	137	2828	308	992
	$\bar{X}$ (1-10)	135	99	222	763	777					
	$\bar{X}$ (4-10)	171	58	61	246	215	25	63	514		

( ) = estimate; no sample taken

Table 17. Kinds and mean numbers per 1000 m<sup>3</sup> of 15 most abundant fish larvae from neuston (505µ) samples, Kiliuda Bay, Kodiak Archipelago, 1978.

Taxa	Month										
	Cruise	1	2	3	4	5	6	7	8	9	10
<u>Lyconectes aleutensis</u>	25	897	100	.	.	.	.	.	.	.	.
<u>Stichaeidae</u>	802	.	.	.	.	.	.	.	.	.	.
<u>Hexagrammos type I</u>	83	276	294	114	4	4	2	180	6	3	365
<u>Osmeridae</u>	.	.	.	.	4	4	2	180	6	3	365
<u>Myoxocephalus type A</u>	35	104	8	11	.	.	.	.	.	.	.
<u>Hexagrammos type D</u>	.	.	.	.	.	.	.	.	.	8	143
<u>Bathymasteridae</u>	.	.	9	25	4	4	.	25	36	21	30
<u>Myoxocephalus type B</u>	14	65	4	8	1	.	.	.	.	.	.
<u>Hexagrammos stelleri</u>	24	19	25	.	.	.	.	.	.	.	.
<u>Gasterosteus aculeatus</u>	.	.	.	.	.	.	.	.	.	43	19
Unidentified	33	5	4	.	.	.	.	.	10	.	3
<u>Leptocottus armatus</u>	.	.	.	.	.	.	.	37	.	4	.
<u>Ammodytes hexapterus</u>	12	14	4	1	3	.	.	.	.	.	.
<u>Lepidopsetta bilineata</u>	.	.	10	17	.	.	.	.	.	.	.
<u>Gadus macrocephalus</u>	.	.	26	.	.	.	.	.	.	.	.

Table 18. Density of larval fish per 1000 m<sup>3</sup> from neuston (505 $\mu$ ) samples, by cruise and station, Kaiuqnak Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations					$\bar{X}$ (1-5)
		1	2	3	4	5	
1	Mar 29-Apr 8	45	138	1027	99	507	363
2	Apr 10-Apr 17	0	0	0	64	97	32
3	Apr 21-May 1	155	724	1658	4116	9949	3320
4	May 3-May 28	0	17	0	0	238	51
5	May 31-Jun 6	0	0	0	34	0	7
6	Jun 14-Jun 26	0	0	0	84	0	17
7	Jun 28-Jul 18	0	93	943	436	16565	3607
8	Jul 21-Jul 29	88	0	24	1428	42	316
9	Aug 1-Aug 9	13	38	0	34	114	40
10	Aug 15-Aug 21	773	60	100	189	5983	1421
$\bar{X}$ (1-10)		107	107	375	648	3350	

Table 19. Kinds and mean numbers per 1000 m<sup>3</sup> of 15 most abundant fish larvae from neuston (505µ) samples, Kaiugnak Bay, Kodiak Archipelago, 1978.

Taxa	Month											
	Cruise	1	2	3	4	5	6	7	8	9	10	Aug
Osmeridae		.	.	.	.	.	6	2877	283	.	.	1172
<u>Hexagrammos</u> type I	227	6	2875	5	7	.	.	.	.	.	.	.
Bathymasteridae	.	.	49	3	.	.	.	640	11	7	.	.
<u>Hexagrammos</u> type D	.	.	.	.	.	.	.	.	9	17	183	.
<u>Myoxocephalus</u> type B	73	.	111	.	.	.	.	.	.	.	.	.
<u>Myoxocephalus</u> type A	12	13	144	.	.	.	.	.	.	.	.	41
<u>Hexagrammos</u> <u>stelleri</u>	35	13	84	.	.	.	.	.	.	.	.	.
<u>Hexagrammos</u> type E	.	.	.	.	.	.	.	.	.	12	63	.
<u>Psettichthys</u> <u>melanostictus</u>	.	.	.	.	.	.	.	44	.	.	.	.
<u>Ammodytes</u> <u>hexapterus</u>	.	.	.	38	.	.	.	.	.	.	.	.
<u>Lyconectes</u> <u>aleutensis</u>	14	.	16	.	.	.	.	.	.	.	.	.
Unidentified	.	.	17	.	.	.	.	5	.	.	.	.
Pleuronectidae	.	.	.	.	.	.	.	17	.	.	.	.
Scorpaenidae	.	.	.	.	.	.	6	11	.	.	.	.
Cottidae type L	.	.	.	.	.	.	6	7	.	.	.	.

Table 20. Density of fish eggs per 1000 m<sup>3</sup> from bongo (505 $\mu$ ) samples, by cruise and station, Izhut Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations								$\bar{x}$ (1-5)	$\bar{x}$ (6-8)
		1	2	3	4	5	6	7	8		
1	Mar 29-Apr 8	0	0	0	0	0	-	-	-	0	-
2	Apr 10-Apr 17	0	7	0	9	9	-	-	-	5	-
3	Apr 21-May 1	8	23	63	2	6	-	-	-	20	-
4	May 3-May 28	12	18	26	35	77	912	1801	130	34	948
5	May 31-Jun 6	48	29	38	74	0	1085	1263	4125	38	2158
6	Jun 14-Jun 26	87	165	30	42	3	2534	2650	8058	65	4414
7	Jun 28-Jul 18	364	131	40	9	42	2749	3450	6263	117	4154
8	Jul 21-Jul 29	412	46	34	39	375	1804	1475	2272	181	1850
9	Aug 1-Aug 9	194	172	2	71	44	1344	1582	1716	97	1547
10	Aug 15-Aug 21	284	77	4	50	22	1602	335	308	87	748
	$\bar{x}$ (1-10)	141	67	54	33	58	-	-	-	-	-
	$\bar{x}$ (4-10)	200	91	69	46	80	1719	1794	3267		

Table 21. Kinds and mean numbers per 1000 m<sup>3</sup> of fish eggs from bongo (505μ) samples, Izhut Bay, Kodiak Archipelago, Alaska, 1978.

Taxa	Month										Total
	Cruise	1	2	3	4	5	6	7	8	9	
Pleuronectidae	.	2	3	356	829	1692	1628	803	637	327	
<u>Theragra</u> <u>chalcogramma</u>	.	3	16	7	2	2	.	2	1	.	
<u>Hippoglossoides</u> <u>elassodon</u>	.	.	1	13	2	1	3	2	3	1	
Osmeridae	.	.	.	.	.	.	.	.	.	7	
Unidentified	.	.	1	.	.	.	.	1	+	.	
<u>Glyptocephalus</u> <u>zachirus</u>	.	.	.	.	.	1	.	.	.	.	

+ = < .5 egg/1,000 m<sup>3</sup>.

Table 22. Density of fish eggs per 1000 m<sup>3</sup> from bongo (505 $\mu$ ) samples, by cruise and station, Chiniak Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations					$\bar{X}$ (1-5)
		1	2	3	4	5	
1	Mar 29-Apr 8	0	6	9	5	0	4
2	Apr 10-Apr 17	227	14	81	13	57	78
3	Apr 21-May 1	166	2	78	12	113	74
4	May 3-May 28	250	23	119	439	152	197
5	May 31-Jun 6	292	25	54	374	437	236
6	Jun 14-Jun 26	2038	783	258	337	431	769
7	Jun 28-Jul 18	22772	852	191	84	15	4783
8	Jul 21-Jul 29	2698	596	185	43	23	709
9	Aug 1-Aug 9	6189	657	101	11	20	1396
10	Aug 15-Aug 21	4899	427	13	2	19	1072
$\bar{X}$ (1-10)		3953	338	109	132	127	

Table 23. Kinds and mean numbers per 1000 m<sup>3</sup> of fish eggs from bongo (505μ) samples, Chiniak Bay, Kodiak Archipelago, Alaska, 1978.

Taxa	Month										Aug
	Cruise	1	2	3	4	5	6	7	8	9	
Pleuronectidae	2	56	46	120	235	757	4770	707	1394	1071	
<u>Theragra</u> <u>chalcogramma</u>	2	20	18	42	1	11	2	.	.	.	
<u>Hippoglossoides</u> <u>elassodon</u>	.	3	7	31	.	2	10	2	2	.	
Unidentified	1	.	2	2	.	.	.	.	.	1	

Table 24. Density of fish eggs per 1000 m<sup>3</sup> from bongo (505μ) samples, by cruise and station, Kiliuda Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations								$\bar{X}$ (1-5)	$\bar{X}$ (6-8)
		1	2	3	4	5	6	7	8		
1	Mar 29-Apr 8	480	58	34	0	138	-	-	-	142	
2	Apr 10-Apr 17	132	122	11	4	81	-	-	-	70	
3	Apr 21-May 1	131	56	38	207	192	-	-	-	125	
4	May 3-May 28	16	230	19	68	126	100	29	418	92	182
5	May 31-Jun 6	51	326	206	650	45	969	161	1760	256	963
6	Jun 14-Jun 26	54	489	49	865	449	3333	1245	4307	381	2962
7	Jun 28-Jul 18	2148	680	419	771	1130	2734	3681	4494	1030	3636
8	Jul 21-Jul 29	1884	1368	173	768	237	2557	3093	2084	886	2578
9	Aug 1-Aug 9	1437	1030	527	485	338	1736	3161	4142	763	3013
10	Aug 15-Aug 21	472	1389	63	663	425	1518	1700	2058	602	1759
	$\bar{X}$ (1-10)	680	575	375	448	316					
	$\bar{X}$ (4-10)	866	787	524	610	393	1850	1867	2752		

Table 25. Kinds and mean numbers per 1000 m<sup>3</sup> of fish eggs from bongo (505μ) samples, Kiliuda Bay, Kodiak Archipelago, Alaska, 1978.

Taxa	Month Cruise	1	2	3	4	5	6	7	8	9	10
				Apr	May	Jun	Jun	Jul	Jul	Aug	Aug
Pleuronectidae		114	57	83	125	519	1348	2006	1521	1605	1035
<u>Theragra</u> <u>chalcogramma</u>		28	12	40	1	3	1	1	.	.	.
Unidentified		.	1	1	.	.	.	.	.	2	1
<u>Hippoglossoides</u> <u>elassodon</u>		.	.	1	.	.	.	.	.	.	47
<u>Glyptocephalus</u> <u>zachirus</u>		.	.	.	+	.	.	.	.	.	.

< .5 egg/1000 m<sup>3</sup>

Table 26. Density of fish eggs per 1000 m<sup>3</sup> from bongo (505 $\mu$ ) samples, by cruise and station, Kaiognak Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations					$\bar{X}$ (1-5)
		1	2	3	4	5	
1	Mar 29-Apr 8	45	211	64	90	19	86
2	Apr 10-Apr 17	36	329	72	7	394	168
3	Apr 21-May 1	203	631	104	74	404	283
4	May 3-May 28	0	172	5	34	0	42
5	May 31-Jun 6	0	26	2	39	12	16
6	Jun 14-Jun 26	11	47	52	15	168	59
7	Jun 28-Jul 18	2648	132	14	135	7	587
8	Jul 21-Jul 29	78	286	278	52	50	149
9	Aug 1-Aug 9	807	438	28	1510	460	649
10	Aug 15-Aug 21	421	64	72	21	211	158
$\bar{X}$ (1-10)		425	234	69	198	172	

Table 27. Kinds and mean numbers per 1000 m<sup>3</sup> of fish eggs from bongo (505μ) samples, Kaiugnak Bay, Kodiak Archipelago, Alaska, 1978.

Taxa	Month Cruise	1	2	3	4	5	6	7	8	9	10
Pleuronectidae		23	73	90	41	5	59	587	149	649	157
<u>Theragra</u> <u>chalcogramma</u>		62	89	79	+	5	.	.	.	.	.
<u>Hippoglossoides</u> <u>elassodon</u>		1	3	107	.	5	.	.	.	.	.
Unidentified		.	3	8	.	1	.	.	.	.	.
<u>Glyptocephalus</u> <u>zachirus</u>		.	.	.	1	+	.	.	.	.	.

+ = < .5 egg/1,000 m<sup>3</sup>.

Table 28. Density of larval fish per 1000 m<sup>3</sup> from bongo (505 $\mu$ ) samples, by cruise and station, Izhut Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations								$\bar{X}$ (1-5)	$\bar{X}$ (6-8)
		1	2	3	4	5	6	7	8		
1	Mar 29-Apr 8	172	243	31	55	268	-	-	-	154	-
2	Apr 10-Apr 17	221	151	54	116	71	-	-	-	123	-
3	Apr 21-May 1	275	262	78	127	50	-	-	-	158	-
4	May 3-May 28	91	87	149	296	255	217	307	417	176	314
5	May 31-Jun 6	155	117	86	187	219	379	111	199	153	230
6	Jun 14-Jun 26	1644	1882	52	128	11	4449	3197	534	743	2727
7	Jun 28-Jul 18	47867	5359	3858	14038	5719	88806	58975	22227	16112	56669
8	Jul 21-Jul 29	1147	648	408	1278	0	2239	1384	4878	696	2834
9	Aug 1-Aug 9	4127	1769	72	246	503	7277	17167	13752	1343	12732
10	Aug 15-Aug 21	48567	864	3114	7561	7864	27922	8252	3673	13594	13282
	$\bar{X}$ (1-10)	10427	1138	790	2403	1496	-	-	-	-	-
	$\bar{X}$ (4-10)	14800	1532	1106	3391	2082	18756	12770	6526		

Table 29. Kinds and mean numbers per 1000 m<sup>3</sup> of 15 most abundant fish larvae from bongo (505µ) samples, Izhut Bay, Kodiak Archipelago, Alaska, 1978.

Taxa	Month										Aug
	Cruise	1	2	3	4	5	6	7	8	9	
Osmeridae	.	.	.	.	.	.	1339	30519	1459	5478	13323
Bathymasteridae	.	.	+	27	85	69	91	4	25	3	
<u>Ammodytes hexapterus</u>	121	49	26	13	2	.	1	.	.	.	
Cottidae type L	.	1	1	2	9	15	99	8	33	17	
<u>Psettichthys melanostictus</u>	.	.	.	.	6	20	27	7	36	88	
Cottidae Type I	10	13	18	9	12	10	42	1	3	.	
<u>Lepidopsetta bilineata</u>	.	12	33	50	14	8	.	.	.	.	
<u>Icelinus</u> spp.	.	.	.	1	5	2	17	3	27	25	
<u>Myoxocephalus</u> type B	.	6	22	22	2	.	.	.	.	.	
<u>Lumpenus medius</u>	1	1	1	29	8	1	.	.	.	.	
Cyclopteridae	.	1	7	11	4	2	12	2	1	1	
<u>Theragra chalcogramma</u>	.	16	14	4	.	.	.	.	.	.	
<u>Anoplarchus</u> spp.	.	.	3	8	9	6	2	.	.	.	
<u>Myoxocephalus</u> type A	7	4	12	5	+	.	.	.	.	.	
<u>Sebastes</u> spp.	.	.	.	2	1	2	2	2	4	13	

+ = <.5 larvae/1000 m<sup>3</sup>

Table 30. Density of larval fish per 1000 m<sup>3</sup> from bongo (505 $\mu$ ) samples, by cruise and station, Chiniak Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations					$\bar{X}$ (1-5)
		1	2	3	4	5	
1	Mar 29-Apr 8	1382	30	75	56	41	317
2	Apr 10-Apr 17	745	87	92	19	27	194
3	Apr 21-May 1	1054	335	183	293	25	378
4	May 3-May 28	249	147	254	73	109	166
5	May 31-Jun 6	77	47	173	30	79	81
6	Jun 14-Jun 26	318	64	48	113	50	119
7	Jun 28-Jul 18	27685	4767	883	170	30	6707
8	Jul 21-Jul 29	5259	2881	677	400	424	1928
9	Aug 1-Aug 9	8442	2496	209	118	153	2284
10	Aug 15-Aug 21	7119	784	451	486	163	1801
$\bar{X}$ (1-10)		5233	1164	305	176	110	

Table 31. Kinds and mean numbers per 1000 m<sup>3</sup> of 15 most abundant fish larvae from bongo (505µ) samples, Chiniak Bay, Kodiak Archipelago, Alaska, 1978.

Taxa	Month										Aug	10
	Cruise	1	2	3	4	5	6	7	8	9		
Osmeridae	.	.	.	.	1	1	16	6588	1831	2228	1709	.
<u>Ammodytes hexapterus</u>	217	57	153	29	1	.	.	.	.	.	.	.
<u>Lepidopsetta bilineata</u>	3	31	87	37	9	6	26	5	3	3	.	.
<u>Lumpenus medius</u>	44	50	51	12	1	3	.	.	1	.	.	.
Bathymasteridae	.	.	.	10	28	17	17	7	13	13	30	53
Cottidae type L	.	2	1	1	+	3	13	26	11	8	8	19
<u>Psettichthys melanostictus</u>	.	.	.	.	2	2	18	14	8	19	.	.
<u>Lumpenus maculatus</u>	20	28	10	3	1	.	.	.	.	.	.	.
Unidentified	1	1	7	.	3	49	.	.	1	1	1	1
<u>Myoxocephalus type B</u>	8	1	11	25	1	.	.	.	.	.	.	.
<u>Hippoglossoides elassodon</u>	.	.	.	5	2	1	14	8	1	1	+	+
Cottidae type I	.	2	7	2	8	7	4	1	.	.	1	1
Gadidae	.	.	14	15	1	.	.	.	.	.	.	.
<u>Sebastes</u> spp.	.	.	.	.	.	5	9	1	4	10	10	10
<u>Theragra chalcogramma</u>	2	10	15	.	1	.	.	1	.	.	.	.

+ = <.5 larvae/1000 m<sup>3</sup>

Table 32. Density of larval fish per 1000 m<sup>3</sup> from bongo (505μ) samples, by cruise and station, Kiliuda Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations								$\bar{X}$ (1-5)	$\bar{X}$ (6-8)
		1	2	3	4	5	6	7	8		
1	Mar 29-Apr 8	269	386	77	74	872	-	-	-	336	-
2	Apr 10-Apr 17	178	115	15	107	761	-	-	-	235	-
3	Apr 21-May 1	169	963	67	137	154	-	-	-	298	-
4	May 3-May 28	179	90	2	55	135	98	199	80	92	126
5	May 31-Jun 6	21	193	106	73	277	54	21	63	134	46
6	Jun 14-Jun 26	42	74	47	129	58	30	111	370	70	170
7	Jun 28-Jul 18	444	1759	615	1840	587	278	892	1601	1049	924
8	Jul 21-Jul 29	101	369	89	125	112	206	158	437	159	267
9	Aug 1-Aug 9	155	597	487	2066	919	70	114	686	845	290
10	Aug 15-Aug 21	1708	3697	1120	564	2793	392	2711	11937	1976	5013
$\bar{X}$ (1-10)		327	824	263	517	667					
$\bar{X}$ (4-10)		379	968	352	693	697	1128	762	2168		

Table 33. Kinds and mean numbers per 1000 m<sup>3</sup> of 15 most abundant fish larvae from bongo (505µ) samples, Kiliuda Bay, Kodiak Archipelago, Alaska, 1978.

Taxa	1	2	3	4	5	6	7	8	9	10
Month Cruise										
Osmeridae	.	.	.	.	.	25	889	155	592	3069
<u>Lumpenus medius</u>	135	79	37	5	1	1	.	.	.	.
<u>Ammodytes hexapterus</u>	92	45	31	24	2	.	.	.	.	.
<u>Lepidopsetta bilineata</u>	8	11	63	26	21	8	+	2	.	.
<u>Theragra chalcogramma</u>	2	5	102	.	.	.	.	.	.	.
<u>Psettichthys melanostictus</u>	.	.	.	1	5	20	24	8	7	7
Bathymasteridae	.	.	6	11	14	7	7	6	12	3
<u>Myoxocephalus type B</u>	13	18	30	.	.	+	.	.	.	.
Cottidae type L	4	.	.	2	8	13	13	4	4	11
<u>Lumpenus maculatus</u>	9	26	6	.	.	.	+	.	.	.
<u>Isopsetta isolepis</u>	.	.	.	.	+	1	34	3	2	.
<u>Lumpenus sagitta</u>	26	12	.	1	.	.	.	.	.	.
Cyclopteridae	1	6	4	3	9	7	1	3	1	1
Cottidae type I	4	8	5	2	6	4	6	.	.	.
<u>Myoxocephalus type A</u>	19	7	6	2	1	.	.	.	.	.

