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ANNUAL REPORT

DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE AND TROPHIC RELATIONSHIPS OF THE NEARSHORE BENTHOS OF THE KODIAK SHELF

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With

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

Until recently little was known about the biology of the invertebrates of the shallow, nearshore benthos of Kodiak Island. Since these invertebrates may be the ones most affected by petroleum operaions in waters adjacent to Kodiak Island, baseline data on these species are essential before industrial activities begin there.

The specific objectives of this investigation of Kodiak Island addressed in this Annual Report are:

1. On a limited basis, assess distribution and relative abundance of epifaunal invertebrates in selected bays and offshore areas.

2. Determine the feeding habits of the principal inshore epifaunal invertebrate species, emphasizing king crabs, and selected bottomfishes.

Thirty-nine permanent benthic stations were established in two bays - 25 stations in Izhut Bay and 14 stations in Kiliuda Bay. These stations were sampled with a try net and/or a 400-mesh Eastern otter trawl on six separate cruises: April, May, June, July, August, and November 1978. Taxonomic analysis of the epifauna collected delineated nine phyla in each bay. The dominant invertebrate species had distinct biomass differences between the bays. Important species, in terms of biomass, in Izhut Bay were snow crabs (*Chionoecetes bairdi*) and sunflower sea stars (*Pycnopodia helianthoides*). Kiliuda Bay was dominated by king crabs (*Paralithodes camtschatica*), snow crabs, and pink shrimps (*Pandalus borealis*).

Offshore sampling was conducted in March 1978 adjacent to Portlock Bank and in June-July 1978 along the entire east side of the Kodiak Island continental shelf. The most important group, in terms of biomass, collected near Portlock Bank was echinoderms, specifically sea stars and sea urchins. King and snow crabs were the second-most important group from this area. Kodiak shelf sampling in June–July revealed king and snow crabs as the dominant species.

Stomachs of king crabs collected via trawling and spring SCUBA activities, contained a wide variety of prey. Prey of crabs from Izhut Bay was dominated by fishes. Crabs from Kiliuda Bay mainly preyed upon molluscs, specifically clams. Food obtained from king crabs from the June-July 1978 Kodiak shelf sampling consisted mainly of clams and cockles, however, crustaceans and fishes were also important. King crabs collected during SCUBA sampling mainly contained clams and acorn barnacles.

Food data for king and snow crabs, and pink shrimps will be available for the Final Report, and these data, in conjunction with similar data from Cook Inlet and the Bering Sea, will enhance our understanding of the trophic role of these crustaceans in their respective ecosystems. Additional food data for the sea star *Pycnopodia helianthoides* and bottomfishes, as well as an assessment of the literature, will make it possible to develop a food web for benthic and nektobenthic species of inshore and offshore waters around Kodiak Island. Comprehension of basic food interrelationships is essential for assessment of the potential impact of oil on the crab-shrimp-dominated benthic systems of the waters adjacent to Kodiak.

The importance of deposit-feeding clams in the diet of king and snow crabs in Kodiak waters has been demonstrated by preliminary feeding data collected there. It is suggested that an understanding of the relationship between oil, sediment, deposit-feeding clams, and crabs be developed in a further attempt to understand the possible impact of oil on the two commercially important species of crabs in the Kodiak area.

Initial assessment of data suggests that a few unique, abundant and/or large invertebrate species (king crab, snow crab, several species of clams) are characteristic of the bays investigated and that these species may represent organisms that could be useful for monitoring purposes.

It is suggested that a complete understanding of the benthic systems of Kodiak waters can only be obtained when the infauna is also assessed in conjunction with the epifauna. Based on stomach analyses, infaunal species are important food items for king and snow crabs. However, the infaunal components of the Kodiak shelf have not been quantitatively investigated to date. A program designed to examine the infauna should be initiated in the very near future.

II. INTRODUCTION

GENERAL NATURE AND SCOPE OF STUDY

The operations connected with oil exploration, production, and transportation in the northeast Gulf of Alaska (NEGOA) and waters adjacent to Kodiak Island present a wide spectrum of potential dangers to the marine environment (see Olson and Burgess, 1967 and Malins, 1977 for general discussion of marine pollution problems). Adverse effects on the marine environment of this area cannot be assessed, or even predicted, unless background data are recorded prior to industrial development.

Insufficient long-term information about an environment, and the basic biology and recruitment of species in that environment, can lead to erroneous interpretations of changes in types and density of species that might occur if the area becomes altered (see Nelson-Smith, 1973; Pearson, 1971, 1972, 1975; Rosenberg, 1973 for general discussions on benthic biological investigations in industrialized marine areas). Populations of marine species fluctuate over a time span of a few to 30 years, but such fluctuations are typically unexplainable because of the absence of long-term data (Lewis, 1970; and personal communication).

Benthic organisms (primarily the infauna but also sessile and slow-moving epifauna) are particularly useful as indicator species for a disturbed area because they tend to remain in place, typically react to long-rang environmental changes, and by their presence, generally reflect the nature of the substratum. Consequently, the organisms of the infaunal benthos have frequently been chosen to monitor long-term pollution effects, and are believed to reflect the biological health of a marine area (see Pearson, 1971, 1972, 1975 and Rosenberg, 1973 for discussion on long-term usage of benthic organisms for monitoring pollution; and Feder and Matheke, in press; for data and discussion on the infauna of NEGOA).

The presence of large numbers of epifaunal species of actual or potential commercial importance (crabs, shrimps, snails, finfishes) in NEGOA and on the shallow shelf adjacent to Kodiak Island further dictates the necessity of understanding benthic communities since many commercial species feed on infaunal and small epifaunal residents of the benthos (see Zenkevitch, 1963 for a discussion of the interaction of commercial species and the benthos;

also see appropriate discussion in Feder *et al.*, 1978a; Feder *et al.*, 1978b). Any drastic changes in density of the food benthos could affect the health and numbers of these commercially important species.

Experience in pollution-prone areas of England (Smith, 1968); Scotland (Pearson, 1972, 1975); and California (Straughan, 1971) suggests that at the completion of an initial study, selected stations should be examined regularly on a long-term basis to determine changes in species content, diversity, abundance and biomass. Such long-term data acquisition should make it possible to differentiate between normal ecosystem variation and pollutan-induced biological alteration. Intensive investigations of the benthos of the Kodiak Continental Shelf are essential to understand the trophic interactions involved in this area and the changes that might take place once oil-related activities are initiated.

The benthic biological program in NEGOA (Feder, 1978) has emphasized development of an inventory of species as part of the examination by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) of biological, physical and chemical components of shelf slated for oil exploration and drilling activity. In addition, a program designed to quantitatively assess assemblages (communities) of benthic species on the NEGOA shelf has expanded the understanding of distribution patterns of species there (Feder *et al.*, 1978a; Feder and Matheke, in press). Investigations connected with distribution, abundance, community structure, and trophic relationships of benthic species in Cook Inlet, two Kodiak Island bays, and the S. E. Bering Sea have recently been completed (Feder *et al.*, 1978a; Feder and Jewett, 1977; Feder *et al.*, 1978b). However, detailed information on the temporal and spatial variability of the benthic fauna is sparse.

The project considered in this Annual Report was designed to survey the benthic fauna including feeding interactions, on the Kodiak Island shelf in regions of potential oil and gas concentrations. Data were obtained seasonally on faunal composition and abundance to develop baselines to which future changes could be compared. Long-term studies on life histories and trophic interactions of important species should define aspects of communities and ecosystems potentially vulnerable to environmental damage, and should help to determine rates at which damaged environments can recover.

RELEVANCE TO PROBLEMS OF PETROLEUM DEVELOPMENT

Lack of an adequate data base elsewhere makes it difficult to predict the effects of oil-related activity on the subtidal benthos of the Kodiak shelf. However, OCSEAP – sponsored research activities on the shelf should ultimately enable us to point to certain species or areas that might bear closer scrutiny once industrial activity is initiated. It must be emphasized that a considerable time frame is needed to comprehend long-term fluctuations in density of marine benthic species; thus, it cannot be expected that short-term research programs will result in predictive capabilities. Assessment of the environment must be conducted on a continuing basis.

As indicated previously, infaunal organisms tend to remain in place and, consequently, have been useful as indicator species for disturbed areas. Thus, close examination of stations with substantial complements of infaunal species is warranted (see Feder and Mueller, 1975; Feder and Matheke, in press, and NODC data on file for examples of such stations). Changes in the environment at stations with relatively large numbers of species might be reflected by a decrease in diversity with increased dominance of a few species (see Nelson-Smith, 1973 for further discussion of oil-related changes in diversity). The potential effects of loss of species to the trophic structure on the Kodiak shelf cannot be assessed at this time, but the problem can be better addessed once benthic food studies resulting from recent projects are analyzed (Jewett and Feder, 1976; Feder *et al.*, 1978a; Feder and Jewett, 1977, 1978; Smith *et al.*, 1978).

Data indicating the effect of oil on subtidal benthic invertebrates are fragmentary (see Boesch *et al.*, 1974; Malins, 1977 and Nelson-Smith, 1973 for reviews; Baker, 1977 for a general review of marine ecology and oil pollution), and virtually no data are available for the Kodiak shelf. Snow crabs (*Chionoecetes bairdi*) are conspicuous members of the shallow shelf of the Gulf of Alaska, inclusive of the Kodiak region, and this species supports a commercial fishery of considerable importance. Laboratory experiments with this species have shown that postmolt individuals lose most of their legs after exposure to Prudhoe Bay crude oil; obviously this aspect of the biology of the snow crab must be considered in the continuing assessment of this species (Karinen and Rice, 1974). Mecklenburg *et al.* (1976) examined the effects of Cook Inlet crude oil water soluble fractions on survival and molting of king crab (*Paralithodes camtschatica*) and coon-stripe shrimp (*Pandalus hypsinotus*) larvae. Molting was permanently inhibited by exposing both larvae for 72 hours at a concentration of 0.8 to 0.9 ppm. Larvae that failed to molt had died in seven days, although the contaminated water had been replaced with clean water. Although high concentrations of oil killed the larvae in 96 hours, lower concentrations disrupted swimming and molting in the same period and also ultimately resulted in death. Little other direct data based on laboratory experiments are available for subtidal benthic species. Experimentation on toxic effects of oil on other common members of the subtidal benthos should be encouraged in future in OCSEAP programs.

A direct relationship between trophic structure (feeding type) and bottom stability has been demonstrated by Rhoads (see Rhoads, 1974 for review). A diesel fuel spill resulted in oil becoming absorbed on sediment particles with resultant mortality of many deposit feeders on sublittoral muds. Bottom stability was altered with the death of these organisms, and a new complex of species became established in the altered substratum. The most common members of the infauna of the Gulf of Alaska and the Bering Sea are deposit feeders; thus, oil-related mortality of these species could result in a changed near-bottom sedimentary regime with subsequent alteration of species composition.

As suggested above, upon completion of initial baseline studies in pollution prone areas, selected stations should be examined regularly on a long-term basis. Also, intensive examination of the biology (e.g., age, growth, condition, reproduction, recruitment, and feeding habits) of selected species should afford obvious clues of environmental alteration.

III. CURRENT STATE OF KNOWLEDGE

Few data on non-commercially important invertebrates of the nearshore benthos of the Gulf of Alaska were published until recent OCSEAP studies were initiated, e.g. Feder (1977), although a summary of information prior to OCSEAP was available in the literature review of Rosenberg (1972).

To date, Russian workers have published most of the data from the western Gulf of Alaska (AEIDC, 1974); however, OCSEAP investigations in the northeast Gulf of Alaska (NEGOA) provide some useful data from adjacent areas (Feder, 1977; Feder *et al.*, 1978a). The Soviet benthic work was accomplished in the deeper waters of the Kodiak shelf, and was of a semi-quantitative nature with little data useful for predicting the effects of oil on the benthos.

The exploratory trawl program of the National Marine Fisheries Service is the most extensive investigation of commercially important species of the Kodiak shelf (Ronholt *et* aZ., 1978; unpublished data; reports available from the National Marine Fisheries Service Laboratory, Kodiak). Some information on non-commercial invertebrates species is included in the data reports of the National Marine Fisheries Service, but the general nature of the taxonomy of species caught on their surveys makes their data difficult to interpret. However, the dominant groups of organisms likely to be encountered in the offshore waters of the Kodiak shelf are suggested by these studies. The International Pacific Halibut Commission surveys parts of the Kodiak shelf annually, but only records commercially important species of crabs and fishes; non-commercially important invertebrate and fish species are generally lumped together in the survey reports with little specific information available.

Additional, but unpublished data on the epifauna in the vicinity of Kodiak Island are available as a by-product of the Alaska Department of Fish and Game King Crab Indexing Surveys (inquiries concerning these reports may be directed to Alaska Department of Fish and Game, Box 686, Kodiak).

A compilation of data on renewable resources of the Kodiak shelf is included in the publication on Kodiak by AEIDC (1974).

A recent inshore survey of the Kodiak shelf examined the invertebrate benthos, and collected limited data on the food of the yellowfin sole (Feder and Jewett, 1977). This study investigated the distribution, abundance, aspects of reproduction, and feeding interactions of the benthos of two bays of Kodiak Island, Alitak and Ugak Bays. The food of the Pacific cod and two species of sculpins from the outer Kodiak shelf are presented in Jewett (1978) and Jewett and Powell (in prep.), respectively. Sufficient data were available from these studies and MacDonald and Petersen (1976) to develop a preliminary food web for the two bays and inshore waters around Kodiak Island (Feder and Jewett, 1977). The potential response of the inshore benthic system to oil-related activities in the two bays and inshore waters around Kodiak island is discussed in Feder and Jewett (1977).

Commercial catch statistics of Kodiak crab stocks in past years showed classic exploitation patterns with a peak year catch occurring in the 1965-66 season. Since that time, annual harvest levels (quotas) have been imposed. Recent data substantiate that king crab stocks are responding to the reduced fishing pressure resulting from this management decision, and populations are apparently in the rebuilding phase. The two most commercially utilized stocks are southern district stocks II and III which cover Kodiak Island's southern waters to the continental shelf edge (Guy Powell and Alaska Department of Fish and Game Reports, unpub.). Recent trawl studies conducted in two Kodiak Bays (Alitak and Ugak) show king crabs as the dominant species there (Feder and Jewett, 1977). Alitak Bay is also a major king crab breeding area (Gray and Powell, 1966; Kingsbury and James, 1971).

Based on OCSEAP feeding studies initiated in the northeast Gulf of Alaska (inclusive of Cook Inlet) and two bays on Kodiak Island (Feder, 1977; Feder and Jewett, 1977), it is apparent that benthic invertebrates play a major role in the food dynamics of commercial crabs and demersal fishes on the Kodiak shelf.

Although OCSEAP sponsored research has initiated some inshore benthic studies in the Kodiak area, the coverage has been restricted geographically. Furthermore, little offshore benthic data is available to integrate with the inshore benthic work. Species found in bays, shallow inshore areas and deeper benthos of the Kodiak shelf are all highly mobile, and some of the more important species (e.g. king crabs, snow crabs, halibut) migrate between deep and shallow water during the course of a year. Data collected for these species only from inshore areas will not address their biological interactions in deeper shelf waters. Expansion of the data base from inshore to offshore waters is especially important to fully comprehend the biology of the commercially important king crab. The commercial pursuit of the latter species results in the most important invertebrate fishery in Alaska waters, and Kodiak king crab stocks support a substantial portion of the fishery.

IV. STUDY AREA

A large number of stations were occupied on the Kodiak Continental Shelf in conjunction with the Alaska Department of Fish and Game and National Marine Fisheries Service (Appendix A, Table 1). Inshore areas most extensively sampled by trawl included Izhut Bay, located on the southeast side of Afognak Island, and Kiliuda Bay, located on the east side of Kodiak Island (Figs. 1 and 2). Additional inshore areas were sampled on Kodiak Island by SCUBA: Near Island Basin; McLinn Island, and Anton Larsen Bay (Fig. 3). Outer shelf stations were occupied by trawl near Portlock Bank (Fig. 4), and by trawl and pipe dredge along the east side of the Kodiak Island Shelf (Fig. 5).

V. SOURCES, METHODS AND RATIONALE OF DATA COLLECTION

Data on benthic epifauna, including feeding data on crabs, and fishes, were collected during ten cruises in 1978-79. The NOAA Ship *Miller Freeman* was used primarily for offshore sampling, and the M/V Yankee *Clipper* and the R/V Commando were used primarily for inshore collecting.

Sampling from the *Miller Freeman* was conducted 21-24 March 1978, 19-9 June-July 1978, and 14–24 February 1979 using a commercial-size 400-mesh Eastern otter trawl (12.2 m horizontal opening). A pipe dredge was also used from the *Freeman* in June-July 1978 and February 1979 to obtain invertebrates to aid in the identification of invertebrate and fish stomach contents.

The Yankee *Clipper* sampled 10-22 April, 7–15 May, 7-22 June, 9-21 July, and 8–23 August 1978. The *Commando* also sampled 7–15 May, 7-22 June, 9-21 July, and 8-23 August 1978, in addition to 4-17 November 1978 and 1-20 March 1979. A trynet (6.1 m horizontal opening) was used from the *Clipper*, and a try-net and Eastern otter trawl were used from the Commando.

Exploratory diving for crabs, via SCUBA, was conducted near the city , of Kodiak in May, June and October 1978. SCUBA-caught king crabs, obtained for stomach analysis, were caught in May at Near Island Basin (57°47.0' lat. N, 152°3.0′ long. W and near McLinn Island (57°46.2′ lat. N, 152°27.0′ long. W.)

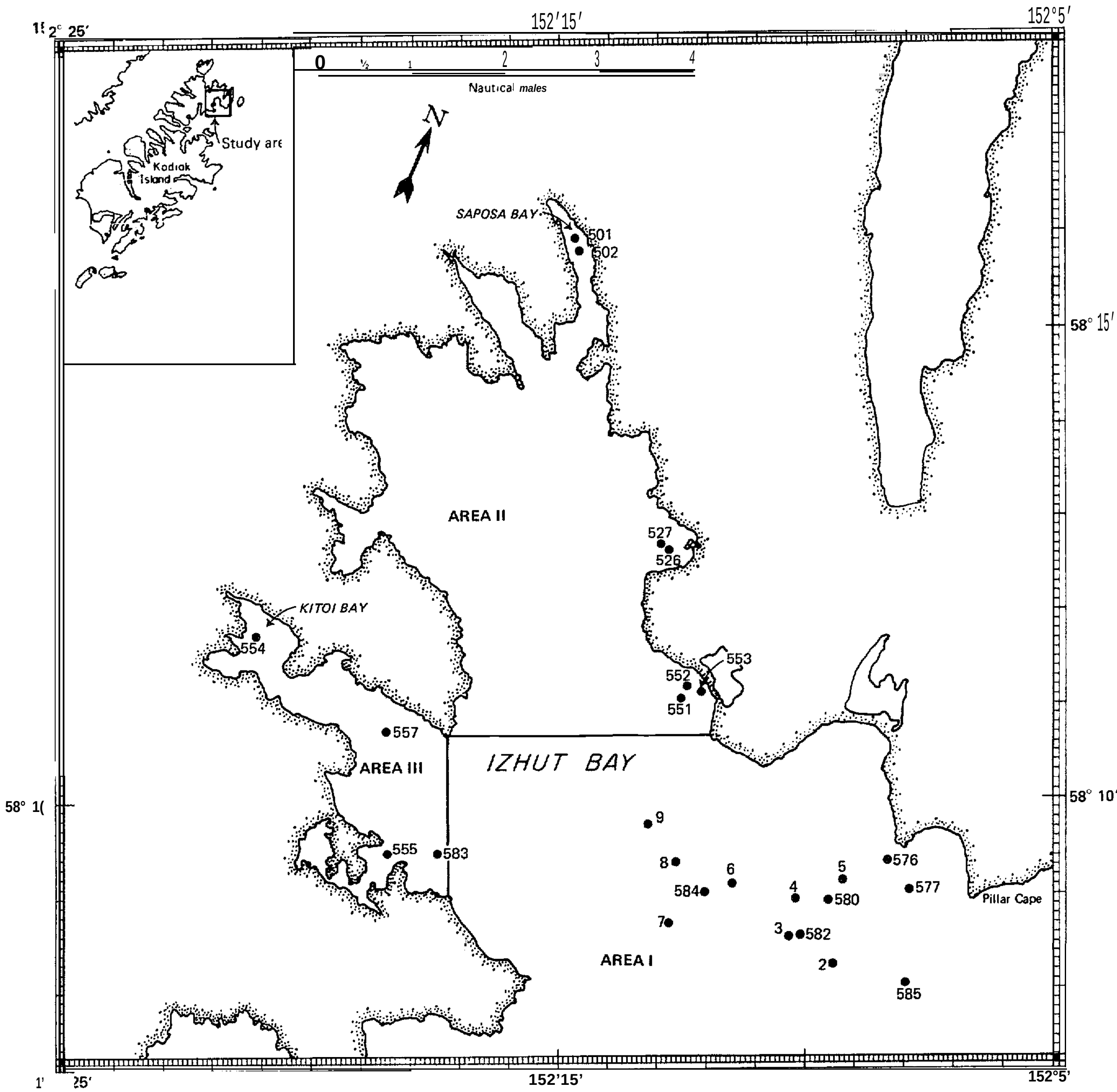


Figure 1. Benthic trawl stations occupied in Izhut Bay, Afognak Island, 1978. The bay is divided into three areas referred to in the text.

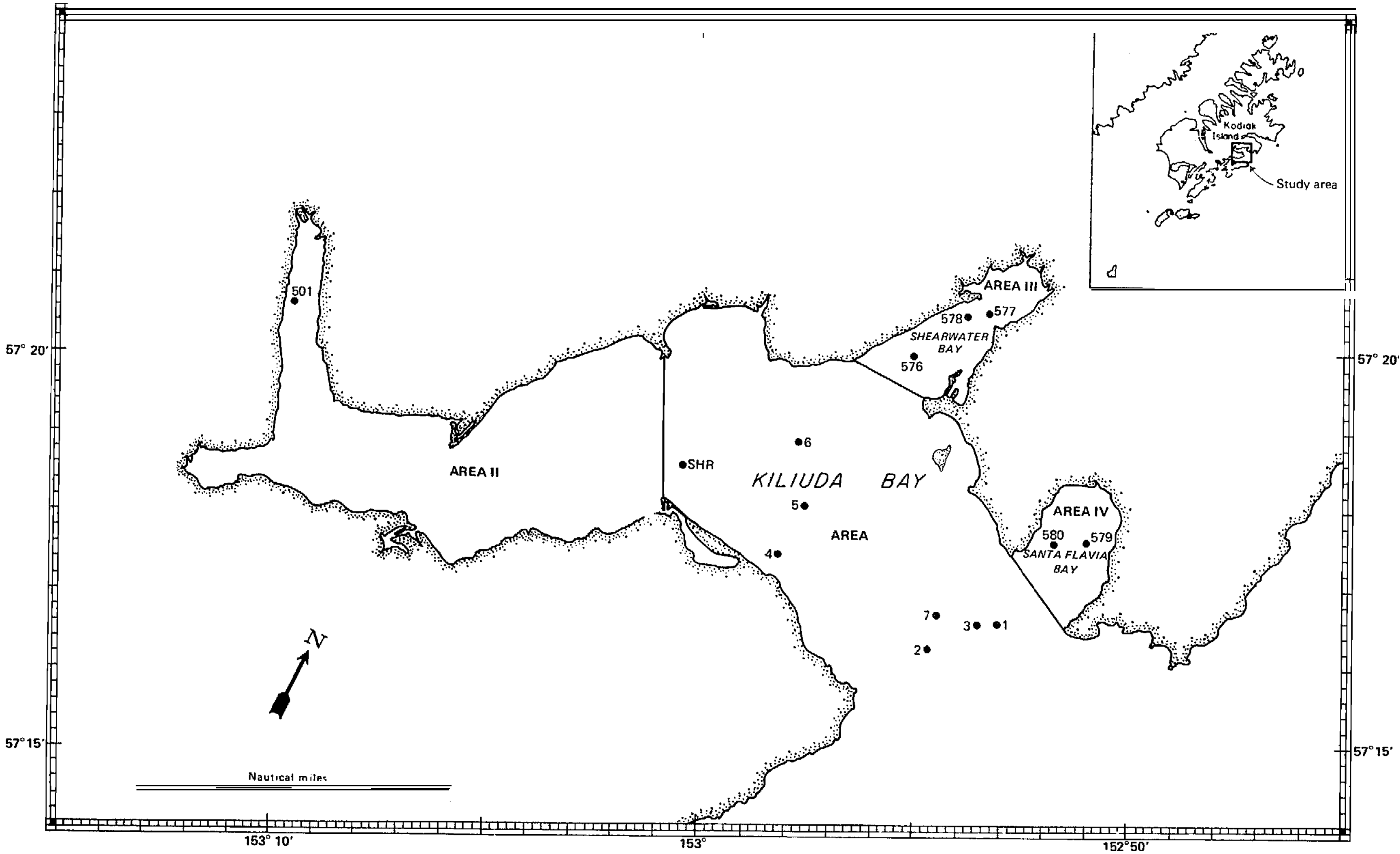


Figure 2. Benthic trawl stations occupied in Kiliuda Bay, Kodiak Island, 1978. They bay is divided into four areas referred to in the text.

