Calvin J. Lensink

Environmental Assessment of the Alaskan Continental Shelf

Annual Reports of Principal Investigators for the year ending March 1979

Volume III. Receptors — Fish, Littoral, Benthos

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

U.S. DEPARTMENT OF INTERIOR
Bureau of Land Management

VOLUME I	RECEPTORS -- MAMMALS BIRDS
VOLUME II	RECEPTORS -- BIRDS
VOLUME III	RECEPTORS -- FISH, LITTORAL, BENTHOS
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VOLUME VIII	TRANSPORT
VOLUME IX	HAZARDS
VOLUME X	HAZARDS DATA MANAGEMENT

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Outer Continental Shelf Environmental Assessment Program
Boulder, Colorado

October 1979

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ACKNOWLEDGMENT

These annual reports were submitted as part of contracts with the Outer Continental Shelf Environmental Assessment Program under major funding from the Bureau of Land Management.

RECEPTORS -- FISH, LITTORAL, BENTHOS

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OCSEAP ANNUAL REPORT

Contract: #03-5-022-56
Task Order: #15
Research Unit: #5
Reporting Period: 4/1/78-3/31/79
Number of Pages: 77

DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE AND TROPHIC RELATIONSHIPS OF THE NEARSHORE BENTHOS OF COOK INLET AND NEGOA

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March 1979

ACKNOWLEDGEMENTS

We would like to thank the officers and crew of the NOAA vessels involved in sampling in lower Cook Inlet, and Tom Rosenthal of the M/V *Searcher* for excellent support of trawling activities adjacent to Hinchinbrook Entrance, Prince William Sound. We would also like to thank the following personnel of the Institute of Marine Science, University of Alaska: Cydney Hansen and the staff of the data processing group for most effective assistance, Ana Lea Vincent for drafting, and the publications staff for aid in preparation of this report.

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SECTION I

DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE AND TROPHIC RELATIONSHIPS OF THE NEARSHORE BENTHOS OF COOK INLET AND THE NORTHEAST GULF OF ALASKA

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

The long-term objectives of this study are: 1) a qualitative and quantitative inventory of benthic species within and adjacent to identified oil-lease sites in the northeast Gulf of Alaska (NEGOA) and lower Cook Inlet, 2) a description of spatial distribution patterns of selected species in the designated study areas, and 3) observations of biological interrelationships, specifically trophic interactions, between components of the benthic biota in designated study areas.

Forty-two widely dispersed permanent stations for quantitative grab sampling have been established in the northeastern Gulf of Alaska, and these stations represent a reasonable nucleus around which a monitoring program can be developed. Sixty-one widely dispersed stations were occupied with a van Veen grab in Cook Inlet; thirteen of these stations were ultimately selected for detailed analysis.

A pipe dredge was used in lower Cook Inlet to compliment data obtained by grab and trawl, and was also valuable for obtaining large numbers of clams used in age-growth studies.

The general patchiness of fauna initially observed at most stations in the Gulf of Alaska suggested that at least five replicates be taken per station. At least this number of replicates were taken at all stations. Analysis of grab data by the end of the project should enable us to suggest the optimum number of replicates per station for monitoring programs.

One hundred and forty stations were occupied with an otter trawl in the northeastern Gulf of Alaska. Forty-seven stations were occupied with three types of trawls in Cook Inlet.

Four hundred and fifty-seven invertebrate species were collected in the grab sampling program, and 168 invertebrate species were taken in the trawl program in the northeast Gulf of Alaska. Two hundred and eleven species have been determined from the grab sampling program, and 189 invertebrate species from the trawl and dredge programs in Cook Inlet. It is probable that all species with numerical and biomass importance have been collected in all areas of investigation and that only rare species will be added in future sampling.

Basic information on diversity, dominance and evenness is now available for all permanent stations on the NEGOA grid. Caution is indicated in the interpretation of these values until further data are available over a longer time base.

Infaunal invertebrates taken by van Veen grab in the northeast Gulf of Alaska have been used to comprehend station/species aggregations by cluster analysis. Preliminary groupings of stations into three basic clusters have been accomplished. Further understanding of station clustering has been gained by clustering species, and constructing two-way coincidence tables of species vs. station groups. By this means, specific groupings of species can be related to station clusters, and intermediate positions of stations (or clusters) can be determined by the particular groupings of species they have in common.

The joint National Marine Fisheries Service trawl charter for investigation of epifaunal invertebrates and demersal fishes in the northeast Gulf of Alaska was effective, and excellent spatial coverage was achieved. However, no seasonal information was obtained for this area. Trawl surveys in lower Cook Inlet achieved good coverage, although only limited seasonal data were obtained. Integration of information from these cruises with infaunal benthic data will enhance our understanding of these shelf ecosystems.

Information on feeding biology of species from the Gulf of Alaska is available from literature analysis and information collected on Outer Continental Shelf Environmental Assessment Program (OCSEAP) cruises. A Kodiak Island food web has been developed. The major food items in the web were polychaetes, gastropods (snails), pelecypods (clams), amphipods, hermit crabs, true crabs, and shrimps. Snow and king crabs fed heavily on benthic animals that, in turn, relied in whole or in part on sediment-associated organic material, detritus, bacteria, and benthic diatoms for food. The invertebrates in two Kodiak bays relied on a variety of feeding methods while fishes tended to be predators. The principal food groups used by the Pacific cod, *Gadus macrocephalus*, at all sites in the northeast Gulf of Alaska and the Kodiak shelf were molluscs, crustaceans, and fishes. There were some small quantities (less than 10% of the total occurrence) of annelids, euphausiids and mysids, isopods and echinoderms taken by cod. A food web, inclusive of major epifaunal species, for Cook Inlet is also available. The snow crab, *Chionoecetes bairdi*, fed, in order of decreasing importance, on clams, hermit crabs, barnacles and crangonid shrimps. King crabs, *Paralithodes camtschatica*, in Cook Inlet fed on two deposit-feeding clams, *Nuculana* and *Macoma*, and barnacles.

Clam studies in Cook Inlet have resulted in age-growth data for six species: *Nucula tenuis, Nuculana fossa, Glycymeris subobsoleta, Macoma calcarea, Tellina nuculoides* and *Spisula polynyma*. Such age-growth analyses will make available biological parameters useful for long-range monitoring programs in these areas.

Initial assessment of all data suggests that: 1) sufficient station and/or area uniqueness exists to permit development of monitoring programs based on species composition at selected stations utilizing both grab and trawl sampling techniques, and 2) adequate numbers of biologically well-known, unique, abundant, and/or large species are available to permit nomination of likely monitoring candidates for the areas once industrial activity is initiated.

II. INTRODUCTION

General Nature and Scope of Study

The operations connected with oil exploration, production, and transportation in the Gulf of Alaska present a wide spectrum of potential dangers to the marine environment (see Olson and Burgess, 1967, for general discussion of marine pollution problems). Adverse effects on the marine environment of these areas cannot be quantitatively 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 (Lewis, 1970, and personal communication). Such fluctuations are typically unexplainable because of absence of long-term data on physical and chemical environmental parameters in association with biological information on the species involved (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-range 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).

The presence of large numbers of benthic epifaunal species of actual or potential commercial importance (crabs, shrimps, snails, fin fishes) in the Gulf of Alaska further dictates the necessity of understanding benthic communities there 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 discussions in Feder, 1977 and 1978). 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 pollutant-induced biological alteration. Intensive investigations of the benthos of the Gulf of Alaska are essential to understand the trophic interactions involved in these areas and the changes that might take place once oil-related activities are initiated.

The benthic biological program in the northeast Gulf of Alaska (NEGOA) has emphasized development of an inventory of species as part of the examination of biological, physical and chemical components of those portions of the shelf slated for oil exploration and drilling activity. In addition, the program designed to assess assemblages (communities) of benthic species on the NEGOA shelf will expand the understanding of distribution patterns of species here. A developing investigation concerned with the biology (primarily concerned with feeding activity) of selected species on the Kodiak shelf and in Cook Inlet will further the understanding of the trophic dynamics of the Gulf of Alaska benthic system.

The study program was designed to survey the benthic fauna on the Alaska continental shelf in regions of potential oil and gas concentrations. During the first phases of research, data were obtained on faunal composition and abundance to develop baselines to which future changes can be compared. Long-term studies on life histories and trophic interactions of identified 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 at present to predict the effects of oil-related activity on the subtidal benthos of the Gulf of Alaska (NEGOA). However, the rapid expansion of research activities in NEGOA should ultimately enable us to point with some confidence to certain species or areas that might bear closer scrutiny if industrial activity is initiated. It must be emphasized that an extensive data base is needed to comprehend long-term fluctuations in density of marine benthic species; 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 benthic 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, 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). Likewise, stations with substantial numbers of epifaunal species should be assessed on a continuing basis (see Feder and Mueller, 1975; Feder, 1977; Jewett and Feder, 1976 for references to relevant stations). The potential effects of loss of species to the trophic structure in the Gulf of Alaska cannot be assessed at this time, but the problem can be better addressed once benthic food studies resulting from current projects are available (Feder, unpublished data from Cook Inlet, Bering Sea; Jewett and Feder, 1976; Feder, 1977; Feder and Jewett, 1977; Smith *et al.*, 1977).

Data indicating the effects of oil on most subtidal benthic invertebrates are fragmentary (see Boesch, *et al.*, 1974; Malins, 1977 for review; Baker, 1977 for a general review of marine ecology and oil pollution), but echinoderms are "notoriously sensitive to any reduction in water quality" (Nelson-Smith, 1973). Echinoderms (ophiuroids, asteroids, and holothuroids) are conspicuous members of the benthos of the Gulf of Alaska (see Feder, 1977 for references to relevant stations in the northeast Gulf of Alaska), and could be affected by oil activities there. Asteroids (sea stars) and ophiuroids (brittle stars) are components of the diet of large crabs (for example king crabs feed on sea stars and brittle stars: unpub. data, Guy Powell, Alaska Dept. of Fish and Game; Feder, 1977) and demersal fishes. Snow crabs (*Chionoecetes* spp.) are conspicuous members of the shallow shelf of NEGOA and lower Cook Inlet, and support commercial fisheries 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). Little other direct data based on laboratory experiments are available for subtidal benthic species (see Nelson-Smith, 1973). Experimentation on toxic effects of oil on other common members of the subtidal benthos should be strongly encouraged for the near future in OCS 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 adsorbed 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. Cluster analysis techniques, supplemented by principal components and/or principal coordinate analysis, should provide techniques for the selection of stations useful for monitoring the infauna (see Feder, 1978; Feder and Matheke, in press) for such studies in NEGOA). In addition, these techniques should provide an insight into normal ecosystem variation (Clifford and Stephenson, 1975; Williams and Stephenson, 1973; Stephenson *et al.*, 1974). 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

Gulf of Alaska

Little was known about the biology of the invertebrate benthos of the northeast Gulf of Alaska (NEGOA) at the time that OCSEAP studies were initiated there, although a compilation of some relevant data on the Gulf of Alaska was available (Rosenberg, 1972). A short but intensive survey in the summer of 1975 added some benthic biological data for a specific area south of the Bering Glacier (Bakus and Chamberlain, 1975). Results of the latter study are similar to those reported by Feder and Mueller (1975) in their OCSEAP investigation. Some scattered data based on trawl surveys by the Bureau of Commercial Fisheries (National Marine Fisheries Service) were available, but much of the information on the invertebrate fauna was so general as to have little value. A summarization of existing literature is included in Feder and Mueller (1977) and AEIDC and ISEGR (1974).

In the summer and fall of 1961 and spring of 1962, otter trawls were used to survey the shellfishes and bottomfishes on the continental shelf and upper continental slope in NEGOA (Hitz and Rathjen, 1965). The surveys were part of a long-range program begun in 1950 to determine the size of bottomfish stocks in the northeastern Pacific Ocean between southern Oregon and northwest Alaska. Invertebrates taken in the trawls were of secondary interest, and only major groups and/or species were recorded. Invertebrates that comprised 27 percent of the total catch were grouped into eight categories; heart urchins (Echinoidea), snow crabs (*Chionoecetes bairdi*), sea stars (Asteroidea), Dungeness crabs (*Cancer magister*), scallops (*Pecten caurinus*), shrimps (*Pandalus borealis, P. platyceros*, and *Pandalopsis dispar*), king crabs (*Paralithodes camtschatica*), and miscellaneous invertebrates (shells, sponges, etc.) (Hitz and Rathjen, 1965). Heart urchins accounted for about 50 percent of the invertebrate catch and snow crabs ranked second, representing about 22 percent. Approximately 20 percent of the total invertebrate catch was composed of sea stars.

Further knowledge of invertebrate stocks in the north Pacific is scant. The International Pacific Halibut Commission (IPHC) surveys parts of the Gulf of Alaska annually, and records selected commercially important invertebrates; however, non-commercial species are discarded. The benthic investigations of Feder and Mueller (1975), Feder *et al.* (1976) and Matheke *et al.*, (in press), and Feder, (1977) represent the first intensive qualitative and quantitative examinations of the benthic infauna and epifauna of the Gulf of Alaska.

Data on the infauna collected in the first year (1974-1975) of the OCSEAP study in NEGOA served as a springboard and an intensive data base for the studies in 1975-1977. Information in the literature will aid in the interpretation of the biology of some dominant infaunal organisms in the Gulf of Alaska. The use of cluster and multivariate techniques for the analysis of infaunal data (now being applied to our data from the Gulf of Alaska; Matheke *et al.*, in press; Feder and Matheke, in press) has been widely used by numerous investigators examining shallow-water marine environments. Techniques are well reviewed in Clifford and Stephenson (1975).

Few data on non-commercially important benthic invertebrates of lower Cook Inlet were available until recent OCSEAP studies were initiated [Feder, 1977 and D. Lees, unpub. data and reports; draft copy of lower Cook Inlet

Synthesis Report, 1977 (Scientific Applications, 1977)]. The primary data available were principally catch and assessment records for commercial shellfish species. Based on OCSEAP feeding studies accomplished in lower Cook Inlet, NEGOA, and the Kodiak Shelf (Feder, 1977; Feder, 1978; Feder and Jewett, 1977), it is apparent that benthic invertebrates play an important role in the food dynamics of commercial crabs and demersal fishes on the Gulf of Alaska shelf.

Dennis Lees (unpub. data) suggests that the macrophytes of the intertidal and shallow subtidal regions produce materials utilized by detritivores in shallow and deep waters throughout Cook Inlet. Many of the organisms depending on these plant materials are either of commercial importance or are food items important to commercial species. In the past few years information linking the macrophyte producers to commercially important species has begun to emerge, but the full importance of this linkage has yet to be recognized. Many marine birds and mammals depend heavily on organisms living in the inshore areas which in turn are dependent on plant material produced by macrophytes. Studies by D. Lees and Feder (OCSEAP data) strongly suggest that the abundant deposit feeders in lower Cook Inlet are concentrated in regions of detrital accumulations (e.g. Kamashak Bay).

IV. STUDY AREAS

The established stations for the NEGOA and Cook Inlet study areas are tabulated, figured and discussed in the 1977 OCSEAP Annual Reports (Feder, 1977; 1978;). Additional stations of opportunity were established in the summer of 1978 in Port Etches (Hinchinbrook Island) and Zaikof and Rocky Bays (both on Montague Island) (locations of stations in the latter areas will be included in the NEGOA Final Report).

V. SOURCES, METHODS AND RATIONALE OF DATA COLLECTION

Lower Cook Inlet

Detailed methodology for the investigations of 1976-78 is included in Feder (1977, 1978). Sampling was accomplished with an Eastern otter trawl, try net, Agassiz trawl, pipe dredge, and van Veen grab. Preliminary workup of trawl material was accomplished onboard ship. All dredge and grab material were washed on 1.0 mm screens. All invertebrates were given tentative identifications, and representative samples of individual species preserved in 10% buffered formalin, and labeled for final identification at the Institute of Marine Science and the Marine Sorting Center, University of Alaska, Fairbanks. Stomachs of selected species (e.g. shrimps, king crabs, snow crabs, hermit crabs) were either examined on shipboard or in the laboratory. All species used in feeding studies were measured, separated by sex where readily possible (e.g., in crabs but not necessarily in shrimps), and separated into as many size groups as possible. Clams used in growth studies were separated from sediments on shipboard and in the laboratory, and measurements made on them in the laboratory.

Final analysis of material was accomplished by methods developed in past OCSEAP studies (Jewett and Feder, 1976; Feder, 1977; Feder and Jewett, 1977). All species were assigned Taxon Code numbers, and summarized according to computer programs developed for other benthic studies by Feder (for example, see Feder, 1977).

All data were summarized and analyzed with the aid of available or specially written computer programs at the University of Alaska. Growth-history analyses of clam species was applied according to techniques described in Feder and Paul (1974) and Paul *et al.* (1976).

Northeast Gulf of Alaska (NEGOA)

Sampling with a small try net was accomplished in Port Etches, Zaikof Bay and Rocky Bay (at entrance to Prince William Sound) with a try net and van Veen grab. No laboratory activities took place on this project in 1978. Most of the activities in 1978 were concerned with analysis of infaunal data to be included in the Final Report (see Feder, 1977 for methodology employed for workup of quantitative infaunal data collected on past cruises).

VI. RESULTS

Lower Cook Inlet

A Summary Report, based on some of the data collected on cruises of the NOAA Ships *Miller Freeman* and *Surveyor*, is included with this Annual Report (Summary Report, Sect. II). All data will be included in the Final Report.

1732 specimens of juvenile king and snow crabs, and adult shrimps from lower Cook Inlet were examined for food contents in stomachs. The shrimp species and numbers of each species examined are as follows:

Pandalus goniurus (humpy shrimp) - 176
Pandalus borealis (pink shrimp) - 257
Pandalus hypsinotus (coonstripe shrimp) - 159
Pandalus danae (no common name) - 27
Crangon dalli (sand or gray shrimp) - 858
Crangon fransciscorum (sand or gray shrimp) - 12
Crangon communis (sand or gray shrimp) - 25
Sclerocrangon boreas (no common name) - 49
Lebbeus groenlandica (no common name) - 25

108 juvenile snow crab and 35 post larval king crab are included in the above total of specimens examined. Adult snow, king and Dungeuess crab stomachs were also examined. Data and discussions are either found in Summary Report II of this Annual Report (also see Paul *et al.*, in press) or will be summarized in the Final Report.

Observations of shallow-water areas by D. Lees (subcontract to this study) will be included and discussed in the Final Report.

Northeast Gulf of Alaska (NEGOA)

Epifaunal samples were collected in Port Etches (Hinchinbrook Island) on board the R/V *Acona* in March 1978. Additional epifaunal and infaunal samples were collected July - August 1978 in Port Etches, Zaikof and Rocky Bays (all at entrance to Prince William Sound) on the M/V *Searcher*.

Activities for the past year have consisted primarily of data analysis and manuscript preparation for the NEGOA infaunal Final Report. This report is in its final phases of preparation (Feder and Matheke, in press).

A Final Report entitled, "Distribution and Abundance of some Epibenthic Invertebrates of the Northeastern Gulf of Alaska With Notes on the Feeding Biology of Selected Species," was submitted to OCSEAP in August 1978.

Food Studies

Food studies in Cook Inlet have centered on the snow crab, *Chionoecetes bairdi*, the king crab (*Paralithodes camtschatica*), the Dungeness crab (*Cancer magister*), shrimps of the Families Pandalidae and Crangonidae, and the known prey species taken by these organisms. The goal of these studies is to expand and make the food webs presented in previous reports more comprehensible (Feder, 1977, 1978). The results of these studies will also be useful in (1) explaining the distribution of adult and juvenile of the above species, (2) understanding the interrelationships of these species to other organisms, such as some bottom fishes, which also feed in the benthic environment, and (3) describing the effect of feeding by these species on the populations of prey species.

The results of some of the above studies are included in Feder (1977; 1978) and in the Summary Report (Summary Report, Sect. II of this Annual Report).

A master's thesis treating the feeding biology and trophic interactions of the abundant crangonid shrimp *Crangon dalli*, is in progress. Completion date for this thesis is expected to coincide with the submission period for the lower Cook Inlet Final Report.

VII. DISCUSSION

Lower Cook Inlet

A preliminary discussion of (1) important habitats for biologically important Crustacea in lower Cook Inlet, and (2) the food of snow, king and Dungeness crabs in lower Cook Inlet are included in this Annual Report as Summary Report II.

Additional food data on three crangonid shrimps (*Crangon dalli, C. franciscorum, Sclerocrangon boreas*), one species of hippolytid shrimp (*Lebbeus groenlandica*), and four species of pandalid shrimps (*Pandalus borealis* - pink, *P. goniurus* - humpy, *P. hypsinotus* - coonstripe, and *P. danae* - no common name) will be included and discussed in the Final Report.

Additional discussions on the performance of the van Veen grab, number of grabs taken per station, station coverage, species composition, biomass, food studies, and clam studies are included in Feder (1978) and Feder and Matheke (in press).

Northeast Gulf of Alaska (NEGOA)

Data and discussions for NEGOA investigations are available in the OCSEAP Annual Reports for 1977 and 1978 (Feder, 1977, 1978) and the Final Report on the epifauna (Feder and Jewett, 1978; also see Jewett and Feder, 1976).

Activities planned for 1979 include analysis of the trawl data collected in 1978 on the M/V *Searcher* in the vicinity of Hinchinbrook Entrance and examination of stomachs of selected species of invertebrates and fishes taken on this cruise, if time permits.

A Final Report on the infauna of NEGOA will be submitted to OCSEAP shortly, and will include a discussion of species assemblages on the shelf and possible factors responsible for the maintenance of these assemblages (Feder and Matheke, in press).

VIII. CONCLUSIONS

Lower Cook Inlet

The Annual Report for 1978 (Feder, 1978) and the enclosed Summary Report for lower Cook Inlet (Summary Report in Section II of this Annual Report), summarize the benthic invertebrate work accomplished in this region through 1978. Additional data are available, but are not presented or discussed here. These data will be included with the Final Report.

Northeast Gulf of Alaska (NEGOA)

Data collected since the inception of the studies in NEGOA in 1974 have made it possible to comprehend various aspects of the distribution, abundance, and general biology of the more important invertebrate components of the shelf. Some generalizations are now possible, and are included below (also see Feder and Mueller, 1975; Feder *et al.*, 1976; Feder, 1977 for the data base used for conclusions below).

Forty-two widely dispersed permanent stations have been established to sample the infauna in the northeastern Gulf of Alaska in conjunction with the physical, chemical, heavy metals and hydrocarbon programs. These stations represent a reasonable nucleus around which a monitoring program can be developed (Feder, 1977).

The sampling device chosen, the van Veen grab, functioned effectively in all weather and adequately sampled the infauna at most stations. Penetration was excellent in the soft sediments characteristic of the majority of stations; poor penetration occurred at a few stations where the substratum was sandy or gravelly. General patchiness of many components of the infauna and quantitative field testing for optimum number of replicates per station suggest that five replicate grabs are adequate.

There is now a reasonable understanding, for grab stations occupied on the NEGOA shelf, of the invertebrate species present and general species distribution. Four hundred and fifty-seven (457) species have been identified. Fourteen marine phyla are represented in the collections. The important groups, in terms of number of species in descending order, are the polychaetous annelids, mollusca, arthropod crustaceans, and echinoderms. It is probable that all species with numerical and biomass importance have been collected and that only rare species will be added to the list in the future.

The diversity indices included in the 1976 Annual Report (Feder *et al.*, 1976), Simpson, Brillouin, and Shannon-Wiener, are complimentary since the former reflects dominance of a few species and the latter two are weighted in favor of rare species. Values calculated in the 1977 Annual Report (Feder, 1977), in general, reflect these weightings. A preliminary examination of the two measures of evenness (or equitability) indicates a reasonable relationship to the calculated diversity values. In general, high measures of evenness show numerical codominance of many species (with low Simpson index and high Shannon-Wiener and Brillouin indices) while low evenness measures imply marked dominance of a few species (high Simpson index and low Shannon-Wiener and Brillouin indices). All of these indices and measures must still be interpreted with considerable caution until more data are available. Further assessment of the meaning of the calculated values will be included in the NEGOA Final Report.

Criteria established for Biologically Important Taxa (BIT) for the grab data have delineated 95 species. Representative members of the BIT should be the organisms most intensively studied for their general biology in future work on the NEGOA shelf.

Information on feeding biology of most species has been compiled. Most of the information for the northeast Gulf of Alaska is from literature source material; it is suggested that experimental work on feeding biology of selected species be encouraged for this region (Feder and Matheke, in press).

Clustering techniques have supplied valuable insights into species distributions on the shelf of the northeast Gulf of Alaska (see Clifford and Stephenson, 1975 for review of numerical classification). The preliminary grouping of stations by three different classification schemes has delineated three basic clusters - Group I, which is characterized by a group of stations south of Prince William Sound; Group II, which generally consists of stations close to shore; and Group III, composed of stations that are at or near the shelf edge. Further insight into the meaning of stations clustered by our analysis is gained by means of the two-way coincidence table of station groups vs. species groups. Specific groupings of species can be related to station clusters, and intermediate positions of stations (or clusters) can be determined by the particular groupings of species they have in common. Some insight into the stability of the cluster groups should be gleaned by examination of clustering of the second year station data. Analysis of this data is completed, and is included in the Final Report (Feder and Matheke, in press) now ready to submit to OCSEAP (preliminary data and analysis are included as Appendix Table V in Feder, 1977).

Initial assessment of data printouts of infaunal species (data to be stored at the National Environmental Data Center) indicates that (1) sufficient station uniqueness exists to permit development of an adequate monitoring program based on species composition at selected stations, and (2) adequate numbers of unique, abundant, and/or large species are available to ultimately permit nomination of likely monitoring candidates.

The trawl survey on the NEGOA shelf for investigation of epifaunal invertebrates and demersal fishes was effective (Jewett and Feder, 1976; Feder and Jewett, 1978). The major limitations of the survey were those imposed by the selectivity of the gear used and the seasonal movements of certain species taken. In addition, rocky bottom areas were not sampled since otter trawls of the type used in the survey could only be fished on relatively smooth bottom. However, the study was effective for determining the epibenthic invertebrates and demersal fishes present on sediment bottom and for achieving maximum spatial coverage of the area. Integration of this information with data on the infaunal benthos (Feder *et al.*, 1976; Feder, 1977) should enhance our understanding of the shelf ecosystem.

To date the epifaunal investigation by OCSEAP discussed above represents the only intensive taxonomic survey of epibenthic invertebrates in the Gulf of Alaska (Feder and Jewett, 1978). Although Hitz and Rathjen (1965) surveyed invertebrates and bottom fishes on the continental shelf of the northeast Gulf of Alaska in 1961 and 1962, invertebrates taken in their trawls were of secondary interest. Only major invertebrate species and/or groups were recorded, and organisms were grouped into eight categories in descending order of importance: heart urchins (Echinoidea), snow crabs (*Chionoecetes bairdi*), scallops (*Pecten caurinus*), shrimps (*Pandalus borealis, P. platyceros*, and *Pandalopsis dispar*), king crabs (*Paralithodes camtschatica*), and miscellaneous invertebrates (shells, sponges, etc.). Additional data on commercially important shellfishes are available in Ronholt *et al.* (1976).

Analysis of epifaunal data from the present NEGOA investigation (Feder and Jewett, 1978) indicates that molluscs, crustaceans, and echinoderms are the leading invertebrate groups on the shelf with the commercially important crab, *Chionoecetes bairdi*, clearly dominating all other species. Furthermore, stomach analysis of the Pacific cod, *Gadus macrocephalus*, on the adjacent Kodiak shelf area, reveals that *C. bairdi* is a dominant food item of that fish. Thus, the Pacific cod, a non-commercial species which has commerical potential (Jewett, 1977; and 1978), is preying intensively on a species of great commercial significance. Laboratory experiments with *C. bairdi* have shown that postmolt individuals lose most of their legs after exposure to Prudhoe Bay crude oil (Karinen and Rice, 1974). The results of these experiments must be seriously considered as the petroleum resources in the Gulf of Alaska are developed.

Highest densities of *Chionoecetes bairdi, Pandalus borealis, Ophiura sarsi, Ctenodiscus crispatus*, and fishes were recorded in the vicinity of the Copper River delta southwest of Kayak Island (see Ronholt *et al.*, 1976, for distribution and density data for fishes there). Little is known about the productivity of this area, but primary and secondary production may be higher there as a result of nutrients supplied by the Copper River. Furthermore, enhanced productivity there may be related to the presence of gyres that extend vertically from the water surface to the bottom (Galt, 1976).

The biological samples now available for the eipifauna from three bays adjacent to Hinchinbrook Entrance, Prince William Sound (Port Etches, Zaikof Bay, Rocky Bay) should be useful as a data base in the event of an oil tanker accident adjacent to these sensitive areas. Furthermore, Port Etches has been suggested as a possible site to tow damaged tankers following accidents in Prince William Sound (Melteff, 1978).

Availability of many readily identifiable, biologically well-understood infaunal and epifaunal invertebrates is a preliminary to the development of monitoring programs. Sizeable biomasses of taxonomically well-known molluscs, crustaceans, and echinoderms were typical of most of our stations, and many species of these phyla were sufficiently abundant to represent organisms potentially useful as monitoring tools. The present investigation clarifies some aspects of the biology of many of these organisms, and should increase the reliability of future monitoring programs for the NEGOA shelf and lower Cook Inlet.

IX. NEEDS FOR FURTHER STUDY

The number of grab stations occupied in lower Cook Inlet and NEGOA was dictated by available ship time and funding for processing of samples. Thus, a relatively small number of stations were occupied on the extensive shelf of the northeastern Gulf of Alaska and in lower Cook Inlet. It is possible that some areas of biological importance were omitted. Additional stations should be occupied in the future to accumulate data for some of the larger unsampled areas.

All samples taken on a semi-seasonal basis in lower Cook Inlet and NEGOA should be processed, and all data made available. Analysis of all archived samples will make it possible to better comprehend the seasonality of benthic infauna.

Selected members of the infauna should be chosen for intensive study as soon as possible so that basic information can be available for monitoring programs. Specific biological parameters that should be examined for each species selected are reproduction, recruitment, growth, age, feeding biology, and trophic interactions with other invertebrates and vertebrates.

The advantage of cluster analysis techniques, used to examine infauna, is that it provides a method for delineating station groups useful for developing monitoring schemes and delimiting areas that can be used in studies of trophic interactions. It is obvious that food webs will vary in areas with differing species assemblages. An inaccurate or even erroneous description of the shelf ecosystem could occur if trophic data collected on species from one station cluster (with its complement of species) is loosely applied to another area encompassing a totally different station cluster (with its differing complement of species). Thus, continuing development of clustering and other multivariate techniques should be pursued to refine methods so that the best approach is available to an offshore monitoring program.

It appears that temporal change in species groups at stations may lead to confusion in the interpretation of station groups if stations are always pooled in time. Williams and Stephenson's (1973) technique (species x time x sites) provides an excellent solution to this problem, but it requires that a study area be completely sampled at least three times per year. Additional sampling will be necessary to understand temporal variability of infauna.

The cruises on NOAA vessels for grab-sampling and dredging, and the extensive trawl program in lower Cook Inlet and NEGOA resulted in relatively good coverage of the benthos for invertebrates. The needs for the future are (1) the development of a monitoring plan, (2) acquisition of additional data on a seasonal basis inclusive of intensive sampling of stomachs of a diversity of species, and (3) assessment of the sediment - deposit feeder - predator relationships.

It is highly recommended that serious thought be given to the development of an extensive modeling effort in the northeastern Gulf of Alaska inclusive of Kodiak and Cook Inlet. The substantial body of data on trophic interactions of organisms of the benthos, collected by Feder (1977), Feder and Jewett (1977), and Smith *et al.* (1977) for this region, suggests that a sufficiently large data base may now be available to initiate such an effort or at least to convene workshops to assess the data base available for the development of a benthic model.

X. SUMMARY OF FOURTH QUARTER OPERATIONS

A. Ship or Laboratory Activities

1. Ship or field activities:

   a. No field activities in lower Cook Inlet or NEGOA for this quarter

2. Methods, results and discussion

   a. Analysis of all grab data from NEGOA was completed, and a Final Report is in the final stages of preparation.

   b. Stomach analyses of juvenile snow and king crabs, and nine species of shrimps from Cook Inlet are in progress.

   c. A thesis on the sand or gray shrimp *Crangon dalli* is now in its final stages of preparation.

   d. A major portion of this quarter was used in the preparation of the Annual Report and developing major sections for the Final Report.

   e. A summary report by Alaska Coastal Research (subcontract to R.U. #5) is in final stages of preparation, and will be included with the Final Report.

B. Problems Encountered

No major problems were encountered during this quarter.

C. Milestones

It is intended to maintain a consistent schedule for report preparation. Some of the reports will be subdivided into sections, each section to be submitted as it is completed. The latter procedure should increase the data flow and data interpretation available to OCSEAP. The schedule for report submissions and the Final Reports submitted are as follows:

1. Kodiak (Alitak and Ugak Bays) Final Report - Submitted November, 1977.
2. Norton Sound-Chukchi Sea Final Report - Submitted February, 1977.
3. Cook Inlet Summary Report - Submitted mid-March, 1978.
4. Bering Sea Epifauna Final Report - Submitted May 1978.
5. NEGOA Epifauna Final Report. I. - Submitted August 1978.
6. NEGOA Infauna Final Report - To be submitted May 1979.
7. Bering Sea Infauna Final Report - To be submitted June 1979.
8. Cook Inlet Final Report - To be submitted December 1979.
9. NEGOA Epifauna Final Report II - To be submitted October 1979.

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SECTION II

SUMMARY REPORT

KEY ORGANISMS IN BENTHIC FOOD WEBS AND THEIR RELATIONSHIP TO IMPORTANT HABITATS IN LOWER COOK INLET

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

It was the intent of this investigation to broaden the background on composition, distribution, and biology of the infaunal and epifaunal invertebrates of lower Cook Inlet. The specific objectives were: (1) a quantitative and qualitative inventory of dominant benthic invertebrate species, (2) a description of spatial distribution patterns of selected species, and (3) preliminary observations of biological interrelationships between selected segments of the benthic biota.

Much of the baseline data on infaunal and epifaunal species needed prior to onset of petroleum-related activities in lower Cook Inlet is now documented. The van Veen grab, the only quantitative infaunal sampling device used, was of limited value because the high proportion of sand in sediments generally impeded grab penetration. On the other hand, a pipe dredge, also used to sample the infauna, provided valuable qualitative data. Agassiz trawls, try-nets, and Eastern otter trawls made it possible to quantitatively sample the larger, more motile species.

In general, species composition decreased with larger sampling gear. Although only 13 stations were sampled with the van Veen grab, they yielded 211 species. The number of species taken by the small Agassiz trawl (149) exceeded the number taken by large Eastern otter trawl (53).

Biomass (g/m^2) from grabs and trawls were strikingly different. Use of trawls resulted in loss of infaunal and small epifaunal organisms, important components of the benthic biomass. Therefore, the total benthic biomass value is best expressed by combining both grab and trawl values.

Seventy-four percent of the species taken by grab were polychaetous annelids and molluscs; 56% of the pipe-dredge species were polychaetes and molluscs. Snow crabs (*Chionoecetes bairdi*) dominated the catches at most trawl stations. Based on the large numbers of juvenile snow crabs taken by trawl and found in fish stomachs in the deep-water region east of Cape Douglas, it appears that this ares is a major snow crab nursery ground. The importance of this crustacean in lower Cook Inlet is further emphasized by the existence of an intensive fishery for *C. bairdi* in lower Cook Inlet.

Food data for snow crab (*Chionoecetes bairdi*), king crab (*Paralithodes camtschatica*), Dungeness crab (*Cancer magister*), 9 species of shrimps, and 19 species of fishes are now available. The importance of deposit-feeding clams in the diet of king and snow crabs, and some bottomfishes is clear. It is suggested that comprehension of the relationship between oil, sediment, deposit-feeding clams, king and snow crabs is essential to understand the potential impact of oil on the latter two commercially important species.

Initial assessment of all data suggests that: (1) sufficient station uniqueness exists to permit development of monitoring programs based on species composition at selected stations utilizing grab, dredge, and trawl sampling techniques, and (2) adequate numbers of biologically well-known, unique, and/or large species are available to permit nomination of likely monitoring candidates once industrial activity is initiated.

II. INTRODUCTION

General Nature and Scope of Study

The operations connected with oil exploration, production, and transportation in Cook Inlet present a wide spectrum of potential dangers to the marine environment (see Olson and Burgess, 1967, for general discussion of marine pollution problems). Adverse effects of oil on the marine environment of these areas 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 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 Lewis, 1970; Nelson-Smith, 1973; Pearson, 1971, 1972; Rosenberg, 1973, for general discussions on benthic biological investigations in industrialized marine areas).

Benthic invertebrates (primarily the infauna, and slow-moving epifauna) are useful as indicator species for a disturbed area because they tend to remain in place, typically react to long-range environmental changes, and, by their presence, generally reflect the nature of the substratum. Consequently, 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). The presence of numerous benthic epifaunal species of actual or potential commercial importance (crabs, shrimps, fin fishes) in lower Cook Inlet emphasizes the need to understand benthic communities there since many commercial species feed on infaunal and small epifaunal residents of the benthos (see Zenkevitch, 1963; Feder, 1977a; Feder and Jewett, 1977; Jewett, 1978; Paul *et al.*, in press; and this report for discussions of the interaction of commercial species and the invertebrate benthos). Any drastic changes in density of the food benthos would directly impact 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 exploratory study, selected stations should be examined regularly on a long-term basis to determine any changes in species composition, diversity, abundance and biomass. Such long-term data acquisition should make it possible to differentiate between normal ecosystem variation and pollutant-induced biological alteration. Intensive investigations of the benthos of lower Cook Inlet are also essential to understand trophic interactions there and to predict changes that might take place once oil-related activities are initiated.

A benthic biological program in the northeast Gulf of Alaska (NEGOA) provided a qualitative and quantitative inventory of prominent species of the benthic infauna and epifauna there (Feder *et al.*, 1976; Jewett and Feder, 1976). In addition, investigations concerned with the biology of selected benthic species from NEGOA and the Kodiak shelf (Jewett and Feder, 1976; Feder and Jewett, 1977; Jewett, 1978) have furthered our understanding of the overall Gulf of Alaska benthic system (Feder, 1977a). Initiation of a program designed to examine the subtidal benthos of lower Cook Inlet expanded coverage of the Gulf of Alaska benthic system and extended the assessment of fauna of the Gulf into little-known shallow-water benthic systems. The study reported here is a preliminary examination of the sediment-dwelling benthic fauna of lower Cook Inlet, and is intended to precede a greater overall investigation of lower Cook Inlet (Feder, 1977b).

Relevance to Problems of Petroleum Development

The effects of oil pollution on subtidal benthic systems have, until recently, been neglected, and only a few studies on such systems, conducted after serious oil spills, have been published (see Boesch *et al.*, 1974; Malins, 1977; Nelson-Smith, 1973, for reviews; Baker, 1976, for a general review of marine ecology and oil pollution). Lack of a broad data base makes it difficult to predict the effects of oil-related activity on the subtidal benthos of lower Cook Inlet. However, the rapid expansion of Outer Continental Shelf Environmental Assessment Program (OCSEAP)-sponsored research activities in this body of water should ultimately enable us to point with some confidence to certain species, biological events, and areas that might bear closer scrutiny once industrial activity is initiated. It must be reemphasized 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.

As indicated previously, infaunal benthic 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; National Oceanic Data Center (NODC) data on file for examples of such stations). Changes in the environment at these stations might be reflected in a decrease in diversity of species with increased dominance of a few (see Nelson-Smith, 1973, for further discussion of oil-related changes in diversity). Likewise, stations with substantial numbers of epifaunal species should be assessed on a continuing basis. The potential effects of loss of species to the overall trophic structure in lower Cook Inlet can be partially assessed on the basis of benthic food studies (e.g. see, Jewett and Feder, 1976; Feder, 1977a; Feder and Jewett, 1977).

The snow crab (*Chionoecetes bairdi*) is a conspicuous member of the shallow shelf of lower Cook Inlet, and supports a commercial fishery of considerable importance there. 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). Few other direct data based on laboratory experiments are available for subtidal benthic species (Nelson-Smith, 1973; also see Malins, 1977). Experimentation on toxic effects of oil on other common members of the subtidal benthos should be strongly encouraged in lower Cook Inlet as well as for all Outer Continental Shelf (OCS) areas of investigation. In addition, potential effects of loss of sensitive species to the trophic structure of Cook Inlet must be examined.

A direct relationship between trophic structure (feeding type) and bottom stability has been demonstrated by Rhoads (see Rhoads, 1974, for review). He describes a diesel fuel spill that resulted in oil becoming adsorbed on sediment particles which in turn caused death of many deposit feeders living 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. Many common members of the infauna of lower Cook Inlet are deposit feeders; thus, oil-related mortality of these species could likewise result in a changed near-bottom sedimentary regime with subsequent alteration of species composition there. In addition, the commercially important king (*Paralithodes camtschatica*) and snow crabs (*Chionoecetes bairdi*), and some bottom fishes, use deposit-feeding invertebrates as food; also, varying amounts of sediment are found in the digestive tract of snow crabs (Feder, 1977a; Feder and Jewett, 1977) and other benthic Crustacea (data in present report). Thus, contamination of the bottom by oil might directly or indirectly affect these commercial species in lower Cook Inlet.

III. CURRENT STATE OF KNOWLEDGE

A compilation of data is available on commercially important shellfish of lower Cook Inlet. The U.S. Bureau of Commercial Fisheries (National Marine Fisheries Service) have conducted distribution and abundance surveys in this area on shrimps and crabs since 1958 (see references below). More recent investigations on larval and/or adult stages of shellfish species have been carried out (Hennick, 1973; ADF&G, 1976; Feder, 1977a). A detailed examination of the food of snow crabs from lower Cook Inlet is included in Paul *et al.* (in press).

The snow crab, *Chionoecetes bairdi* Rathbun, a common epibenthic invertebrate found in Cook Inlet has been commerically harvested there since 1968. The annual catches for the area from 1968 to 1976 ranged from 590 to 3600 metric tons. The 1975-76 Cook Inlet catch was worth approximately 1.3 million U.S. dollars to the fisherman (catch and price data-Allen Davis, Alaska Dept. of Fish and Game, Homer, Alaska, person. commun., 1976). Approximately 55% of the snow crab caught in the Inlet came from the Kamishak Bay area, 18% from the mouth of the Inlet, and 15% from the Kachemak area.

The king crab, *Paralithodes camtschatica*, is also commercially harvested in Cook Inlet, Alaska. Approximately 69% if the king crab are caught in the Kamishak Bay area with an additional 34% in the Kachemak Bay region. The remainder are captured near the mouth of the Inlet. Catches of king crab from the Inlet averaged 1,860 metric tons during 1971-1975 (Alaska 1976 catch and production statistical leaflet No. 28).

Dungeness crab occurs primarily in Kachemak Bay. Catches of Dungeness crab from Cook Inlet averaged 141 metric tons during 1971-1975 (Alaska 1976 catch and production statistical leaflet No. 28).

Data on non-commercial, benthic invertebrates are not as extensive as that available for commercial species in lower Cook Inlet (U.S. Bureau of Commercial Fisheries, 1958, 1961, 1963 cited in U.S. Dept. Inter., 1977; Feder, 1977a). Further studies on the interactions of selected benthic invertebrate species from lower Cook Inlet are currently underway (Feder, 1977b). Littoral zone studies have been conducted (Dames and Moore, 1977) and are being continued by Lees (1977).

IV. STUDY AREA

A station grid, in addition to several stations of opportunity, were established for benthic sampling in lower Cook Inlet (see Feder, 1977b and 1978a for stations occupied in 1976; Figs. 1, 2, 3 this report for stations on this grid occupied in 1977 and 1978; data for all stations are compiled in Appendix I).