+ = <.5 larvae/1000 m<sup>3</sup>

Table 34. Density of larval fish per 1000 m<sup>3</sup> from bongo (505 $\mu$ ) samples, by cruise and station, Kaiugnak Bay, Kodiak Archipelago, Alaska, 1978.

Cruise	Date	Stations					$\bar{X}$ (1-5)
		1	2	3	4	5	
1	Mar 29-Apr 8	132	238	89	714	286	292
2	Apr 10-Apr 17	209	168	108	143	601	246
3	Apr 21-May 1	395	376	237	358	234	320
4	May 3-May 28	24	77	65	417	145	146
5	May 31-Jun 6	17	117	47	233	130	109
6	Jun 14-Jun 26	124	23	76	230	204	131
7	Jun 28-Jul 18	0	191	208	444	114	191
8	Jul 21-Jul 29	155	115	46	161	205	136
9	Aug 1-Aug 9	436	139	126	1963	291	591
10	Aug 15-Aug 21	298	468	954	5389	857	1593
	$\bar{X}$ (1-10)	179	191	196	1005	307	

Table 35. Kinds and mean numbers per 1000 m<sup>3</sup> of 15 most abundant fish larvae from bongo (505μ) samples, Kaiugnak Bay, Kodiak Archipelago, Alaska, 1978.

Taxa	Month										
	Cruise	1	2	3	4	5	6	7	8	9	10
Osmeridae	.	.	.	.	.	.	46	114	68	547	1551
<u>Ammodytes hexapterus</u>	175	96	63	15	5	3	.	.	.	.	.
<u>Lepidopsetta bilineata</u>	7	7	111	36	15	30	.	.	.	.	.
Bathymasteridae	.	.	5	75	53	8	16	4	7	1	1
<u>Myoxocephalus</u> type B	29	47	53	+	2	.	.	.	.	.	.
Cottidae type L	.	1	.	.	1	17	6	15	8	20	57
<u>Lumpenus maculatus</u>	13	34	7	1	.	.	.	.	.	1	4
<u>Psettichthys melanostictus</u>	.	.	.	.	1	1	24	11	8	4	.
<u>Gadus macrocephalus</u>	.	.	33	.	.	.	.	.	.	.	.
Cottidae type I	11	1	5	4	7	3	.	.	1	.	.
<u>Lumpenus medius</u>	11	12	3	.	2	1	.	.	1	.	.
<u>Isopsetta isolepis</u>	.	.	.	.	.	.	16	7	4	1	1
<u>Gymnocanthus</u> spp.	14	8	2	2	1	.	.	.	.	.	.
Gadidae	3	.	17	2	1	1	.	1	1	.	.
<u>Hippoglossoides elassodon</u>	.	.	1	.	1	3	9	2	4	4	4

+ = <.5 larvae/1000 m<sup>3</sup>

Table 36. Neuston caught larval fishes not found among the 15 most abundant taxa, by bay, Kodiak Archipelago near-shore zooplankton research, March-August, 1978.\*

Taxa	Izhut	Chiniak	Kiliuda	Kaiugnak
<u>Oncorhynchus gorbuscha</u>			+	-
<u>Mallotus villosus</u>	-	-	+	-
Gadidae	-	-	+	+
<u>Theragra chalcogramma</u>	-	-	+	-
<u>Gasterosteus aculeatus</u>	+			+
Scorpaenidae			+	
<u>Sebastes</u> spp.	-	+	+	-
Hexagrammidae	+		+	-
<u>Hexagrammos</u> type E	+		+	
Cottidae	+	-	+	+
<u>Artedius</u> type 1	+	-	-	-
<u>Blepsias</u> spp.	-	-	-	+
<u>Hemilepidotus jordani</u>	-		+	-
<u>Leptocottus armatus</u>	+			+
<u>Radulinus asprellus</u>	+	-	-	-
Cottidae type I		-	-	+
Cottidae type L		-	+	
Agonidae	-	-	+	-
Cyclopteridae	+	+	-	-
Stichaeidae	-	-		+
<u>Chirolophis</u> spp.	+	-	+	-
<u>Lyconectes aleutensis</u>	+	-		
Pleuronectidae	-	-	+	-
<u>Hippoglossoides elassodon</u>	+	-	-	-
<u>Isopsetta isolepis</u>	-	-	+	-
<u>Lepidopsetta bilineata</u>	-	-		+
<u>Limanda aspera</u>	-	-	+	-
<u>Platichthys stellatus</u>	-	-	-	+

\*Some of the species listed above may occur among the 15 most abundant taxa in 1-3 bays. Therefore,

(+) = not among 15 most abundant.

(-) = not found in bay.

Blank = among 15 most abundant taxa.

Table 37. Bongo caught larval fishes not found among the 15 most abundant taxa, by bay, Kodiak Archipelago near-shore zooplankton research, March-August, 1978.\*

Taxa	Z	C	L	G
Bathylagidae	-	+	-	-
<u>Mallotus villosus</u> (juvenile)	+	-	+	-
Myctophidae	+	+	+	+
Gadidae	+		+	
<u>Gadus macrocephalus</u>	+	-	-	
<u>Microgadus proximus</u>	-	+	-	+
<u>Theragra chalcogramma</u>				+
<u>Lycodes</u> spp.	+	-	-	+
Scorpaenidae	+	+	+	+
<u>Sebastes</u> spp.			+	+
<u>Sebastolobus</u> spp.	+	+	+	-
<u>Hexagrammos stelleri</u>	+	+	-	-
<u>Hexagrammos</u> type D	-	-	+	-
<u>Hexagrammos</u> type I	+	+	+	+
<u>Ophiodon elongatus</u>	-	+	-	-
Cottidae	+	+	+	+
<u>Artedius</u> type 1	+	+	+	+
<u>Artedius</u> type 2	+	+	+	-
<u>Clinocottus</u> spp.	+	+	+	-
<u>Cottus</u> spp.	-	-	+	-
<u>Dasycottus setiger</u>	+	+	+	+
<u>Enophrys</u> spp.	+	-	+	
<u>Gymnocanthus</u> spp.	+	+	+	-
<u>Hemilepidotus</u> spp.	-	+	+	+
<u>Hemilepidotus hemilepidotus</u>	+	+	-	+
<u>Hemilepidotus jordani</u>	+	-	+	-
<u>Icelinus</u> spp.		+	+	+
<u>Leptocottus armatus</u>	+	+	+	-
<u>Malacocottus</u> spp.	+	+	-	+
<u>Myoxocephalus</u> type A		+		+
<u>Psychrolutes</u> type	-	-	+	-
<u>Radulinus asprellus</u>	+	+	+	+
<u>Triglops</u> spp.	-	+	-	+
Cottidae type 2	-	-	+	-
Agonidae	+	+	+	+
Cyclopteridae		+		+
<u>Ptilichthys goodei</u>	-	+	-	+
Stichaeidae	+	+	+	+
<u>Anoplarchus</u> spp.		+	+	+
<u>Chirolophis</u> spp.	+	-	+	+

Table 37. Bongo caught larval fishes not found among the 15 most abundant taxa, by bay, Kodiak Archipelago near-shore zooplankton research, March-August, 1978.\* - Continued.

Taxa	Z	C	L	G
<u>Lumpenella longirostris</u>	+	+	+	+
<u>Lumpenus maculatus</u>	+			
<u>Lumpenus sagitta</u>	+	+		+
<u>Poroclinus rothrocki</u>	-	-	-	+
<u>Stichaeus punctatus</u>	+	-	-	+
<u>Lyconectes aleutensis</u>	+	+	+	+
<u>Delolepis gigantea</u>	-	-	+	-
Pholidae	+	+	+	+
Pleuronectidae	-	+	+	+
<u>Glyptocephalus zachirus</u>	-	-	-	+
<u>Hippoglossoides elassodon</u>	+		+	
<u>Hippoglossus stenolepis</u>	-	-	-	+
<u>Isopsetta isolepis</u>	+	+		
<u>Limanda aspera</u>	+	+	+	+
<u>Platichthus stellatus</u>	-	-	+	-

\*Some of the species listed above may occur among the 15 most abundant taxa in 1-3 bays. Therefore,

(+) = not among 15 most abundant.

(-) = not found in bay.

Blank = among 15 most abundant taxa.

Table 38. List of scientific and common names for larval fishes and fish eggs captured with bongo and neuston nets, Kodiak Archipelago, Alaska, March-August, 1978.

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Salmonidae - trouts
<u>Oncorhynchus gorbuscha</u> - pink salmon
Osmeridae - smelts
<u>Mallotus villosus</u> - capelin
Bathylagidae - deep sea smelts
Myctophidae - lantern fishes
Gadidae - codfishes
<u>Gadus macrocephalus</u> - Pacific cod
<u>Microgadus proximus</u> - Pacific tomcod
<u>Theragra chalcogramma</u> - walleye pollock
Zoarcidae - eelpouts
<u>Lycodes</u> spp.
Bathymasteridae - ronquils
Gasterosteidae - sticklebacks
<u>Gasterosteus aculeatus</u> - threespine stickleback
Cyclopteridae - lumpfishes and snailfishes
Trichodontidae - sandfishes
<u>Trichodon trichodon</u> - Pacific sandfish
Stichaeidae - pricklebacks
<u>Anoplarchus</u> spp.
<u>Chirolophis</u> spp.
<u>Lumpenella longirostris</u> - longsnout prickleback
<u>Lumpenus maculatus</u> - daubed shanny
<u>Lumpenus medius</u> - stout eelblenny
<u>Lumpenus sagitta</u> - snake prickleback
<u>Poroclinus rothrocki</u> - whitebarred prickleback
<u>Stichaeus punctatus</u> - Arctic shanny
Pholidae - gunnels
Ptilichthyidae - quillfishes
<u>Ptilichthys goodei</u> - quillfish
Cryptacanthodidae - wrymouths
<u>Delolepis gigantea</u> - giant wrymouth
<u>Lyconectes aleutensis</u> - dwarf wrymouth

Table 38. List of scientific and common names for larval fishes and fish eggs captured with bongo and neuston nets, Kodiak Archipelago, Alaska, March-August, 1978. - Continued.

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Ammodytidae - sand lances

Ammodytes hexapterus - Pacific sand lance

Scorpaenidae - scorpionfishes

Sebastes spp.

Sebastolobus spp.

Hexagrammidae - greenlings

Hexagrammos stelleri - whitespotted greenling

Ophiodon elongatus - lingcod

Hexagrammos type D

Hexagrammos type E

Hexagrammos type I

Cottidae - sculpins

Artedius type 1

Artedius type 2

Blepsias spp.

Clinocottus spp.

Cottus spp.

Dasycottus setiger - spinyhead sculpin

Enophrys spp.

Gymnocanthus spp.

Hemilepidotus spp.

Hemilepidotus hemilepidotus - red Irish lord

Hemilepidotus jordani - yellow Irish lord

Icelinus spp.

Leptocottus armatus - Pacific staghorn sculpin

Malacocottus (?)

Myoxocephalus type A

Myoxocephalus type B

Nautichthys spp.

Psychrolutes (?)

Radulinus asprellus - slimp sculpin

Rhamphocottus richardsoni - grunt sculpin

Triglops spp.

Cottidae type 1

Cottidae type 2

Cottidae type I

Cottidae type L

Agonidae - poachers

Table 38. List of scientific and common names for larval fishes and fish eggs captured with bongo and neuston nets, Kodiak Archipelago, Alaska, March-August, 1978. - Continued.

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Pleuronectidae

- Glyptocephalus zachirus - rex sole
  - Hippoglossoides elassodon - flathead sole
  - Hippoglossus stenolepis - Pacific halibut
  - Isopsetta bilineata - rock sole
  - Limanda aspera - yellowfin sole
  - Platichthys stellatus - starry flounder
  - Pleuronectes quadrituberculatus - Alaska plaice
  - Psettichthys melanostictus - sand sole
-

Table 39. Mean temperature and salinity data at depth for Izhut Bay, Kodiak Archipelago, Alaska, March-August, 1978.

Date	Cruise	Depth												Range				
		1M				25M				50M					100M			
		°C	o/oo*	N	o/oo	°C	o/oo	N	o/oo	°C	o/oo	N	o/oo		°C	o/oo	N	o/oo
3/29-4/8	I	3.9	34.3	5	4.2	34.3	5	3.9	34.3	5	3.8	34.3	4	3.8-4.2	34.3			
4/10-4/17	II	4.4	34.2	5	4.3	34.3	5	4.2	34.3	5	4.2	34.3	4	4.2-4.2	34.2-34.3			
4/21-5/1	III	5.2	33.9	5	4.6	34.1	5	4.6	34.1	5	4.5	34.2	4	4.5-5.2	33.9-34.2			
5/3-5/28	IV	5.9	31.6	8	4.8	34.0	8	4.8	34.0	5	4.6	34.1	4	4.6-5.9	31.6-34.1			
5/31-6/6	V	6.3	33.3	8	5.5	34.1	8	5.5	34.2	5	5.3	34.2	4	5.3-6.3	33.3-34.2			
6/14-6/24	VI	8.3	33.4	8	6.5	33.9	8	6.2	34.0	5	5.8	34.0	4	5.8-8.3	33.4-34.0			
6/28-7/18	VII	8.7	33.5	8	7.2	33.7	8	7.0	33.8	5	6.8	33.9	3	6.8-8.7	33.5-33.9			
7/21-7/29	VIII	9.7	33.2	8	7.6	33.6	8	7.3	33.8	5	6.8	33.9	4	6.8-9.7	33.2-33.9			
8/1-8/9	IX	11.4	33.4	8	7.9	33.7	8	7.5	33.7	5	7.0	33.8	4	7.0-11.4	33.4-33.8			
8/15-8/21	X	10.8	33.4	8	8.9	33.7	8	8.4	33.7	5	7.2	33.9	4	7.2-10.8	33.4-33.9			
Range °C		3.9-11.4			4.2-8.9			3.9-8.4			3.8-7.2							
o/oo			31.6-34.3			33.6-34.3			33.7-34.3						33.8-34.3			

\*Each value = mean for all stations in bay  
N = number of observations.

Table 40. Mean temperature and salinity data at depth for Chiniak Bay, Kodiak Archipelago, Alaska, April-August, 1978.

Date	Cruise	Depth												Range				
		1M				25M				50M				100M		°C	o/oo	N
		°C*	o/oo*	N	°C	o/oo	N	°C	o/oo	N	°C	o/oo	N					
3/29-4/8	I	3.5	34.0	5	3.5	34.4	5	3.5	34.3	4	3.6	34.5	4	3.5-3.6	34.0-34.5			
4/10-4/17	II	4.5	33.8	5	3.9	34.1	5	3.9	34.1	4	3.8	34.1	4	3.8-4.5	33.8-34.1			
4/21-5/1	III	4.3	34.1	5	4.0	34.3	5	4.1	34.3	4	4.0	34.3	4	4.0-4.3	34.1-34.3			
5/3-5/28	IV	5.2	33.2	5	4.5	34.1	5	4.4	34.2	4	4.3	34.3	4	4.3-5.2	33.2-34.3			
5/31-6/6	V	6.8	32.1	5	5.6	34.0	5	5.5	34.0	4	5.3	34.1	4	5.3-6.8	32.0-34.1			
6/14-6/24	VI	7.1	33.5	5	5.9	34.0	5	5.8	34.0	4	5.4	34.2	4	5.4-7.1	33.5-34.2			
6/28-7/18	VII	9.2	33.2	5	7.3	33.7	5	6.9	33.8	4	6.5	33.8	4	6.5-9.2	33.2-33.8			
7/21-7/29	VIII	9.0	33.1	5	7.7	33.6	5	7.3	33.8	4	6.9	33.9	4	6.9-9.0	33.1-33.9			
8/1-8/9	IX	10.5	33.4	5	8.3	33.6	5	7.4	33.8	4	6.7	33.9	4	6.7-10.5	33.4-33.9			
8/15-8/21	X	11.3	33.3	5	9.3	33.6	5	8.7	33.6	4	7.1	33.8	4	7.1-11.3	33.3-33.8			
Range °C		3.5-11.3			3.5-9.3			3.5-8.7			3.6-7.1							
o/oo		32.1-34.1			33.6-34.4			33.6-34.3			33.8-34.5							

\*Each value = mean for all stations in bay.  
N = number of observations.

Table 41. Mean temperature and salinity data at depth for Kiliuda Bay, Kodiak Archipelago, Alaska, April-August, 1978.

Date	Cruise	Depth												Range	
		1M			25M			50M			100M				
		°C*	o/oo	*N	°C	o/oo	N	°C	o/oo	N	°C	o/oo	N	°C	o/oo
3/29-4/8	I	3.6	33.7	5	3.4	34.4	5	3.5	34.4	5	3.5	34.4	2	3.4-3.6	33.7-34.4
4/10-4/17	II	4.5	33.9	5	3.8	34.2	5	3.8	34.3	5	4.0	34.4	1	3.8-4.5	33.9-34.4
4/21-5/1	III	4.7	33.9	5	4.2	34.3	5	4.0	34.3	4	4.1	34.5	1	4.0-4.7	33.9-34.5
5/3-5/28	IV	6.8	31.2	8	5.4	33.7	8	5.1	34.1	4	4.7	34.2	3	4.7-6.8	31.2-34.1
5/31-6/6	V	7.4	31.4	8	5.7	33.8	8	5.4	33.9	5	5.6	34.1	2	5.6-7.4	31.4-34.1
6/14-6/24	VI	8.2	31.4	8	5.8	33.8	8	5.7	34.2	5	5.4	34.3	3	5.4-8.2	31.4-34.3
6/28-7/18	VII	9.7	30.7	8	7.7	33.7	8	6.7	33.8	5	5.7	34.0	2	5.7-9.7	30.7-34.0
7/21-7/29	VIII	10.6	31.4	8	8.2	33.5	8	7.2	33.7	5	7.0	33.8	1	7.0-10.6	31.4-33.8
8/1-8/9	IX	12.6	30.5	8	8.6	33.5	8	7.4	33.8	5	6.9	34.1	1	6.9-12.6	30.5-34.1
8/15-8/21	X	10.9	32.9	8	8.5	33.6	8	7.5	33.8	5	7.6	33.9	1	7.6-10.9	32.9-33.9
Range °C		3.6-10.9			3.4-8.6			3.5-7.5			3.5-7.6				
o/oo		30.5-33.9			33.5-34.4			33.7-34.4			33.8-34.5				

\*Each value = mean for all stations in bay  
N = number of observations.

Table 42. Mean temperature and salinity data at depth for Kaiugnak Bay, Kodiak Archipelago, Alaska, April-August, 1978.

Date	Cruise	Depth													
		1M		25M		50M		100M		Range					
		°C*	o/oo*	N	°C	o/oo	N	°C	o/oo	N	°C	o/oo	°C	o/oo	
3/29-4/8	I	3.7	34.1	5	3.5	34.2	5	3.5	34.3	4	3.5	34.5	2	3.5-3.7	34.1-34.3
4/10-4/17	II	4.2	34.0	5	3.9	34.2	5	3.8	34.2	3	4.1	34.3	2	3.8-4.2	34.0-34.3
4/21-5/1	III	4.6	33.8	5	4.5	34.1	5	4.3	34.2	3	4.3	33.8	2	4.3-4.6	33.8-34.2
5/3-5/28	IV	6.6	32.5	5	5.0	34.0	5	4.8	34.0	4	4.8	34.1	3	4.8-6.6	32.5-34.1
5/31-6/6	V	6.9	33.1	5	5.8	33.9	5	5.6	33.9	3	5.2	34.0	2	5.2-6.9	33.1-34.0
6/14-6/24	VI	6.6	33.4	5	5.8	34.0	5	5.6	34.1	3	5.6	34.2	2	5.6-6.6	33.4-34.2
6/28-7/18	VII	9.5	32.6	5	8.8	33.6	5	7.8	33.9	3	6.4	34.1	2	6.4-9.5	32.6-34.1
7/21-7/29	VIII	11.3	32.7	5	8.5	33.6	5	7.8	33.7	3	6.8	33.9	2	6.8-11.3	32.7-33.9
8/1-8/9	IX	12.3	33.0	5	9.7	33.5	5	8.4	33.6	3	7.3	33.8	2	7.3-12.3	33.0-33.8
8/15-8/21	X	9.4	33.5	5	8.0	33.8	5	7.6	33.8	3	7.2	33.5	2	7.2-9.4	33.5-33.8
Range °C		3.7-12.3			3.5-9.7			3.5-8.4			3.5-7.3				
o/oo			32.5-34.1			33.5-34.2			33.6-34.3			33.5-34.5			

\*Each value - mean for all stations in bay.