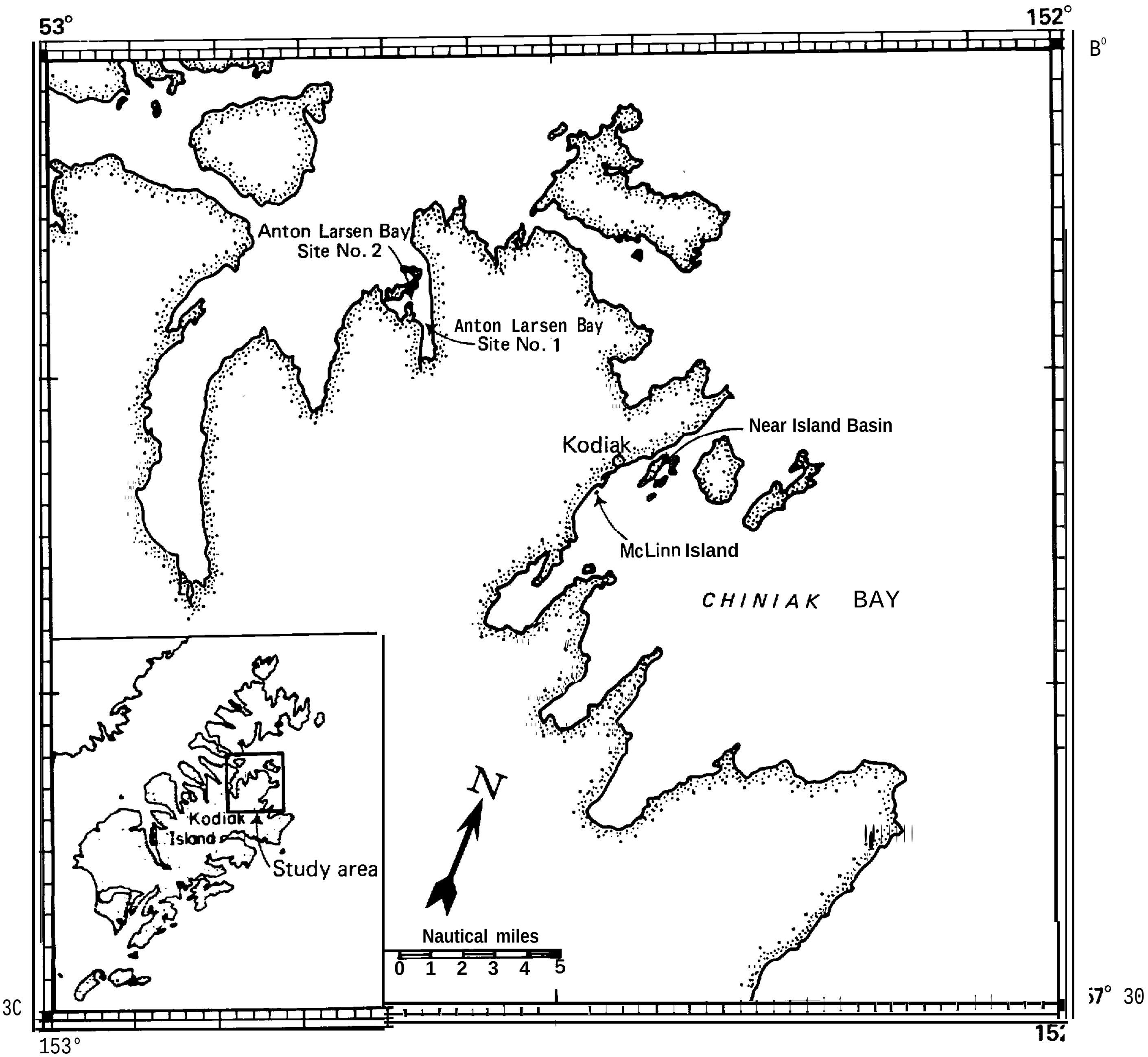
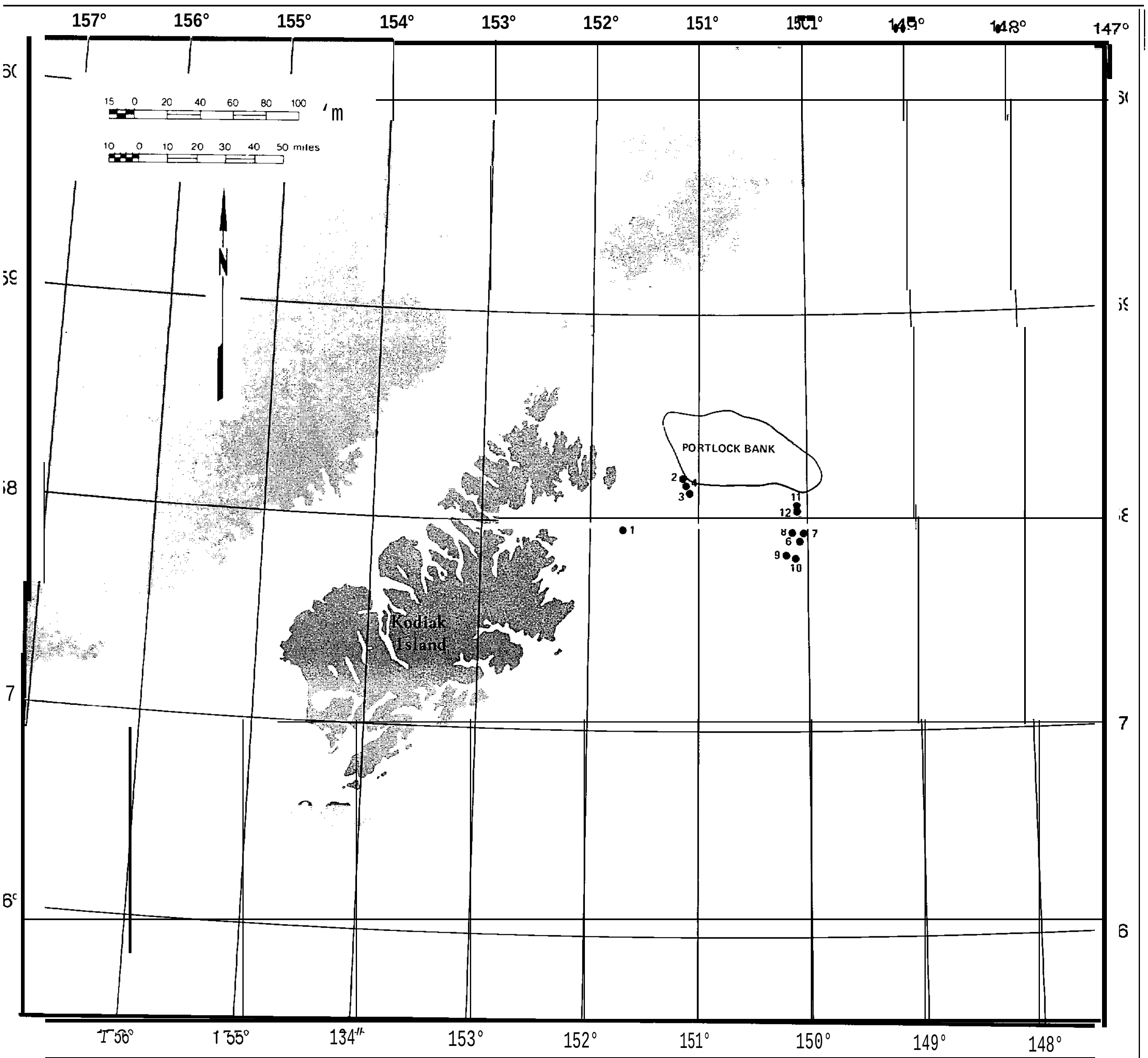


Figure 3. Locations where king crabs were collected via SCUBA for stomach analysis, 1978.



igure 4. Benthic trawl stations occupied adjacent to Portlock Bank, March 1978.

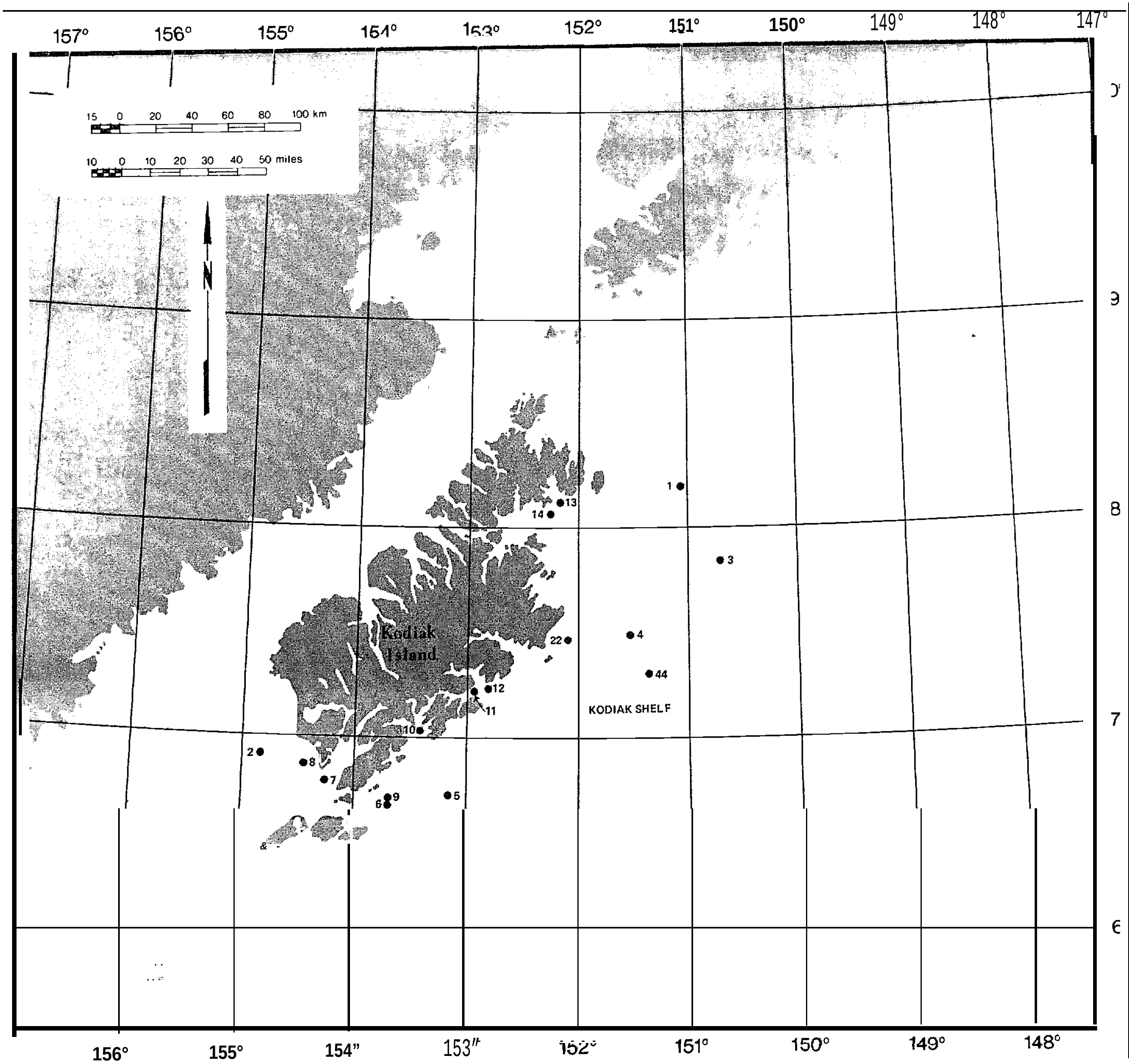


Figure 5. Benthic stations occupied on the Kodiak continental shelf, June-July 1979.

and in June at Near Island Basin and two locations in Anton Larsen Bay (57°52.0′ lat. N, 152°37.4′ long. W and 57°52.5′ lat. N, 152°39.0′ long. W).

Invertebrates from the trawls were sorted on shipboard, given tentative identifications, counted and weighed. Aliquot samples of individual taxa were labeled and preserved for final identification at the University of Alaska, Fairbanks. Invertebrates from the pipe dredge were sorted, identified, and counted at the University of Alaska. Non-commercial invertebrates from some Izhut and Kiliuda Bay stations in June and August were inadvertently not recorded.

Biomass per unit area (g/m^2) is included for all trawl data and is calculated as follows:

$$\text{Biomass} = \sum_{i=1}^{k} [\text{weight}/(\text{distance fished} \times \text{trawl width})]$$

Analysis of food habits of a variety of predators taken by trawl was conducted in the laboratory at the University of Alaska. A summary of the number of stomachs examined by sampling area and collection period is ineluded in Table I.

On shipboard, king crabs selected for stomach analysis were measured (length in millimeters) and weighed (wet weight in grams). Carapace length is defined as the distance from the posterior margin of the right orbital indentation to the mid-point of the posterior marginal indentation. Crabs were categorized as belonging to one of eight classes (Powell *et al.*, 1974): (1) juvenile females less than 120 mm; (2) adult females greater than 94 mm; (3) newshell males less than 100 mm– individuals that molted during the last molting period; (4) oldshell males less than 100 mm– individuals that failed to molt during the last molting period, often referred to as skipmolts; (5) very oldshell males less than 100 mm-individuals that failed to molt during the two or more molting periods, often referred to as double skipmolts; (6) newshell males greater than 100 mm; (7) oldshell males greater than 100 mm; and (8) very oldshell males greater than 100 mm. Stomachs* and intestines removed and were placed in plastic "Whirlpak" bags and fixed in 10% buffered formalin and final identification at the University of Alaska, Fairbanks.

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[1]In this study, references to crab stomachs includes that portion extending from the terminal portion of the esophagus to the beginning of the intestine.

TABLE I

THE NUMBER OF STOMACHS FROM EACH PREDATOR EXAMINED BY SAMPLING AREA AND COLLECTION, FERIOD. ALL PREDATORS WRRE TAKEN BY TRAWL.

Predators	Izhut Bay						Kiliuda Bay					Kodiak Shelf		TOTALS
	April	May	June	July	August	November	April	June	July	August	November	March	June	
	STOMACHS EXAMINED													
Paralithodes camtschatica (red king crab)			22	18			49	83	71	44	55	6	196	544
Chionoecetes bairdi (snow crab)	31	117	159	121	31	50	64	117	51	61	50	95	167	1114
Pandalus borealis (pink shrimp)		300		300	300				200	300	400			1800
Pycnopodia helianthoides (sunflower sea star)		105	44		14	36								199
Gadus macrocephalus (Pacific cod)		18								20			190	228
Theragra chalcogramma (walleye pollock)										20				20
Myoxocephalus spp. (sculpins)		19											72	91
Hemilepidotus jordani (yellow Irish lord)						.-						39	189	228
Lepidopsetta bilineata (rock sole)		23											94	117
Hippoglossoides elassodon (flathead sole)													156	156
Atheresthes stomias (arrowtooth flounder)													18	18
Pleuogrammus monopterigius (Atka mackerel)													20	20
Anaplopoma fimbria (sablefish)													31	31

In the laboratory, stomach contents were removed, and sorted by taxon. Each taxon was blotted dry, weighed to the nearest 0.001 g, measured volumetrically by water displacement to the nearest 0.01 ml. Taxon weighing was accomplished by weighing a vial with a known quantity of water and then weighing the vial and water plus the taxon. The difference in the two weights equal the taxon weight.

Food material may never completely fill a stomach to the theoretical maximum volume. Large quantities of digestive fluids, in addition to hard and bulky food material that is not readily compressed prevents filling to capacity.

The fullness of stomach was calculated using a method adapted from Cunningham (1969) for southeast Bering Sea king crabs. He delineated a curvilinear relationship between king crab length and the theoretical maximum stomach volume. To do this, he measured the maximum stomach volume of 216 crabs which ranged from 80-180 mm carapace length. The regression formula was $Y = 34.25 - 0.72x + 0.0047x^2$, and the correlation coefficient was 0.899. Since king crabs examined in our study were similar in size to those examined by Cunningham, we used his regression formula with our crabs to calculate the theoretical maximum volumes. The percent of fullness was derived by dividing the observed volume by the theoretical maximum volume. The prey in the intestines of king crabs were examined and recorded by frequency of occurrence.

Fish stomachs were examined when possible, and contents were recorded as frequency of occurrence.

VI. RESULTS

TRAWL DATA: DISTRIBUTION-BIOMASS

Izhut Bay

April 1978 (Tables II-VII; Fig. 1)

Eight stations were successfully trawled with a try net in Izhut Bay, April 1978. All station depths were less than 36 m. The mean epifaunal invertebrate biomass was 1.56 g/m^2, and the dominant phyla, in terms of percent biomass, were Porifera (21.9%) and Echinodermata (61.7%). Sponges were not identified to species. The leading echinoderm species was the sea star *Pycnopodia helianthoides (60.7%).* The only commercially-important invertebrate was the snow crab *Chionoecetes bairdi* which comprised 3.7% of the invertebrate biomass. The majority of snow crabs came from Kitoi Bay, Area III, station 554.

May 1978 (Tables II-VII; Fig. 1)

A total of *14* stations were occupied in Izhut Bay in May, 12 with a try net and two with an otter trawl. The mean epifaunal invertebrate biomass for all stations was 1.83 g/m^2. Leading phyla were Arthropoda (Crustacea) (44% of the biomass) and Echinodermata (50.8%}. Arthropods consisted primarily of the pink shrimp *Pandalus borealis (22.5%), Chionoecetes bairdi (12.7%),* the king crab *Paralithodes camtschatica (3.9%),* and the dungeness crab *Cancer magister* (3.7%). The largest catch of *P. borealis* came from Area III at station 557; 33.7 kg or 3.45 g/m^2. The largest snow crab catch was 26.5 kg in Area I at station 3. Dominant echinoderms were the sea stars *Pycnopodia helianthoides (37.9%)* and *Stylasterias forreri* (11.4%).

June 1978 (Tables II-VII; Fig. 1)

Benthic trawling in Izhut Bay in June was successfully accomplished at 14 stations, 11 try net stations and three otter trawl stations. Use of the try net aboard the *Yankee Clipper* was restricted to stations in less than 73 m of water due to the loss of the trawl winch on the preceding cruises (May 1978). The try net had to be deployed via the use of a capstan and 5/8 inch polyethylene line. Several unsuccessful attempts to

TABLE II

TRAWL STATIONS OCCUPIED IN IZHUT AND KILIUDA BAYS, 1978, AND STATIONS WHERE LARGE NUMBERS OF KING CRABS, SNOW CRABS AND/OR PINK SHRIMP WERE COLLECTED

T = Try Net Stations, 0 = Otter Trawl Stations

Izhut Bay Stations	April	May	June	July	August	November
2		O*				0
3		0	0	0		0
4				0		
5					O*	
6					0	
7			O+*			0*
8			0+*	0+*	0*	0
9				0		
501	T	T	T			
502		T	T	T		
526		T	T	T#		
527	T	T		T#	T	T
551	T			T	T	T
552	T	T	T	T	T	T
553	T	T	T	T	T	T
554	T*	-	T	T	T	T
555	-	T		T	T	T
557	-	T#		T#	T#	T
576		T	T	T	T	T
577	T	T	T	T	T	T
580	T	-	T	T	T	T
582		T	T		T	
583		T	T	T	T	T
584				T		
585				T		

Kiliuda Bay Stations	April	June	July	August	November
1			0+		
2				0+*	
3		0+			
4		0*	O+	0	
5		0		0+	O*#
6			0*		
7					0+*
501			T	T	T
576	T+	T	T	T	T
577	T		T	T	T
578	T+	T	T		
579	T+	T	T+*	T*	T
580	T+	T	T+*	T	T
SHR	T	T	T	T#	T+#

1 +Important King Crab Stations
*Important Snow Crab Stations
#Important Pink Shrimp Stations

TABLE III

SUMMARY OF TRAWL Acclivities FROM IZHUT AND KILIUDA BAYS, 1978

		Izhut Bay				Kiliuda Bay			
Date	Gear	Successful Stations	Distance Fished, km	Invertebrate Weight, kg	Mean Biomass g/m²	Successful Stations	Distance Fished, km	Invertebrate Weight, kg	Mean Biomass g/m²
April 10-22	Try-Net	8	6.33	60,611	1.56	6	9.14	113.669	2.04
May 7-15	Try-Net	12	12.00	95.837					
	Otter Trawl	2	3.70	121.420					
	TOTALS	14	15.70	217.257	1.83				
June 7-22	Try-Net	11	8.80	77.598		5	7.20	59.326	
	Otter Trawl	3	4.80	719.886		3	2.40	209.850	
	TOTALS	14	13.60	797.484	7.10	8	9.60	269.176	3.68
July 9-21	Try-Net	15	15.50	129.996		7	7.11	72.440	
	Otter Trawl	4	6.40	342.725		3	4.80	154.970	
	TOTALS	19	21.90	472.721	2.74	10	11.91	227.410	2.23
August 8-23	Try-Net	12	14.36	372.343		6	5.80	281.069	
	Otter Trawl	3	5.30	147.800		3	4.80	159.755	
	TOTALS	15	19.66	520.143	3.41	9	10.60	440.824	4.69
November 4-17	Try-Net	11	10.40	51.154		6	5.60	163.959	
	Otter Trawl	4	7.40	280.774		2	1.60	102.000	
	TOTALS	15	17.80	331.928	2.16	8	7.20	265.959	4.95

TABLE IV

PERCENT BIOMASS COMPOSITION OF THE INVERTEBRATE PHYLA OF IZHUT AND KILIUDA BAYS, 1978

PHYLUM	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER
	Izhut Bay					
Porifera	21.93	0	0	0.30	0	<0.01
Cnidaria	7.49	2.26	0.29	2.80	0.05	2.17
Annelida	0.06	<0.01	0.08	0.09	0	<0.01
Mollusca	2.09	2.89	0.09	4.58	2.10	0.16
Arthropoda	5.76	43.99	83.45	58.71	64.70	56.92
Ectoprocta	<0.01	0	0	0.04	0	0.01
Brachiopoda	<0.01	0	0	0.01	<0.01	0
Echinodermata	61.72	50.84	15.58	33.33	32.98	40.28
Urochordata	0.95	0.02	0.50	0.14	0.15	0.45
	Kiliuda Bay					
Porifera	0.09	N	0	0.01	0	0.02
Cnidaria	0	0	0	13.93	0.04	0.91
Annelida	0.07		0	<0.01	0	0.02
Mollusca	6.90	S	0	3.58	2.35	2.76
Arthropoda	90.42	A	100.00	81.90	96.97	96.12
Ectoprocta	<0.01	M	0	0.07	0	0
Brachiopoda	0	P	0	0	0	0
Echinodermata	2.42	L	0	0.67	0.63	0.17
Urochordata	0.10	E	0	0.05	0	0

TABLE V

PERCENT BIOMASS COMPOSITION OF THE INVERTEBRATE FAMILIES
OF IZHUT AND KILIUDA BAYS, 1978

FAMILY	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER
			Izhut Bay			
Porifera (unid. family)	21.93	0	0	0	0	<1
Actiniidae	7.49	<1	0	0	0	<1
Metridiidae	0	1.99	<1	2.71	<1	<1
Pectiniidae	0	2.55	<1	1.03	<1	0
Cymatiidae	0	<1	<1	<1	1.60	<1
Dorididae	1.78	0	0	0	0	0
Octopodidae	0	0	0	1.98	0	0
Pandalidae	<1	22.56	<1	14.83	44.84	<1
Paguridae	<1	<1	<1	1.26	<1	<1
Lithodidae	0	3.93	3.30	5.44	<1	<1
Maj idae	4.59	13.12	78.85	30.12	14.98	44.80
Cancridae	<1	3.67	<1	6.62	3.67	10.68
Asteridae	61.36	49.93	14.93	29.93	31.90	40.18
Ophiuridae	0	< 1	<1	1.66	<1	0
Stichopodidae	0	0	<1	1.11	0	0
			Kiliuda Bay			
Cyaneidae	0	N	0	*1.81*	0	0
Metridiidae	0	O	0	12.11	<1	0
Cymatidae	5.43		0	2.67	1.69	1.25
Pandalidae	11.12	S	0	3.68	69.26	59.46
Crangonidae	2.89	A	0	<1	<1	<1
Lithodidae	72.89	M	72.95	48.16	11.35	24.42
Maj idae	1.70	P	26.38	23.58	13.43	7.96
Cancridae	0	L	<1	4.81	2.05	3.51
Stichopodidae	2.11	E	0	<1	<1	0

TABLE VI

PERCENT BIOMASS COMPOSITION OF THE INVERTEBRATES
OF IZHUT AND KILIUDA BAYS, 1978

SPECIES	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER
	Izhut Bay					
Porifera (unidentified species)	21.93	0	0	0	0	<1
Actiniidae (unidentified species)	7.49	<1	0	0	0	0
Metridum senile	0	1.99	<1	2.71	<1	<1
Pecten caurinus	0	2.46	0	1.03	0	0
Fusitriton oregonensis	0	<1	<1	<1	1.60	<1
Dorididae (unidentified species)	1.78	0	0	0	0	0
octopus Sp.	0	0	0	1.98	0	0
Pandalus borealis	0	22.52	<1	12.28	44.82	<1
Pandalus hypsinotus	<1	<1	<1	1.08	<1	<1
Paralithodes camtschatica	0	3*93	3.30	5.44	<1	<1
Chionoecetes bairdi	3.75	12.66	78.84	29.98	13.93	44.74
Cancer magister	0	3.66	<1	6.62	3.66	10.68
Orthasterias koehleri	0	0	0	2.28	0	<1
Evasterias troschelii	<1	<1	<1	<1	5.19	<1
Stylasterias forreri	0	11.40	0	0	0	o "
Pycnopodia helianthoides	60.68	37.92	14.88	26.83	26.72	38.82
Ophiura sarsi	0	<1	<1	1.66	<1	0
Parastichopus californicus	0	0	0	1.11	0	0
	Kiliuda Bay					
Cyanea capillata	0	N	0	1.81	0	0
Metridium senile	0	0	0	12.11	<1	0
Fusitriton oregonensis	5.43		0	2.67	1.69	1.25
Pandalus borealis	7.51	S	0	2.77	69.26	58.13
Pandalus goniurus	2.39	A	0	0	0	<1
Pandalus hypsinotus	1.17	M	0	<1	0	<1
Crangan dalli	2.27	P	0	<1	<1	<1
Paralithodes camtschatica	72.89	L	72.95	48.16	11.35	24.42
Chionoecetes bairdi	<1	E	26.38	23.28	13.38	7.80
Cancer *magister*	0		<1	4.80	2.05	3.51
Parastichopus californicus	2.11		0	<1	<1	0