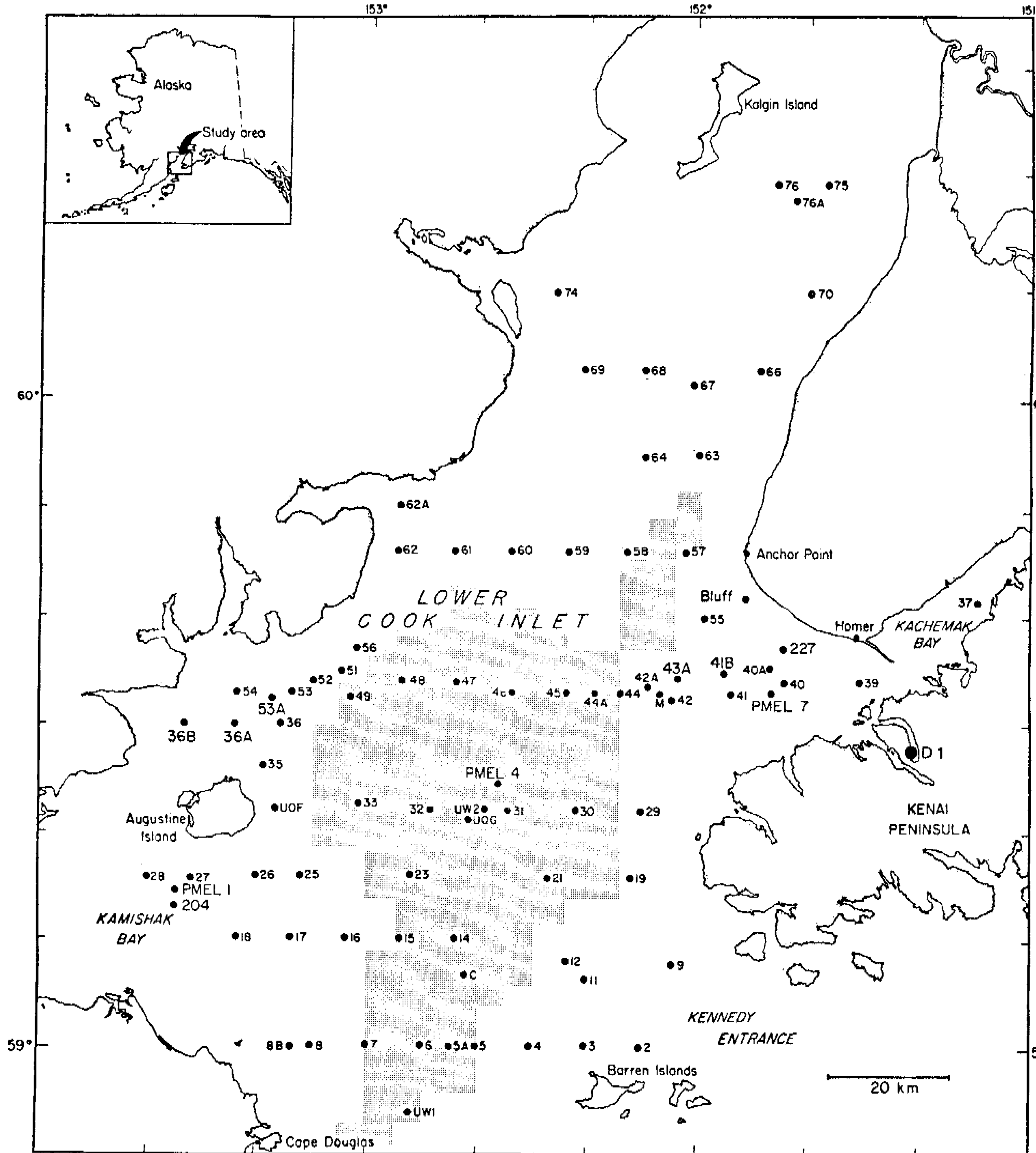


Figure 1. Lower Cook Inlet Benthic Stations occupied 1976-1978. The shaded portion represents the tract selection area.

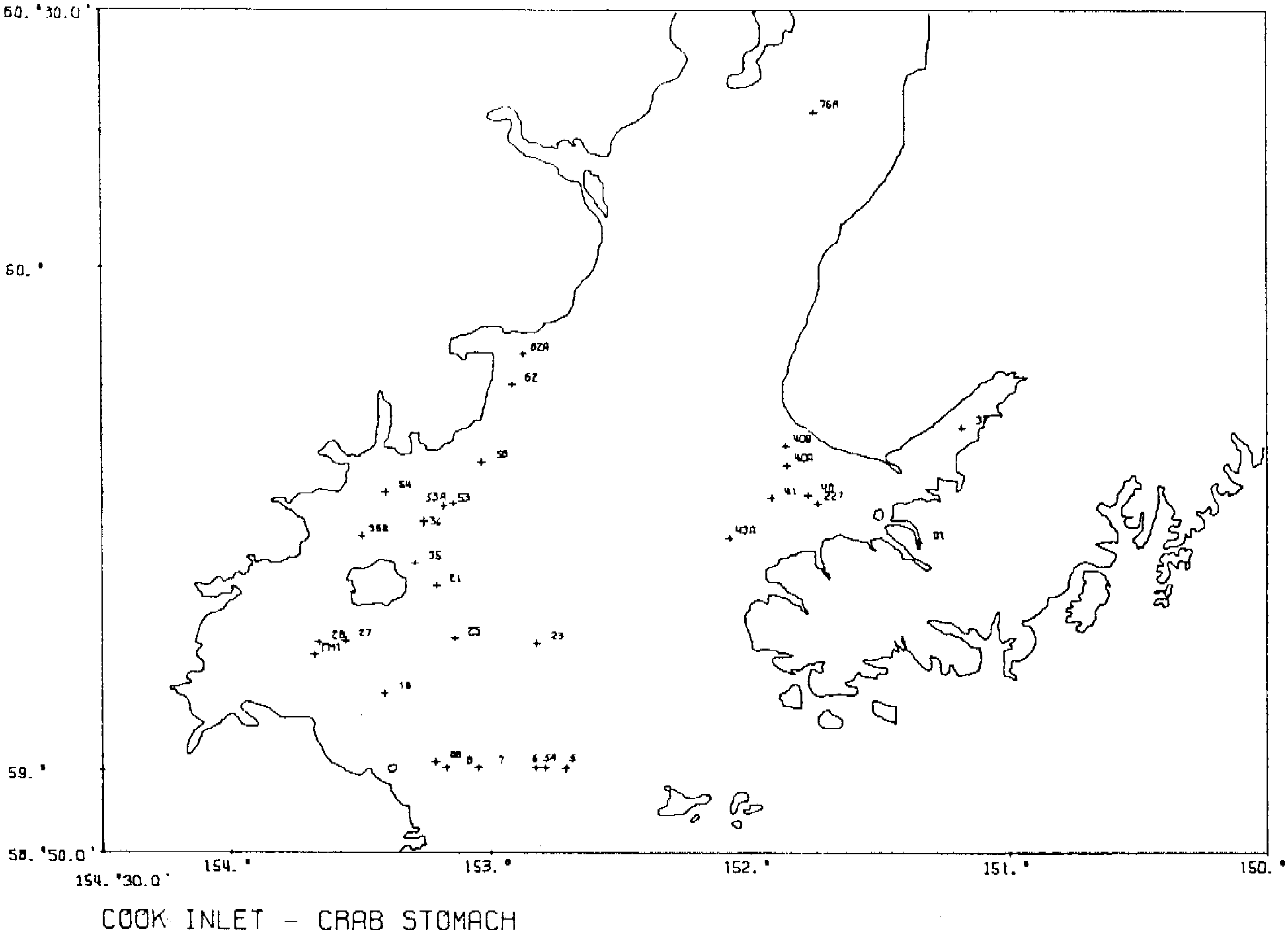
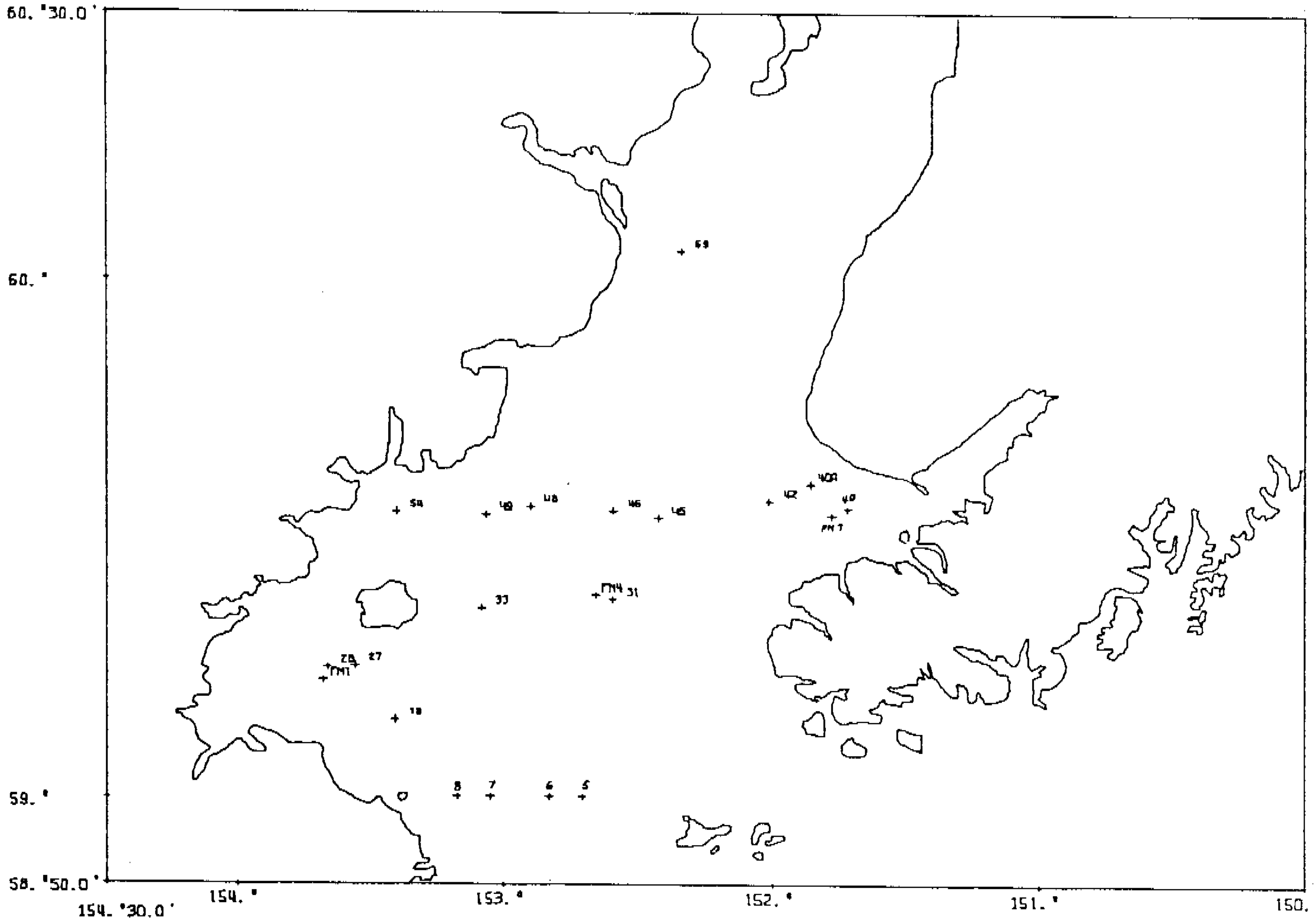


Figure 2. Locations of stations where snow crab, king crab and Dungeness crab were captured for stomach analysis.



COOK INLET - GRAB STATIONS

Figure 3. Lower Cook Inlet Grab Stations for which infaunal data available. All data will be included in Final Report.

V. SOURCES, METHODS, AND RATIONALE OF DATA COLLECTION

Benthic infauna and epifauna were collected aboard the R/V *Moana Wave* from March 30-April 15, 1976, and the NOAA Ships *Miller Freeman* and *Surveyor* on a series of cruises from October 1976 to July 1978. Sampling in 1976 was carried out using a 0.1 m^2 van Veen grab, a pipe dredge (36 x 91 cm), an Agassiz trawl (2.0 m horizontal opening), a try-net (3.7 m horizontal opening), and a clam dredge. Sampling in 1977-78 was conducted with a van Veen grab, pipe dredge, Agassiz trawl, 400-mesh Eastern otter trawl (12.2 m horizontal opening), and a clam dredge. The pipe dredge, try-net, clam dredge, and bottom skimmer were used for qualitative sampling only, while the van Veen grab, Agassiz and Eastern otter trawl data were treated quantitatively. Five or six grabs were generally obtained at selected stations. Sampling time for the Agassiz and Eastern otter trawls was usually 15 and 30 minutes, respectively.

Material from each grab was washed on a 1.0 mm stainless steel screen, and preserved in 10% formalin buffered with hexamine. Labeled samples were returned to the Marine Sorting Center, University of Alaska, where all organisms were identified, counted, and wet-weighed after excess moisture was removed.

The pipe dredge was used to, (1) determine if the van Veen grab was adequately sampling infauna; (2) provide additional infaunal data in areas where van Veen grabs could not penetrate properly; (3) provide specimens for comparison with items found in stomachs of crabs and fishes examined in feeding studies; and (4) collect large numbers of clams for age-growth investigations. Clams were removed from pipe-dredge samples, preserved in 10% buffered formalin, and shipped to the Seward Marine Station for examination. The remainder of the material from the dredge was examined in Fairbanks.

All invertebrates from trawls were sorted on shipboard, given tentative identifications, counted, weighed, and aliquot samples of individual species preserved and labeled for final identification at the Institute of Marine Science, University of Alaska.

After final identification, all invertebrate species were assigned code numbers to facilitate computer analysis of data (Mueller, 1975).

Representative and voucher samples of invertebrates were stored at the Institute of Marine Science, University of Alaska, Fairbanks, Alaska.

The crabs used for the feeding studies discussed in this report were taken by trawl from October 1976 to July 1978. Stations selected for detailed examination were those where crabs were abundant.

The stomachs of snow crab, king crab, Dungeness crab, and selected species of fishes were collected. Stomachs were removed immediately, fixed in 10% buffered formalin, and their contents examined with a dissection and/or compound microscope in the laboratory in Fairbanks. Prey organisms were counted and identified to the lowest possible taxon. If the number of prey could not be determined, contents were recorded as a single specimen of the food item. This was often the case with barnacles and occasionally bivalves. Crabs were separated by size, sex, and state of maturity. Male snow crabs with carapace widths greater than 110 mm were considered sexually mature (Brown and Powell, 1972). Female snow crabs were classified as immature (pre-reproductive) or mature (reproductive or post-reproductive) based on the enlarged abdomen, modified pleopods, and egg clutch of the adults (Yoshida, 1941). Food items were recorded as frequency of occurrence, in which prey items were expressed as the percent of the predator containing various food items relative to the total number of the predator analyzed.

The percent of fullness of snow crab stomachs was examined by injecting the stomachs with water until full, then emptying the contents into graduated centrifuge tubes, centrifuging and then determining the percent of total volume that consisted of stomach contents.

Stomach contents of snow crabs from selected stations were dried at 60°C, weighed and then digested with Potassium Hydroxide and redried to determine what percentage of the weight was animal and plant tissue (IBP Handbook 16). Next, large pieces of carapace were removed and the sample treated with concentrated hydrochloric acid to elimate calcareous shell and carapace fragments. The sample was redried to determine the weight of sediments present. Sediment weight determined by this method is somewhat conservative since carbonates naturally associated with the sediment are destroyed. Snow crabs were fed live *Macoma balthica* in the laboratory to determine typical prey consumption rates.

Sampling with dredges, grabs and trawls at each station made it possible to obtain information on potential prey of snow crab, and facilitated indentification of stomach contents.

In 1976 an extensive trawl survey of Cook Inlet was undertaken to determine distribution and abundance of benthic invertebrates (Feder, 1978a). This survey was utilized to determine critical habitats in the Inlet. Stations where king (*Paralithodes camtschatica*), and snow, (*Chionoecetes bairdi*), and Dungeness crabs, (*Cancer magister*), and pandalid shrimps were abundant were selected for continued study in 1977 and 1978. In addition, three stations established by Pacific Marine Environmental Laboratory (PMEL) and two by Oregon State University scientists were occupied to enable integration with these studies. The primary objective of the 1977 and 1978 trawling activities was to collect stomachs from the commercially important crustaceans and some of their major prey species. These data are necessary to determine key organisms in the benthic food web. Information on size distribution of the snow crab and the reproductive biology of this crab and other commercially important crustaceans was also obtained from the data.

The critical habitats for commercially important crustaceans include the areas where adults are captured by fisheries activities (summarized by ADF&G, 1976) and areas where juveniles, egg bearing females, and moulting individuals are found. Many of these areas were identified during the 1976, 1977-1978 surveys. However, other areas, not defined, probably exist because only a limited number of stations were occupied in the surveys.

VI. RESULTS - DISCUSSION

Important Habitats for Biologically Important Crustacea

All data reported here are primarily based on the 1977-78 survey (Feder, 1978a); some comparative data are included. Data from the 1976 surveys will be integrated with the 1977-78 survey in the Final Report.

Major concentrations of snow crabs were found primarily in the western part of lower Cook Inlet in all surveys. In terms of numbers, the largest catches occurred at stations 5(111 crab per km fished), 25

(100 per km fished), A53 (50 per km fished), 8 (43 per km fished), 18 (17 per km fished), A62 (15 per km fished), and 27 (11 per km fished), (Table I). At all other stations in the Inlet the average number captured in all trawls was less than 10 per km fished. In Kachemak Bay, snow crabs were most abundant at stations 41 and 40 with an average of 8 and 5 snow crabs per km fished (Table I).

The size-distribution data for snow crabs (Table II) indicate that the areas sampled are inhabited by size segregated populations. Snow crabs less than 20 mm carapace width were encountered primarily near the mouth of the Inlet and lower Kamishak Bay. Station 5 was the area where these small crabs were most abundant ranging from 7 to 414 per km fished. Station 8 (4 to 135 per km fished) and 25 (8 to 238 per km fished) also had significant numbers of these young crabs (Table II). The size distribution data suggest the existence of a nursery area for snow crabs that encompasses stations 5, 6, 7, 8, 18, 23, 25, 53, and A53 (Table II), and strengthens the qualitative assessment of 1976 that also indicated this region (in particular stations 5, 6, 7, and 8) to be a nursery ground for snow crabs (Feder, 1978a). Stations 6 and 23 are in the current lease area and the other stations, with the exception of 53 and A53, are directly in the path of prevailing currents which flow southward over the lease area. The absence of snow crabs less than 20 mm carapace width in the Kachemak Bay area is puzzling since the area supports a commercial fishery. Their absence in Kachemak Bay may be due to recruitment failure, or perhaps crabs move from the nursery area described above or from other nursery areas not discovered, to Kachemak Bay and other parts of the Inlet. Further observations on the distribution of these small crabs are necessary to determine the importance of nursery areas as a source of recruitment to Cook Inlet and the adjacent Gulf of Alaska.

Low numbers of sub-adult crabs 21 to 80 mm carapace widths, were encountered at all snow crab study stations (Table I). Perhaps snow crabs of this size range inhabits shallow waters not sampled. It is essential to know where this important size group of crab is located if the dynamics of this important species and its potential interaction with oil is to be comprehended.

TABLE I

MEAN NUMBER AND PERCENT OVIGEROUS KING, SNOW AND DUNGENESS CRABS CAPTURED IN ALL QUANTITATIVE TRAWLS IN 1977 AND 1978 IN LOWER COOK INLET

$\bar{x}$ = mean, km = kilometers, – = no specimens collected

Station Cook Inlet	King crab $\bar{x}$/km fished	King crab % of catch w/eggs	Snow crab $\bar{x}$/km fished	Snow crab % of catch w/eggs	Dungeness crab $\bar{x}$/km fished	Dungeness crab % of catch w/eggs
5	–	–	111	>1	1	–
6	–	–	6	17	–	–
8	–	–	43	>1	1	1
18	2	33	17	0	1	0
23	1	50	4	4	–	–
25	–	–	100	>1	–	–
27	8	39	11	8	–	–
28	–	–	5	0	–	–
35	20	7	8	0	–	–
36	1	0	22	3	–	–
A36	–	–	10	0	–	–
B36	2	0	34	0	–	–
37	2	50	3	7	3	0
38	–	–	2	0	–	–
A38	–	–	1	0	–	–
39	16	40	2	0	–	–
40	2	38	5	4	13	19
A40	9	20	1	25	8	2
41	1	20	8	69	6	3
B41	1	0	5	0	–	–
B43	29	18	–	–	–	–
A47	–	–	1	0	–	–
49	–	–	42	0	–	–
A49	–	–	6	0	–	–
Bluff	–	–	21	0	–	–
53	2	78	8	4	–	–
A53	2	50	50	1	–	–
54	2	33	7	13	–	–
55	2	0	–	–	–	–
56	–	–	7	5	–	–
A56	–	–	5	0	–	–
62	–	–	16	20	–	–
A62	–	–	15	2	–	–
B62	–	–	1	0	–	–
204	–	–	6	0	–	–
227	–	–	3	0	2	0
PME1	–	–	11	12	–	–
PME7	1	0	4	0	1	0

TABLE II

SIZE DISTRIBUTION OF *CHIONOECETES BAIRDI* FROM SELECTED TRAWLS FROM COOK INLET STATIONS. DATA FROM ALL QUANTITATIVE TRAWLS 1977 AND 1978

Data recorded as number of crabs; - = not sexed

Station	5-20 mm	21-80 mm	81+ mm	No. Male/Female Crabs 81 mm	Comments
5	1469	16	27	15/12	Large crabs have fungus growth
6	7	0	5	3/2	
8	248	0	2	2/0	
18	44	0	14	-	
23	22	0	3	-	
25	396	-	2	-	
40A	0	2	2	1/1	
41	0	1	79	7/37	Most crabs were old shell covered with barnacles
53	81	2	30	14/4	
53A	92	0	13	1/12	
62A	32	1	105	48/57	

Female snow crabs with eggs ready to hatch, moulting individuals, and old shell individuals between clutches constituted significant percentages of the catches at the following stations on the west side of the Inlet: station 62 (20%), PMEL 1 (12%), 54 (13%), 53 (4%), and 23 (4) (see Table I). Near the mouth of the Inlet at Station 6, 17% of the snow crabs captured were females with eggs. In Kachemak Bay 25% to 69% of the snow crabs captured were females with eggs. These areas must be considered critical habitats because moulting success of snow crabs and survival of their zoea are negatively affected by crude oil (Rice *et al.*, 1978). No newly moulted females or females with hatching eggs were collected during the study period 1977-78.

On the west side of lower Cook Inlet king crabs were most abundant at stations 35 (20 per km fished), and 27 (8 per km fished; see Table I). No king crabs were captured near the mouth of the Inlet in 1977 or 1978. In Kachemak Bay, king crabs were most abundant at stations 43 (30 per km fished), 39 (16 per km fished), A40 (9 per km fished) and 40 (2 per km fished). Juvenile king crabs did not make up a significant portion of any of the catch at the stations sampled. Over 95% of the king crabs captured were sexually mature individuals. No "pods" of juveniles were encountered. Soft-shell male king crabs were encountered in March at station 41, in May at station 54, and June at station PMEL 7. One grasping pair was captured in March at station 55. Soft-shell females were observed at station 53 in June and July, and station 35 in June. By June, the majority of the crabs captured had new carapaces. King crab eggs probably hatched in Kachemak Bay in April and May (Haynes, 1977).

Dungeness crabs were captured with regularity at stations 40 (13 per km fished), A40 (8 per km fished), and 41 (6 per km fished; see Table I). Females with eggs constituted 19%, 2%, and 3%, respectively, of the catch at these same stations. In August, 64 Dungeness crabs with carapace widths of 22 to 45 mm were captured at station A40. The remainder of the Dungeness crabs captured were generally over 100 mm in carapace width. In non-quantitative trawls taken in June, 99% (n= 45 ♀♀) of the mature females examined had egg clutches. In July, only one female (n= 36 ♀♀) with eggs was observed. Kachemak Bay must be considered as the most important habitat for Dungeness crab in Cook Inlet.

The pink shrimp (*Pandalus borealis*) was encountered in the greatest abundance at station 37, inner Kachemak Bay, where catches for all trawls in 1977 and 1978 averaged 926 per km fished (Table III). Highest concentrations in outer Kachemak Bay were observed at stations 227 (278 per km fished), PMEL 7 (202 per km fished) and 40 (167 per km fished). At station 62, near the mouth of Chinitna Bay, 123 per km fished were encountered in November. No areas where pink shrimps were abundant were observed in Kamishak Bay. Near the mouth of the Inlet at stations 5, 6, and 8, pink shrimps were observed at average population densities of 9, 11, and 35 per km fished. In Kachemak Bay hatching of pink shrimp eggs probably occurs in April and May (Haynes, 1977). The results of the survey indicate Kachemak Bay to be the major habitat for pink shrimp in Cook Inlet.

Humpy shrimp (*Pandalus goniurus*) was most abundant at station 56 in northern Kamishak Bay with an average of 792 per km fished (Table III). In the same area, stations A62 and A56, the average number captured was 275 and 125 per km fished. Near the mouth of the Inlet, 166 humpy shrimps were captured per km fished. In the Kachemak Bay area humpy shrimps were most abundant at stations 38 (301 per km fished), A38 (224 per km fished), and 37 (171 per km fished) all in the inner bay. Few humpy shrimps were encountered at any of the outer Kachemak Bay stations, less than 10 per km were fished. Hatching of humpy shrimp probably occurs in April and May in Kachemak Bay (Haynes, 1977). Based on this survey the critical habitats for humpy shrimp are northern Kamishak Bay, Chinitna Bay, and inner Kachemak Bay.

Coonstripe shrimp (*Pandalus hypsinotus*) was most abundant in inner Kachemak Bay. At stations 37, 38, and A38 catches of coonstripes averaged 176, 41 and 71 per km fished. Smaller numbers, 4 to 30 per km fished, were observed in outer Kachemak Bay. No large concentrations of coonstripe shrimps were observed at any of the other stations examined in Cook Inlet (Table III).

Sidestripe shrimp (*Pandalopsis dispar*) was also most abundant, an average of 15 per km fished, in inner Kachemak Bay station 37. Average catches of less than 10 per km fished were made in outer Kachemak Bay stations PMEL 7, 39, and station 8 near the mouth of the Inlet (Table III).

TABLE III

MEAN NUMBER OF PINK, HUMPY, COONSTRIPE AND SIDESTRIPE SHRIMPS CAPTURED IN TRAWLS IN COOK INLET, 1977 AND 1978

$\bar{x}$ = mean, km = kilometers, - = no specimens collected

Station Cook Inlet	Pink Shrimp $\bar{x}$/km fished	Humpy Shrimp $\bar{x}$/km fished	Coonstripe Shrimp $\bar{x}$/km fished	Sidestripe Shrimp $\bar{x}$/km fished
5	9	1	-	1
6	11	-	-	-
8	35	166	-	9
25	-	4	-	-
35	-	19	1	-
A36	-	10	-	-
37	926	171	176	15
38	65	301	41	-
A38	-	224	71	-
39	18	104	30	7
40	167	5	4	-
A40	-	-	10	-
41	1	-	-	-
49	-	36	-	-
A49	-	5	-	-
54	-	9	-	-
55	-	-	2	-
56	-	792	12	-
A56	-	125	-	-
C56	-	-	3	-
62	124	-	-	-
A62	-	275	-	-
B62	2	-	-	-
227	278	3	1	-
PMEL 7	202	24	19	5

Food of Snow Crab (*Chionoecetes bairdi*), King Crab (*Paralithodes camtschatica*), and Dungeness Crab (*Cancer magister*) in Cook Inlet

A detailed food survey of commercially important Crustacea and two of their major prey organisms was undertaken in order to identify the key species involved in the flow of carbon to these organisms which in turn, are utilized by man as food. The animals examined were snow, king, and dungeness crabs, hermit crabs, and pink, sidestripe, coonstripe, humpy, and crangonid shrimps. Examination of the food requirements of zoea larvae of snow and king crabs, and pink shrimp, and post larval king crabs is in progress. Data from the latter studies will be included in the Final Report.

Stations where crab stomachs were collected are presented in Figure 2.

Snow crab

Food occurred in 772 (64%) of 1198 *Chionoecetes bairdi* examined (Tables IV - VII). In the outer Kachemak Bay area, stations 40, 40A, and 41, small clams were the most frequently encountered prey, occurring in 33% of the stomachs. The clams *Spisula polynyma*, *Nucula tenuis*, and *Macoma* spp. occurred in 16%, 6%, and 4% of the stomachs, respectively. Hermit crabs were observed in 17% of the stomachs and barnacles in 14%. All other prey categories were observed in less than 10% of the stomachs. In inner Kachemak Bay, station 37, the dominant foods were the clam *Nuculana fossa*, which occurred in 7% of the stomachs, and polychaetous annelids found in 5% of them.

In Kamishak Bay, stations 18, 25, 27, 28, 35, 53, 56, PMEL 1 and E1, small bivalves occurred in 37% of the stomachs. Clams of the genus *Macoma* were the most frequently occurring clam found in 13% of the stomachs. Barnacles and hermit crabs were observed in 19% and 17% of the stomachs, respectively. All other categories of food were observed in less than 10% of the stomachs. Juvenile *Chionoecetes bairdi* were found in 4 stomachs at station 23 (Table IV).

In the outer district of the Inlet, stations 5, 5A, 8A, and 23, two food types dominated. Clams of the genus *Macoma* and hermit crabs were observed in 45% and 12% of the stomachs, respectively.

TABLE IV

FOOD OF COOK INLET SNOW CRAB, OCTOBER 1976. DATA RECORDED AS FREQUENCY OF OCCURRENCE OF FOOD ITEMS

Station	No. stomachs examined	No. stomachs with food	Polychaeta	Gastropoda	*Nucella lamellosa*	*Nuculana fossa*	*Yoldia hyperborea*	*Macoma* spp.	*Spisula polynyma*	*Tellina nuculoides*	*Serripes groelandicus*	*Astarte* spp.	Unidentified Bivalvia	Amphipoda	*Balanus* spp.	*Pandalus* spp.	Crangonidae	Paguridae	*Pagurus ochotensis*	*Chionoecetes bairdi*	Unidentified Crustacea	Ophiuroidea	Sediment
			PREY ITEMS																				
5A	38	23		1		5		19													1		
8B	24	14												4		2	2	4			1		
18	79	31				2	1	1			6				12		5	6					16
23	141	106	1					100		1		1			5			15		4			13
25	87	67	3					27				5	2		14		2	5	14	1			5
28	6	3						1										3			1		
40A	96	64	5	1	3				3				1		22			11	23			1	9
41	22	10							9						1		1						2
53	78	43	1					1					2		13		3	6	17		3		8
62A	104	54													6		14	11	30				6
76A	40	13													3		10		2				6
Total Frequency of Occurrence	715	428	10	2	3	7	1	149	12	1	6	6	5	4	76	2	37	61	86	5	6	1	65
Percent Frequency of Occurrence		60	1	0.3	0.4	1	0.1	21	2	0.1	1	1	1	0.5	11	0.3	5	9	12	1	1	0.1	9

TABLE V

FOOD OF COOK INLET SNOW CRAB, NOVEMBER 1977. DATA RECORDED AS FREQUENCY OF OCCURRENCE OF FOOD ITEMS

			PREY ITEMS																											
Station	No. stomachs examined	No. stomachs with food	Foraminifera	Polychaeta	Unidentified Bivalvia	*Solariella* sp.*	Unidentified Gastropoda	Scaphopoda	*Nucula tenuis*	*Nuculana fossa*	*Glycymeris subobsoleta*	Mytilidae	Pectinidae	*Astarte* spp.	*Cyclocardia* spp.	*Spisula polynyma*	*Macoma* spp.	*Balanus* spp.	Amphipoda	Crangonidae	*Pagurus ochotensis*	*Pagurus capillatus*	Unidentified Paguridae	*Cancer* spp.	Unidentified Crustacea	Unidentified tissue	Unid. plant material	Teleost scales	Eggs	Sediment
5	16	15	2	4				1										5		1			3			1				8
27	6	3					1		1							1									2	1				2
35	53	53	2		4	2	3		3	4	5			4	3	2	11	39	1	1	1		22		14	2	2	1		14
40	16	16	8	2	5	1	2		2				1			2	2				1			1	3	7	2			12
53	46	45	3		7	3	1		6	13				1	1	2	17	2			2		9		13	1		1	1	20
62 & 62A	23	14										1						9			1	1	4				1			3
Total Frequency of Occurrence	160	146	15	6	16	6	7	1	12	17	5	1	1	5	4	7	35	55	1	2	5	1	38	1	32	12	5	2	1	59
Percent Frequency of Occurrence		91	9	4	10	4	4	0.6	8	11	3	1	1	3	2	4	22	34	0.6	1	3	0.6	24	0.6	20	8	3	1	0.6	37

* The genus *Margarites* occurs in the area and may be included.

TABLE VI

FOOD OF COOK INLET SNOW CRAB, MARCH 1978. DATA RECORDED AS FREQUENCY OF OCCURRENCE OF FOOD ITEMS

Station	No. stomachs examined	No. stomachs with food	PREY ITEMS																					
			Hydrozoa	Bryazoa	Polychaeta	*Solariella* sp.*	Unidentified Gastropoda	Gastropoda eggs	*Nucula tenuis*	*Nuculana fossa*	*Yoldia* spp.	*Glycymeris subobsoleta*	*Serripes groenlandicus*	*Spisula polymyma*	*Macoma* spp.	Unidentified Bivalvia	*Balanus* spp.	Crangonidae	Pandalidae	Paguridae	Unidentified Crustacea	Teleost	Plant material	Sediment
5	4	3			1	1									2									
25	23	21	1			2					1	1		1	1	2	2			3	6		1	16
56	12	10		1	1															9				5
62A	48	39	1	1			1	1		1		2	1	1	1	3	1	8	1	20	2	2	1	
E-1	4	3	1						2														1	3
Total Frequency of Occurrence	91	76	3	2	2	2	2	1	2	1	1	3	1	2	4	5	2	8	1	32	8	2	3	24
Percent Frequency of Occurrence		84	3	2	2	2	2	1	2	1	1	3	1	2	4	6	3	9	1	35	9	2	3	26

* The genus *Margarites* occurs in the area and may be included.

TABLE VII

FOOD OF COOK INLET *CHIONOECETES BAIRDI*, JULY 1979. DATA RECORDED AS FREQUENCY OF OCCURRENCE OF FOOD ITEMS

Station	No. stomachs examined	No. stomachs with food	Foraminifera	Hydrozoa	Polychaeta	*Solariella* sp.*	Unidentified Gastropoda	*Nucula tenuis*	*Nuculana fossa*	*Spisula polynyma*	*Macoma* spp.	*Tellina nuculoides*	Unidentified Bivalvia	*Balanus* spp.	Cumacea	Amphipoda	*Crangon* sp.	Paguridae	*Oregonia gracilis*	*Pinnixa* sp.	Unidentified Crustacea	Ophiuroidea	Asidiacea	Unidentified tissue	Plant material
	PREY ITEMS																								
5	72	57			16	1	2		1		7					7	1	18	1		6		2	9	
27	39	8	1					2		5				2	1	1									2
37	15	9			5		2		7				2					2			2			1	
PMELI	21	17		1	4			8		9		1		1		3	1	3		1	1			1	
40	26	20	1		1	1	1	10	3	16	1			2		3		3			2	2			
41	43	8	1		1					5				4											
62A	6	3			1												1	2							
Total Frequency of Occurrence	232	122	3	1	28	2	5	20	11	35	8	1	2	9	1	14	3	28	1	1	11	2	3	11	2
Percent Frequency of Occurrence		52	1	0.4	12	0.8	2	9	5	15	3	0.4	0.8	4	0.4	6	1	12	0.4	0.4	5	0.8	0.8	5	0.8

* The genus *Margarites* occurs in the area and may be included.

Throughout Cook Inlet, snow crab stomachs with food commonly contained the remains of several barnacles or clams. In one stomach, 16 recently settled *Macoma* spp. were observed. Few stomachs contained more than one large crustacean. The total number of each prey, estimated primarily by counting hard parts of prey, is presented in Table VIII. These data must be considered qualitative since the estimates are made by counting shell and exoskeleton; soft, easily digested tissues are underestimated. Also, feeding observations in the laboratory have demonstrated that snow crabs may often eat the tissue of small bivalves without ingesting much of the shell (these observations will be discussed in more detail in the Final Report).

No difference was detected in the frequency of occurrence of prey in *Chionoecetes bairdi* of different sexes or sizes examined (Tables VIII - IX).

Barnacles, hermit crabs, crangonid shrimps, and small clams are widely distributed throughout lower Cook Inlet (see Feder, 1978a), and are fed upon by *Chionoecetes bairdi* in proportion to their abundance. Other species used for food are discontinuous in their distribution of lower Cook Inlet (Feder, 1978a). This discontinuous distribution, probably more than their acceptability as food, explains the infrequent occurrence of these species in snow crab stomachs.

Small amounts of sediment were observed in stomachs of crabs, from the three areas; however, sediment seldom contributed to more than 16% of the dried weight of stomach contents (Table X).

In the Kodiak area the most commonly encountered stomach contents were small clams, shrimps, plant material, and sediment (Feder *et al.*, 1977b; Feder and Jewett, 1977). In Cook Inlet plant material, possibly eelgrass, was only observed in one stomach.

Tarverdieva (1976) found in the southeastern Bering Sea that adult *C. bairdi* feed mainly on polychaetes (60-70%). Echinoderms were found in less than 10% of the stomachs, and mollusks play a large role only in feeding of the young (63%) which live separately from the adults. Commercial-size *C. opilio* feeds, as *C. bairdi*, mainly on polychaetes (more than 50% with respect to predominance), and the young and non-commercial part of the population feed on crustaceans (30-40%), polychaetes (20-30%, and mollusks 20%). Feder (1978b) reported polychaetes,

TABLE VIII

NUMBER OF PREY SPECIMENS IN SNOW CRAB STOMACHS
BY SIZE AND SEX, OCTOBER 1976

MF = mature female, MM = mature male, IF = immature female,
IM = immature male

Carapace Width	Number of Stomachs	Sex	Number of Prey in Stomachs	Number of Crab Feeding
Station 5A				
5 - 10	1	IM	Full of sediment	0
61 - 70	2	IM	No food	0
81 - 90	2	IM	Several *Nuculana fossa*	2
91 - 100	2	-	No food	0
101 - 110	2	IM	1 crustacean	1
111 - 120	6	MM	8 *Macoma* spp., 1 *Nuculana fossa*	6
121 - 130	4	MM	2 *Macoma* spp., 1 *Nuculana fossa*, 1 *Balanus* spp.	3
131 - 140	1	MM	Several *Macoma* spp.	1
141 - 150	3	MM	No food	0
71 - 80	2	MF	Several *Macoma* spp.	2
81 - 90	3	MF	Several *Macoma* spp.	3
91 - 100	2	MF	2 *Macoma* spp., 1 *Nuculana fossa*	2
101 - 105	1	MF	1 *Macoma* spp.	1
81 - 90	6	IF	3 *Macoma* spp.	3
91 - 100	2	IF	2 *Macoma* spp.	2
Total	39		Total	26
Station 8B				
5 - 10	4	IM	1 amphipod, 1 crustacean, sediment	2
11 - 20	3	IM	2 tissue, sediment	2
21 - 30	3	IM	1 amphipod, 1 Crangonidae	2
81 - 90	1	IM	1 Paguridae, 1 *Macoma* spp.	1
101 - 110	1	IM	1 Crangonidae	1
5 - 10	9	IF	2 amphipods, 1 tissue, sediment	3
11 - 20	2	IF	1 Natantia, 1 amphipod	2
21 - 30	1	IF	1 Paguridae	1
Total	24		Total	14

TABLE VIII

CONTINUED

Carapace Width	Number of Stomachs	Sex	Number of Prey in Stomachs	Number of Crab Feeding
Station 18				
61 - 70	6	IM	4 *Serripes groenlandicus*	2
71 - 80	16	IM	2 *S. groenlandicus*, 2 Paguridae 3 Crangonidae, 3 *Balanus* spp., sediment	11
81 - 90	19	IM	3 *S. groenlandicus*, 4 Paguridae, 2 Crangonidae, 2 *Balanus* spp., 1 *Pectinaria* spp., sediment	13
91 - 100	13	IM	1 *S. groenlandicus*, 4 *Balanus* spp.	5
101 - 110	15	IM	1 *Macoma* spp., 1 *Nuculana fossa*, 1 Crangonidae, 3 *Balanus* spp., sediment	7
111 - 120	7	MM	No food	0
121 - 130	2	MM	No food	0
141 - 145	1	MM	No food	0
Total	79		Total	38
Station 23				
61 - 70	1	IM	2 *Macoma* spp.	1
71 - 80	9	IM	1 *Yoldia hyperborea*, 17 *Macoma* spp.	7
81 - 90	42	IM	70 *Macoma* spp., 2 *Chionoecetes bairdi*	38
91 - 100	16	IM	13 *Macoma* spp., 1 *C. bairdi*, 1 polychaete, 2 Paguridae, sediment	16
101 - 110	11	IM	4 *Macoma* spp., 2 *Balanus* spp., sediment	7
111 - 120	9	MM	1 Paguridae, 1 *C. bairdi*, 1 *Balanus* spp. 1 Pelecypoda	4
121 - 130	7	MM	1 *Macoma* spp., sediment	1
131 - 140	1	MM	No food	0
141 - 150	2	MM	No food	0
161 - 165	2	MM	No food	0
81 - 90	17	MF	21 *Macoma* spp., 1 *Astarte* spp., 1 Pelecypoda, 1 Gastropoda, 3 Paguridae, sediment	15
91 - 100	12	MF	19 *Macoma* spp., 1 Pelecypoda, 1 Paguridae	9
101 - 110	3	MF	5 *Macoma* spp.	3
71 - 80	5	IF	6 *Macoma* spp.	3
81 - 90	4	IF	3 *Macoma* spp., sediment	3
Total	141		Total	107

TABLE VIII

CONTINUED

Carapace Width	Number of Stomachs	Sex	Number of Prey in Stomachs	Number of Crab Feeding
Station 25				
31 - 40	2	IM	1 *Macoma* spp.	1
61 - 70	2	IM	2 *Macoma* spp.	2
71 - 80	5	IM	1 *Macoma* spp., 1 *Astarte* spp., 1 *Pagurus ochotensis*	3
81 - 90	22	IM	7 *Macoma* spp., 6 *P. ochotensis*, 5 *Balanus* spp., 2 polychaetes, sediment	18
91 - 100	9	IM	2 *Macoma* spp., 4 *P. ochotensis*, 2 Paguridae, 2 *Balanus* spp.	10
111 - 120	3	MM	1 *P. ochotensis*, 1 Paguridae, 1 Crangonidae	3
121 - 130	5	MM	5 *Macoma* spp., 1 *Astarte* spp., 1 *Pandalus* spp., 2 amphipods, 1 polychaete	5
131 - 140	3	MM	1 *P. ochotensis*, 1 *Chionoecetes bairdi*	2
81 - 90	8	MF	2 *Macoma* spp., 1 *Astarte* spp., 1 *P. ochotensis*, 1 *Balanus* spp.	4
91 - 95	1	MF	1 Pelecypoda, sediment	1
21 - 30	3	IF	5 *Macoma* spp.	3
61 - 70	4	IF	2 *Macoma* spp., 1 *Balanus* spp., sediment	3
71 - 80	15	IF	7 *Macoma* spp., 1 *Astarte* spp., 1 Pelecypoda, 1 Paguridae, 1 *Balanus*	11
81 - 90	5	IF	24 *Macoma* spp., 1 Paguridae, 1 Crangonidae	5
Total	87		Total	71
Station 28				
91 - 100	2	IM	1 *Macoma* spp., 2 Paguridae, 1 *Balanus* spp.	2
111 - 120	4	MM	1 Paguridae	1
Total	6		Total	3

TABLE VIII

CONTINUED

Carapace Width	Number of Stomachs	Sex	Number of Prey in Stomachs	Number of Crab Feeding
Station 40A				
41 - 50	9	IM	1 Pelecypoda, 1 *Pagurus ochotensis*, 2 *Balanus* spp., 2 polychaetes, sediment	5
51 - 60	23	IM	11 *P. ochotensis*, 2 Paguridae, 5 *Balanus* spp., 2 polychaetes, sediment	18
61 - 70	30	IM	2 *Spisula polynyma*, 3 *Nucella* spp., 4 *P. ochotensis*, 5 Paguridae, 9 *Balanus* spp., 1 crustacean, 1 Ophiuridae, 1 tissue	22
71 - 80	3	IM	1 *P. ochotensis*, 1 Paguridae, 1 *Balanus* spp., sediment	2
81 - 90	3	IM	1 *P. ochotensis*	1
41 - 50	13	IF	1 *P. ochotensis*, 1 Paguridae, 3 *Balanus* spp., 1 polychaete	6
51 - 60	15	IF	3 *P. ochotensis*, 2 Paguridae, 4 *Balanus* spp., 1 plant material, sediment	10
Total	96		Total	67

TABLE IX

FOOD OF COOK INLET SNOW CRAB BY SIZE OF CRAB, NOVEMBER 1977.
DATA RECORDED AS FREQUENCY OF OCCURRENCE OF FOOD ITEMS

Stations 5, 27, 35, 40, 53, 62 & 62A	PREY ITEMS																													
Size of Crab (mm)	No. stomachs examined	No. stomachs with food	Foraminifera	Polychaeta	*Solariella* sp.*	Unidentified Gastropoda	Scaphopoda	*Nucula tenuis*	*Nuculana fossa*	*Glycymeris subobsoleta*	Mytilidae	Pectinidae	*Astarte* spp.	*Cyclocardia* spp.	*Spisula polynyma*	*Macoma* spp.	Unidentified Bivalvia	*Balanus* spp.	Amphipoda	Crangonidae	*Pagurus ochotensis*	*Pagurus capillatus*	Unidentified Paguridae	*Cancer* spp.	Unidentified Crustacea	Unidentified tissue	Unid. plant material	Teleost scales	Eggs	Sediment
0.0 - 9.9	7	6			2				1							3									5					4
10.0 - 19.9	31	29	1		1			3	9				1	1	1	9	4	5			1		6		5	1	1	2		16
20.0 - 29.9	51	46	2	4	2	3	1	3	2	5	1		2	2	2	7	2	29	1	1	1		19		5		1			14
30.0 - 39.9	18	18	3						1				2	1	1	5	2	11					7		9	1				7
40.0 - 59.9	2	2							1									1								1				
60.0 - 79.9	4	4	1	1		2		1				1			1	3	1				1				1					4
80.0 - 99.9	25	23	4	1	1			4	2						2	7	5	6		1	1		4	1	5	2				7
100.0 - 119.9	17	14	2			2		1	1							1	2	3			1	1	2		2	4	2		1	3
120.0	5	4	2																							3	1			4
Total Frequency of Occurrence	160	146	15	6	6	7	1	12	17	5	1	1	5	4	7	35	16	55	1	2	5	1	38	1	32	12	5	2	1	59
Percent Frequency of Occurrence		91	10	4	4	4	1	8	11	3	1	1	3	2	4	22	10	34	1	1	3	1	24	1	20	8	3	1	1	37

* The genus *Margarites* occurs in the area and may be included.