N = number of observations.

Table 43. Number of zooplankton samples collected by bay and gear type, Kodiak Island, Alaska, 1979.

Bay	Cruise 01* - Commando 3/4/79 - 3/16/79		RU 553		Epibenthic sled				
	Neuston		Bongo		505 $\mu$		3 mm		Epibenthic sled
	505 $\mu$	333 $\mu$	Day	Night	Day	Night	Day	Night	
Izhut	8	8	6	6	-	-	-	-	-
Kalsin-Chiniak	4	4	-	-	-	-	-	-	-
Kiliuda	8	8	6	6	-	-	-	-	-
Kaiugnak	5	5	-	-	-	-	-	-	-
Total	25	25	12	12	12	12	12	12	
Cruise total 99									
Scientific party:	Doug Rabin, Project Leader, FRI								
	Biff Bermingham, Cruise leader, FRI								

\*Cruise 01 for inshore zooplankton work in CY 1979.

## PART B: FOOD HABITS

### I. SUMMARY OF OBJECTIVES, CONCLUSIONS, AND IMPLICATION WITH RESPECT TO OCS OIL AND GAS DEVELOPMENT

The objectives of this study are to determine the food habits of several nearshore fish species with respect to season, area, habitat, and life history stage. These data may then be used, after oil production is underway in the Kodiak area, to detect disruptions in the food webs of the fish that may be caused by petroleum contaminants.

### II. INTRODUCTION

#### General Nature and Scope of Study

Exploitation of oil in the lease areas east of Kodiak Island introduces potential hazards to the marine environment, especially in the vicinity of Kodiak Island. The productive waters surrounding Kodiak now support a sizable fishing industry, which could be damaged by an oil industry. The fish living in the bays and fjords of the island are especially vulnerable to an oil spill since they would probably suffer a greater exposure to the oil than would fish living in the open waters offshore.

The food web of a fish species could be disturbed by an oil spill if it caused the depletion or contamination of critical prey types. This could, in turn, result in the depletion of fish stocks in an area or in the contamination of fish with petroleum hydrocarbons. This study will greatly increase our knowledge about the food habits and trophic relationships of the inshore fish of Kodiak Island. The baseline information will be used, if oil production is initiated in the area, to quantitatively assess the effects of oil on the feeding relationships of the inshore fish.

#### Specific Objectives

Our objectives are to determine the food habits of several nearshore pelagic and demersal fish species with respect to season, area, habitat, and life history stage.

### III. CURRENT STATE OF KNOWLEDGE

Gosho (1977) studied the feeding habits of pink salmon juveniles from stomachs taken during the summer of 1971 in Alitak and Kiliuda bays. He also collected data (unpublished) on the feeding habits of juvenile greenling and chum salmon which were caught along with the pinks. Harris and Hartt (1977) examined stomachs from 18 species of fish caught by four types of gear (towsnet, herring trawl, beach seine, trynet), in Kaiugnak, Alitak, and Ugak bays during late May to mid-September of 1976. Hunter (1979) studied the food habits of 12 species of demersal fish taken offshore near Kodiak Island during July 1977. Information from some of

his sampling may be applied to our onshore work since six of the species that he examined occur frequently inshore.

#### IV. STUDY AREA

The Kodiak Archipelago is located in the western Gulf of Alaska, southeast of the Alaska Peninsula. It is composed of many islands, 16 of which have an area greater than 18 km<sup>2</sup>; Kodiak Island (9,293 km<sup>2</sup>) and Afognak Island (1,813 km<sup>2</sup>) are the largest. Mountains rise sharply from the ocean floor to elevations of over 1,200 m. The coastline is intricately carved by deep, narrow bays and fjords, and most of the shoreline is composed of rocky bluffs and narrow beaches. The continental shelf, which is about 120 km wide, and the nearshore waters of the archipelago are among the most productive in the world and support commercial fisheries for halibut, salmon, and crab.

There is a strong marine influence on the climate, resulting in cloudy skies, moderately heavy annual precipitation, and mild temperatures for the latitude of the islands. The average maximum air temperature during the summer is about 15°C and the average minimum temperature during the winter is about -5°C (AEIDC 1975). Ice does form in the more protected inlets during the winter months, and surface water temperatures of 1°C are not uncommon. Daylight ranges from 8.25 hr at the winter solstice to 22.50 hr at the summer solstice.

Our study areas include Izhut, Kalsin, Kiliuda, and Kaiugnak bays. They are located on the east side of Afognak and Kodiak islands and represent most of the nearshore habitats of that area. Izhut Bay, which is located on Afognak Island, opens southward to the Gulf. It is 15 km long and is fringed by many protected inlets and lagoons. The mean depth at midbay is about 135 m and depths of over 200 m are found at the mouth. Izhut Bay has a fairly irregular bottom. The surrounding terrain has a moderate to low relief, and peaks reach just over 600 m. Lower-lying hills predominate at the head. Sitka spruce is the most obvious form of vegetation and some of this has been logged.

Kalsin Bay is only 11 km long and opens to the northeast into Chiniak Bay. Numerous small islands are located near the mouth. Kalsin Bay has a mean depth at midbay of about 50 m. The peaks are larger around Kalsin than around Izhut, but like Izhut, the bay head is less mountainous. Sedimentary rock predominates. Due to glaciation, there is an absence of Sitka spruce, and the principal vegetation consists of Sitka alder and willow, the latter often occurring in dense thickets in depressions such as stream basins.

Kiliuda Bay is our longest bay, reaching inland approximately 24 km. It is exposed to the southeast near the northern end of Sitkalidak Strait and has a few protected arms, bays, and small lagoons. The mean depth at midbay is about 70 m and there is a fairly irregular bottom. A sill is located off Coxcomb Point, thus making Kiliuda a true fjord. The surrounding hillsides and mountains are steep and are composed primarily of sedimentary rock with a small amount of volcanic rock. The vegetation

is much like that in Kalsin Bay, but it also has some areas of moist tundra.

Kaiugnak Bay is about 15 km long and has two large protected lagoons, Kiavak and Kaiugnak. It opens to the southeast at the southern end of Sitkalidak Strait. The bottom is irregular and the mean depth at midbay is about 80 m; however, the lagoons are quite shallow. Steep hillsides and mountains with vegetation much like those in Kalsin Bay predominate.

#### V. SOURCES, METHODS, AND RATIONAL OF DATA COLLECTION

The stomachs were collected off the R/V COMMANDO during April, May, June, July, August, November (1978), and March (1979). Our stomach sampling followed the fish sampling planned by RU #552 (Alaska Department of Fish and Game, ADF&G). As the fish were landed, they were first sorted to species. The field crew next selected specimens according to species and size; the emphasis was on both the most abundant species and on the economically important fish. Larger fish were measured and dissected in the field. Gonads were examined for level of maturity, then the stomachs were removed and placed in a Whirlpak bag along with 10% formalin. Smaller fish were preserved whole.

In the laboratory, the stomach contents of each large fish were blotted dry and then weighed to the nearest .01 g. The contents were next sorted into the lowest possible taxonomic categories, and each group was then counted and weighed to the nearest .001 g.

If the fish were small, lengths were taken for each fish in a group and then an average length was recorded. Stomach contents were pooled and the contents from the pooled stomachs were treated as above. Average numbers and weights of prey items were then calculated.

The data were stratified by species of predator, life history stage, area, month, and habitat, which will allow us to examine the effect of each variable on the feeding habits of the more frequently sampled fish. For each prey type, the mean number and weight per stomach and its frequency of occurrence within a sample were calculated.

These data will elucidate the major food web characteristics for the more abundant fish species, and thereby provide some insight into the trophic interactions between species.

#### VI. RESULTS

During 7 months of sampling, we collected stomachs from nearly 14,000 fish (Table 1). Approximately 40 species were sampled and more than 500 stomachs were collected from each of 12 species. These data are from shipboard logs and will be modified after all the stomachs have been processed and recounted in the lab. Because the types of food eaten by a fish may be dependent on its habitat, the numbers of stomachs examined are presented by bay, gear, and life history stage in Table 2.

The stomach contents in mean weight and numbers for June and July are presented by fish species, month, and life history stage in Tables 3-23. The mean stomach fullness for each sample is also indicated on these tables. Stomach fullness was rated on a scale of 1-7 where 1 indicated an empty stomach and 7 a distended one. For each of the 12 most frequently sampled species of fish, the average percent composition of major prey types by weight and number are shown in Figs. 1-7. We originally planned to use IRI values (Pinkas et al. 1971) to designate the relative importance of each prey type to the diet of a sample of fish. However, since we pooled stomachs within several of the samples so that we could process more stomachs, data on the number of stomachs in which a type of prey (frequency of occurrence) occurred was lost. Since this statistic is part of the IRI formula, we decided for this report to drop IRI values and instead to rank prey types in order of importance by weight and number, and to average these two rankings for an estimate of the overall importance of each prey type in a sample.

These data will be compared with data for April and May, which were submitted in the quarterly report for the period ending December 31, 1978. Two changes must be made, however, on the April-May tables. Weights were reported to the mg when they were actually mg x 10. For this report, the June-July weights are in mg. In addition, empty stomachs in a sample were not used to compute mean contents per stomach during April-May, whereas the total number of stomachs was used in June-July. We feel that the latter method more accurately reflects the degree of feeding by each species and that such data will be easier to use for modeling the Kodiak nearshore ecosystem.

#### Salmonidae

##### Pink Salmon

More types of prey were found in stomachs of pink salmon juveniles in June-July than in April-May, but in all 4 months, harpacticoid and/or calanoid copepods were the most important foods by weight and number (Table 3). The contribution of harpacticoids to the total weight of the pink juvenile diet decreased steadily from a high 77% in April to 7% in July whereas the contribution of the larger calanoids steadily increased from 2% in April to 41% of the total weight in July. Harpacticoids were the most important food in April-May, calanoids and harpacticoids were equally important in June and calanoids were the most important food in July. This shift to a larger prey may be a result of the juveniles growing from a mean length of 35 mm in April to 70 mm in July.

Over all 4 months, harpacticoids followed by calanoids and then gammarid amphipods were the most important foods in both numbers and weight (Fig. 1).

Only two adult pink salmon were sampled that had food in their stomachs. These were caught in July and their stomachs contained only fish.

Chum Salmon

During April, only four chum juveniles were sampled and insects were their most important food (83% of the total weight of the stomach contents). Sample sizes were larger between May and July and ranged from 76 to 367 stomachs. Harpacticoids were the most important foods during May and June but during July, both harpacticoids, because of their numbers (73% of the total number) and gammarid amphipods, because of their weight (81% of the total weight) ranked first (Table 4).

Over the four months, harpacticoids contributed more than 50% of the total number of organisms eaten by the chums while harpacticoids, gammarid amphipods, and insects each accounted for approximately 25% of the weight of the diet (Fig. 1).

Coho Salmon

Few coho have been sampled: only 15 juveniles in May, 3 in July, and 6 in June. Calanoid and harpacticoid copepods ranked first and second in importance during May and harpacticoids ranked first in July (Table 5). The coho in June relied most heavily on *Oxyrhyncha* (spider crab) larvae and then on gammarid amphipods and teleosts (fish).

OsmeridaeCapelin

Among the 33 capelin sampled in June, calanoid copepods comprised nearly 100%, by weight and number, of their diet (Table 5).

AmmodytidaeSand Lance

The sand lance depend to a great extent on small, pelagic organisms for their food, much like the pink and chum juveniles. In April-July and for both juveniles and adults, calanoid copepods were the most important food (Fig. 1). Gammarid amphipods contributed 44% by weight to the diet of the juveniles in April and barnacle (cirripede) larvae were as important as calanoids to adults in July (Table 6). Other occasionally high-ranking organisms were pandalid shrimp, harpacticoids, the cladoceran Podon and unidentified eggs.

GadidaePacific Cod

Caridean shrimp, especially Pandalus borealis was the major food of adult cod (average length of about 450 mm) and was also important but to a lesser degree to the smaller juveniles (average length of about 200 mm). Among the adults, shrimp formed 60-87% by weight of the total diet between May and July and among juveniles, shrimp formed 19-59% by weight of the diet between April and July (Table 7). Gammarid amphipods, because of their numbers, ranked high in the diet of the juveniles during April, May, and July and fish, because of their weight, ranked high during April-June.

During July, fish ranked low in the diets of the juveniles because of the low numbers consumed, even though they amounted to 45% of the total weight of the stomach contents.

In general, caridean shrimp were the major food of adult cod while gammarid amphipods were most important by number and shrimp and fish were most important by weight to the juveniles (Fig. 2).

### Walleye Pollock

Juvenile pollock fed the most heavily on small prey such as chaetognaths (in May) and calanoid copepods. Also important were unidentified crustacea and crustacean larvae in June and euphausiids and shrimp in July (Table 8). During May and July, pollock adults fed most often on shrimp and euphausiids. Also in May, fish constituted 55% of the total weight of the adult stomach contents.

### Hexagrammidae

#### Rock Greenling

The rock greenling ate a wide variety of primarily benthic foods (Table 9). Gammarid amphipods, and polychaetes in April and May, numerically prevailed in the diet of the juveniles while clam (pelecypod) siphons prevailed by weight in May and June. Even though few fish were eaten in May, they contributed 27% of the total weight of the diet and in July, decapods and hydrozoans, while low in numbers, contributed about 50% of the total weight of the diet of the juveniles.

Fish eggs contributed high numbers to the adult rock greenling diet during April, May, and July. Gammarids were also important numerically during May, June, and July. In all 4 months, brachyuran crabs were most important by weight and in May, fish composed 20% by weight of the diet.

The rock greenling juveniles ate large numbers of gammarid amphipods while the adults ate large numbers of eggs and secondarily, gammarid amphipods (Fig. 3). No one food greatly outweighed the rest. The most important organisms by weight in the juvenile diet were polychaete worms and these accounted for less than 25% of the weight of the total diet. Similarly, brachyuran crabs, which were most important in terms of weight to the adults, contributed less than 25% to the total weight of the diet.

#### Whitespotted Greenling

In May, miscellaneous decapods (including shrimp) were the most important food of the juvenile whitespotted greenling and these were followed by polychaetes and gammarid amphipods. However, in June and July, fish (including fish eggs in July) were the primary foods (Table 10). Of secondary importance during June were gammarids and polychaetes. Harpacticoids contributed 41% of the total number and brachyuran crabs contributed 22% of the total weight of the diet in July.

Caridean shrimp were the primary food of the adults in May followed by gammarid amphipods. However, in June, shrimp, crab, and fish all ranked first. Crabs were the most important food in July followed by fish and caprellid amphipods. Fish eggs in June and July constituted more than 50% of the diet by number; however, their weights were very low.

Over all 3 months, fish, brachyuran crabs and caridean shrimp contributed by weight 24, 20, and 19%, respectively, to the diet of the juveniles (Fig. 3). Harpacticoids and gammarids contributed 16 and 20% to the total numbers of prey in the diet. Fish (17%), crabs (25%), and shrimp (31%) also dominated the biomass of the adult whitespotted greenling diet while gammarid amphipods and eggs dominated in numbers (26 and 42%, respectively).

#### Masked Greenling

Gammarid and polychaetes were the most important foods to juvenile masked greenling in April, and in addition, harpacticoids contributed 41% of the number of organisms eaten. During May through July, gammarid amphipods were the primary food, ranging from 38% to 57% of the total biomass. In July, the juveniles also consumed large numbers of harpacticoids (Table 11).

The adults fed predominantly on gammarid amphipods in each of the 4 months. In addition, during April, 26% of the diet by weight was clam siphons and eggs were 27% by number.

In general, gammarids were the most important food for both juveniles and adults (Fig. 4). In the juvenile diet, polychaetes ranked high by weight and harpacticoids ranked high by weight and harpacticoids ranked high by number. Gammarids dominated the adult diet in terms of numbers, but in terms of weight, polychaetes, crab, and clam siphons closely followed gammarids in importance.

#### Kelp Greenling

Between April and July, only 13 juvenile and adult kelp greenling stomachs were taken. The six adult stomachs from May contained primarily fish eggs, gammarid amphipods, and caridean shrimp while the four taken in June and July contained mainly gammarids, brachyuran crabs, fish, and clam siphons (Table 12). The primary foods of the two juveniles taken in June were pagurid crabs and fish.

#### Cottidae

##### Yellow Irish Lord

Except for one time in 3 months (May-July), shrimp and brachyuran crabs ranked first or second in the yellow Irish lord diet. Fish, and these were primarily cottids, formed 59% by weight of the adult diet in July (Table 13). Fish were also relatively important to juveniles and adults in June.

Over all 3 months, shrimp formed 65% and 53% of the weight of juvenile and adult diets, respectively (Fig. 5). Brachyuran crabs and then gammarid amphipods (because of their large numbers) were of secondary importance to the juveniles. Fish (26% of the weight) and crabs (16% of the number and 12% of the weight) were of secondary importance to the adults.

#### Red Irish Lord

Only seven stomachs were sampled: two from adults in June and five from adults in July (Table 14). During June, fish constituted most of the diet and during July, crabs were the most important food.

#### Myoxocephalus spp.

Three species of Myoxocephalus probably occur in the Kodiak area, the most common of which is M. polyacanthocephalus, the great sculpin. Shipboard identification was somewhat difficult and was probably not always correct. For this reason, we have pooled the stomach data from all Myoxocephalus spp.

In all four months, gammarid amphipods numerically dominated (51-83% of the total numbers of prey consumed each month) the diet of the juveniles, whereas fish and brachyuran crab dominated by weight (Fig. 5). In May, fish and crab were each about 45% of the total weight of the diet. During April and July, fish composed about 50% of the weight of the diet and in June, crabs were about 50% of the total weight of the diet (Table 15).

Fish were by far the most important food of the adults, ranging from 66% of the total weight of the stomach contents in July to 91% in June. Crab, in each month (May-July) ranked second and in May and June, shrimp were also important numerically.

#### Trichodontidae

##### Sandfish

Only adult sandfish were sampled between May and July. The 12 stomachs that were taken in May contained mostly euphausiids (65% of the total number) and fish (87% of the total weight). The one stomach taken in June contained only brachyura megalops and unidentified crustacea (Table 16). In July, the stomach contents were dominated by fish (70% by number and 97% by weight). Fairly large numbers of euphausiids were also present.

#### Stichaeidae

##### Snake Prickleback

The snake prickleback primarily fed upon benthic organisms. One juvenile stomach containing food was taken in May and it contained polychaetes, gammarids and bivalve siphons. One taken in June contained

mainly polychaetes, then gammarids and ostracods. Gammarid amphipods were the most important food in July (Table 17) followed by fish eggs.

Among adults, those taken in June fed mostly on polychaetes (41% of the total weight) and fish eggs (90% of the total number and 33% of the weight) while those sampled in July contained mostly gammarids (97% of the total number and 73% of the weight).

#### Pholidae

##### Crescent Gunnel

The primary foods of adult crescent gunnel sampled in May-June were benthic while those of the juveniles were both benthic and pelagic. Gammarid amphipods, which are usually benthic, were the most important food for both juveniles and adults with the exception of two juveniles in July which fed mostly on epibenthic harpacticoid copepods (Table 18). Also important to the juveniles were polychaetes in April, harpacticoids and isopods in June, and calanoids in July. Polychaetes were relatively important to the adults in May (39% of the weight) and ostracods were as important as gammarids in July (62% of the number and 22% of the weight).

#### Pleuronectidae

##### Flathead Sole

Juveniles and especially adult flathead sole fed heavily on caridean shrimp (Fig. 6) and the most frequently consumed species of shrimp was Pandalus borealis. Only in April, when the juveniles were about one-half the size (80 mm) of those from other months, were shrimp unimportant. Instead, during April, 64% of the biomass of the diet was composed of polychaetes while nemertean worms ranked second in importance. No juveniles were sampled in May but in June, mysids and euphausiids were major contributors to the diet (Table 19). Among adults, however, shrimp composed 51-86% of the numbers and 84-94% of the weight of the diet each month.