TABLE VII

INVERTEBRATES TAKEN BY TRAWL IN IZHUT BAY, 1978
X = Taxon Collected

Taxon	Common Name	Sampling Months					
		APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER
Porifera	sponge	X					X
Halichondria panicea	sponge				X		
Suberites spp.	sponge				X		
Hydrozoa	hydroid				X		X
Scyphozoa	jellyfish					X	
Anthozoa	sea anemone, sea pen				X		X
Ptilosarcus gurneyi	sea pen	X					
Actiniidae	sea anemone	X	X				
Tealia crassicornis	sea anemone						X
Metridium senile	sea anemone	X	X			X	X
Ctenophora	comb jelly					X	
Polycladia	flat worm				X		
Polychaeta	segmented worm	X					
Arctonoe fragilis	segmented worm	X					
Arctonoe vittata	segmented worm				X		
Eunoe depressa	segmented worm				X		
Harmothoe imbricata	segmented worm		X				
Cheilonereis cyclurus	segmented worm				X		X
Nereis sp.	segmented worm			X	X		
Platynereis bicanaliculata	segmented worm	X					
Nephtys puncata	segmented worm				X		
Flabelligera affinis	segmented worm	X					
Idanthyrsus armatus	segmented worm				X		
Crucigera zygophora	segmented tube worm				X		
Aplacophora	solengaster	X					
Mopalia swanii	chiton	X					
Yoldia amygdalea	almond *Yoldia*			X	X		
Mytilus edulis	mussel			X			
Chlamys rubida	Hinds' scallop		X	X	X	X	
Pecten caurinus	weathervane scallop		X		X		
Glycymeris subobsoleta	west coast bittersweet				X	X	X
Pododesmus macrochisma	sea jingle	X	X				
Modiolus modiolus	northern horse mussel						X
Astarte spp.	clam			X			
Astarte rollandi	clam				X		
Cyclocardia crebricostata	cockle			X		X	
Clinocardium ciliatum	Iceland cockle	X	X		X		
Clinocardium fucanum	fucan cockle		X		X		X
Serripes groenlandicus	Greenland cockle	X	X	X	X		
Serripes laperousii	cockle				X		
Humilaria kennerleyi	Kennerley's Venus		X	X			
Compsomyax subdiaphana	milky Pacific Venus				X		

TABLE VII (Continued)

Taxon	Common Name	Sampling Months					
		APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER
Tellina nuculoides	Salmon Tellin	X					
Macoma spp.	clam			X		X	X
Macoma lipara	clam		X				
Macoma brota	Brota *Macoma*				X		
Macoma obliqua	incongruous Macoma				X		
Siliqua alta	Dall's razor clam					X	
Hiatella arctica	Arctic Nestler clam	X			X		
Mya truncata	soft shell clam		X				X
Puncturella glaeata	helmet Puncturella	X					
Cryptobranchia alba	limpet	X					
Collisella spp.	limpet		X		X		
Collisella ochracea	limpet		X			X	
Margaritas *pupillus*	puppet Margarite	X	X		X	X	
Crepidula spp.	slipper shell				X		
Crepidula nummaria	slipper shell	X			X		
Trichotropsis cancellata	cancellate hairy-shell	X					
Polinices pallida	moon-shell					X	
Natica clausa	moon shell	X	X	X	X		
Fusitrition oregonensis	Oregon triton		X	X	X	X	X
Trophonopsis smithi	gastropod				X		
Nucella lamellosa	frilled dogwinkle	X	X		X	X	X
Buccinum spp.	snail		X				
Buccinum plectrum	Plectrum Buccinum				X	X	
Clione limacina	pteropod	X					
Octopus spp.	octopus				X		
Dorididae	nudibranch	X					
Gammaridae	amphipod		X				
Balanus spp.	barnacle	X					
Balanus crenatus	barnacle			X	X		
Balanus rostratus	barnacle				X		
Balanus nubilis	barnacle	X					
Rocinela augustata	isopoda				X		
Caprella spp.	amphiopod				X		
Pandalus borealis	pink shrimp		X	X	X	X	X
Pandalus goniurus	bumpy shrimp	X		X			
Pandalus platyceros	spot shrimp	X			X		X
Pandalus hypsinotus	coon-stripe shrimp	X		X	X		X
Pandalopsis dispar	side-stripe shrimp				X		X
Spirontocaris lamellicornis	shrimp					X	
Spirontocaris arcuata	shrimp						X
Heptacarpus brevirostris	shrimp			X			
Heptacarpus tridens	shrimp	X					
Eualus suckleyi	shrimp				X	X	
Crangon septemspinosa	gray or sand shrimp		X			X	X
Crangon dalli	gray or sand shrimp	X	X	X	X	X	X
Crangon resima	gray or sand shrimp						X

TABLE VII (Continued)

Taxon	Common Name	Sampling Months APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER
Crangon communis	gray or sand shrimp				X		
Crangon munita	gray or sand shrimp	X					
Sclerocrangon boreas	shrimp					X	
Argis lar	rock shrimp	X	X	X			X
Argis dentata	rock shrimp	X	X	X	X	X	
Argis crassa	rock shrimp			X			
Pagurus ochotensis	hermit crab	X	X	X	X	X	X
Pagurus aleuticus	hermit crab		X		X		X
Pagurus capillatus	hermit crab	X	X		X	X	X
Pagurus kennerlyi	hermit crab	X			X	X	
Pagurus hirsutiusculus hirsutuisculus	hermit crab		X				
Elassochirus tenuimanus	hermit crab	X	X	X		X	X
Elassochirus gilli	hermit crab				X		
Elassochirus cavimanus	hermit crab					X	
Labidochirus splendescens	hermit crab		X	X	X	X	
Paralithodes camtschatica	red king crab		X	X	X	X	X
Rhinolithodes wosnessenskii	crab				X		X
Cryptolithodes sitchensis	helmet crab					X	
Oregonia gracilis	decorator crab	X	X	X'	X	X	X
Hyas lyratus	lyre crab	X	X		X	X	X
Chionoecetes bairdi	snow crab	X	X	X	X	X	X
Pugettia gracilis	kelp crab			X		X	
Cancer magister	dungeness crab		X	X	X	X	X
Cancer oregonensis	crab	X	X		X	X	
Telmessus cheiragonus	hairy crab		X	X	X	X	
Ectoprocta	moss animal				X		X
Microporina spp.	moss animal	X			X		
Heteropora spp.	moss animal	X					
Flustridae	moss animal						X
Flustrella gigantea	moss animal	X			X		
Hemithiris psittacea	brachiopod				X		
Terebratalia transversa	brachiopod				X	X	
Terebratalina unguicula	brachiopod	X					
Henricia spp.	sea star		X				
Henricia leviuscula	blood star		X		X	X	
Pteraster tesselatus	slime star		X		X		
Crossaster papposus	rose star	X	X		X	X	X
Solaster spp.	sun star						X
Solaster stimpsoni	sun star		X		X		
Solaster dawsoni	sun star			X			
Solaster endeca	sun star				X		
Evasterias troschelii	sea star	X	X	X		X	X
Evasterias echinosoma	sea star			X			
Stylasterias forreri	sea star		X				

TABLE VII (Continued)

Taxon	Common Name	Sampling Months					
		APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER
Pycnopodia helianthoides	sunflower star	X	X	X	X	X	X
Asterias amurensis	sea star				X		
Leptasterias hexactis	sea star				X		
Orthasterias koehleri	sea star				X		X
Lethasterias nanimensis	sea star						X
Echinarachnius parma	sand dollar	X	X	X	X	X	X
Strongylocentrotus droebachiensis	green urchin	X	X	X	X	X	X
Strongylocentrotus purpuratus	purple urchin		X				
Ophiuria sarsi	brittle star			X	X	X	
Ophiopholis sp.	brittle star	X					
Ophiopholis aculeata	brittle star				X		
Parastichopus californicus	sea cucumber			X	X		
Cucumaria spp.	sea cucumber			X	X		
Urochordata	tunicate	X		X	X	X	X
Styelidae	tunicate	X					
Cnemidocarpa rhizopus	tunicate	X		X	X	X	X
Pelonaria corrugata	tunicate					X	
Halocynthia aurantium	tunicate - sea peach	X					
Salpidae	tunicate			X			

sample stations deeper than 73 m were made. Of the five tows taken aboard the *Commando,* two were taken at depths of 174-201 m, stations 7 and 8 in Area I. These two tows yielded a total of 840 *Chionoecetes bairdi* and 22 *Paralithodes camtschatica*. Approximately 65-75% of the C. *bairdi* were relatively soft; most had formed a new exoskeleton and were nearing ecdysis. Several of the *P. camtschatica* were also in this condition. The mean epifaunal invertebrate biomass for all stations was 7.10 g/m^2. Dominant phyla from all stations were Arthropoda (83.4%) and Echinodermata (15.6%). *Chionoecetes bairdi* (78.8%) and *Pycnopodia helianthoides* (14.9%) were the most important arthropods and echinoderms, respectively.

<u>July 1978</u> (Tables II-VII; Fig. 1)

Nineteen stations were successfully sampled in Izhut Bay in July. The try net was used at 15 stations and the otter trawl was used at four stations. The mean invertebrate biomass was 2.74 g/m^2. Dominant taxa, in terms of percent biomass, were arthropods (58.7%), specifically, *Chionoecetes bairdi* (30%) and *Pandalus borealis* (12.3%), and echinoderms (33.3%), specifically, *Pycnopodia helianthoides* (26.8%).

The greatest diversity occurred southwest of Pillar Cape in Area I at station 585 where approximately 62 species of invertebrates were taken. In Saposa Bay, with the exception of the sea anemone *Metridium senile*, both tows contained dead and decaying invertebrate and plant material. The strong odor of H_2S in the black mud was present in both tows. Of the four tows taken by otter trawls, two (Area I, stations 8 and 9) were taken at depths of 87 to 189 m. These two tows yielded 350 *Chionoecetes bairdi*. Eighteen *Paralithodes camtschatica* came from station 9. Stations 557 of Area 111 and 526 and 527 of Area II yielded the largest catches of pink shrimp.

<u>August 1978</u> (Tables 11-VII; Fig. 1)

A total of 15 successful tows were made in Izhut nay in August, 12 with the try net and three with the otter trawl. The mean invertebrate biomass was 3.41 g/m^2. Arthropods and echinoderms contributed most to the biomass with 64.7% and 32.9% respectively. Pandalid shrimps, specifically *Pandalus borealis* (44.8%) dominated the arthropod biomass. *Chionoecetes* *bairdi* contributed 13.9% of the biomass. Station 557 of Area III yielded the largest catch of pink shrimp (200 kg). Stations 6 and 8 of Area I were important C. *bairdi* stations. Important echinoderms were the sea stars *Pycnopodia helianthoides (26.7%)* and *Evasterias troschelii (5.2%).*

Stations in Saposa Bay and Kitoi Bay were nearly devoid of living organisms.

Large concentrations of the Pacific sand lance *Ammodytes hexapterus*, were noted in most portions of Izhut Bay.

<u>November 1978</u> (Tables II-VII; Fig. 1)

November sampling in Izhut Bay yielded 15 successful stations, 11 with try net and four with otter trawl. Two Saposa Bay stations were inaccessible due to the large size of the *Commando.* The mean invertebrate biomass was 2.16 g/m^2. The biomass was again dominated by arthropods (56.9%) and echinoderms (40.3%). Major arthropods were *Chionoecetes bairdi (44.7%)* and *Cancer magister (10.7%).* Most C. *bairdi* came from station 7 of Area I. *Pycnopodia helianthoides* again dominated the echinoderms with 38.8% of the biomass.

Kiliuda Bay

<u>April 1978</u> (Tables II-VI, VIII; Fig. 2)

Only six try net stations were successfully sampled in Kiliuda Bay in April. Five stations were less than 36 m deep and one was at approximately 100 m. The mean invertebrate biomass was 2.04 g/m^2. Arthropods (90.4% of the biomass), mainly *Paralithodes camtschatica (72.9%),* made up the majority of the biomass. The majority of king crabs came from Shearwater and Santa Flavia Bay at stations 576, 578, 579 and 580.

<u>June 1978</u> (Tables II-VI, VIII; Fig. 2)

Successful stations sampled in Kiliuda Bay in June totaled eight, five with try net and three with otter trawl. The mean invertebrate biomass was 3.63 g/m^2. Only commercially-important invertebrates were recorded. *Paralithodes camtschatica* and *Chionoecetes bairdi* made up 72.9% and 26.4% of the mean invertebrate biomass, respectively. Stations 3 and 4 of Area I yielded the greatest number of *P. camtschatica.* The majority

(~85%) of C. *bairdi* greater than 160 mm in carapace width were soft-shelled crabs which had recently undergone ecdysis. The highest catch of C. *bairdi* was 55.6 kg in Area I, station 5.

July 1978 (Tables II-VI, VIII; Fig. 2)

July sampling in Kiliuda Bay yielded ten successful stations; seven with try net and three with otter trawl. The mean invertebrate biomass was 2.23 g/m^2. Arthropods were the leading group. *Paralithodes camtschatica* and *Chionoecetes bairdi* accounted for 48.2% and 23.3% of the invertebrate biomass, respectively. Stations 1 and 4 of Area I and stations 579 and 580 of Area IV yielded the greatest catch of *P. camtschatica*. Large catches of C. *bairdi* came from stations 579, 580 and 6. The cnidarian *Metridium senile* also made up 12.1% of the biomass.

August 1978 (Tables II-VI, VIII; Fig. 2)

A total of nine stations were successfully sampled in Kiliuda Bay in August. Six stations were sampled by try net and three stations were sampled by otter trawl. The mean invertebrate biomass was 4.68 g/m^2. The biomass was dominated by arthropods (96.9%), specifically, *Pandalus borealis* (69.3%), *Chionoecetes bairdi* (13.4%), and *Paralithodes camtschatica* (11.3%). Large catches of *C. bairdi* came from Areas I and IV, stations 2 and 579 respectively. Stations 2 and 5 in Area I yielded large catches of *P. camtschatica*. Most *P. borealis* came from station SHR. Station 5 yielded high numbers of the large Pacific cod *Gadus macrocephalus* and walleye pollock *Theragra chalcogramma*.

November 1978 (Tables II-VI, VIII; Fig. 2)

November sampling in Kiliuda Bay yielded eight successful stations; six with try net and two with otter trawl. One otter trawl site and one try net station were not sampled due to large numbers of "stored" king crab pots and "fishing" dungeness crab pots. The mean invertebrate biomass was 4.95 g/m^2, with arthropods again dominating the biomass (96.1%). Leading species were *Pandalus borealis* (58.1%), *Paralithodes camtschatica* (24.4%), and *Chionoecetes bairdi* (7.8%). Most shrimps were taken from Area I at stations SHR and 5. Important *P. camtschatica* stations were 7 and SHR. Snow crabs were mainly taken at stations 5 and 7.

TABLE VIII

INVERTEBRATES TAKEN BY TRAWL IN KILIUDA BAY, 1978
X = Taxon Collected

Taxon	Common Name	Sampling Months: APRIL	JUNE	JULY	AUGUST	NOVEMBER
Porifera	sponge	X				
Suberites suberea	sponge			X		X
Hydrozoa	hydroid					X
Cyanea capillata	jelly fish			X		
Metridium senile	sea anemone			X	X	
Polychaeta	segmented worm			X		
Polynoidae	segmented worm			X		
Harmothoe multisetosa	segmented worm	X				
Eunoe depressa	segmented worm					X
Peisidice aspera	segmented worm	X				
Cheilonereis cyclurus	segmented worm					X
Crucigera irregularia	segmented tube worm	X				
Crucigera zygophora	segmented tube worm	X				X
Mopalia swanii	chiton	X				
Nucula tenuis	soft nut clam	X				
Modiolus modiolus	northern horse mussel	X				X
Yoldia amygdalea	almond Yoldia			X	X	X
Chlamys spp.	scallop					X
Chlamys rubida	Hind's scallop	X		X	X	
Pecten caurinus	weathervane scallop	X		X	X	X
Pododesmus macrochisma	sea jingle	X		X	X	X
Clinocardium ciliatum	Iceland cockle			X		
Clinocardium nuttallii	Nuttall's cockle			X		
Cyclocardia crassidens	cockle	X				
Serripes groenlandicus	Greenland cockle			X	X	X
Macoma spp.	clam				X	X
Macoma carlottensis	clam			X		
Tellina nuculoides	Salmon Tellin				X	
Hiatella arctica	Arctic nestler clam	X		X	X	X
Puncturella galeata	helmet Puncturella	X		X	X	
Collisella ochracea	limpet	X			X	
Cryptobranchia alba	limpet	X				
Margarites pupillus	puppet Margarite	X				
Lacuna variegata	variegated Lacuna	X				
Trichotropis cancellata	cancellate hairy-shell	X				
Fusitriton oregonensis	Oregon triton	X		X	X	X
Trophonopsis lasius	sandpaper Trophon				X	
Nucella lamellosa	frilled dogwinkle				X	X
Neptunea lyrata	common northwest Neptune	X		X	X	X
Neptunea heros	snail				X	
Admete couthouyi	common northern Admete				X	
Octopus sp.	octopus			X	X	
Clione limacina	pteropod					

TABLE VIII

CONTINUED

Taxon	Common Name	Sampling Months APRIL	JUNE	JULY	AUGUST	NOVEMBER
Balanus nubilis	acorn barnacle	X				
Balanus crenatus	acorn barnacle			X		
Balanus nostratus	acorn barnacle			X		
Pandalus spp.	shrimp				X	
Pandalus borealis	pink shrimp	X		X		X
Pandalus goniurus	bumpy shrimp	X				X
Pandalus platyceros	spot shrimp	X			X	
Pandalus hypsinotus	coon-stripe shrimp	X		X		X
Pandalus danae	dock shrimp			X		
Spirontocaris lamellicornis	shrimp			X		
Lebbeus groenlandica	shrimp	X				
Eualus suckleyi	shrimp	X		X		
Eualus macilenta	shrimp	X				
Heptacarpus brevirostris	shrimp	X				
Crangon spp.	gray or sand shrimp				X	X
Crangon dalli	gray or sand shrimp	X		X	X	
Crangon communis	gray or sand shrimp	X		X		
Crangon munita	gray or sand shrimp	X				
Sclerocrangon boreas	shrimp	X				
Argis spp.	rock shrimp					X
Argis lar	rock shrimp	X				X
Argis dentata	rock shrimp	X		X	X	X
Paracrangon echinata	shrimp	X				
Pagurus spp.	hermit crab			X		
Pagurus ochotensis	hermit crab	X		X	X	X
Pagurus capillatus	hermit crab	X		X	X	X
Pagurus aleuticus	hermit crab			X		X
Elassochirus tenuimanus	hermit crab	X		X	X	X
Labidochirus splendescens	hermit crab				X	X
Paralithodes camtschatica	red king crab	X	X	X	X	X
Oregonia gracilis	decorator crab	X		X	X	X
Hyas lyratus	Lyre crab	X		X	X	X
Chionoecetes bairdi	snow crab	X	X	X	X	X
Cancer magister	dungeness crab		X	X	X	X
Cancer oregonensis	crab			X		
Pugettia gracilis	kelp crab	X		X	X	X
Telmessus cheiragonus	hairy crab	X		X	X	
Flustridae	moss animal	X				
Flustrella gigantea	moss animal			X		
Solaster stimpsoni	sun star				X	

TABLE VIII

CONTINUED

Taxon	Common Name	Sampling Months				
		APRIL	JUNE	JULY	AUGUST	NOVEMBER
Evasterias troschelii	sea star				X	X
Leptasterias spp.	sea star	X				
Orthasterias koehleri	sea star			X		X
Pycnopodia helianthoides	sunflower star	X			X	
Strongylocentrotus droebachiensis	green urchin	X			X	X
Parastichopus californicus	sea cucumber	X		X	X	
Urochordata	tunicate	X		X		

Portlock Bank

March 1978 (Tables IX, XI; Fig. 3)

In March 1978, 12 stations were occupied adjacent to Portlock Bank by the *Miller* Freeman. The mean invertebrate biomass was low, 0.47 g/m^2. The highest biomass station was station 9 where the biomass was 1.02 $g/^2$. The major phyla were Echinodermata (37.1% of the biomass), Arthropoda (30.8%), and Mollusca (28.0%). Leading echinoderms were the sea star *Dipsacaster borealis* (24.7X), the sea urchin *Strongylocentrotus* spp. (10.2%), and the sea star *Diplopteraster multipes* (2.2%). Largest catches of *Diplopteraster* came from stations 5 and 12. Important arthropods were *Chionoecetes bairdi* and *Paralithodes camtschatica* which made up 24.6% and 5.0% of the total invertebrate biomass, respectively. Highest catches of *Chionoecetes* came from stations 3 and 4. Dominant molluscs were the snail *Fusitriton oregonensis* (14.5%), the snail *Neptunea lyrata* (6.9%), and *Octopus* Sp. (4.4%).

Kodiak Shelf

June-July 1978 (Tables X, XI; Fig. 5)

In June-July 1978, 16 stations were occupied by the *Miller Freeman* on the Kodiak Continental Shelf. One station, station 2, was not considered quantitative because the net was torn, however, fish stomachs were examined from this station. The mean invertebrate biomass was 3.94 g/m^2. Arthropods made up 80.5% of the biomass. *Paralithodes camtschatica* and *Chionoecetes bairdi* accounted for 50.9% and 42.4%, respectively of the arthropod biomass and 41% and 34%, respectively of the total invertebrate biomass. *Paralithodes camtschatica* was present at nine stations. Highest catches of *P. camtschatica* came from stations 7, 8 and 9. The king crab catch at stations 7 and 8 mainly consisted of ovigerous females (78%). King crabs at station 9 were mainly ovigerous females (48%) and adult males (46%).

Chionoecetes bairdi was present at 13 stations and large catches came from stations 7, 12 and 13. *Pandalus borealis* also made up 4.2% of the total biomass. *Pandalus borealis* was present at seven stations and was most abundant at station 13.

The second leading phylum was Cnidaria, contributing 8.8% of the biomass. Leading cnidarians were the sea pen *Ptilosarcus gurneyi* (3.6% of the biomass),

TABLE IX

PERCENT BIOMASS COMPOSITION OF THE LEADING INVERTEBRATE SPECIES COLLECTED NEAR PORTLOCK BANK, MARCH 1978

Phylum	% Biomass of All Phyla	Leading Species	% Biomass of Phylum	% Biomass of All Phyla
Echinodermata	41.1	*Dipsacaster borealis*	60.1	24.7
		Strongylocentrotus spp.	24.8	10.2
		Diplopteraster multipes	5.4	2.2
		Totals	90.3	37.1
Arthropoda	30.8	*Chionoecetes bairdi*	79.9	24.6
		Paralithodes camtschatica	16.2	5.0
		Totals	96.1	29.6
Mollusca	28.0	*Fusitriton oregonensis*	51.7	14.5
		Neptunea lyrata	24.8	6.9
		octopus Sp.	15.6	4.4
		Totals	92.1	25.8
Total	99.9			

TABLE X

PERCENT BIOMASS COMPOSITION OF THE LEADING INVERTEBRATE SPECIES COLLECTED ON THE KODIAK SHELF, JUNE - JULY 1978

Phylum	% Biomass of All Phyla	Leading Species	% Biomass of Phylum	% Biomass of All Phyla
Arthropoda	80.5	*Paralithodes camtschatica*	50.9	41.0
		Chionoecetes bairdi	42.4	34 [illegible]
		Pandalus borealis	5.2	4.2
		Totals	98.5	79.3
Cnidaria	8.8	*Ptilosarcus gurneyi*	40.4	3.6
		Metridium spp.	28.6	2.5
			26.0	2,3
		Totals	95.0	8.4
Echinodermata	7.9	*Echinarachni* us *parma*	47.1	3.7
		Holothuroidea	41.2	3.3
		Totals	88.3	7.0
Total	97.2			

TABLE XI

INVERTEBRATES TAKEN BY TRAWL ON THE KODIAK SHELF, 1978
x = Taxon Collected

Taxon	Common Name	Sampling Months: MARCH[1]	Sampling Months: JUNE[2]
Porifera	sponge		X
Anthozoa	sea anemone, sea pea	X	
Stylatula gracile	sea pen	X	X
Ptilosarcus gurneyi	sea pen		X
Actiniidae	sea anemone		X
Metridium senile	sea anemone		X
Polynoidae	segmented worm - scale worm	X	
Nereidae	segmented worm	X	
Aphrodita japonica	segmented worm	X	
Modiolus modiolus	northern horse mussel		X
Pecten caurinus	weathervane scallop	X	
Chlamys spp.	scallop		X
Pododesmus macrochisma	sea jungle	X	X
Astarte montagui	Montagu's Astarte		X
Astarte esquimalti	clam		X
Cyclocardia crassidens	cockle		X
Clinocardium fucanum	Fucan cockle		X
Fusitriton oregonensis	Oregon triton	X	X
Nucella lamellosa	frilled dogwinkle		X
Beringius kennicotti	Kennicott's Buccinum	X	X
Neptunea lyrata	common northwest Neptune	X	X
Neptunea pribiloffensis	Pribiloff Neptune	X	
Pyrolofusus harpa	left-handed Buccinum	X	
Arcteomelon stearnsii	Stearn's Volute	X	
Leucosyrinx circinata	snail	X	
octopus Spp.	octopus	X	
Pandalus borealis	pink shrimp	X	X
Pandalus goniurus	bumpy shrimp		X
		MARCH	FEBRUARY
Pandalus hypsinotus	coon-stripe shrimp		X
Pandalopsis dispar	side-stripe shrimp	X	X
Eualus biunguis	shrimp		X
Heptacarpus cristata	shrimp		X
Crangon spp.	gray or sand shrimp		X
Crangon dalli	gray or sand shrimp		X
Crangon communis	gray or sand shrimp		X
Argis lar	rock shrimp		X
Argis dentata	rock shrimp		X
Pagurus spp.	hermit crab		X
Pagurus ochotensis	hermit crab	X	X
Pagurus aleuticus	hermit crab	X	X

[1]Portlock Bank stations
[2]Kodiak Shelf stations inclusive of one station on Portlock Bank

TABLE XI

CONTINUED

Taxon	Common Name	Sampling Months MARCH	FEBRUARY
Pagurus capillatus	hermit crab	X	X
Pagurus kennerlyi	hermit crab		X
Pagurus hirsutiusculus hirsutiusculus	hermit crab		X
Pagurus confragosus	hermit crab	X	X
Pagurus corn.utus	hermit crab	X	
Elassochirus tenuimanus	hermit crab		X
Elassochirus cavimanus	hermit crab		X
Elassochirus gilli	hermit crab	X	X
Placetron wosnessenskii	scale crab		X
Paralithodes camtschatica	red king crab	X	X
Chionoecetes bairdi	snow crab	X	X
Oregonia gracilis	decorator crab		X
Hyas lyratus	Lyre crab		X
Cancer oregonensis	crab		X
Telmessus cheiragonus	hairy crab		X
Brachiopoda	lamp shell		X
Terebratalia transversal	lamp shell		X
Dipsacaster borealis	sea star	X	
Gephyreaster swifti	sea star	X	
Hippasterias spinosa	sea star	X	
Pseudarchaster parelii	sea star	X	
Henricia spp.	sea star	X	
Henricia leviuscula	blood star		X
Diplopteraster multipes	sea star	X	
Pteraster tesselatus	sea star		X
Crossaster papposus	rose star		X
Lophaster furcilliger	sea star	X	
Solaster spp.	sun star	X	
Solaster dawsoni	sun star		X
Asterias amurensis	sea star	X	
Evasterias spp.	sea star	X	
Leptasterias polaris	sea star	X	
Pycnopodia helianthoides	sunflower star		X
Echinarachnius parma	sand dollar		X
Brisaster townsendi	heart urchin	X	
Strongylocentrotus spp.	sea urchin	X	
Strongylocentrotus droebachiensis	green urchin		X
Strongylocentrotus purpuratus	purple urchin	X	
Ophiuroidea	brittlestar, basket star		X
Gorgonocephalus caryi	basket star	X	X
Ophiopholis aculeata	brittlestar	X	X
Ophiura sarsi	brittlestar		X

TABLE XI

CONTINUED

Taxon	Common Name	Sampling Months	
		MARCH	FEBRUARY
Holothuroidea	sea cucumber		X
Molpadia spp.	sea cucumber		X
Cucumaria spp.	sea cucumber		X
Urochordata	tunicate	X	

the sea anemone *Metridium* spp. (2.5%), and Actiniidae (2.3%). The largest catch of *Ptilosarcus* came from station 1.