TABLE X

THE PERCENT FULLNESS OF STOMACH (%f), MEAN DRY WEIGHT (g) OF STOMACH CONTENTS ($\bar{x}$dw), PERCENT OF DRY WEIGHT PLANT AND ANIMAL TISSUE (%t), AND PERCENT SEDIMENT WEIGHT (%s) OF *CHIONOECETES BAIRDI*, COOK INLET, NOVEMBER 1977

Blanks indicate no specimens at size

Size of Crab	Station 5				Station 27				Station 35				Station 40				Station 53				Station 62, 62A			
(mm)	%f	$\bar{x}$dw	%t	%s	%f	$\bar{x}$dw	%t	%s	%f	$\bar{x}$dw	%t	%s	%f	$\bar{x}$dw	%t	%s	%f	$\bar{x}$dw	%t	%s	%f	$\bar{x}$dw	%t	%s
0 - 9																	-	.028	57	8				
10 - 19	6	.022	82	10					30	.030	60	6					34	.282	77	16				
20 - 29	23	.086	85	13					40	.042	60	13												
30 - 39									35	.176	78	10					29	.082	78	6				
40 - 59									11	.177	90	4												
60 - 79													30	.151	42	25								
80 - 99					8	.212	93	5					29	.213	44	31	19	.275	73	8	16	.135	59	8
100 - 119	0												78	.191	68	16	19	.284	79	10	6	.167	54	3
>120	0												13	.340	67	12	10	.114	83	2				

clams and ophiuroids as important food items for *C. opilio* in the southeastern Bering Sea.

Yasuda (1967) examined stomachs of *Chionoecetes opilio elongatus* Rathbun from Japanese waters, and found the most frequently occurring invertebrate prey to be brittle stars (*Ophiura* sp.), and young *C. opilio elongatus*, and protobranch clams. Polychaetes, shrimps, gastropods, scaphopods and flatfishes were also taken by *C. opilio elongatus*.

Polychaetes and gastropods were common in Cook Inlet but rarely preyed upon. It is possible that with a dissection microscope, often used in stomach analyses, very small polychaete fragments were not observed and that this group may occur more frequently in snow crab stomachs than reported. Brittle stars are relatively rare in the lower Cook Inlet. In Cook Inlet cannibalism was infrequent. Scaphopods and fishes were encountered in few *C. bairdi* stomachs.

A comparison of the percent fullness of stomachs of Cook Inlet snow crab at different times of day (Table XI) indicates that there are no definite day-night trends in the fullness of snow crab stomachs. These data also indicate the normal degree of stomach fullness encountered in fall, spring, and summer collections. Data on percent fullness of stomachs, average dry weight of stomach contents, and percent tissue weight of stomach contents is presented in Table X. In the laboratory, total clearance of the stomach required 3 days (Table XII). In the laboratory consumption of *Macoma balthica* tissue by snow crab averaged 4.2% and 3.4% of total live weight and total dry weight of snow crab, respectively (Table XIII). These data may be useful in indicating a change in feeding habits resulting from a change in the environment, such as the addition of oil.

King crab

A total of 117 king crab stomachs were examined from Kamishak Bay, 90% contained food. The mean carapace length of all crab examined was 105 mm with a range of 35-150 mm. The three most frequently observed individual foods were barnacles, 81%; bivalves of the family Mytilidae, probably *Modiolus* sp., 13%; and hermit crabs, 12%. In addition, 17 other categories of food items were observed; none occurred in more than

TABLE XI

A COMPARISON OF PERCENT FULLNESS OF STOMACHS OF COOK INLET SNOW CRAB AT DIFFERENT TIMES OF CAPTURE

$\bar{x}$ = mean, N = number

Time/day	$\bar{x}$ % Fullness	Station	N
November 1977			
0130	55	53	42
0500	37	40	16
1900	34	35	47
2140	7	5	16
2140	8	27	3
2320	10	62, 62A	10
March 1978			
0000	28.6	62A	6
0335	50.0	62A	4
0740	60.0	62A	1
0815	38.1	25	21
1040	25.0	62A	1
1206	60.2	62A	6
1402	100.0	62A	1
1440	62.8	62A	2
1537	45.0	62A	2
1700	50.0	62A	2
2206	72.2	62A	3
July 1978			
0530	14	40	18
1100	5	37	6
1430	24	PMEL1	12
1800	54	62A	2
1800	15	5	46

TABLE XII

PERCENT FULLNESS OF STOMACHS OF *CHIONOECETES BAIRDI* AFTER FEEDING IN THE LABORATORY (5°C)

N = Number of specimens examined

Time After Feeding (hrs)	N	Mean Carapace Width (mm)	Mean Percent Stomach Fullness	Standard Deviation
Experiment 1				
24	5	62	11.0	6.8
32	5	51	5.6	2.4
44	5	55	6.7	5.1
56	5	53	3.4	3.2
80	5	52	1.5	0.5
Experiment 2				
24	5	47	7.3	2.3
48	5	43	4.8	2.8
72	5	45	2.4	1.1

TABLE XIII

CONSUMPTION OF *MACOMA BALTHICA* BY *CHIONOECETES BAIRDI* OVER A TWENTY-FOUR HOUR PERIOD

$\bar{x}$ = mean, N = number of specimens

$\bar{x}$ Carapace Width (mm)	N	Whole Crab Weight (g)	Mean *Macoma* Meat Weight Eaten (g)	Standard Deviation	*Macoma* Meat as % Crab Weight
Wet Weight Basis					
42	5	19.5	1.630	1.2337	8.4
50	4	35.2	0.7422	0.2672	2.1
51	5	35.2	0.9917	0.5408	2.8
72	2	107.5	3.6918	1.7976	3.4
					$\bar{x}$ 4.2
Dry Weight Basis					
42	5	5.4	0.4315	0.3266	7.9
50	4	9.3	0.0915	0.3929	1.0
51	5	10.2	0.2917	0.1591	2.9
72	2	30.1	0.5067	0.2466	1.7
					$\bar{x}$ 3.4

6% of the stomachs. Bivalves (clams), all species combined, occurred in 27% of the stomachs, and gastropods were found in 12% of the stomachs (Table XIV). In May, 41% of the crabs with empty stomachs were newly molted or molting individuals.

Stomachs from crabs in Kamishak Bay generally contained only barnacle remains. Eighteen king crabs collected at station 35 in November 1977 had full stomachs, and were feeding exclusively on the barnacles, *Balanus crenatus*. The contents of these stomachs were digested in KOH and barnacle shell weights remaining after KOH digestion and rinsing with distilled water determined. The average shell and meat weights of 100 barnacles taken from the same trawls, were determined in a similar manner. An estimation of the average number of barnacles, based on shell weight, in each stomach was made. The stomachs contained the equivalent of 11.2 (s.d. = 7.4) barnacles per crab. The average wet meat weight for the eleven barnacles would be 2g.

In Kachemak Bay, 113 king crabs were captured, 72% contained food. Bivalves, all species together, occurred in 60% of the stomachs. The clam, *Spisula polynyma*, was the most frequently occurring prey species, observed in 38% of the stomachs. Barnacles were found in 14% of the stomachs. The snail, *Neptunea lyrata*, occurred in 11% of the stomachs (Table XV). By examining shell thickness and sizes of resilium or cardinal teeth of *Spisula polynyma* shells in stomachs, it was possible to estimate sizes and age of the clams eaten (see Feder, 1978a clam-aging methodology and data). In the 43 king crab stomachs containing *S. polynyma*, 13 had large clam meats and pieces of shell 1 to 2 mm thick. *Spisula* with shells this thick would exceed 80 mm in shell length and be seven years of age or older. Shells of *S. polynyma*, probably less than 10 mm in length (young of the year or one year old clams) occurred in 30 stomachs. Pieces of *Neptunea lyrata* opercula up to 15 mm in length were found in the stomachs of adult crabs.

In contrast to Kamishak Bay, king crab in Kachemak Bay, generally contained the remains of a variety of organisms. For example, one specimen contained 21 small *Spisula polynyma*, 2 *Solariella* sp. (snail), 1 *Oenopota* sp. (snail), and *Balanus* sp. shell.

TABLE XIV

FOOD OF *PARALITHODES CAMTSCHATICA* FROM KAMISHAK BAY, COOK INLET, ALASKA.
DATA RECORDED AS FREQUENCY OF OCCURRENCE OF FOOD ITEMS

				PREY ITEMS																			
Station	Date month/year	No. stomachs examined	No. stomachs with food	Hydrozoa	Bryozoa	Polychaeta	*Solariella* sp.*	*Polinices* spp.	*Neptunea lyrata*	Unidentified Gastropoda	Gastropod eggs	*Nucula tenuis*	*Nuculana fossa*	*Glycymeris subobsoleta*	Mytilidae	*Macoma* spp.	*Tellina nuculoides*	Unidentified Bivalvia	*Balanus* spp.	Amphipoda	Paguridae	Unidentified Crustacea	Plant material
18	6/78	5	5				4	1		1		2	1	2		1			5	1	1		
27	6/78	30	30	2	1		1			1	2				14		1	1	30		9		
35	11/77	36	36			1			1	1			1	1	1				29		1		1
35	5/78	22	17										2						17				1
35	6/78	13	13	1				1		1			1					1	13		3		
36	5/78	3	1													1			1				
36B	5/78	2	0																				
53	11/77	3	3						1	1			2							1		1	
54	5/78	3	0																				
Total Frequency of Occurrence		117	105	3	1	1	5	5	5	5	2	2	7	3	15	2	1	2	95	2	14	1	2
Percent Frequency of Occurrence			90	3	1	1	4	2	2	4	2	2	6	3	13	2	1	2	81	2	12	1	2

* The genus *Margarites* occurs in the area and may be included.

TABLE XV

FOOD OF *PARALITHODES CAMTSCHATICA* FROM KACHEMAK BAY, COOK INLET, ALASKA.
DATA RECORDED AS FREQUENCY OF OCCURRENCE OF FOOD ITEMS

Station	Date month/year	No. stomachs examined	No. stomachs with food	Foraminifera	Hydrozoa	Bryozoa	Polychaeta	*Solariella* sp.*	*Neptunea lyrata*	*Oenopota* spp.	Unidentified Gastropoda	Gastropod eggs	*Nucula tenuis*	*Nuculana fossa*	*Glycymeris subobsoleta*	*Modiolus modiolus*	*Chlamys* spp.	*Clinocardium ciliatum*	*Spisula polynyma*	*Macoma* spp.	*Tellina nuculoides*	Unidentified Bivalvia	*Balanus* spp.	Amphipoda	*Pandalus* spp.	Paguridae	Unidentified Crustacea	Ophiuroidea	Asteroidea	Unidentified tissue	Plant material
				PREY ITEMS																											
40	6/78	1	1						1		1							1								1		5			
40	7/78	35	29	1		1	3	6	2	9	1		3	3		2			26	2			2	1	9	1	1				
40A	6/78	42	36	2	8			2	8		3				1	2	1	1	13	2		1	9				3	1		2	3
40B	6/78	3	2		1	1	1	1	1		1	1					1		1			1	1					1			
41	6/78	2	2	1			1												2				1			1			1		
43A	3/78	28	10	1	8	1										1					1	1	3			5			2		1
227	8/78	2	1											1					1											1	
Total Frequency of Occurrence		113	81	5	17	3	5	9	12	9	6	1	3	4	1	5	2	2	43	4	1	3	16	1	9	8	4	7	3	3	4
Percent Frequency of Occurrence			72	4	14	3	4	8	11	8	5	1	3	4	1	4	2	2	38	4	1	3	14	1	8	7	4	6	3	3	4

* The genus *Margarites* occurs in the area and may be included.

Sixteen king crabs were captured at station 6 near the mouth of the Inlet. In the 12 that contained food, 10 had eaten *Nuculana fossa*. These stomachs contained between 10 and 25 of these small bivalves. Clams of the genus *Macoma* occurred in 4 stomachs, and one crab had unidentifiable crustacean remains.

Tarverdieva (1976) provides information on feeding of king crabs from Bristol Bay, Alaska. There, echinoderms and molluscs were the predominant food items occurring in 50% and 35% of the stomachs respectively. Feder (1978b) observed *Chionocardium ciliatum* in 67%, *Solariella* spp. in 55%, *Naculana fossa* in 50%, *Cistenides* sp. and brittle stars of the family Amphiuridae in 35% of 124 king crab stomachs from the southeastern Bering Sea. Takeuchi (1968a, b) examined the food of king crabs from the Kamchatka region of Japan, and found that molluscs, crustaceans, and echinoderms were the main food items. Takeuchi (1967) found that the frequency of occurrence of the above prey groups in crab stomachs corresponded to the relative abundance of these organisms. In Cook Inlet, barnacles, clams, snails, and hermit crabs are widely distributed (Feder, 1978a), and are fed upon in proportion to their abundance. At the stations examined, small echinoderms were relatively rare (Feder, 1978a).

Dungeness crab

Food occurred in 331, 80%, of the 413 Dungeness crab stomachs examined (Tables XVI and XVII). The average shell width of the Dungeness crabs examined was 142 mm with a range of 22 to 210 mm. The individuals over 50 mm carapace width preyed primarily on small bivalves, barnacles, and amphipods (Table XVI). Small clams were the most important food items, present in 67% of the stomachs. The clam *Spisula polynyma* was the most frequently occurring species, observed in 48% of the stomachs. All other prey species occurred in less than 5% of the stomachs examined.

In 93% of the *Cancer magister* stomachs containing *Spisula polynyma*, the shell fragments belonged to clams probably less than 10 mm in shell length (young of the year or one-year old clams). By counting the number of umbos or hinge ligaments present, it was possible to make an estimate of the number of small *S. polynyma* present in some stomachs. The maximum

TABLE XVI

FOOD OF *CANCER MAGISTER* WITH CARAPACE WIDTH GREATER THAN 50 mm FROM COOK INLET, ALASKA

Station	Date month/year	No. stomachs examined	No. stomachs with food	Foraminifera	Hydrozoa	Bryozoa	Polychaeta	*Solariella* sp.*	*Natica* sp.	*Neptunea lyrata*	Unidentified Gastropoda	*Nucula tenuis*	*Nuculana fossa*	*Glycymeris subobsoleta*	*Modiolus modiolus*	*Chlamys* spp.	*Clinocardium ciliatum*	*Spisula polynyma*	*Macoma* spp.	*Tellina nuculoides*	Unidentified Bivalvia	*Balanus* spp.	Amphipoda	*Pandalus* spp.	*Crangon* spp.	Paguridae	*Chionoecetes bairdi*	Unidentified Crustacea	Ophiuroidea	Teleost	Unidentified tissue	Plant material
																	PREY ITEMS															
40	7/78	25	18						1		1		6					11	1	1	8	1			1	1			1			
40	8/78	52	40							1		10	7					33			6	1	1	1	1	1			2	1		
40A	12/77	18	12	3			2	3										9	1			2				1			2			
40A	6/78	132	104	5	1	1	5	2						3		6		80	3		5	2	10	10			1	6	3	4	2	
40A	7/78	9	5	4			1											2				3	1									
40A	8/78	6	5	1			1	1										2					2	2						1		
41	6/78	3	3															3														
41	7/78	22	21	1			1		1									9		1		10	1			2						
41	8/78	13	8	2														5			1	3			1	1						
227	8/78	6	2															1							1							
D1	6/78	63	33	1			6								7		4	13				17	6			9		4		2	6	4
Total Frequency of Occurrence		349	251	17	1	1	16	6	2	1	1	10	13	3	7	6	4	168	5	2	20	39	21	14	4	15	1	10	8	8	8	4
Percent Frequency of Occurrence			72	4.8	<1	<1	4	2	<1	<1	<1	3	4	1	2	2	1	48	1	<1	6	11	6	4	<1	4	<1	3	2	2	2	1

* The genus *Margarites* occurs in the area and may be included.

TABLE XVII

FOOD OF *CANCER MAGISTER* WITH CARAPACE WIDTHS OF 22-45 mm FROM COOK INLET, ALASKA

Station	Date month/year	No. stomachs examined	No. stomachs with food	Foraminifera	Polychaeta	*Solariella* sp.*	Unidentified Gastropoda	*Nucula tenuis*	*Spisula polynyma*	*Tellina nuculoides*	Unidentified Bivalvia	*Balanus* spp.	Amphipoda	Paguridae	Unidentified Crustacea	Unidentified tissue	Sand
		PREY ITEMS															
40A	8/78	64	51	23	18	2	1	1	9	1	6	18	1	8	2	2	27
Total Frequency of Occurrence		64	51	23	18	2	1	1	9	1	6	18	1	8	2	2	27
Total Frequency of Occurrence			80	36	28	3	2	2	14	2	9	28	2	13	3	3	42

* The genus *Margarites* occurs in the area and may be included.

number countable was 125 young clams. The meats of large *S. polynyma* and pieces of shell 1 to 2 mm thick were observed in 29 stomachs.

In the one sample of *Cancer magister* composed of crabs with carapace widths or 22 to 44 mm (Table XVII), the most frequently occurring animals were: Foraminifera, 36%; Polychaeta, 28; barnacles, 28%; and small clams 25%. The individuals with empty stomachs were generally in a newly molted or molting condition.

In a northern California study, the five most frequently observed categories of prey for *Cancer magister* were: clams, 35%; fishes, 24%; isopods, 17%; amphipods, 16%; and razor clams (*Siliqua patula*), 12% (Gotshall, 1977). Butler (1954) examined *C. magister* from British Columbia, Canada, and found that crustaceans (59%) and clams (56%) were the most frequently occurring food items. Butler (1954) reported fish remains in only 4 Dungeness stomachs.

The results of the previous two studies are similar to our data in that all three investigations show that clams and several kinds of crustaceans are important as prey for *Cancer magister*. The major difference between the studies is the importance of fishes in the diet of northern California Dungeness crabs, and the low frequency of occurrence of fishes in crab diets in British Columbia and Cook Inlet. Isopods or razor clams were rarely encountered in grabs or dredges in Cook Inlet. The mollusc most commonly taken by dredging and in the stomachs of other predators in the study area, was *Spisula polynyma*. Therefore, the high incidence of predation on this species is probably a reflection of its abundance.

VII. CONCLUSIONS

The trawl surveys of 1977-78 extend the data collected in 1976 for important habitats of commercially-harvested Crustacea in lower Cook Inlet (Feder, 1978a). In 1977-78, snow crabs were most abundant on the western side of the Inlet in Kamishak Bay (15 to 100 crab per km fished). Catches were less than 10 snow crab per km fished at all other stations trawled in the Inlet. Snow crabs less than 20 mm carapace width (i.e. juveniles) were found only in outer Kamishak Bay and between Cape Douglas and the Barren Islands. This apparent snow crab nursery area includes parts of the lease area. Few snow crabs of 20 to 80 mm carapace widths were captured at any of the stations occupied. The areas that this size grouping inhabit are currently unknown.

The important habitats, based on abundance, for king crabs were in Kamishak Bay Stations 35 and 27 and Kachemak Bay Stations 43, 39, 40 and A40. Dungeness crabs were observed only in mid-Kachemak Bay Stations 40, A40, and 41. With the exception of a large number of humpy shrimp captured in northern Kamishak Bay, Station 56, the major concentrations of pink, humpy, sidestripe and coonstripe shrimps were found in inner Kachemak Bay; lesser numbers of these shrimps were observed in mid-Kachemak Bay.

The areas discussed above must be considered among the known important habitats for commercially harvested crustaceans in Cook Inlet. Furthermore, Cook Inlet crude oil negatively affects survival of the zoea of these commercial Crustacea and the moulting success of juvenile snow crabs (Rice *et al.*, 1976). Oil input in these important habitat areas could be damaging to adult stocks if a spill occurred (1) at the period of peak larval abundance in the upper layers of the water column, or (2) shortly after settlement and metamorphosis of young on the bottom.

The most frequently observed prey types in snow crab stomachs were small bivalves (especially *Macoma* spp., *Spisula polynyma, Nacula tenuis, Naculana fossa*), hermit crabs and barnacles. These same organisms as well as mussels and the snail *Neptunea lyrata* were found to be important prey for king crabs, Dungeness crabs fed primarily on young individuals of the clam *Spisula polynyma*. The results indicate that small bivalves, barnacles, and hermit crabs are key species in the food webs of the commercially important crabs of lower Cook Inlet. No data concerning the effect of Cook Inlet crude oil on the bivalves, barnacles, and hermit crabs utilized as food by the commercially important crabs is available. Work by D. Shaw (person. commun; unpub. data), Shaw *et al* (1976), and Feder *et al.* (1976) indicate that the survival rate, condition index, filtering rate, growth, and burrowing behavior of *Macoma balthica* are negatively affected by Prudhoe Bay crude oil.

The Final Report for lower Cook Inlet will include a complete analysis of clam growth, growth history, natural mortality rates, age-size-meat weight-carbon values, and biomass by station for selected species of clams. Estimates of secondary productivity of clams were restricted to 1976 preliminary observations only; curtailment of funds and the field program in 1978-79 precluded completion of this task. Grab data including species composition, biomass and diversity will be available for 24 stations (Fig. 3). These stations are either in the current lease area, areas where commercially important benthic organisms were encountered in the trawl survey, or represent PMEL detritus-trap stations (J. Lawrence, PMEL, person. commun.). These stations will be grouped into 7 areas: inner Kachemak Bay, mid-Kachemak Bay, outer Kachemak Bay, central zone, lower Kamishak Bay, upper Kamishak Bay, and outer region (Fig. 4). When possible, distribution of feeding types and biomass will be integrated, with information on detrital deposition rates and bacterial activity levels available from other OCSEAP projects in lower Cook Inlet.

The trawl data will be regionalized in the same manner as the grab data (Figs. 2, 3, 4). The results of the trawl survey will include mean (and standard deviations) of numbers and weights of individuals by species for each station occupied. The data will be a summarization for all quantitative data collected at stations between April 1976 and August 1978. Information on size distribution for snow crab and distribution of egg-bearing females will be available for all commercially important crustaceans. Data on nursery areas for snow crabs located in lower Cook Inlet will also be available.

A major goal of the Final Report for lower Cook Inlet will be a description of critical habitats and periods of vulnerability of key invertebrates to oil pollution. A first assessment of some of these critical habitats is included in this Annual Report.

Food data beyond that which occurs in the Annual Report, i.e. snow crab, king crab and Dungeness crab data, will be available for six species of hermit crabs, three species of crangonid shrimps, five species of pandalid shrimps, and several species of fishes. Feeding observations will also be extended to cover the zoea larvae of king crab, snow crab, and pink shrimp in the laboratory. Relative to the latter studies, data will be available on prey concentrations necessary for successful feeding response of these zoea. These data are necessary to analyze food availability as a factor affecting survival of larvae of the above species. Information on post-larval king

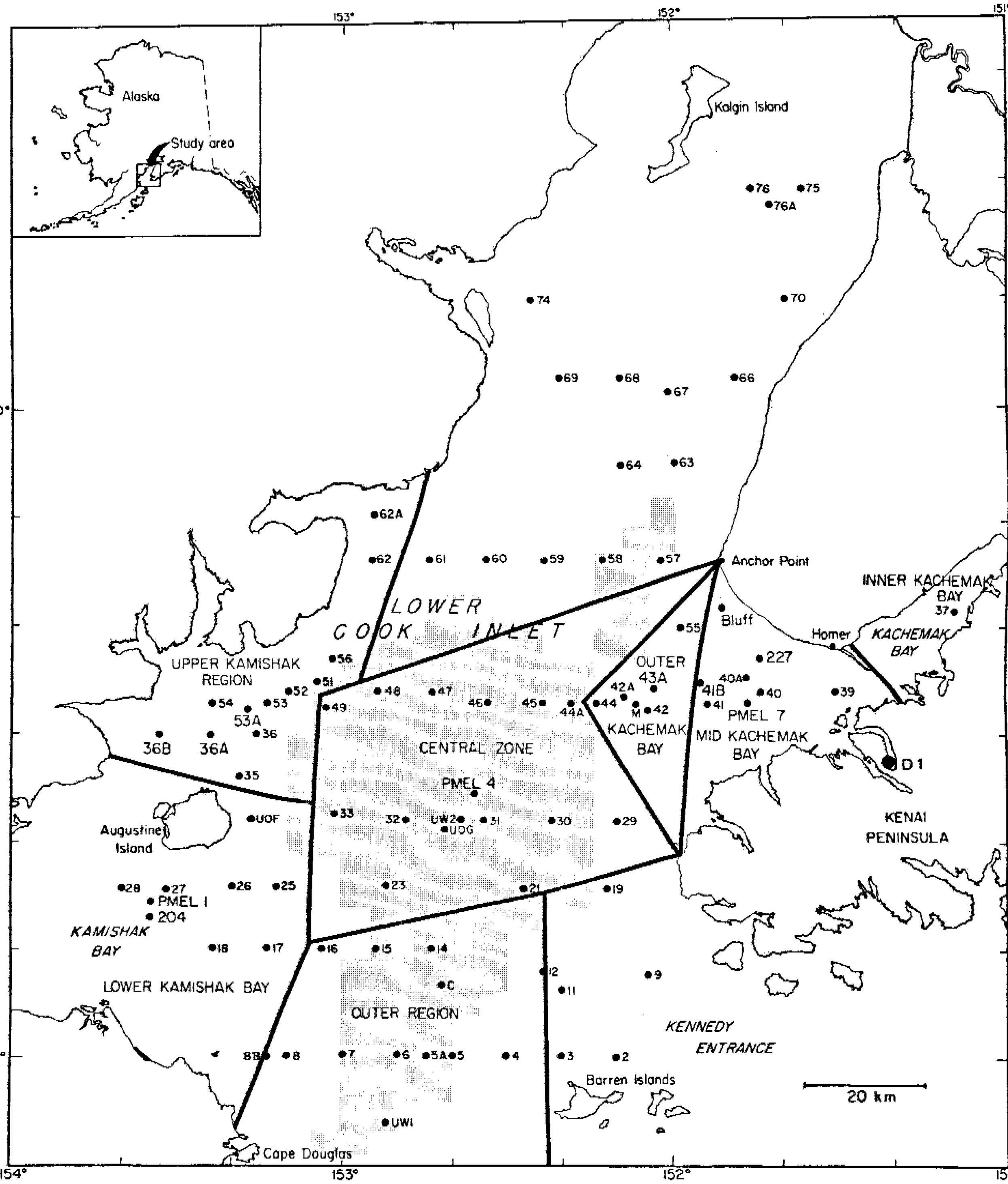


Figure 4. Lower Cook Inlet Benthic Trawl Stations and regions for grouping data for 1976, 1977 and 1978.

crab collected by Alaska Department of Fish and Game from Kachemak Bay will also be included in the Final Report.

Limited laboratory observations amd experiments on reproduction, molting, and feeding of snow and king crabs will be available. Data for this part of the study will be limited since laboratory work was eliminated from the 1978-1979 project period, and these observations and experiments were not initiated until late 1978.

VIII. NEEDS FOR FURTHER STUDIES

Suggestions for further work in Cook Inlet are included in the 1979 Annual Report, Section I of this document.

In addition, the following studies are highly recommended:

1. Examine juvenile snow crab feeding habits.
2. Find nursery areas for snow crabs on the east side of Cook Inlet.
3. Examine small bays throughout Cook Inlet for crab and shrimp distributions, abundance, and reproductive activities.
4. Initiate a major program to understand recruitment and natural mortalities in crab and shrimp populations in Cook Inlet.

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APPENDIX I

LOWER COOK INLET BENTHIC STATIONS OCCUPIED 1976-1978

Station Name	Latitude	Longitude	Depth (m)
2	59°00.3'	152°11.6'	117
3	59°00.3'	152°21.6'	123
4	59°00.3'	152°30.0'	152
5	59°00.3'	152°42.5'	166
5A	59°00.3'	152°47.5'	181
6	59°00.3'	152°49.7'	166
7	59°00.3'	153°03.1'	150
8	59°00.3'	153°10.6'	121
8B	59°01.0'	153°13.0'	111
9	59°08.4'	152°04.2'	129
11	59°06.0'	152°20.0'	116
12	59°08.9'	152°26.1'	121
14	59°10.3'	152°47.1'	146
15	59°10.0'	152°54.0'	139
16	59°09.8'	153°06.9'	91
17	59°10.0'	153°13.5'	67
18	59°09.3'	153°24.8'	44
19	59°15.5'	152°10.7'	110
21	59°15.3'	152°26.6'	90
23	59°15.3'	152°49.3'	91
25	59°15.9'	153°08.5'	59
26	59°15.8'	153°20.0'	42
27	59°15.6'	153°33.8'	32
28	59°15.4'	153°40.0'	31
29	59°22.6'	152°09.4'	81
30	59°21.5'	152°24.1'	81
31	59°23.3'	152°35.7'	73
33	59°22.3'	153°05.0'	53
35	59°24.9'	153°17.7'	42
36	59°30.0'	153°15.7'	33
36B	59°28.1'	153°30.0'	-
37	59°41.3'	151°11.1'	59
39	59°34.9'	151°30.4'	99
40	59°33.1'	151°46.8'	69
40A	59°36.7'	151°51.6'	31
40B	59°39.5'	151°54.6'	-
41	59°32.7'	151°55.3'	35
42	59°32.1'	152°04.5'	40
42A	59°33.8'	152°12.5'	32
43A	59°28.0'	152°05.0'	-
44	59°33.1'	152°13.7'	68
44A	59°33.1'	152°18.6'	61
45	59°32.7'	152°25.5'	57
46	59°33.5'	152°35.5'	81
47	59°33.9'	152°43.7'	55
48	59°34.0'	152°54.0'	42

CONTINUED

Station Name	Latitude	Longitude	Depth (m)
49	59°33.1'	153°04.0'	37
51	59°35.0'	153°05.0'	36
52	59°34.0'	153°10.0'	35
53	59°31.8'	153°11.0'	37
53A	59°32.0'	153°08.9'	-
54	59°33.4'	153°24.5'	24
55	59°40.0'	151°59.5'	29
56	59°37.0'	153°02.0'	35
57	59°45.1'	152°03.3'	35
58	59°46.1'	152°13.0'	58
59	59°46.2'	152°23.4'	82
60	59°46.8'	152°34.7'	38
61	59°47.0'	152°43.7'	34
62	59°46.2'	152°55.0'	26
62A	59°49.8'	152°52.3'	24
63	59°55.7'	151°58.6'	31
64	59°54.9'	152°08.9'	60
66	60°03.3'	151°48.3'	44
67	60°01.5'	152°01.0'	51
68	60°02.8'	152°13.3'	60
69	60°03.3'	152°20.5'	55
70	60°10.3'	151°39.8'	41
74	60°10.0'	152°23.3'	55
75	60°20.3'	151°34.5'	27
76	60°20.0'	151°46.0'	27
76A	60°18.3'	151°45.2'	47
C	59°07.5'	152°46.1'	147
M	59°32.9'	152°08.2'	48
UWI	58°53.1'	152°51.4'	172
UW2	59°22.7'	152°42.6'	?
UOF	59°21.0'	153°15.2'	44
UOG	59°20.8'	152°43.8'	68
PMEL 1	59°14.4'	153°41.1'	-
PMEL 4	59°22.3'	152°40.3'	-
PMEL 7	59°33.3'	151°39.8'	-
204	59°14.3'	153°38.5'	-
227	59°33.4'	151°44.1'	-

Contract: #03-5-022-56
Task Order: #15
Research Unit: #5
Reporting Period: 4/1/78-3/31/79
Number of Pages: 113

ANNUAL REPORT

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

H. M. Feder, Principal Investigator

With

Max Hoberg and Stephen C. Jewett

May 1979

ACKNOWLEDGEMENTS

We would like to thank the officers and crew of the NOAA Ship *Miller Freeman*, the R/V *Commando*, and the M/V *Yankee Clipper* for their assistance in data collection. Thanks also go to the Alaska Department of Fish & Game (ADF&G) and Fisheries Research Institute (FRI) personnel for their assistance onboard ship. A special acknowledgement goes to Guy C. Powell of ADF&G Kodiak for his assistance in the collection of king crabs via SCUBA. We would also like to thank the following Institute of Marine Science, University of Alaska, personnel: John Rose, Camille Stevens, and Kristy McCumby for shipboard and laboratory assistance; Cydney Hansen and Robert Sutherland for assistance in data processing; and Suzette Carlson, Ana Lea Vincent and the IMS Publication Staff for aid in preparation of this report.

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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 activitiies 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 coonstripe 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 al.*, 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.)

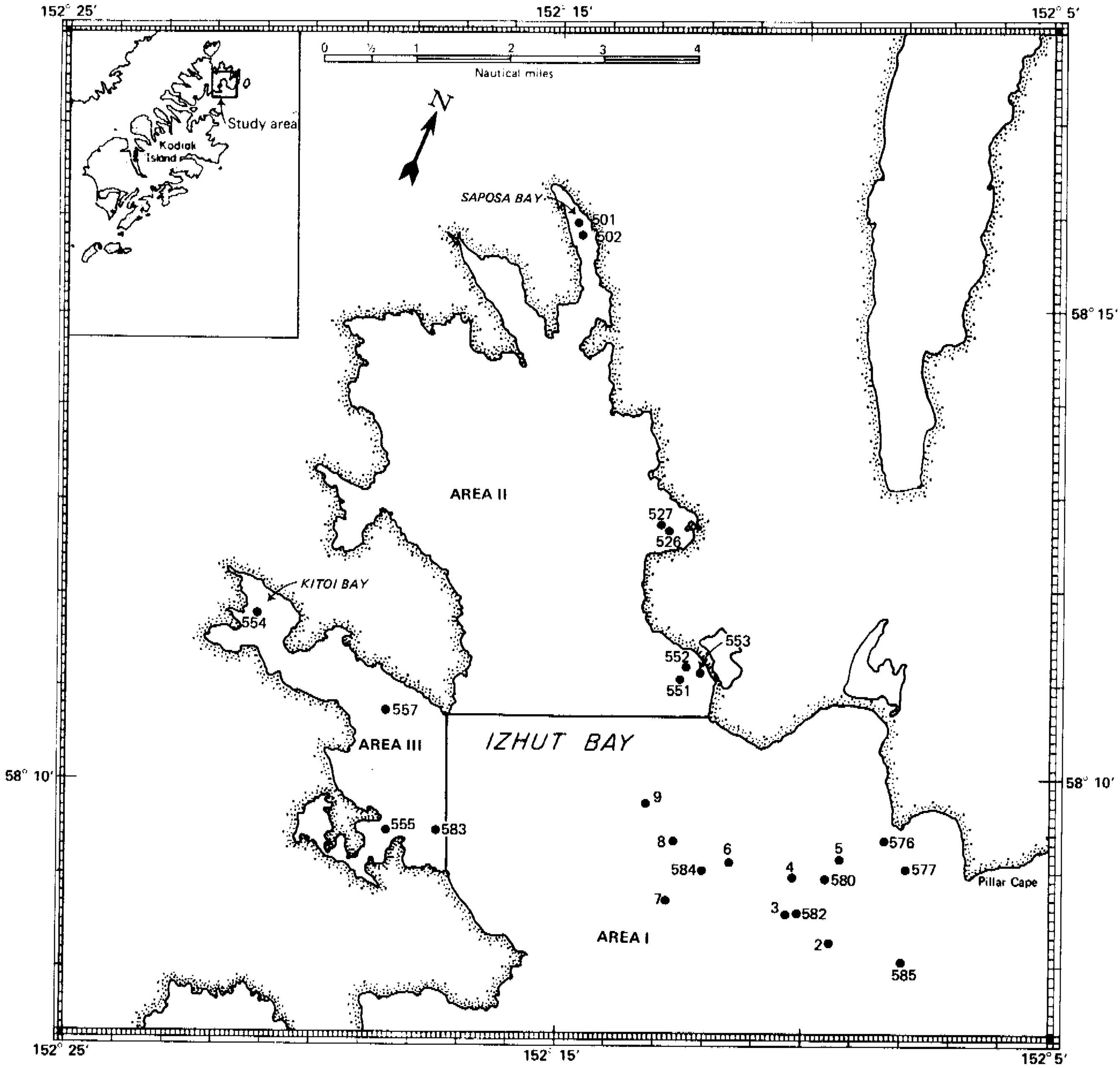

Figure 1. Benthic trawl stations occupied in Izhut Bay, Afognak Island, 1978. The bay is divided into three areas referred to in the text.

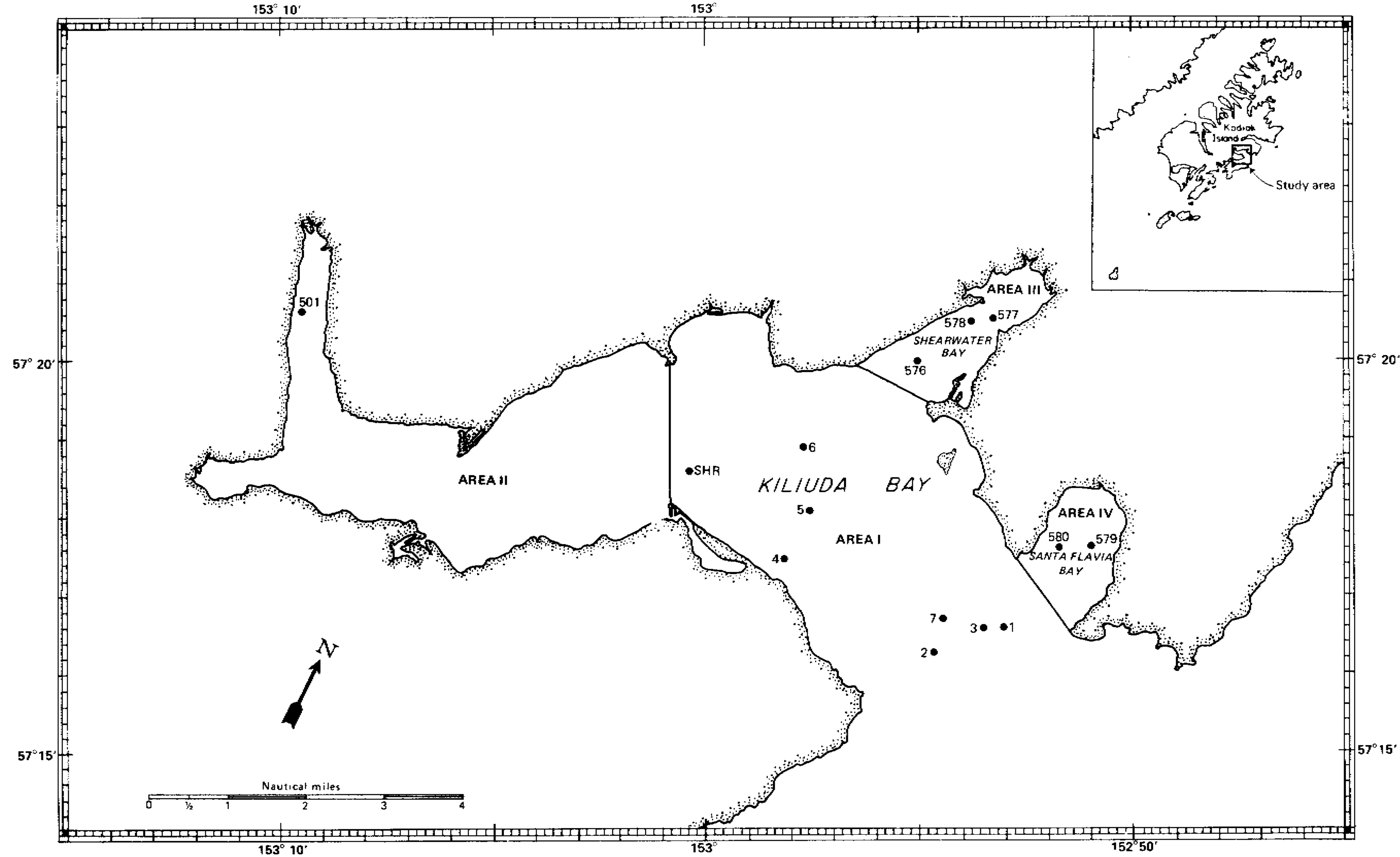

Figure 2. Benthic trawl stations occupied in Kiliuda Bay, Kodiak Island, 1978. They bay is divided into four areas referred to in the text.

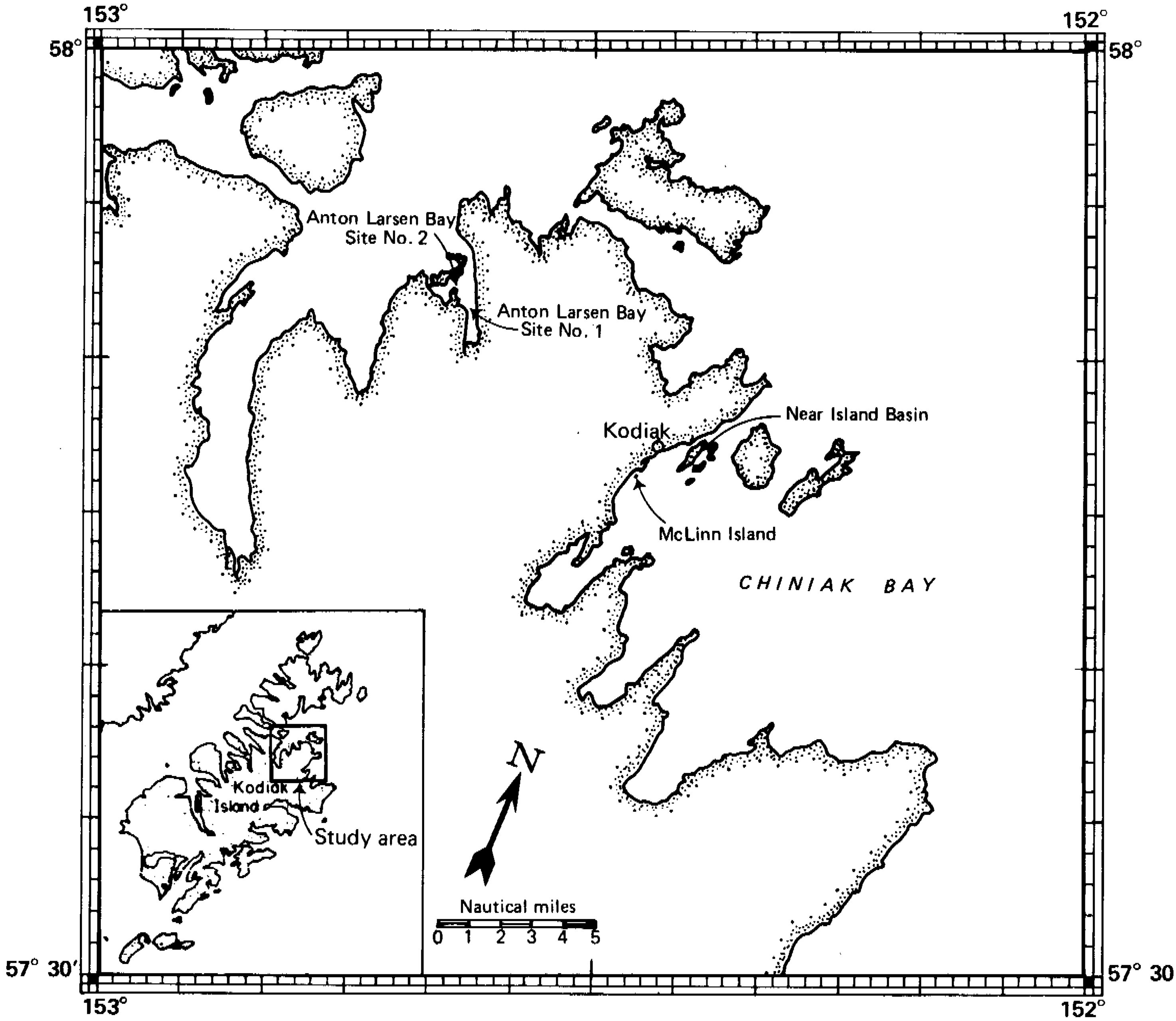

Figure 3. Locations where king crabs were collected via SCUBA for stomach analysis, 1978.