##### Rock Sole

The rock sole ate a wide variety of polychaete worms (Table 20). In all 4 months, polychaetes ranked first and occasionally second in the diet of both juveniles and adults. The rock sole also snipped many clam siphons --siphons ranked first in the diet of the juveniles during April and second in May and June. They were also consumed in fairly large numbers by juveniles in May and by adults each month. Gammarid amphipods contributed a large proportion of the numbers of food items eaten by juveniles during May-July and by adults in May. Fish, which were not consumed by the juveniles to any great extent, contributed 22-50% by weight of the adult diet each month.

In general, rock sole juveniles ate primarily clam siphons (37% by number) and polychaetes (43% by weight), while adults ate primarily polychaetes, eggs, and fish (Fig. 7).

### Yellowfin Sole

Yellowfin sole ate a wide variety of foods but no organism dominated the diet in both numbers and weight (Fig. 7). Juveniles ate greater numbers of clam siphons in May, June, and July than any other food, but in April, they consumed even more unidentified eggs than clam siphons. Polychaetes were important in either numbers or weight each month and cottids contributed 29% by weight in May and fish, 40% by weight in July (Table 21).

Adults fed primarily on polychaetes (34% by number and 67% by weight) in April. However, in no other instance did one food dominate in both numbers and weight. During May, polychaetes were 41% by number, but only 8% by weight of the total diet. Clam siphons were relatively important in terms of numbers in April, May, and July. During May, June, and July, shrimp were 20% or more of the total weight of the diet and in June, fish were 20% of the total weight of the adult diet.

### Pacific Halibut

Few halibut were sampled, but the 27 juvenile stomachs that were taken during April and June yielded primarily shrimp and the 10 stomachs taken in July contained primarily fish (Table 22). The six adult stomachs taken in June and July contained mostly fish by weight and in June, there were also large numbers of shrimp.

### Anoplopomatidae

#### Sablefish

The 25 sablefish stomachs examined in June contained 95% fish by weight and 60% euphausiids by number (Table 23).

## VII. DISCUSSION

The preceding section presented the diet of each species of fish sampled during June and July. The data were stratified by month and life history stage of each predator but not by bay or gear type. In addition, family was the lowest taxon used to categorize the food organisms. Information on the prey to genus or species will be presented after all the stomachs have been processed and the data will be analyzed by gear type, bay, and perhaps length of the more frequently sampled species of fish.

The percent composition of food of the 12 most commonly sampled species of fish, averaged over April-July, are presented in Figs. 8 and 9. Data from juveniles (and adult sand lance) are presented in Fig. 8 and data from adults are shown in Fig. 9.

Three species fed predominantly on small, planktonic organisms: the sand lance (both juveniles and adults) and pink and chum salmon juveniles. All three species were caught primarily by beach seine and a few by townet. Sand lance fed mostly on calanoid copepods, while chum salmon fed

more on harpacticoid copepods than calanoids. The pink juveniles ate more harpacticoids than did the chum salmon but they also consumed large amounts of calanoid copepods. All three species ate some gammarid amphipods (which are not pelagic) but the chum juveniles consumed the most (about 20% of the total weight of the diet). This was due to the large amount of gammarids eaten during July.

None of the greenling, juveniles, or adults seemed to specialize in any one type of food. Both juvenile and adult masked greenling depended more on gammarid amphipods than did the rock or whitespotted greenlings, but the juvenile masked greenling ate more polychaetes than did the adults. The rock greenling juveniles ate more gammarids and polychaetes than other types of food, but the adult diet shifted more to crabs. Shrimp, crab, and fish formed the bulk of both the juvenile and adult whitespotted greenling diet.

Yellowfin sole ate a fairly generalized diet with the adults tending toward polychaetes and shrimp and the juveniles toward polychaetes, crab, and fish. The rock sole juveniles fed mostly on polychaetes and the adults fed mostly on fish and polychaetes. Adult flathead sole and Pacific cod diets were amazingly similar with a very high proportion of shrimp and a few crab and fish in the diet. The juveniles also ate large amounts of shrimp, but other food such as polychaetes in the juvenile flathead diet and fish in the juvenile cod diet were also fairly important.

The yellow Irish lord also consumed large numbers of shrimp but in addition, fish were fairly important to the adults. The diet of the adult Myoxocephalus, more than any other fish, was almost entirely of fish. The juveniles also consumed mostly fish, but they also ate large amounts of crab and about 10% of the diet was gammarid amphipods.

#### VIII. CONCLUSIONS

The objectives of our research are to determine the food habits of several nearshore fish species of Kodiak Island with respect to location, season, habitat, and life history stage. This report discusses food habits primarily in terms of season (spring and early summer) and life history stage.

Among the 12 most frequently sampled species of fish, zooplankton was consumed mostly by sand lance, chum and pink juveniles. Gammarid amphipods were important in terms of weight to masked greenling, rock greenling juveniles, and chum salmon juveniles. Polychaetes were important to masked greenling juveniles, rock greenling juveniles, yellowfin sole, and rock sole. Two species appeared to be shrimp specialists: flathead sole and Pacific cod (especially the adults). A large proportion of the yellow Irish lord diet was shrimp, but the adult diet also consisted nearly 30% by weight of fish. Shrimp were also important to the whitespotted greenling. Rock greenling adults, whitespotted greenling, Myoxocephalus juveniles, and yellowfin sole juveniles ate more crab than the other fish species. Only the adult

Myoxocephalus specialized by eating fish. Others, rock sole adults, cod juveniles, and Myoxocephalus juveniles ate sizable amounts of fish along with the other foods in their diets.

The greenling all appeared to eat a wide variety of foods as did the yellowfin and rock soles. In contrast, sand lance, chum and pink salmon juveniles fed mostly on calanoids, harpacticoids and gammarids, and harpacticoids, respectively. Flathead sole and Pacific cod adults fed primarily on shrimp, and yellow Irish lord adults ate shrimp, fish, and crab in descending order of importance. The Myoxocephalus adults were fish specialists. The juveniles of the last four species had more varied diets than the adults, but even so, shrimp was still the most important food to juveniles of the flathead sole, cod, and yellow Irish lord and fish was the most important food to Myoxocephalus juveniles.

#### IX. NEEDS FOR FURTHER STUDY

Not applicable at this time.

#### X. SUMMARY OF JANUARY-MARCH QUARTER

##### A. Ship or Laboratory Activities

1. Ship or Field Trip Schedule
  - a. Dates: March 3-18, 1979
  - b. Name of Vessel: R/V COMMANDO  
(Chartered)
2. Scientific Party
  - a. Names: Mr. Mark Wangerin and Mr. Chris Wilson
  - b. Affiliation: Fisheries Research Institute,  
University of Washington
  - c. Role: Fish samplers
3. Methods: Same as described in this annual report and in previous quarterly reports
4. Sample localities: See RU #552 for sampling sites
5. Data collected or analyzed
  - a. Number and Types of Samples: Stomachs from 971 fish were collected in March from about 23 species of fish.
  - b. Number and Types of Analysis: Data from the first 4 months of sampling (April-July) have been analyzed for mean numbers, weights, and IRI values of each prey type per stomach. The data are grouped by species and life history stage of predator and month. Data from August have been keypunched and will be analyzed in the same way.

## XI. AUXILIARY MATERIAL

References Used

- Arctic Environmental Information and Data Center. 1975. Kadyak. A background for living. Univ. Alaska. IX, 326 pp.
- Gosho, M. 1977. The food and feeding habits of juvenile pink salmon in the estuaries of Kodiak Island, Alaska. M.S. Thesis, Univ. Washington. 87 pp.
- Harris, C. and A. Hartt. 1977. Assessment of pelagic and nearshore fish in three bays on the east and south coasts of Kodiak Island, Alaska. Univ. Washington, Fish. Res. Inst. Final Rep. to OCSEAP/BLM. Contract No. 03-5-022-67, T.O. No. 12. 190 pp.
- Hunter, M. 1979. Food resource partitioning among demersal fishes in the vicinity of Kodiak Island. M.S. Thesis, Univ. Washington. 131 pp.
- Pinkas, L., M. S. Oliphant, and I. L. K. Iverson. 1971. Food habits of albacore, bluefin tuna, and bonito in California waters. Calif. Fish Game, Fish. Bull. 152:1-105.

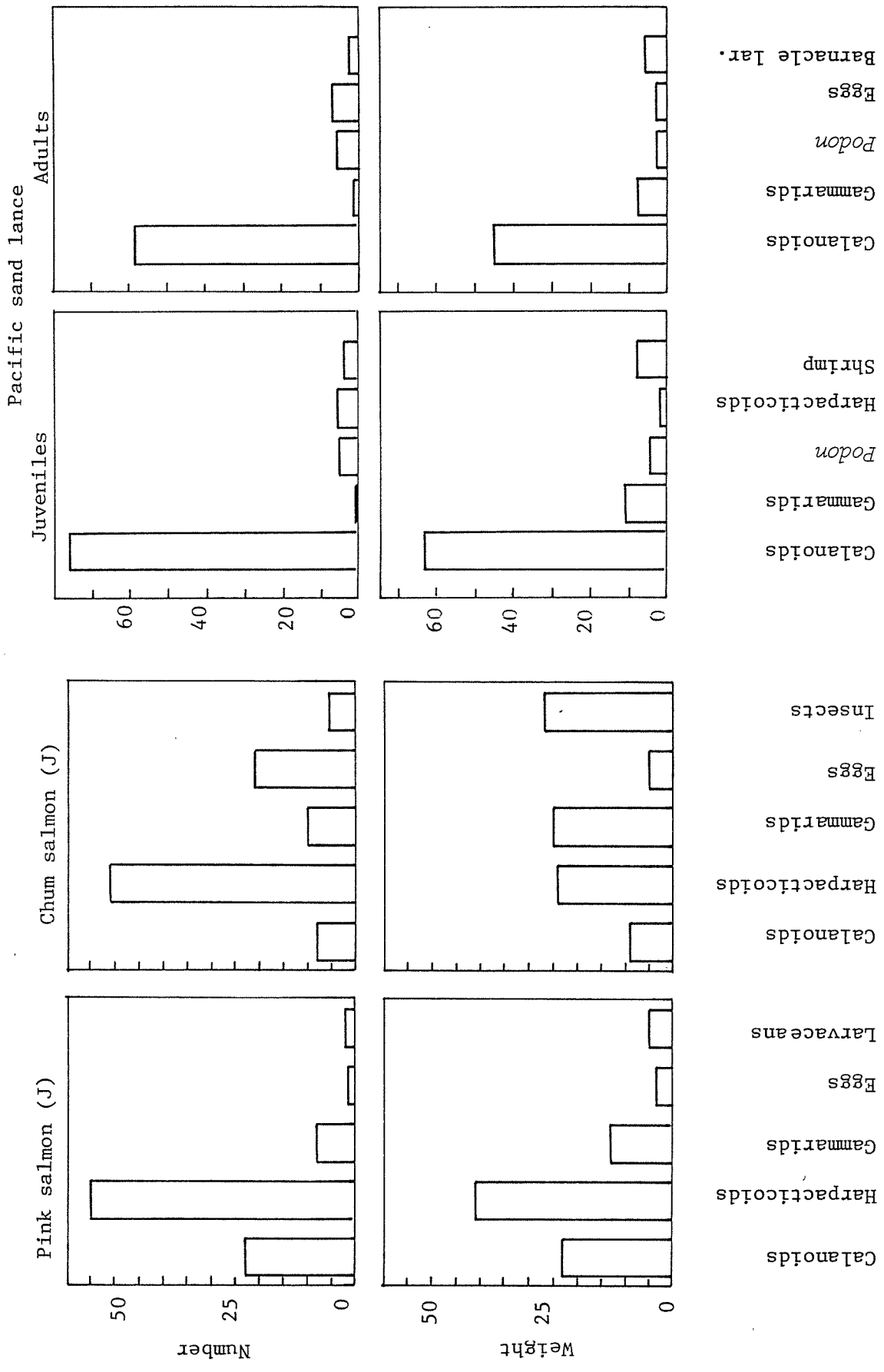


Fig. 1. Percentage composition of major food items in pink and chum salmon and Pacific sand lance. Samples primarily from beach seine hauls during May-July, 1978. (J = juvenile.)

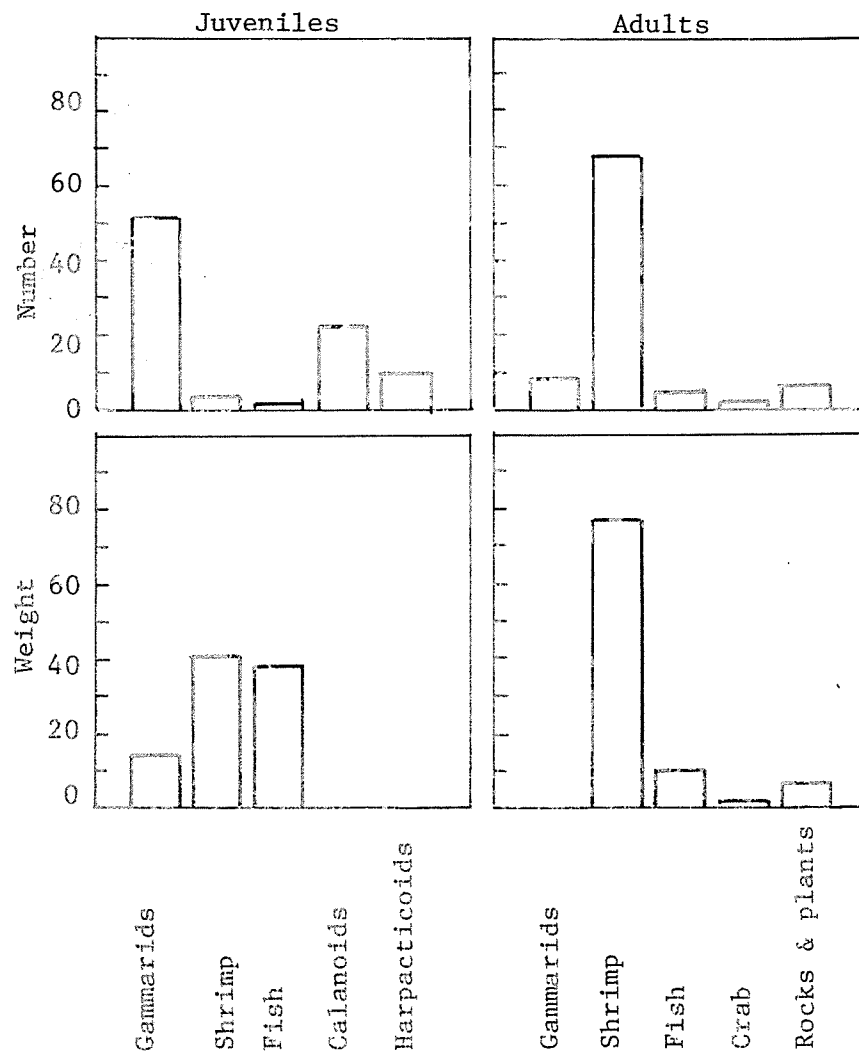


Fig. 2. Percentage composition of the major food items in Pacific cod. Juveniles from all gear and adults from otter trawls, primarily during June to July.

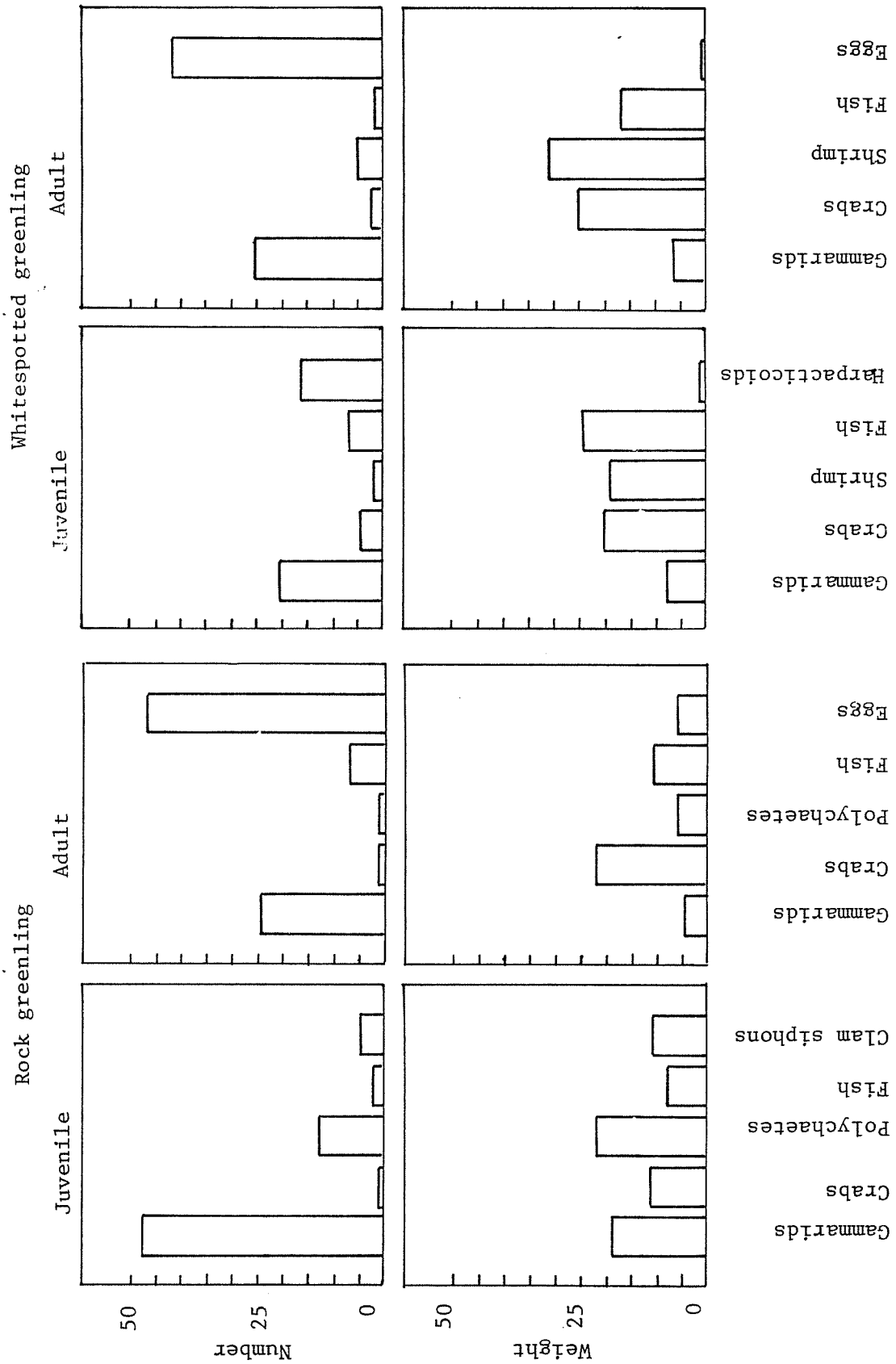


Fig. 3. Percentage composition of major food items in rock and whitespotted greenling. Samples primarily from May to July. Rock greenling from beach seine and trammel nets and whitespotted from all gears except townet.