Echinoderms ranked third in biomass (7.9%). Dominant echinoderms were the sand dollar *Echinarachnius parma* and sea cucumbers, Holothuroidea, which contributed 3.7% and 3.3% of the total biomass, respectively. *Echinarachnius parma* was mainly taken at station 1.

PIPE DREDGE DATA: DISTRIBUTION - RELATIVE ABUNDANCE

Pipe dredge data collected on the Kodiak Shelf in June-July 1978 and February 1979 to aid in the identification of fish and invertebrate stomach contents will be included in the Final Report.

REPRODUCTIVE OBSERVATIONS

Reproductive data collected throughout this study will be presented in the Final Report.

FOOD STUDIES

Paralithodes camtschatica (king crab)

Izhut Bay

June 1978 (Tables XII, XIII; Fig. 1)

King crabs were collected for food analysis in Izhut Bay in June at stations 7 and 8 of Area I. Twenty-two crabs were taken, of which, 55% were ovigerous females and 36% were newshell males greater than 100 mm in length. Twenty of the crabs were feeding on a total of 18 taxa. The mean percent fullness was 5.5 ± 7.9%. King crab stomachs were dominated by fishes; 55% by frequency of occurrence and 69% by weight. Arthropods, echinoderms, and molluscs each accounted for less than 5% of the total food weight.

Food examined from the intestines of Izhut Bay king crabs was similar to food found in the stomachs.

July 1978 (Tables XIII, XIV; Fig. 1)

The 18 king crabs collected in July at Izhut Bay, Area I, station 9, were composed of ovigerous females (66.7%) and newshell males greater than 100 mm in length (33.3%). All but one crab were feeding. Nine different

TABLE XII

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* TRAWLS IN IZHUT BAY
June 1978. Mean depth 184±6 meters

Number Examined: 22
Number Empty: 2
Percent Composition of Crab Classes: 1=9.1%; 2=54.5%; 6=36.4%
Mean Length: 115±11 mm
Mean Weight: 1200±364 g
Mean Percent Fullness: 5.5±7.9%[1]
Number of Prey Taxa: 18

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence[1]	% by Weight	% by Volume
Chordata	Pisces (fishes)	55	68.6	77.4
Arthropoda	Hippolytidae (shrimp)	5	3.2	2.0
	Decapoda	23	0.3	0.5
Echinodermata	Ophiuroidea (brittle star)	5	6.3	3.2
Mollusca	*Clinocardium ciliatum* (cockle)	14	1.4	0.9
Unidentified plant material		32	14.0	10.8
Unidentified animal material		28	4.2	4.1

[1]Based on all stomachs examined

[2]Species or lowest level of identification

TABLE XIII

INTESTINE CONTENTS OF KING CRABS (*Paralithodes camtschatica*)
FROM THE KODIAK ISLAND REGION, 1978

(N) = Number of Intestines

Intestine Contents	Percent Frequency of Occurrence Based on Intestines	Total
Kiliuda Bay - 10-22 April, 1978	N = 17	N = 49
Empty (32)		65.3
Polychaeta (5)	29.4	10.2
Nuculana fossa (5)	29.4	10.2
Decapoda (5)	29.4	10.2
Nucula tenuis (3)	17.6	6.1
Unidentified animal remains (3)	17.6	6.1
Pelecypoda (2)	11.8	4.1
Ophiuroidea (2)	11.8	4.1
Hydrozoa (1)	5.9	2.0
Foraminifera (1)	5.9	2.0
Macoma sp. (1)	5.9	2.0
Clinocardium nuttallii (1)	5.9	2.0
Serripes groenlandicus (1)	5.9	2.0
Gastropoda (1)	5.9	2.0
Trochidae (1)	5.9	2.0
Polinices sp. (1)	5.9	2.0
Balanus sp. (1)	5.9	2.0
Natantia (1)	5.9	2.0
Sediment (1)	5.9	2.0
Near Island Basin – 17 May, 1978 (SCUBA)	N = 35	N = 35
Plant (22)	62.9	62.9
Pelecypoda (20)	57.1	57.1
Foraminifera (12)	34.3	34.3
Unidentified animal remains (12)	34.3	34.3
Hydrozoa (11)	31.4	31.4
Owenia fusiformis (11)	31.4	31.4
Pectinariidae (10)	28.6	28.6
Strongylocentrotus sp. (10)	28.6	28.6
Macoma sp. (9)	25.7	25.7
Golden fiber (9)	25.7	25.7
Sand (9)	25.7	25.7
Polychaeta (8)	22.9	22.9
Gastropod (8)	22.9	22.9
Balanus sp. (7)	20.0	20.0
Trochidae (7)	20.0	20.0

TABLE XIII

cONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on: Intestines with Food	Total Intestines
Protothaca staminea (6)	17.1	17.1
Hiatella arctica (5)	14*3	14.3
Saxidomus gigantea (3)	8.6	8.6
Crabs (3)	8.6	8 . 6
Echinodermata (3)	8.6	8.6
Crucigera zygophora (2)	5.7	5.7
Amphipoda (2)	5.7	5.7
Decapoda (2)	5.7	5.7
Ophiuroidea (2)	5.7	5.7
Byssal thread (2)	5.7	5.7
Sabellariidae (1)	2.9	2.9
Eteone sp. (1)	2.9	2.9
Serpulidae (1)	2.9	2.9
Polyplacophora (1)	2.9	2.9
Yoldia sp. (1)	2.9	2.9
Clinocardium sp. (1)	2.9	2.9
Serripes groenlandicus (1)	2.9	2.9
Lyonsia bracteata (1)	2.9	2.9
Pectinidae (1)	2.9	2.9
Cyclostremella concordia (1)	2.9	2.9
Polinices SF. (1)	2.9	2.9
Fusitriton oregonensis (1)	2.9	2.9
Limpet (1)	2.9	2.9
Echinoidea (1)	2.9	2.9
Diamphiodia craterodmeta (1)	2.9	2.9
Asteroidea (1)	2.9	2.9
Fabriciinae (1)	2.9	2.9
Pisces (1)	2.9	2.9
Egg (1)	2.9	2.9
Unidentified material (1)	2.9	2.9
McLinn Island - 19 May, 1978 (SCUBA)	*N* = 49	N = 4 9
Plant (30)	61.2	61.2
Pectinariidae (29)	59.2	59.2
Pelecypoda (29)	59.2	59.2
Strongylocentrotus sp. (28)	57.1	57.1
Foraminifera (23)	46.9	46.9
Golden fiber (21)	42.9	42.9
Macoma sp. (19)	38.8	38.8
Balanus sp. (16)	32.7	32.7

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on Intestines with Food	Total Intestines
Trichotropis cancellata (15)	30.6	30.6
Hiatella arctica (14)	28.6	28.6
Trochidae (13)	26.5	26.5
Protothaca staminea (12)	24.5	24.5
Crabs (10)	20.4	20.4
Ophiuroidea (10)	20.4	20.4
Sand (10)	20.4	20.4
Gastropoda (9)	18.4	18.4
Hydrozoa (8)	16.3	16.3
Amphipoda (8)	16.3	16.3
Polychaeta (6)	12.2	12.2
Unidentified animal remains (6)	12.2	12.2
Owenia sp. (5)	10.2	10.2
Decapoda (5)	10.2	10.2
Tonicella lineata (3)	6.1	6.1
Mya sp. (3)	6.1	6.1
Echinodermata (3)	6.1	6.1
Bryozoa (2)	4.1	4.1
Crustacea (2)	4.1	4.1
Pisces (2)	4.1	4.1
Charcoal ? (2)	4.1	4.1
Unidentified material (2)	4.1	4.1
Serpulidae (1)	2.0	2.0
Dexiospira sp. (1)	2.0	2.0
Mitrella gouldi (1)	2.0	2.0
Axinopsida serricata (1)	2.0	2.0
Clinocardium ciliatum (1)	2.0	2.0
Spisula polynyma (1)	2.0	2.0
Modiolus sp. (I.)	2.0	2.0
Crepidula sp. (1)	2.0	2.0
Fusitriton oregonensis (1)	2.0	2.0
Homalopoma sp. (1)	2.0	2.0
Polyplacophora (1)	2.0	2.0
Collisella sp. (1)	2.0	2.0
Mopalia sp. (1)	2.0	2.0
Crangonidae (1)	2.0	2.0
Ostracoda (1)	2.0	2.0
Atylus sp. (1)	2.0	2.0
Echinoidea (1)	2.0	2.0
Wood (1)	2.0	2.0

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on: Intestines with Food	Total Intestines
Feather (1)	2.0	2.0
Byssal thread (1)	2.0	2.0
Izhut Bay - 7-22 June, 1978	N = 8	N = 9
Unidentified material (7)	87.5	77.8
Pisces (5)	62.5	55.6
Sediment (3)	37.5	33.3
Pelecypoda (1)	12.5	11.1
Clinocardium ciliatum (1)	12.5	11.1
Clinocardium sp. (1)	12.5	11.1
Natantia (1)	12.5	11.1
Echinodermata (1)	12.5	11.1
Plant (1)	12.5	11.1
Golden fiber (1)	12.5	11.1
Empty (1)		11.1
Kiliuda Bay - 7-22 June, 1978	N = 48	N = 50
Nuculana fossa (29)	60.4	58.0
Decapoda (26)	54.2	52.0
Balanus sp. (22)	45.8	44.0
Pelecypoda (20)	41.7	40.0
Polychaeta (19)	39.6	38.0
Macoma sp. (16)	33.3	32.0
Axinopsida serricata (13)	27.1	26.0
Foraminifera (10)	20.8	20.0
Nucula tenuis (10)	20.8	20.0
Clinocardium ciliatum (10)	20.8	20.0
Gastropod (10)	20.8	20.0
Unidentified animal remains (10)	20.8	20.0
Turridae (7)	14.6	14.0
Plant (6)	12.5	12.0
Clinocardium sp. (4)	8.3	8.0
Trochidae (4)	8.3	8.0
Ophiuroidea (4)	8.3	8.0
Golden fiber (4)	8.3	8.0
Modiolus modiolus (3)	6.3	6.0
Balanus crenatus (3)	6.3	6.0
Paguridae (3)	6.3	6.0
Grabs (3)	6.3	6.0
Hydrozoa (2)	4.2	4.0
Peisidice aspera (2)	4.2	4.0
Pectinariidae (2)	4.2	4.0

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on: Intestines with Food	Total Intestines
Limpet (2)	4.2	4.0
Unidentified material (2)	4.2	4.0
Sediment (2)	4.2	4.0
Empty (2)		4.0
Idanthyrsus armatus (1)	2.1	2.0
Cistenides sp. (1)	2.1	2.0
Serripes groenlandicus (1)	2.1	2.0
Spisula polynyma (1)	2.1	2.0
Pandora sp. (1)	2.1	2.0
Hiatella arctica (1)	2.1	2.0
Puncturella sp. (1)	2.1	2.0
Natica clausa (1)	2.1	2.0
Ectoprocta (1)	2.1	2.0
Chionoecetes bairdi (1)	2.1	2.0
Pisces (1)	2.1	2.0
Byssal thread (1)	2.1	2.0
Near Island Basin - 15 June, 1978 (SCUBA)	N = 31	N = 32
Sand (25)	80.6	78.1
Pelecypoda (21)	67.7	65.6
Plant (21)	67.7	65.6
Balanus sp. (20)	64.5	62.5
Hydrozoa (19)	61.3	59.4
Golden fiber (16)	51.6	50.0
Protothaca staminea (13)	41.9	40.6
Unidentified animal remains (13)	41.9	40.6
Pectinariidae (12)	38.7	37.5
Crabs (12)	37.7	37.5
Strongylocentrotus sp. (10)	32.3	31.3
Owenia fusiformis (8)	25.8	25.0
Macoma sp. (6)	19.4	18.8
Mya sp. (6)	19.4	18.8
Amphipoda (5)	16.1	15.6
Clinocardium sp. (4)	12.9	12.5
Gastropoda (4)	12.9	12.5
Pisces (3)	9.7	9.4
Foraminifera (2)	6.5	6.3
Polychaeta (2)	6.5	6.3
Saxidomus gigantea (2)	6.5	6.3
Axinopsida serricata (2)	6.5	6.3
Balanus crenatus (2)	6.5	6.3
Unidentified material (2)	6.5	6.3
Myriochele heeri (1)	3.2	3.1

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on Intestines with Food	Total Intestines
Hiatella arctica (1)	3.2	3.1
Polinices sp. (1)	3.2	3.1
Mopalia sp. (1)	3.2	3.1
Balanus hesperius (1)	3.2	3.1
Echiurus sp. (1)	3.2	3.1
Ophiuroidea (1)	3.2	3.1
Byssal thread (1)	3.2	3.1
Empty (1)		3.1
Anton Larsen Bay #1 - 16 June, 1978 (SCUBA)	N = 27	N = 31
Plant (18)	66.7	58.1
Pelecypoda (15)	55.6	48.4
Sand (15)	55.6	48.4
Balanus sp. (11)	40.7	35.5
Hydrozoa (9)	33.3	29.0
Owenia fusiformis (8)	29.6	25.8
Pectinariidae (8)	29.6	25.8
Protothaca staminea (7)	25.9	22.6
Golden fiber (7)	25.9	22.6
Macoma sp. (6)	22.2	19.4
Balanus crenatus (6)	22.2	19.4
Unidentified animal remains (5)	18.5	16.1
Gastropoda (4)	14.8	12.9
Polinices sp. (4)	14.8	12.9
Unidentified material (4)	14.8	12.9
Empty (4)		12.9
Polychaeta (3)	11.1	9.7
Mytilus edulis (3)	11.1	9.7
Crabs (3)	11.1	9.7
Trochidae (2)	7.4	6.5
Littorina sitkana (2)	7.4	6.5
Decapoda (2)	7.4	6.5
Wood (2)	7.4	6.5
Foraminifera (1)	3.7	3.2
Lumbrineris sp. (1)	3.7	3.2
Tellinidae (1)	3.7	3.2
Clinocardium sp. (1)	3.7	3.2
Axinopsida serricata (1)	3.7	3.2
Alvinia compacta (1)	3.7	3.2
Limpet (1)	3.7	3.2
Balanus hesperius (1)	3.7	3.2
Balanus glandula (1)	3.7	3.2
Amphipoda (1)	3.7	3.2

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on	
	Intestines with Food	Total Intestines
Anton Larsen Bay #2 - 16 June, 1978 (SCUBA)	N = 19	N = 21
Plant (14)	73.7	66.7
Hydrozoa (11)	57.9	52.4
Balanus crenatus (11)	57.9	52.4
Hiatella arctica (5)	26.3	23.8
Balanus sp. (5)	26.3	23.8
Pectinariidae (4)	21.1	19.0
Macoma sp. (4)	21.1	19.0
Gastropoda (4)	21.1	19.0
Pelecypoda (3)	15.8	14.3
Mytilus edulis (3)	15.8	14.3
Protothaca staminea (3)	15.8	14.3
Crabs (3)	15.8	14.3
Strongylocentrotus sp. (2)	10.5	9.5
Unidentified animal material (2)	10.5	9.5
Sand (2)	10.5	9.5
Empty (2)		9.5
Foraminifera (1)	5.3	4.8
Polychaeta (1)	5.3	4.8
Nuculana fossa (1)	5.3	4.8
Axinopsida serricata (1)	5.3	4.8
Nucula tenuis (1)	5.3	4.8
Veneridae (1)	5.3	4.8
Alvinia compacta (1)	5.3	4.8
Trochidae (1)	5.3	4.8
Paguridae (1)	5.3	4.8
Echiurus sp. (1)	5.3	4.8
Asteroidea (1)	5.3	4.8
Wood (1)	5.3	4.8
Unidentified remains (1)	5.3	4.8
Kodiak Shelf - 19 June - 9 July, 1978	N = 184	N = 196
Unidentified animal remains (127)	69.0	64.8
Nucula tenuis (117)	63.6	59.7
Nuculana fossa (110)	59.8	56.1
Sediment (104)	56.5	53.1
Axinopsida serricata (98)	53.3	50.0
Blue thread (63)	34.2	32.1
Foraminifera {50)	27.2	25.5
Gastropoda (47)	25.5	24.0

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on Intestines with Food	Total Intestines
Clinocardium ciliatum (45)	24.5	23.0
Pandora grandis (43)	23.4	21.9
Chionoecetes bairdi (43)	23.4	21.9
Decapoda (42)	22.8	21.4
Pisces (40)	21.7	20.4
Polychaeta (27)	14.7	13.8
Echiuridae (26)	14.1	13.3
Ophiuridae (26)	14.1	13.3
Cucumaria sp. (26)	14.1	13.3
Cardiomya sp. (24)	13.0	12.2
Macoma sp. (23)	1.2.5	11.7
Pelecypoda (23)	12.5	11.7
Plant (21)	11.4	10.7
Cylichna alba (21)	11.4	10.7
Pinnixa occidentalis (21)	11.4	10.7
Serripes groenlandicus (18)	9.8	9.2
Natantia (18)	9.8	9.2
Golden fiber (18)	9.8	9.2
Diamphiodia craterodmeta (16)	8.7	8.2
Pandalidae (15)	8.2	7.7
Red thread (13)	7.1	6.6
Dentalium sp. (12)	6.5	6.1
Amphipoda (12)	6.5	6.1
Empty (12)		6.1
Cistenides sp. (10)	5.4	5.1
Amphiuridae (10)	5.4	5.1
Lyonsia bracteata (8)	4.3	4.0
Yoldia sp. (7)	3.8	3.6
Ophiura sarsi (7)	3.8	3.6
Myriochele heeri (6)	3.3	3.1
Turbonilla sp. (6)	3*3	3.1
Clinocardium nuttallii (5)	2.7	2.6
Owenia fusiformis (4)	2.2	2.0
Turridae (4)	2.2	2.0
Naticidae (4)	2.2	2.0
Crustacea (4)	2.2	2.0
Echinoidea (4)	2.2	2.0
Echinodermata (4)	2.2	2.0
Pecten sp. (3)	1.6	1.5
Clinocardium sp. (3)	1.6	1.5

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on	
	Intestines with Food	Total Intestines
Paguridae (3)	1.6	1.5
Hydrozoa (2)	1.1	1.0
Retusa sp. (2)	1.1	1.0
Spisula polynyma (2)	1.1	1.0
Lepidepecreum coma-turn (2)	1.1	1.0
Balanus sp. (2)	1.1	1.0
Pugettia gracilis (2)	1.1	1.0
Bryozoa (2)	1.1	1.0
Strongylocentrotus sp. (2)	1.1	1.0
Feather (2)	1.1	1.0
Nematoda (1)	0.5	0.5
Pectinariidae (1)	0.5	0.5
Onuphidae (1)	0.5	0.5
Cyclocardia sp. (1)	0.5	0.5
Psephidia lordi (1)	0.5	0.5
Cerithiopsis sp. (1)	0.5	0.5
Alvinia sp. (1)	0.5	0.5
Polinices sp. (1)	0.5	0.5
Bankia *setacea* (1)	0.5	0.5
Diastylis paraspinulosa (1)	0.5	0.5
Green thread (1)	0.5	0.5
Izhut Bay - 9-12 July, 1978	N = 13	N = 18
Mud (8)	61.5	44.4
Pisces (6)	46.2	33.3
Pelecypoda (5)	38.5	27.8
Empty (5)		27.8
Nuculana fossa (4)	30.8	22.2
Polychaeta (3)	23.1	16.7
Gastropoda (2)	15.4	11.1
Crustacea (2)	15.4	11.1
Hydrozoa (1)	7.7	5.6
Axinopsida serricata (1)	7.7	5.6
Clinocardium ciliatum (1)	7.7	5.6
Clinocardium sp. (1)	7.7	5.6
Macoma sp. (1)	7.7	5.6
Plant (1)	7.7	5.6
Golden fiber (1)	7.7	5.6

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on: Intestines with Food	Total Intestines
Kiliuda Bay - 9-21 July 1978	N=69	N = 71
Nuculana fossa (47)	68.1	66.2
Nucula tenuis (30)	43.5	42.3
Clinocardium ciliatum (27)	39.1	38.0
Axinopsida serricata (26)	37.6	36.6
Macoma sp. (25)	36.2	35.2
Balanus sp. (20)	29.0	28.2
Gastropod (16)	23.2	22.5
Decapoda (15)	21.7	21.1
Chionoecetes bairdi (15)	21.7	21.1
Balanus crenatus (12)	17.4	16.9
Pectinariidae (8)	11.6	11.3
Clinocardium sp. (8)	11.6	11.3
Foraminifera (7)	10.1	9.9
Polychaeta (7)	10.1	9.9
Serripes groenlandicus (6)	8.7	8.5
pectinidae (6)	8.7	8.5
Idanthyrsus armatus (5)	7.2	7.0
Hiatella arctica (5)	7.2	7.0
Trichotropis cancellata (5)	7.2	7.0
Turridae (4)	5.7	5.6
Unidentified animal remains (4)	5*7	5.6
Flabelligeridae (3)	4.3	4.2
Pelecypoda (3)	4.3	4.2
Pandora sp. (3)	4.3	4.2
Ophiuroidea (3)	4.3	4.2
Owenia fusiformis (2)	2.9	2.8
Stylarioides sp. (2)	2.9	2.8
Spiochaetopterus costarum (2)	2.9	2.8
Yoldia sp. (2)	2.9	2.8
Mya sp. (2)	2.9	2.8
Naticidae (2)	2.9	2.8
Natica clausa (2)	2.9	2.8
Oenopota sp. (2)	2.9	2.8
Collisella sp. (2)	2.9	2.8
Strongylocentrotus droebachiensis (2)	2.9	2.8
Pisces (2)	2.9	2.8
Plant (2)	2.9	2.8
Sediment (2)	2.9	2.8
Empty (2)		2.8
Hydrozoa (1)	1.4	1.4

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on: Intestines with Food	Total Intestines
Crucigera sp. (1)	1.4	1.4
Veneridae (1)	1.4	1.4
Saxidomus gigantea (1)	1.4	1.4
Clinocardium nuttallii (1)	1.4	1.4
Modiolus modiolus (1)	1.4	1.4
Trochidae (1)	1.4	1.4
Cylichna alba (1)	1.4	1.4
Buccinum sp. (1)	1.4	1.4
Turbonilla sp. (1)	1.4	144
Balanus rostratus (1)	1.4	1.4
Natantia (1)	1.4	1.4
Paguridae (1)	1.4	1.4
Oregonia gracilis (1)	1.4	1.4
Ophiura sarsi (1)	1.4	1.4
Echinarachnius parma (1)	1.4	1.4
Echiurus echiurus (1)	1.4	1.4
Kiliuda Bay - 8-23 August 1978	N = 40	N = 44
Macoma sp. (18)	45.0	40.9
Axinopsida serricata (14)	35.0	31.8
Nucula tenuis (12)	30.0	27.3
Nuculana fossa (12)	30.0	27.3
Sediment (10)	25.0	22.7
Gastropod (8)	20.0	18.2
Animal material (8)	20.0	18.2
Polychaeta (7)	17.5	15.9
Clinocardium ciliatum (6)	15.0	13.6
Yoldia sp. (5)	12.5	11.3
Foraminifera (4)	10.0	9.1
Balanus sp. (4)	10.0	9.1
Golden fiber (4)	10.0	9.1
Empty (4)		6.8
Pelecypoda (3)	7.5	6.8
Natantia (3)	7.5	6.8
Pectinariidae (2)	5.0	4.5
Paguridae (2)	5.0	4.5
Chionoecetes bairdi (2)	5.0	4.5
Plant (2)	5.0	4.5
Hydrozoa (1)	2.5	2.3
Nereis sp. (1)	2.5	2.3
Spiochaetopterus costarum (1)	2.5	2.3
Spionidae (1)	2.5	2.3

TABLE XIII

CONTINUED

Intestine Contents	Percent Frequency of Occurrence Based on: Intestines with Food	Total Intestines
Myriochele heeri (1)	2.5	2.3
Spisula polynyma (1)	2.5	2.3
Cylichnidae (1)	2.5	2.3
Cumacea (1)	2.5	2.3
Crustacea (1)	2.5	2.3
Ophiura sarsi (1)	2.5	2.3
Strongylocentrotus droebachiensis (1)	2.5	2.3
Echinarachnius parma (1)	2.5	2.3
Pisces (1)	2.5	2.3
Zostera sp. (1)	2.5	2.3
Kiliuda Bay - 4-17 November 1978	N=49	N=55
Unidentified animal material (38)	77.6	69.1
Sediment (29)	59.2	52.7
Macoma sp. (23)	46.9	41.8
Axinopsida serricata (20)	40.8	36.4
Pollutant (14)	28.6	25.5
Empty (14)		25.5
Chionoecetes bairdi (12)	24.5	21.8
Foraminifera (11)	22.4	20.0
Gastropoda (8)	16.3	14.5
Nucula tenuis (6)	12.2	10.9
Nuculana fossa (4)	8.2	7.3
Pisces (4)	8.2	7.3
Decapoda (3)	6.1	5.5
Plant (2)	4.1	3.6
Polychaeta (2)	4.1	3.6
Yoldia sp. (2)	4.1	3.6
Turbonilla sp. (1)	2.0	1.8
Sabellidae (1)	2.0	1.8
Spiochaetopterus sp. (1)	2.0	1.8
Polynoidae (1)	2.0	1.8
Serripes groenlandicus (1)	2.0	1.8
Lyonsia bracteata (1)	2.0	1.8
Trochidae (1)	2.0	1.8
Balanus rostratus (1)	2.0	1.8
Shrimp (1)	2.0	1.8
Pandalus sp. (1)	2.0	1.8
Paguridae (1)	2.0	1.8
Echiuridae (1)	2.0	1.8

TABLE XIV

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* TRAWLS IN IZHUT BAY
July 1978. Mean Depth 177 meters

Number Examined: 18
Number Empty: 1
Percent Composition of Crab Classes: 2=66.6%; 6=33.3%
Mean Length: 115±11 mm
Mean Weight: 1217±257 g
Mean Percent Fullness: 10.3±10.4%[1]
Number of Prey Taxa: 9

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence	% by Weight	% by Volume
Chordata	Pisces (fishes)	78	92,8	92.2
Mollusca	*Nuculana* sp. (clam)	11	0.7	0.6
	Clinocardium spp. (cockle)	11	0.4	0.4
	Axinopsida sp. (clam)	6	0.4	0.2
Unidentified plant material		28	4.2	4.1

[1]Based on all stomachs examined

[2]Species or lowest level of identification

prey taxa were identified. The mean fullness was 10.3 ± 10.4%. As in June, the leading prey was fishes; 78% by frequency of occurrence and 92.8% of the total food weight. Molluscan prey was only 1.5% of the total weight.