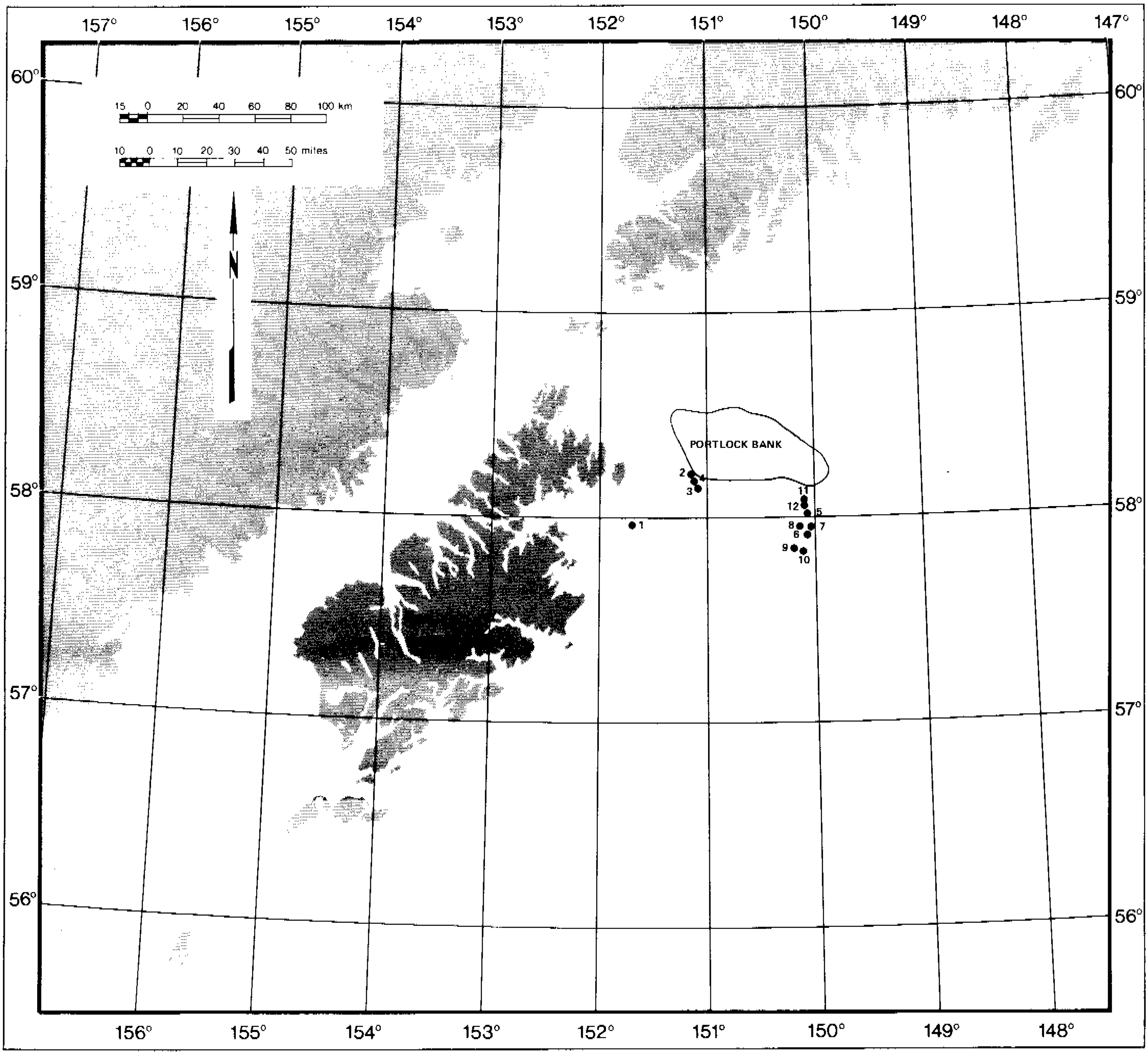

Figure 4. Benthic trawl stations occupied adjacent to Portlock Bank, March 1978.

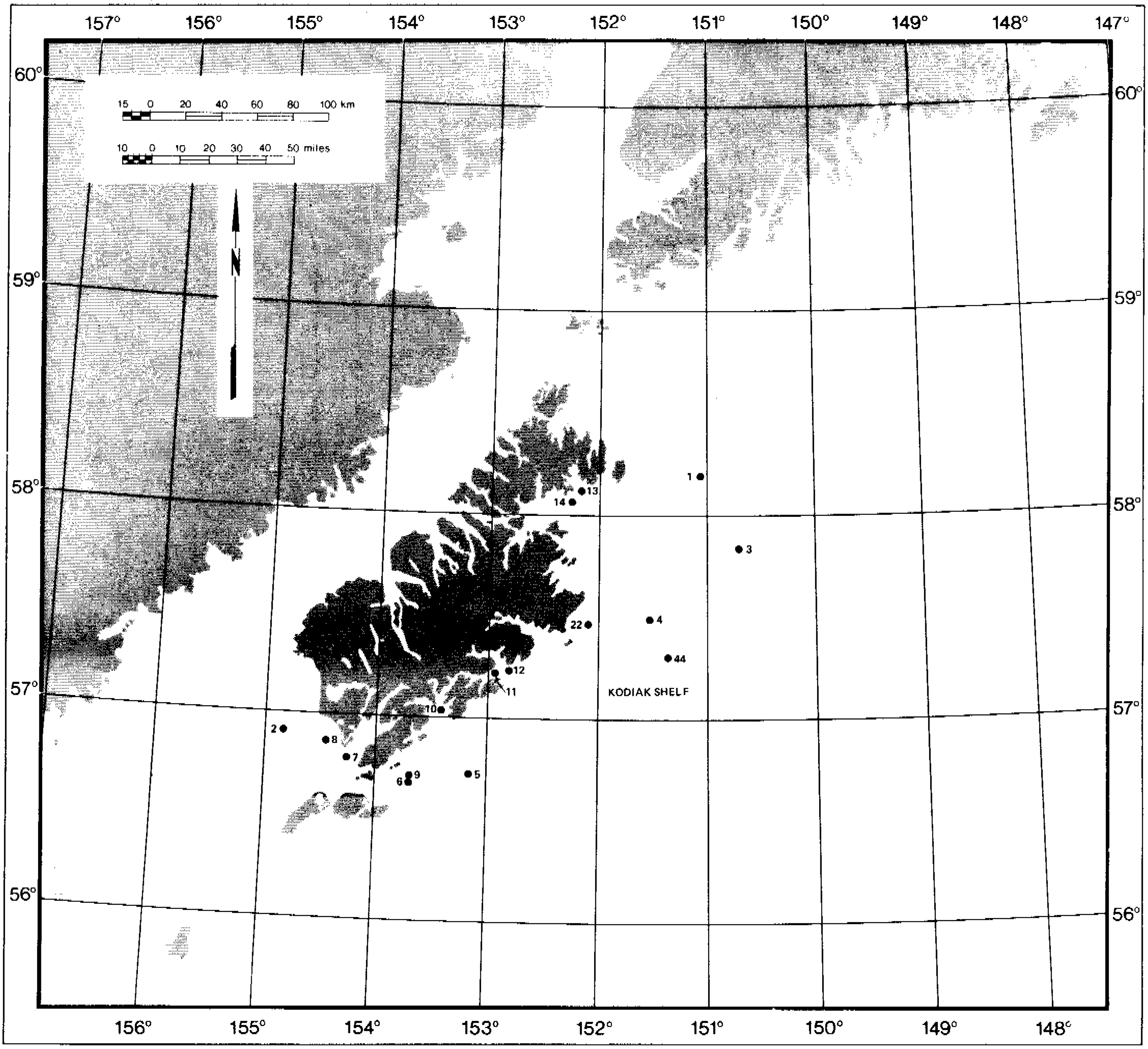

Figure 5. Benthic stations occupied on the Kodiak continental shelf, June-July 1979.

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 included 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[1] 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 PERIOD. ALL PREDATORS WERE 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	–	0	–	–	–	0
3	–	0*	0	0	–	0
4	–	–	–	0	–	–
5	–	–	–	–	0	–
6	–	–	–	–	0*	–
7	–	–	0+*	–	–	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+	0+	0	–
5	–	0*	–	0+	0*#
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 ACTIVITIES FROM IZHUT AND KILIUDA BAYS, 1978

		Izhut Bay				Kiliuda Bay			
Date	Gear	Successful Stations	Distance Fished, km	Invertebrate Weight, kg	Mean Biomass g/m^2	Successful Stations	Distance Fished, km	Invertebrate Weight, kg	Mean Biomass g/m^2
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

	Izhut Bay					
PHYLUM	APRIL	MAY	JUNE	JULY	AUGUST	NOVEMBER
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	O	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 COMPOSITON 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
Majidae	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
Majidae	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	0
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	O	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	
Margarites 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	humpy 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.

July 1978 (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 III and 526 and 527 of Area II yielded the largest catches of pink shrimp.

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

A total of 15 successful tows were made in Izhut Bay 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.

November 1978 (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

April 1978 (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.

June 1978 (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	X				

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	humpy 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* (24.7%), 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	34.1
		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	*Echinarachnius 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]	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	humpy 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 cornutus	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 transversa	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 with Food	Total Intestines
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
Gastropoda (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 sp. (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 = 49
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. (1)	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
Gastropoda (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
Crabs (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)	12.5	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 comatum (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
Gastropoda (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	1.4
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
Gastropoda (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[1]	% 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 (95%). 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[1]	% 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[1]	% 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. The 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[1]	% 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[2]	% Freq. Occurrence[1]	% 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 gastropods (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 subtidal 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[1]	% 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
Arthropoda	*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 gastropods 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.

<u>June 1978</u> (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

<u>May 1978</u> (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: 1072±515 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 XIII, 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 individuls 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%), gastropods (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[1]	% 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
	Gastropoda (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 #2

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]Species 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: 1379±669 g
Mean Percent Fullness: 9.1±10%[1]
Number of Prey Taxa: 86

DOMINANT PREY

Phylum	Species[2]	% Freq. Occurrence	% by Weight	% 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 *Nucula tenuis*-21.2 *Nuculana fossa*-19.5 *Axinopsida serricata*-3.4	Pisces-32.2 *Nucula tenuis*-14.6 *Nuculana fossa*-9.3 Decapoda-8.1 *Yoldia* sp.-6.9 *Macoma* spp.-1.7 *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 *Paralithodes camtschatica*-3.8 *Axinopsida serricata*-<0.1	*Pinnixa occidentalis*-47.3 Pisces-23.0 Unid. animal-17.7 Decapoda-3.2 *Macoma* spp.-1.4 *Axinopsida serricata*-0.4	Pisces-46.9 *Chionoecetes bairdi*-31.0 Unid. Plant-17.3

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 *Nuculana 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
Balanus 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	N = 15	N = 44
Izhut Bay - 8-25 June 1978		
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	N = 12	N = 14
Izhut Bay - 8-23 August 1978		
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	Total Stomachs
GADUS MACROCEPHALUS (Pacific cod)		
Gadus macrocephalus	N = 182	N = 190
Kodiak Shelf - 19 June-9 July 1978		
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	N = 17	N = 18
Izhut Bay - 11-14 May 1978		
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	N = 20	N = 20
Kiliuda Bay - 8-23 August 1978		
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	N = 36	N = 39
Portlock Bank - 21-24 March 1978		
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 Kodiak Shelf - 19 June-9 July 1978	N = 152	N = 189
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

CONTINUED

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 occurrency), *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 II 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 al.*, 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 gastropods 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 gastropods 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 parma* 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 gastropods. Subtidal *Pycnopodia* prey was dominated by the protobranch clam *Nuculana fossa* and small gastropods.

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 gastropods, 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 al.* (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 al.* (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

Thanks go to the officers and crew of the *Miller Freeman* for their assistance. We also appreciate the assistance of Kenneth Waldron, Ann Materese, and Gary Shigenaka of NWAFC.

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APPENDIX A

TABLE I

BENTHIC TRAWL AND SCUBA STATIONS OCCUPIED IN 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]

Kiliuda Bay

Station Name	Latitude	Longitude
1	57°16.5'	152°53.1'[2]
2	57°16.2'	152°54.7'[2]
3	57°16.5'	152°53.5'[2]
4	57°17.4'	152°58.2'[2]
5	57°18.0'	152°57.6'[2]
6	57°18.8'	152°57.7'[2]
7	57°16.6'	152°54.0'[1]
501	57°20.6'	153°09.5'[1]
576	57°19.9'	152°55.0'[1]
577	57°20.4'	152°53.3'[1]
578	57°20.4'	152°53.8'[1]
579	57°17.5'	152°51.0'[1]
580	57°17.5'	152°51.8'[1]
SHR	57°18.5'	153°04.0'[1]

SCUBA Stations

Station Name	Latitude	Longitude
Near Is. Basin	57°47.0'	152°03.0'[1]
McLinn Is.	57°46.2'	152°27.0'[1]
Anton Larsen Bay #1	57°52.0'	152°37.4'[1]
Anton Larsen Bay #2	57°52.5'	152°39.0'[1]

TABLE I
CONTINUED

Near Portlock Bank			Kodiak Shelf		
Station Name	Latitude	Longitude	Station Name	Latitude	Longitude
1	57°58.6'	151°40.8'[2]	1	58°12.4'	151°05.9'[2]
2	58°13.0'	151°11.4'[2]	2	56°54.4'	154°47.5'[2]
3	58°10.9'	151°07.9'[2]	3	57°48.7'	150°40.9'[2]
4	58°12.0'	151°10.3'[2]	4	57°29.1'	151°30.6'[2]
5	58°00.0'	150°06.2'[2]	5	56°42.7'	153°10.8'[2]
6	57°56.8'	150°05.9'[2]	6	56°40.9'	153°41.2'[2]
7	57°57.5'	150°02.6'[2]	7	56°46.9'	154°18.5'[2]
8	57°57.7'	150°07.8'[2]	8	56°51.9'	154°27.5'[2]
9	57°51.3'	150°10.2'[2]	9	56°42.5'	153°41.2'[2]
10	57°50.7'	150°07.7'[2]	10	57°02.1'	153°25.7'[2]
11	58°05.1'	150°06.9'[2]	11	57°12.8'	152°59.0'[2]
12	58°04.1'	150°07.0'[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	22	209	150	55

TABLE I

CONTINUED

Station Name	Stomachs Examined						
	Y. Irish Lord	Great Sculpin	Flathead Sole	Yellowfin 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

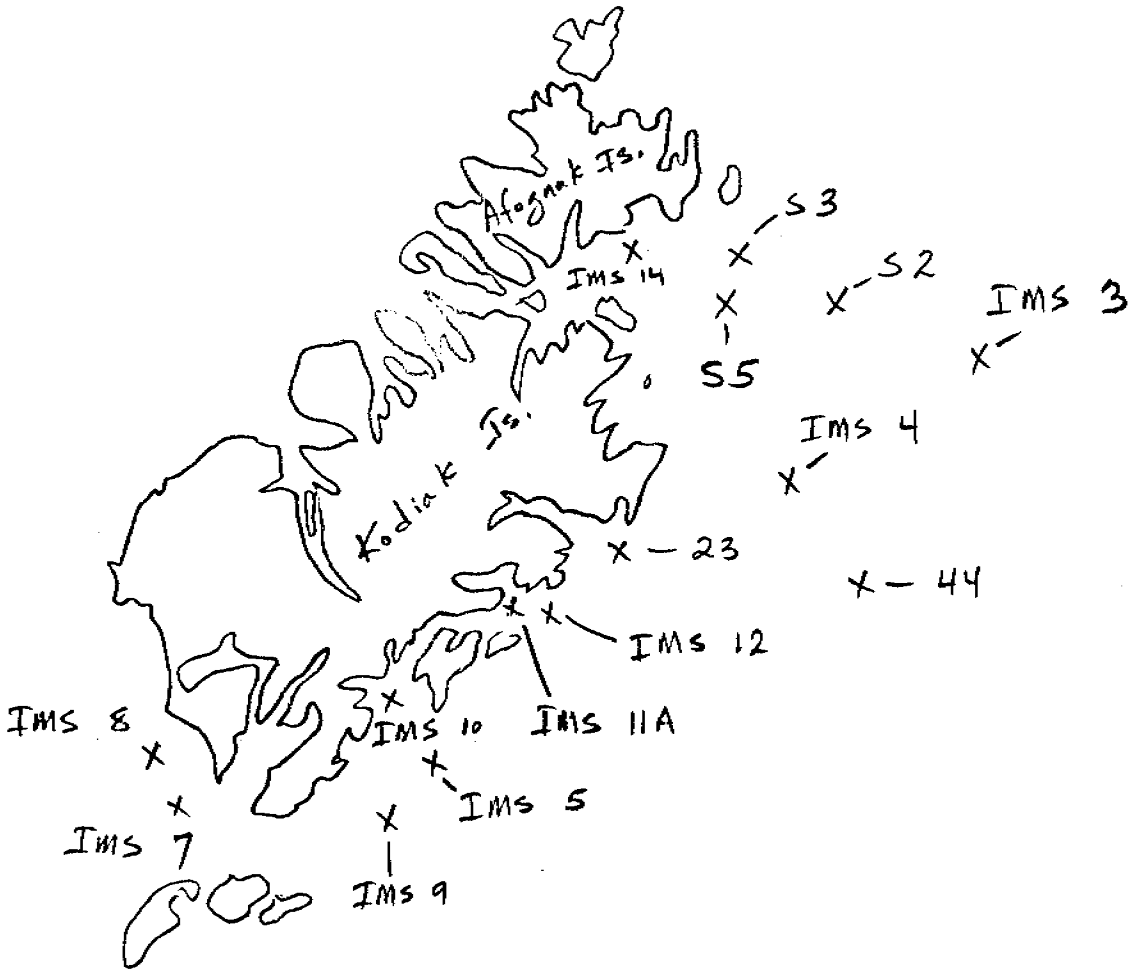

Figure 1. Stations occupied by the NOAA Ship *Miller Freeman*, 14-24 February 1979. From Cruise Report NOAA Ship *Miller Freeman*.

ANNUAL REPORT

Contract No. 03-5-022-68, Task Order 5
Research Unit #6
Reporting Period: 1 April 1978-31 March 1979

The distribution, abundance, diversity and productivity of the western Beaufort Sea benthos.

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I. Summary of Objectives, Conclusions, and Implications with Respect to OCS Oil and Gas Development.

Extensive exploration and development for oil and gas on the Alaskan and Canadian continental shelf have the potential to significantly influence the marine environment of the Beaufort Sea. It is impossible with our present knowledge to accurately predict the consequences of petroleum development on the marine benthos.

The past and continuing goal of this project has been to acquire the knowledge of the ecology of benthic invertebrate faunas of the Beaufort Sea continental shelf necessary to evaluate the consequences of offshore oil and gas development. The distribution and abundance of the fauna has been examined in detail with studies of the spatial and temporal variability of these. These data will provide a baseline against which future changes in the benthic environment and community structure can be evaluated. Of current importance are: (1) the definition of temporal changes in sublittoral community structure, (2) the determination of the life histories and secondary production estimates of dominant and ecologically important species, (3) the description of the benthic food web, and (4) the study of the ecology of benthic invertebrates important as prey organisms to the marine mammals, birds, and fishes. Now that broad ecological patterns of benthic invertebrates on the Beaufort Sea shelf are becoming fairly well known, it is imperative to define the dynamic processes maintaining temporal and spatial structure.

II. Introduction

A. General nature and scope of the study.

The present benthic ecological studies on the continental shelf include functional, process-oriented research that is built on a strong base of descriptive work on ecological patterns and their relationship to the environment. Seasonal changes in the numerical abundance and biomass of the large macro-infauna (>1.0 mm) are defined at stations across the shelf. The benthic food web and its relationship to bird, fish and mammalian predators and the relationships between the epontic ice algal community and the benthic community beneath are under investigation.

The species composition, distribution and abundance of the benthos are being defined in the southwestern Beaufort Sea. Species and station groupings are statistically analyzed and the relationships to the bottom environment and to the biological relationships explored. Dominant species are identified. These patterns provide an insight into the relative importance of various features of the environment in determining the distribution and abundance of the benthic invertebrate fauna. Abundance patterns provide data on potentially productive areas of the shelf that may support the large and important top predators. Biological and ecological information on important prey species are necessary for an understanding of the functioning of the oceanic food web.

The development of the research on the continental shelf benthic invertebrates has proceeded along a logical sequence. As very little was known about the fauna at the initiation of the exploration and developmental phases of the oil and gas fields on the Alaskan North Slope, the early research involved basic survey work on the 1971 and 1972 U.S. Coast Guard oceanographic cruises in the Beaufort Sea, WEBSEC-71 and WEBSEC-72. Initial processing and analysis of bottom grab and otter trawl samples and bottom photographs were sponsored by the Oceanographic Section of the National Science Foundation by a grant to the Principal Investigator.

When NOAA, under sponsorship of BLM, started an environmental assessment research program around the continental shelves of Alaska, Oregon State University participated in the benthic program in the Beaufort Sea. A combination NSF and NOAA/BLM research program supported several approaches and phases of research. Detailed analysis of benthic communities and identification of the total polychaete worm fauna over a wide range of depths could be accomplished under the National Science Foundation's auspices. Further continental shelf survey sampling could be continued under the OCSEAP with the cooperation of the Coast Guard and their Beaufort Sea icebreaker program. With NOAA's interest and logistics support, seasonal sampling and study of temporal changes in the continental shelf communities could be accomplished for the first time.

During the first year of operation a major objective of Task Order #4 for RU #6 was to summarize the literature and unpublished data. The majority of this information came from the work-up of the samples and the analysis of the data already on hand at Oregon State University as a result of participation in the WEBSEC program. The objectives for Task Order #5 under the present research contract for RU #6 emphasize the delineation of the benthic food web and the description of the coastal benthos. Efforts to characterize the composition of the Beaufort Sea fauna to the species level are continuing as this is a critical step toward understanding the dynamics of the benthic ecosystem. Detailed studies on temporal changes in the continental shelf benthic communities continue.

The OCS research on benthic ecology has been directed toward defining the distribution and abundance of the sea floor organisms, estimating the natural range of spatial and temporal variability, determining the effects of the environment on the fauna, estimating various biological rates, and delimiting the food web interactions of the benthic invertebrates.

The present benthic ecological studies on the continental shelf include functional, process-oriented research that is built on a strong base of descriptive work on ecological patterns and their relationship to the environment. Seasonal changes in the total numerical abundance and biomass of the large macro-infauna (>1.0 mm) are defined at stations across the shelf. The benthic food web and its relationship to bird, fish and mammalian predators are under investigation.

The species composition, distribution and abundance of the benthos are being defined in the southwestern Beaufort Sea. Species and station groupings are statistically analyzed and the relationships to the bottom environment and to biological relationships explored. Dominant species are identified. These patterns provide an insight into the relative importance of various features of the environment in determining the distribution and abundance of the benthic invertebrate fauna. Abundance patterns provide data on potentially productive areas of the shelf that may support the large and important top predators. Biological and ecological information on important prey species are necessary for an understanding of the functioning of the oceanic food web.

It has come to the attention of NOAA/BLM-OCSEAP that further year-round information is needed on the oceanographic and ecological processes taking place in the coastal waters of the Beaufort Sea. As exploratory and probably production drilling will take place in lagoonal and coastal waters out to 20 meters depth, studies are planned in this region to determine if the winter-spring months are biologically quiescent or whether organisms may be active and/or vulnerable to the oil-related activities during the ice-covered months of the year.

The research being undertaken in cooperation with other scientists, is oriented toward the processes maintaining the coastal and lagoonal ecosystems in the Beaufrot Sea. Of particular interest is the source of carbon that fuels the heterotrophic organisms living within the system. In lower latitude oceanic waters most of the carbon fixed by photosynthesis is ultimately derived from the phytoplankton, but in coastal waters much of the organic material may be land-derived. Water acts as a three dimensional reservoir and transporter of living and non-living organic carbon. The carbon cycle is a complex one that involves a large extent on interacting organisms. The benthos as an ecological group depend to a large extent on detritus that falls down to them. In the ice-covered waters of the Arctic, the epontic diatoms on the undersurface of the sea ice is an added source of carbon to the system (Horner, 1976), and in shoal waters benthic algae add to the primary production (Matheke and Horner, 1974). In the coastal Beaufort Sea and its bordering lagoons detrital peat from the coastal erosion may also add carbon.

The underice diatom bloom is known to exist in coastal waters in the Chukchi Sea off Barrow, AK (Horner and Alexander, 1972) and in the Eskimo Lakes, an estuarine inlet from the eastern Beaufort Sea (Grainger, 1975). Though its areal extent either in coastal waters or offshore over the continental shelf is now known, it has been suggested that these epontic diatoms could be an important energy source to the southern Beaufort Sea ecosystem (Clasby, et al. 1976) and for the Chukchi Sea (Hameedi, 1978). The pennate diatoms may fall to the sea floor upon ice melt in June (Matheke and Horner, 1974). There are very few ice algae data from the Beaufort Sea and no direct measurements to determine if the epontic diatoms fall to the bottom during ice melt. It is not resolved whether the ice algae add to the phytoplankton population (Hameedi, 1978) or fall to the sea floor (Matheke and Horner, 1974).

Various organisms become associated with the ice-sea water interface as the diatom bloom progresses through the months of April, May and June (Horner, 1976). Nematode worms are most abundant but harpacticoid copepods, amphipods and polychaete larvae have been observed on the underice surface. A coastal amphipod Onisimus affinis, an important member of the demersal fish food chain, has been reported as migrating up to the epontic community presumably to feed (Percy, 1975).

The degree of linkage between the underice epontic community and the benthic community beneath is not known. There is no direct evidence that this "upside down benthic community" is important in the energetics of the bottom communities themselves (Horner, 1976; Hameedi, 1978). It has been hypothesized that the sinking of detritus and diatom cells from the epontic community could provide a sizeable downward organic input to the benthic communities and that the vertical migration of benthic fauna up to the ice undersurface could provide another significant and earlier source of energy-rich organics to certain faunal groups of the benthos.

The research pilot project (RU #6W) on the interactions of the benthic community and the underice epontic community should provide necessary background data for the design of detailed studies to prove whether direct fluxes of food materials and organisms exist between the two surfaces.

The scope of the proposed project has been narrowed in terms of research to be accomplished, but not in terms of the objectives or hypothesis to be tested. Funding constraints dictate a pilot project, but careful selection of indicator organisms and critical processes should provide estimates of the degree of interaction between the sea ice undersurface and the sediment surface below should be possible.

Harpacticoid copepods are known to be associated with both the epontic and the benthic communities. These are small crustaceans that are easy to quantitatively sample with small cores. Though some species of gammarid amphipods are critical in the benthic food web (Carey, 1978), careful quantitative sampling of these larger organisms would require a substantial increase in the effort expended in this subproject. However, this epifaunal group will be wualitatively sampled by scoop net along the underice surface, along the sediment surface and midway between the two substrates to determine if benthic species become associated with the epontic community in April through early June. If feasible upward and downward-oriented traps similar to stream insect emergent traps will be deployed to attempt the collection of vertically migrating fauna such as the gammarid species Onissimus affinis.

B. Specific Objectives

Objective I - Beaufort Sea Macrofaunal and Megafaunal Benthic Food Web Studies Based on Icebreaker Cruises

1) The numerical density, biomass and gross taxonomic composition of the large benthic macro-infauna (>1.0 mm) will be obtained at three water column and integrated benthic food web stations in the lease area from samples collected during the 1978 USCGC NORTHWIND cruise to the western Beaufort Sea.

2) The identification of prey and predator species important in the benthic food web will be undertaken as far as possible for the selected 1978 stations.

3) The gastrointestinal tract contents of selected species of benthic invertebrates and demersal fishes (to be supplied by ADF and G and OSU) will be analyzed as far as possible to determine the food web links within the benthic communities and the ocean ecosystem.

4) The species composition, distribution and relative abundance of the macro-epifauna will be determined at three characteristic food web stations.

5) The distribution and abundance of primary benthic prey species (when identified) will be summarized for the Beaufort Sea continental shelf from extant processed samples and analyzed data plus the new data to be acquired from the 1978 summer field season samples.

6) The numerical density biomass and gross taxonomic structure of the large macro-infauna (>1.0 mm) at the 5 standard benthic seasonal stations will be obtained across the continental shelf on the Pitt Point Transect.

Justification

Food web studies are important because these feeding links are the routes by which energy, elements and pollutants are transferred from one trophic level to another. Such studies are necessary to identify the keystone species and important feeding areas on the Beaufort Sea continental shelf. Icebreakers are a suitable platform for integrated multidisciplinary research, and many parts of the coastal food web were studied during the 1978 curise. Efforts were made during the cruise to sample inshore of the 20 meter contour and in the lease area. Sampling will be coordinated as much as possible with the inshore efforts of Carter Broad (RU #356) on the R/V ALUMIAK. Efforts were made to include the outer edges of the oil and gas exploratory case area within the 20 meter contours.

Objective II - The life history, reproductive activity and yearly variability of selected benthic species at standard stations on the Pitt Point Transect.

1) The reproductive activity and population size structure of abundant species of bivalve molluscs, gammarid amphipods and polychaete worms will be determined as far as possible from the 1975-76 Smith-McIntyre grab samples on hand.

2) The yearly variability in numerical density and biomass of dominant species will be determined at the benthic Pitt Point stations.

Objective III

General: To determine the interrelationships between the underice epontic community and the underlying benthic community in the Boulder Patch and in Ste. Fansson Sound in the spring of 1979.

Specific: To determine the abundance and taxonomic composition by major group of the meiofauna and small macrofauna of the organisms on the undersurface of the sea ice and associated with the sediments below.

To determine the abundance and species composition of the harpacticoid copepods in the sediments and the undersurface of the sea ice.

To determine the downward flux of particles, e.g. fecal pellets, detritus, benthic diatoms from the undersurface of the ice to the sediment-water interface.

To determine if vagile benthic fauna, e.g. gammarid amphipods and harpacticoid copepods, undergo vertical migrations up to the productive epontic community in April and May and downward to the sediments upon ice break-up and melt in June.

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C. Relevance to Problems Associated with Petroleum Development.

Extensive exploratory and production drilling for petroleum on the Alaskan and Canadian continental shelf has the potential to significantly influence the marine benthic environment and its associated biota. It is impossible with the present state of our knowledge of the benthos and the Arctic environment to accurately predict either the long or short term consequences of oil and gas development on the marine invertebrate benthos and the benthic food web. Only recently has descriptive baseline data on species distribution, composition, and abundance become available with estimates of variability in space and time.

III. Current State of Knowledge

Since intensive sampling of the benthos of the southwestern Beaufort Sea beginning in 1971, ample collections have been made to define the broad ecological patterns of the bottom invertebrate organisms. These data have been submitted as part of the Final Report of NOAA/BLM-OCSEAP Contract No. 03-5-022-68, Task Order No. 4 submitted to NOAA by the Benthic Ecology Group at Oregon State University under Dr. Andrew G. Carey, Jr. in Quarterly and Annual Reports for Task Order No. 5 of RU #6, and in publications (Carey, Ruff, Castillo and Dickinson, 1974; Carey and Ruff, 1977; Montagna and Carey, 1978; Bilyard and Carey, unpublished M.S.).

Temporal and spatial variability are also fairly well defined, but the processes involved in maintaining these are not known. In some areas the scoring of the sea floor by ice gouging appears to increase the patchiness of the large infauna (Carey et al., 1974 and Carey and Ruff, 1977). It is suggested that the temporal variability of the outer continental shelf communities are seasonal and caused by reproductive cycles, but no data are yet available to test this hypothesis (Carey, Ruff, and Montagna, unpublished M.S.).

Benthic invertebrates that are important as food sources of marine mammals and birds have been designated by other research groups (UR's 230, 232, 172 and 196), but the ecology of these particular prey species are not well known. Research has just been initiated on the benthic food web itself; its structure and rates are not known at the present time.

In summary, most of our information about the benthic invertebrates is descriptive in nature, and the studies of the processes that cause the described patterns are only just in the beginning stages.

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IV. Study Area

The Beaufort Sea is an integral part of the Arctic Ocean (Coachman and Aagaard, 1974). Normally the sea ice melts and is advected seaward during July and August in the southern fringe of the sea over the continental shelf. This is a response to regional wind stresses which are variable from year to year. For example, in some years the polar pack ice can remain adjacent to the coastline throughout the entire season. The extent of ice cover during the sunlit summer months affects wind mixing of surface waters and the penetration of light into the water column. These factors affect the onset and intensity of phytoplankton production which is highly variable and of low magnitude (Horner, 1976; Clasby, Alexander and Horner, 1976). The keels of sea ice pressure ridges ploughing through the sediments cause significant disturbance of the benthic environment in water depths between 20 and 40 meters (Barnes and Reimnitz, 1974; Reimnitz and Barnes, 1974). They gouge the bottom as they are transported across the inner shelf by the Beaufort Sea gyral circulation and by wind stress.

Generally the bottom water masses of the southwestern Beaufort Sea are stable, and except for the shallow coastal zone, differ little in thermohaline characteristics throughout the year (Coachman and Aagaard, 1974). However, the outer shelf region from Point Barrow to about 150°W is influenced by Bering-Chukchi water that is advected as a subsurface layer and moves around Point Barrow throughout the year in pulses controlled in part by atmospheric pressure gradients (Hufford et al., 1977). Coastal upwelling was observed in the Barter Island region on the shelf near 143°W during the summer of 1971 when the pack ice had moved relatively far offshore (Mountain, 1974).

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V. Sources, Methods and Rationale of Data Collection

In general, two areas of continuing benthic ecological research are: (1) the extension of research into a food web project which is designed to elucidate the biological interactions within the benthos and between the benthic organisms and other portions of the ecosystem; and (2) the further accumulation of data from existing samples to provide a more complete understanding of the patterns of distribution and abundance of benthic invertebrates across the continental shelf. This descriptive detailing will provide baseline data with more accurate estimates of natural spatial and temporal variability.

To date, the experimental design has included a description of the benthic macro-infaunal and mega-epifaunal communities based on the WEBSEC and OCS samples. Numerical densities, total biomass, and major taxonomic composition have all been examined. As the species within the taxonomic groups have been identified, statistical analysis have delimited species and station groupings, and these groups have been correlated with the environmental characteristics of the benthic boundary. Estimates of natural spatial variability have been of major concern, and the descriptive phases of the research have been extended through a twelve month period to provide estimates of temporal variability and to provide initial information of the life histories of the arctic invertebrates. The study of interactive pathways with other portions of the ecosystem through the food web is a logical extension of the current benthic research.

A. WEBSEC

A large series of Smith-McIntyre 0.1 m^2 grab samples were collected during the 1971 and 1972 WEBSEC cruises of the U.S. Coast Guard. These formed the basis for our initial survey of the large benthic infauna (>1.0 mm) and mega-epifauna (>1.3 cm). Five grab samples were collected per station. Details of methodology may be found in the 1977 Final Report for RU #6 Task Order #4, and in Carey and Ruff (1977). These samples form the source of much of the polychaete results reported here. Gordon R. Bilyard under support of the National Science Foundation and NOAA/BLM is analyzing these collections as part of his Ph.D. dissertation.

B. OCS - Coastal and Shelf

Continued sampling of the benthos for the OCS program has added survey information critical to the description and understanding of species distributions and abundances and ecological patterns. A minimum of 5 quantitative grabs per station has been adherred to as a sampling strategy whenever possible.

The OCSEAP-sponsored foodweb cruise in the Beaufort Sea during the 1977 summer sampling season allowed the sampling of further stations in previously unsurveyed areas (Figure 1) on the continental shelf and continental slope. The coastal areas sampled from the R/V ALUMIAK are summarized in Figure 2 and Table 1.

C. Temporal Variability Study Methods

In October 1975 we inititate year-round sampling at standard stations across the southwestern Beaufort Sea continental shelf. Our major objectives were: (a) to determine the degree and timing of changes, if any, in the numerical abundance, biomass, and species composition of the benthic communities and (b) to determine the size distribution and reproductive activity of dominant species

V. C. Temporal Variability Study Methods (continued)

throughout the year. Five stations at 15 meter depth intervals from 25 to 100 meters were sampled on five occasions over a 13-month period off Pitt Point, Alaska. Sampling was accomplished from an icebreaker during the summer field season and with the aid of a helicopter during the remainder of the year. A minimum of five standard 0.1 m^2 Smith-McIntyre grab samples were takén at each station occupied.

Navigation was by DEW station radar, depth sounder, and sometimes aided by OMEGA during ice field trips and by satellite navigator, Loran-C and depth sounder on the summer cruise. New techniques and lighweight gear were developed for use of the grab through the ice on airborne trips. The basic station set-up consisted of a steel pipe tripod positioned over a 1.2 m square hole in the ice and a portable gasoline hydro winch hauling 3/16" cable rigged through blocks.

The collected sediment was initially washed through 0.42 and 1.0 mm sieves, and the larger infaunal organisms (>1.0 mm) were sorted into major taxonomic groups, counted and weighed (wet) in the laboratory. Numerical density is based on all taxa (>1.0 mm) except foraminiferans and nematodes. Wet-preserved weight includes soft-bodied organisms (>1.0 mm); for greater accuracy and fidelity shelled molluscs, ophiuroids and 5 large, rare specimens weighing more than 3.0 g each were excluded. Significance of seasonal difference (P) was determined by the Kruskal-Wallis one-way analysis by ranks: J.M. Elliot, Some Methods for the Statistical Analysis of Samples of Benthic Invertebrates. (Freshwater Biological Association, Scientific Publication No. 25, Ambleside, England 1971), p. 118. During the last quarter, the 0.5-1.0 mm fraction of the grab samples have been picked and rough sorted. This allows further analysis of temporal variability, particularly of the juvenile macro-faunal forms for definition of periods of recruitment of young into the benthic populations. (See Quarterly Report for detailed data summaries.)

D. Epontic ice algal community relationships with the benthic fauna and environment.

During the last quarter preliminary fieldwork was accomplished as the initial phase of a study of the interrelationships between the "benthic" community that develops on the undersurface of coastal sea ice and the benthic community below. Cores of sediments and ice were taken by divers, and vertical animal migration traps and particle collectors were also deployed. Further details on these techniques may be found in the Quarterly Report appended to this Annual Report.

VI. Results (A summary of earlier results and conclusions can be found in the expanded Quarterly Report for the period 1 October - 31 December 1978 for RU #6.)

A. Depth distribution and abundance of dominant pelecypod molluscs and polychaetous annelids across the western Beaufort Sea continental shelf.

There is clear evidence of depth zonation of species from the two major taxonomic groups, the bivalve molluscs and the polychaete worms (Figures 1-19. Specimens from these groups from the RU #6 Smith-McIntyre grab collections have almost entirely been identified to species. Detailed quantitative ecological grouping analyses have been undertaken for the polychaetes collected on WEBSEC-71 and 72 and several OCS icebreaker cruises (Bilyard and Carey, unpublished M.S.). Preliminary ecological analyses for the bivalves and the remaining polychaetes are in progress.

The preliminary distribution-abundance data are summarized for the Pingok Island and Barter Island transects for 12 dominant species of bivalves and 26 dominant species of polychaetes. The depths sampled range from 5 meters in the coastal environment to 100 meters at the edge of the continental shelf. Each station was sampled by 5 to 10 multiple grab samples from the 1976-78 summer seasons. The deeper stations were occupied by the USCGC GLACIER and the coastal ones by the R/V ALUMIAK. In the bar graphs (Figures 1 through 19) the abundance of each species is plotted for the 8 depths across the shelf on the two transects. Zeros are interpreted as absences, and a zero count in a depth zone of low faunal density is interpreted as being within the normal ecological range of that species. In the latter case, the depth range is inferred to extend over the whole depth range within which the species was collected. At the present stage of analysis only preliminary comments can be made about these data; and only two transects are summarized.

The bivalve molluscs are distributed across the entire shelf areas sampled (Figures 1-6). Most of the species are abundant on the inner half of the continental shelf. Some of the abrupt changes in average abundance per square meter may be directly or indirectly caused by the effect of ice gouging and hydrographic and/or geologic characteristics of the shear zone. This zone of active ice deformation and pressure-ridging is at an average depth of 25 meters on the Beaufort Sea continental shelf. If these significant changes in distribution and abundance are caused by the ice gouging in the active shear zone, the effects could be caused by direct destruction as well as by indirect effects, e.g. increased turbidity of the water, increased localized erosion and deposition, etc.

Though some of the basic distributional patterns of individual species are similar for both transects, distinct differences are present in some molluscan distributional patterns between the two regions of the shelf. These are probably caused by differences in the environment, or perhaps to patchiness of the organisms, but in any case it is difficult to generalize from these data at the present time.

The polychaetous annelids are also distributed across the entire continental shelf in the areas sampled (Figures 7-19; Table 1). These data also suggest some characteristic depth distribution-abundance patterns; some species are found on the inner shelf e.g. *Marenzellaria wireni* (Figure 7), some on the mid-shelf e.g. *Cistenides hyperborea* (Figure 13), and others on the outer shelf e.g. *Lumbrineris minuta* (Figure 16). Still other species e.g. *Minuspio cirrifera* (Figure 16) are distributed across the entire shelf, but may show large abundances nearshore. Bimodal patterns of distribution and abundance of some species, e.g. *Micronephthys minuta* (Figure 19) suggest again some direct and/or indirect effects of the ice-gouging phenomenon associated with the seasonal sea ice shear zone.

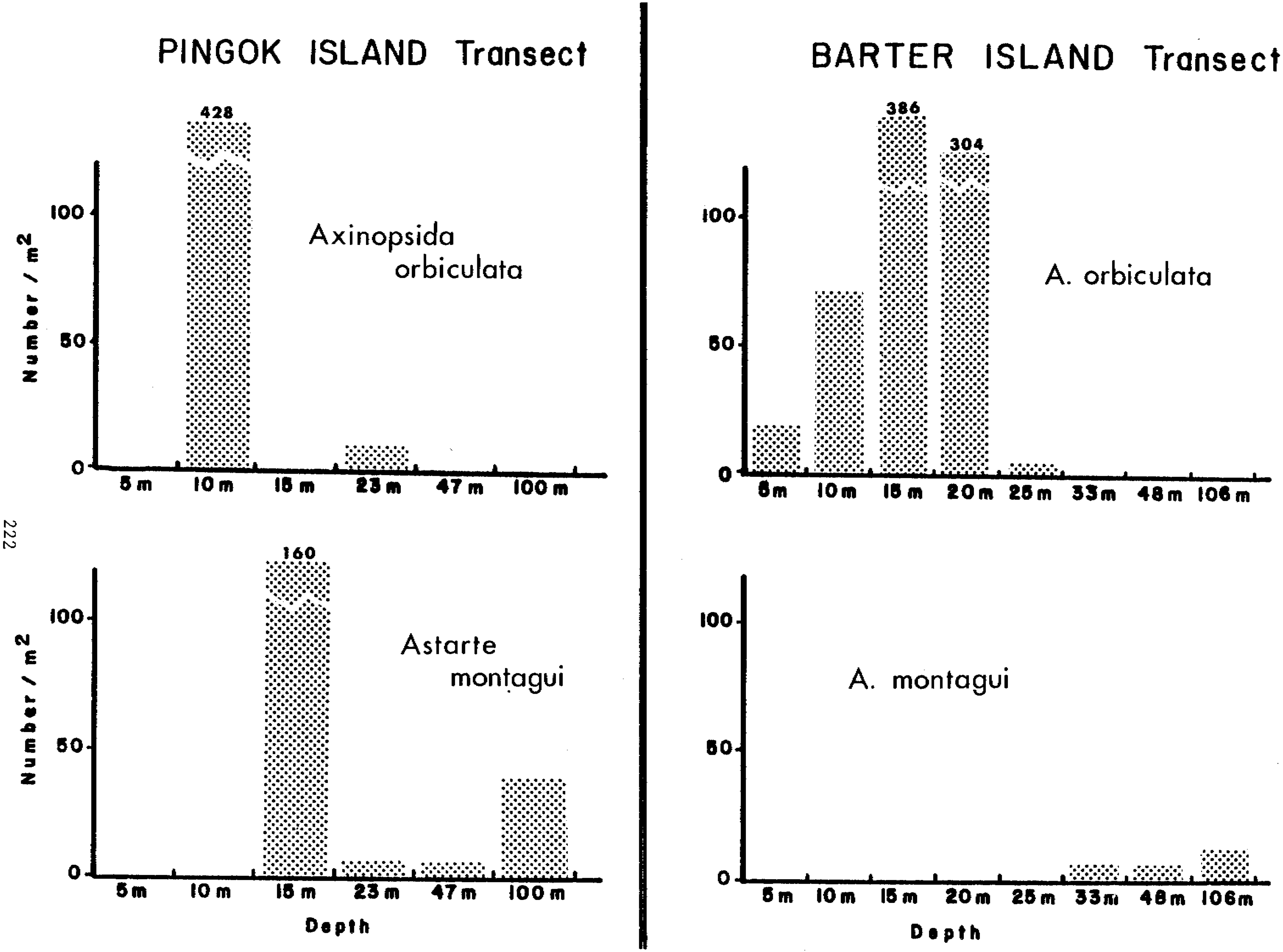


Figure 1. Bivalve mollusc distribution-abundance patterns across the Beaufort Sea shelf.