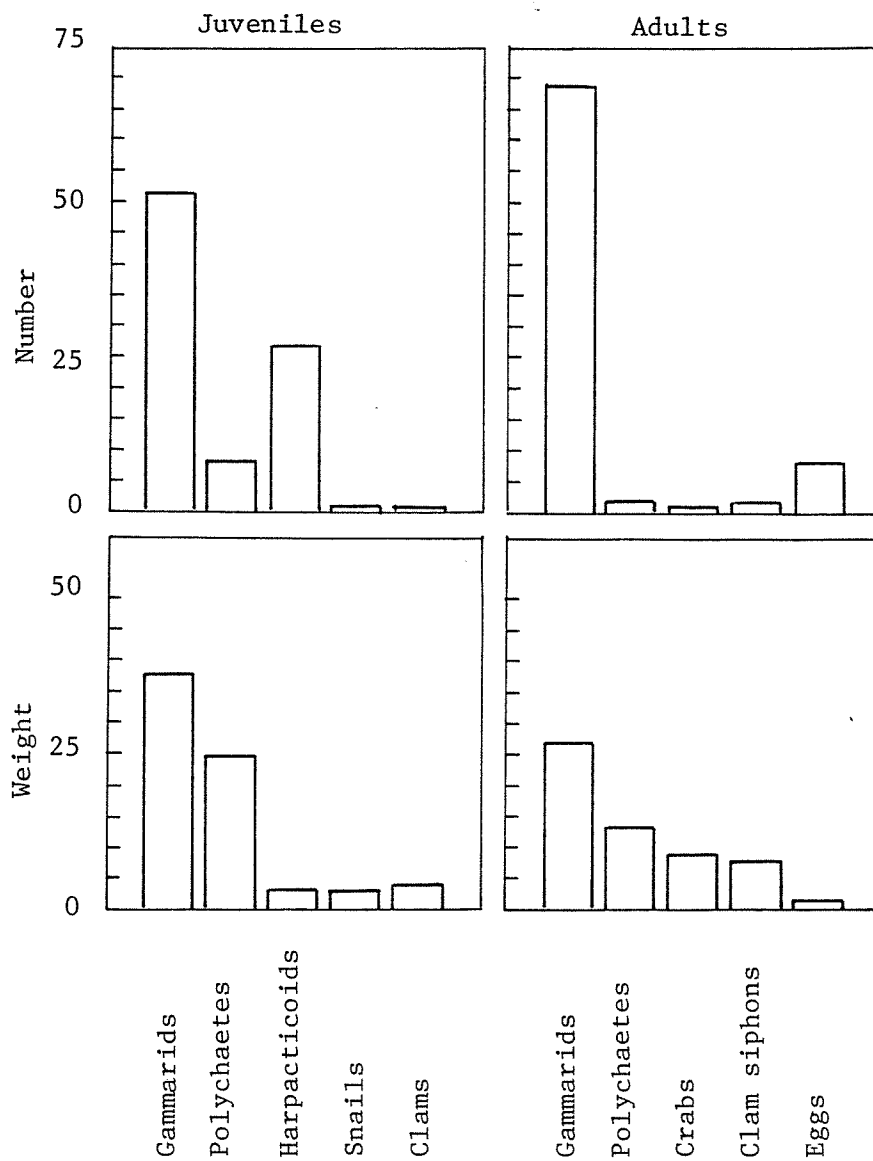


Fig. 4. Percentage composition of the major food items in masked greenling. Samples primarily from beach seine and trammel nets during May to July.

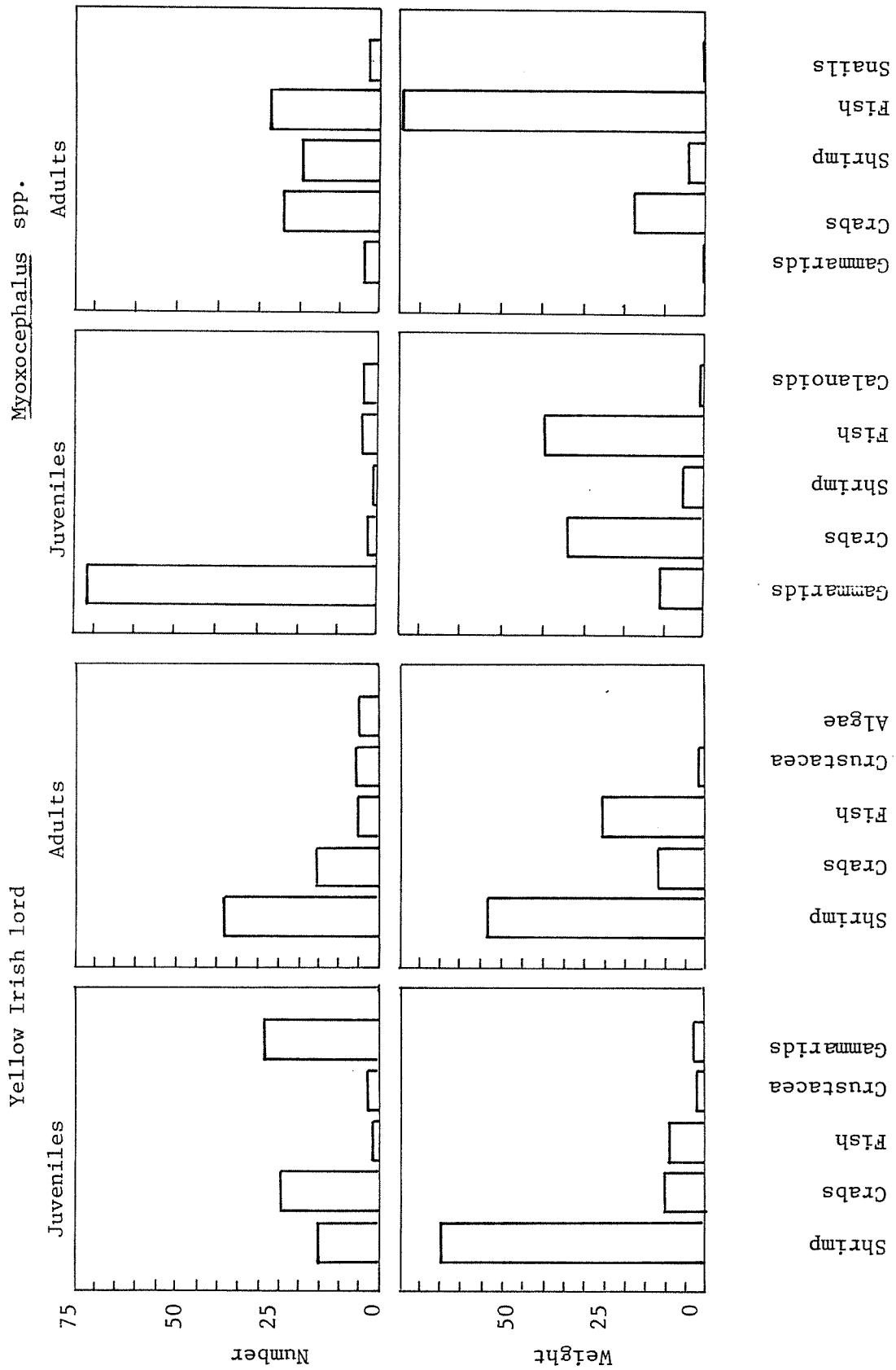


Fig. 5. Percentage composition of major food items in yellow Irish lord and Myoxocephalus. Yellow Irish lord primarily from trynet and otter trawl (Izhut and Kiliuda), whereas juvenile Myoxocephalus are primarily from beach seine and adults from all gear except townet.

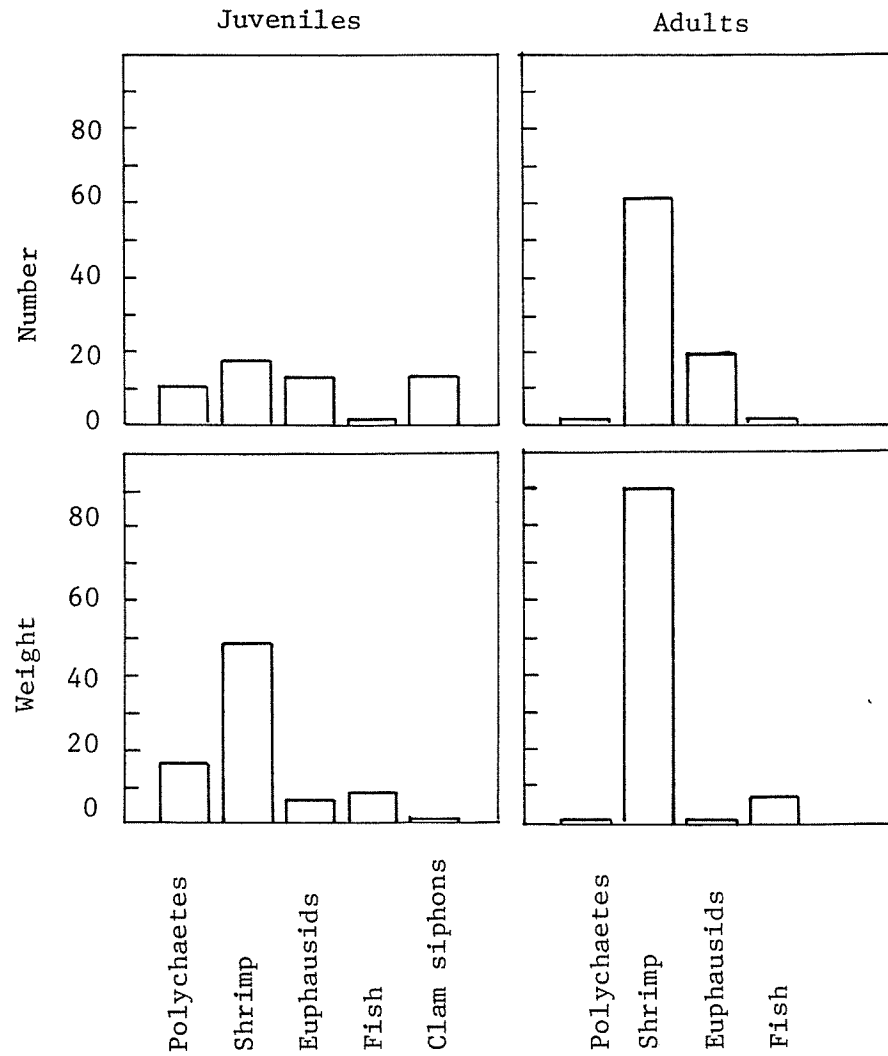


Fig. 6. Percentage composition of major food items in flathead sole during May to July. Juveniles from trynet and otter trawl and adults primarily from otter trawl in Izhut and Kiliuda bays.

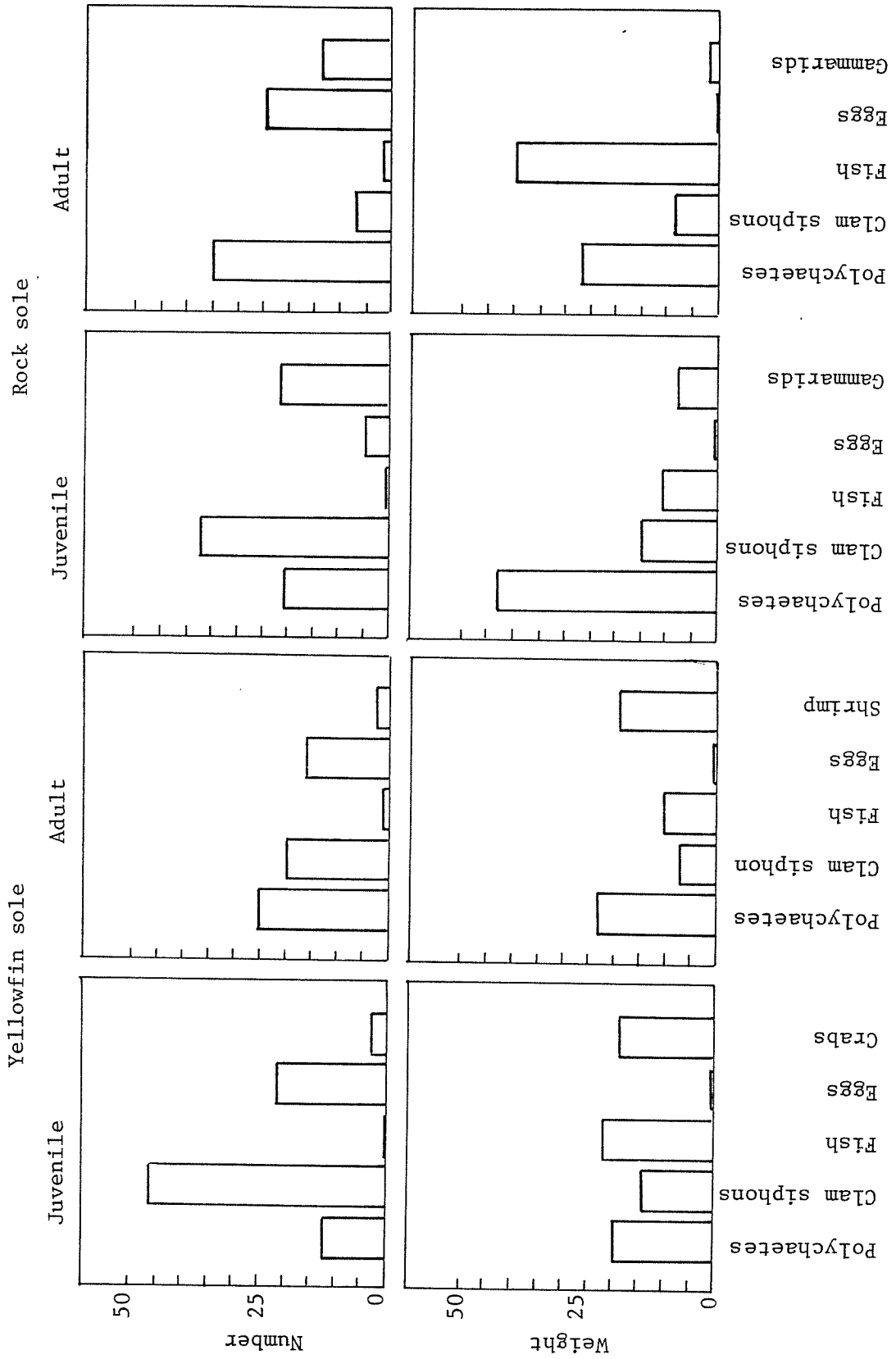


Fig. 7. Percentage composition of major food items in yellowfin and rock sole during April to July. Samples primarily from trynets.

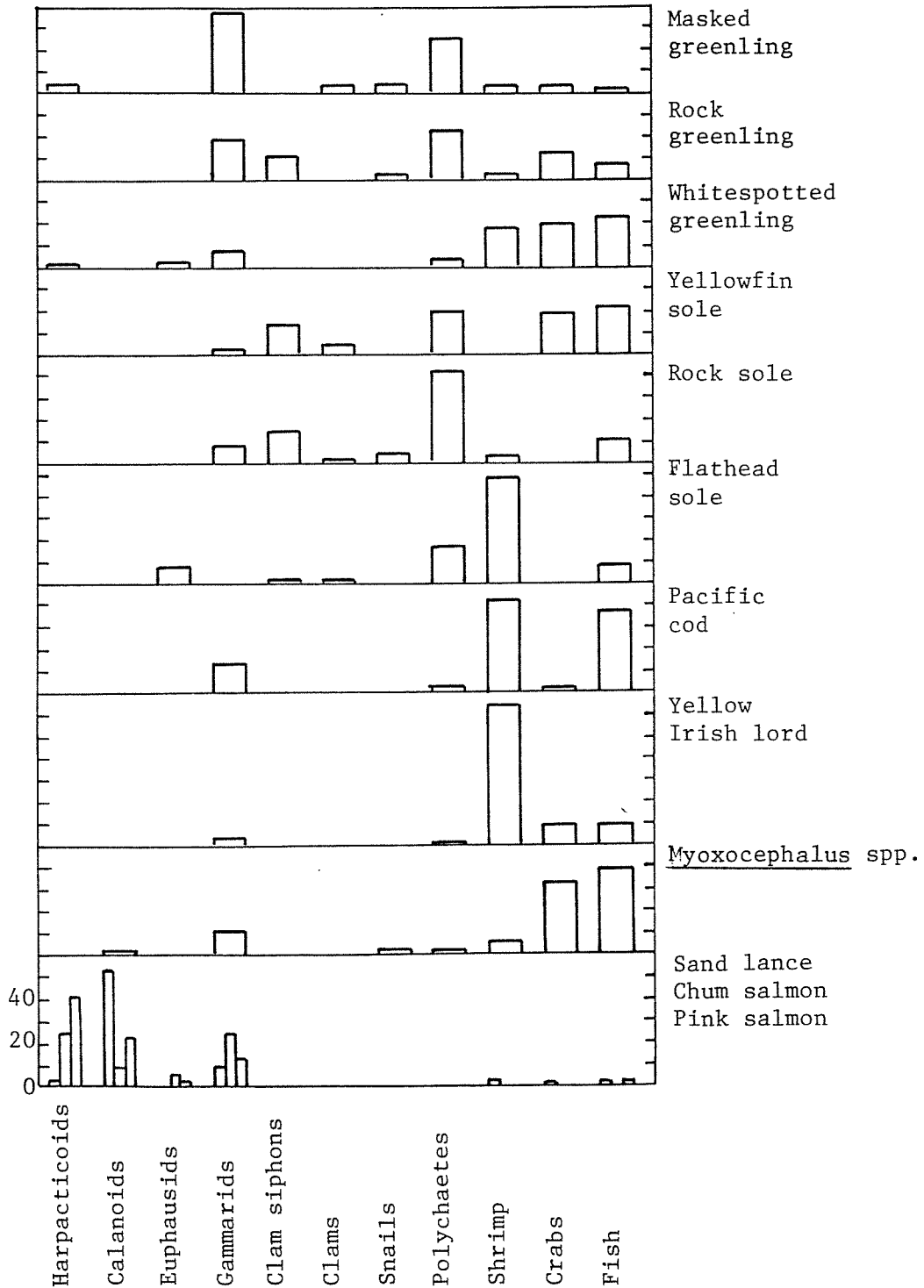


Fig. 8. Percentage composition by weight of major food items in the stomachs of juvenile fish. Composition for sand lance (juveniles and adults), chum salmon, and pink salmon from left to right, respectively.

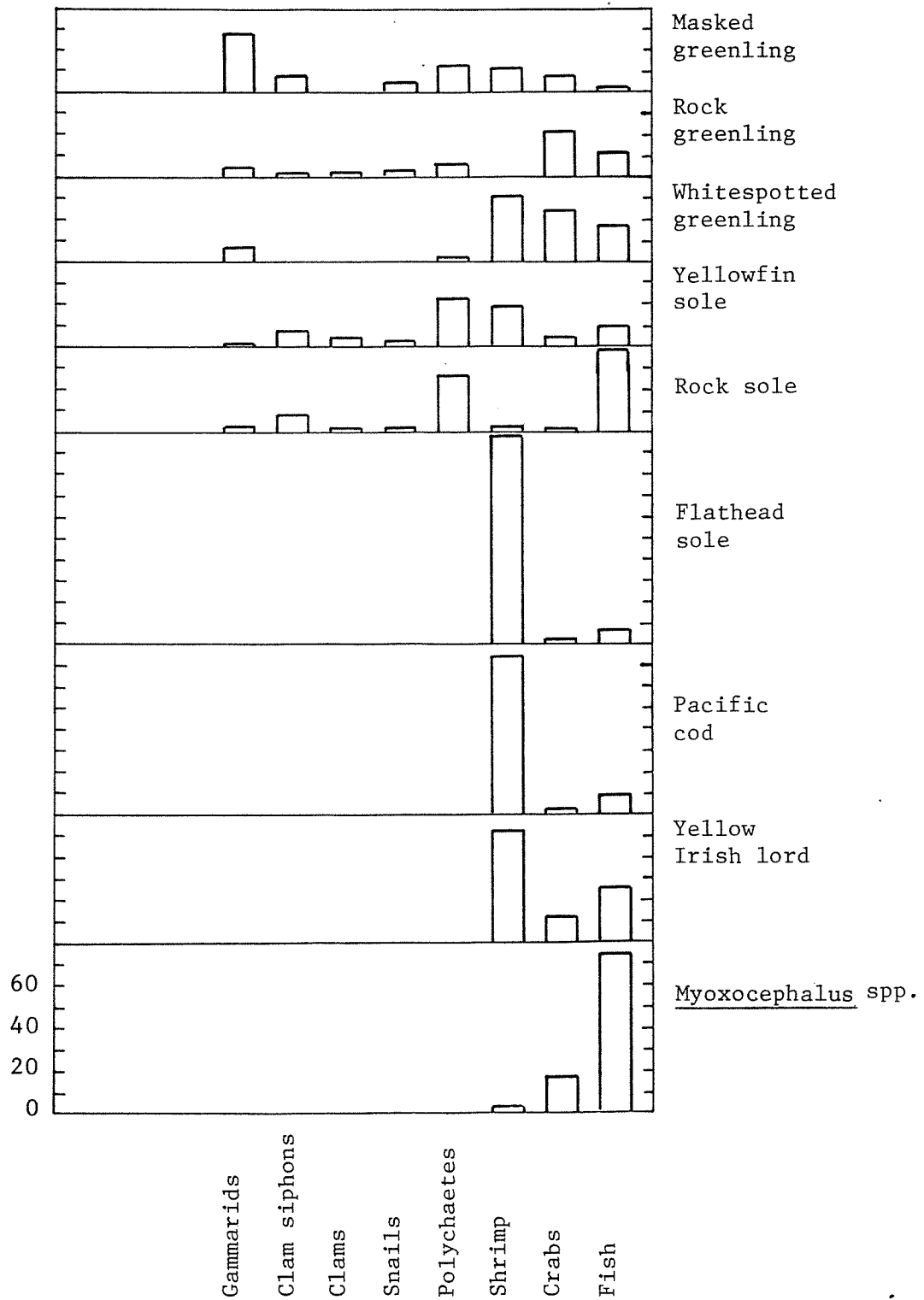


Fig. 9. Percentage composition by weight of major food items in stomachs of adult fish.