Food found in the intestine of Izhut Bay king crabs was similar to food found in the stomachs.

Kiliuda Bay

April 1978 (Tables XIII, XV; Fig. 2)

Forty-nine king crabs collected in Kiliuda Bay in April came from stations 576, 577, 578, 579, 580 and SHR. Only 16 (33%) of the crabs collected contained food. Twenty different taxa were identified. The mean fullness of the 49 stomachs was 1.9 ± 8.1%. The crab class composition was mainly ovigerous females (57.1%) and newshell males greater than 100 mm in length (22.4%). No single prey dominated the stomach contents. The bivalve molluscs *Nuculana* sp., *Clinocardium* spp. and *Nucula tenuis* each made up 2% or less of the total prey weight. Decapod crustaceans (crabs and/or shrimps) were found in 8% of the crab examined but only accounted for 3.2% of the weight. Fishes were found in 2% of the crabs and accounted for 6.7% of the weight. Seventy percent of the food weight was unidentified animal material.

Food found in the intestines of Kiliuda Bay king crabs was similar to food found in the stomachs.

June 1978 (Tables XIII, XVI; Fig. 2)

Eighty-three king crabs collected in Kiliuda Bay in June were of mixed composition i.e., 12% were ovigerous females, 8.4% were newshell males less than 100 mm long, 3.6% were oldshell males less than 100 mm, 18.1% were newshell males greater than 100 mm, 55.4% were oldshell males greater than 100 mm, and 2.4% were very oldshell males greater than 100 mm. All king crabs examined came from seven stations: 3, 4, 5, 576, 578, 579 and 580. Most crabs examined were feeding (9.5%). A total of 44 different prey taxa were identified. The mean fullness was 6.9 ± 9.3%. Important prey, in terms of percent of total prey weight, were pelecypod molluscs (clams), specifically, *Nuculana* sp. (14.4%) and *Macoma* spp. (13.9%). Crustaceans were dominated by barnacles, *Balanus* spp., (32%) and decapods 6.3%). Fishes also accounted for 8.3% of the prey weight.

TABLE XV

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* TRAWLS IN KILIUDA BAY
April 1978. Mean Depth 38.6±30.4 meters

Number Examined: 49
Number Empty: 33
Percent Composition of Crab Classes: 1=4.1%; 2=57.1%; 3=6.1%; 6= 22.4%; 7=2.0%; 8=8.2%
Mean Length: 118±30 mm
Mean Weight: 1411±1059 g
Mean Percent Fullness: 1.9±8.1%[1]
Number of Prey Taxa: 20

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence	% by Weight	% by Volume
Mollusca	*Nuculana* sp. (clam)	4	2.3	2.0
	Clinocardium spp. (cockle)	6	1.0	1.4
	Nucula tenuis (clam)	4	0.8	0.7
Arthropoda	Decapoda	8	3.2	1.4
Chordata	Pisces (fishes)	2	6.7	6.6
Unidentified animal material		14	70.7	77.6
Unidentified plant material		8	1.0	1.5

[1]Based on all stomachs examined

[2]Species or lowest level of identification

TABLE XVI

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* TRAWLS IN KILIUDA BAY
June 1978. Mean depth 46±25 meters

Number Examined: 83
Number Empty: 5
Percent Composition of Crab Classes: 2=12.0%; 3=8.4%; 4=3.6%; 6=18.1%; 7=55.4%; 8=2.4%
Mean Length: 117±35 mm
Mean Weight: 1786?2377 g
Mean Percent Fullness: 6.9±9.3%[1]
Number of Prey Taxa: 44

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence	% by Weight	% by Volume
Mollusca	*Nuculana* Sp. (clam)	42	14.4	9.6
	Macoma spp. (clam)	28	13.9	12.6
	Pelecypoda (clams)	42	1.6	2.6
	Nucula tenuis (clam)	23	2.5	2.6
	Clinocardium spp. (cockle)	11	1.5	1.1
Anthropoda	*Balanus* spp.[3] (barnacle)	35	32.3	29.3
	Decapoda	40	6.3	8.2
Chordata	Pisces (fishes)	7	8.3	9.7
Annelida	Polychaeta (segmented worms)	22	1.6	2.6
Unidentified animal material		31	4.7	6.8
Unidentified plant material		30	1.4	0.8

[1]Based on all stomachs examined

[2]Species or lowest level of identification

[3]Includes some *Balanus crenatus*

Food found in the intestines of Kiliuda Bay king crabs was similar to food found in the stomachs.

July 1978 (Tables XIII, XVII; Fig. 2)

Seventy-one king crabs were collected in Kiliuda Bay in July at stations 1, 4, 6, 576, 578, 579, 580 and SHR. The crabs were mainly ovigerous females (57.5%), oldshell males greater than 100 mm in carapace length (18.3%), and newshell males greater than 100 mm (11.3%). All but one crab contained food. T'ne mean percent fullness was 8.8 ± 9.5%. Sixty-five different taxa were identified as prey. The most important prey items, in terms of percent of total food weight, were the Arthropoda. Barnacles, mainly *Balanus crenatus*, accounted for more than 50% of the food weight. *Chionoecetes bairdi* occurred in 27% of the stomachs examined but made up only 5.1% of the weight. Another important food group was the Pelecypoda (clams, cockles). The clams *Nuculana* spp. and *Macoma* spp. accounted for 15.8% and 11.1% of the weight, respectively. *Nucula tenuis* and *Clinocardium ciliatum* contributed 4.8% and 2.5% of the weight, respectively. Fishes composed 1.4% of the food weight.

Food from the intestines of these king crabs was similar to food found in the stomachs.

August 1978 (Tables XIII, XVIII; Fig. 2)

Forty-four king crabs were collected for food analysis at stations 2, 4, 5, 579 and SHR. The crabs were mainly composed of newshell males greater than 100 mm in length (43.2%), oldshell males greater than 100 mm (25%), and ovigerous females (25%). Twelve of the crabs had empty stomachs. The mean percent fullness was 1.9 ± 3.2%. Thirty different prey taxa were identified. Prey was dominated by pelecypod molluscs, specifically, *Macoma* sp. (48.3% of weight), *Nuculana* sp. (11.4%), and *Nucula tenuis* (7.2%). Decapods occurred in 11% of the stomachs but accounted for only 0.9% of the weight. The sea urchin *Strongylocentrotus droebachiensis* occurred in only 2% of the crabs but accounted for 15.2% of the weight.

Food found in the intestines of Kiliuda Bay king crabs was similar to food found in the stomachs.

TABLE XVII

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* TRAWLS IN KILIUDA BAY
July 1978. Mean Depth 52±31 meters

Number Examined: 71
Number Empty: 1
Percent Composition of Crab Classes: 1=9.9%; 2=57.7%; 6=11.3%; 7=18.3%; 8=2.8%

Mean Length: 115±18 mm
Mean Weight: 1319±506 g
Mean Percent Fullness: 8.8 ±9.5%[1]
Number of Prey Taxa: 65

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence	% by Weight	% by Volume
Arthropoda	*Balanus crenatus* (barnacles)	20	37.8	33.9
	Balanus spp. (barnacles)	27	10.2	8.5
	Balanus rostratus (barnacles)	14	2.6	2.4
	Chionoecetes bairdi (snow crab)	27	5.1	6.5
Mollusca	*Nuculana* spp. (clams)	63	15.8	12.0
	Macoma spp. (clams)	38	11.1	12.0
	Nucula tenuis (clam)	39	4.8	5.4
	Clinocardium ciliatum (cockle)	31	2.5	3.3
Chordata	Pisces (fishes)	8	1.4	1.8

[1]Based on all stomachs examined

[2]Species or lowest level of identification

TABLE XVIII

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* TRAWLS IN KILIUDA BAY
August 1978. Mean Depth 71±27 meters

Number Examined: 44
Number Empty: 12
Percent Composition of Crab Classes: 1=4.5%; 2=25%; 3=2.3%; 6=43.2%; 7=25%
Mean Length: 113±18 mm
Mean Weight: 1217*394 g
Mean Percent Fullness: 1.9±3.2%[1]
Number of Prey Taxa: 30

DOMINANT PREY

Phylum	Species*	% Freq. Occurrence	% by Weight	% by Volume
Mollusca	*Macoma* sp. (clam)	41	48.3	40.1
	Nuculana sp. (clam)	23	11.4	8.4
	Nucula tenuis (clam)	20	7.2	8.2
Arthropoda	Decapoda	11	0.9	1.2
	Pandalus sp. (shrimp)	2	2.4	2.6
Echinodermata	*Strongylocentrotus droebachiensis* (sea urchin)	2	15.2	18.0

[1]Based on all stomachs examined

[2]Species or lowest level of identification

November 1978 (Tables XIII, XIX; Fig. 2)

Fifty-five king crabs were collected for food analysis in Area I at stations 7 and SHR. The crabs were mainly composed of juvenile females (32.7%), ovigerous females (36.4%), and newshell males greater than 100 mm (18.2%). Forty-nine (89% of all crabs examined) contained food. The mean percent fullness was 7.8 ± 12.4%, and the total identified food taxa was 28. Molluscs and arthropods were the dominant foods. Leading molluscs were the clams *Macoma* sp. (18.8% of the total weight) and *Axinopsida serricata* (4.9%), and gastropod (0.5%). Arthropods were dominated by *Chionoecetes bairdi* (3.4%) and *Pandalus* sp. (18.1%). Fishes composed 5.7% of the prey weight.

Food found in the intestines of Kiliuda Bay king crabs was similar to food found in the stomachs.

Near Island Basin

May 1978 (Tables XIII, XX; Fig. 3)

In early May 1978, large concentrations of king crabs were located in Near Island Basin adjacent to the Kodiak city boat harbor. The crabs were first sighted from a skiff as they congregated just below the exposed low intertidal region. Portions of the crabs were uncovered. Subsequent SCUBA diving revealed several hundred crabs in the low intertidal and shallow sub-tidal regions. All crabs appeared to have new exoskeletons. King crabs were observed feeding on green algae, polychaetous annelids, clams - *Protothaca staminea*, *Mya arenaria* -, *Balanus* spp., *Strongylocentrotus droebachiensis*, and sea stars - *Pycnopodia helianthoides* and *Evasterias troschelii*. Small king crabs (15 mm in length) were found under rocks.

Diving was again accomplished at the Near Island Basin site in mid-May . King crabs were congregated in the shallow sub-tidal region only. A few crabs were observed feeding on the cockle *Clinocardium nuttallii*. Thirty-five crabs were randomly collected for stomach analysis. The crabs were mainly immature males and females, although some mature individuals of both sexes were taken.

All crabs taken in mid-May contained food. Thirty-seven prey taxa were identified, and the mean percent fullness was 4.9 ± 7.5%. Prey items dominating the stomach weight were molluscs, specifically *Macoma* spp.

TABLE XIX

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA TRAWLS* IN KILIUDA BAY
November 1978. Mean Depth 89.5±10.6 meters

Number Examined: 55
Number Empty: 6
Percent Composition of Crab Classes: 1=32.7%; 2=36.4%; 5=5.5%; 4=3.6%; 6=18.2%; 7=3.6%
Mean Length: 105±14 mm
Mean Weight: 981±416 g
Mean Percent Fullness: 7.8±12.4%[1]
Number of Prey Taxa: 28

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence	% by Weight	% by Volume
Mollusca	*Macoma* sp (clam)	44	18.8	16.5
	Axinopsida serricata (clam)	24	4.9	4.1
	Gastropoda (snail)	13	0.5	0.6
Arthropoda	*Chionoecetes bairdi* (snow crab)	24	3.4	2.9
	Pandalus Sp. (shrimp)	4	18.1	18.6
Chordata	Pisces (fishes)	7	5.7	5.5
Unidentified animal material		31	25.7	25.9
Unidentified plant material		47	14.4	12.8
Sediment		64	0.8	1.4

[1]Based on all stomachs examined

[2]Species or lowest level of identification

TABLE XX

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* SCUBA IN NEAR ISLAND BASIN
May 1978. Mean Depth 5 meters

Number Examined: 35
Number Empty: 0
Percent Composition of Crab Classes: 1=34.3%; 2=17.1%; 3=5.7%; 6=42.9%
Mean Length: 106±10 mm
Mean Weight: 958±315 g
Mean Percent Fullness: 4.9±7.5%
Number of Prey Taxa: 37

DOMINANT PREY

Phylum	Species[1]	% Freq. Occurrence	% by Weight	% by Volume
Mollusca	*Macoma* spp. (clam)	29	17.4	18.8
	Mya sp. (clam)	9	2.5	2.4
	Trochidae (snails)	14	< 0.1	0.2
	Protothaca staminea (clam)	9	< 0.1	0.1
Echinodermata	Echinoidea (urchins)	14	16.8	14.7
	Asteroidea (sea stars)	3	7.0	7.0
Annelida	*Owenia fusiformis* (tube-dwelling worm)	37	< 0.1	0.7
	Pectinariidae (tube-dwelling worm)	23	< 0.1	0.4
Arthropods	*Balanus* spp. (barnacles)	23	0.8	5.0
Unidentified animal material		57	42.1	31.1
Unidentified plant material		66	2.7	3.9

[1]Species or lowest level of identification

(17.4%), and echinoderms, specifically sea urchins (16.8%). Other important molluscs were the clams *Mya* sp. (2.5%). *Protothaca staminea* and gastropod of the family Trochidae each accounted for < 0.1% of the total food weight. Sea stars consisted of 7% of the total food weight. The annelids, *Owenia fusiformis* and pectinarids, and barnacles, *Balanus* spp., were frequently found among stomach contents although they contributed little to the overall volume.

Intestines were not examined for food content.

June 1978 (Tables XIII, XXI; Fig. 3)

The Near Island Basin site was revisited in mid-June. Crabs were in the same location as in May, however, unlike the aggregative behavior of crabs in May, individuals in June were mainly solitary. The crab class composition was also the same as in May. Crabs were observed feeding on *Protothaca staminea*. Dense clouds of mud in deeper water suggested that crabs were actively feeding in the immediate vicinity. Thirty-two king crabs were randomly collected for food analysis. All contained food.

Thirty prey taxa were identified and the mean percent stomach fullness was 7.6 ± 7.6%. Barnacles were the most important prey contributing 33% of the food weight. Unidentified pelecypods (10.6%), *Macoma* spp. (3.5%), and *Protothaca staminea (0.3%)*, were the most important clams. Once again annelid worms were dominated by *Owenia fusiformis* and pectinarids, the latter worms were frequently taken but added little to the total prey weight.

Food examined from the intestines of Near Island Basin king crabs was similar to food found in their stomachs.

McLinn Island

May 1978 (Tables XIII, XXII; Fig. 3)

Diving near McLinn Island in mid-May yielded 49 king crabs for stomach analysis. Crabs were not widely dispersed, but were found in aggregates of 4–8 crabs at a mean depth of 9 m. Most crabs were inactive at the time of capture. Most were immature, newshell crabs of both sexes (mean length 100 ± 9 mm). All crabs examined in the laboratory contained food (48 different prey taxa) with a mean percent fullness of 9.3 ± 11.8%. Dominant

TABLE XXI

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* SCUBA IN NEAR ISLAND BASIN
June 1978. Mean Depth 6 meters

Number Examined: 32
Number Empty: 0
Percent Composition of Crab Classes: 1=21.9%; 2=12.5%; 3=12.5; 6=53.1%
Mean Length: 110±17 mm
Mean Weight: 10721515 g
Mean Percent Fullness: 7.6±7.6%
Number of Prey Taxa: 30

DOMINANT PREY

Phylum	Species[1]	% Freq. Occurrence	% by Weight	% by Volume
Mollusca	Pelecypoda (clams)	44	10.6	11.6
	Mya sp. (clam)	19	14.2	9.4
	Macoma sp. (clam)	31	3.5	3.3
	Protothaca staminea (clam)	38	0.3	2.7
Arthropoda	*Balanus* spp.[2] (barnacle)	63	33.9	22.2
Annelida	*Owenia fusiformis* (tube-dwelling worm)	50	3.4	4.4
	Pectinariidae (tube-dwelling worm)	28	0.2	1.6
Unidentified animal material		69	23.3	20.3
Sediment		66	0.5	4.3

[1]Species or lowest level of identification

[2]Includes *Balanus crenatus*

TABLE XXII

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* SCUBA IN NEAR McLINN ISLAND
May 1978. Mean Depth 9 meters

Number Examined: 49
Number Empty: 0
Percent Composition of Crab Classes: 1=42.9%; 2=22.4%; 3=18.4% 6=16.3%
Mean Length: 100±9 mm
Mean Weight: 758?183 g
Mean Percent Fullness: 9.3±11.8%
Number of Prey Taxa: 48

DOMINANT PREY

Phylum	Species[1]	% Freq. Occurrence	% by Weight	% by Volume
Mollusca	Pelecypoda (clams)	49	30.3	31.4
	Trichotropis cancellata (snail)	29	8.5	6.5
	Hiatella arctica (clam)	43	5.1	4.2
	Macoma sp. (clam)	41	1.5	1.3
	Protothaca staminea (clam)	18	0.9	0.8
Arthropoda	Decapoda	40	2.7	1.5
	Balanus spp.[2] (barnacles)	27	1.5	1.4
Unidentified animal material		82	16.8	16.6
Unidentified plant material		69	3.3	3.9
Unidentified material		51	16.1	16.7

[1]Species or lowest level of identification

[2]Includes *Balanus crenatus*

prey items were molluscs and crustaceans. Unidentified clams were the main molluscs taken and contributed 30% of the weight. Important clams that were identified were *Hiatella arctica* (5.1%), *Macoma* spp. (1.5%), and *Protothaca staminea* (0.9%). The snail *Trichotropis cancellata* contributed 8.5% by weight. Unidentified decapods (2.7%) and *Balanus* spp. (3.3%) were the most important crustaceans.

Food examined from the intestines of McLinn Island king crabs was similar to food found in their stomachs.

An attempt was made to locate king crabs via SCUBA in the shallows of Kalsin and Womans Bay in mid-May. No crabs were found although they were reported one week earlier by ADF&G divers.

The McLinn Island site was revisited in mid-June and no crabs were found.

Food examined from the intestines of McLinn Island crabs was similar to food found in their stomachs.

Anton Larsen Bay - Site #1

June 1978 (Tables X111, XXIII; Fig. 3)

Two sites were examined by SCUBA in Anton Larsen Bay to obtain king crabs. One collection (site #1) was made across the bay from the boat ramp. The dive began on a steep slope at 19 m. Ascending up the slope toward shore it was apparent that barnacles had recently been removed from the rocky substrate. King crabs were observed at 5 m depth as single individuals or groups of 2-4. All were actively feeding. Thirty-one crabs were collected, of which 9.4% were ovigerous females and 81.3% were old-shell males. Only four of the crabs examined in the laboratory did not contain food. The mean percent fullness of all crabs examined was 4.4 ± 5.2%. Stomach contents were dominated by *Balanus* spp. Barnacles made up 56.2% of the stomach weight. Molluscs, specifically *Macoma* spp. (4.0%), gastropod (1.5%), *Protothaca staminea* (0.5%), and *Clinocardium* spp. (0.8%) were also important. Hydroids were frequently taken (52%) but yielded only 0.2% of the volume.

Food examined from the intestines of Anton Larsen Bay site #1 king crabs was similar to food found in their stomachs.

TABLE XXIII

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* SCUBA AT ANTON LARSEN BAY
Site #1. June 1978. Mean Depth 5 meters

Number Examined: 31
Number Empty: 4
Percent Composition of Crab Classes: 1=6.3%; 2=9.4%; 6=3.1%; 7=81.3%
Mean Length: 118±13 mm
Mean Weight: 1356?465 g
Mean Percent Fullness: 4.4±5.2%[1]
Number of Prey Taxa: 21

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence	% by Weight	% by Volume
Arthropoda	*Balanus* spp. (barnacles)	39	41.5	31.5
	Balanus crenatus (barnacle)	13	14.7	9.9
Mollusca	*Macoma* spp. (clam)	16	4.0	5.3
	Gastropod (snail)	10	1.5	2.1
	Protothaca staminea (clam)	10	0.5	0.4
	Clinocardium spp. (cockle)	3	0.8	1.0
Cnidaria	Hydrozoa (hydroid)	52	0.2	0.9
Annelida	*Owenia fusiformis* (tube-dwelling worm)	16	0.2	0.6
Unidentified plant material		71	15.7	19.4
Unidentified animal material		32	4.5	6.4
Sediment		32	< 0.1	0.6

[1]Based on all stomachs examined

[2]Species or lowest level of identification

Anton Larsen Bay - Site #Z

June 1978 (Table XIII, XXIV; Fig. 3)

The second collection of king crabs in Anton Larsen Bay was in a rocky, kelp-covered region approximately 1.8 km west of the boat ramp. A few crabs were observed feeding on barnacles. Approximately 12 large and very old-shell male king crabs were found dead and decaying in this region. Twenty-one crabs were collected at an average depth of 9 m; 40% were ovigerous females and 50% were oldshell males of mixed maturity. All crabs examined in the laboratory, except one, contained food. Food was similar to that found in the crabs at site #1. Barnacles, mainly *Balanus crenatus*, accounted for 77% of the total prey weight. Major molluscs consisted of unidentified clams (1.8%), *Protothaca staminea* (1.7%), *Hiatella arctica* (0.3%), and *Macoma* spp. (1.1%). Hydroids were found in 76% of the crabs examined, but accounted for only 0.2% of the weight.

Food examined from the intestines of king crabs from Anton Larsen Bay site #2 was similar to food found in their stomachs.

Kodiak Shelf

June-July 1978 (Tables XIII, XXV, XXVI; Fig. 5)

The June-July cruise on the Kodiak Shelf yielded 196 king crabs from nine stations. One hundred and eighty-seven crabs (95%) had food in their stomachs. The crabs were mainly composed of ovigerous females (42.9%) and newshell males greater than 100 mm in carapace length (42.3%). The mean percent fullness was 9.1 ± 10%. Although station 14 had the highest mean percent stomach fullness, 21.4 ± 18.2%, only four crabs were collected and examined. Crabs of stations 13 and 9 also had high stomach fullnesses, 16.2 ± 26.7% and 13.5 ± 9.1%, respectively. King crabs from station 9 had the highest diversity of prey taxa (63) and the highest diversity of prey taxa within a single crab (25). The fullest king crab stomach was 78.1% full; a 112 mm ovigerous female from station 13. This crab was feeding on *Chionoecetes bairdi* and fish.