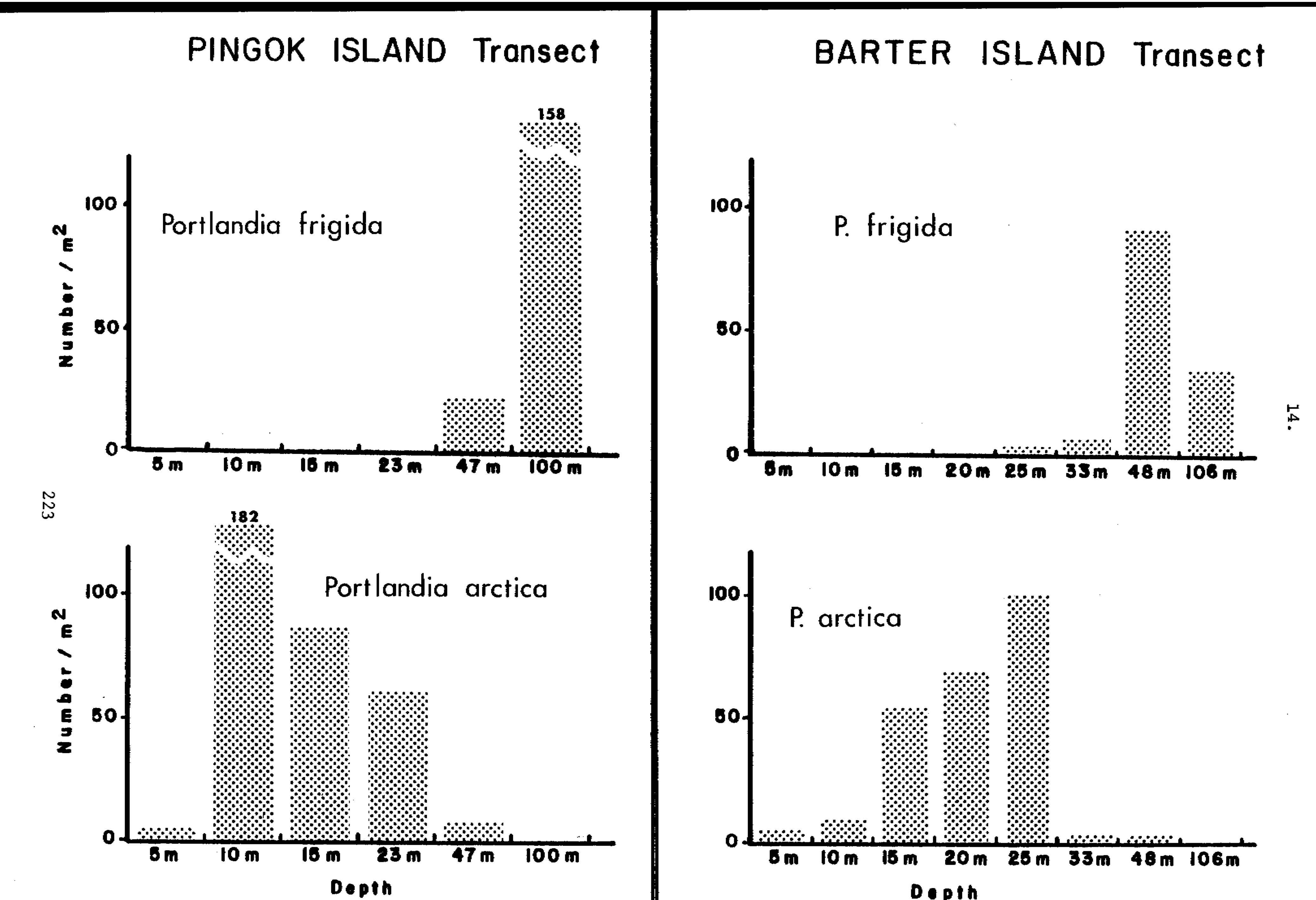


Figure 2. Bivalve mollusc distribution-abundance patterns across the Beaufort Sea shelf.

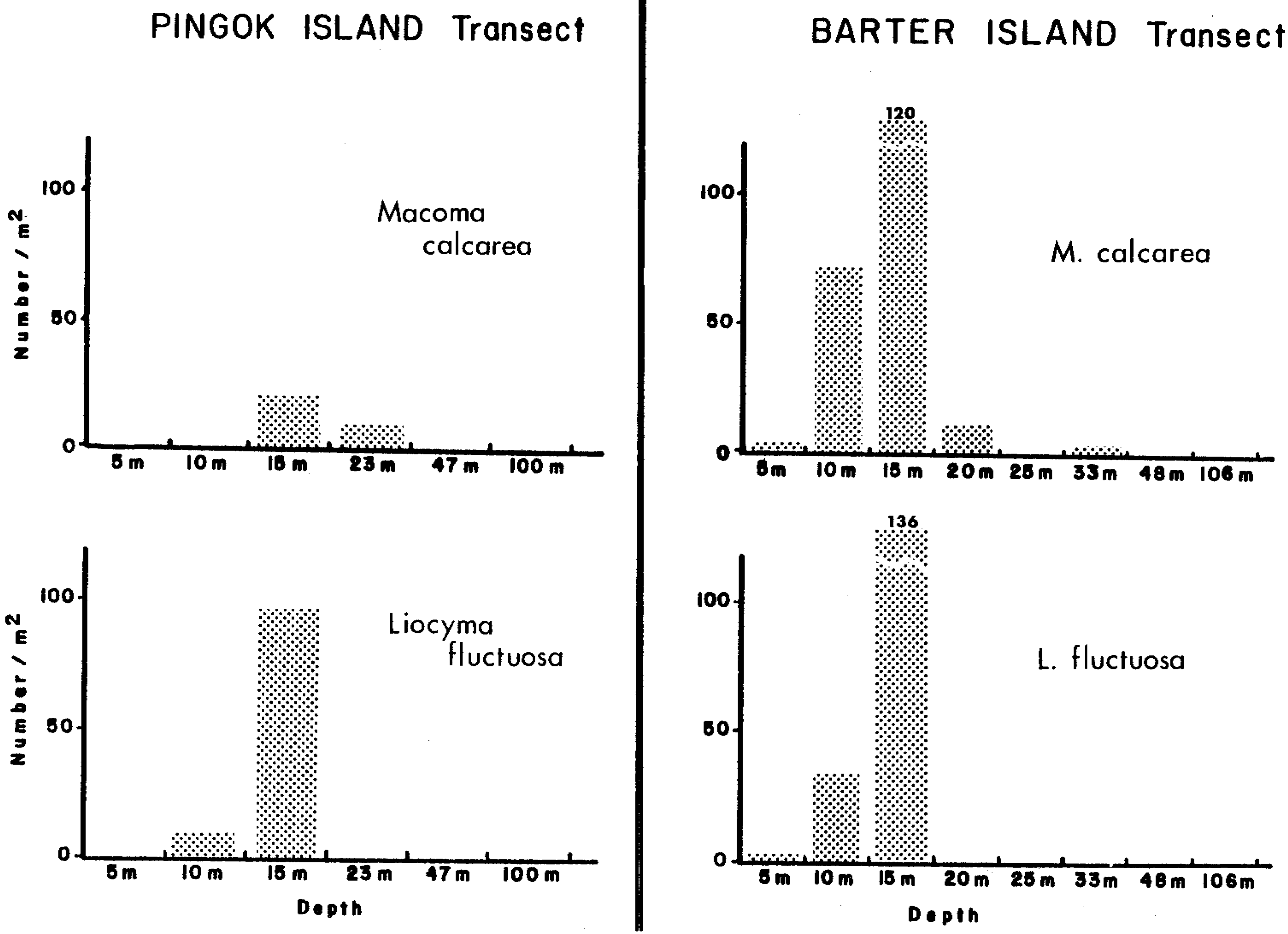


Figure 3. Bivalve mollusc distribution-abundance patterns across the Beaufort Sea shelf.

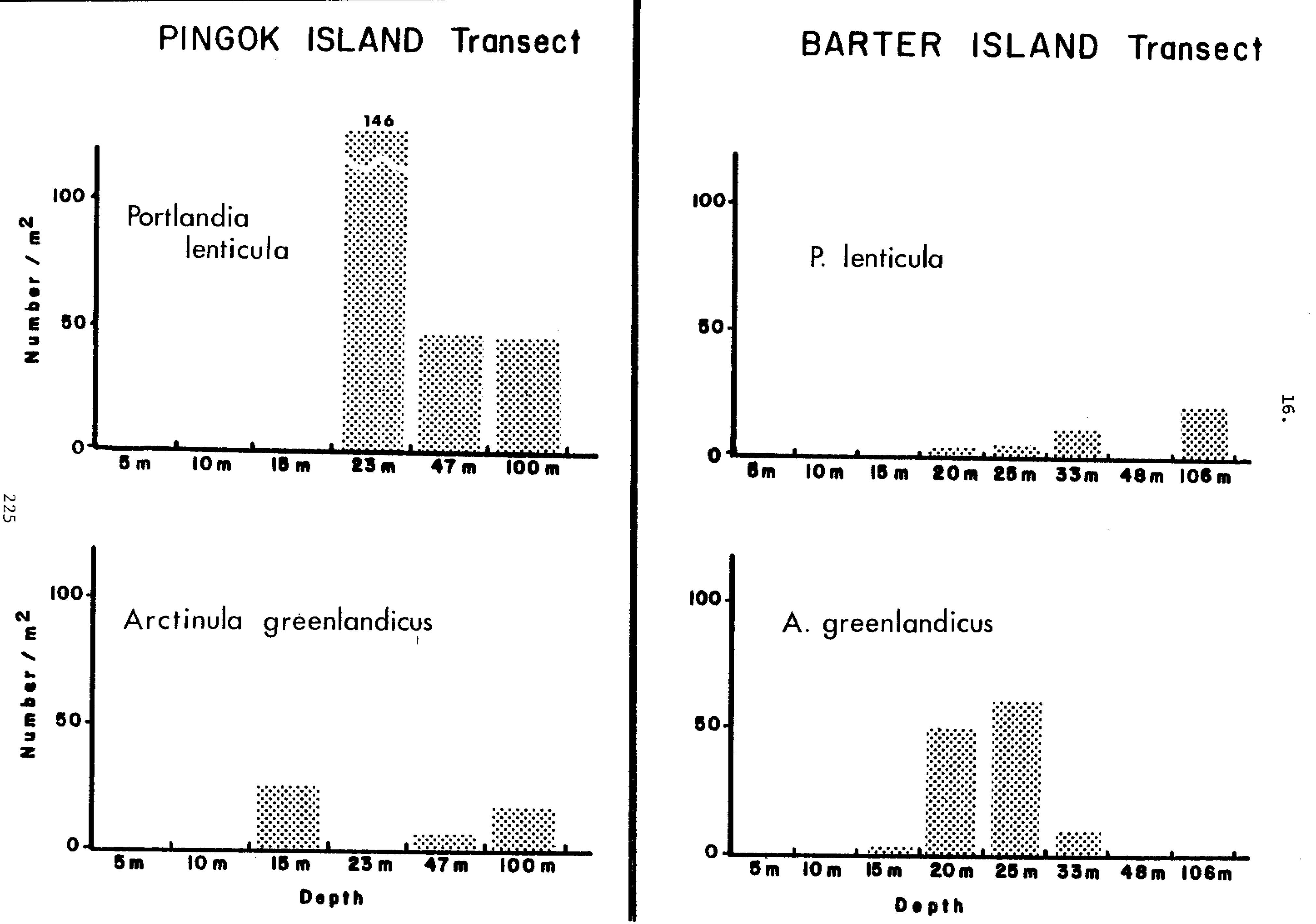


Figure 4. Bivalve mollusc distribution-abundance patterns across the Beaufort Sea shelf.

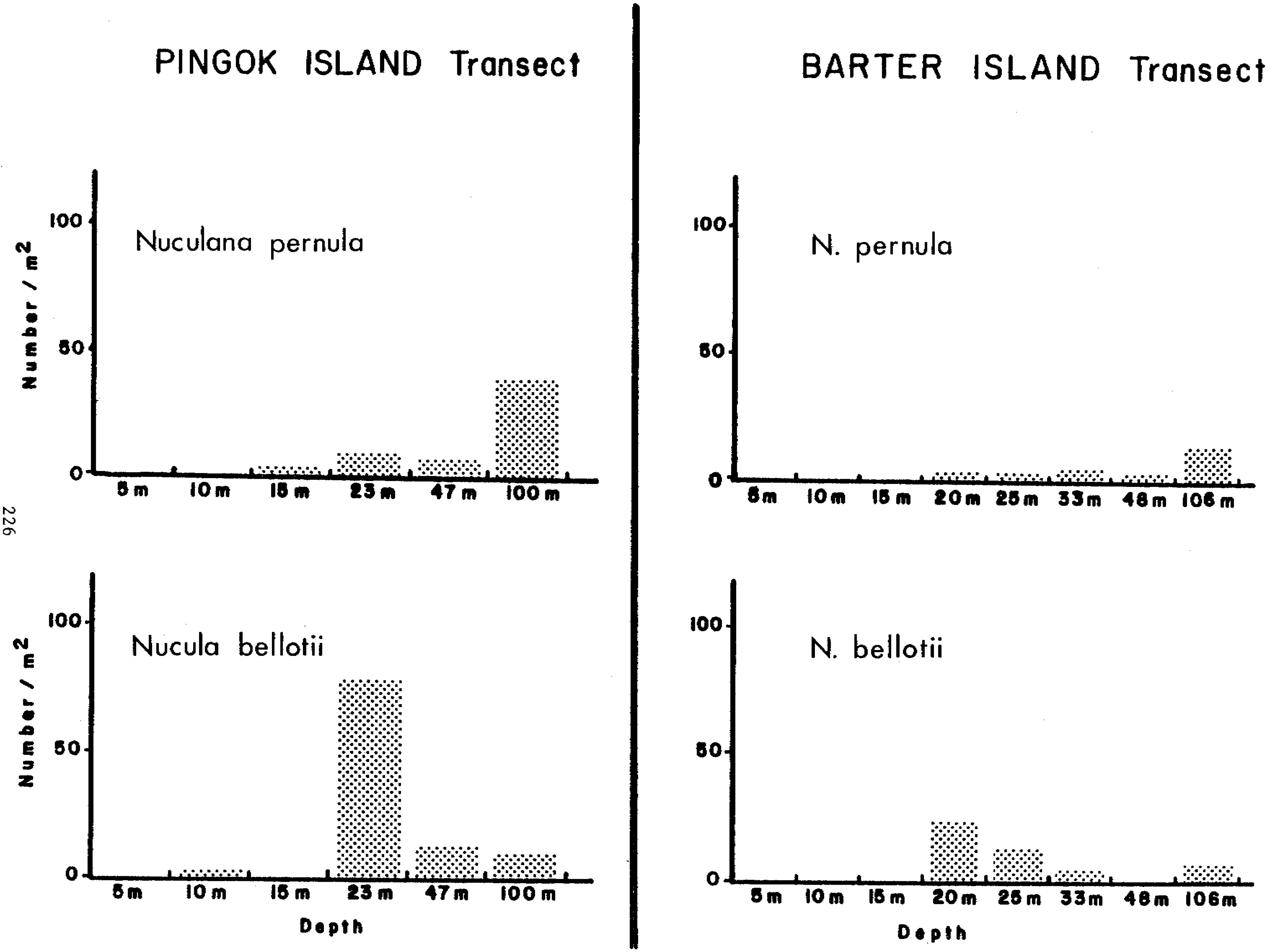


Figure 5. Bivalve mollusc distribution-abundance patterns across the Beaufort Sea shelf.

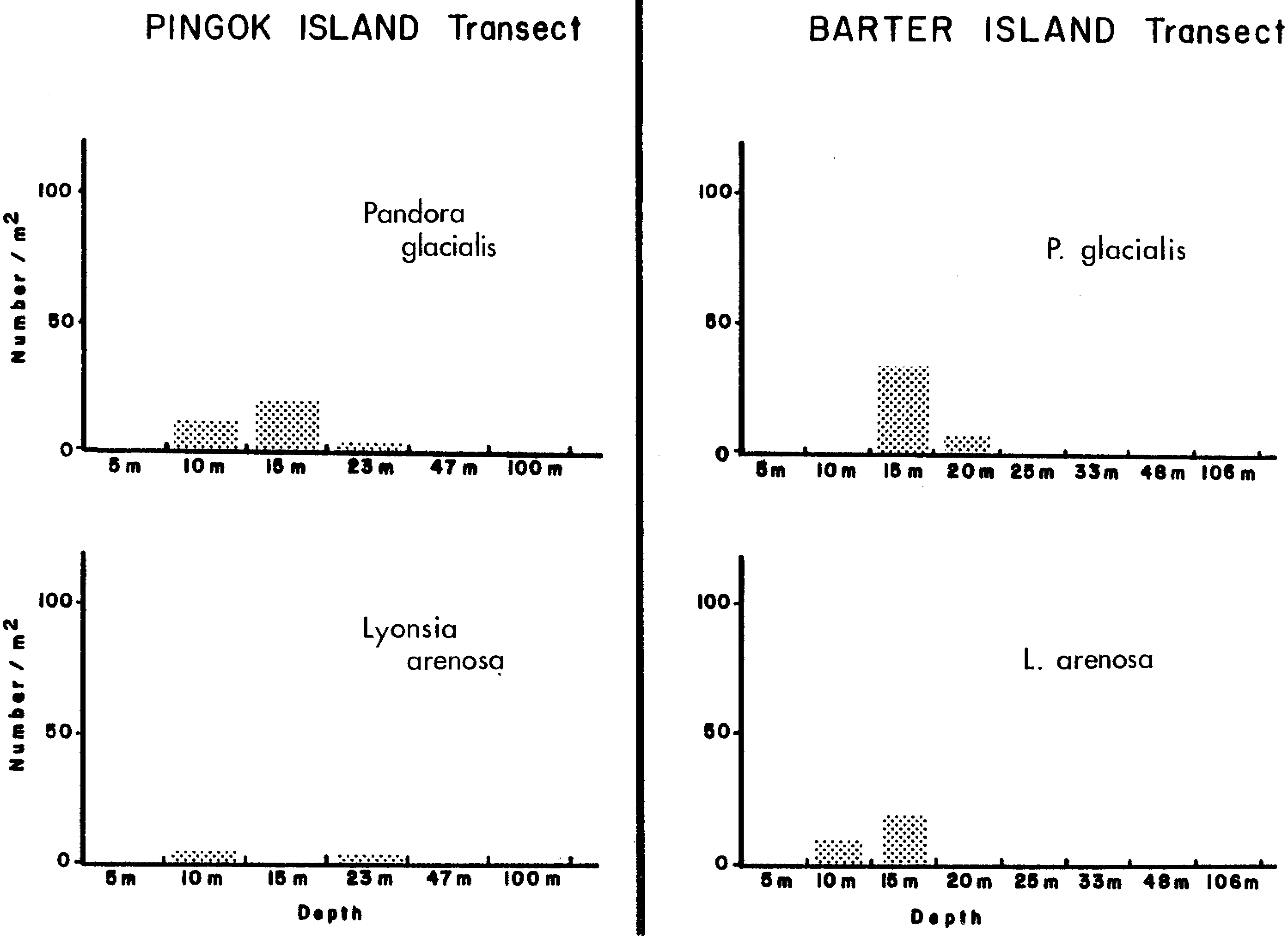


Figure 6. Bivalve mollusc distribution-abundance patterns across the Beaufort Sea shelf.