Table 1. The number of fish stomachs sampled by species and month, April–November, 1978 and March, 1979.

	April	May	June	July	August	November	March	Total
Rock sole	229	530	673	384	285	417	275	2,793
Yellowfin sole	25	381	601	249	297	267	225	2,045
Flathead sole	18	209	366	183	179	184	113	1,252
Starry flounder	3					4		7
Arrowtooth flounder	1	41						42
Butter sole		12						12
Alaska plaice	1					2		3
Pacific halibut	4		26	20				50
Rock greenling	6	78	240	177	169	105	27	802
Masked greenling	69	108	124	258	254	180	15	1,008
Whitespotted greenling		49	112	176	284	68	21	710
Kelp greenling		6	5	2	7	6	1	26
Unidentified greenling		3	4	6	5			18
<i>Myoxocephalus</i> spp.	13	84	81	97	153	158	70	656
<i>Oligocottus</i> sp.	1							1
Staghorn sculpin		1						1
<i>Gymnocephalus</i> spp.	1	7					14	22
Buffalo sculpin		2					1	3
Silverspotted sculpin	7						3	10
Yellow Irish lord	1	100	155	99	113	41	33	542
Red Irish lord			3	10	9	2		24
Pink salmon	22	220	414	150	42		1	849
Chum salmon	4	200	337	74		1	1	617
Silver salmon		15	4					19
Dolly Varden	13							13
Pacific sand lance	26	197	217	155	291	80	26	992
Eulachon						4	33	37
Capelin		1	31			1		33
Sandfish		13	1	28	42	2	6	92
Snake prickleback		2	17	40	11		4	74
Crescent gunnel		20	16	17	64	1	4	222
Penpoint gunnel					2			2
Blennioids	2							2
Daubed shanny		1						1
Shortfin eelpout						1		1
Pacific cod	21	84	97	159	121	80	32	594
Walleye pollock		81	55	47	78	62	44	367
Tomcod					9	23	21	53
Sablefish			25		35	13		73
Searcher		1						1
Prowfish				1				1
Black rockfish					4			4
Lingcod					12	5	1	18
Total	467	2,446	3,603	2,332	2,467	1,706	971	13,992

Table 2. The number of stomachs examined by bay, gear, and life history stage for the period April-July, 1978. (J = juvenile, A = adult).

Species	Bay	Gear											
		Seine		Try		Trammel		Otter trawl		Townet			
		J	A	J	A	J	A	J	A	J	A		
Rock sole	Izhut	6	5	261	305	6	31	61	49				
	Kalsin	11	11	282	173	1	40						
	Kiliuda	44	9	254	104	3	53	9	49				
	Kaiugnak	3		53	4		6						
Yellowfin sole	Izhut			71	59		1	27	93				
	Kalsin		1	291	286		11						
	Kiliuda			212	102		4	9	99				
	Kaiugnak			66	20								
Flathead sole	Izhut			181	7			82	82				
	Kalsin			138	9								
	Kiliuda			97	9			95	71				
	Kaiugnak			17									
Pacific halibut	Izhut			1		1		22	8				
	Kalsin			3	1								
	Kiliuda							12	1				
Rock greenling	Izhut	7	12			15	102					1	
	Kalsin	4				9	75						
	Kiliuda		7			8	83						
	Kaiugnak	12	16			5	134						
Whitespotted greenling	Izhut	8	6	2	8		21		5				
	Kalsin	2	6	7	13	2	20						
	Kiliuda	41	7	3	14	4	68	4	54				
	Kaiugnak	18	1	2	3	2	14						
Masked greenling	Izhut	74	30				69					2	
	Kalsin	2	12				49						
	Kiliuda	59	49	1	4	12	157				2		
	Kaiugnak	19	18		5	1	83						

Table 2. The number of stomachs examined by bay, gear, and lift history stage for the period April-July, 1978. (J = juvenile, A = adult). - Continued.

Species	Bay	Gear															
		Seine			Try			Trammel			Otter trawl			Townet			
		J	A		J	A		J	A		J	A		J	A		
Kelp greenling	Izhut	2							3						1		
	Kiliuda								2								
	Kaiugnak								5								
<u>Myoxocephalus</u> spp.	Izhut	21	2	4	1	6	4	1	1	19	1	1	19				1
	Kalsin	29	7	1	1	7	1	1	7								
	Kiliuda	27	17	9	7	2	12	2	12	2	58						
	Kaiugnak	23	2	3	2												
Yellow Irish lord	Izhut	2				20	5			14	54						
	Kalsin	1				4	2										
	Kiliuda					33	35		2	66	102						
	Kaiugnak					10	8		2								
Red Irish lord	Izhut									3							
	Kiliuda									2							
	Kaiugnak									3							
Pacific cod	Izhut	2				3		5		26	60						
	Kalsin					5		8	1								
	Kiliuda	39				26		32		41	59	9					
	Kaiugnak	23				2		1									
Walleye pollock	Izhut	1				2		1		30	3						
	Kalsin					34	2										
	Kiliuda					8				103	28						
Pacific sand lance	Izhut	67	113														
	Kalsin	12	3														
	Kiliuda	118	124														31
	Kaiugnak	32	77														



Table 3. The average number and weight (mg) of prey items per pink salmon stomach. (T = trace, J = juvenile, P = pooled\*).

	Pink salmon ( <i>Oncorhynchus gorbuscha</i> )					
	June (J)		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight
Mollusca						
Gastropoda			0.6	0.8		
Gastropod larvae	T	T	0.1	0.2		
Arthropoda						
Crustacea zoea	T	T	0.1	T		
Copepoda	1.3	0.2				
Calanoida	14.0	11.2	124.1	24.2		
Harpacticoida	18.0	10.9	32.3	4.2		
Cladocera	T	T	28.1	1.9		
Ostracoda	T	T				
Cirripedia larvae	0.3	T	17.8	2.2		
Mysidacea	0.1	0.5	0.3	0.1		
Cumacea	2.9	0.9	0.6	9.0		
Isopoda			T	T		
Sphaeromatidae			T	T		
Idoteidae			T	T		
Amphipoda						
Caprellidea			4.0	0.2		
Gammaridea	1.0	1.4	4.8	4.8		
Corophiidae	T	T	T	T		
Hyperiididea			0.1	T		
Euphausiacea	T	3.5	0.6	0.5		
Decapod zoea	0.1	0.1	0.2	T		
Anomura						
Paguridae	T	T	T	T		
Brachyura						
Oxyrhyncha			0.1	0.3		
Insecta	0.2	0.2	0.1	T		
Diptera	0.2	0.5	1.7	2.7		
Diptera larvae	0.1	0.1	0.1	0.1		
Chironomid larvae			T	T		
Chironomid pupae	T	T				
Chordata						
Urochordata						
Larvacea			0.9	2.1		
Vertebrata						
Teleostei	T	0.1			2.2	2,653
Unidentified	1.1	4.1	10.8	1.1		
Total number stomachs		371		119		6
Number empty stomachs		P		P		4
Mean stomach fullness		4.2		3.8		2.2
Mean length (mm)		49.0		68.4		506.3

\* In tables 3-27, P indicates that at least some of the stomachs within a month and life history stage were pooled, but not necessarily that all of them were.

Table 4. The average number and weight (mg) of prey items per chum salmon stomach. (T = trace, J = juvenile, P = pooled).

	Chum salmon ( <i>Oncorhynchus keta</i> )			
	June (J)		July (J)	
	Number	Weight	Number	Weight
Ectoprocta			T	T
Mollusca				
Pelecypoda	T	T		
Gastropoda	T	T		
Annelida				
Polychaeta			T	T
Nereidae	T	T		
Arthropoda				
Crustacea				
Copepoda				
Calanoida	9.9	11.0	1.4	0.3
Cyclopoida	0.4	0.1	2.3	0.4
Harpacticoida	37.6	13.4	248	20.7
Gladocera	T	T		
Ostracoda			T	T
Cirripede larvae	0.4	0.2	1.9	0.3
Cumacea	6.1	5.5	1.3	1.0
Isopoda	T	T	0.1	0.1
Idoteidae	T	T		
Sphaeromatidae	T	T		
Amphipoda				
Gammaridea	5.8	6.4	81.9	115
Amphithoidae	0.2	0.2		
Corophiidae			T	T
Hyperiidea			0.1	T
Euphausiacea	0.2	19.0		
Decapod zoea	0.2	T		
Carides			T	T
Caridea larvae	T	0.1		
Insecta	0.5	1.0	0.1	0.1
Diptera	0.6	2.2	2.1	4.3
Diptera larvae	T	T	1.0	0.4
Chironomidae larvae	T	T	0.2	0.1
Coleoptera	T	T		
Homoptera	T	T		
Hymenoptera	T	T		
Chordata				
Vertebrata				
Teleostei	0.3	9.3		
Teleost eggs	0.7	0.1		
Teleost larvae	T	4.8		
Clupeidae	T	2.2		
Cottidae	T	0.3		
Pholidae	T	0.6		
Unidentified	1.5	1.4		
Total number stomachs		367		76
Number empty stomachs		P		P
Mean fullness		4.4		3.8
Mean length (mm)		78.7		57.8

Table 5. The average number and weight (mg) of prey items per coho salmon and capelin stomach. (T = trace, J = juvenile, P = pooled).

	Coho salmon ( <i>Oncorhynchus kisutch</i> )				Capelin ( <i>Mallotus villosus</i> )	
	June (J)		July (J)		June	
	Number	Weight	Number	Weight	Number	Weight
Annelida						
Polychaeta	0.3	1.7				
Phyllodocidae			0.3	2.0		
Arthropoda						
Crustacea					0.1	0.5
Copepoda						
Calanoida					37.2	203
Harpacticoida			13.7	2.3		
Cumacea			2.3	1.0		
Amphipoda						
Gammaridea	2.2	23.8				
Decapod zoea					0.3	0.2
Anomura						
Paguridae	0.8	4.5				
Brachyura						
Oxyrhyncha zoea	3.0	31.7				
Insecta	0.2	2.5				
Diptera			0.7	1.7		
Chordata						
Vertebrata						
Teleostei	0.3	115				
Unidentified	0.2	22.5				
Total number stomachs		6		3		33
Number empty stomachs		P		1		P
Mean fullness		4.2		2.0		2.9
Mean length (mm)		123.3		96.3		127.2

Table 6. The average number and weight (mg) of prey items per sand lance stomach. (T = trace, J = juvenile, P = pooled).

	Sand lance ( <i>Ammodytes hexapterus</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Annelida								
Polychaeta			T	T				
Polychaete larva							1.5	0.2
Mollusca								
Gastropoda	0.3	0.3	T	T				
Gastropod veliger			T	T	0.2	T	0.2	T
Pelecypod veliger					4.6	0.1	0.1	T
Arthropoda								
Crustacea zoea			T	T	T	T	2.6	0.7
Crustacea nauplius					0.8	T		
Cladocera					14.2	0.9	107	11.8
Ostracoda			T	T				
Copepoda								
Calanoida	56.1	55.5	109	54.3	37.1	3.3	138	16.5
Cyclopoida			6.0	0.5				
Harpacticoida	16.9	3.3	32.5	6.2	1.2	0.1	T	T
Cirripedia			T	T				
Cirripede larvae	0.5	T	0.1	T	2.7	0.1	148	16.3
Mysidacea			T	0.2	T	T		
Cumacea			0.1	0.2				
Isopoda								
Sphaeromatidae			0.1	0.1				
Amphipoda								
Gammaridea	0.4	0.1	0.6	0.3	T	T	0.1	T
Amphithoidae			10.4	39.0				
Euphausiacea			T	0.5				
Decapoda								
Decapod zoea			T	T	0.1	T	0.6	T
Caridea			T	0.1				
Caridea zoea			T	T				
Insecta								
Chironomid pupa							T	T
Chordata								
Vertebrata								
Teleostei			T	T				
Teleost larva							0.3	1.2
Teleost egg							24.7	3.4
Unidentified			46.5	15.7	0.2	0.1	T	48.7
Total number stomachs	28		173		111		43	
Number empty stomachs	P		P		P		P	
Mean fullness	4.8		3.5		2.9		3.2	
Mean length (mm)	99.2		121.3		80.6		129.4	

Table 7. The average number and weight (mg) of prey items per Pacific cod stomach. (T = trace, J = juvenile, P = pooled).

	Pacific cod ( <i>Gadus macrocephalus</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Phaeophyta			T	519	T	1.7		
Angiosperma								
Potamogetonaceae					T	1.2		
Porifera							0.1	1,322
Annelida								
Polychaeta	T	0.1			T	4.4		
Nereidae					T	4.9		
Mollusca								
Gastropoda			T	348	T	T	0.2	203
Lacunidae					0.1	0.4		
Pelecypoda			T	6.1	T	0.3	0.1	54.2
Pelecypod siphons					0.1	0.3		
Arthropoda								
Crustacea	1.2	89.9	0.1	120	0.1	24.3	0.2	58.8
Copepoda								
Calanoida	9.8	1.8			9.3	1.1		
Cyclopoida					T	T		
Harpacticoida	0.4	0.2			16.1	3.9		
Caligoida					T	T		
Cladocera					2.2	0.2		
Ostrocoda	T	T			T	T		
Cirripedia larvae					0.7	0.1		
Mysidacea	0.1	3.3			T	0.1		
Isopoda					T	T		
Valvifera								
Idoteidae					0.1	24.4		
Flabellifera								
Sphaeromatidae					0.2	7.8	0.4	37.1
Amphipoda								
Gammaridea	1.8	29.9	T	T	10.8	77.3	2.1	4.3
Corophiidae					T	0.1		
Caprellidea					2.8	30.4		
Euphausiacea	0.1	0.3	0.1	T	0.2	1.6		
Decapod	T	154	T	29.2				
Carides	0.2	50.2	0.3	472			0.5	1,585
Crangonidae	T	18.5	T	13.5	T	15.1	0.1	79.3
Hippolytidae	0.1	38.6			T	4.9		
Pandalidae	0.7	1,848	2.4	8,238	0.2	281	3.5	14,972
Anonura								
Paguridae			0.1	155	T	16.0	0.1	45.6
Brachyura	0.2	105						
Oxyrhyncha			0.1	100	T	0.8		
Majidae			0.1	250	0.1	6.7		
Chordata								
Vertebrata								
Teleostei	0.1	257	0.3	1,156	0.2	106		
Ammodytidae					T	53.7	0.1	144
Bathymasteridae							0.1	466
Clupeidae	0.1	840	T	237	T	260		
Cottidae			T	153				
Osmeridae			T	204				
Pleuronectidae							0.1	900
Salmonidae			T	179				
Unidentified	0.1	645	0.7	2,234	0.5	5.1	0.2	476
Total number stomachs		51		43		126		18
Number empty stomachs		8		9		P		0
Mean fullness		4.0		4.2		4.0		4.6
Mean length (mm)		247.7		416.6		152.2		467.9

Table 8. The average number and weight (mg) of prey items per wall-eye pollock stomach. (T = trace, J = juvenile, P = pooled.)

	Walleye pollock ( <i>Theragra chalcogramma</i> )					
	June (J)		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight
Annelida						
Polychaeta	0.1	13.4				
Arthropoda						
Crustacea	13.8	220	2.8	25.6	0.4	6.4
Crustacea zoea	12.4	14.1				
Crustacea megalops	3.4	16.0				
Copepoda						
Calanoida	161	185	38.2	189	0.1	0.8
Caligoida	T	T				
Nebaliacea	T	T				
Mysidacea	25.9	28.2	17.2	85.7		
Cumacea	0.5	3.9	27.1	14.4		
Amphipoda						
Gammaridea	1.4	12.6	0.5	1.6		
Hyperiidea	T	T	0.1	0.7		
Euphausiacea	0.3	30.1	6.6	658	9.6	929
Decapod zoea	T	T	5.1	3.2		
Decapod megalops	T	0.2				
Carides	T	10.1	2.6	161	0.3	1,239
Carides larvae	T	T	2.4	8.3		
Crangonidae			T	28.2		
Pandalidae	T	68.7	T	18.0	3.1	1,556
Anomura						
Paguridae	0.2	0.4	0.2	1.3		
Brachyura	T	0.4				
Oxyrhyncha						
Majidae			0.1	0.2		
Chordata						
Teleostei	T	0.1	0.1	135	0.1	151
Teleost larvae	T	0.1				
Ammodytidae	T	2.7	T	34.0		
Perciformes			T	3.1		
Total number of stomachs		83		37		9
Number empty stomachs		P		1		0
Mean fullness		4.3		5.5		4.9
Mean length (mm)		173.0		191.8		553.3

Table 9. The average number and weight (mg) of prey items per rock greenling stomach. (T = trace, J = juvenile, P = pooled).

	Rock greenling ( <i>Hexagrammos lagocephalus</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Chlorophyta			T	6.7			T	0.2
Ulotrichales			T	3.6			0.1	0.4
Rhodophyta	T	0.9	0.1	25.0			0.4	14.3
Phaeophyta	T	5.4	0.2	306	0.1	0.8	0.1	154
Desmarestiaceae			T	24.2				
Cnidarea			T	0.4				
Anthozoa							T	12.2
Metridiidae			T	9.5				
Hydrozoa			T	0.3	T	149	0.1	102
Nemertinea	0.1	0.7	T	6.2				
Ectoproct			T	0.7			T	T
Mollusca			0.4	133			0.4	171
Amphineura								
Polyplacophora			0.5	78.0	0.5	20.0	0.2	119
Gastropoda	0.1	2.2	1.0	47.7	T	0.7	0.6	21.0
Prosobranchia								
Acmaeidae	1.1	20.5	T	2.1			T	0.3
Lacunidae	6.2	48.8	10.8	590	1.6	21.6	4.3	82.2
Littorinidae	0.1	5.2	T	1.8			1.2	30.2
Naticidae							T	0.5
Trichotropididae							T	0.8
Trochidae			T	2.4				
Velutinidae			T	T			0.1	19.0
Opisthobranchia								
Tectibranchia								
Aglajidae			T	1.2				
Bullidae			T	14.9				
Nudibranchia								
Doridae			0.1	30.7			1.1	61.8
Tritonidae							T	3.2
Pelecypoda	T	T	0.6	96.2	0.1	0.3	0.5	72.3
Pelecypod siphons	4.8	324	4.2	887	0.1	3.1	0.6	192
Mytilidae			T	0.4			T	0.5
Cephalopoda			T	0.9				
Octopoda			T	26.7				
Echiuroidea			T	T				
Annelida								
Polychaeta	1.8	192	1.2	124	0.3	4.6	0.4	151
Ampharetidae			T	0.3				
Flabelligeridae			T	3.5			T	8.4
Glyceridae			T	3.3			T	3.2
Goniadidae							T	0.5
Lumbrineridae			T	0.1				
Nereidae			0.1	24.1	T	3.1	0.1	3.1
Opheliidae			0.2	2.5				
Owenidae	0.4	3.3						
Polynoidae			T	6.7				
Sabellaridae			0.1	0.8				
Serpulidae	0.5	6.1	0.2	1.6	T	0.1	0.1	0.8
Arthropoda								
Pyncnogonida							T	T
Crustacea			0.2	8.9	0.1	4.2	0.1	67.8
Copepoda								
Harpacticoida	1.9	0.2			9.8	3.9		
Cirripedia	T	0.6	0.1	2.9	0.4	2.1	0.5	11.4
Mysidacea			T	0.3			T	0.3
Cumacea							T	0.1
Isopoda			T	0.4			T	0.1
Idoteidae	T	3.6	0.6	85.3	0.1	6.9	0.8	123
Sphaeromatidae			4.3	258	1.4	43.4	2.7	1.7

Table 9. The average number and weight (mg) of prey items per rock greenling stomach. (T = trace, J = juvenile, P = pooled). - Continued.