Eighty-six different prey taxa were identified from crabs taken at all stations. Dominant prey belonged to three phyla: Mollusca, Arthropoda and Chordata. Clams were the most important molluscs. The clams *Nuculana* spp.

TABLE XXIV

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* SCUBA AT ANTON LARSEN BAY
Site #2. June 1978. Mean Depth 9 meters

Number Examined: 21
Number Empty: 1
Percent Composition of Crab Classes: 1=10%; 2=40%; 7=50%
Mean Length: 121±20 mm
Mean Weight: 1380±791 g
Mean Percent Fullness: 11.3±14.2%[1]
Number of Prey Taxa: 30

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence[1]	% by Weight	% by Volume
Arthropoda	*Balanus crenatus* (barnacles)	48	71.6	66.5
	Balanus spp. (barnacles)	33	5.7	5.6
Mollusca	Pelecypoda (clams)	38	1.8	2.0
	Protothaca staminea (clam)	24	1.5	1.7
	Hiatella arctica (clam)	33	0.3	0.7
	Macoma spp. (clam)	14	1.1	0.9
Cnidaria	Hydrozoa	76	0.2	0.8
Unidentified plant material		71	4.2	5.1

[1]Based on all stomachs examined

[2]Specfes or lowest level of identification

TABLE XXV

STOMACH CONTENTS OF KING CRABS COLLECTED *VIA* TRAWLS ON THE KODIAK SHELF
June-July 1978. Mean Depth 118±44 meters

Number Examined: 196
Number Empty: 9
Percent Composition of Crab Classes: 1=5.6%; 2=42.9%; 3=2%; 6=42.3%;
7=6.1%; 8=1%
Mean Length: 119±18 mm
Mean Weight: 13791669 g
Mean Percent Fullness: 9.1±10%[1]
Number of Prey Taxa: 86

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence	Z by Weight	Z by Volume
Mollusca	*Nuculana* spp. (clams)	57	22.5	20.2
	Nucula tenuis (clam)	56	8.4	7.1
	Pandora grandis (clam)	20	2.7	2.2
	Clinocardium spp. (cockle)	26	< 0.1	0.7
Arthropoda	Decapoda	27	6.0	6.4
	Chionoecetes bairdi (snow crab)	26	4.4	4.4
	Pinnixa occidentalis (pea crab)	11	9.4	9.7
Chordata	Pisces (fishes)	29	19.6	20.7
Unidentified animal material		60	10.4	10.3

[1]Based on all stomachs examined

[2]Species or lowest level of identification

TABLE XXVI
STATION DATA AND STOMACH CONTENTS OF KING CRABS COLLECTED VIA TRAWLS ON THE KODIAK SHELF
June-July 1978

Station Name	1	7	8	9
$\bar{x}$ Depth, m	68	55	73	140
Number examined	7	33	40	44
Number empty	0	6	0	0
% crab composition	2=100%	1=18;% 2=39%; 3=3%; 6=39%	1=5%; 2=45%; 3=5%; 6=35%; 7=10%	1=2%; 2=43%; 6=50%; 7=4%
$\bar{x}$% Fulness	5.6±7.1%	4.5±5.8%	5.3?6.5%	13.5±9.1%
Prey taxa	15	21	26	63
Dominant prey-% wt.	Unid. Animal-21.4 *Ophiura sarsi*-21.3 Paguridae-2.2	Decapoda-37. 1 *Nucu la tenuis*-21. 2 *Nuculana fossa*-19.5 *Axinopsida serricata*-3 .4	Pisces-32.2 *Nucula tenuis*-14. 6 *Nucu lana fossa*-9. 3 Decapoda-8. 1 *Yoldia* sp. -6.9 *Macoma* spp. -l. 7 *Clinocardium* sp. -0.2 *Axinopsida serricata*-<0. 1	*Nuculana* spp.-61.4 *Nucula tenuis*-13.9 Pandora *grandis*-9.0 Unid. animal- 3.8 *Chionoecetes bairdi* -3.4 *Axinopsida serricata*-0.5

Station Name	10	11	12	13
Depth, m	126	117	135	173
Number examined	16	16	28	8
Number empty	1	1	1	0
% Crab composition	2=37%; 6=44%; 7=6%; 8=12%	1=6%; 2=44%; 3=6%; 6=31%; 7=12%	1=4%; 2=36%; 6=53%; 7=7%	2=37%; 6=50%; 7=12.5%
$\bar{x}$% Fullness	8.3±10.6%	6.8±60%	11.7*6.8%	16.7±26.7%
Prey taxa	33	14	27	10
Dominant prey-% wt.	Pisces-40.33 Unid. animal-20.1 *Nuculana fossa*-13.4 *Nucula tenuis*-4.8 Echiuridae-2.1 *Axinopsida serricata*-1.0	Unid. animal-46.9 Pisces-30.0 Decapoda-4. 3 *Para li thodes camtschatica*-3.8 *Axinopsida serricata*-<0. 1	*Pinnixa occideztalis*-47. 3 Pisces-23. 0 Unid. animal-17.7 Decapoda-3. 2 *Macoma* spp. -1.4 *Axinopsida serricata*-0.4	Pisces-46.9 *Chionoece tes bairdi*-31.0 Unid. Plant-1?. 3

Station Name	14
$\bar{x}$ Depth, m	176
Number examined	4
Number empty	0
% Crab composition	2=25%; 6=75%
$\bar{x}$% Fullness	21.4±18.2%
Prey taxa	
Dominant prey-% wt.	Pisces-55.6 Decapoda-4. 3 Unid. plant-4.2 *Nucu lana fossa*-4. 1 *Chionoecetes bairdi*-3.1

and *Nucula tenuis* made up 22.5% and 8.4% of the weight, respectively, and were important prey at stations 7, 8, 9 and 10. Important arthropods were unidentified decapods (6.0%), *Chionoecetes bairdi* (4.4%), and the pea crab *Pinnixa occidentalis* (9.4%). The decapods were important prey at stations 7, 8, 11, 12 and 14. *Chionoecetes bairdi* was important prey at stations 9, 13 and 14, and *Pinnixa occidentalis* was important at station 12. Fishes accounted for 19.6% of the weight and were found in 29% of the crabs. Fishes were important prey at stations 8, 10, 11, 12, 13 and 14. Unidentified animal material made up 10.4%.

Food found in king crab intestines were similar to food found in their stomachs.

Chionoecetes bairdi (snow crab) and *Pandalus borealis* (pink shrimp)

Feeding data on snow crabs and the pink shrimps will appear in the Final Report.

Pycnopodia helianthoides (sunflower sea star)

Izhut Bay

May, June, August & November 1978 (Table XXVII)

In four months of sampling for sunflower sea stars, 199 were examined for food and 148 (74%) contained food. The sea stars were sampled at a variety of stations. Molluscs dominated the stomach contents in all months. The snails *Oenopota* sp. and *Solariella* sp. were consistently taken as food. Dominant clams included *Nuculana fossa*, *Psephidia lordi* and *Spisula polynyma*.

Pycnopodia examined in May and June by SCUBA in shallow bays adjacent to the city of Kodiak, were observed feeding on the cockle *Clinocardium nuttallii*, the clams *Mya arenaria*, *Protothaca staminea*, and *Saxidomus gigantea*, and barnacles.

Gadus macrocephalus (Pacific cod)

Kodiak Shelf (Table XXVII; Fig. 5)

Pacific cod stomachs examined from the June–July 1978 cruise were dominated by crustaceans. Ninety-six percent of all cod examined were feeding, and 41

TABLE XXVII

STOMACH CONTENTS OF ADDITIONAL SELECTED SPECIES
FROM THE KODIAK ISLAND REGION, 1978

(N) = Number of Stomachs

Stomach Contents	Percent Frequency of Occurrence Based on: Stomachs W/ food	Total Stomachs
PYCNOPODIA HELIANTHOIDES (sunflower sea star)		
Pycnopodia helianthoides Izhut Bay - 4-19 May 1978	N = 91	N = 105
Oenopota sp. (snail) (34)	37.4	32.4
Solariella sp. (snail) (23)	25.3	21.9
Nuculana fossa (Fossa nut clam) (15)	16.5	14.3
Empty (14)		13.3
Psephidia lordi (Lord's dwarf venus) (12)	13.2	11.4
Spisula polynyma (surf clam) (9)	9.0	8.6
BaZanus spp. (barnacle) (9)	9.0	8.6
Mitrella gouldi (snail) (6)	6.6	5.7
Chionoecetes bairdi (snow crab) (6)	6.6	5.7
Clinocardium ciliatum (Iceland cockle) (5)	5.5	4.8
Natica clausa (moon shell) (4)	4.4	3.8
Amphipoda (sand flea) (3)	3.3	2.9
Crangonidae (gray shrimp) (3)	3.3	2.9
Parastichopus sp. (sea cucumber) (3)	3.3	2.9
Serripes groenlandicus (Greenland cockle) (3)	3.3	2.9
Polychaeta (segmented worm) (2)	2.2	1.9
Macoma sp. (bivalve) (2)	2.2	1.9
Mya priapus (bivalve) (2)	2.2	1.9
Mya sp. (bivalve) (2)	2*2	1.9
Musculus discors (discord musculus) (2)	2.2	1.9
Nucula tenuis (soft nut clam) (2)	2.2	1.9
Pandora sp. (bivalve) (2)	2.2	1.9
Nucella lamellosa (frilled dogwinkle) (2)	2*2	1.9
Gastropoda (snail) (2)	2.2	1.9
Cancer sp. (crab) (2)	2.2	1.9
Pagurus sp. (hermit crab) (2)	2.2	1.9
Elassochirus tenuimanus (hermit crab) (2)	2.2	1.9
Siliqua sp. (razor clam) (1)	1.1	1.0
Tellina nuculoides (Salmon Tellin) (1)	1.1	1.0
Tellinidae (bivalve) (1)	1.1	1.0
Macoma lipara (bivalve) (1)	1.1	1.0
Macoma moesta (doleful macoma) (1)	1.1	1.0
Pandora grandis (bivalve) (1)	1.1	1.0
Musculus Sp. (bivalve) (1)	1.1	1.0
Thyasira flexuosa (flexuose cleft clam) (1)	1.1	1.0

TABLE XXVII

CONTINUED

Stomach Contents	Percent Frequency of Occurrence Based on: Stomachs w/food	Total Stomachs
Clinocardium sp. (cockle) (1)	1.1	1.0
Liocyma sp. (bivalve) (1)	1.1	1.0
Mya truncata (soft shell clam) (1)	1.1	1.0
Pelecypoda (bivalves) (1)	1.1	1.0
Admete couthouyi (common northern admete) (1)	1.1	1.0
Suavodrillia sp. (snail) (1)	1.1	1.0
Buccinum plectrum (Plectrum buccinum) (1)	1.1	1.0
Pagurus ochotensis (hermit crab) (1)	1.1	1.0
Balanus rostratus (barnacle) (1)	1.1	1.0
Oregonia gracilis (decorator crab) (1)	1.1	1.0
Bankia setacea (shipworm) (1)	1.1	1.0
Sand (1)	1.1	1.0
Pycnopodia helianthoides Izhut Bay - 8-25 June 1978	N = 15	N = 44
Empty (29)		65.9
Solariella sp. (snail) (4)	26.7	9.1
Echinarachnius parma (sand dollar) (3)	20.0	6.8
Cucumaria sp. (sea cucumber) (2)	13.3	4.5
Oenopota sp. (snail) (2)	13.3	4.5
Spisula polynyma (surf clam) (2)	13.3	4.5
Macoma sp. (bivalve) (2)	13.3	4.5
Psephidia lordi (Lord's dwarf venus) (2)	13.3	4.5
Siliqua sp. (razor clam) (1)	6.7	2.3
Pandora sp. (bivalve) (1)	6.7	2.3
Admete couthouyi (common northern admete) (1)	6.7	2.3
Natica clausa (moon shell) (1)	6.7	2.3
Scyphozoa (jellyfish) (1)	6.7	2.3
Pleuronectidae (flatfishes) (1)	6.7	2.3
Fish (1)	6.7	2.3
Pycnopodia helianthoides Izhut Bay - 8-23 August 1978	N = 12	N = 14
Balanus sp. (barnacle) (4)	33.3	28.6
Psephidia lordi (Lord's dwarf venus) (3)	25.0	21.4
Spisula polynyma (surf clam) (3)	25.0	21.4
Mya sp. (bivalve) (3)	25.0	21.4
Solariella sp. (snail) (3)	25.0	21.4
Oenopota sp. (snail) (3)	25.0	21.4
Pagurus sp. (hermit crab) (3)	25.0	21.4

TABLE XXVII

CONTINUED

Stomach Contents	Percent Frequency of Occurrence Based on Stomachs w/food	Total Stomachs
Ctenophora (comb jelly) (3)	25.0	21.4
Empty (2)		14.3
Polychaeta (segmented worm) (1)	8.3	7.1
Macoma sp. (bivalve) (1)	8.3	7.1
Musculus sp. (bivalve) (1)	8.3	7.1
Polinices sp. (moon shell) (1)	8.3	7.1
Pycnopodia helianthoides	N = 30	N = 36
Izhut Bay - 4-17 November 1978		
Oenopota sp. (snail) (17)	56.7	47.2
Solariella sp. (snail) (17)	56.7	47.2
Nuculana fossa (fossa nut clam) (11)	36.7	30.6
Psephidia lordi (Lord's dwarf venus) (7)	23.3	19.4
Empty (6)		16.7
Spisula polynyma (surf clam) (3)	10.0	8.3
Glycymeris subobsoleta (west coast buttersweet) (3)	10.0	8.3
Natica clausa (moon shell) (3)	10.0	8.3
Chionoecetes bairdi (snow crab) (3)	10.0	8.3
Cnidaria (jellyfish, sea anemones, corals) (2)	6.7	5.6
Cylichna sp. (snail) (2)	6.7	5.6
Macoma sp. (bivalve) (2)	6.7	5.6
Polychaeta (segmented worm) (1)	3.3	2.8
Cistenides sp. (polychaeta worm) (1)	3.3	2.8
Cyclocardia sp. (bivalve) (1)	3.3	2.8
Lyonsia sp. (bivalve) (1)	3.3	2.8
Veneridae (bivalves) (1)	3.3	2.8
Mitrella sp. (snail) (1)	3.3	2.8
Naticidae (snails) (1)	3.3	2.8
Turritellidae (snails) (1)	3.3	2.8
Turridae (snails) (1)	3.3	2.8
Balanus sp. (barnacle) (1)	3.3	2.8
Crangon sp. (gray shrimp) (1)	3.3	2.8
Cancer sp. (crab) (1)	3.3	2.8
Pugettia gracilis (kelp crab) (1)	3.3	2.8
Pagurus sp. (hermit crab) (1)	3.3	2.8
Pagurus ochotensis (hermit crab) (1)	3.3	2.8
Echinodermata (sea star) (1)	3.3	2.8
Trichodon trichodon (Pacific swordfish) (1)	3.3	2.8
Fish (1)	3.3	2.8

TABLE XXVII

CONTINUED

Stomach Contents	Percent Frequency of Occurrence Based on stomachs w/food	Percent Frequency of Occurrence Based on Total Stomachs
GADUS MACROCEPHALUS (Pacific cod)		
Gadus macrocephalus Kodiak Shelf - 19 June-9 July 1978	N = 182	N = 190
Chionoecetes bairdi (snow crab) (61)	33.5	32.1
Pandalus borealis (pink shrimp) (51)	28.0	26.8
Euphausiacea (krill) (45)	24.7	23.7
Fishes (35)	19.2	18.4
Crangonidae (gray shrimp) (27)	14.8	14.2
Pinnixa occidentalis (pea crab) (19)	14.4	10.0
Theragra chalcogramma (Pacific cod) (19)	14.4	10.0
octopus Sp. (11)	6.0	5.8
Ammodytes hexapterus (Pacific sand lance) (11)	6.0	5.8
Lumpenus sagitta (Pacific snake prickleback) (10)	5.5	5.3
Polychaeta (segmented worm) (9)	4.9	4.7
Empty (8)		4.2
Pelecypoda (bivalves) (6)	3.3	3.2
Hyas lyratus (lyre crab) (5)	2.7	2.8
Zoarcidae (eelpouts) (4)	2.2	2.1
Unidentified material (4)	2.2	2.1
Spisula polynyma (surf dam) (3)	1.6	1.6
Paralithodes camtschatica (red king crab) (3)	1.6	1.6
Crabs (3)	1.6	1.6
Pleuronectidae (flatfishes) (3)	1.6	1.6
Aphrodita sp. (polychaeta worm) (2)	1.1	1.1
Nematoda (round worms) (2)	1.1	1.1
Nuculana fossa (fossa nut clam) (2)	1.1	1.1
Gastropoda (snail) (2)	1.1	1.1
Hippolytidae (shrimp) (2)	1.1	1.1
Pagurus sp. (hermit crab) (2)	1.1	1.1
Elassochirus gilli (hermit crab) (2)	1.1	1.1
Pandalopsis dispar (side-stripe shrimp) (2)	1.1	1.1
Hippoglossoides elassodon (flathead sole) (2)	1.1	1.1
Tellina nuculoides (salmon tellin) (1)	0.5	0.5
Serripes groenlandicus (Greenland cockle) (1)	0.5	0.5
Shrimp (1)	0.5	0.5
Paguridae (hermit crabs) (1)	0.5	0.5
Elassochirus tenuimanus (hermit crab) (1)	0.5	0.5
Pagurus kennerlyi (hermit crab) (1)	0.5	0.5
Balanus sp. (barnacle) (1)	0.5	0.5
Ophiuroidea (brittle stars) (1)	0.5	0.5

TABLE XXVII

CONTINUED

Stomach Contents	Percent Frequency of Occurrence Based on: Stomachs W/ food	Total Stomachs
Dasycottus setiger (spinyhead sculpin) (1)	0.5	0.5
Cottidae (sculpins) (1)	0.5	0.5
Trichodon trichodon (Pacific sandfish) (1)	0.5	0.5
Lumpenella longirostris (longsnout prickleback) (1)	0.5	0.5
Lyconectes aleutensis (dwarf wrymouth) (1)	0.5	0.5
Rock (1)	0.5	0.5
Gadus macrocephalus Izhut Bay - 11-14 May 1978	N = 17	N = 18
Pandalus borealis (pink shrimp) (15)	88.2	83.3
Fishes (4)	23.5	22.2
Chionoecetes bairdi (snow crab) (3)	17.6	16.7
Elassochirus gilli (hermit crab) (1)	5.9	5.6
Empty (1)		5.6
Gadus macrocephalus Kiliuda Bay - 8-23 August 1978	N = 20	N = 20
Pandalus borealis (pink shrimp) (20)	100.0	100.0
Pandalus hypsinotus (coon-stripe shrimp) (4)	20.0	20.0
HEMILEPIDOTUS JORDANI (Yellow Irish lord)		
Hemilepidotus jordani Portlock Bank - 21-24 March 1978	N = 36	N = 39
Chionoecetes bairdi (snow crab) (19)	52.8	48.7
Pagurus ochotensis (hermit crab) (8)	22.2	20.5
Polychaeta (segmented worm) (6)	16.7	15.4
Fishes (6)	16.7	15.4
Shrimps (5)	13.9	12.8
Amphipoda (sand flea) (4)	11.1	10.3
Octopus sp. (3)	8.3	7.7
Empty (3)		7.7
Crangonidae (gray shrimp) (2)	5.6	5.1
Cylichna sp. (snail) (1)	2.8	2.6
Gastropoda (snail) (1)	2.8	2.6
Neptunea sp. (snail) (1)	2.8	2.6
Pelecypoda (bivalve) (1)	2.8	2.6
Hermit crab (1)	2.8	2.6

TABLE XXVII

CONTINUED

Stomach Contents	Percent Frequency Of Occurrence Based on: Stomachs w/food	Total stomachs
Paralithodes camtschatica (red king crab) (1)	2.8	2.6
Ophiuroidea (brittle star) (1)	2.8	2.6
Lycodes brevipes (shortfin eelpout) (1)	2.8	2.6
Cyclopteridae (1)	2.8	2.6
Hemilepidotus jordani	N = 152	N = 189
Kodiak Shelf - 19 June-9 July 1978		
Polychaeta (segmented worms) (37)	24.3	19.6
Empty (37)		16.9
Pinnixa occidentalis (pea crab) (30)	19.7	15.9
Chionoecetes bairdi (snow crab) (20)	13.2	10.6
Euphausiacea (krill) (18)	11.8	9.5
Unidentified material (15)	9.9	7.9
Pandalus borealis (pink shrimp) (14)	9.2	7.4
Fishes (14)	9.2	7.4
Pagurus aleuticus (hermit crab) (12)	7.9	6.3
Elassochirus tenuimanus (hermit crab) (11)	7.2	5.8
Paguridae (hermit crab) (7)	4.6	4.6
Unidentified pelecypods (7)	4.6	3.7
Yoldia myalis (comb Yoldia) (6)	3.9	3.2
Hyas lyratus (lyre crab) (6)	3.9	3.2
Ophiuroidea (brittle stars) (6)	3.9	3.2
Gastropoda (snail) (5)	3.3	2.6
Echiurus echiurus (The fat innkeeper)	3*3	2.6
Lumpenus sagitta (Pacific snake prickleback) (4)	2.6	2.1
Macoma moesta (doleful macoma) (3)	2.0	1.6
Amphipoda (sand flea) (3)	2.0	1.6
octopus sp. (2)	1.3	1.1
Oregonia gracilis (decorator crab) (2)	1.3	1.1
Labidochirus splendescens (hermit crab) (2)	1.3	1.1
Crabs (2)	1.3	1.1
Pectinidae (scallop) (1)	0.7	0.5
Nuculana fossa (fossa nut clam) (1)	0.7	0.5
Bfuccinum plectrum (Plectrum Buccinum) (1)	0.7	0.5
Crangonidae (gray shrimp) (1)	0.7	0.5
Shrimp (1)	0.7	0.5
Cancer sp. (crab) (1)	0.7	0.5
Lycodes brevipes (shortfin eelpout) (1)	0.7	0.5

TABLE XXVII

CONTINUED

Stomach Contents	Percent Frequency of Occurrence Based on: Stomachs w/food	Total Stomachs
MYOXOCEPHALUS spp. (Sculpins)		
Myoxocephalus spp. Kodiak Shelf - 19 June-9 July 1978	N = 47	N = 72
Fishes (26)	55.3	36.1
Empty (25)		34.7
Pandalus borealis (pink shrimp) (9)	19.1	12.5
Lycodes brevipes (shortfin eelpout) (5)	10.6	6.9
Octopus sp. (3)	6.4	4.2
Crangonidae (gray shrimp) (3)	6.4	4.2
Chionoecetes bairdi (snow crab) (3)	6.4	4.2
Hyas lyratus (lyre crab) (3)	6.4	4.2
Mallotus villosus (capelin) (3)	6.4	4.2
Lumpenus sagitta (Pacific snake prickleback) (3)	6.4	4.2
Pelecypoda (bivalves) (2)	4.3	2.8
Echinarachnius parma (sand dollar) (2)	4.3	2.8
Pleuronectidae (flatfishes) (2)	4.3	2.8
Cottidae (sculpins) (2)	4.3	2.8
Nuculana fossa (fossa nut clam) (1)	2.1	1.4
Pandalopsis dispar (side-stripe shrimp (1)	2.1	1.4
Shrimp (1)	2.1	1.4
Unidentified material (1)	2.1	1.4
Theragra chalcogramma (walleye pollock) (1)	2.1	1.4
Myoxocephalus spp. Izhut Bay - 4-19 May 1978	N = 15	N = 19
Pandalus borealis (pink shrimp) (10)	66.7	52.6
Chionoecetes bairdi (snow crab) (6)	40.0	31.6
Empty (4)		21.1
Fishes (2)	13.3	10.5
Nuculana fossa (fossa nut clam) (1)	6.7	5.3
Lumpenus sagitta (Pacific snake prickleback) (1)	6.7	5.3
HIPPOGLOSSOIDES ELASSODON (Flathead sole)		
Hippoglossoides elassodon Kodiak Shelf - 19 June-19 July 1978	N = 118	N = 156
Pandalus borealis (pink shrimp) (46)	39.0	29.5
Empty (38)		24.4
Euphausiacea (krill) (21)	17.8	13.5
Chionoecetes bairdi (snow crab) (13)	11.0	8.3

TABLE XXVII

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Stomach Contents	Percent Frequency of Occurrence Based on Stomachs w/food	Total stomachs
Macoma moesta (doleful macoma) (10)	8.5	6.4
Ophiura sarsi (brittle star) (9)	7.6	5.8
Ophiuridae (brittle star) (6)	5.1	3.8
Unidentified material (5)	4.2	3.2
Shrimps (4)	3.4	2.6
Tube-dwelling polychaetes (3)	2.5	1.9
Pelecypoda (bivalves) (3)	2.5	1.9
Clinocardium ciliatum (Iceland cockle) (3)	2.5	1.9
Actiniidae (sea anemone) (3)	2.5	1.9
Pagurus aleuticus (hermit crab) (3)	2.5	1.9
Polychaeta (segmented worm) (2)	1.7	1.3
Nuculana fossa (fossa nut clam) (2)	1.7	1.3
Crangonidae (gray shrimp) (2)	1.7	1.3
Pinnotheridae (pea crabs) (2)	1.7	1.3
Sand (2)	1.7	1.3
Yoldia scissurata (bivalve) (1)	0.8	0.6
Cardiidae (bivalves) (1)	0.8	0.6
Axinopsida serricata (silky Axinopsis) (1)	0.8	0.6
Gastropoda (1)	0.8	0.6
pteropoda (1)	0.8	0.6
Isopoda (1)	0.8	0.6
Labidochirus splendescens (hermit crab) (1)	0.8	0.6
Spisula polynyma (surf clam) (1)	0.8	0.6
Lycodes brevipes (shortfin eelpout) (1)	0.8	0.6
Clupea harengus pallasi (Pacific herring) (1)	0.8	0.6
LEPIDOPSETTA BILINEATA (Rock sole)		
Lepidopsetta bilineata Izhut Bay - 4-19 May 1978	N = 16	N = 23
Polychaeta (segmented worm) (12)	75.0	52.2
Empty (7)		30.4
Algae (2)	12.5	8.7
Pandalus borealis (pink shrimp) (1)	6.3	4.3
Shrimps (1)	6.3	4.3
Lepidopsetta bilineata Kodiak Shelf - 19 June-9 July 1978	N = 84	N = 94
Yoldia myalis (comb Yoldia) (29)	34.5	30.9
Polychaeta (segmented worm) (27)	32.1	28.7