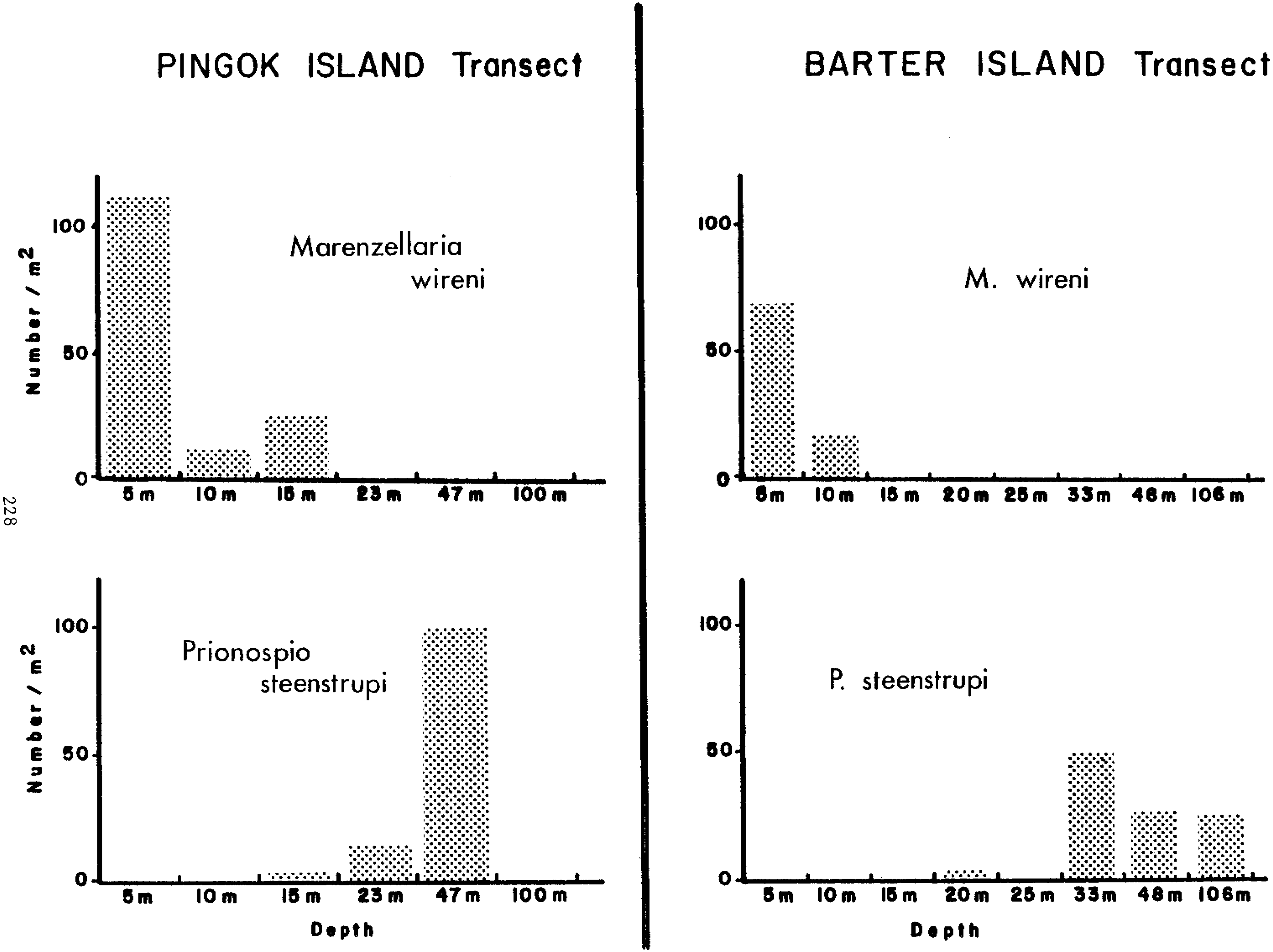


Figure 7. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

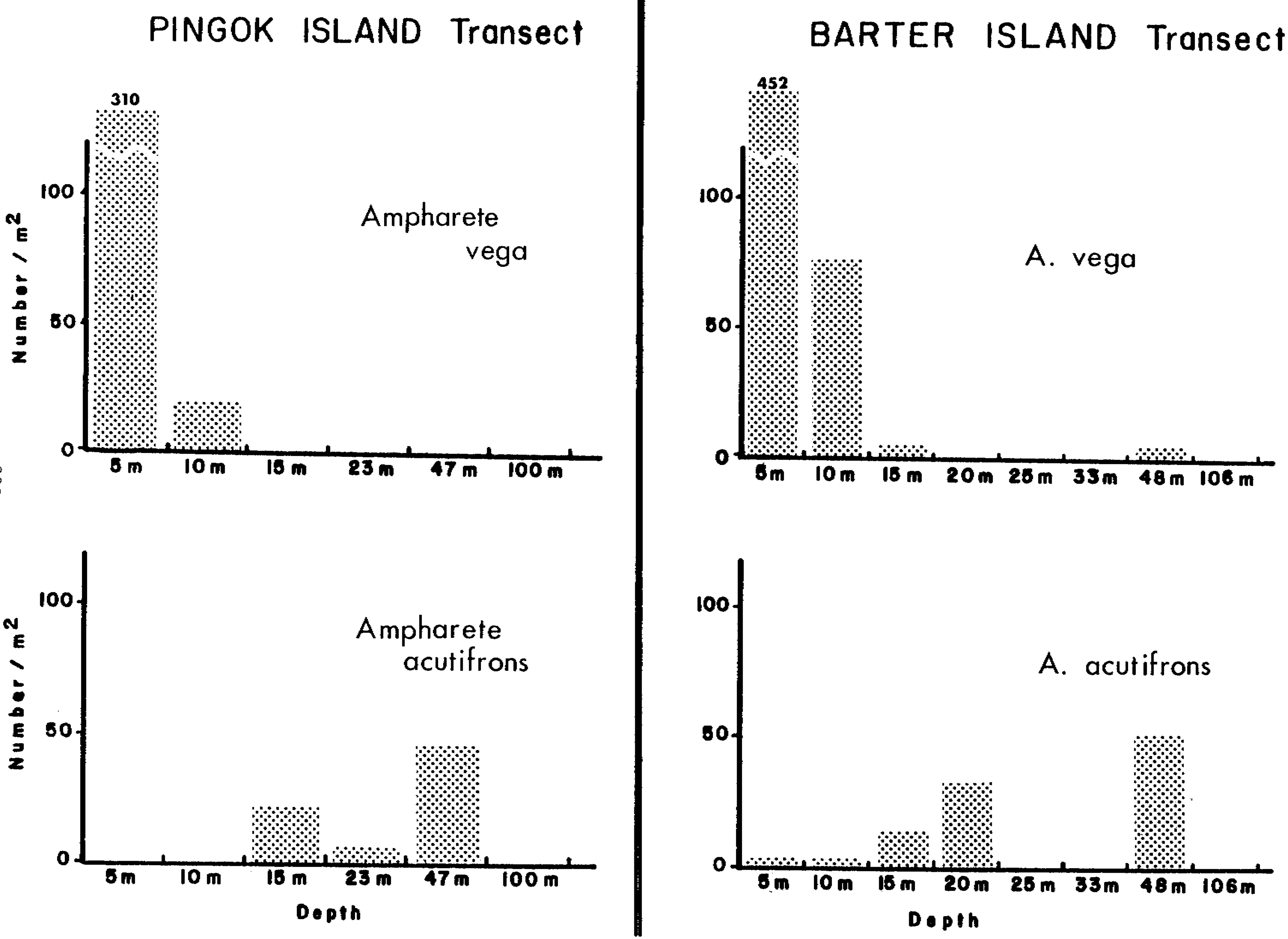


Figure 8. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

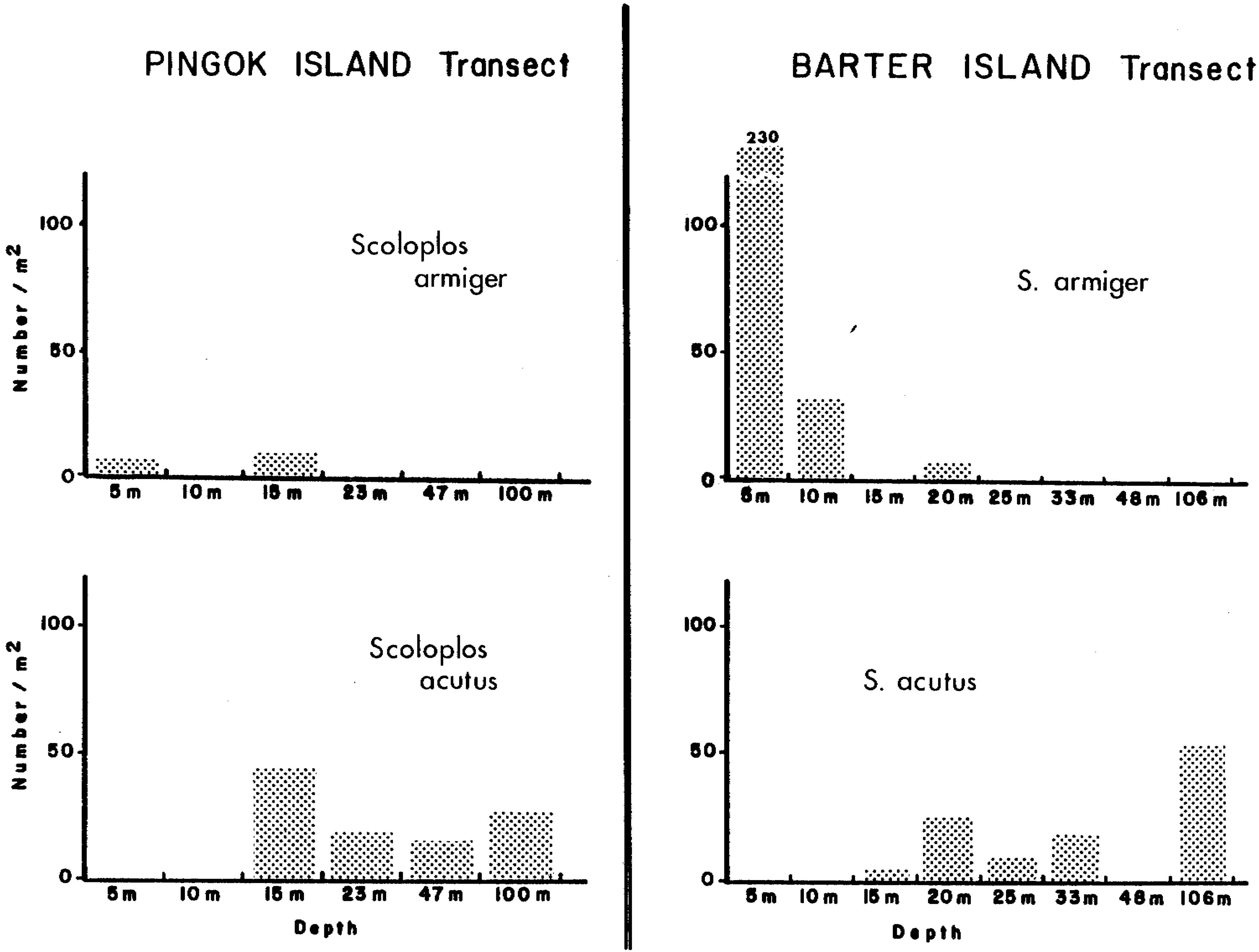


Figure 9. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

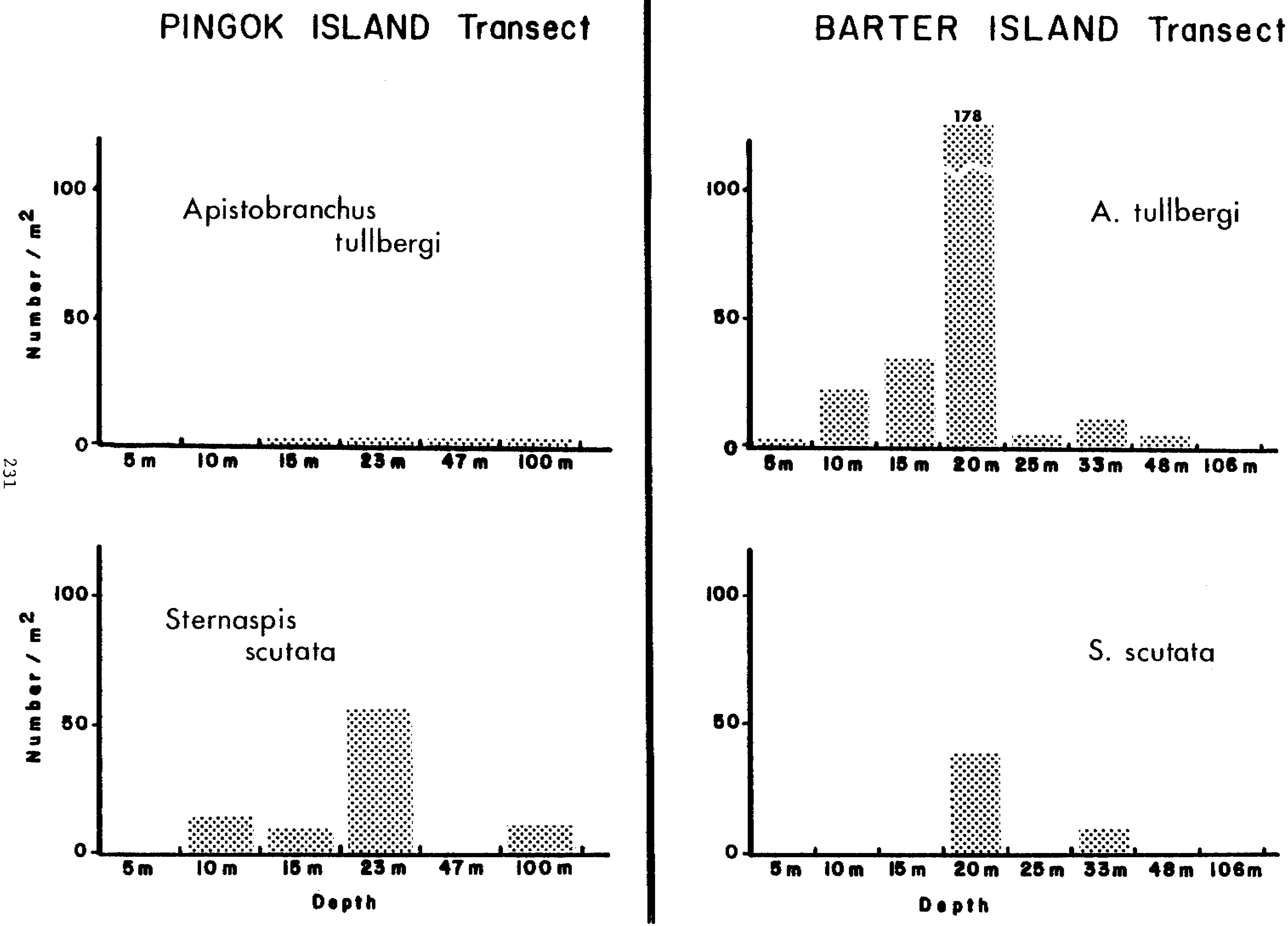


Figure 10. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

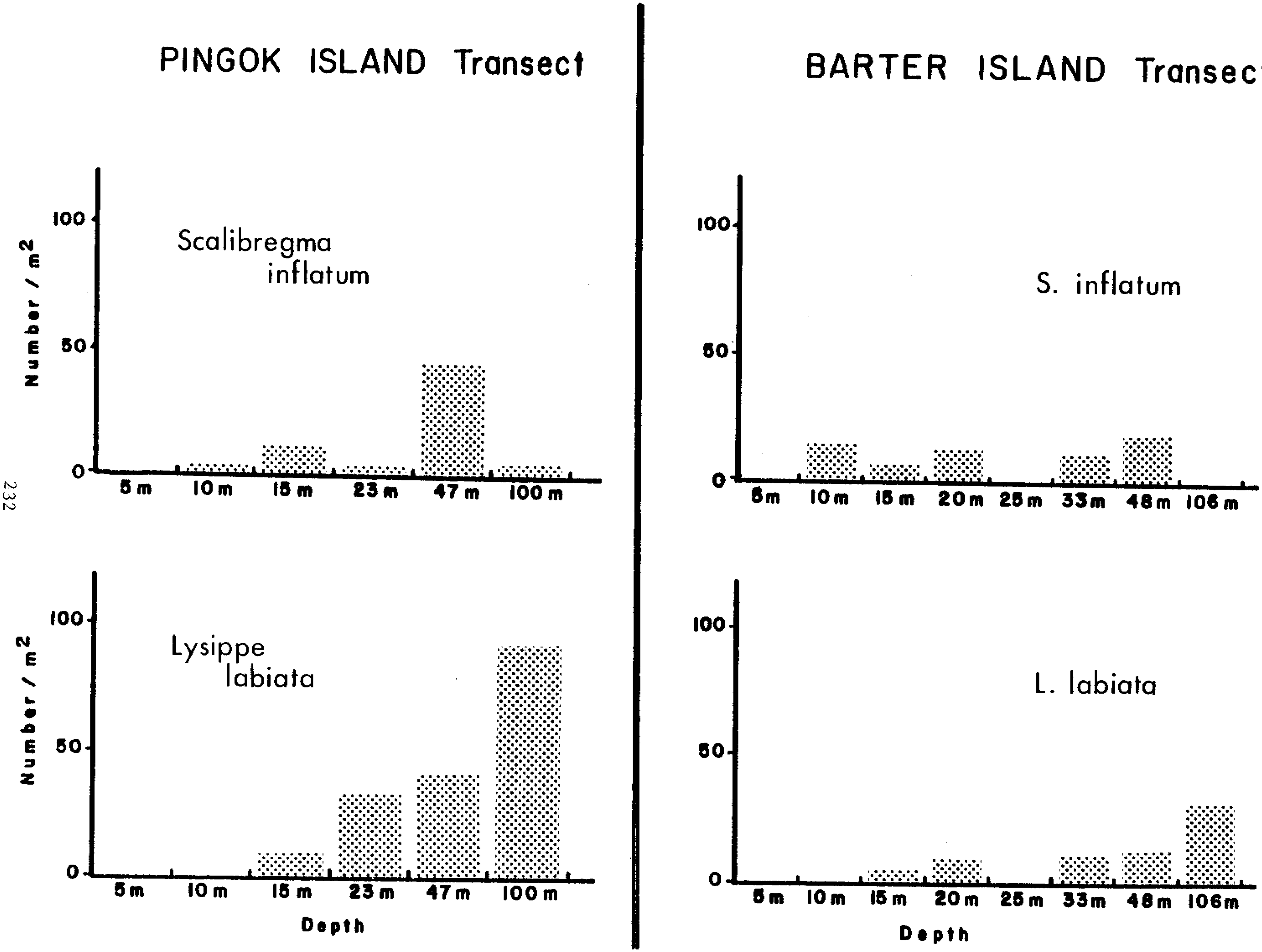


Figure 11. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

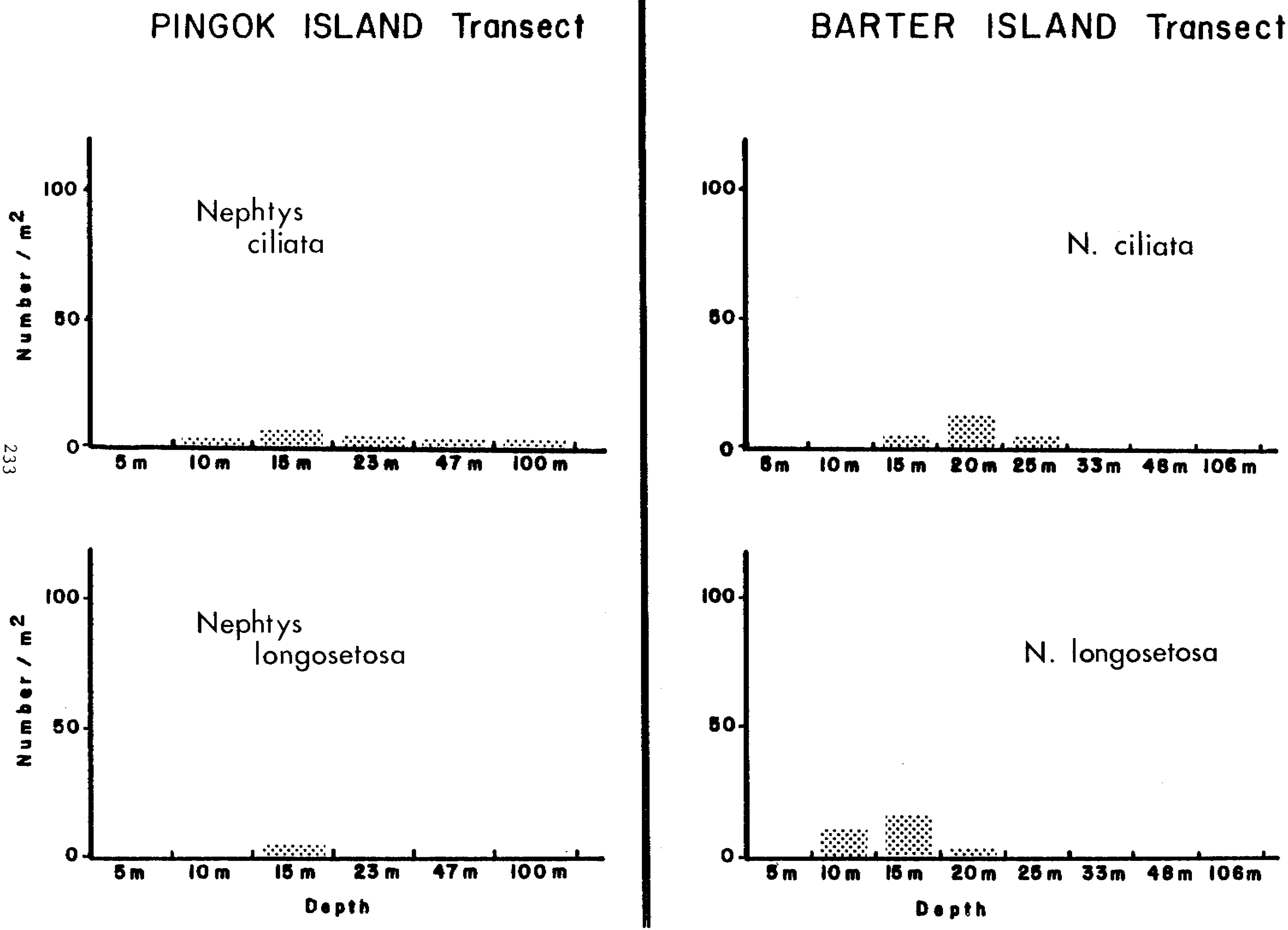


Figure 12. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

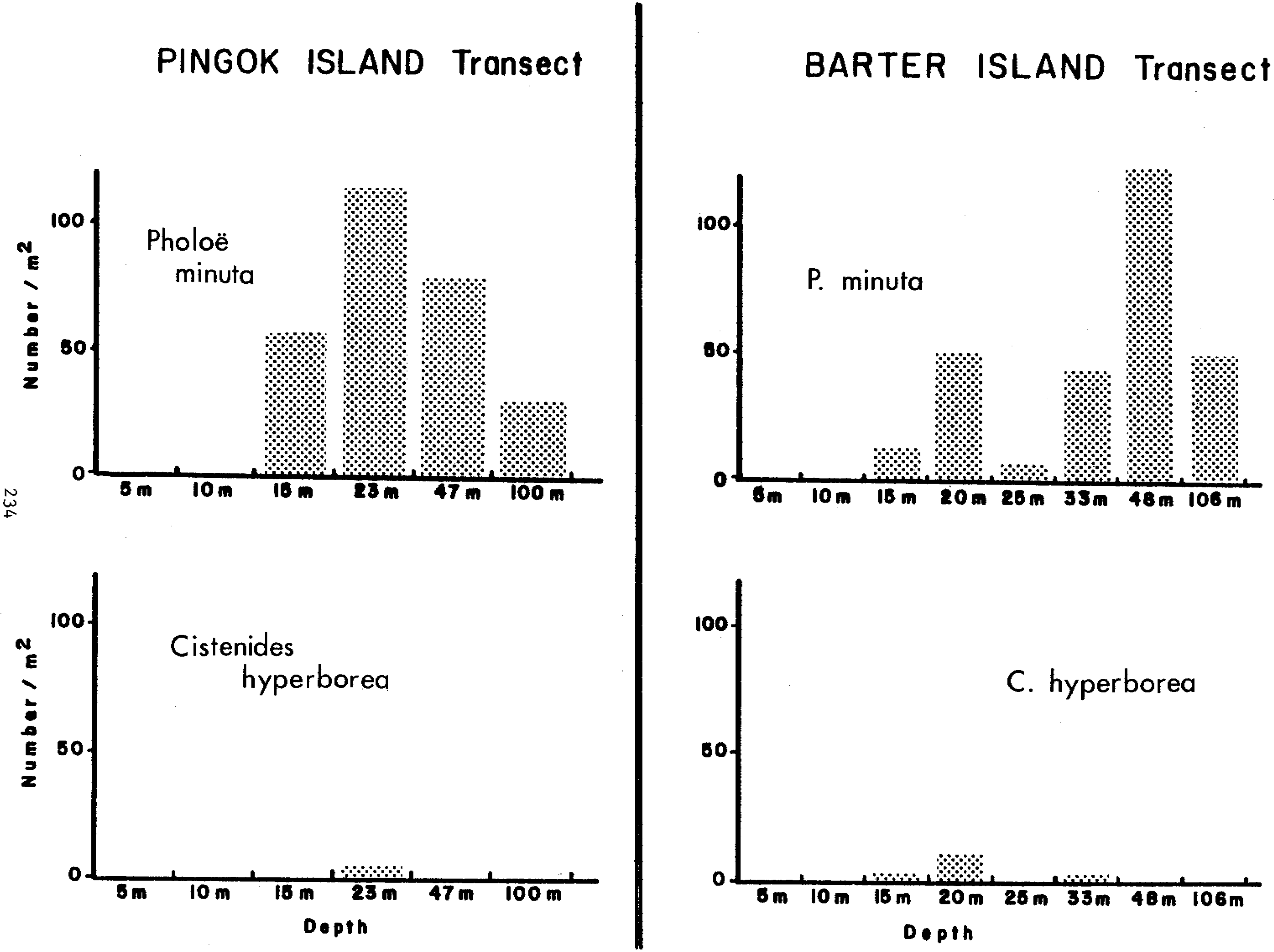


Figure 13. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

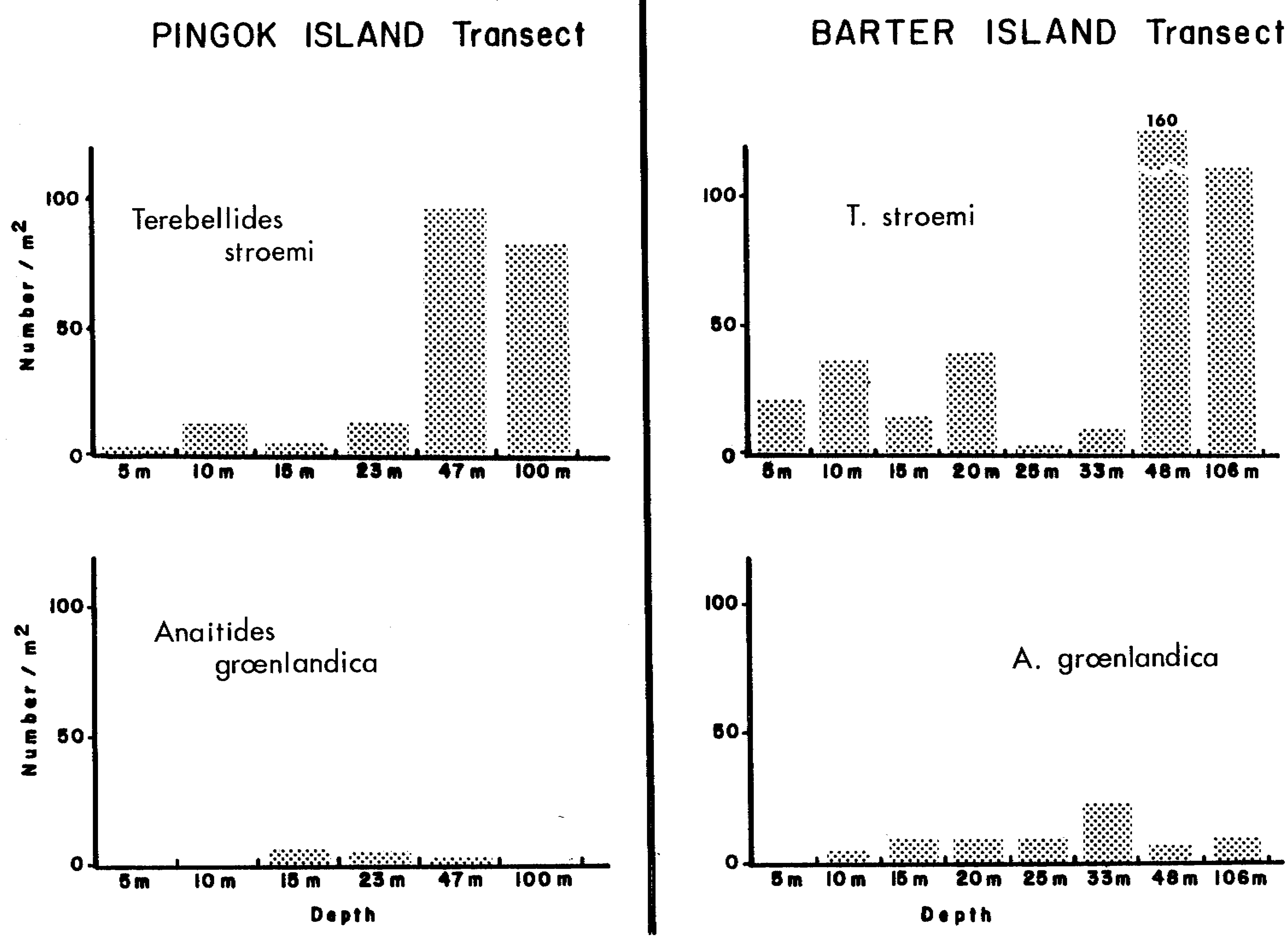


Figure 14. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

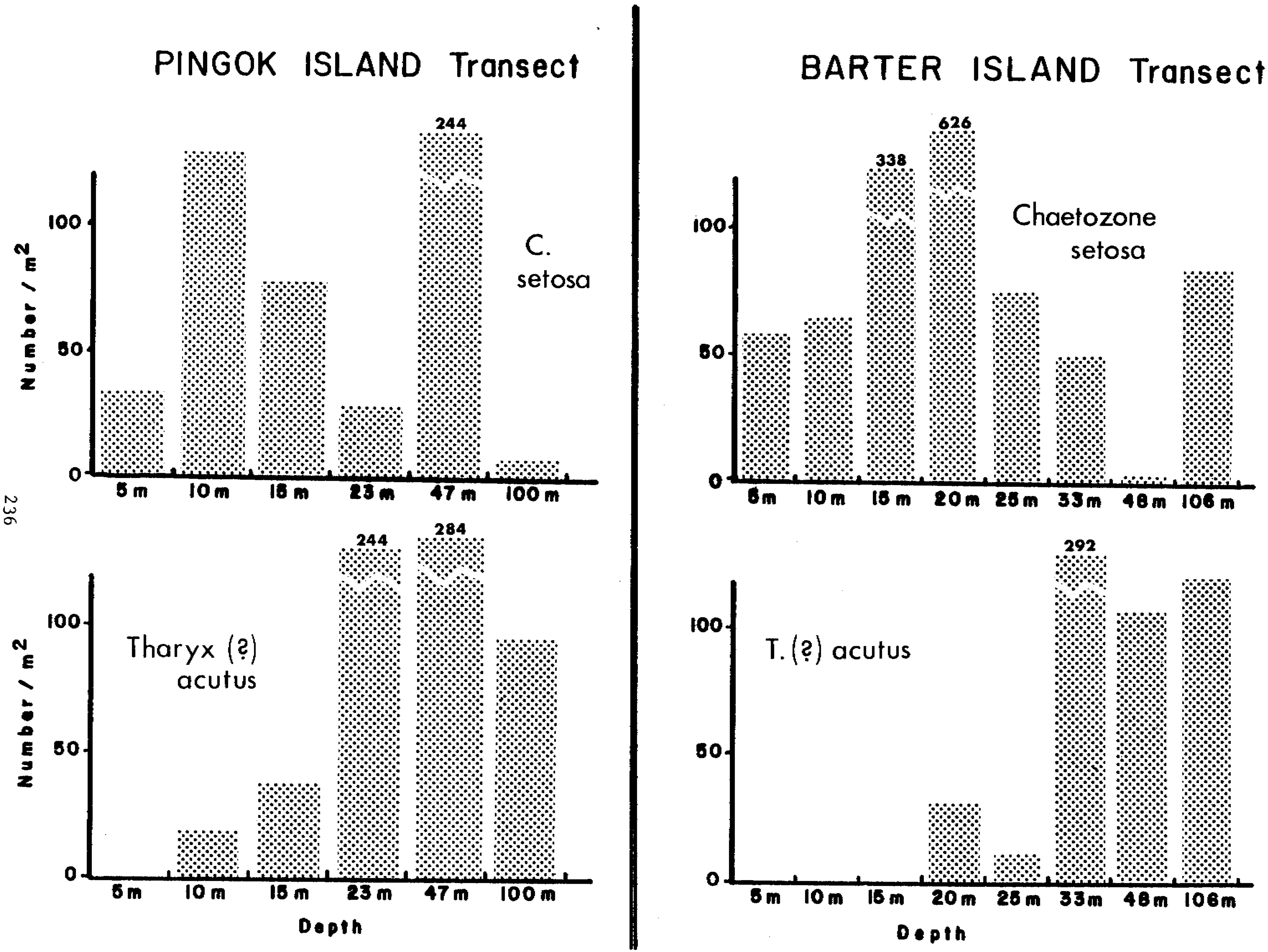


Figure 15. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

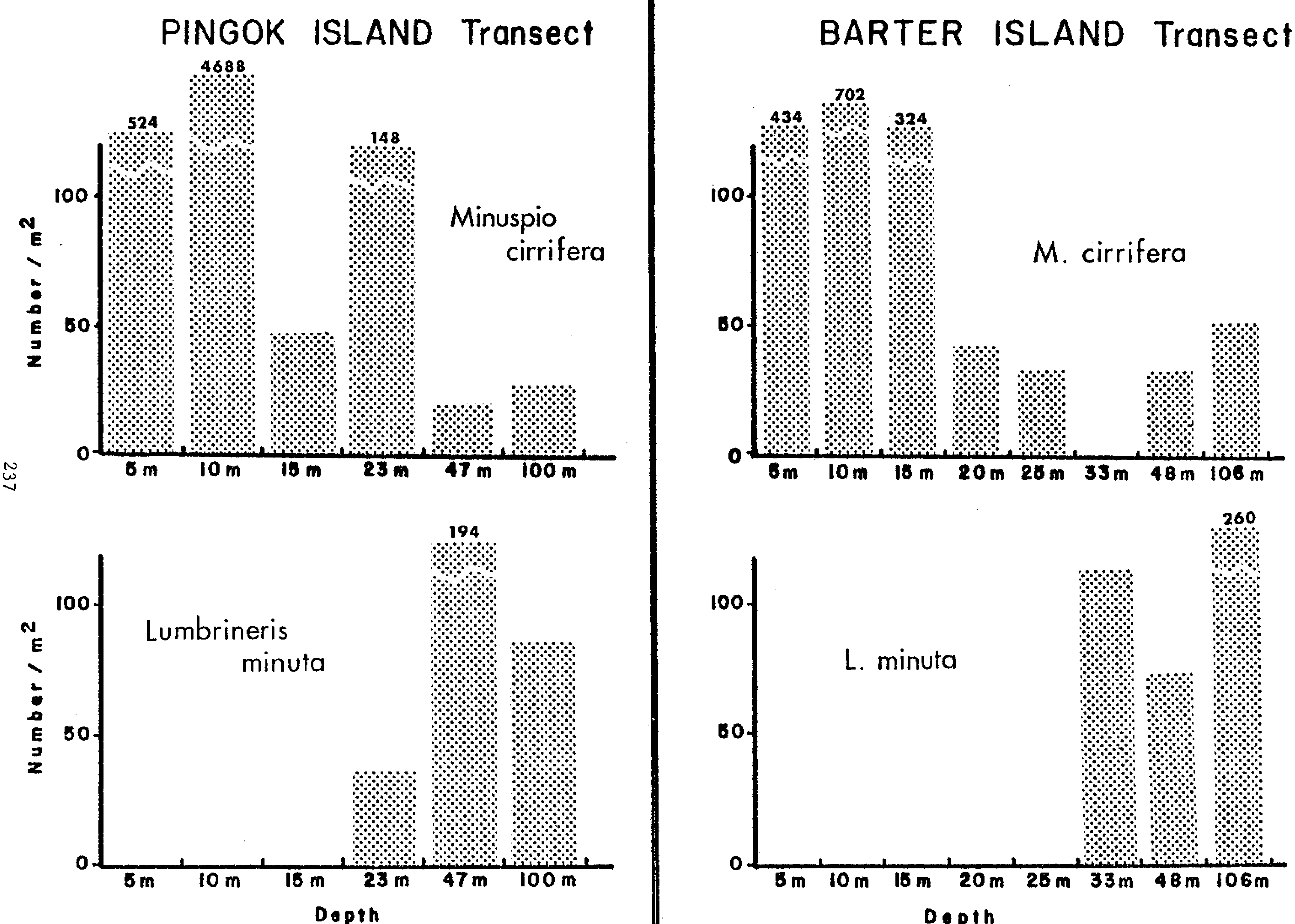


Figure 16. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

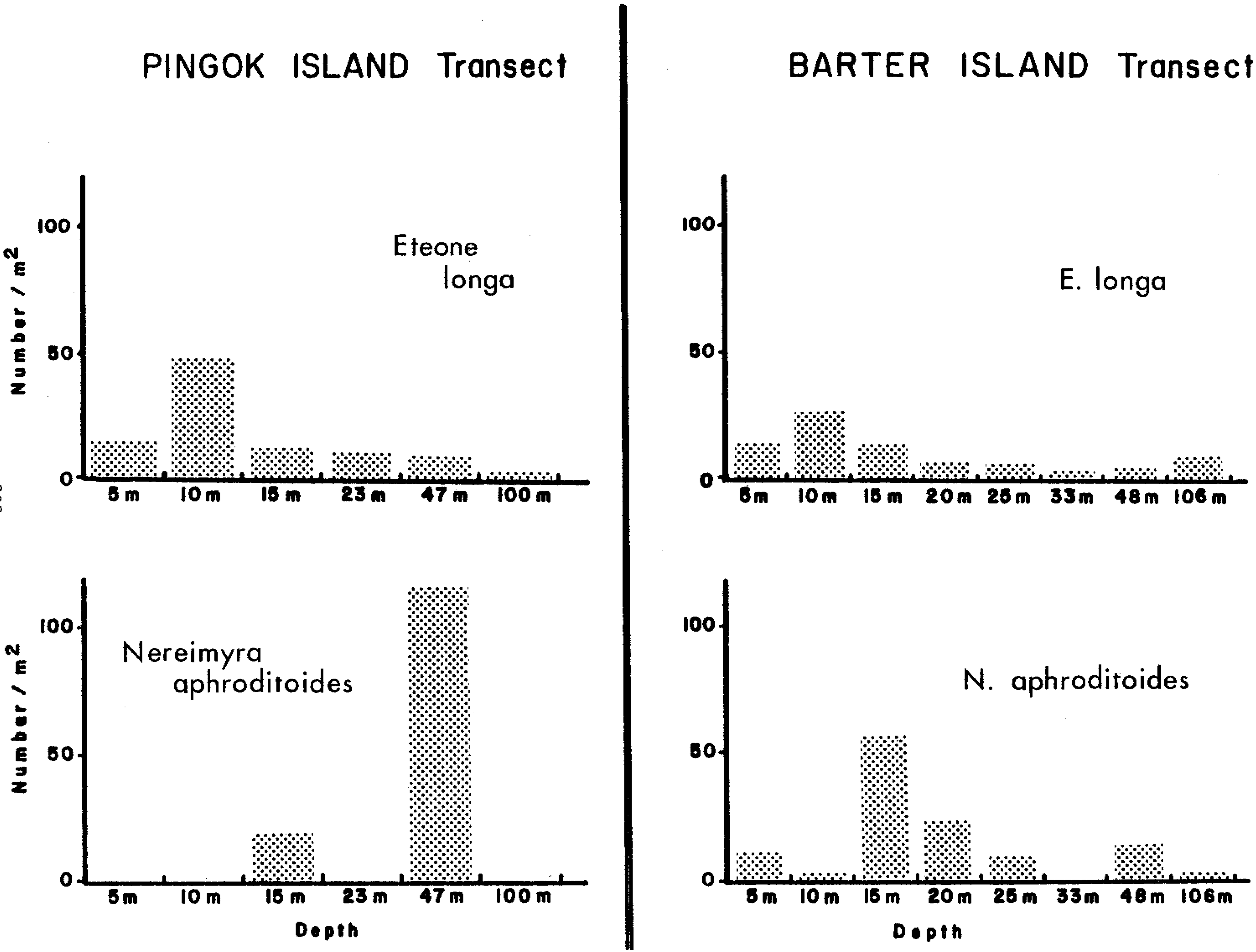


Figure 17. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

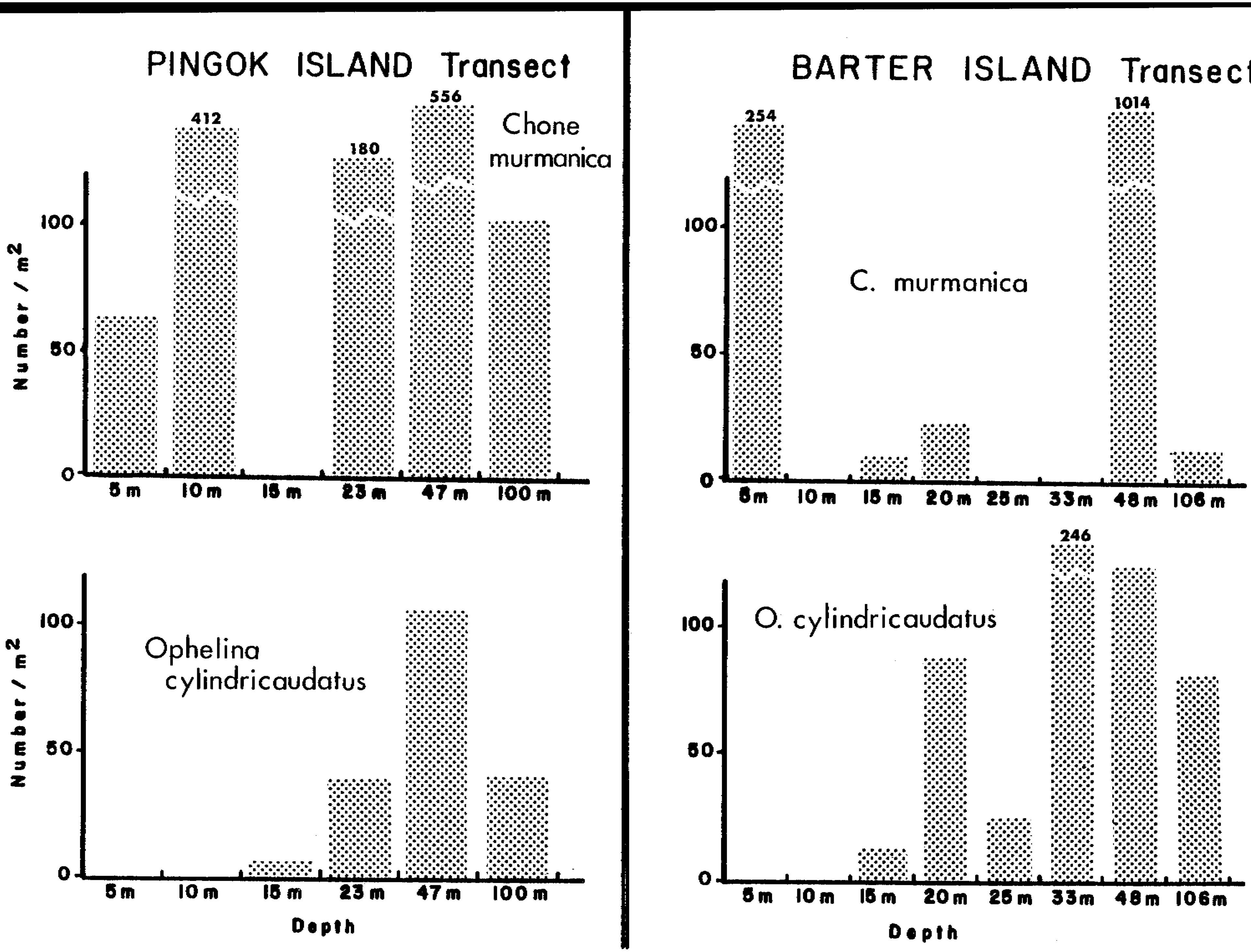


Figure 18. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

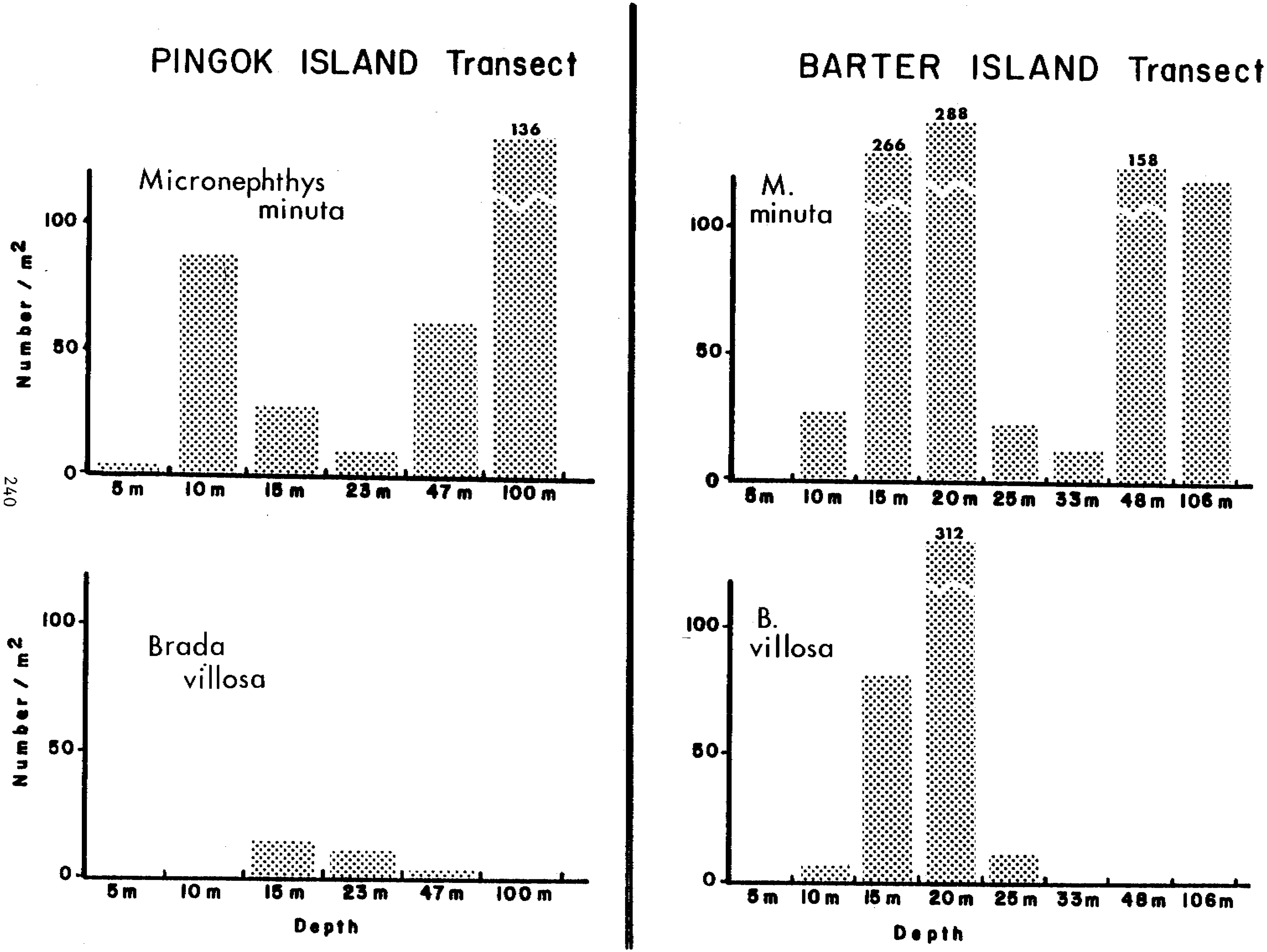


Figure 19. Polychaetous annelid distribution-abundance patterns across the Beaufort Sea shelf.

	PINGOK ISLAND TRANSECT						BARTER ISLAND TRANSECT							
	5m	10m	15m	23m	47m	100m	5m	10m	15m	20m	25m	33m	48m	106m
Ampharetidae														
<u>Ampharete</u> <u>vega</u>	310	18					452	78	4				4	
<u>Ampharete</u> <u>acutifrons</u>			20	6	44		2	2	14	32		50		
<u>Lysippe</u> <u>labiata</u>			8	32	40	92			4	8		10	12	30
Scalibregmidae														
<u>Scalibregma</u> <u>inflatum</u>		2	10	2	44	4		14	6	12		10	18	
Apistobranchidae														
<u>Apistobranchus</u> <u>tullbergi</u>			2	2	2	2	2	20	34	178	4	10	4	
Sternaspidae														
<u>Sternaspis</u> <u>scutata</u>		14	8	56		10				38		8		
Nephtyidae														
<u>Nephtys</u> <u>ciliata</u>		2	6	4	2	2			4	12	4			
<u>Nephtys</u> <u>longosetosa</u>			4					10	16	2				
<u>Micronephthys</u> <u>minuta</u>	2	84	26	8	58	136		26	266	288	22	12	158	118
Flabelligeridae														
<u>Brada</u> <u>villosa</u>			14	10	2			6	80	312	10			
Sigalionidae														
<u>Pholoe</u> <u>minuta</u>			56	114	78	32			12	50	6	44	120	50
Pectinariidae														
<u>Cistenides</u> <u>hyperborea</u>				4					2	10		2		
Phyllodocidae														
<u>Eteone</u> <u>longa</u>	14	46	12	10	8	2	14	28	14	6	6	2	4	8
<u>Anaitides</u> <u>groenlandica</u>			6	4	2			4	8	8	8	22	6	8
Hesionidae														
<u>Nereimyra</u> <u>aphroditoides</u>			18		58		10	2	56	20	8		14	2
Trichobranchidae														
<u>Terebellides</u> <u>stroemi</u>	2	12	4	12	94	78	20	36	14	38	2	8	160	110
Cirratulidae														
<u>Chaetozone</u> <u>setosa</u>	32	128	76	26	244	6	56	64	338	626	72	52	2	86
<u>Tharyx</u> (?) <u>acutus</u>		18	34	244	284	94				32	14	292	108	118
Lumbrineridae														
<u>Lumbrineris</u> <u>minuta</u>				34	194	84						112	72	260
Spionidae														
<u>Minuspio</u> <u>cirrifera</u>	524	4688	46	148	18	28	434	702	324	42	32		32	52
<u>Marenzellaria</u> <u>wireni</u>	110	10	26				66	8						
<u>Prionospio</u> <u>steenstrupi</u>			2	14	98					2		48	26	24
Orbiniidae														
<u>Scoloplos</u> <u>armiger</u>	6		8				230	32		6				
<u>Scoloplos</u> <u>acutus</u>			42	18	16	24			4	26	8	18		52
Sabellidae														
<u>Chone</u> <u>murmanica</u>	60	412		180	556	104	254		8	22			1014	12
Opheliidae														
<u>Ophelina</u> <u>cylindricaudatus</u>			6	40	104	44			12	86	28	246	128	82

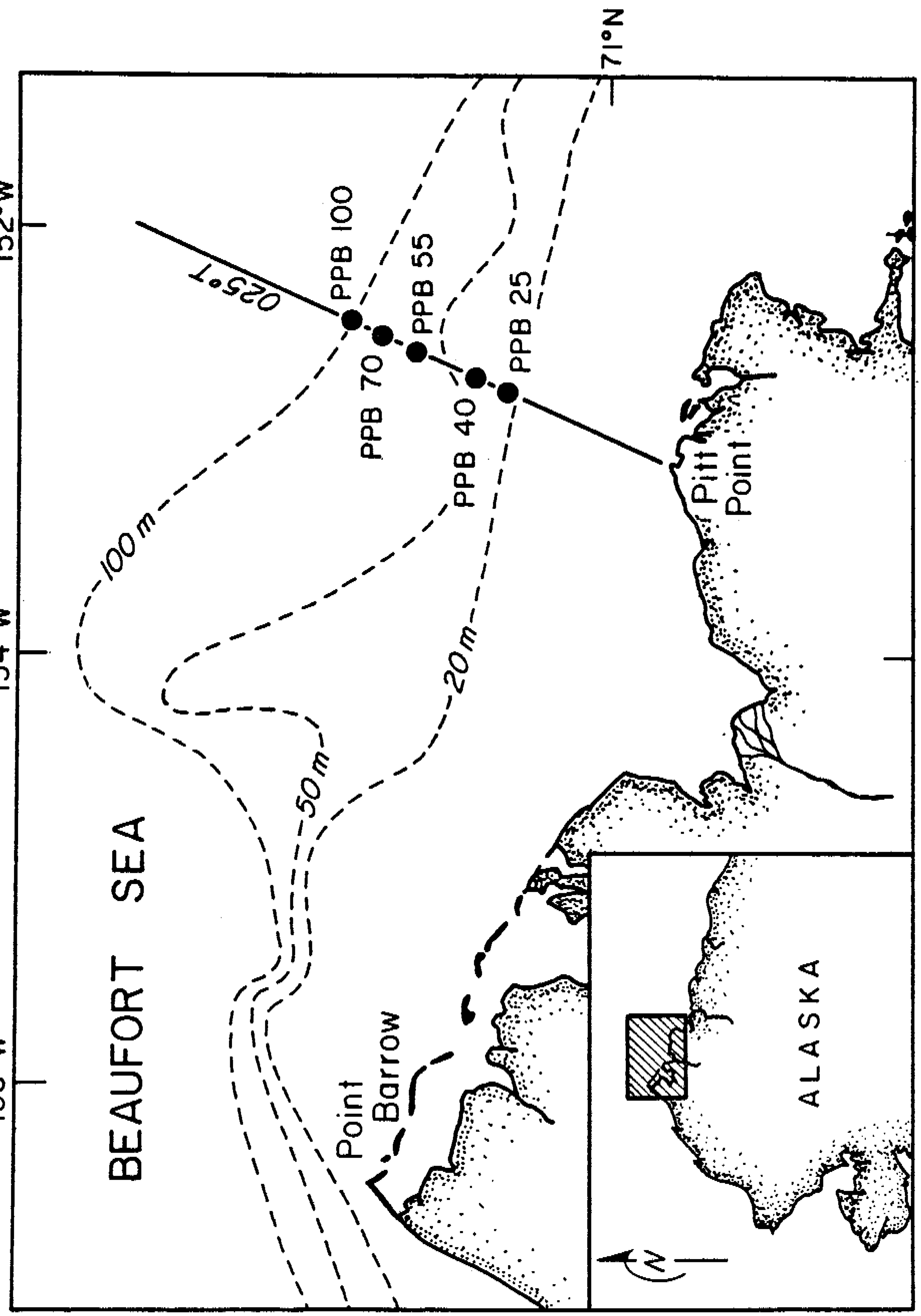
Table 1. Summary of the distribution-abundances for the dominant species of polychaete worms on two station transects across the western Beaufort Sea continental shelf. The data are experessed as numbers per square meter.

Additional data and further statistical analyses including error terms are necessary before regional conclusions can be drawn for the western Beaufort Sea continental shelf. As additional analysis and synthesis is undertaken some general conclusions about the distribution-abundance and species grouping patterns can be drawn for important prey species in the marine coastal and continental shelf food web.

B. Temporal variability of benthic infauna across the continental shelf on the OCS Station Transect - Pitt Point.

Further analysis of the macro-infaunal time series samples from the OCS Pitt Point Station Transect (Figure 20) has been undertaken. The small fraction (0.5-1.0 mm) of the Smith-McIntyre grab samples has now been completely picked, rough-sorted and quantified (See the appended Quarterly Report for the remaining detailed data Tables). These data now allow a closer examination of the recruitment process of young individuals to the benthic populations throughout the year. The preliminary mean data (Figure 21) demonstrate significant changes in faunal numerical density, particularly in the small macrofaunal fraction (0.5-1.00 mm) and at the edge of the continental shelf. At station PPB-100 at 100 meters depth, maximum numbers were found in August 1976, while maximum numbers of large macro-fauna (>1.0 mm) were found in May, 1976. It is evident that population changes in smaller-sized groups such as the nematode worms, the harpacticoid copepods and ostracods contribute most of the variability (Tables 2 - 7) that occurs season to season. It is difficult to determine the life history patterns of the macro-infauna at the stage of analysis. Analysis of the reproduction and recruitment of individual species populations will be necessary before more firm conclusions can be drawn concerning the causes of the temporal changes in the continental shelf infaunal communities.

Figure 20. Location chart illustrating the five seasonal stations sampled on the Pitt Point Transect.



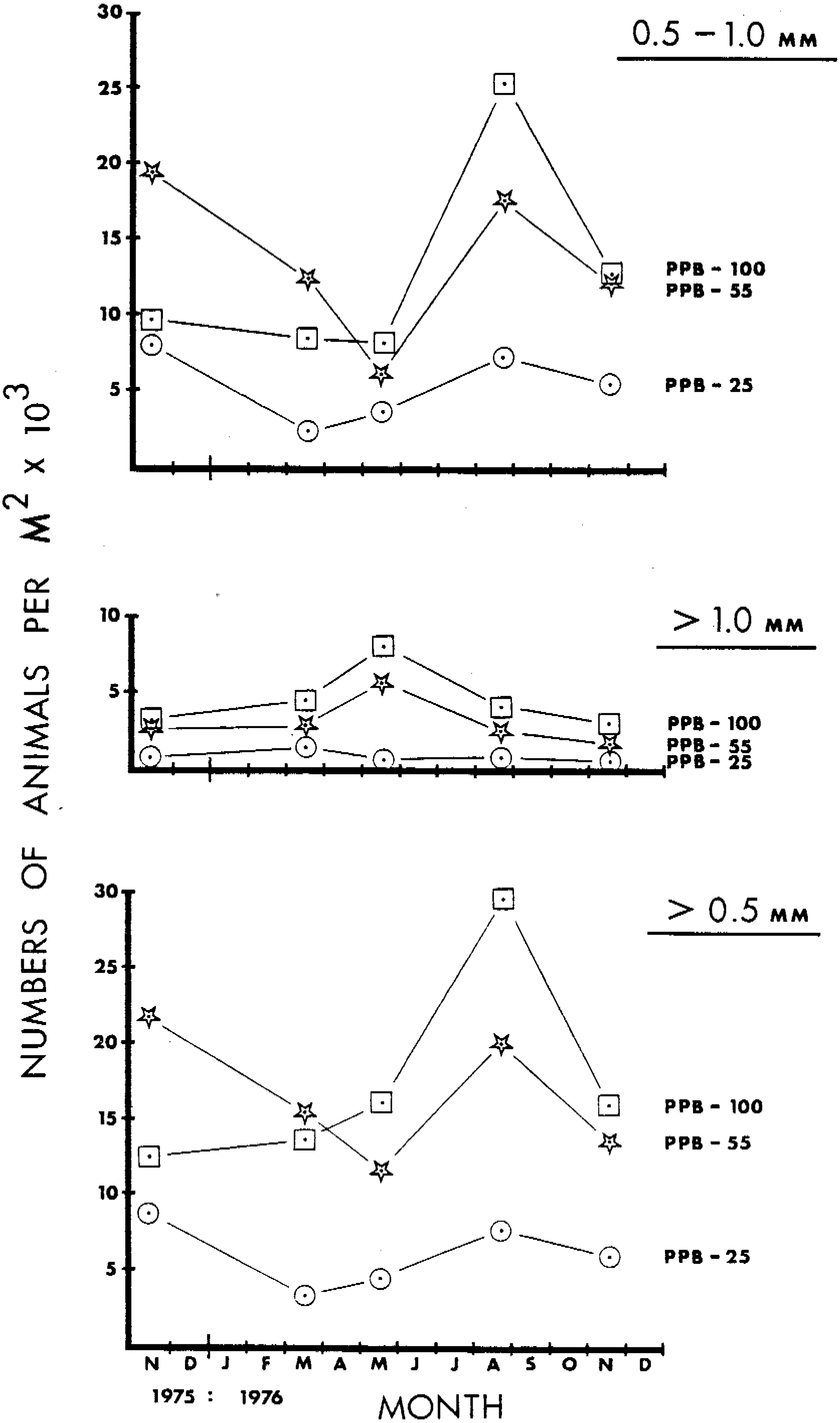


Figure 21. Mean data demonstrating significant changes in faunal numerical density.

Table 2. Percent composition of dominant major taxa of the small macro-infauna (0.5-1.0 mm in size) at station PPB-25 during the period November 1975 through November 1976.

PPB-25	0.5-1.0 mm fraction				
	OCS-1 Nov 75	OCS-2 Mar 76	OCS-3 May 76	OCS-4 Aug 76	OCS-6 Nov 76
Nematoda	30.6%	19.5%	14.5%	20.6%	42.9%
Polychaeta	13.3%	41.0%	15.4%	29.5%	35.6%
Gammarid Amphipoda	3.5%	0.1%	2.1%	2.2%	1.7%
Ostracoda	31.9%	30.7%	50.3%	25.0%	6.7%
Harpacticoid Copepoda	12.9%	3.5%	10.7%	14.8%	2.9%
Cumacea	0.2%	0.4%	0.2%	0.6%	0.8%
Pelecypoda	3.9%	1.2%	2.1%	2.5%	0.8%
Misc.	3.7%	3.6%	4.7%	4.8%	8.6%

Table 3. Percent composition of dominant major taxa of the small macro-fauna (0.5-1.0 mm in size) at station PPB-55 during the period November 1975 through November 1976.

PPB-55	0.5-1.0 mm fraction				
	OCS-1 Nov' 75	OCS-2 Mar 76	OCS-3 May 76	OCS-4 Aug 76	OCS-6 Nov 76
Nematoda	13.6%	14.0%	21.1%	31.6%	16.0%
Polychaeta	13.2%	9.5%	6.8%	15.2%	13.4%
Gammarid Amphipoda	7.0%	5.5%	13.8%	4.0%	3.3%
Ostracoda	47.9%	56.9%	45.9%	33.4%	55.0%
Harpacticoid Copepoda	4.4%	2.6%	1.5%	3.6%	2.4%
Cumacea	1.2%	0.9%	1.7%	1.8%	1.0%
Pelecypoda	1.7%	2.1%	1.6%	2.7%	1.6%
Misc.	11.0%	8.5%	7.6%	7.7%	7.3%

Table 4. Percent composition of dominant major taxa of the small macro-infauna (0.5-1.0 mm in size) at station PPB-100 during the period November 1975 through November 1976.

PPB-100	0.5-1.0 mm fraction				
	OCS-1 Nov 75	OCS-2 Mar 76	OCS-3 May 76	OCS-4 Aug 76	OCS-6 Nov 76
Nematoda	54.4%	13.9%	38.0%	45.4%	25.0%
Polychaeta	14.3%	16.2%	12.9%	10.7%	16.8%
Gammarid Amphipoda	3.7%	14.2%	10.1%	10.2%	15.6%
Ostracoda	10.6%	40.9%	28.3%	21.2%	24.9%
Harpacticoid Copepoda	8.7%	1.4%	0.4%	2.4%	2.4%
Cumacea	0.5%	2.5%	1.6%	3.2%	5.8%
Pelecypoda	1.2%	1.6%	0.9%	1.7%	0.9%
Misc.	6.6%	9.3%	7.8%	5.2%	8.6%

Table 5. Percent composition of dominant major taxa of the large macro-infauna (>1.0 mm in size) at station PPB-25 during the period November 1975 through November 1976.

PPB-25	>1.0 mm fraction				
	OCS-1 Nov 75	OCS-2 Mar 76	OCS-3 May 76	OCS-4 Aug 76	OCS-6 Nov 76
Nematoda	3.9%	1.6%	3.5%	2.5%	7.2%
Polychaeta	52.0%	79.9%	68.7%	61.0%	64.5%
Gammarid Amphipoda	5.9%	3.3%	5.4%	3.6%	10.0%
Ostracoda	1.3%	0.2%	2.6%	0.6%	4.6%
Harpacticoid Copepoda	0	0.3%	0.4%	0.4%	0
Cumacea	1.6%	0.5%	2.6%	1.1%	1.2%
Pelecypoda	30.1%	10.9%	7.2%	23.1%	5.6%
Misc.	5.2%	3.3%	9.6%	7.7%	6.9%

Table 6. Percent composition of dominant major taxa of the large macro-infauna (>1.0 mm in size) at station PPB-55 during the period November 1975 through November 1976.

PPB-55	>1.0 mm fraction				
	OCS-1 Nov 75	OCS-2 Mar 76	OCS-3 May 76	OCS-4 Aug 76	OCS-6 Nov 76
Nematoda	9.4%	6.9%	16.0%	17.1%	13.1%
Polychaeta	30.5%	24.5%	16.4%	42.1%	27.1%
Gammarid Amphipoda	22.6%	19.7%	16.9%	10.7%	15.9%
Ostracoda	18.8%	26.3%	31.8%	11.0%	22.9%
Harpacticoid Copepoda	0.3%	0.6%	0.9%	0.6%	0.4%
Cumacea	3.6%	3.3%	3.4%	5.2%	2.8%
Pelecypoda	5.3%	7.0%	5.7%	4.0%	7.9%
Misc.	9.5%	11.7%	8.9%	9.3%	9.9%

Table 7. Percent composition of dominant major taxa of the large macro-infauna (>1.0 mm in size) at station PPB-100 during the period November 1975 through November 1976.

PPB-100	>1.0 mm fraction				
	OCS-1 Nov 75	OCS-2 Mar 76	OCS-3 May 76	OCS-4 Aug 76	OCS-6 Nov 76
Nematoda	34.7%	12.0%	34.5%	27.8%	15.3%
Polychaeta	28.1%	27.7%	19.2%	32.2%	24.2%
Gammarid Amphipoda	8.3%	18.8%	12.7%	16.6%	26.1%
Ostracoda	16.8%	21.9%	19.4%	8.7%	15.4%
Harpacticoid Copepoda	3.0%	0.6%	0.5%	0.5%	0.1%
Cumacea	2.3%	4.7%	3.6%	3.9%	6.5%
Pelecypoda	2.7%	3.2%	2.7%	3.7%	3.8%
Misc.	4.1%	11.1%	7.4%	6.6%	8.6%

VI. Results (continued)

C. The zoogeography of western Beaufort Sea Polychaeta (Annelida).*

ABSTRACT

The western Beaufort Sea polychaete fauna may be divided into sublittoral and bathyal components. Sublittoral species occur at depths of less than 141 m, but may be stenobathic or eurybathic. Bathyal species are found exclusively below 358 m.

The youthful character of the sublittoral fauna, as evidenced by the dominance of Amphiboreal-arctic species, the near absence of endemic species, and the relatively low number of species in the sublittoral environment, is attributed to invasion of the sublittoral environment during interglacial intervals. The prevalence of endemic and Atlantic-boreoarctic species and the absence of Pacific-boreoarctic species within the bathyal fauna reflects the relative isolation of the bathyal and abyssal Arctic Ocean: some bathyal faunal exchange between the Atlantic and Arctic Oceans across the North Atlantic Transversal Ridge has been permitted since the Miocene, while the shallowness of the Bering Strait has prevented a similar exchange of Pacific and Arctic bathyal faunas since the Late Cretaceous. Isolation of the basin below 1098 m has been of sufficient duration (65 m.y.) for a strong endemic fauna to evolve.

*This section is extracted from the draft version of a manuscript by G.R. Bilyard and A.G. Carey, Jr. to be submitted to Sarsia within the next quarter.

I. INTRODUCTION

The zoogeography of high arctic regions has been investigated through the study of benthic polychaetes from the western Beaufort Sea (Point Barrow to Demarcation Line). Holthe (1978) has shown that despite the tendency toward widespread geographic distribution and eurybathy within the group, the study of polychaetous annelids can significantly contribute to our understanding of marine zoogeography. The intent of this discussion is to elucidate the zoogeographic relationships of the western Beaufort Sea polychaete fauna, and to interpret those relationships through consideration of the evolution of the Arctic Ocean basin and present and past attributes of the western Beaufort Sea marine environment. Comparisons with other groups of benthic invertebrates will be included in the discussion.

II. MATERIALS AND METHODS

The benthic invertebrates of the western Beaufort Sea (20-4200 m) were intensively sampled during the Western Beaufort Sea Ecological Cruises (1971-1972) and the Outer Continental Shelf Environmental Assessment Program Cruises (1975-1978). Samples collected at 58 stations across the continental shelf and slope (Fig. 1, Table 1) were selected for detailed analysis of the polychaete fauna. Included were 151 Smith-McIntyre grab samples (0.1 m^2; Smith and McIntyre, 1954), 19 otter trawl samples (3.7 and 6.7 m headrope semi-balloon shrimp trawls lined with 1.3 cm stretch mesh), and 3 box core samples (0.25 m^2; Sandia-Hessler box corer, Model Mk-3).

Terminology consistent with that of Holthe (1978) has been used to group polychaete species by the similarity of their geographic distributions. Arctic species are defined as those species occurring north of 66.5°N latitude. Amphiboreal-arctic species are found in the arctic, boreal Pacific (Bering Sea and Sea of Okhotsk), and boreal Atlantic (Laborador Sea, Norwegian-Greenland Sea and the waters of Greenland, Iceland, and northern Europe). Pacific-boreoarctic species inhabit arctic waters and the boreal waters of the Pacific, but do not occur in the boreal waters of the Atlantic. Atlantic-boreoarctic species inhabit arctic waters and the boreal waters of the Atlantic, but do not occur in the boreal waters of the Pacific.

Undescribed species, which have been given letter designations in the following discussion (e.g., *Allia* sp. A), are considered as Arctic species. Since some of these species may be collected in subarctic regions in the future, the level of endemism in the western Beaufort Sea polychaete fauna may be overestimated. Generic assignments for undescribed species follow Fauchald (1977).

III. RESULTS

The polychaete species encountered in this study may be divided into a sublittoral fauna and a bathyal fauna. The sublittoral fauna includes 114 species with upper depth range limits of 20 to 140 m (Table 2). All degrees of stenobathy and eurybathy are exhibited by sublittoral species. Assigned to the bathyal fauna (Table 3) are 17 species with minimum depths of occurrence in excess of 358 m. One described sublittoral species (*Barantolla americana*) and four described bathyal species (*Ephesiella macrocirrus*, *Sigambra tentaculata*, *Allia abranchiata*, *Aricidea tetrabranchia*) have not been previously collected in arctic waters.