	Rock greenling ( <i>Hexagrammos lagocephalus</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Amphipoda								
Caprellidea	0.4	2.4	16.6	154	0.4	2.8	3.3	36.0
Gammaridea	23.7	303	27.1	278	30.2	154	58.5	280
Amphithoidae			0.1	7.1			0.1	9.8
Corophiidae	1.5	4.3	0.1	0.3	0.3	1.0	T	T
Eusiridae			0.2	2.1				
Hyperiidea			T	T				
Euphausiacea			T	0.2			T	2.7
Decapoda	0.4	20.9	0.3	309	0.2	134	1.2	174
Decapoda megalops	0.3	2.9	T	1.8				
Carides	0.1	10.8	0.1	21.0			0.2	6.1
Crangonidae	T	5.6	T	1.5			T	0.5
Hippolytidae	0.1	32.3	0.3	73.6			1.0	45.5
Pandalidae	T	0.7	T	3.0			0.3	12.1
Anomura			T	0.2				
Lithodidae	T	0.6	T	0.2			T	8.6
Paguridae	0.2	82.7	0.4	358	0.1	6.8	0.1	100
Brachyura megalops	T	0.8	0.2	4.4				
Oxyrhyncha	0.1	29.1	0.3	32.3			0.2	9.7
Majidae	T	46.9	1.1	326	T	10.3	0.4	389
Brachyrhyncha								
Atelecyclidae	0.1	124	T	1,333			0.3	666
Cancridae	0.1	38.3	0.1	146	T	3.5	0.2	97.7
Insecta								
Diptera larvae			0.2	0.6	T	T		
Chironomid larvae					2.6	0.3	0.1	0.1
Echinodermata								
Asteroidea								
Asteroiidae							T	0.1
Holothuroidea			T	0.1				
Chordata								
Urochordata								
Ascidacea			T	85.2			T	6.9
Vertebrata								
Teleostei	0.2	69.0	0.7	404	T	5.3	0.4	930
Teleost larvae			T	2.3			T	0.4
Teleost egg	3.1	2.1	39.8	105	0.3	0.2	72.2	316
Ammodytidae							0.1	143
Cottidae			T	4.9			T	22.6
Cottid larva			T	0.6				
Cyclopteridae							T	132
Hexagrammidae							T	84.3
Perciformes			T	11.3			T	22.7
Pholid larvae			T	T			T	87.6
Unidentified	2.8	13.7	24.7	765	1.3	46.9	15.4	777
Total number stomachs	30		201		20		157	
Number empty stomachs	0		3		0		P	
Mean fullness	4.8		5.2		4.8		5.0	
Mean length (mm)	193.0		320.6		144.4		313.5	

Table 10. The average number and weight (mg) of prey items per whitespotted greenling stomach. (T = trace, J = juvenile, P = pooled).

	Whitespotted greenling ( <i>Hexagrammos stelleri</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Chlorophyta			T	1.6			0.1	35.8
Ulotrichales			0.1	3.2			T	14.1
Phaeophyta			T	3.8			T	6.6
Desmarestiaceae			T	3.6				
Rhodophyta			0.2	19.2			T	4.6
Angiosperma								
Potamogetonaceae			T	2.7			0.2	54.8
Cnidarea			T	0.3				
Hydrozoa							T	39.9
Nemertinea			T	0.1				
Ectoprocta							T	T
Mollusca								
Amphineura								
Polyphacophora							T	9.5
Gastropoda	0.1	0.8	T	43.3	0.2	0.3	T	20.7
Lacunidae							0.3	2.5
Littorinidae							T	0.2
Trichotropidae			0.3	1.5				
Pelecypoda	0.1	2.3	T	0.2			0.1	7.8
Pelecypod siphons	1.4	9.5	0.1	3.1	T	0.1	T	71.3
Mytilidae			T	T			T	T
Cephalopoda							T	0.4
Octopoda			T	T				
Echiuroidea							0.1	39.5
Annelida								
Polychaeta	0.7	53.9	0.3	1,898	T	0.3	0.7	46.3
Flabelligeridae							T	2.7
Glyceridae			T	20.3			T	0.1
Opheiliidae	1.4	16.1						
Pectinariidae					T	T	T	0.8
Nephtyidae							T	12.4
Nereidae			T	17.3	T	T	T	3.6
Sabellidae			T	1.7				
Syllidae			T	136				
Arthropoda								
Pyncnogonida			T	0.3				
Crustacea	0.7	16.1	0.2	119	T	3.1	T	319
Ostracoda					T	T		
Copepoda					1.3	0.3		
Calanoida					12.8	2.5		
Harpacticoida					65.4	6.5	1.3	0.1
Cirripedia	0.4	1.8			0.6	11.7	0.1	1.9
Mysidacea	1.1	65.7	0.2	21.7	0.3	11.1	0.9	6.7
Cumacea	0.1	0.1	0.1	1.1	T	T	0.9	1.8
Isopoda							T	0.2
Idoteidae			T	10.4	T	T		
Sphaeromatidae	0.3	7.4	0.1	4.3	0.4	1.2	1.1	55.9
Amphipoda								
Caprellidea	0.3	2.5	4.5	42.2	0.6	1.9	16.2	209
Gammaridea	6.2	38.4	4.7	90.5	14.8	31.6	11.0	127
Corophiidea					0.9	1.6	T	T
Euphausiacea					T	7.2		

Table 10. The average number and weight (mg) of prey items per whitespotted greenling stomach. (T = trace, J = juvenile, P = pooled). - Cont.

	Whitespotted greenling ( <i>Hexagrammos stelleri</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Decapoda	0.1	2.4	0.7	292			0.3	460
Decapod megalops	0.9	6.9	T	0.5	T	0.3		
Carides			0.4	264	T	6.2	0.3	190
Crangonidae	0.3	60.7	0.1	95			0.2	73.1
Hippolytidae			T	9.3	T	0.2	0.2	15.4
Pandalidae	0.2	5.1	0.4	1,031	T	1.7	0.6	267
Ancmura larva			T	0.1				
Albuneidae			T	2.5				
Paguridae			0.1	66.4			0.1	47.5
Lithodidae							0.5	11.3
Brachyura	0.2	2.1	0.1	8.6	0.1	43.7	0.6	119
Oxyrhyncha			0.2	238	T	0.6	0.2	184
Majidae	0.4	14.6	0.4	97.5			1.0	243
Brachyrhyncha								
Atelecyclidae			0.2	720			0.2	1,576
Cancridae			T	110			0.1	87.0
Insecta					T	T	T	6.7
Diptera larva					0.1	0.1	T	T
Echinodermata								
Holothuroidea			T	20.0				
Teleostei	0.6	162	0.3	470	0.2	16.9	0.8	552
Teleost egg					61.2	38.7	35.8	180
Teleost larva	0.1	3.1	0.1	5.9				
Ammodytidae			0.1	65.5			T	29.5
Cottidae	0.3	83.6	0.1	15.9			0.1	62.3
Cottid larvae			0.1	4.9			T	0.7
Hexagrammid	0.1	8.9					T	113
Pleuronectidae	0.2	58.9					T	2.1
Scorpaeniformes	0.6	224	T	369			T	13.8
Stichaeidae							0.4	161
Unidentified	5.5	18.8	49.0	188	1.4	6.9	15.1	161
Total number stomachs	14		96		67		110	
Number empty stomachs	2		4		P		6	
Mean fullness	4.2		4.6		3.7		4.8	
Mean length	167		263		99.4		261.7	



Table 11. The average number and weight (mg) of prey items per masked greenling stomach. (T = trace, J = juvenile, P = pooled. Continued.

	Masked greenling ( <i>Hexagrammos octogrammus</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Terebellidae			0.1	1.5			T	0.9
Arthropoda								
Crustacea			T	6.0			T	2.5
Copepoda								
Calanoida					0.5	0.2	T	T
Cyclopoida					0.1	T		
Harpacticoida	6.0	1.2	T	T	51.7	9.7	0.2	T
Caligoida			T	0.1				
Cladocera					0.5	0.3	T	T
Ostracoda					5.1	0.9	T	T
Cirripedia	0.8	1.6	0.1	1.6			0.1	0.2
Cirripede larvae					0.2	T		
Nebaliacea			T	0.3				
Mysidacea	T	1.8	T	1.4				
Cumacea	0.2	0.5	0.2	1.4			T	0.4
Tanaidacea							T	T
Isopoda			T	0.9			T	1.6
Idoteidae			0.1	23.1			0.1	13.9
Limnoriidae							T	0.1
Munnidae			T	T				
Sphaeromatidae	0.3	8.6	1.3	56.0			1.4	36.1
Amphipoda								
Gammaridea	67.7	190	71.7	381	37.7	44.2	77.9	397
Amphithoidae			0.1	4.6				
Corophiidae	0.2	0.3	0.7	2.0			0.3	0.4
Gammaridae			T	1.0				
Caprellidae	0.8	4.6	4.3	50.0	0.2	0.6	13.5	121
Euphausiacea					0.1	0.1		
Decapoda			0.2	26.5				
Decapod megalops	0.1	0.4	T	0.4	T	0.5	0.5	40.3
Carides	0.1	17.8	0.1	54.3			0.1	2.9
Crangonidae			0.1	3.7			0.2	12.1
Hippolytidae	0.1	16.6	0.1	35.1			0.2	24.4
Pandalidae			0.1	6.7			0.2	20.9
Anomura			T	0.5				
Callinassidae			T	28.8				
Lithodidae							T	0.1
Paguridae	0.2	37.6	0.3	77.8	T	4.7	0.1	33.7
Brachyura							0.3	7.3
Oxyrhyncha	0.1	0.4	0.5	13.5			0.2	11.2
Majidae			0.1	21.6			0.1	15.9
Brachyrhyncha	T	0.5					0.1	1.5
Atelecyclidae			0.1	62.3			1.4	90.4
Cancriidae	0.1	3.6	T	7.2			0.1	12.2
Insecta	T	0.7						
Diptera larvae					2.1	4.3	T	T
Chironomid larvae					0.5	0.3	2.7	1.3
Echinodermata								
Ophiuroidea			T	0.2			T	0.2
Echinoidea			T	0.2				
Chordata								
Vertebrata								
Teleostei	0.2	16.7	0.2	47.5			0.1	19.1
Teleost eggs			1.3	10.2			2.9	13.9

Table 11. The average number and weight (mg) of prey items per masked greenling stomach. (T = trace, J = juvenile, P = pooled. Continued.

	Masked greenling ( <i>Hexagrammus octogrammus</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Teleost larvae			T	3.6				
Cottidae			0.1	14.5			0.1	31.7
Cottid larvae			T	0.7				
Cyclopteridae							T	0.1
Hexagrammidae							T	1.5
Pleuronectidae			T	10.6				
Unidentified	0.2	15.5	1.9	41.6	0.1	T	3.5	48.2
Total number stomachs	36		187		42		207	
Number empty stomachs	P		2		P		6	
Mean fullness	4.5		4.8		5.1		4.6	
Mean length (mm)	140.8		205.4		76.5		204.7	

Table 12. The average number and weight (mg) of prey items per kelp greenling stomach. (T = trace, J = juvenile).

	Kelp greenling ( <i>Hexagrammos decagrammus</i> )					
	June (J)		June		July	
	Number	Weight	Number	Weight	Number	Weight
Rhodophyta			1.0	53.3		
Mollusca					1.0	232
Gastropoda			0.7	26.0		
Pelecypoda	1.5	22.5	1.0	337		
Pelecypod siphons			1.0	325	1.0	15,038
Annelida						
Polychaeta					1.0	359
Arthropoda						
Crustacea						
Isopoda						
Sphaeromatidae	0.5	11.0				
Gammaridea			159	125		
Decapoda				1,255	5.0	1,050
Carides						
Hippolytidae			0.3	52.3		
Anomura						
Paguridae	0.5	152	1.3	218		
Brachyura						
Oxyrhyncha						
Majidae					1.5	790
Brachyrhyncha						
Atelecyclidae			1.0	7,238	0.5	2,250
Cancridae			0.3	871	0.5	1,184
Chordata						
Vertebrata						
Teleostei	0.5	150	2.0	986	1.0	7,111
Unidentified			1.0	421	128.5	3,984
Total number stomachs		2		3		2
Number empty stomachs		0		0		0
Mean fullness		6.0		5.3		6.0
Mean length (mm)		137.0		383.3		391.0

Table 13. The average number and weight (mg) of prey items per yellow Irish lord stomachs. (T - trace, J = juvenile).

	Yellow Irish lord ( <i>Hemilepidotus jordani</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Chlorophyta							T	59.2
Phaeophyta			T	39.1	T	0.1	T	1.7
Rhodophyta							T	2.5
Angiosperma								
Potamogetonaceae			T	1.8				
Cnidarea								
Scyphozoa							T	17.7
Ectoprocta	0.2	0.9	T	T				
Mollusca								
Gastropoda							0.1	10.4
Prosobranchia								
Acmaeidae							T	2.2
Fisurellidae							0.1	16.8
Lacunidae	T	0.1			T	0.7	0.3	8.8
Opisthobranchia								
Nudibranchia								
Doridae							T	0.9
Pelecypoda			0.1	28.5	0.2	0.5	0.2	16.7
Pelecypod siphons	T	1.0					0.1	5.3
Cardiidae					T	2.1		
Nuculandae	T	11.0			T	1.6		
Nuculidae								
Veneridae			T	1.6				
Cephalopoda			T	1.7				
Annelida								
Polychaeta	T	4.3	T	36.3			T	50.5
Eunicidae			T	3.1				
Glyceridae					T	6.8		
Goniadidae			T	11.1				
Onuphidae							T	31.5
Arthropoda								
Crustacea	0.2	71.3	0.4	114	T	0.4	T	89.8
Copepoda								
Calanoida	T	T						
Harpacticoida	0.1	T						
Cirripedia			T	1.1			T	1.7
Mysidacea	T	0.1					T	3.4
Isopoda								
Munnidae	T	T						
Sphaeromatidae	0.1	5.7					0.1	5.1
Amphipoda								
Caprellidea					0.5	3.1	T	0.2
Gammaridea	0.1	2.9	T	0.1	1.1	23.3	0.3	6.9
Euphausiacea					T	0.6	0.1	3.2
Decapoda	0.1	10.7	T	69.1	0.2	5.5	0.1	113
Decapod megalops	0.2	13.4			0.7	28.1	T	0.5
Carides	0.1	168	0.3	753	0.7	240	0.3	822
Crangonidae					T	8.2		
Hippolytidae							T	1.3
Pandalidae	0.1	277	0.6	2,795	0.1	212	0.1	439
Anomura								
Lithodidae					T	0.5		

Table 13. The average number and weight (mg) of prey items per yellow Irish lord stomachs. (T = trace, J = juvenile). - Cont.

	Yellow Irish lord ( <i>Hemilepidotus jordani</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Paguridae	0.1	46.2	0.1	263	0.1	10.7	0.1	127
Brachyura	T	0.9	T	109	0.9	31.7		
Oxyrhyncha	T	9.4			0.2	7.6	0.2	10.0
Majidae	0.4	103	0.3	968	0.8	111	0.9	960
Brachyrhyncha					T	6.6		
Atelecyclidae							0.1	73.4
Cancriidae					T	4.2		
Pinnotheridae			T	1.1			0.1	50.3
Echinodermata								
Ophiuroidea	T	3.8	0.1	11.7	0.1	4.5	T	14.7
Chordata								
Vertebrata								
Teleostei	0.1	181	0.1	212	0.1	89.8	0.2	328
Teleost larva			T	0.8				
Anoplomatidae			T	531				
Clupeiformes							T	76.2
Cottidae							0.1	3,694
Stichaeidae			T	45.1	T	16.9	T	210
Unidentified	T	3.1			0.3	3.4	0.3	56.2
Total number stomachs		73		80		42		65
Number empty stomachs		27		13		3		12
Mean fullness		3.3		4.0		4.4		3.8
Mean length		171.3		293.4		150.6		281.4

Table 14. The average number and weight (mg) of prey items per red Irish lord stomach.

	Red Irish lord ( <i>Hemilepidotus hemilepidotus</i> )			
	June		July	
	Number	Weight	Number	Weight
Chlorophyta				
Ulotrichales			0.2	65.8
Phaeophyta			0.2	48.7
Mollusca				
Gastropoda			0.2	115
Prosobranchia				
Trochidae			0.2	2.5
Amphineura				
Polyplacophora	0.5	6.6	0.2	275
Pelecypoda				
Mytilidae			0.2	30.8
Cephalopoda			0.2	8.8
Arthropoda				
Crustacea				
Cirripedia			0.3	786
Decapoda			0.2	182
Brachyura				
Oxyrhyncha				
Majidae			0.7	410
Brachyrhyncha				
Atelecyclidae			0.3	8,761
Cancriidae			3.2	2,775
Chordata				
Vertebrata				
Teleostei	2.5	3,140		
Unidentified			1.3	1,217
Total number stomachs		2		6
Number empty stomachs		0		1
Mean fullness		4.0		4.0
Mean length (mm)		279.0		252.0

Table 15. The average number and weight (mg) of prey items per *Myoxocephalus* spp. stomach. (T = trace, J = juvenile, P = pooled).

	<i>Myoxocephalus</i> spp.							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Phaeophyta			T	249				
Desmarestiaceae			T	139				
Rhodophyta							T	95.9
Angiosperma								
Potamogetonaceae	T	15.4					0.2	83.8
Cnidarea								
Anthozoa							0.1	21.5
Mollusca								
Pelecypoda	0.1	15.2						
Pelecypod siphons			T	5.7				
Annelida								
Polychaeta			0.1	13.2	T	0.1	T	91.4
Arthropoda								
Crustacea	0.1	10.6			0.2	3.2		
Copepoda								
Calanoida					1.5	11.1		
Harpacticoida					1.5	6.0		
Cirripedia							T	26.7
Mysidacea					T	1.1		
Isopoda					T	0.1		
Idoteidae	0.1	2.1						
Sphaeromatidae	0.2	13.1			T	1.0		
Amphipoda								
Caprellidea	T	0.5						
Gammaridea	6.2	182			4.3	51.3		
Decapoda	T	28.0	0.2	47.7				
Carides	0.1	85.8	0.1	239	T	0.1		
Crangonidae	T	109	0.1	162				
Pandalidae	0.1	353	0.4	1,524			0.1	944
Anomura								
Paguridae					0.1	11.6		
Brachyura							T	2.1
Oxyrhyncha	0.1	12.8	T	130			T	118
Majidae	0.4	1,660	0.2	1,233	T	55.9	0.4	2,981
Brachyrhyncha								
Atelecyclidae			T	1,029	0.2	11.7	0.1	368
Cancriidae	0.1	51.4	T	798			0.1	1,330
Insecta								
Tricoptera							T	7.0
Teleostei	0.1	72.2	0.3	6,365	0.2	129	0.2	2,170
Ammodytidae	0.1	99.4			T	16.4		
Anoplopomatidae			0.1	18,471				
Clupeidae	T	21.6						
Cottidae			0.1	28,543	0.1	30.6	T	5,603
Gadidae			T	1,680			T	2,595
Osmeridae			0.1	836				
Perciformes			T	346				
Pleuronectidae	T	69.2	T	3,088			0.1	1,798
Salmonidae							T	37.4
Unidentified	0.2	3.3	T	T	0.1	18.6	0.1	219
Total number stomachs	39		33		58		36	
Number empty stomachs	4		8		P		14	
Mean fullness	4.7		3.5		3.9		2.9	
Mean length (mm)	138.7		403.8		103.6		401.4	

Table 16. The average number and weight (mg) of prey items per sandfish stomach. (J = juvenile).

	Sandfish ( <i>Trichodon trichodon</i> )			
	June		July	
	Number	Weight	Number	Weight
Arthropoda				
Crustacea	20.0	793		
Euphausiacea			0.5	125
Amphipoda				
Gammaridea			0.1	3.5
Decapoda				
Carides			0.2	11.9
Anomura				
Paguridae			0.1	0.7
Brachyura megalops	33.0	383	0.2	0.7
Chordata				
Vertebrata				
Teleostei			0.9	2,809
Ammodytidae			1.5	834
Clupeiformes			0.1	366
Total number stomachs		1		26
Number empty stomachs		0		0
Mean fullness		6.0		5.4
Mean length (mm)		121.0		168.8

Table 17. The average number and weight (mg) of prey items per snake prickleback stomach. (T = trace, J = juvenile, P = pooled).