TABLE XXVII

CONTINUED

Stomach Contents	Percent Frequency of Occurrence Based on Stomachs w/food	Total Stomachs
Ophiuridae (brittle stars) (16)	19.0	17.0
Cucumaria sp. (sea cucumber) (11)	13.1	11.7
Echinarachnius parma (sand dollar) (11)	13.1	11.7
Empty (10)		10.6
Tellina nuculoides (salmon tellin) (8)	9.5	8.5
Spisula polynyma (surf clam) (7)	8.3	7.4
Amphipoda (sand flea (7)	8.3	7.4
Cancer sp. (crab) (6)	7.1	6.4
Clinocardium californiense (bivalve) (6)	7.1	6.4
Hyas lyratus (lyre crab) (6)	7.1	6.4
Pelecypoda (bivalves) (5)	6.0	5.3
Fishes (5)	6.0	5.3
Sipunculida (peanut worm) (4)	4.8	4.3
Nuculana fossa (fossa nut clam) (4)	4.8	4.3
Cistinides sp. (polychaeta worm) (4)	4.8	4.3
Chlamys rubida (Hind's scallop) (4)	4.8	4.3
Chionoecetes bairdi (snow crab) (4)	4.8	4*3
Travisia forbesii (polychaeta worm) (3)	3.6	3.2
Crangonidae (gray shrimp) (3)	3.6	3.2
Shrimps (3)	3.6	3.2
Strongylocentrotus sp. (sea urchin) (3)	3.6	3.2
Ammodytes hexapterus (Pacific sand lance) (3)	3.6	3.2
Unidentified material (3)	3.6	3.2
Propeamussium alaskense (scallop) (2)	2.4	2.1
Macoma moesta (doleful Macoma) (2)	2.4	2.1
Cardiidae (bivalves) (2)	2.4	2.1
Musculus Sp. (bivalve) (1)	1.2	1.1
Laqueus californianus (lamp shell) (1)	1.2	1.1
Balanus sp. (barnacle) (1)	1.2	1.1
Elassochirus tenuimanus (hermit crab) (1)	1.2	1.1
Elassochirus gilli (hermit crab) (1)	1.2	1.1
Oregonia gracilis (decorator crab) (1)	1.2	1.1
Ctenodiscus crispatus (mud star) (1)	1.2	1.1
Ophiura sarsi (brittle star) (1)	1.2	1.1
Stichaeidae (pricklebacks) (1)	1.2	1.1
Golfingia vulgaris (peanut worm) (1)	1.2	1.1
Diamphiodia craterodmeta (brittle star) (1)	1.2	1.1
Ophiopenia disacantha (brittle star) (1)	1.2	1.1
Serripes groenlandicus (Greenland cockle) (1)	1.2	1.1
Spisula polynyma (surf clam) (1)	1.2	1.1
Maldanidae (bambo worm) (1)	1.2	1.1

TABLE XXVII

CONTINUED

Stomach Contents	Percent Frequency of Occurrence Based on: Stomachs w/food	Total Stomachs
ATHERESTHES STOMIAS (arrowtooth flounder)		
Atheresthes stomias Kodiak Shelf - 19 June-9 July 1978	N = 9	N = 18
Empty (9)		50.0
T'-eragra chalcogramma (walleye pollock) (5)	55.6	27.8
Ammodytes hexapterus (Pacific sand lance) (2)	22.2	11.1
Fish (1)	11.1	5.6
Unidentified material (1)	11.1	5.6
PLEUROGRAMMUS MONOPTERIGIUS (atka mackerel)		
Pleurogrammus monopterigius Kodiak Shelf - 19 June-9 July 1978	N = 20	N = 20
Ammodytes hexapterus (Pacific sand lance) (17)	85.0	85.0
Euphausiacea (krill) (6)	30.0	30.0
Gastropoda (1)	5.0	5.0
ANAPLOPOMA FIMBRIA (sablefish)		
Anaplopoma fimbria Kodiak Shelf - 19 June-9 July 1978	N = 31	N = 31
Ammodytes hexapterus (Pacific sand lance) (31)	100.0	100.0
Euphausiacea (krill) (2)	6.5	6.5
THERAGRA CHALCOGRAMMA (walleye pollock)		
Theragra chalcogramma Kiliuda Bay - 8-23 August 1978	N = 20	N = 20
Pandalus borealis (pink shrimp) (20)	100.0	100.0
Pandalus hypsinotus (coon-stripe shrimp) (4)	20.0	20.0

prey taxa were identified. The most frequent species were *Chionoecetes bairdi* (32.1%), *Pandalus borealis* (26.8%), Euphausiacea (23.7%), fishes (18.4%), crangonid shrimps (14.2%), the pea crab *Pinnixa occidentalis* (10%), and walleye pollock *Theragra chalcogramma* (10%).. All cod came from stations 1, 3, 4, 5, 6, 9, 10, 11, 13, 22 and 44. The highest frequency of C. *bairdi* in cod stomachs came from stations 4, 9 and 11. *Pandalus* borealis, as a food item, was mainly taken at stations 11 and 13.

Izhut Bay (Table XXVII; Fig. 1)

A total of 18 Pacific cod were examined in mid-May 1978. Seventeen fish contained food; only four taxa were present. The most frequently occurring prey was *Pandalus borealis* (83.3%). Unidentified fishes (22.2%) and *Chionoecetes bairdi* (16.7%) were less frequently found. Cod were taken from stations 2 and 3.

Kiliuda Bay (Table XXVII; Fig. 2)

Twenty Pacific cod were examined during the August 1978 sampling. Stomach contents contained only two taxa. All were feeding on *Pandalus borealis* and four were feeding on *P. hypsinotus*. All 20 fish came from station 5.

Theragra chalcogramma (walleye pollock)

Kiliuda Bay (Table XXVII; Fig. 2)

Pandalid shrimps were the food of walleye pollock from Kiliuda Bay in August 1978. *Pandalus borealis* was found in all 20 fish examined and *P. hypsinotus* was only found in four stomachs. All pollock were examined from station 5.

Hemilepidotus jordani (yellow Irish lord)

Portlock Bank (Table XXVII; Fig. 4)

Thirty-nine yellow Irish lord were examined during the March 1978 cruise. A total of 17 prey taxa were found in 36 feeding fish. Leading prey, in terms of frequency of occurrence, were *Chionoecetes bairdi* (48.7%), the hermit crab *Pagurus ochotensis* (20.5%), shrimps (12.8%), and amphipods (10.3%). Polychaeteous annelids and fishes occurred in 15.4% of the fish. Yellow Irish lord were examined from stations 1, 2, and 5.

Kodiak Shelf (Table XXVII; Fig. 5)

Yellow Irish lord examined from the June-July cruise was dominated by polychaetes (19.6% frequency occurrence), *Pinnixa occidentalis* (15.9%), and *Chionoecetes bairdi* (10.6%). Thirty different prey taxa were found in 152 feeding fish. All fish came from stations 3, 4, 5, 6, 9, 10, 11, 12, 13, 22, and 44. The highest frequency of polychaetes in yellow Irish lords came from station 4 and 44. *Pinnixa* was mainly taken at station 12.

Myoxocephalus spp. (sculpins)

Kodiak Shelf (Table XXVII; Fig. 5)

Sculpins examined (72) on the June-July 1978 cruise contained 19 different prey taxa. Only 47 (65%) contained food. Dominant food items were unidentified fishes (36.1%) and *Pandalus borealis* (12.5%). Sculpins came from station 1, 3, 5, 6, 8, 10, 11, and 22.

Izhut Bay (Table XXVII; Fig. 1)

Sculpins examined (19) in May 1978 mainly contained *Pandalus borealis* (52.6%) and *Chionoecetes bairdi* (31.6%). Sculpins were examined for food contents from stations 2 and 3.

Hippoglossoides elassodon (flathead sole)

Kodiak Shelf (Table XXVII; Fig. 5)

One hundred and fifty-six flathead sole stomachs were examined during June-July 1978. A total of 118 (76%) were feeding. Although 28 prey were identified, the only dominant food items were *Pandalus borealis* (29.5%) and Euphausiacea (13.5%). Flathead sole came from nine stations: 3, 4, 5, 6, 9, 11, 13, 14, and 44. Pink shrimp dominated the prey at stations 11, 13, and 14.

Lepidopsetta bilineata (rock sole)
Kodiak Shelf (Table XXVII; Fig. 5)

Rock sole examined in June-July 1978 contained a wide variety of prey items. Eighty-four percent were feeding. Forty-two different prey taxa were identified. Leading prey, in terms of frequency of occurrence, were the clam *Yoldia myalis* (30.9%), Polychaeta (28.7%), brittle stars, Ophiuridae (17%), sea cucumbers, *Cucumaria* sp. (11.7%), and the sand dollar, *Echinarachnius parma* (11.7%). Rock sole examined came from stations 1, 2, 3, 6, 22, and 44. Among the three stations where *Yoldia* was taken as food, stations 2 and 3 were most important.

Atheresthes stomias (arrowtooth flounder)
Kodiak Shelf (Table XXVII; Fig. 5)

Only nine out of the 18 arrowtooth flounders examined during June-July 1978 contained food. Dominant prey were *Theragra chalcogramma* (27.8%) and the sand lance *Ammodytes hexatperus* (11.1%). Flounders came from stations 1 and 3.

Pleurogrammus monopterigius (Atka mackerel)
Kodiak Shelf (Table XXVII; Fig. 5)

All Atka mackerel examined (20) during June-July 1978 came from station 1. The fish contained mainly *Ammodytes hexapterus* (85%). However, Euphausiacea was taken to a limited degree (30%).

Anaplopoma fimbria (sablefish)
Kodiak Shelf (Table XXVII; Fig, 5)

Sablefish examined (31) during June-July 1978 came from station 2. All were intensively feeding on *Ammodytes hexapterus*. Only 6.5% were feeding on Euphausiacea.

VII. DISCUSSION

TRAWL DATA: DISTRIBUTION-BIOMASS

Since crustaceans, specifically commercially-important species, dominated the epifaunal biomass, the following discussion is limited to those species i.e., *Paralithodes camtschatica*, *Chionoecetes bairdi*, and *Pandalus borealis.* A limited discussion for the other epifaunal species included in the results of this annual report will be deferred to the Final Report. Data obtained from February and March 1979 cruises will also be included in the Final Report.

Izhut and Kiliuda Bays

Paralithodes camtschatica (king crab)

A necessary prerequisite for the management of Alaska's king crab fishery is knowledge of the crabs' distribution, abundance, and behavior. King crabs follow yearly migration patterns between deep and shallow waters. Most authors agree that king crabs migrate to shallow waters to spawn during March, April, and May (Marukawa, 1933; Rumyantsev, 1945; Vingradov, 1945; Wallace *et al.*, 1949; Bright *et* al., 1960; Powell, 1964). The inshore areas of Kodiak Island provide a suitable environment where molting, breeding and feeding activities take place (Wallace *et al.*, 1949; Powell and Nickerson, 1965; Gray and Powell, 1966; Kingsbury and James, 1971; Kingsbury *et al.*, 1974; Feder and Jewett, 1977, present report). After breeding, king crabs gradually migrate to deeper water. King crabs are known to breed in the offshore ocean environment (McMullen, 1967).

Based on data collected in the present study, Izhut Bay apparently is not an important area for king crabs (see Tables II-VII). The king crab biomass here never exceeded 5.4% of the total invertebrate biomass. The only appreciable quantities came from Area 1, at the entrance to the bay, at stations 7, 8, and 9 in June and July (Fig. 1).

Unlike Izhut Bay, Kiliuda Bay yielded king crabs from a variety of stations. Evidence of the spring migration of crabs into shallow water was seen in April and June when the crab biomass was highest. Crabs in April were only found in Areas III and IV, Shearwater Bay and Santa Flavia Bay, respectively. The July, August, and November king crab biomass was much lower than April and June, but still not as low as the king crab biomass in Izhut Bay in June or July. Crabs found in Kiliuda Bay in June through November came from Areas I and IV. The fact that adult crabs were present through early winter suggests the presence of a resident population in Kiliuda Bay.

Benthic trawling has been conducted in two other Kodiak Island Bays, Alitak and Ugak Bay (Feder and Jewett, 1977). The king crab biomass from Alitak Bay in June, July, August 1976, and March 1977 was 12.9%, 26.6%, 26.9%, and 68% respectively. These data reflect an influx of adult crabs in March to spawn, and unlike Kiliuda Bay, by June most crabs had migrated from the bay. Changes in the king crab biomasses from Ugak Bay are not as explainable. During the June, July, August, and March sampling the percent of the invertebrate biomass that was king crabs was 17%, 44.3%, 46.7%, and 30.1% respectively (Feder and Jewett, 1977). King crabs in Ugak Bay were mainly juveniles.

Chionoecetes bairdi (snow crab)

Snow crabs inhabit the entire Kodiak Shelf to a depth of over 400 meters with greatest concentrations found below 130 meters (ADF&G, 1976; Donaldson, 1977). Adult snow crabs move into the shallower portions of their habitat in early spring to spawn (Bright, 1967; AEIDC, 1974; ADF&G, 1976). Exact depths and site preferences for spawning in Kodiak are not known; however, 50-130 meters depths are used south of the Alaska Peninsula (AEIDC, 1974). Snow crabs typically move into deeper water in the fall. Except for spawning migrations, which are less extensive than king crab migrations, snow crabs (*Chionoecetes* spp.) appear to remain in a given location (Watson, 1969).

Data collected during the present study (see Tables II-VII) indicate that snow crabs in Izhut Bay were mainly located in Area I, outer Izhut Bay, although the largest catch for April was made at station 554 in Area III. Area II did not contain any appreciable quantity of crabs in any sampling period. June sampling yielded the largest catch of snow crabs (78.8% of the biomass) and April yielded the lowest catch (3.7%).

Snow crabs in Kiliuda Bay were also found primarily in the outer portion of the bay, Areas I and IV. Both Izhut and Kiliuda Bays, as well as Alitak and Ugak Bays, are producers of snow crabs in commercial quantities (ADF&G, unpub. reports; Feder and Jewett, 1977). Furthermore, commercial snow crab gear was prevalent in the outer portions of Izhut and Kiliuda Bays in February 1979.

Pandalus borealis (pink shrimp)

Adult pink shrimps inhabit water depths from the intertidal region to beyond the continental shelf (AEIDC, 1974). They appear to concentrate in specific areas around Kodiak, especially in bays and submarine gullies, such as Sitkalidak, Marmot and Afognak Bays, Horse's Head and Marmot Gullies, the Kiliuda Trough and the northeast section of the Shelikof Strait (ADF&G, 1976; Ronholt *et al.*, 1978). During 1975-76 shrimp biomass was estimated at 5500-9500 metric tons in the Kiliuda trough area (ADF&G, 1976).

Pink shrimps were important to the invertebrate biomass in Izhut and Kiliuda Bay as well as Alitak and Ugak Bays (Feder and Jewett, 1977). The largest catches in Izhut Bay came from small bays in May, July, and August i.e., station 526 and 527 of Area 11 and station 557 of Area III. Pink shrimps were not present in Izhut Bay in April, June, and November sampling. Ivanov (1969) reported that pink shrimps move into shallow bays and around islands to spawn in August and September.

In Kiliuda Bay, high biomasses were noted in August and November at stations SHR and 5 of Area I.

Portlock Bank

The only commercial species in any abundance found adjacent to Portlock Bank stations was the snow crab, *Chionoecetes bairdi.* Although it was a dominant species it still made up less than 25% of the total invertebrate biomass, and was mainly found at two stations. Large numbers of snow crabs and/or king crabs were seldom associated with the organisms that were common to stations near Portlock Bank i.e. , sea stars, urchins, and large snails. Nevertheless, Portlock Bank is considered an important offshore shallow area for king crab (McMullen, 1967) and snow crab (ADF&G, 1976).

It is not surprising that pink shrimps were absent from these stations, since, as previously noted, pink shrimps mainly concentrate in bays and submarine gullies (ADF&G, 1976; Ronholt *et al.*, 1978).

Kodiak Shelf

Paralithodes camtschatica (king crab)

Two of the three stations where most king crabs were present were located off Alitak Bay at the south end of the island (Fig. 5). The composition of king crabs in outer Alitak Bay during June 17-22 1976 (Feder and Jewett, 1977) was similar to the king crab composition found at stations 7 and 8 of the present study in June-July, i.e., mainly ovigerous females. Alitak Bay has a past history as a king crab mating ground (Kingsbury and James, 1971; Feder and Jewett, 1977), and has been a major producer of commercial-sized crabs in the Kodiak Island area since 1953 (Gray and Powell, 1966). Outer Alitak Bay was also the site of king crab distribution, abundance, and composition studies conducted by the Alaska Department of Fish and Game during the summer months of 1962 and 1970 (Gray and Powell, 1966; Kingsbury *et aZ.,* 1974).

Station 9, located in an ADF&G statistical region, sometimes known as the "Horse's Head", was another station where large numbers of adult king ' crabs were taken. The "Horse's Head" annually supports one of the largest concentrations of legal size king crabs (145 mm carapace length) (ADF&G, unpub. reports).

Chionoecetes bairdi (snow crab)

Snow crab biomass was high in June–July at stations 7, located in outer Alitak Bay, and 13 and 14 located off Izhut Bay of Afognak Island (Fig. 5). Alaska Department of Fish and Game crab population index studies of Kodiak Island, show moderate catches of snow crabs in the vicinity of Alitak Bay (Donaldson, 1977). The area off Izhut Bay was not sampled during the above index studies, and so relative abundance data are not available to compare with findings of the present study. Snow crab data from stations 13 and 14 are parallel with snow crab data from our Izhut Bay sampling.

Pandalus borealis (pink shrimp)

The seven stations where pink shrimps were caught were nearshore stations (stations 7, 8, 10, 11, 13, and 14) with the exception of station 5, located in the outer Sitkalidak gully (Fig. 5). The largest concentration came from station 13 in outer Izhut Bay. At this station flathead sole and Pacific cod were intensively feeding on pink shrimps (see section on Food Studies for appropriate fish species).

FOOD STUDIES

Paralithodes camtschatica (king crab)

Year-round food habits of the Alaska king crab are difficult to assess due to the migratory nature of the crab. For this reason, it is essential to know the general areas where the greatest concentrations of crabs can be expected at particular months of the year, and it is at these areas that the crabs should be sampled seasonally for their food contents.

Feeding takes place throughout the year in the Bering Sea and Okhotsk Sea, except during the molting-mating periods when feeding ceases or is at a minimum (Kun and Mikulich, 1954; Kulichkova, 1955; and Cunningham, 1969). Kulichkova (1955) demonstrated that the duration of fasting before and after these periods does not extend beyond a few weeks. King crabs that were examined for food in April in Kiliuda Bay were all newshell crabs that had recently undergone ecdysis. Feeding activity of the latter crabs was minimal, and only 16 out of 49 (33%) crabs contained food. Stomach data and SCUBA observations indicate that feeding resumes at shallow depths before deep-water migration and continues throughout the year.

The chief prey items of king crabs in shallow Kodiak regions were barnacles and soft-shelled clams. Kulichkova (1955), who examined king crabs within a commercial king crab fishing region in the Okhotsk Sea, found that recently molted crabs mainly fed on the young of the clam *Tellina lutea* while hardshell crabs fed on the clam *Siliqua media*. He also noted that the chief food of recently molted king crabs taken from a depth of 16 m consisted of barnacles. He suggests that crabs need to replace the calcium carbonate lost during molting and that young clams and barnacles of shallow waters represent an abundant resource to fulfill this need. Feeding data in the present study indicate that barnacles are a prey item throughout the year, but are only an important component of the diet in the spring and summer months.

Although barnacles are seldom prey for king crabs in the fall and winter months, Feder *et al.* (1978a) report intensive feeding on barnacles in November 1977 in lower Cook Inlet. All crabs examined had barnacles in their stomachs, and 60% were feeding exclusively on barnacles. The volcanic eruption of St. Augustine Island, lower Cook Inlet in February 1976 provided a new benthic substrate, pumice, suitable for barnacle settlement. Prior to the eruption, much of the surrounding area was composed of unconsolidated sediments unsuitable for barnacle settlement. Settlement was ultimately followed by the appearance of various species of crabs, and the subsequent predation by these crabs on the barnacles.

Little is known about the effect of petroleum hydrocarbons on barnacles. The hydrocarbon content of goose barnacles (*Lepas fascicularis*) living on tarballs has been compared with the hydrocarbon content of the tarballs (Morris, 1973). While there is some contamination of the barnacles, there is no evidence of gross pollution and the analyses suggested that oil hydrocarbons are assimilated and then discharged, unmetabolized, quite rapidly.

Bivalve molluscs, principally clams , were the dominant food of king crabs from Kiliuda Bay and the Kodiak Continental Shelf (fishes were the dominant food in Izhut Bay). Molluscs dominate the food of king crabs in many northern waters. Feniuk (1945), Kulichkova (1955), and Takeuchi (1959, 1967) analyzed the feeding of king crabs in the Okhotsk Sea near the western shore of Kamchatka, and found pelecypods and gastropod to dominate the diet. The works of McLaughlin and Hebard (1959), Cunningham (1969), Tarverdieva (1976) and Feder and Jewett (1978 and in press), carried out in the southern Bering Sea, also showed pelecypods and gastropod as important king crab food items. The most common molluscs fed upon by king crabs from most regions are protobranch clams, i.e. *Nuculana, Nucula* and *Yoldia*, and snails of the family Trochidae. Other important clam prey are representatives of the families Tellinidae and Cardiidae.

There is no evidence to show that king crabs are scavengers (Cunningham, 1969) . However, data from the present study suggest that scavenging can be an important dietary stratagem, although predation is the major method for acquiring food. King crab stomachs examined in Izhut Bay and the Kodiak continental shelf in June and July were dominated by fishes. During both sampling months in Izhut Bay active feeding by large numbers of sooty shearwaters, black-legged kittiwakes and Steller sea lions was observed from the sampling vessel. The shearwaters and kittiwakes were feeding on the schooling fishes, capelin and Pacific sand lance (Pers. Comm. Gerald Sanger, USF&WS), and it is probable that the sea lions were also feeding on these fishes. Kulichlova (1955) reported that king crabs from the west coast of South Sakhalin contained herring at 13.4% of the total stomach fullness. He reports that the fish were not alive when taken from the sea bed. Fishes were found in 10% of all Bering Sea king crabs examined by Cunningham (1969). Feniuk (1945) also found fishes (2% frequency of occurrence) among stomach contents of hard-shelled king crabs off the west Kamchatkan shelf. In the cases where fishes are taken, it probably represents a prey of opportunity with high energy value. It is probable that schooling fishes that are heavily preyed upon at the surface are falling to the benthos after being injured or regurgitated by the predators. These fishes in turn are being taken in a scavenging manner by king crabs. Live fishes, especially schooling fishes, are doubtfully taken by the relatively lethargic king crabs.

Some food species of king crabs are area specific. King crabs examined from the Kodiak Shelf in June-July 1978 came from nine widely separated stations (Fig. 4). Although the foods from crabs examined at these stations were mainly pelecypods (Table XXV), distinct differences could be detected in the dominant prey items taken between stations (Table XXVI). Clams were only important, in terms of total weight, at stations 7, 8, 9, and 10. Important prey at other stations were fishes at stations 8, 10, 11, 12, 13, and 14, the pea crab *Pinnixa occidentalis* at station 12; the brittle star *Ophiura sarsi* at station 1; and the snow crab *Chionoecetes bairdi* at station 8.

Other regional differences in king crab food have been reported. Cunningham (1969) determined that echinoderms (*Ophiura sarsi*, the basket star *Gorgonocephalus* sp., *Strongylocentrotus* sp., and *Echinarachnius* sp.) were the most important food (based on total food weight) of S.E. Bering Sea crabs. Molluscs (37%) and crustaceans (10%) were next in importance. Feder and Jewett (1978 and in press) found molluscs as the most frequently consumed group (87.1%) among S.E. Bering Sea king crab, although echinoderms were also frequently taken (66.1%). Kun and Mikulich (1954) found wide food differences between king crabs from the Kurile Islands, Tartar Strait, and Okhotsk Sea. The sand dollar *Echinarachnius pma* dominated the food by weight of king crabs from the Kurile Islands. The sea urchin *Strongylocentrotus* sp. dominated in the Gulf of Tartar, and the Greenland cockle *Serripes groenlandicus* dominated the prey in the southern Okhotsk Sea.

In addition to regional food differences detected in the present study, the prey taken within any region was usually very diverse. Crabs collected *via* SCUBA within small sampling areas of Near Island Basin, McLinn Island, and Anton Larsen Bay contained 21 to 48 different prey taxa. Among the 86 different prey taxa taken by Kodiak Shelf king crabs, 63 taxa were identified from stomachs at a single station and 25 taxa were identified from a single crab. The number of prey species was lowest in Izhut Bay crabs.