The absence of species with upper depth range limits of 141 to 358 m probably reflects sampling intensity (Table 1), rather than a gap in the occurrence of additional species with increasing depth, yet the assignment of species to the sublittoral or bathyal faunas may be justified by the substantial difference in the zoogeographic affinities of the two faunas. The sublittoral fauna (Table 3) is predominantly composed of Amphiboreal-arctic species (89 species, 77% of the fauna), the vast majority of which (78 species) also occur in temperate and.or tropical latitudes. Species with Arctic (4 described species; 7 undescribed species), Atlantic-boreoarctic (9 species), and Pacific-boreoarctic (6 species) distributions account for only 23% of the fauna. By contrast, a majority (9) of the bathyal species (Table 3) are undescribed and probably endemic to the Arctic Ocean. Five bathyal species are Atlantic-boreoarctic, three are Amphiboreal-arctic, and none are Pacific-boreoarctic.

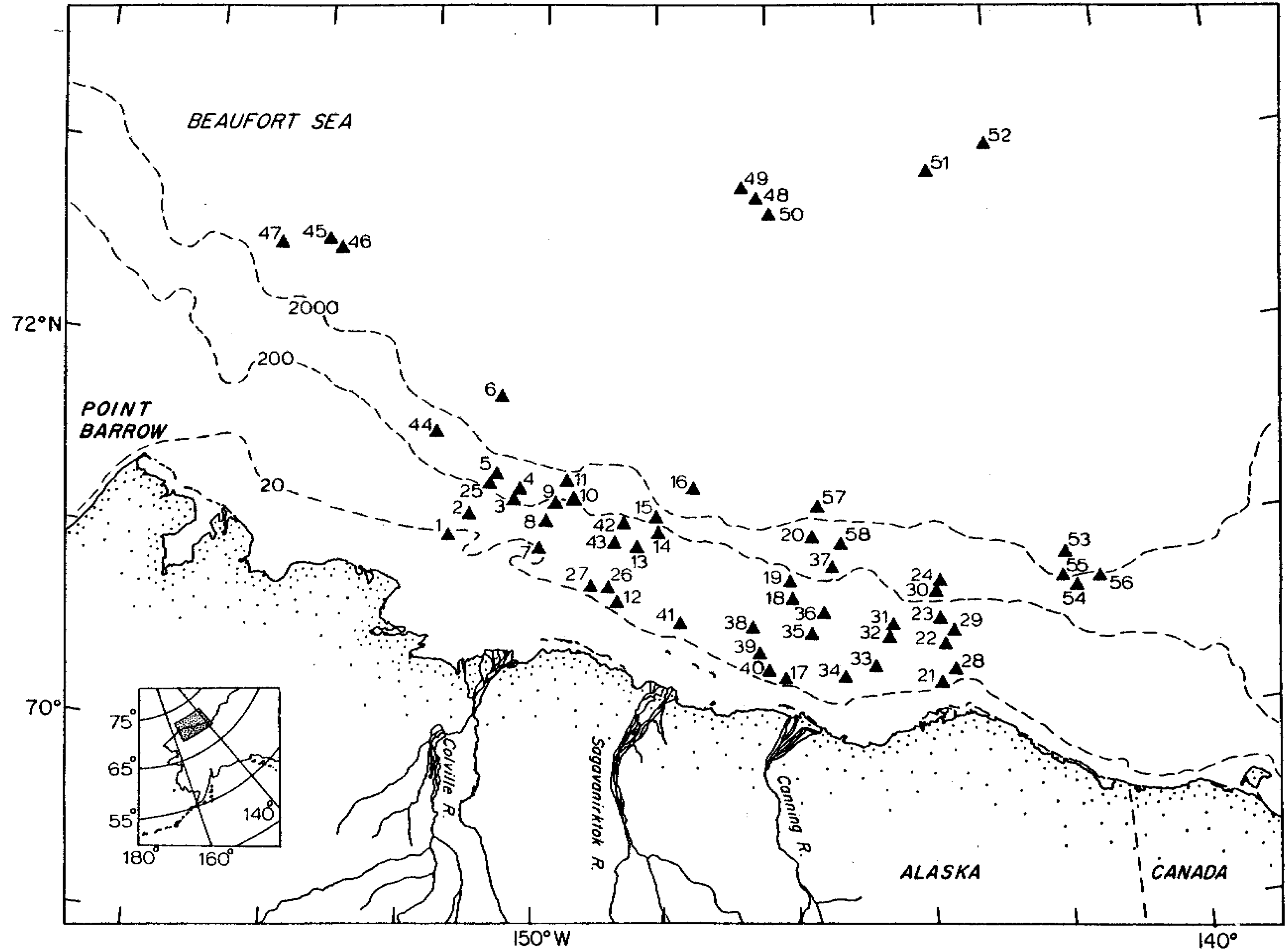


Fig. 1. Polychaete stations (1-58) in the western Beaufort Sea. Depth contours are in meters.

Table 1. Stations and samples selected for analysis of the polychaete fauna. SMG, Smith-McIntyre grab; OTB, otter trawl; BXC, box core.

Station number	Depth (meters)	Sampling gear	Number of samples
1	20-21	SMG	5
2	45	SMG	5
3	132-140	SMG	5
4	540-831	SMG	5
5	795-997	SMG	5
6	2139-2461	SMG	4
7	27-28	SMG	5
8	44-45	SMG	5
9	169-232	SMG	5
10	603-991	SMG	5
11	1618-1926	SMG	5
12	23-24	SMG	5
13	46-48	SMG	5
14	85-111	SMG	5
15	324-430	SMG	5
16	2295-3010	SMG	5
17	26-27	SMG	5
18	57-58	SMG	5
19	81-84	SMG	5
20	447-480	SMG	5
21	32-34	SMG	5
22	48	SMG	5
23	105-109	SMG	5
24	494-498	SMG	5
25	574-700	SMG	3
26	50	OTB	1
27	31	OTB	1
28	28-37	OTB	2
29	51	OTB	1
30	464	OTB	1
31	71	OTB	1
32	41	OTB	1
33	27	OTB	1
34	30	OTB	1
35	50	OTB	1
36	79	OTB	1
37	357	OTB	1
38	48	OTB	1
39	34	OTB	1
40	27	OTB	1
41	29	OTB	1

Table 1 (continued).

Station number	Depth (meters)	Sampling gear	Number of samples
42	159	OTB	1
43	55	OTB	1
44	1643-1738	BXC	3
45	2470	SMG	1
46	2840	SMG	1
47	2650	SMG	1
48	3750-3841	SMG	3
49	3511-4200	SMG	5
50	3569-3570	SMG	2
51	3386	SMG	1
52	3475	SMG	1
53	1958-2086	SMG	4
54	997-1097	SMG	2
55	640-686	SMG	5
56	1025	SMG	1
57	2104	SMG	1
58	1144	SMG	2

Table 2. The sublittoral polychaete fauna. Species found in temperate and/or tropical latitudes are preceeded by an asterisk (*). Depth ranges within the study area are noted. Undescribed taxa are given letter designations.

Amphiboreal-arctic species	Depth range (m)
*Ophelina acuminata ØRSTED, 1843	21-41
*Dexiospira spirillum (LINNAEUS, 1758)	23-33
*Brada villosa (RATHKE, 1843)	23-47
*Sphaerodoropsis minuta (WEBSTER & BENEDICT, 1887)	24-48
*Harmothoe imbricata (LINNAEUS, 1767)	27
*Eunoe oerstedi (MALMGREN, 1865)	27-34
Melaenis loveni MALMGREN, 1865	27-34
Sabellides borealis SARS, 1856	27-44
*Nephtys paradoxa MALM, 1874	44-47
*Chone infundibuliformis KRÖYER, 1856	47
*Cirratulus cirratus (MÜLLER, 1776)	47-48
*Pherusa plumosa (MÜLLER, 1776)	48
*Typosyllis fasciata (MALMGREN, 1867)	48
*Schistomeringos caecus (WEBSTER & BENEDICT, 1884)	23-85
*Nicolea zostericola ØRSTED, 1844	26-58
*Brada inhabilis (RATHKE, 1843)	27-57
*Polycirrus medusa GRUBE, 1855	47-83
*Leaena abranchiata MALMGREN, 1866	48-58
*Sphaerosyllis erinaceus (CLAPARÈDE, 1863)	48-58
Axionice flexuosa (GRUBE, 1860)	48-94
*Lagisca extenuata (GRUBE, 1840)	23-106
*Spirorbis granulatus (LINNAEUS, 1767)	23-137
*Exogone naidina ØRSTED, 1845	28-105
*Nereis zonata MALMGREN, 1867	29-106
*Exogone dispar (WEBSTER, 1879)	32-105
*Polydora caulleryi MESNIL, 1897	33-140
*Gattyana cirrosa (PALLAS, 1766)	47-132
*Eucranta villosa MALMGREN, 1865	48-109
*Autolytus alexandri MALMGREN, 1867	48-132
*Trichobranchus glacialis (MALMGREN, 1866)	48-139
*Apistobranchus tullbergi (THÉEL, 1879)	20-189
*Lysippe labiata MALMGREN, 1866	21-169
*Ampharete arctica MALMGREN, 1866	45-169
*Cistenides hyperborea (MALMGREN, 1866)	20-232
*Praxillella praetermissa (MALMGREN, 1865)	23-204
*Proclea graffii (LANGERHANS, 1884)	23-232
*Artacama proboscidea MALMGREN, 1866	26-232
Laphania boecki MALMGREN, 1866	34-204
*Amphicteis gunneri (SARS, 1835)	47-357
Lanassa venusta MALM, 1874	48-324
*Chone duneri MALMGREN, 1867	21-496
*Lumbrineris fragilis (MÜLLER, 1776)	23-494
*Typosyllis cornuta (RATHKE, 1843)	23-498
*Euchone papillosa (SARS, 1851)	27-464

Table 2 (continued).

Amphiboreal-arctic species (continued)	Depth range (m)
Mysta barbata (MALMGREN, 1865)	44-498
Lanassa nordenskioldi MALMGREN, 1866	48-447
Nothria conchylega (SARS, 1835)	48-464
*Glyphanostomum pallescens (THÉEL, 1879)	48-496
*Anaitides groenlandica (ØRSTED, 1843)	20-540
*Pholoe minuta (FABRICIUS, 1780)	20-676
*Lumbrineris impatiens (CLAPARÈDE, 1868)	23-640
*Ampharete acutifrons (GRUBE, 1860)	24-640
*Melinna cristata (SARS, 1851)	32-640
*Prionospio steenstrupi MALMGREN, 1867	20-717
*Spiochaetopterus typicus SARS, 1856	44-717
*Eteone longa (FABRICIUS, 1780)	20-831
*Nephtys ciliata (MÜLLER, 1789)	20-831
*Barantolla americana HARTMAN, 1963	20-887
*Cossura longocirrata WEBSTER & BENEDICT, 1887	20-997
*Tauberia gracilis (TAUBER, 1879)	21-997
*Trochochaeta carica (BIRULA, 1897)	23-991
*Eteone flava (FABRICIUS, 1780)	21-1144
*Scalibregma inflatum RATHKE, 1843	21-1144
*Ophelina cylindricaudata (HANSEN, 1878)	20-1926
*Sternaspis fossor STIMPSON, 1854	20-1926
*Antinoella sarsi (MALMGREN, 1865)	23-1643
Diplocirrus longisetosus (MARENZELLER, 1890)	27-1926
*Laonice cirrata (SARS, 1851)	44-1738
*Onuphis quadricuspis SARS, 1872	44-1926
Antinoella badia (THÉEL, 1879)	20-2204
*Capitella capitata (FABRICIUS, 1780)	21-2470
*Owenia fusiformis DELLE CHAIJE, 1841	48-2204
*Micronephthys minuta (THÉEL, 1879)	20-2560
*Chaetozone setosa MALMGREN, 1867	20-2650
*Heteromastus filiformis (CLAPARÈDE, 1864)	21-2560
*Sphaerodorum gracilis (RATHKE, 1843)	33-2650
*Minuspio cirrifera (WIRÉN, 1883)	20-3010
*Terebellides stroemi SARS, 1835	20-3386
*Maldane sarsi MALMGREN, 1865	32-3010
*Myriochele heeri MALMGREN, 1867	47-3010
*Allia nolani (WEBSTER & BENEDICT, 1887)	21-3511
*Aglaophamus malmgreni (THÉEL, 1879)	24-4200
*Nereimyra punctata (MÜLLER, 1776)	26-3750
*Anaitides citrina (MALMGREN, 1865)	58-71
*Mystides borealis THÉEL, 1879	84
Amage auricula MALMGREN, 1866	71-1025
*Enipo gracilis VERRILL, 1874	134-137
*Arcteobia anticostiensis (McINTOSH, 1874)	137
*Petaloproctus tenuis (THÉEL, 1879)	140-676

Table 2 (continued).

Arctic species	Depth range (m)
Genus A	23-45
Brada incrustata STØP-BOWITZ, 1948	27
Ampharete vega (WIREN, 1883)	21-58
Paraonis sp. A	21-494
Clymenura polaris (THÉEL, 1879)	20-759
Allia sp. A	21-831
Chone murmanica LUKASCH; 1910	20-991
Sphaerodoridium sp. A	47-991
Parheteromastus sp. A	23-2840
Sphaerodoropsis sp. B	81-923
Eclysippe sp. A	71-1025
Atlantic-boreoarctic species	
Lumbriclymene minor ARWIDSSON, 1907	35-48
Sphaerodoridium claparedii (GREEFF, 1866)	45
Autolytus fallax MALMGREN, 1867	26-58
*Polyphysia crassa (ØRSTED, 1843)	27-84
Notoproctus oculatus var. arctica ARWIDSSON, 1907	48-686
*Scoloplos acutus (VERRILL, 1873)	20-1926
Diplocirrus hirsutus (HANSEN, 1879)	33-1800
Jasmineira schaudinni AUGENER, 1912	57
Paranaitis wahlbergi (MALMGREN, 1865)	71
Pacific-boreoarctic species	
Brada nuda ANNENKOVA, 1922	47-57
Glycinde wireni ARWIDSSON, 1898	44-137
Magelona longicornis JOHNSON, 1901	45-134
Sphaerodoropsis biserialis (BERKELEY & BERKELEY, 1944)	47-1144
Aricidea ushakovi ZAKS, 1925	26-1618
Lumbrineris minuta THÉEL, 1879	23-4200

Table 3. The bathyal polychaete fauna. Species found in temperate and/or tropical latitudes are preceeded by an asterisk (*). Depth ranges within study area are noted. Undescribed taxa are given letter designations.

Arctic species	Depth range (m)
Sphaerodoropsis sp. A	359-887
Lumbrineris sp. B	447-659
Schistomeringos sp. A	447-686
Ophelina sp. A	640-3750
Genus B	644-2086
Tachytrypane sp. A	1958-2086
Lumbrineris sp. A	2104-2800
Cossura sp. A	2204-2840
Nicon sp. A	2400-2470
Atlantic-boreoarctic species	
*Ophelina abranchiata STØP-BOWITZ, 1948	447-2800
*Apomatus globifer THÉEL, 1879	464
*Ephesiella macrocirrus HARTMAN & FAUCHALD, 1971	494
*Allia abranchiata (HARTMAN, 1965)	640-3843
*Aricidea tetrabranchia HARTMAN & FAUCHALD, 1971	1958-2086
Amphiboreal-arctic species	
Branchiomma infarcta (KRÖYER, 1856)	464
*Sigambra tentaculata (TREADWELL, 1941)	447-3010
*Lumbrineris latreilli (AUDOUIN & MILNE-EDWARDS, 1833)	686-2086

IV. DISCUSSION

The sublittoral fauna

Zoogeographic affinities of the sublittoral polychaete fauna are not atypical within the Arctic Ocean basin. A polychaete fauna dominated by Amphiboreal-arctic species, but including some Pacific-boreoarctic and Atlantic-boreoarctic species was reported from the Canadian Archipelago (Grainger, 1954). Similarly, about half the species of western Beaufort Sea bivalve molluscs with upper depth ranges shallower than 356 m exhibit amphiboreal-Arctic distributions. The balance of the bivalve fauna includes Atlantic-boreoarctic (32%) and Pacific-boreoarctic (17%) species (Bernard, in press). A predominance of species with geographic distributions extending into the Atlantic and/or Pacific Oceans, coupled with a dearth of endemic species, has also been reported for isopod crustaceans (Menzies et al., 1973), sea stars (Grainger, 1966), bryozoans (Powell, 1968), and a mixed collection of benthic invertebrates from the Point Barrow region (MacGinitie, 1955).

The absence of a strong endemic component and the consequent boreal character of the Arctic Ocean sublittoral fauna have been cited as evidence of a youthful fauna (Zenkevitch, 1963; Briggs, 1974; Knox and Lowry, 1977). Zoogeographic affinities of the western Beaufort Sea sublittoral polychaete fauna further substantiate the boreal character of the sublittoral fauna and are supportive of this hypothesis.

That the shallow water fauna appears to be depauperate in numbers of species has also been presented as evidence in s-pport of an immature fauna (Zenkevitch, 1963; Dunbar, 1968; Knox and Lowry, 1977). Knox and Lowry (1977) estimate that 300 species of polychaetes occur in the Arctic Ocean. By comparison, more than 650 species probably occur in the Antarctic region (Knox and Lowry, 1977), more than 750 species probably occur in the shallow waters off South Africa (Day, 1967), and about 550 species of polychaetes have been reported from depths of less than 200 m off southern California (Hartman, 1969a; Hartman, 1969b). The collection of 114 species of sublittoral polychaetes in the present study is, therefore, not inconsistent with the concept of a depauperate shallow water fauna.

Climatic changes during the Pliocene and Pleistocene are likely responsible for the youthful character of the sublittoral fauna (Zenkevitch, 1963; Dunbar, 1968). The intervals of Northern Hemisphere glaciation which began at 3.0 m.y.B.P. and intensified to maximum severity about 0.4 m.y.B.P. (Berggren, 1972) generally persist about 90,000 years; interglacial intervals generally persist about 10,000 years (Broecker and van Donk, 1970). In the arctic glacial intervals were probably accompanied by seasonal pack ice from 2.43 m.y.B.P. to 0.7 m.y. B.P., and permanent pack ice thereafter (Herman and O'Neil, 1975).

A conservative reconstruction of full glacial conditions in the arctic would include a sea-level drop of about 85 m (CLIMAP Project Members, 1976), ice sheets over North America, Greenland, Iceland, Great Britain, Scandanavia, the Barents Sea, and the Kara Sea (Boulton and Rhodes, 1974; Hughes et al., 1977; Kvasov and Blazhchishin, 1978), and thick pack ice and/or floating ice shelves within the Arctic Ocean basin (Hughes et al., 1977). Thick permanent pack ice would have substantially decreased light transmission, and hence, primary productivity in the water column, while lowered sea-level and the presence of grounded ice sheets on most of the present continental shelves would have severely reduced the areal extent of the sublittoral environment.

Under such severe conditions, which are thought to have abated less than 10,000 years ago (Hughes et al., 1977), the elimination of many sublittoral species probably occurred (Bernard, in press). Loss of habitat and low nutrient supply were the probable agents of faunal extinction, as Dunbar (1968) has shown that low temperature alone is insufficient to preclude the existence of a rich marine fauna. Re-invasion of the sbulittoral environment by Atlantic and Pacific species during interglacial intervals would be consistent with the hypothesis of an immature sublittoral fauna, depauperate in the total number of species and in the number of endemic species.

The bathyal fauna

Different zoogeographic affinities of the fauna found exclusively below 300 or 400 m in the Arctic Ocean are not unique to the polychaetous annelids. Few endemic species of isopods are found on the continental shelf, but endemic and Atlantic-boreoarctic species are prevalent in the isopod fauna below 425 m (Menzies et al., 1973). Of the seven species of western Beaufort Sea bivalves with upper depth range limits in excess of 300 m, four are endemic and three have Atlantic-boreoarctic distributions (Bernard, in press). In addition, the bathyal ostracod fauna (Joy and Clark, 1977) and the total benthic invertebrate fauna in bathyal and abyssal depths off Siberia (Zenkevitch, 1963) are dominated by endemic and Atlantic-boreoarctic species. Conspicuously absent from the bathyal fauna of this and other studies (Zenkevitch, 1963; Menzies et al., 1973; Joy and Clark, 1977; Bernard, in press) is a Pacific-boreoarctic element.

The composition of the bathyal polychaete fauna clearly reflects the geological history of the Arctic Ocean basin. The absence of Pacific-boreoarctic polychaetes and other taxa is due to the effectiveness of the Bering Strait as a topographic barrier to faunal dispersion. After having been emergent since the Late Cretaceous, the Bering land bridge submerged briefly during the Middle and Late Miocene (Hopkins and Scholl, 1970). Subsidence to its present elevation at 3.5 m.y.B.P. during the Pliocene (Hopkins and Scholl, 1970) has permitted the exchange of shallow water species at a maximum depth of 70 m only during interglacial intervals. Hence, no exchange of truly bathyal or abyssal species between the Arctic and Pacific Oceans has been possible for over 65 m.y.

Domination of the Arctic Ocean bathyal fauna by endemic and Atlantic-boreoarctic species is well documented (Ekman, 1953; Zenkevitch, 1963; this study), and understandable within an historical framework. Although the northward extension of the Mid-Atlantic Redge generated a deep-water connection between the Arctic Ocean and the Norwegian-Greenland Sea during the Oligocene (Talwani and Eldholm, 1977), the presence of the North Atlantic Transversal Ridge between Greenland, Iceland, and Great Britain prevented deep water faunal exchange. Submergence of that portion of the ridge between Iceland and the Faeroe Islands began in the Oligocene and was sufficient to permit substantial water exchange sometime during the Miocene (Schrader et al., 1976). An exchange of Arctic and Atlantic bathyal species was probably initiated at that time.

Because the North Atlantic Transversal Ridge has never been deeper than at present (average, 500-600 m; maximum, 1098 m), only those bathyal and abyssal bivalves which occur at 560 m or less are found in both the Arctic and Atlantic Ocean basins (Clarke, 1963). Similarly, of the eight described species of bathyal polychaetes found in this study, six occur at depths of less than 1,000 m in the Atlantic Ocean. The remaining two species (Ephesiella macrocirrus, 2000-2500 m; Allia abranchiata, 1500-2000 m) are known from only one study (Hartman, 1965).

The existence of many endemic bathyal and abyssal species is explained by geographic isolation. The Arctic Ocean has not been in contact with the Atlantic or Pacific Oceans at depths greater than 1098 m since possibly the Late Cretaceous (65 m.y.B.P.) and adequate time for speciation has elapsed.

By its presence the endemic fauna further reveals that the Arctic Ocean has not been anoxic in the recent past. If permanent ice cover on the Arctic Ocean and Norwegian-Greenland Sea during glacial intervals (CLIMPA Project Members, 1976) had prevented a flow of oxygenated water into the ARctic Ocean at depth, extinction of the bathyal and abyssal faunas would have ensued. The existant endemic fauna is too rich to have evolved since the end of the last glacial interval.

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VI. Results (continued)

D. Polychaeta (Annelida): Data Sheets

One hundred thirty-three species of polychaetes (Table) have been collected and identified from the continental shelf and slope of the western Beaufort Sea (20-4200 m). Species given letter designations in Table 1 (example: Eclysippe sp. A) are new to science and will be described at a later date in an appropriate journal. The assistance of Dr. Kristian Fauchald is gratefully acknowledged: the high degree of taxonomic accuracy achieved in this study would not have been possible without his help.

The following data include all samples of polychaetes which have been completely sorted and identified to the species level as of March 1, 1979. (Unidentified material was, in most cases, too damaged to permit identification.) The data given below were generated from samples collected during the Western Beaufort Sea Ecological Cruises of 1971 (WEBSEC-71) and 1972 (WEBSEC-72), and during the Outer Continental Shelf Environmental Assessment Program cruises of Summer, 1976 (OCS-4) and Summer, 1977 (OCS-7). Station designations (U.S.C.G., Oceanographic Report No. CG373-64, 1974) for stations occupied during the WEBSEC cruises are included on the data sheets: a WBS designation indicates the Western Beaufort Sea Ecological Cruise station number, while a CG designation indicates the Coast Guard station number.

Sampling gear included a Smith-McIntyre grab (SMG), a 1/4m^2 Hessler-Sandia box corer (BxC), and two otter trawls (OTB). Both otter trawls (3.7m and 6.7m headropes) were lined with 1.3cm stretch mesh. Only Smith-McIntyre grab data should be considered quantitative in the following data set, since the box corer over-penetrated the bottom sediments when deployed, and the area sampled by the otter trawls is difficult to quantify.

The Smith-McIntyre grab data collected during the WEBSEC-71 cruise, exclusive of Smith-McIntyre grabs 885, 886, and 887, formed the data base for the manuscript "Distributional Patterns of Western Beaufort Sea Polychaetous Annelids" which was submitted to the journal Marine Biology in January, 1979. A draft of this manuscript (by G.R. Bilyard and A.G. Carey, Jr.) was included as part of the Quarterly Report to NOAA-OCSEAP for the period 1 October - 31 December, 1978 (Contract No. 03-5-022-68, Research Unit #6).

Table

AMPHARETIDAE
- Amage auricula Malmgren, 1866
- Ampharete acutifrons (Grube, 1860)
- Ampharete arctica Malmgren, 1866
- Ampharete vega (Wirén, 1883)
- Amphicteis gunneri (Sars, 1835)
- Eclysippe sp. A
- Glyphanostomum pallescens (Théel, 1879)
- Lysippe labiata Malmgren 1866
- Melinna cristata (Sars, 1851)
- Sabellides borealis Sars, 1856
- Genus "A"

APISTOBRANCHIDAE
- Apistobranchus tullbergi (Théel, 1879)

CAPITELLIDAE
- Barantolla americana Hartman, 1963
- Capitella capitata (Fabricius, 1780)
- Heteromastus filiformis (Claparède, 1864)
- Parheteromastus sp. A
- Genus "B"

CHAETOPTERIDAE
- Spiochaetopterus typicus Sars, 1856

CIRRATULIDAE
- Chaetozone setosa Malmgren, 1867
- Cirratulus cirratus (Müller, 1776)
- Tharyx ? acutus Webster and Benedict, 1887

COSSURIDAE
- Cossura longocirrata Webster and Benedict, 1887
- Cossura sp. A

DORVILLEIDAE
- Schistomeringos caecus (Webster and Benedict, 1884)
- Schistomeringos sp. A

FLABELLIGERIDAE
- Brada incrustata Støp-Bowitz, 1948
- Brada inhabilis (Rathke, 1843)
- Brada nuda Annenkova, 1922
- Brada villosa (Rathke, 1843)
- Diplocirrus hirsutus (Hansen, 1879)
- Diplocirrus longisetosus (v. Marenzeller, 1890)
- Pherusa plumosa (Müller, 1776)

GONIADIDAE
- Glycinde wireni Arwidsson, 1899

HESIONIDAE
- Nereimyra aphroditoides (Fabricius, 1780)

LUMBRINERIDAE

Lumbrineris fragilis (Müller, 1776)
Lumbrineris impatiens (Claparède, 1868)
Lumbrineris latreilli (Audouin and Milne-Edwards, 1833)
Lumbrineris minuta Théel, 1879
Lumbrineris sp. A
Lumbrineris sp. B

MAGELONIDAE

Magelona longicornis Johnson, 1901

MALDANIDAE

Clymenura polaris (Théel, 1879)
Lumbriclymene minor Arwidsson, 1907
Maldane sarsi Malmgren, 1865
Notoproctus oculatus var. arctica Arwidsson, 1907
Petaloproctus tenuis (Théel, 1879)
Praxillella praetermissa (Malmgren, 1865)

NEPHTYIDAE

Aglaophamus malmgreni (Théel, 1879)
Micronephthys minuta (Théel, 1879)
Nephtys ciliata (Müller, 1776)
Nephtys discors Ehlers, 1868
Nephtys paradoxa Malm

NEREIDAE

Nereis zonata Malmgren, 1867
Nicon sp. A

ONUPHIDAE

Nothria conchylega (Sars, 1835)
Onuphis quadricuspis Sars, 1872)

OPHELIIDAE

Ophelina abranchiata Støp-Bowitz, 1948
Ophelina acuminata Oersted, 1843
Ophelina cylindricaudatus (Hansen, 1879)
Ophelina sp. A
Tachytrypane sp. A

ORBINIIDAE

Scoloplos acutus (Verrill, 1873)

OWENIIDAE

Myriochele heeri Malmgren, 1867
Owenia fusiformis delle Chiaje, 1841

PARAONIDAE

Allia abranchiata (Hartman, 1965)
Allia suecica (Elaison, 1920)
Allia sp. A
Aricidea tetrabranchia Hartman and Fauchald, 1971
Aricidea ushakovi Zachs, 1925
Paraonis sp. A
Tauberia gracilis (Tauber, 1879)

PECTINARIIDAE
Cistenides hyperborea (Malmgren, 1865)

PHYLLODOCIDAE
Anaitides citrina (Malmgren, 1865)
Anaitides groenlandica (Oersted, 1843)
Eteone flava (Fabricius, 1780)
Eteone longa (Fabricius, 1780)
Mysta barbata (Malmgren, 1865)
Mystides borealis Théel, 1879
Paranaitis wahlbergi (Malmgren, 1865)

PILARGIIDAE
Sigambra tentaculata (Treadwell, 1941)

POLYNOIDAE
Antinoella badia (Théel, 1879)
Antinoella sarsi (Malmgren, 1865)
Arcteobia anticostiensis (McIntosh, 1874)
Enipo gracilis Verrill, 1874
Eucranta villosa Malmgren, 1865
Eunoe oerstedi (Malmgren, 1865)
Gattyana cirrosa (Pallas, 1766)
Harmothoe imbricata (Linnaeus, 1767)
Lagisca extenuata (Grube, 1840)
Melaenis loveni Malmgren, 1865

SABELLIDAE
Branchiomma infarcta (Kröyer, 1856)
Chone duneri Malmgren, 1867
Chone infundibuliformis Kröyer, 1856
Chone murmanica Lukasch, 1910
Euchone papillosa (Sars, 1851)
Jasmineira schaudinni Augener, 1912

SCALIBREGMIDAE
Polyphysia crassa (Oersted, 1843)
Scalibregma inflatum Rathke, 1843

SERPULIDAE
Apomatus globifer Théel, 1879

SIGALIONIDAE
Pholoe minuta (Fabricius, 1780)

SPAERODORIDAE
Ephesiella macrocirrus Hartman and Fauchald, 1971
Sphaerodoridium claparedii (Greef, 1866)
Sphaerodoridium sp. A
Sphaerodoropsis biserialis (Berkeley and Berkeley, 1944)
Sphaerodoropsis minuta (Webster and Benedict, 1887)
Sphaerodoropsis sp. A
Sphaerodoropsis sp. C
Sphaerodorum gracilis (Rathke, 1843)

SPIONIDAE
- Laonice cirrata (Sars, 1851)
- Minuspio cirrifera (Wiren, 1883)
- Polydora caulleryi Mesnil, 1897
- Prionospio steenstrupi Malmgren, 1867

SPIRORBIDAE
- Dexiospira spirillum (Linnaeus, 1758)
- Spirorbis granulatus (Linnaeus, 1767)

STERNASPIDAE
- Sternaspis fossor Stimpson, 1854

SYLLIDAE
- Autolytus alexandri Malmgren, 1867
- Autolytus fallax Malmgren, 1867
- Exogone dispar (Webster, 1879)
- Exogone naidina Oersted, 1845
- Sphaerosyllis erinaceus (Claparede, 1863)
- Typosyllis cornuta (Rathke, 1843)
- Typosyllis fasciata (Malmgren, 1867)

TEREBELLIDAE
- Artacama proboscidea Malmgren, 1866
- Axionice flexuosa (Grube, 1860)
- Lanassa nordenskioldi Malmgren, 1866
- Lanassa venusta Malm, 1874
- Laphania boecki Malmgren, 1866
- Leaena abranchiata Malmgren, 1866
- Nicolea zostericola Oersted, 1844
- Polycirrus medusa Grube, 1855
- Proclea graffi (Langerhans, 1844)

TRICHOBRANCHIDAE
- Terebellides stroemi Sars, 1835
- Trichobranchus glacialis (Malmgren, 1866)

TROCHOCHAETIDAE
- Trochochaeta carica (Birula, 1897)

SMG 829 Station WBS-1/CG-1
70°15.5'N 143°39.6'W
34m 19 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture - 1.00mm

POLYCHAETA

Allia suecica	27
Anaitides groenlandica	2
Barantolla americana	7
Chaetozone setosa	9
Cossura longocirrata	2
Diplocirrus hirsutus	1
Eteone longa	1
Exogone dispar	4
Heteromastus filiformis	12
Laphania boecki	1
Lumbriclymene minor	1
Lumbrineris minuta	18
Lysippe labiata	4
Maldane sarsi	34
Melaenis loveni	1
Melinna cristata	3
Micronephthys minuta	4
Nereis zonata	4
Ophelina cylindricaudatus	27
Paraonis sp. A	3
Pholoe minuta	7
Polydora caulleryi	1
Prionospio steenstrupi	4
Scalibregma inflatum	4
Scoloplos acutus	1
Tauberia gracilis	36
Tharyx ? acutus	38
Typosyllis cornuta	1
Genus "A" (Ampharetidae)	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	2
Cirratulidae	1
Maldanidae	13
Spionidae	1

SMG 830 Station WBS-1/CG-1
70°15.5'N 143°39.6'W
33m 19 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture - 1.00mm

POLYCHAETA

Allia suecica	17
Anaitides groenlandica	2
Antinoella badia	1
Apistobranchus tullbergi	1
Barantolla americana	1
Chaetozone setosa	7
Cossura longocirrata	3
Dexiospira spirillum	1
Diplocirrus hirsutus	2
Exogone naidina	2
Heteromastus filiformis	10
Lumbrineris fragilis	2
Lumbrineris minuta	18
Lysippe labiata	1
Maldane sarsi	63
Melinna cristata	1
Micronephthys minuta	1
Nereis zonata	2
Ophelina cylindricaudatus	34
Pholoe minuta	15
Polydora caulleryi	1
Prionospio steenstrupi	13
Scoloplos acutus	1
Sphaerodorum gracilis	4
Sternaspis fossor	1
Tauberia gracilis	15
Terebellides stroemi	2
Tharyx ? acutus	28

UNIDENTIFIED POLYCHAETA

Maldanidae	3
Phyllodocidae	1
Polynoidae	1

SMG 831 Station WBS-1/CG-1
70°15.5'N 143°39.6'W
33m 19 August 1971
R/V GLACIER WEBSEC-71
Sieve aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Anaitides groenlandica	2
Antinoella badia	2
Capitella capitata	4
Ophelina cylindricaudatus	4
Tharyx ? acutus	1
Trochochaeta carica	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Maldanidae	1

SMG 832 Station WBS-1/CG-1
70°15.5'N 143°39.6'W
32m 19 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture - 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	10
Antinoella sarsi	1
Apistobranchus tullbergi	2
Barantolla americana	1
Clymenura polaris	5
Cossura longocirrata	1
Exogone dispar	2
Heteromastus filiformis	5
Lumbrineris minuta	5
Maldane sarsi	7
Melinna cristata	1
Micronephthys minuta	1
Ophelina cylindricaudatus	40
Paraonis sp. A	1
Prionospio steenstrupi	6
Scalibregma inflatum	1
Scoloplos acutus	1
Sternaspis fossor	1
Tauberia gracilis	2
Terebellides stroemi	2
Tharyx ? acutus	64
Trochochaeta carica	1
Genus "A" (Ampharetidae)	4

UNIDENTIFIED POLYCHAETA

Ampharetidae	2
Maldanidae	9

SMG 833 Station WBS-1/CG-1
70°15.5'N 143°39.6'W
33m 19 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	19
Anaitides groenlandica	5
Apistobranchus tullbergi	2
Barantolla americana	9
Capitella capitata	4
Chaetozone setosa	10
Cistenides hyperborea	1
Cossura longocirrata	1
Heteromastus filiformis	8
Lumbrineris minuta	15
Maldane sarsi	44
Melinna cristata	2
Nereis zonata	1
Ophelina cylindricaudatus	18
Prionospio steenstrupi	1
Scoloplos acutus	6
Sphaerodorum gracilis	3
Sternaspis fossor	2
Tauberia gracilis	19
Tharyx ? acutus	15
Trochochaeta carica	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	2
Maldanidae	11
Terebellidae	1

SMG 834 Station WBS-2/CG-3
70°27'N 143°34'W
48m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	2
Ampharete acutifrons	5
Ampharete arctica	3
Ampharete vega	1
Amphicteis gunneri	1
Anaitides groenlandica	2
Apistobranchus tullbergi	1
Autolytus fallax	2
Clymenura polaris	5
Chone duneri	4
Chone murmanica	11
Cossura longocirrata	1
Diplocirrus longisetosus	2
Eteone longa	2
Eucranta villosa	1
Euchone papillosa	1
Exogone dispar	11
Exogone naidina	3
Gattyana cirrosa	1
Glyphanostomum pallescens	1
Lagisca extenuata	4
Lanassa nordenskioldi	1
Laonice cirrata	1
Laphania boecki	6
Lumbrineris fragilis	1
Lumbrineris minuta	6
Melinna cristata	13
Micronephthys minuta	14
Myriochele heeri	1
Nereimyra aphroditoides	1
Nereis zonata	9
Nothria conchylega	2
Ophelina cylindricaudatus	11
Parheteromastus sp. A	2
Pholoe minuta	9
Pherusa plumosa	1
Prionospio steenstrupi	2
Scalibregma inflatum	6
Sphaerodoropsis minuta	1
Spirorbis granulatus	7
Tauberia gracilis	1
Terebellides stroemi	15
Tharyx ? acutus	4
Typosyllis cornuta	4
Typosyllis fasciata	1

UNIDENTIFIED POLYCHAETA

Maldanidae	4
Terebellidae	1

SMG 835 Station WBS-2/CG-3
70°27'N 143°34'W
48m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	4
Ampharete acutifrons	8
Ampharete arctica	4
Ampharete vega	1
Anaitides groenlandica	1
Antinoella sarsi	1
Apistobranchus tullbergi	1
Autolytus fallax	1
Chone duneri	2
Chone murmanica	141
Euchone papillosa	2
Eucranta villosa	2
Exogone dispar	22
Exogone naidina	3
Glyphanostomum pallescens	4
Heteromastus filiformis	6
Lagisca extenuata	3
Laonice cirrata	1
Laphania boecki	1
Lumbrineris minuta	5
Maldane sarsi	3
Melinna cristata	8
Micronephthys minuta	16
Myriochele heeri	2
Nereimyra aphroditoides	3
Nereis zonata	2
Nicolea zostericola	1
Notoproctus oculatus var. *arctica*	1
Ophelina cylindricaudatus	6
Owenia fusiformis	2
Pholoe minuta	12
Prionospio steenstrupi	4
Scalibregma inflatum	2
Sphaerodorum gracilis	6
Spirorbis granulatus	1
Terebellides stroemi	15
Tharyx ? *acutus*	15
Typosyllis cornuta	2

UNIDENTIFIED POLYCHAETA

Maldanidae	9
Sabellidae	1
Terebellidae	2

SMG 386 Station WBS-2/CG-3
70°27'N 143°34'W
48m 20 August 1971
R/VGLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	4
Ampharete acutifrons	7
Ampharete arctica	1
Amphicteis gunneri	1
Autolytus alexandri	1
Autolytus fallax	2
Chaetozone setosa	1
Chone duneri	2
Chone murmanica	146
Cirratulus cirratus	1
Clymenura polaris	1
Diplocirrus longisetosus	2
Exogone dispar	5
Exogone naidina	5
Heteromastus filiformis	9
Lagisca extenuata	3
Lanassa nordenskioldi	2
Laonice cirrata	2
Laphania boecki	1
Lumbrineris fragilis	2
Lumbrineris minuta	13
Lysippe labiata	3
Melinna cristata	5
Micronephthys minuta	17
Minuspio cirrifera	3
Myriochele heeri	4
Nereimyra aphroditoides	1
Nereis zonata	4
Nicolea zostericola	1
Nothria conchylega	1
Ophelina cylindricaudatus	15
Parheteromastus sp. A	11
Pholoe minuta	21
Polycirrus medusa	1
Praxillella praetermissa	1
Prionospio steenstrupi	2
Scalibregma inflatum	1
Sphaerodorum gracilis	3
Terebellides stroemi	26
Tharyx ? *acutus*	8
Trichobranchus glacialis	1
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Maldanidae	7
Sabellidae	2
Terebellidae	2

SMG 837 Station WBS-2/CG-3
70°27'N 143°34'W
48m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture - 1.00mm

POLYCHAETA

Allia suecica	10
Ampharete acutifrons	4
Ampharete arctica	3
Antinoella badia	1
Antinoella sarsi	1
Autolytus alexandri	2
Autolytus fallax	3
Dexiospira spirillum	1
Eucranta villosa	1
Euchone papillosa	2
Exogone dispar	7
Exogone naidina	3
Heteromastus filiformis	3
Lanassa nordenskioldi	3
Lanassa venusta	4
Laonice cirrata	1
Laphania boecki	2
Lumbrineris minuta	4
Lysippe labiata	3
Maldane sarsi	2
Melinna cristata	14
Micronephthys minuta	22
Minuspio cirrifera	2
Myriochele heeri	3
Nereimyra aphroditoides	2
Nereis zonata	5
Nicolea zostericola	3
Ophelina cylindricaudatus	19
Parheteromastus sp. A	1
Pholoe minuta	8
Polycirrus medusa	1
Prionospio steenstrupi	5
Sphaerodorum gracilis	7
Sphaerosyllis erinaceus	2
Spirorbis granulatus	1
Terebellides stroemi	12
Tharyx ? acutus	17
Trichobranchus glacialis	1
Typosyllis cornuta	3

UNIDENTIFIED POLYCHAETA

Maldanidae	12
Polynoidae	2
Sabellidae	3
Terebellidae	1

SMG 838 Station WBS-2/CG-3
70°27'N 143°34'W
48m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture - 1.00mm

POLYCHAETA

Allia suecica	5
Ampharete acutifrons	1
Ampharete arctica	2
Autolytus alexandri	1
Autolytus fallax	1
Axionice flexuosa	4
Brada nuda	2
Chaetozone setosa	1
Chone duneri	1
Chone murmanica	74
Clymenura polaris	1
Diplocirrus longisetosus	1
Exogone dispar	6
Lagisca extenuata	1
Lanassa nordenskioldi	2
Lanassa venusta	8
Laonice cirrata	1
Laphania boecki	1
Lumbrineris minuta	8
Maldane sarsi	5
Melinna cristata	11
Micronephthys minuta	10
Minuspio cirrifera	11
Nereis zonata	3
Nicolea zostericola	1
Notoproctus oculatus var. arctica	1
Ophelina cylindricaudatus	13
Parheteromastus sp. A	4
Pholoe minuta	10
Polycirrus medusa	2
Praxillella praetermissa	1
Spirorbis granulatus	1
Terebellides stroemi	12
Tharyx ? acutus	10
Typosyllis cornuta	2
Typosyllis fasciata	1

UNIDENTIFIED POLYCHAETA

Maldanidae	3
Terebellidae	2

SMG 839 Station WBS-3/CG-5
70°34.6'N 143°38'W
106m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	8
Artacama proboscidea	1
Chaetozone setosa	6
Diplocirrus longisetosus	1
Euchone papillosa	1
Heteromastus filiformis	6
Laonice cirrata	3
Lumbrineris minuta	12
Lysippe labiata	2
Nereimyra aphroditoides	1
Nereis zonata	1
Ophelina cylindricaudatus	7
Sphaerodoropsis biserialis	4
Spiochaetopterus typicus	17
Terebellides stroemi	2
Tharyx ? acutus	13
Typosyllis cornuta	4

SMG 840 Station WBS-3/CG-5
70°34.6'N 143°38'W
106m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Chaetozone setosa	6
Chone murmanica	1
Diplocirrus longisetosus	3
Eucranta villosa	1
Heteromastus filiformis	8
Lagisca extenuata	2
Laonice cirrata	1
Lumbrineris minuta	13
Lysippe labiata	1
Minuspio cirrifera	2
Nereis zonata	1
Ophelina cylindricaudatus	15
Sphaerodorum gracilis	1
Spiochaetopterus typicus	14
Terebellides stroemi	5
Tharyx ? acutus	2
Typosyllis cornuta	6

SMG 841 Station WBS-3/CG-5
70°34.6'N 143°38'W
105m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Anaitides groenlandica	1
Chaetozone setosa	3
Eteone longa	1
Exogone dispar	1
Heteromastus filiformis	4
Lumbrineris minuta	30
Lysippe labiata	4
Maldane sarsi	7
Micronephthys minuta	1
Minuspio cirrifera	9
Ophelina cylindricaudatus	6
Pholoe minuta	1
Scoloplos acutus	2
Spiochaetopterus typicus	20
Tauberia gracilis	4
Terebellides stroemi	5
Tharyx ? acutus	15

UNIDENTIFIED POLYCHAETA

Polynoidae	1

SMG 842 Station WBS-3/CG-5
70°34.6'N 143°38'W
105m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	2
Allia sp. A	2
Anaitides groenlandica	2
Chaetozone setosa	14
Chone murmanica	5
Eteone longa	2
Exogone naidina	1
Heteromastus filiformis	5
Lagisca extenuata	3
Laonice cirrata	3
Lumbrineris minuta	37
Lysippe labiata	5
Maldane sarsi	2
Micronephthys minuta	18
Minuspio cirrifera	10
Myriochele heeri	1
Onuphis quadricuspis	1
Ophelina cylindricaudatus	10
Pholoe minuta	11
Prionospio steenstrupi	5
Scoloplos acutus	11
Spiochaetopterus typicus	33
Tauberia gracilis	31
Terebellides stroemi	15
Tharyx ? acutus	17
Typosyllis cornuta	1