	Snake prickleback ( <i>Lumpenus sagitta</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Protozoa								
Foraminifera							T	T
Ectoprocta			0.1	0.1			T	T
Mollusca								
Gastropoda					0.2	0.4	T	0.2
Opisthobranchia								
Tectibranchia	4.0	12.0	0.1	T	0.1	T		
Pelecypoda	3.0	17.0	2.2	7.5			0.1	T
Pelecypod siphons	2.0	2.0	0.2	3.4			T	0.1
Cardiidae			0.1	0.3				
Nuculanidae			0.1	T				
Annelida								
Polychaeta	20.0	189	5.9	102	0.6	9.4	2.4	39.9
Lumbrineridae			0.4	1.9				
Nereidae			0.1	T				
Oweniidae	2.0	56.0						
Polynoidae			0.1	0.2				
Phyllodocidae			0.1	0.1			T	0.2
Spionidae							T	T
Arthropoda								
Crustacea								
Ostracoda	6.0	8.0						
Copepoda								
Calanoida			0.4	0.3	0.3	T		
Harpacticoida			0.1	0.1	15.1	2.6	0.9	0.2
Cirripede larvae					0.3	0.1		
Cumacea			2.2	3.9	0.2	0.1		
Amphipoda								
Gammaridea	10.0	10.0	4.5	34.0	101	91.7	392	255
Euphausiacea			0.1	0.2				
Decapoda								
Caridea							6.8	51.0
Brachyura megalops			0.6	6.2				
Echinodermata								
Echinoida			0.1	0.1				
Ophiuroida			0.1	0.2			T	0.3
Chordata								
Vertebrata								
Teleostei			0.1	T				
Teleost egg			242	84.8	23.3	26.7	0.7	0.8
Unidentified			7.7	8.2	0.9	0.3	2.2	1.4
Total number stomachs	1		17		10		27	
Number empty stomachs	0		1		P		4	
Mean fullness	6.0		4.2		4.2		4.5	
Mean length (mm)	229.0		344.9		196.6		286.8	

Table 18. The average number and weight (mg) of prey items per crescent gunnel stomach. (T = trace, J = juvenile, P = pooled).

	Crescent gunnel ( <i>Pholis laeta</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Rhodophyta	0.3	T					0.1	T
Mollusca								
Gastropod veliger					0.5	0.1		
Pelecypoda							0.1	T
Pelecypod siphons							1.3	7.8
Annelida								
Polychaeta							0.1	5.2
Arthropoda								
Crustacea								
Copepoda								
Calanoida					4.0	0.1	3.7	0.1
Harpacticoida	5.0	1.2	2.3	1.0	35.0	1.6	5.3	0.4
Ostracoda					3.5	0.1	37.8	17.7
Cirripedia							2.6	4.9
Cirripede larvae	0.5	T						
Cumacea	0.8	0.5					0.3	0.3
Isopoda								
Idoteidae	0.5	1.0	0.2	7.8				
Limnoridae	0.8	2.8	1.4	3.7	0.5	0.5	1.1	2.8
Munnidae					0.5	0.1		
Sphaeromatidae	0.5	1.8	0.9	7.8			0.1	0.3
Amphipod								
Gammaridea	9.5	57.5	16.6	117			7.0	37.6
Decapod								
Decapod megalops	0.3	0.8						
Carides							0.2	1.3
Anomura								
Paguridae			0.1	0.6				
Unidentified			2.8	1.3			0.7	3.2
Total number stomachs	4		12		2		12	
Number empty stomachs	0		P		0		1	
Mean fullness	4.8		3.1		3.0		3.6	
Mean length (mm)	99.7		167.0		101.5		158.3	

Table 19. The average number and weight (mg) of prey items per flathead sole stomach. (T = trace, J = juvenile, P = pooled).

	Flathead sole ( <i>Hippoglossoides elassodon</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Cnidarea								
Hydrozoa	T	0.3						
Ectoprocta					T	1.7	T	0.3
Brachiopoda			T	0.9				
Mollusca								
Pelecypoda	T	0.2			0.1	0.1		
Pelecypod siphons	0.9	2.0	T	T	1.7	5.8		
Cardiidae			T	8.9				
Nuculidae	T	0.1						
Nuculanidae	0.1	3.9						
Annelida								
Polychaeta	0.1	0.6	T	0.1	0.2	2.0	T	1.5
Capitelliidae	T	0.1						
Glyceridae					T	T		
Maldanidae	T	0.4			T	1.3		
Opheliidae	T	T			T	0.7		
Pectinariidae	T	0.1						
Arthropoda								
Crustacea	0.1	2.4			T	0.3		
Copepoda								
Calanoida	1.1	0.4			0.1	0.6		
Harpacticoida	T	T						
Mysidacea	0.4	19.7	0.1	8.9	0.8	6.5		
Cumacea	T	T			T	1.4		
Isopoda								
Munnidae	T	T						
Amphipoda								
Gammaridea	0.2	0.6			0.1	0.8		
Euphausiacea	0.9	32.5	0.8	59.4	1.6	15.2	0.7	6.2
Decapod megalops	0.1	0.7						
Decapod zoea								
Caridea	T	26.5	0.1	48.7	4.1	23.6	0.2	120
Crangonidae	T	11.2			T	16.1		
Hippolytidae	T	0.1						
Pandalidae	T	22.8	1.0	3,049	0.1	223	0.9	2,012
Anomura								
Paguridae							T	18.2
Brachyura megalops	0.1	2.2						
Majidae	T	0.8			T	4.5		
Echinodermata								
Ophiuroidea	T	0.7	T	0.6				
Chordata								
Teleostei	0.1	11.0	T	76.6	0.2	48.2	T	85.0
Teleost larva	T	2.2	T	2.0				
Ammodytidae					T	5.4		
Cottidae					T	2.4		
Cottid larva	0.1	4.1			T	0.6		
Hexagrammidae					T	3.5		
Osmeridae					0.1	18.4		
Perciformes	T	0.5						
Perciform larva	T	0.5						
Pholidae			T	13.3	T	7.4		
Pleuronectidae	T	0.2			T	3.0		
Stichaeidae			T	91.5	T	20.1	T	295
Unidentified	T	T			T	0.1		
Total number stomachs		305		89		134		42
Number empty stomachs		P		29		P		15
Mean fullness		3.2		3.6		3.4		3.0
Mean length (mm)		147.7		307.3		149.5		338.4

Table 20. The average number and weight (mg) of prey items per rock sole stomach. (T = trace, J = juvenile, P = pooled).

	Rock sole ( <i>Lepidopsetta bilineata</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Chlorophyta	T	0.9	T	12.3				
Ulotrichales			T	T			T	14.7
Rhodophyta	T	0.9	T	12.1	T	4.5	T	15.2
Phaeophyta	T	0.3			T	0.3	T	0.8
Angiosperma								
Potamogetonaceae			T	2.7			T	T
Protozoa								
Foraminifera					T	T	T	T
Cnidarea								
Hydrozoa					T	0.1	T	T
Nemertinea			T	0.1			T	13.0
Priapulida			T	17.8	T	0.2	T	12.2
Ectoprocta					T	0.2	T	T
Mollusca								
Amphineura								
Polyplacophora					T	T		
Gastropoda								
Prosobranchia								
Acmaeidae	T	0.1	T	T	T	T	T	2.1
Fissurellidae			T	1.4	T	2.7	T	1.2
Lacunidae			T	T				
Lepetidae	T	21.9	0.1	17.9	0.1	16.3	0.3	83.3
Opisthobranchia								
Tectibranchia								
Aglajidae							0.4	19.1
Bullidae			T	T			T	T
Nudibranchia								
Dorididae					T	0.1	T	0.1
Pelecypoda	0.1	3.8	0.5	31.3	0.9	3.9	0.6	60.7
Pelecypod siphons	5.7	14.6	0.8	23.9	3.0	11.9	2.0	376
Cardiidae			T	0.5				
Nuculanidae			T	1.8	T	0.8	T	10.4
Myidae			T	2.6			T	0.1
Tellinidae			0.7	37.8			T	3.1
Veneridae	T	T	0.3	8.3	T	T		
Cephalopoda			T	0.1				
Annelida								
Polychaeta	1.9	52.4	7.6	244	1.7	34.9	6.2	217
Ampharetidae	T	1.8	0.1	1.4	T	0.1	T	1.8
Cirratulidae			T	0.1				
Flabelligeridae							T	1.0
Glyceridae	0.1	18.2	0.2	25.3	0.1	1.0	0.1	27.4
Goniadidae			T	T	0.1	1.5	0.2	3.6
Lumbrineridae	0.2	1.9	0.9	3.4	0.4	2.2	0.3	6.9
Maldanidae			T	23.7	T	10.8	0.1	6.8
Nephtyidae					T	10.9	T	17.2
Nereidae	T	2.2	T	55.0			0.1	136
Onuphidae			T	0.9	T	T	T	53.2
Opheleididae	0.2	3.9	0.2	3.7	T	0.2	0.1	6.4
Orbiniidae			T	0.3	T	0.1	T	25.6
Oweniidae	0.2	3.7	0.5	13.5	T	0.6	1.7	22.5
Pectinariidae	T	0.9	T	3.2	T	1.1	T	3.6
Phyllodocidae	T	0.2	0.1	5.5	0.3	4.6	0.2	3.4

Table 20. The average number and weight (mg) of prey items per rock sole stomach. (T = trace, J = juvenile, P = pooled). - Continued.

	Rock sole ( <i>Lepidopsetta bilineata</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Pilargidae			T	1.2				
Polynoidea			T	0.3				
Sabellaridae	T	T			T	0.6	0.1	5.6
Serpulidae	T	0.2	0.1	2.1	T	0.4		
Sabellidae					0.1	0.5	T	0.1
Spionidae	0.3	5.0			T	0.2		
Syllidae			2.3	49.8	1.6	12.8	T	1.3
Terebellidae	T	0.1	T	T	T	T		
Arthropoda			0.1	0.4			T	17.0
Crustacea			T	T				
Ostracoda	T	T						
Copepoda								
Calanoida					T	0.1		
Harpacticoida	T	0.1						
Cirripedia			T	0.6	0.1	0.2	T	0.2
Mysidacea					T	0.2	T	0.1
Cumacea	0.2	0.6	0.2	1.1	0.2	0.9	0.8	2.1
Isopoda							T	0.3
Sphaeromatidae	T	0.1	0.5	12.8				
Amphipoda								
Caprellidea	T	T	T	T	0.1	0.3	T	T
Gammaridea	2.5	14.1	3.9	51.8	6.7	25.2	5.8	58.5
Amphithoidae			T	2.7				
Corophiidae					T	0.1		
Gammaridae			0.4	9.6				
Euphausiacea			T	0.1	T	T		
Decapoda			T	28.8	T	0.1		
Decapod megalops	0.3	3.3	0.1	0.6			T	0.4
Carides	0.3	32.1	T	6.3	0.2	1.1	0.4	6.9
Crangonidae			T	0.4				
Anomura								
Lithodidae megalops	T	T						
Paguridae	T	1.4	T	4.4	T	T	T	18.4
Brachyura			T	23.3				
Oxyrhyncha	0.1	1.0	0.1	3.2	T	0.1		
Majidae	T	0.1	T	0.2	0.1	2.3	0.1	8.9
Brachyrhyncha								
Atelecyclidae			T	12.2			T	0.2
Insecta								
Diptera larva					T	T		
Chironomid pupa					T	T		
Echinodermata								
Holothuroidea			T	1.3			T	6.4
Echinoidea			T	T				
Dendrasteridae								
Strongylocentrotidae	T	0.5						
Ophiuroidea	T	0.1	0.1	1.9	T	0.1	0.1	0.6
Chordata								
Vertebrata								
Teleostei	T	0.3	0.1	174	T	40.7	0.3	1,501
Teleost larva	0.1	4.0	T	33.4				
Teleost egg	T	T	63.4	26.3	0.2	0.2	2.3	2.6
Agonidae	T	0.2						

Table 20. The average number and weight (mg) of prey items per rock sole stomach. (T = trace, J = juvenile, P = pooled). - Continued.

	Rock sole ( <i>Lepidopsetta bilineata</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Ammodytidae			0.1	176			T	101
Clupeidae			T	27.7			T	58.0
Cottidae	T	0.5			T	3.8		
Cottid larva			T	1.1				
Hexagrammid larva			T	0.1				
Osmeridae			T	30.0			T	140
Perciform larva								
Pholidae							T	18.5
Stichaeidae							T	4.9
Pleuronectidae	T	1.8	T	0.2			T	17.5
Unidentified	1.9	8.1	0.2	125	0.3	6.8	6.5	33.0
Total number stomachs		382		311		206		182
Number empty stomachs		P		P		P		40
Mean fullness		3.8		3.3		3.8		3.7
Mean length (mm)		142.5		283.2		135.1		296.6

Table 21. The average number and weight (mg) of prey items per yellowfin sole stomach. (T = trace, J = juvenile, P = pooled).

	Yellowfin sole ( <i>Limanda aspera</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Chlorophyta			T	8.7				
Ulotrichales			T	0.2			T	0.2
Rhodophyta	T	4.3	T	4.5			T	22.5
Phaeophyta			T	0.1	T	T		
Angiosperma								
Potamogetonaceae	T	T	T	T			T	T
Protozoa								
Foraminifera	T	T			0.1	T		
Cnidarea			T	10.8			T	6.8
Hydrozoa			T	T	T	T	T	0.7
Scyphozoa							T	31.9
Ctenophora							T	1.8
Nemertinea					T	2.3	T	0.5
Priapulida							T	T
Ectoprocta							T	T
Brachiopoda			T	0.1				
Sipunculida							T	11.1
Mollusca							T	42.1
Gastropoda							T	13.3
Prosobranchia								
Acmaeidae							T	1.2
Fissurellidae			T	0.3				
Lepetidae			0.3	75.3	T	0.6	0.1	29.8
Opisthobranchia								
Tectibranchia								
Retusidae							T	T
Scaphandridae								
Pelecypoda	1.8	10.0	0.8	47.4	0.4	1.8	2.2	81.2
Pelecypod siphons	7.3	15.6	1.4	26.3	8.2	18.2	4.6	42.7
Cardiidae	T	3.7	T	2.1	T	0.1	T	23.7
Hiatellidae					T	T		
Mactridae			T	1.0	T	1.2		
Myidae			T	1.6			T	0.1
Nuculanidae			T	0.2				
Pectiniidae			T	0.1	T	0.3	T	13.7
Tellinidae			0.1	9.9			T	9.0
Veneridae	T	T						
Echiuroidea			T	40.2			T	100
Annelida								
Polychaeta	1.2	28.0	1.3	10	1.1	16.1	1.5	62.1
Ampharetidae					T	0.2	T	2.5
Eunicidae			T	101				
Glyceridae	T	T	T	0.2	T	0.7	0.5	10.2
Goniadidae					T	T	T	0.2
Lumbrineridae	T	0.2	0.1	0.2	0.2	0.4	0.2	0.4
Maldanidae	T	0.1	T	11.7	T	1.0	T	1.4
Nephtyidae			T	10.9			T	2.8
Nereidae			T	2.1			T	T
Opheliidae	0.1	1.5	0.1	7.2			0.6	20.7
Orbiniidae					T	2.9	T	0.1
Oweniidae	0.1	0.3	T	0.4	0.2	3.0	T	0.1
Pectinariidae	T	0.1	T	0.1			T	0.1
Phyllodocidae	T	T	T	1.5	0.2	0.1	T	7.8

Table 21. The average number and weight (mg) of prey items per yellowfin sole stomach. (T = trace, J = juvenile, P = pooled). - Cont.

	Yellowfin sole ( <i>Limanda aspera</i> )							
	June (J)		June		July (J)		July	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Polynoidae	T	1.2					T	T
Sabellaridae	T	T			T	T		
Sabellidae					T	T		
Scalibregmidae							0.5	6.2
Spionidae	T	0.1						
Syllidae							T	0.1
Terebellidae	T	0.1					T	7.1
Arthropoda								
Crustacea	T	0.1	T	3.4	T	0.1	T	0.1
Copepoda								
Calanoida	T	T					T	T
Harpacticoida					0.2	T		
Cirripedia					0.1	0.8	0.2	16.4
Cirripede larvae	T	T			0.1	T		
Mysidacea	T	2.3	T	0.2	0.1	2.5	T	0.1
Cumacea	0.2	1.7	T	0.3	T	0.1	1.0	1.7
Isopoda					T	T		
Sphaeromatidae			T	T				
Amphipoda								
Caprelliidea	T	0.1			T	0.2	0.1	0.5
Gammaridea	0.6	1.9	0.3	2.4	0.6	8.1	2.4	6.9
Hyperiidea							T	T
Euphausiacea	T	T	0.3	8.8	T	0.1	0.1	0.7
Decapoda					T	0.9	T	0.9
Carides	T	T	0.1	85.3	0.2	1.5	1.0	33.4
Crangonidae	T	0.3	T	3.4	T	1.4	T	3.2
Hippolytidae	T	0.1					T	0.1
Pandalidae			0.1	184			0.1	211
Anomura			T	15.8				
Lithodidae	T	0.1						
Paguridae			T	3.7	T	0.1	T	6.2
Brachyura			T	1.1			0.1	14.6
Brachyura megalops	0.6	2.7	0.2	0.3				
Brachyura zoea					T	T		
Oxyrhyncha	0.4	8.3	0.3	7.0	T	1.0	T	0.1
Majidae	0.7	18.8	0.1	28.2	0.4	11.2	T	50.2
Insecta							T	T
Diptera							T	T
Echinodermata								
Echinoidea			T	T	T	T	T	0.3
Holothuroidea					T	0.1		
Ophiuroidea	T	0.3	0.1	1.8	0.1	0.8	0.4	12.1
Chordata								
Vertebrata								
Teleostei	T	24.7	0.1	193	T	51.4	0.1	149
Teleost egg	T	0.1			3.1	2.7		
Teleost larva	T	1.6	T	0.7			T	1.1
Ammodytidae							T	3.4
Cottid larva			T	0.2				
Osmeridae			T	126				
Pleuronectidae					T	0.9		
Stichaeidae			T	4.7				
Unidentified	T	1.5	12.1	47.9	0.4	1.8	0.3	165
Total number stomachs		337		317		133		168
Number empty stomachs		P		116		P		39
Mean fullness		3.2		2.7		3.2		3.2
Mean length (mm)		149.5		257.0		139.9		259.8

Table 22. The average number and weight (mg) of prey items per Pacific halibut stomach. (T = trace, J = juvenile).

	Pacific halibut ( <i>Hippoglossus stenolepis</i> )					
	June (J)		June		July (J)	
	Number	Weight	Number	Weight	Number	Weight
Mollusca						
Gastropoda	T	3.2				
Prosobranchia						
Pelecypoda			0.1	15.5		
Arthropoda						
Crustacea	0.2	61.0				
Mysidacea	0.3	18.6				
Decapoda						
Carides			0.1	5.1		
Crangonidae	0.2	38.3				
Pandalidae	2.1	8,508	4.0	2,304		
Anomura						
Paguridae	T	34.2			0.2	495
Brachyura						
Oxyrhyncha						
Majidae	0.1	37.0			0.1	4.4
Chordata						
Vertebrata						
Teleostei	0.7	1,976	0.5	176	0.4	2,002
Ammodytidae					1.5	1,565
Anoplopomatidae			1.0	27,446		
Clupeidae	0.1	1,069				
Total number stomachs	23		2		13	
Number empty stomachs	1		0		3	
Mean fullness	4.6		5.5		2.9	
Mean length (mm)	387.9		896.0		390.8	
					0.1	121
					0.4	4,773
					0.1	504.1

Table 23. The average number and weight (mg) of prey items per sablefish stomach. (J = juvenile).

	Sablefish ( <i>Anoplopoma fimbria</i> )	
	June (J)	
	Number	Weight
Arthropoda		
Crustacea		
Mysidacea	0.1	0.2
Euphausiacea	4.7	420
Decapoda		
Carides	0.1	97.2
Brachyura megalops	1.7	16.9
Chordata		
Vertebrata		
Teleostei	0.5	1,465
Clupeidae	0.1	233
Osmeridae	0.7	8,317
Total number stomachs		25
Number empty stomachs		3
Mean fullness		5.4
Mean length (mm)		300.8