Most methods employed in obtaining an index of stomach fullness in decapod crustaceans are not comparable. Feniuk's (1945) method, also used by McLaughlin and Hebard (1959), was a cumulative ratio based on visual estimates of the cardiac, gastric mill, and pyloric regions of the stomach. Kun and Mikulich (1954), Kulichkova (1955), and Tarverdieva (1976), employing a method not fully comprehensible from the literature, also estimated stomach fullness by observation and fullness in parts per 10,000. Takeuchi (1959, 1967) derived a fullness index by using the ratio of crab body weight to food content weight. The Feeding Index of Fullness employed by Cunningham (1969) and the present study was derived from a ratio of observed volume to theoretical volume. Visual estimates of fullness are not determined by this method. Cunningham (1969) pointed out that the use of the mathematical approximation (maximum volume) is necessary since an accurate volume cannot be obtained from stomachs preserved in formalin which typically become distorted after preservation.

The smallest size group, 98-120 mm, of king crab from the S.E. Bering Sea examined by Cunningham (1969) had a mean Index (percent) of Fullness of 38 ± 15% while the largest size group, 161-187 mm, had the smallest Index, 9 ± 13%.

It is evident from data in the present report that crabs from Kodiak, in general, were not as full as those from the S.E. Bering Sea. Forty-three percent of king crabs examined by McLaughlin and Hebard (1959) were 1-20% full. Cunningham (1969) reported the maximum stomach fullness of a single crab was 86%, while the fullness of any crab in the Kodiak study did not exceed 78%. A detailed comparison of crab stomach fullness of Kodiak king crabs with that of crabs from the southeastern Bering Sea (Cunningham, 1969) will be made once Kodiak crabs are examined by size groups.

Differences in food types among king crab size groups and sexes in Kodiak will be presented in the Final Report. Kun and Mikulich (1954), Kulichkova (1955), and McLaughlin and Hebard (1969) found no difference in food groups between sexes of *Paralithodes camtschatica*, and Kun and Mikulich (1954), Kulichkova (1955), Cunningham (1969), and Tarverdieva (1976) found no difference in food groups between size groups.

Pycnopodia helianthoides (sunflower sea star)

The food of *Pycnopodia* collected in Prince William Sound was examined by Paul and Feder (1975). Most specimens came from the intertidal region although some subtidal specimens were taken. In general, intertidal *Pycnopodia* was feeding on a variety of food items. The most commonly encountered prey items in the stomachs of intertidal *Pycnopodia* were the blue mussel *Mytilus edulis*. As many as 275 small *M. edulis* were found in a single stomach. Other important prey of intertidal specimens were the clams *Protothaca staminea*, *Saxidomus gigantea*, and unidentified small gastropod. Subtidal *Pycnopodia* prey was dominated by the protobranch clam *Nuculana fossa* and small gastropod.

The food of subtidal *Pycnopodia* collected in Izhut Bay was similar to that found in the subtidal specimens cf. Paul and Feder (1975), i.e., small gastropod, in this case *Oenopota* sp. and *Solariella* sp., and small clams including *Nuculana fossa*.

One of the known predators and food competitors of *Pycnopodia* is the king crab. Many *Pycnopodia* observed by SCUBA were tightly squeezed into rock crevices when king crabs were in the vicinity. This behavior is assumed to be an avoidance response.

Gadus macrocephalus (Pacific cod)

Data on stomach contents from some 4200 Pacific cod from the vicinity of Kodiak, Alaska has been presented (Jewett, 1978). Most of these fish were captured in crab pots; some 344 were taken in bottom trawls from the same area. Data were presented in percent frequency of occurrence and actual frequency of occurrence. Only summer sampling was conducted.

The most important food categories in both pot-caught and trawl-caught cod were fishes, crabs, shrimps and amphipods, in decreasing order of occurrence. The fish most frequently eaten was the walleye pollock *Theragra chalcogramma*, with Pacific sand lance *Ammodytes hexapterus*, and flatfishes (Pleuronectidae) also contributing frequently to the diet of cod. Juveniles of the snow crab *Chionoecetes bairdi* was the most frequently occurring food species, appearing in almost 40% of the stomachs examined.

Jewett (1978) also presents data which indicate little year-to-year variation in the summer diet of Pacific cod in the Kodiak area. He also suggests that food organisms shift in frequency with increased size in cod. Fish and cephalopod frequencies in the diet seemed to be directly related to size, while amphipod and polychaete frequencies were inversely related to size of predator.

Data from 29 Pacific cod from the southeastern Bering Sea show pink shrimp as the most frequently consumed food item (Feder and Jewett, 1978 and in press). Walleye pollock, amphipods, and snow crabs were taken less frequently.

Food of Pacific cod examined in the present study was consistent with Pacific cod food found by Jewett (1978).

Theragra chalcogramma (walleye pollock)

Pollock examined on the Kodiak Shelf by Jewett and Powell (unpubl.) were mainly feeding on pink shrimp and euphausiids.

Smith *et al.* (1978) examined pollock from the northeastern Gulf of Alaska and the southeastern Bering Sea. Gulf of Alaska fish (standard length $\bar{X}$ = 344 ± 84 mm) as well as Bering Sea fish (standard length $\bar{X}$ = 270 ± 145 mm) mainly contained euphausiids.

Young British Columbia pollock, from 4-22 mm standard length, fed on copepods and their eggs (Barraclough, 1967) while adults fed on shrimps, sand lance and herring (Hart, 1949). Armstrong and Winslow (1968) report Alaska pollock feeding on young pink, chum and coho salmon. Suyehiro (1942) reported small shrimps, benthic amphipods euphausiids and copepods in the stomachs of pollock from the Aleutians. Andriyashev (1964) listed mysids and amphipods as the major foods of Bering Sea pollock with *Chionoecetes opilio* (snow crab) also present. He also reports that pollock from Peter the Great Bay and Sakhalin feed on surf smelt and capelin in the spring and shift to planktonic crustaceans in the summer. Nikolskii (1961) lists pollock food organisms from Asian waters as mysids, euphausiids, smelt and capelin.

Myoxocephalus spp. and *Hemilepidotus jordani* (sculpins)

Summer food of the sculpins *Myoxocephalus* spp. and *Hemilepidotus jordani*, near Kodiak Island were examined by Jewett and Powell (in prep.). Crabs were the dominant food of both genera. Major prey of *Myoxocephalus* spp. were the crabs *Chionoecetes bairdi* and *Hyas lyratus*, and fishes. Major prey consumed by *H. jordani* were also *C. bairdi* and *H. lyratus*, in addition to another crab, *Oregonia gracilis*, and amphipods.

Crabs, specifically *Chionoecetes bairdi*, were important in Izhut Bay *Myoxocephalus*, but not in those specimens examined from the Kodiak Shelf. Pink shrimp, *Pandalus borealis*, was an important prey *Myoxocephalus* in both regions.

Crabs were important prey in *Hemilepidotus* from Portlock Bank and the Kodiak Shelf.

Hippoglossoides elassodon (flathead sole)

Smith *et al.* (1978) examined 247 flathead sole in the Gulf of Alaska and 39 flathead sole from the Bering Sea. Euphausiids (probably all *Thysanoessa* spp.) and the brittle star, *Ophiura sarsi*, contributed most of the diet of the 139 feeding individuals from the Gulf of Alaska. The Bering Sea data suggest that the shrimp, *Pandalus borealis* is the most important spring prey, while mysids, amphipods, and *Ophiura sarsi* dominated summer feeding. Crangonid shrimps and juvenile pollock were the most important autumn prey in the Bering Sea.

The dominant prey of flathead sole in the present study is consistent with flathead food as determined by Smith *et al.* (1978).

Lepidopsetta bilineata (rock sole)

Little is known about the feeding habits of the rock sole. Rock sole examined in the present study were feeding intensely. Although *Yoldia myalis* was the leading prey species it was only taken at two stations. Polychaetes, the second most frequent food group, was taken at four of the six stations. In general, food of rock sole from the Kodiak area is similar to that described by other authors.

Skalkin (1963) and Shubnikov and Lisovenko (1964) report that the Bering Sea diet consists chiefly of polychaetes followed by molluscs and crustaceans (mainly shrimp). Kravitz *et al.* (1976) found that rock sole in Oregon waters fed mainly on ophiuroids. Feeding is much reduced during the winter, and is most intense in June and July.

Of 166 Bering Sea rock sole examined by Smith *et aZ.* (1978), 80 were empty. Eleven families of polychaetes contributed most of the food consumed. Crustaceans, pelecypods, ophiuroids and fishes were also important.

Atheresthes stomias (arrowtooth flounder)

The few arrowtooth flounder examined in the present study were dominated by a fish diet.

Smith *et* aZ. (1978) examined arrowtooth flounder' from the northeast Gulf of Alaska. Crustaceans were the most frequently occurring prey items consumed. Of this group, decapods were most often taken, with euphausiids the second most commonly consumed. By number and volume, however, euphausiids were more important. Shuntov (1965) reported that the walleye pollock was the principal food item of the arrowtooth flounder in the Bering Sea.

Fishes were the second most frequently occurring prey items. Members of the families Osmeridae, Gadidae, and Zoarcidae, in descending order of frequency of occurrence, were the most common.

Pleurogrammus monopterigius (Atka mackerel)

We were unable to locate any references pertaining to the food of the Atka mackerel. However, lingcod, another hexagrammid, are voracious feeders of fishes such as herring and sand lance (Hart, 1973). Therefore, based on the food of the closely related lingcod and the food of Atka mackerel in the present study, it appears that fishes are consistent with the Atka mackerel's normal prey.

Anaplopoma fimbria (sablefish)

The sablefish in the present study were full of sand lance. Shubnikov (1963) reported that food items of Bering Sea sablefish were also primarily fishes, including small gadids, flatfishes, gobies, capelin, and herring as well as benthic and nektonic invertebrates.

VIII. CONCLUSIONS

Thirty-nine permanent benthic stations were established in two bays - 25 stations in Izhut Bay and 14 stations in Kiliuda Bay. There is now a general, qualitative understanding, on a station basis for the months sampled, of the distribution and abundance of the major epifaunal invertebrates of the study areas. The dominant invertebrate species had distinct biomass differences between the bays with snow crabs (*Chionoecetes bairdi*) and sunflower sea stars (*Pycnopodia helianthoides*) important in Izhut Bay and king crabs (*Paralithodes camtschatica*), snow crabs, and pink shrimps (*Pandalus borealis*) dominant in Kiliuda Bay.

The most important group, in terms of biomass, collected near Portlock Bank was the Echinodermata, specifically sea stars and sea urchins. King and snow crabs were the second-most important group from this area. Kodiak shelf sampling in June-July revealed king and snow crabs as the dominant species.

Stomachs of king crabs collected in bays and on the shelf of Kodiak Island contained a wide variety of prey items. Food of crabs from Izhut Bay was dominated by fishes while crabs from Kiliuda Bay preyed primarily on molluscs, specifically clams. Food of king crabs from the Kodiak shelf consisted mainly of clams and cockles, although crustaceans and fishes were also important. King crabs taken inshore by SCUBA primarily contained acorn barnacles and clams. Barnacles were a major food resource for king crabs in Kiliuda Bay and inshore areas sampled by SCUBA in June and July.

Food data for king and snow crabs, and pink shrimps will be available for the Final Report, and these data, in conjunction with similar data from other Alaska waters, will enhance our understanding of the trophic role of these crustaceans in their respective ecosystems. The additional food data available to the Final Report as well as an assessment of the literature will make it possible to develop a food web for inshore and offshore areas of the Kodiak shelf. Comprehension of trophic interactions of benthic species is essential to comprehend the potential impact of oil on the crab-shrimp-dominated waters adjacent to Kodiak.

The importance of deposit-feeding clams in the diet of king and snow crabs in Kodiak waters has been demonstrated by preliminary feeding data collected there. It is suggested that an understanding of the relationship between oil, sediment, deposit-feeding clams, and crabs be developed in a further attempt to understand the possible impact of oil on the two commercially important species of crabs in the Kodiak area.

Initial assessment of data suggests that a few unique, abundant and/or large invertebrate species (king crabs, snow crabs, several species of clams) are characteristic of the bays investigated and that these species may represent organisms that could be useful for monitoring purposes.

It is suggested that a complete understanding of the benthic systems of Kodiak waters can only be obtained when the infauna is also assessed in conjunction with the epifauna. Based on stomach analyses, infaunal species are important food items for king and snow crabs. However, the infaunal components of the Kodiak shelf have not been quantitatively investigated to date. A program designed to examine the infauna should be initiated in the very near future.

IX. NEEDS FOR FURTHER STUDY

Although the trawling activities were satisfactory in a general way for qualitatively determining the distribution and abundance of epifauna, a substantial component of both bays - the infauna - was not sampled. Since infaunal species represent important food items, it is essential that the *use* of grabs and/or dredges be accomplished at the bay stations in the near future.

In addition, relative to the suggestions in Problems Encountered in Section X, it is highly recommended that an Eastern otter trawl be used in the near future if either of the two study bays is to be used for monitoring activities.

An attempt should be made to quantify the carbon flow in the crab-shrimp dominated shelf adjacent to Kodiak. Serious consideration should ultimately be given to developing a predictive model embodying trophic interactions in Kodiak and adjacent waters.

X. SUMMARY OF FOURTH QUARTER OPERATIONS

SHIP ACTIVITIES

I. Ship or Field Activities

A. Ship schedules and name of vessel

1. NOAA Ship *Miller Freeman*, 14-24 February 1979
2. R/V *Commando*, 5-18 March 1979

B. Scientific Party

a. NOAA Ship *Miller Freeman* - S. C. Jewett and R. L. Rice
b. R/V *Commando* - K. McCumby

C. Methods

1. NOAA Ship *Miller Freeman*

a. *Sampling* Gear: Selected stations were occupied with a standard 400-mesh Eastern otter trawl, pipe dredge (36 cm x 91 cm) and small otter trawl (6.2 m opening). A CTD was taken at each station.

b. *Processing of Material*:

Material taken by 400-mesh otter trawl was sorted, counted, and weighed. Commercial crabs were also sexed. Various species were examined for food items. Some material including all crab stomachs and shrimp were preserved in formalin for later laboratory examination.

Only crangonid shrimps were utilized from the small otter trawl. These specimens were kept alive for later laboratory experiments.

Pipe dredge material was washed on deck with sea water over a 1.0 mm screen. All washed material was preserved for later laboratory examination and used to aid in crab, shrimp, and fish stomach contents.

Stomachs of crabs were removed and preserved for later laboratory examination. Whole pink shrimps were also preserved (see Appendix B, Table I).

Stomachs of selected species of fishes were examined on board ship and contents were recorded for frequency of occurrence (see Appendix B, Table I).

2. R/V *Commando*

Izhut and Kiliuda Bay stations were sampled with a 400-mesh Eastern otter trawl.

When the weather conditions made it possible, the trawl material was sorted and weighted immediately. However, when weather conditions were such as to prevent working on deck, the invertebrates were placed in labeled buckets and were worked up later when anchored in calmer waters.

II. Results

A. Cruise activities

1. NOAA Ship *Miller Freeman*

a. *400-mesh Eastern Otter Trawl*: Fifteen stations were occupied; the catch was enumerated at 14 stations (see Appendix B, Fig. 1).

b. *Small Otter Trawl*: Five stations were occupied and crangonid shrimp were obtained from each.

c. *Pipe Dredge*: Pipe dredges were obtained from all 15 stations. The average volume was 70 liters of substrate. Station IMS 13 and IMS 3 mainly contained coarse sand and gravel and many *Modiolus* sp. (mussel). Most other stations contained fine grey mud with few organisms.

d. *Trophic Studies:* Few (22 males) king crab were found on this cruise, presumably due to their movement to shallow water for mating. All snow crab that were caught were in excellent, hard-shell condition. Flatfishes, in general, were eating very little, presumably due to their advanced reproductive state; the sexual condition of most species was ripe. Yellow Irish lord was the only fish species not indicating sexual ripeness. This species was also not feeding intensively.

2. R/V *Commando*

a. *Izhut Bay:* A total of four otter trawl tows and nine tows with the try net were taken in Izhut Bay.

Stomachs were removed from three *Paralithodes camtschatica* (king crab) and preserved in 10% buffered formalin. Seventy-one *Chionoecetes bairdi* (snow crab) stomachs were collected and preserved. The stomachs from fifty-two *Pycnopodia helianthoides* (sea star) were examined for food. Approximately 400 *Pandalus borealis* (pink shrimp) were collected for stomach analysis.

b. *Kiliuda Bay:* Six try net tows were made in Kiliuda Bay; one yielded no catch. Three otter trawl tows were also made.

A total of thirty-eight king crab stomachs and eighteen snow crab stomachs were obtained and preserved for analysis. Approximately 300 pink shrimp were collected for stomach analysis.

B. Laboratory Activities

Stomachs of king crabs, snow crabs, and pink shrimps were examined.

C. Problems Encountered and Recommended Changes

1. NOAA Ship *Miller Freeman*

a. Eleven of the 12 high priority stations, as outlined in the project instructions, were occupied. Station IMS 13, the only one not occupied, was deleted due to the presence of crab gear. Four additional, new stations *(23, S2, S3,* and S5) were occupied.

b. We were unable to fish on February 14th due to bad weather. Only one trawl was taken on February 20th and 21st due to delays in repairing the ripped net. Only one trawl was taken on February 23rd due to inability to find trawlable bottom.

2. Inshore-bay activities

The small try net made available on most cruises of this study (not including R/V *Commando)* was inadequate for proper sampling of the epibenthos. It is possible that crabs, shrimps, and fishes were absent from the areas sampled; however, limited trawling with a 400-mesh Eastern otter trawl in stations adjacent to try net stations yielded significant catches of the above organisms. The try net was picking up small bottomfishes to satisfy objectives of ADF&G and FRI. However, based on the effectiveness of past trawl studies, i.e. Ugak and Alitak, with the Eastern otter trawl, the try net did not properly satisfy our objectives requiring quantitative sampling of benthic invertebrates.

III. Acknowledgements

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APPENDIX A

TABLE I

BENTHIC TRAWL AND SCUBA STATIONS OC UP
THE KODIAK REGION, 1978

Izhut Bay

Station Name	Latitude	Longitude
2	58°08.2′	152°09.5′1
3	58°08.5′	152°10.3′2
4	58°09.1′	152.10.5′2
5	58°09.1′	152°09.3′1
6	58′09.1′	152°11.5′2
7	58°08.7′	152°12.8′2
8	58°09.3′	152°12.7′2
9	58°09.7′	152°13.2′2
501	58°15.9′	152.14.6′1
502	58°15.8′	152.14.6′1
526	58°12.6′	152.12.8′1
527	58°12.6′	152°12.9′1
551	58°11.0′	152°12.5′1
552	58°11.1′	152°12.3′1
553	58″11.1′	152°12.1′1
554	58°11.7′	152°21.1′1
555	58°09.4′	152°18.5′1
557	58°10.7′	152°18.5′1
576	58°09.3′	152°07.4′1
577	58°09.0′	152°07.9′1
580	58°08.9′	152″09.6′1
582	58°08.5′	152°10.2′1
583	58°09.4′	152°17.5′1
584	58°09.0′	152°12.0′1
585	58°08.0′	152°08.0'1

Station Name	
1	
2	
3	
4	
5	
6	
7	
501	
576	
577	
578	
579	
580	
SHR	

Station Name	
Near Is. Basin	
McLinn Is.	
Anton Lars Bay #1	
Anton Lars Bay #2	

TABLE I
CONTINUED

Near Portlock Bank

Station Name	Latitude	Longitude
1	.57°58.6′	151°40.8′[2]
2	58°13.0′	151°11.4′[2]
3	58°10.9′	151°07.9′[2]
4	58°12.0′	151°10.3′[2]
.5	58°00.0′	150°06.2′[2]
6	57°56.8′	150°05.9′[2]
7	57°57.5′	150°02.6′[2]
8	57°57.7′	150°07.8′[2]
9	57°51.3′	150°10.2′[2]
10	57°50.7′	150″07.7′[2]
11	58°05.1′	150°06.9′[2]
12	58°04.1′	150°07.0′[2]

Kodiak Shelf

Station Name	Latitude	Longitude
1	58°12.4′	151″05.9′[2]
2	56°54.4′	154°47.5′[2]
3	57°48.7′	150°40.9′[2]
4	57°29.1′	151°30.6′[2]
5	56°42.7′	153°10.8′[2]
6	56°40.9′	153°41.2′[2]
7	56°46.9′	154°18.5′[2]
8	56°51.9′	154°27.5′[2]
9	56°42.5′	153°41.2′[2]
10	57°02.1′	153°25.7′[2]
11	57°12.8′	152°59.0′[2]
12	57°13.5′	152°48.0′[2]
13	58°09.1′	152°13.5′[2]
14	58″04.9′	152°16.8′[2]
22	57°28.2′	152°06.2′[2]
44	57°18.9′	151°19.1′[2]

[1]Mid-point coordinates
[2]Start coordinates

APPENDIX B

TABLE I

STATIONS OCCUPIED, TYPE OF ACTIVITY AT STATION, AND NUMBER OF STOMACHS COLLECTED OR EXAMINED

X = activity accomplished; — = activity not accomplished or no stomachs collected or examined. King crab, snow crab, and pink shrimp stomachs collected for further examination in the laboratory. All fish stomach were examined onboard ship.

				Stomachs Examined			
Station Name	CTD	Pipe Dredge	small Otter Trawl	King Crab	Snow Crab	Pink Shrimp	Pacific Cod
IMS 12	X	X			20		10
IMS 11A	X	X			20		
IMS 10	X	X	X		20		2
IMS 9	X	X	X				10
IMS 7	X	X	X	10	20		
IMS 8	X	X	X	4	20		
IMS 5	X	X					10
23	X	X		8	17		
44	X	X			20		
IMS 4	X	X			20		
IMS 3	X	X					
IMS 14	X	X			20	150	3
S2	X	X					
S3	X	X			12		10
S5	X	X	X		20		10
Totals	15	15	5	2 2	209	150	55

TABLE I

CONTINUED

Station Name	Stomachs Examined: Y. Irish Lord	Great Sculpin	Flathead Sole	Yellow fin Sole	Starry Flounder	Rock Sole	Butter Sole
IMS 12	10		10	10	2		
IMS 11A	10		10	10	–		
IMS 10	10		10	10	2		
IMS 9	10	2				10	10
IMS 7				10			
IMS 8	–	10	–	10	–	–	–
IMS 5	10		10				
23							
44			10			10	
IMS 4	10		10			10	10
IMS 3						10	
IMS 14	10		10				
S2	10					10	
S3	10		10			10	
S5			10			10	
Totals	90	12	90	50	4	70	20

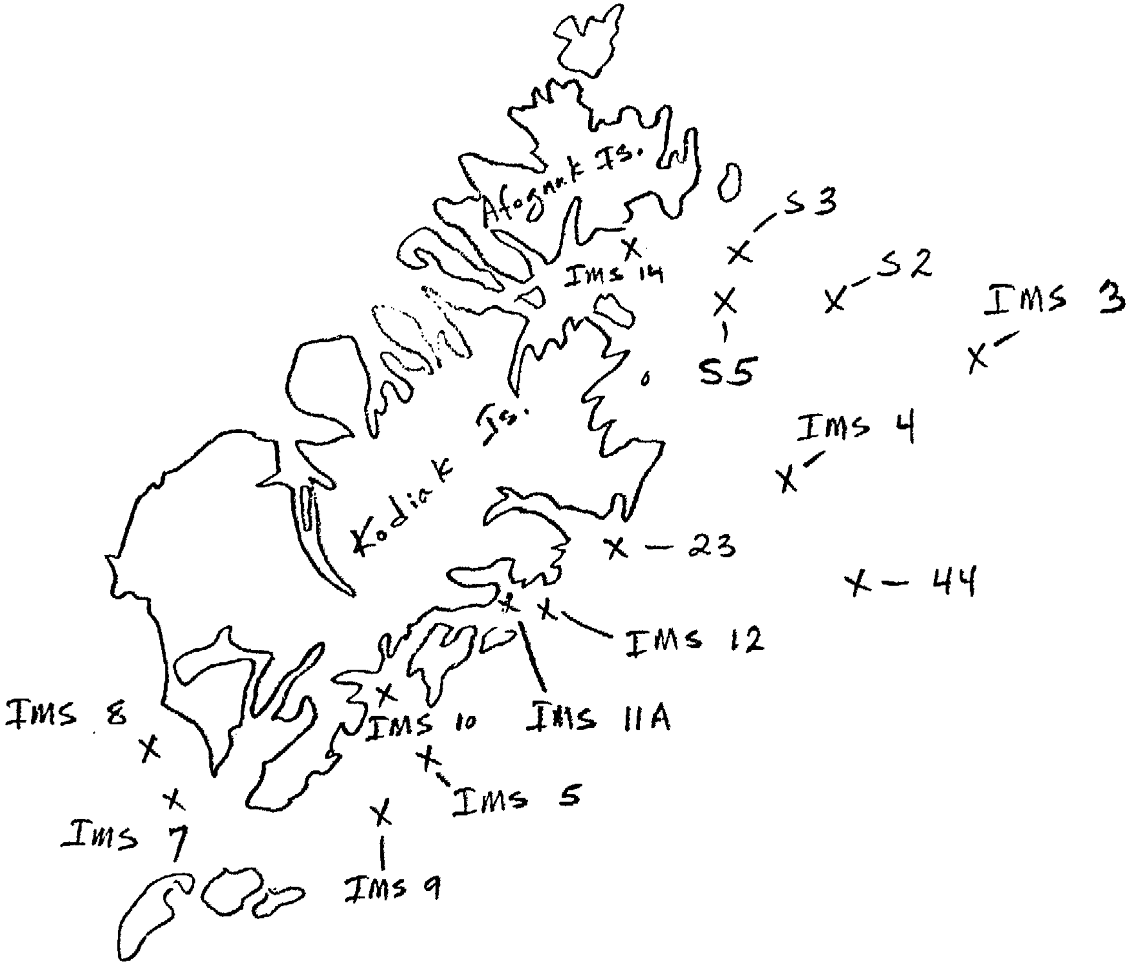

Figure 1. Stations occupied by the NOAA Ship *Miller Freeman*, 14-24 February 1979. From Cruise Report NOAA Ship *Miller Freeman*.