SMG 843 Station WBS-3/CG-5
70°34.6'N 143°38'W
109m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	1
Allia sp. A	5
Anaitides groenlandica	1
Chaetozone setosa	14
Eteone longa	1
Eucranta villosa	2
Heteromastus filiformis	12
Laonice cirrata	1
Lumbrineris fragilis	1
Lumbrineris minuta	48
Lysippe labiata	3
Maldane sarsi	5
Micronephthys minuta	40
Minuspio cirrifera	5
Myriochele heeri	1
Ophelina cylindricaudatus	3
Pholoe minuta	13
Prionospio steenstrupi	7
Scoloplos acutus	13
Spiochaetopterus typicus	15
Tauberia gracilis	12
Terebellides stroemi	28
Tharyx ? acutus	12

SMG 844 Station WBS-4/CG-6
70°45.6'N 143°35.4'W
494m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	16
Barantolla americana	1
Chone duneri	2
Eteone longa	1
Heteromastus filiformis	2
Jasmineira schaudinni	1
Lumbrineris minuta	2
Lumbrineris sp. B	3
Maldane sarsi	63
Melinna cristata	2
Minuspio cirrifera	3
Nephtys ciliata	1
Onuphis quadricuspis	1
Paraonis sp. A	2
Terebellides stroemi	1
Tharyx ? acutus	1
Typosyllis cornuta	2

UNIDENTIFIED POLYCHAETA

Capitellidae	1

SMG 845 Station WBS-4/CG-6
70°45.6'N 143°35.4'W
494m 20 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	7
Amage auricula	3
Barantolla americana	3
Eclysippe sp. A	6
Ephesiella macrocirrus	1
Heteromastus filiformis	2
Laonice cirrata	1
Lumbrineris minuta	4
Lumbrineris sp. B	1
Maldane sarsi	52
Melinna cristata	4
Minuspio cirrifera	1
Onuphis quadricuspis	5
Owenia fusiformis	1
Schistomeringos sp. A	2
Sigambra tentaculata	3
Tharyx ? acutus	2

UNIDENTIFIED POLYCHAETA

Maldanidae	4

SMG 846 Station WBS-4/CG-6
70°45.6'N 143°35.4'W
494m 21 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	9
Amage auricula	3
Barantolla americana	3
Chone duneri	2
Eclysippe sp. A	8
Eteone longa	1
Jasmineira schaudinni	1
Lumbrineris sp. B	5
Maldane sarsi	77
Melinna cristata	1
Minuspio cirrifera	1
Myriochele heeri	1
Schistomeringos sp. A	2
Sigambra tentaculata	1
Tharyx ? acutus	1
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 847 Station WBS-4/CG-6
70°45.6'N 143°35.4'W
496m 21 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	16
Amage auricula	7
Aricidea ushakovi	2
Barantolla americana	1
Chone duneri	2
Eclysippe sp. A	17
Glyphanostomum pallescens	1
Jasmineira schaudinni	4
Lumbrineris minuta	5
Maldane sarsi	83
Melinna cristata	6
Minuspio cirrifera	7
Onuphis quadricuspis	1
Ophelina abranchiata	1
Schistomeringos sp. A	3
Sigambra tentaculata	2
Tauberia gracilis	1
Terebellides stroemi	2
Tharyx ? acutus	10

SMG 848 Station WBS-4/CG-6
70°45.6'N 143°35.4'W
498m 21 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	17
Amage auricula	1
Barantolla americana	4
Eclysippe sp. A	4
Jasmineira schaudinni	3
Heteromastus filiformis	2
Laonice cirrata	1
Lumbrineris minuta	3
Lumbrineris sp. B	3
Maldane sarsi	71
Melinna cristata	5
Minuspio cirrifera	1
Myriochele heeri	4
Mysta barbata	1
Notoproctus oculatus var. arctica	2
Sigambra tentaculata	1
Tharyx ? acutus	8
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Capitellidae	1
Maldanidae	4

SMG 849 Station WBS-5/CG-7
71°00.5'N 145°35'W
480m 21 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	8
Amage auricula	14
Aricidea ushakovi	2
Chone duneri	2
Eclysippe sp. A	2
Jasmineira schaudinni	3
Lumbrineris sp. B	2
Maldane sarsi	48
Melinna cristata	1
Minuspio cirrifera	1
Myriochele heeri	1
Onuphis quadricuspis	2
Ophelina abranchiata	5
Tharyx ? acutus	12
Trochochaeta carica	1
Typosyllis cornuta	3

UNIDENTIFIED POLYCHAETA

Maldanidae	1

SMG 850 Station WBS-5/CG-7
71°00.5'N 145°35'W
464m 21 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Amage auricula	20
Ampharete acutifrons	1
Aricidea ushakovi	3
Barantolla americana	3
Eclysippe sp. A	7
Eteone longa	1
Euchone papillosa	1
Jasmineira schaudinni	2
Lumbrineris minuta	2
Lumbrineris sp. B	1
Maldane sarsi	71
Melinna cristata	1
Micronephthys minuta	1
Myriochele heeri	15
Notoproctus oculata var. *arctica*	1
Onuphis quadricuspis	34
Ophelina abranchiata	12
Tharyx ? acutus	15
Trochochaeta carica	1

UNIDENTIFIED POLYCHAETE

Maldanidae	7

SMG 851 Station WBS-5/CG-7
71°00.5'N 145°35'W
450m 21 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	3
Amage auricula	5
Aricidea ushakovi	1
Barantolla americana	3
Eclysippe sp. A	1
Jasmineira schaudinni	3
Lumbrineris minuta	1
Lumbrineris sp. B	1
Maldane sarsi	74
Onuphis quadricuspis	9
Ophelina abranchiata	11
Tharyx ? acutus	7
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 852 Station WBS-5/CG-7
71°00.5'N 145°35'W
447m 21 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	5
Amage auricula	8
Anaitides groenlandica	1
Aricidae ushakovi	1
Barantolla americana	4
Chone duneri	1
Eclysippe sp. A	3
Heteromastus filiformis	1
Jasmineira schaudinni	2
Lanassa nordenskioldi	1
Lumbrineris sp. B	2
Maldane sarsi	57
Onuphis quadricuspis	4
Ophelina abranchiata	6
Schistomeringos sp. A	1
Sigambra tentaculata	1
Tharyx ? acutus	18
Typosyllis cornuta	2

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 853 Station WBS-5/CG-7
71°00.5'N 145°35'W
476m 21 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	6
Amage auricula	7
Aricidea ushakovi	2
Barantolla americana	4
Chone duneri	1
Eclysippe sp. A	5
Heteromastus filiformis	2
Jasmineira schaudinni	3
Lumbrineris sp. B	2
Maldane sarsi	51
Melinna cristata	1
Myriochele heeri	1
Onuphis quadricuspis	7
Ophelina abranchiata	14
Scoloplos acutus	1
Sigambra tentaculata	1
Sphaerodoropsis biserialis	1
Sternaspis fossor	1
Terebellides stroemi	2
Tharyx ? acutus	2
Typosyllis cornuta	2

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Maldanidae	5

SMG 854 Station WBS-6/CG-8
70°48.5'N 145°56.1'W
84m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	14
Ampharete arctica	1
Amphicteis gunneri	1
Capitella capitata	1
Chaetozone setosa	1
Chone duneri	1
Chone murmanica	12
Eteone longa	1
Glyphanostomum pallescens	5
Heteromastus filiformis	9
Laphania boecki	2
Lumbrineris minuta	6
Lysippe labiata	1
Maldane sarsi	3
Melinna cristata	1
Micronephthys minuta	1
Minuspio cirrifera	5
Myriochele heeri	14
Mystides borealis	1
Ophelina cylindricaudatus	13
Pholoe minuta	4
Prionospio steenstrupi	1
Scalibregma inflatum	1
Spiochaetopterus typicus	8
Terebellides stroemi	5
Tharyx ? acutus	12
Typosyllis cornuta	4

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Scalibregmidae	1
Spionidae	1
Terebellidae	1

SMG 855 Station WBS-6/CG-8
70°48.5'N 145°56.1'W
84m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	3
Ampharete arctica	1
Amphicteis gunneri	1
Chaetozone setosa	3
Chone murmanica	1
Heteromastus filiformis	9
Lumbrineris minuta	4
Lysippe labiata	1
Maldane sarsi	1
Minuspio cirrifera	2
Ophelina cylindricaudatus	11
Pholoe minuta	1
Spiochaetopterus typicus	10
Terebellides stremi	6
Tharyx ? acutus	3
Typosyllis cornuta	7

UNIDENTIFIED POLYCHAETA

Maldanidae	1

SMG 856 Station WBS-6/CG-8
70°48.5'N 145°56.1'W
84m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	3
Ampharete arctica	2
Anaitides groenlandica	1
Barantolla americana	2
Chone duneri	3
Chone murmanica	8
Exogone dispar	1
Exogone naidina	1
Heteromastus filiformis	16
Lagisca extenuata	1
Laonice cirrata	1
Lumbrineris minuta	8
Lysippe labiata	3
Maldane sarsi	4
Melinna cristata	1
Minuspio cirrifera	7
Myriochele heeri	17
Ophelina cylindricaudatus	11
Pholoe minuta	6
Polyphysia crassa	1
Sphaerodoridium sp. A	1
Sphaerodorum gracilis	1
Spiochaetopterus typicus	4
Terebellides stroemi	3
Tharyx ? acutus	18
Typosyllis cornuta	3

UNIDENTIFIED POLYCHAETA

Ampharetidae	1

SMG 857 Station WBS-6/CG-8
70°48.5'W 145°56.1'W
83m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	4
Antinoella sarsi	2
Chaetozone setosa	3
Chone murmanica	7
Eclysippe sp. A	2
Exogone dispar	1
Exogone naidina	1
Glyphanostomum pallescens	1
Heteromastus filiformis	7
Laphania boecki	1
Lumbrineris minuta	4
Lysippe labiata	5
Maldane sarsi	3
Minuspio cirrifera	4
Myriochele heeri	19
Ophelina cylindricaudatus	13
Pholoe minuta	4
Polycirrus medusa	1
Proclea graffii	1
Scalibregma inflatum	1
Sphaerodoropsis biserialis	1
Spiochaetopterus typicus	2
Terebellides stroemi	4
Tharyx ? acutus	1
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 858 Station WBS-7/CG-9
70°48.5'N 145°56.1'W
81m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	6
Anaitides groenlandica	1
Chaetozone setosa	2
Chone murmanica	17
Exogone naidina	1
Heteromastus filiformis	4
Lumbrineris minuta	9
Lysippe labiata	1
Maldane sarsi	3
Minuspio cirrifera	1
Ophelina cylindricaudatus	8
Pholoe minuta	1
Prionospio steenstrupi	2
Sphaerodoropsis sp. B	1
Spiochaetopterus typicus	3
Terebellides stroemi	5
Tharyx ? acutus	9
Typosyllis cornuta	2

UNIDENTIFIED POLYCHAETA

Flabelligeridae	1
Terebellidae	1

SMG 859 Station WBS-7/CG-9
70°44'N 145°52'W
57m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	6
Anaitides groenlandica	1
Antinoella sarsi	2
Barantolla americana	5
Chaetozone setosa	4
Chone duneri	1
Chone murmanica	2
Exogone dispar	1
Heteromastus filiformis	11
Lagisca extenuata	2
Lanassa venusta	1
Laphania boecki	1
Lysippe labiata	4
Lumbrineris minuta	17
Maldane sarsi	12
Melinna cristata	4
Micronephthys minuta	6
Minuspio cirrifera	1
Nephtys ciliata	1
Onuphis quadricuspis	1
Ophelina cylindricaudatus	15
Pholoe minuta	2
Polydora caulleryi	1
Prionospio steenstrupi	1
Scalibregma inflatum	2
Terebellides stroemi	3
Tharyx ? acutus	22
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Maldanidae	1

SMG 860 Station WBS-7/CG-9
70°44'N 145°52'W
58m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture - 1.00 mm

POLYCHAETA

Allia suecica	4
Ampharete acutifrons	9
Ampharete arctica	2
Ampharete vega	1
Anaitides citrina	1
Antinoella sarsi	2
Apistobranchus tullbergi	1
Autolytus fallax	2
Axionice flexuosa	1
Barantolla americana	4
Capitella capitata	1
Chaetozone setosa	8
Chone murmanica	39
Eteone longa	1
Euchone papillosa	1
Exogone dispar	3
Exogone naidina	6
Gattyana cirrosa	1
Heteromastus filiformis	26
Lagisca extenuata	3
Lanassa nordenskioldi	7
Lanassa venusta	1
Laphania boecki	1
Leaena abranchiata	2
Lumbrineris fragilis	1
Lumbrineris impatiens	1
Lumbrineris minuta	35
Lysippe labiata	6
Maldane sarsi	10
Micronephthys minuta	10
Minuspio cirrifera	2
Myriochele heeri	3
Nicolea zostericola	2
Onuphis quadricuspis	1
Ophelina cylindricaudatus	21
Parheteromastus sp. A	4
Pholoe minuta	6
Polycirrus medusa	3
Polydora caulleryi	2
Polyphysia crassa	1
Prionospio steenstrupi	4
Scalibregma inflatum	1
Schistomeringos caecus	2
Sphaerosyllis erinaceus	1
Spiochaetopterus typicus	2
Terebellides stroemi	6
Tharyx ? acutus	28
Typosyllis cornuta	7

UNIDENTIFIED POLYCHAETA

Dorvilleidae	1
Maldanidae	4
Sabellidae	1
Terebellidae	2

SMG 861 Station WBS-7/CG-9
70°44'N 145°52'W
57m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	12
Ampharete acutifrons	1
Ampharete arctica	2
Ampharete vega	6
Antinoella sarsi	1
Apistobranchus tullbergi	1
Autolytus fallax	1
Barantolla americana	10
Brada nuda	2
Chaetozone setosa	16
Chone duneri	2
Chone murmanica	12
Diplocirrus longisetosus	3
Exogone dispar	5
Exogone naidina	3
Heteromastus filiformis	20
Jasmineira schaudinni	1
Lagisca extenuata	2
Laphania boecki	1
Lumbrineris fragilis	1
Lumbrineris minuta	38
Lysippe labiata	2
Maldane sarsi	9
Melinna cristata	2
Micronephthys minuta	5
Minuspio cirrifera	2
Myriochele heeri	2
Nereimyra aphroditoides	1
Ophelina cylindricaudatus	11
Paraonis sp. A	1
Parheteromastus sp. A	7
Pholoe minuta	10
Polydora caulleryi	1
Prionospio steenstrupi	4
Scalibregma inflatum	2
Spiochaetopterus typicus	1
Spirorbis granulatus	1
Terebellides stroemi	5
Tharyx ? acutus	24
Typosyllis cornuta	2

UNIDENTIFIED POLYCHAETA

Opheliidae (Travisia spp.)	6
Polynoidae	1

SMG 862 Station WBS-7/CG-9
70°44'N 145°52'W
57m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	6
Ampharete acutifrons	10
Ampharete arctica	3
Barantolla americana	4
Brada inhabilis	1
Capitella capitata	1
Chaetozone setosa	16
Chone duneri	3
Chone murmanica	15
Diplocirrus longisetosus	1
Eteone longa	1
Exogone dispar	2
Exogone naidina	6
Heteromastus filiformis	10
Lagisca extenuata	4
Lanassa nordenskioldi	1
Lumbrineris minuta	20
Lysippe labiata	3
Maldane sarsi	8
Melinna cristata	3
Micronephthys minuta	3
Minuspio cirrifera	2
Ophelina cylindricaudatus	20
Owenia fusiformis	3
Paraonis sp. A	3
Parheteromastus sp A	4
Pholoe minuta	8
Prionospio steenstrupi	2
Scalibregma inflatum	5
Spiochaetopterus typicus	1
Terebellides stroemi	10
Tharyx ? acutus	18
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Sabellidae	3
Terebellidae	3

SMG 863 Station WBS-7/CG-9
70°44'N 145°52'W
57m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	8
Ampharete acutifrons	3
Anaitides groenlandica	3
Autolytus fallax	1
Barantolla americana	3
Chaetozone setosa	9
Chone murmanica	13
Diplocirrus longisetosus	2
Heteromastus filiformis	20
Lanassa nordenskioldi	1
Lanassa venusta	1
Laphania boecki	1
Lumbrineris fragilis	2
Lumbrineris minuta	16
Lysippe labiata	2
Maldane sarsi	2
Melinna cristata	1
Minuspio cirrifera	3
Nereis zonata	2
Ophelina cylindricaudatus	30
Parheteromastus sp. A	3
Pholoe minuta	3
Prionospio steenstrupi	4
Scalibregma inflatum	2
Terebellides stroemi	6
Tharyx ? acutus	6
Trochochaeta carica	1
Typosyllis cornuta	2

UNIDENTIFIED POLYCHAETA

Maldanidae	1

SMG 864 Station WBS-8/CG-12
70°18'N 146°05'W
27m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Anaitides groenlandica	3
Antinoella sarsi	1
Apistobranchus tullbergi	1
Capitella capitata	10
Chaetozone setosa	3
Chone murmanica	4
Clymenura polaris	1
Cossura longocirrata	5
Diplocirrus longisetosa	1
Eteone longa	3
Heteromastus filiformis	43
Micronephthys minuta	1
Nephtys ciliata	1
Nereimyra aphroditoides	2
Ophelina cylindricaudatus	17
Pholoe minuta	9
Prionospio steenstrupi	1
Scalibregma inflatum	2
Scoloplos acutus	1
Terebellides stroemi	1
Tharyx ? acutus	3

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Syllidae	1

SMG 865 Station WBS-8/CG-12
70°18'N 146°05'W
26m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	10
Allia sp. A	1
Anaitides groenlandica	3
Apistobranchus tullbergi	5
Artacama proboscidea	1
Brada villosa	1
Capitella capitata	20
Chaetozone setoas	28
Chone duneri	1
Chone murmanica	4
Cistenides hyperborea	1
Cossura longocirrata	5
Eteone longa	14
Heteromastus filiformis	45
Lumbrineris minuta	8
Micronephthys minuta	17
Nicolea zostericola	1
Ophelina cylindricaudatus	8
Pholoe minuta	5
Praxillella praetermissa	1
Prionospio steenstrupi	9
Scalibregma inflatum	3
Scoloplos acutus	4
Sternaspis fossor	5
Terebellides stroemi	6
Tharyx ? *acutus*	59

UNIDENTIFIED POLYCHAETA

Maldanidae	3
Terebellidae	1

SMG866 Station WBS-8/CG-12
70°18'N 146°05'W
26m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	1
Antinoella sarsi	1
Apistobranchus tullbergi	2
Capitella capitata	152
Chaetozone setoas	13
Chone murmanica	6
Cistenides hyperborea	1
Cossura longocirrata	14
Eteone longa	14
Heteromastus filiformis	82
Lumbrineris minuta	2
Micronephthys minuta	7
Minuspio cirrifera	12
Nereimyra aphroditoides	2
Ophelina cylindricaudatus	8
Parheteromastus sp. A	7
Pholoe minuta	1
Praxillella praetermissa	1
Prionospio steenstrupi	20
Scalibregma inflatum	1
Scoloplos acutus	8
Sternaspis fossor	1
Terebellides stroemi	3
Tharyx ? *acutus*	28

UNIDENTIFIED POLYCHAETA

Dorvilleidae	1
Maldanidae	1

SMG 867 WBS-8/CG-12
70°18'N 146°05'W
26m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Anaitides groenlandica	1
Antinoella sarsi	2
Apistobranchus tullbergi	34
Aricidea ushakovi	5
Artacama proboscidea	1
Capitella capitata	1
Chaetozone setosa	5
Chone murmanica	19
Clymenura polaris	3
Cossura longocirrata	4
Heteromastus filiformis	36
Micronephthys minuta	6
Minuspio cirrifera	1
Nereimyra aphroditoides	2
Nicolea zostericola	9
Ophelina cylindricaudatus	45
Parheteromastus sp. A	2
Pholoe minuta	4
Prionospio steenstrupi	15
Proclea graffii	3
Scalibregma inflatum	1
Schistomeringos caecus	4
Sphaerodoropsis minuta	1
Sternaspis fossor	4
Terebellides stroemi	3
Tharyx ? acutus	33
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Dorvilleidae	2
Maldanidae	2
Terebellidae	1

SMG 868 Station WBS-8/CG-12
70°18'N 146°05'W
26m 22 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Anaitides groenlandica	1
Ampharete vega	1
Autolytus fallax	1
Capitella capitata	1
Chaetozone setosa	2
Chone murmanica	3
Heteromastus filiformis	2
Nereimyra aphroditoides	5
Pholoe minuta	1
Prionospio steenstrupi	58
Scalibregma inflatum	1
Tharyx ? acutus	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	1

SMG 885 Station WBS-12/CG-19
71°00.0'N 147°04'W
700m 24 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	5
Aricidea ushakovi	1
Eteone longa	4
Laonice cirrata	13
Lumbrineris minuta	5
Maldane sarsi	9
Minuspio cirrifera	82
Ophelina cylindricaudatus	1
Scoloplos acutus	3
Sigambra tentaculata	1
Tharyx ? acutus	3

SMG 886 Station WBS-12/CG-19
71°00.0'N 147°04.0'W
574m 24 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	13
Amage auricula	1
Cossura longocirrata	2
Eclysippe sp. A	4
Eteone longa	1
Heteromastus filiformis	4
Laonice cirrata	2
Lumbrineris minuta	2
Maldane sarsi	102
Minuspio cirrifera	19
Myriochele heeri	73
Onuphis quadricuspis	2
Ophelina abranchiata	2
Parheteromastus sp. A	1
Scoloplos acutus	1
Sigambra tentaculata	1
Sternaspis fossor	1
Terebellides stroemi	2
Tharyx ? acutus	1

SMG-887 Station WBS-12/CG-19
71°00.0'N 147°04.0'W
633m 24 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	18
Aricidea ushakovi	1
Heteromastus filiformis	2
Lumbrineris minuta	2
Maldane sarsi	12
Minuspio cirrifera	34
Scoloplos acutus	5
Sigambra tentaculata	5
Tharyx ? acutus	2
Trochochaeta carica	1

SMG 888 Station WBS-13/CG-20
71°13.7'N 147°22.6'W
3010m 25 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Lumbrineris minuta	2
Maldane sarsi	1
Minuspio cirrifera	1
Myriochele heeri	1
Sigambra tentaculata	7
Tharyx ? acutus	1

SMG 889 Station WBS-13/CG-20
71°19'N 147°46.0'W
2295m 25 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Sigambra tentaculata	7
Tharyx ? acutus	1

SMG 890 Station WBS-13/CG-20
71°19.3'N 147°47.1'W
2377m 25 August 1971
R/V GLACIER WEBSEC_&L
Sieve mesh aperture = 1.00mm

POLYCHAETA

Lumbrineris sp. A	3
Ophelina abranchiata	3
Ophelina sp. A	1
Sigambra tentaculata	2
Tharyx ? acutus	2

SMG 891 Station WBS-13/CG-20
70°19.6'N 147°48.2'W
2560m 25 August 1971
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	3
Heteromastus filiformis	1
Lumbrineris minuta	2
Lumbrineris sp. A	1
Micronephthys minuta	1
Myriochele heeri	1
Ophelina abranchiata	4
Ophelina sp. A	2
Sigambra tentaculata	9
Tharyx ? acutus	7

SMG 892 Station WBS-13/CG-20
71°20'N 147°50'W
2800m 25 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Lumbrineris minuta	2
Ophelina abranchiata	1
Sigambra tentaculata	11
Tharyx ? acutus	5
Lumbrineris sp. A	2

SMG 913 Station WBS-19/CG-29
71°08.5'N 148°00.0'W
430m 29 August 1971
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	2
Barantolla americana	22
Capitella capitata	1
Chaetozone setosa	3
Eteone longa	2
Heteromastus filiformis	2
Laonice cirrata	14
Lumbrineris minuta	12
Maldane sarsi	234
Micronephthys minuta	1
Minuspio cirrifera	27
Nephtys ciliata	1
Nereimyra aphroditoides	1
Onuphis quadricuspis	4
Scoloplos acutus	18
Sphaerodoridium sp. A	1
Spiochaetopterus typicus	2
Sternaspis fossor	2
Tauberia gracilis	11
Tharyx ? acutus	2
Trochochaeta carica	3

UNIDENTIFIED POLYCHAETA

Maldanidae	1

SMG 914 Station WBS-19/CG-39
71°08.6'N 148°00.3'W
359m 29 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	1
Barantolla americana	10
Chaetozone setosa	2
Chone murmanica	2
Eteone longa	2
Heteromastus filiformis	6
Laonice cirrata	9
Lumbrineris minuta	16
Maldane sarsi	109
Micronephthys minuta	3
Minuspio cirrifera	36
Onuphis quadricuspis	5
Prionospio steenstrupi	1
Scoloplos acutus	21
Sphaerodoropsis sp. A	1
Sternaspis fossor	2
Tauberia gracilis	8
Trochochaeta carica	3

UNIDENTIFIED POLYCHAETA

Maldanidae	6

SMG 915 Station WBS-19/CG-29
71°08.7'N 148°00.4'W
355m 29 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	1
Allia sp. A	12
Antinoella badia	1
Barantolla americana	4
Capitella capitata	1
Chaetozone setosa	3
Chone murmanica	1
Diplocirrus hirsutus	1
Eteone longa	2
Laonice cirrata	1
Lumbrineris minuta	8
Micronephthys minuta	4
Minuspio cirrifera	26
Onuphis quadricuspis	4
Ophelina cylindricaudatus	1
Pholoe minuta	1
Scoloplos acutus	13
Sphaerodoridium sp. A	1
Sternaspis fossor	4
Tauberia gracilis	56
Terebellides stroemi	2

UNIDENTIFIED POLYCHAETA

Maldanidae	1

SMG 916 Station WBS-19/CG-29
71°08.9'N 148°00.8'W
335m 29 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	6
Antinoella badia	1
Barantolla americana	6
Chaetozone setosa	12
Chone murmanica	1
Cossura longocirrata	1
Eteone longa	2
Heteromastus filiformis	5
Laonice cirrata	9
Lumbrineris minuta	23
Melinna cristata	1
Micronephthys minuta	8
Minuspio cirrifera	12
Nephtys ciliata	1
Onuphis quadricuspis	2
Ophelina cylindricaudatus	24
Pholoe minuta	2
Prionospio steenstrupi	1
Scoloplos acutus	38
Sternaspis fossor	3
Tharyx ? acutus	9

UNIDENTIFIED POLYCHAETA

Maldanidae	1

SMG 917 Station WBS-19/CG-29
71°09'N 148°01.0'W
324m 29 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Antinoella badia	1
Barantolla americana	4
Chaetozone setosa	9
Eteone longa	5
Heteromastus filiformis	2
Laonice cirrata	6
Lanassa venusta	1
Lumbrineris minuta	12
Maldane sarsi	2
Micronephthys minuta	23
Minuspio cirrifera	3
Nephtys ciliata	3
Onuphis quadricuspis	2
Ophelina cylindricaudatus	12
Pholoe minuta	2
Prionospio steenstrupi	1
Scoloplos acutus	61
Spiochaetopterus typicus	4
Sternaspis fossor	2
Tauberia gracilis	37
Tharyx ? acutus	19

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Maldanidae	2

SMG 919 Station WBS-20/CG-30
71°06'N 147°57'W
85m 30 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	4
Chaetozone setosa	1
Chone murmanica	22
Exogone naidina	2
Gattyana cirrosa	1
Glyphanostomum pallescens	1
Laonice cirrata	1
Lumbrineris minuta	8
Lysippe labiata	3
Melinna cristata	1
Micronephthys minuta	11
Minuspio cirrifera	2
Myriochele heeri	7
Ophelina cylindricaudatus	4
Paraonis sp. A	1
Parheteromastus sp. A	1
Pholoe minuta	8
Polydora caulleryi	1
Scalibregma inflatum	1
Schistomeringos caecus	1
Sphaerodoropsis biserialis	1
Spiochaetopterus typicus	17
Tauberia gracilis	1
Terebellides stroemi	14
Tharyx ? acutus	8

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Sabellidae	10
Terebellidae	1

SMG 918 Station WBS-20/CG-30
71°06'N 147°57'W
94m 30 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	4
Ampharete arctica	1
Antinoella sarsi	1
Apistobranchus tullbergi	2
Axionice flexuosa	1
Barantolla americana	3
Chone murmanica	11
Clymenura polaris	6
Cossura longocirrata	14
Exogone naidina	1
Heteromastus filiformis	5
Lanassa venusta	1
Laonice cirrata	27
Laphania boecki	1
Lumbrineris minuta	13
Lysippe labiata	27
Maldane sarsi	8
Micronephthys minuta	27
Minuspio cirrifera	8
Myriochele heeri	1
Onuphis quadricuspis	1
Ophelina cylindricaudatus	9
Parheteromastus sp. A	2
Pholoe minuta	6
Scalibregma inflatum	1
Scoloplos acutus	5
Spiochaetopterus typicus	19
Sternaspis fossor	3
Tauberia gracilis	20
Terebellides stroemi	14
Tharyx ? acutus	23
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Sabellidae	2

SMG 920 Station WBS-20/CG-30
71°06'N 147°57'W
100m 30 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Chaetozone setosa	2
Chone murmanica	13
Clymenura polaris	1
Eteone longa	1
Glyphanostomum pallescens	2
Heteromastus filiformis	1
Lagisca extenuata	1
Lumbrineris fragilis	1
Lumbrineris impatiens	2
Lumbrineris minuta	4
Lysippe labiata	1
Maldane sarsi	3
Micronephthys minuta	4
Minuspio cirrifera	2
Myriochele heeri	1
Ophelina cylindricaudatus	4
Scoloplos acutus	1
Spiochaetopterus typicus	12
Terebellides stroemi	3
Tharyx ? acutus	5
Trochochaeta carica	1
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Sabellidae	1

SMG 921 Station WBS-20/CG-30
71°06'N 147°57'W
106m 30 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Ampharete arctica	1
Chone murmanica	6
Clymenura polaris	3
Euchone papillosa	1
Heteromastus filiformis	1
Lagisca extenuata	3
Laphania boecki	3
Lumbrineris minuta	5
Lysippe labiata	6
Maldane sarsi	4
Micronephthys minuta	11
Minuspio cirrifera	1
Nephtys ciliata	1
Ophelina cylindricaudatus	4
Parheteromastus sp. A	1
Pholoe minuta	1
Scoloplos acutus	2
Sphaerodorum gracilis	2
Spiochaetopterus typicus	7
Terebellides stroemi	3
Tharyx ? acutus	4

UNIDENTIFIED POLYCHAETA

Sabellidae	3

SMG 922 Station WBS-20/CG-30
71°06'N 147°57'W
111m 30 August 1971
RV GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	2
Antinoella sarsi	1
Apistobranchus tullbergi	1
Barantolla americana	3
Clymenura polaris	2
Lumbrineris minuta	12
Lysippe labiata	9
Maldane sarsi	5
Micronephthys minuta	15
Minuspio cirrifera	1
Ophelina cylindricaudatus	1
Parheteromastus sp. A	3
Pholoe minuta	1
Scoloplos acutus	4
Spiochaetopterus typicus	34
Sternaspis fossor	2
Tauberia gracilis	1
Terebellides stroemi	5
Tharyx ? acutus	7

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 933 Station WBS-23/CG-44
71°01'N 148°22.7'W
48m 31 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	18
Ampharete arctica	5
Autolytus fallax	1
Barantolla americana	6
Chaetozone setosa	41
Chone murmanica	28
Eteone longa	1
Exogone naidina	5
Gattyana cirrosa	2
Heteromastus filiformis	13
Lagisca extenuata	1
Laphania boecki	1
Lanassa venusta	1
Leaena abranchiata	1
Lumbrineris fragilis	3
Lumbrineris minuta	14
Lysippe labiata	5
Maldane sarsi	1
Minuspio cirrifera	3
Nereimyra aphroditoides	25
Nereis zonata	10
Ophelina cylindricaudatus	7
Paraonis sp. A	2
Parheteromastus sp. A	8
Pholoe minuta	3
Prionospio steenstrupi	2
Scalibregma inflatum	9
Scoloplos acutus	3
Spirorbis granulatus	2
Terebellides stroemi	8
Tharyx ? acutus	27
Typosyllis cornuta	3

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Sabellidae	26
Spionidae	1
Terebellidae	1

SMG 934 Station WBS-23/CG-44
71°01'N 148°22.7'W
46.5m 31 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	20
Antinoella sarsi	1
Autolytus fallax	1
Barantolla americana	9
Chaetozone setosa	26
Chone duneri	1
Chone murmanica	56
Clymenura polaris	4
Diplocirrus longisetosus	1
Eteone longa	2
Exogone naidina	4
Heteromastus filiformis	11
Laonice cirrata	2
Laphania boecki	2
Lumbrineris minuta	27
Lysippe labiata	4
Maldane sarsi	5
Micronephthys minuta	8
Minuspio cirrifera	2
Nereimyra aphroditoides	1
Onuphis quadricuspis	3
Ophelina cylindricaudatus	9
Paraonis sp. A	1
Parheteromastus sp. A	12
Pholoe minuta	9
Polydora caulleryi	1
Prionospio steenstrupi	13
Scalibregma inflatum	5
Scoloplos acutus	4
Tauberia gracilis	2
Terebellides stroemi	10
Tharyx ? acutus	38

UNIDENTIFIED POLYCHAETA

Maldanidae	4
Sabellidae	5
Terebellidae	4

SMG 935 Station WBS-23/CG-44
71°01.0'N 148°22.7'W
47m 31 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	22
Ampharete acutifrons	4
Ampharete arctica	1
Antinoella sarsi	1
Apistobranchus tullbergi	1
Autolytus fallax	1
Barantolla americana	4
Chaetozone setosa	31
Chone duneri	1
Chone murmanica	85
Diplocirrus hirsutus	1
Diplocirrus longisetosus	1
Exogone naidina	13
Heteromastus filiformis	1
Lagisca extenuata	1
Laphania boecki	3
Lumbrineris fragilis	3
Lumbrineris minuta	26
Lysippe labiata	10
Micronephthys minuta	14
Nephtys ciliata	1
Nephtys paradoxa	1
Nereimyra aphroditoides	7
Nereis zonata	1
Ophelina acuminata	1
Ophelina cylindricaudatus	14
Paraonis sp. A	1
Parheteromastus sp. A	3
Pholoe minuta	14
Polycirrus medusa	3
Prionospio steenstrupi	19
Scalibregma inflatum	1
Schistomeringos caecus	1
Scoloplos acutus	1
Sphaerodoropsis biserialis	1
Terebellides stroemi	8
Tharyx ? acutus	29
Typosyllis cornuta	6

UNIDENTIFIED POLYCHAETA

Maldanidae	2
Sabellidae	17

SMG 936 Station WBS-23/CG-44
71°01.0'N 148°22.7'W
47m 31 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	10
Ampharete acutifrons	9
Ampharete arctica	1
Amphicteis gunneri	1
Anaitides groenlandica	1
Antinoella sarsi	1
Barantolla americana	4
Brada nuda	1
Chaetozone setosa	6
Chone duneri	1
Chone murmanica	63
Exogone naidina	3
Heteromastus filiformis	1
Lagisca extenuata	2
Laonice cirrata	2
Laphania boecki	4
Lumbrineris fragilis	1
Lumbrineris minuta	7
Lysippe labiata	1
Maldane sarsi	2
Melinna cristata	1
Minuspio cirrifera	1
Micronephthys minuta	8
Nereimyra aphroditoides	17
Nereis zonata	14
Ophelina cylindricaudatus	8
Parheteromastus sp. A	1
Pholoe minuta	1
Prionospio steenstrupi	4
Scalibregma inflatum	4
Spirorbis granulatus	6
Terebellides stroemi	6
Tharyx ? acutus	17

UNIDENTIFIED POLYCHAETA

Maldanidae	2
Sabellidae	17

SMG 937 Station WBS-23/CG-44
71°01.0'N 148°22.7'W
47m 31 August 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	14
Ampharete acutifrons	9
Ampharete arctica	1
Amphicteis gunneri	3
Antinoella sarsi	3
Artacama proboscidea	1
Autolytus fallax	2
Barantolla americana	4
Brada villosa	1
Chaetozone setosa	18
Chone duneri	1
Chone infundibuliformis	1
Chone murmanica	46
Cirratulus cirratus	2
Eteone longa	1
Exogone naidina	5
Gattyana cirrosa	1
Heteromastus filiformis	9
Lagisca extenuata	1
Laonice cirrata	3
Laphania boecki	1
Lumbrineris fragilis	1
Lumbrineris minuta	23
Maldane sarsi	3
Melinna cristata	1
Micronephthys minuta	7
Minuspio cirrifera	3
Myriochele heeri	1
Nereimyra aphroditoides	8
Ophelina cylindricaudatus	14
Paraonis sp. A	2
Parheteromastus sp. A	6
Pholoe minuta	12
Polycirrus medusa	1
Polydora caulleryi	1
Praxillella praetermissa	1
Prionospio steenstrupi	11
Scalibregma inflatum	3
Sphaerodoridium sp. A	1
Spirorbis granulatus	2
Terebellides stroemi	15
Tharyx ? acutus	31
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Maldanidae	2
Sabellidae	34
Terebellidae	2

SMG 943 Station WBS-26/CG-57
71°21.0'N 149°26.2'W
1926m 4 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Capitella capitata	1
Diplocirrus longisetosus	1
Lumbrineris minuta	5
Minuspio cirrifera	26
Onuphis quadricuspis	1
Ophelina abranchiata	1
Ophelina cylindricaudatus	1
Scoloplos acutus	2
Sigambra tentaculata	9
Sternaspis fossor	1

SMG 944 Station WBS-26/CG-57
71°21.1'N 149°28.8'W
1729m 4 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Lumbrineris minuta	7
Minuspio cirrifera	5
Ophelina abranchiata	5
Sigambra tentaculata	10
Terebellides stroemi	3

SMG 945 Station WBS-26/CG-57
71°21.2'N 149°30.4'W
1618m 4 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aricidea ushakovi	1
Heteromastus filiformis	2
Lumbrineris minuta	22
Minuspio cirrifera	23
Ophelina abranchiata	2
Sigambra tentaculata	23
Terebellides stroemi	5

UNIDENTIFIED POLYCHAETA

Ampharetidae	1

SMG 946 Station WBS-26/CG-57
71°21.3'N 149°32.2'W
1800m 4 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	4
Capitella capitata	5
Diplocirrus hirsutus	1
Lumbrineris minuta	10
Minuspio cirrifera	35
Ophelina cylindricaudatus	1
Sigambra tentaculata	10

SMG 947 Station WBS-26/CG-57
71°21.5'N 149°37.0'W
1622m 4 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	10
Laonice cirrata	1
Lumbrineris minuta	9
Minuspio cirrifera	63
Owenia fusiformis	17
Sigambra tentaculata	11
Terebellides stroemi	2

UNIDENTIFIED POLYCHAETA

Maldanidae	5

SMG 948 Station WBS-27/CG-58
71°15.2'N 149°28.8'W
991m 5 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	9
Aricidea ushakovi	1
Capitella capitata	1
Chone murmanica	3
Heteromastus filiformis	1
Laonice cirrata	11
Lumbrineris minuta	1
Maldane sarsi	7
Minuspio cirrifera	143
Ophelina cylindricaudatus	2
Owenia fusiformis	2
Scoloplos acutus	12
Sigambra tentaculata	1
Sphaerodoridium sp. A	1
Sphaerodorum gracilis	1
Tharyx ? acutus	1
Trochochaeta carica	2

UNIDENTIFIED POLYCHAETA

Sphaerodoridae	1

SMG 949 Station WBS-27/CG-58
71°14.5'N 149°24.3'W
494m 5 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	1
Anaitides groenlandica	1
Antinoella badia	1
Barantolla americana	11
Chaetozone setosa	18
Chone murmanica	2
Cossura longocirrata	1
Laonice cirrata	10
Lumbrineris fragilis	2
Lumbrineris minuta	6
Maldane sarsi	171
Minuspio cirrifera	38
Onuphis quadricuspis	9
Owenia fusiformis	1
Prionospio steenstrupi	1
Sphaerodoridium sp. A	1
Sphaerodoropsis sp. A	1
Sternaspis fossor	5
Tauberia gracilis	1
Trochochaeta carica	7

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 950 Station WBS-27/CG-58
71°14.3'N 149°23.0'W
695m 5 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Capitella capitata	3
Chaetozone setosa	8
Chone murmanica	3
Cossura longocirrata	2
Eteone longa	1
Laonice cirrata	3
Lumbrineris minuta	6
Maldane sarsi	13
Micronephthys minuta	1
Minuspio cirrifera	464
Ophelina cylindricaudatus	2
Owenia fusiformis	3
Scoloplos acutus	3
Sphaerodoridium sp. A	4
Sphaerodoropsis sp. B	2
Tauberia gracilis	5

UNIDENTIFIED POLYCHAETA

Maldanidae	18

SMG 951 Station WBS-27/CG-58
71°14.2'N 149°22.3'W
717m 5 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	5
Antinoella badia	1
Barantolla americana	7
Capitella capitata	2
Chaetozone setosa	2
Chone murmanica	1
Cossura longocirrata	7
Eteone longa	1
Laonice cirrata	5
Lumbrineris minuta	7
Maldane sarsi	20
Micronephthys minuta	3
Minuspio cirrifera	252
Owenia fusiformis	3
Prionospio steenstrupi	1
Sphaerodoridium sp. A	1
Spiochaetopterus typicus	1
Tauberia gracilis	9

UNIDENTIFIED POLYCHAETA

Maldanidae	13

SMG 952 Station WBS-27/CG-58
71°14.1'N 149°21.7'W
603m 5 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	2
Barantolla americana	2
Capitella capitata	2
Chaetozone setosa	5
Chone murmanica	4
Cossura longocirrata	5
Eteone longa	3
Laonice cirrata	16
Lumbrineris fragilis	1
Lumbrineris minuta	2
Maldane sarsi	17
Micronephthys minuta	4
Minuspio cirrifera	124
Ophelina cylindricaudatus	1
Owenia fusiformis	1
Scoloplos acutus	4
Sigambra tentaculata	1
Sphaerodoropsis sp. B	1
Spiochaetopterus typicus	2
Tauberia gracilis	11

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 963 Station WBS-30/CG-63
70°43.0'N 149°00.0'W
24m 7 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia sp. A	2
Ampharete acutifrons	3
Anaitides groenlandica	1
Brada villosa	4
Chaetozone setosa	4
Chone murmanica	17
Cistenides hyperborea	1
Clymenura polaris	1
Cossura longocirrata	1
Eteone longa	1
Heteromastus filiformis	32
Lumbrineris minuta	3
Lysippe labiata	3
Micronephthys minuta	2
Nephtys ciliata	1
Ophelina cylindricaudatus	13
Parheteromastus sp. A	1
Pholoe minuta	13
Prionospio steenstrupi	5
Proclea graffii	2
Scoloplos acutus	5
Sternaspis fossor	1
Terebellides stroemi	3
Tharyx ? acutus	22
Genus "A" (Ampharetidae	4

UNIDENTIFIED POLYCHAETA

Sabellidae	1

SMG 964 Station WBS-30/CG-63
70°43.0'N 149°00.0'W
24m 7 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Capitella capitata	13
Chaetozone setosa	2
Chone murmanica	7
Lumbrineris minuta	1
Minuspio cirrifera	64
Scalibregma inflatum	1
Sphaerodoropsis minuta	1

SMG 965 Station WBS-30/CG-63
70°43.0'W 143°00.0'W
23m 7 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	7
Antinoella sarsi	2
Apistobranchus tullbergi	1
Brada villosa	1
Capitella capitata	156
Chaetozone setosa	6
Chone murmanica	49
Cistenides hyperborea	1
Clymenura polaris	6
Cossura longocirrata	12
Eteone flava	1
Eteone longa	3
Heteromastus filiformis	11
Lumbrineris minuta	12
Lysippe labiata	13
Micronephthys minuta	2
Minuspio cirrifera	4
Nephtys ciliata	1
Ophelina cylindricaudatus	1
Parheteromastus sp. A	7
Pholoe minuta	37
Praxillella praetermissa	6
Prionospio steenstrupi	2
Proclea graffii	1
Schistomeringos caecus	2
Scoloplos acutus	4
Sternaspis fossor	27
Terebellides stroemi	2
Tharyx ? acutus	78
Typosyllis cornuta	1
Genus "A" (Ampharetidae)	18

UNIDENTIFIED POLYCHAETA

Ampharetidae	4
Dorvilleidae	1
Maldanidae	1

SMG 966 Station WBS-30/CG-63
70°43.0'N 149°00.0'W
23m 7 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	2
Antinoella sarsi	1
Chaetozone setosa	1
Chone duneri	1
Chone murmanica	10
Clymenura polaris	1
Cossura longocirrata	1
Eteone longa	1
Lagisca extenuata	1
Lumbrineris minuta	1
Minuspio cirrifera	2
Ophelina cylindricaudatus	3
Parheteromastus sp. A	3
Pholoe minuta	2
Proclea graffii	1
Terebellides stroemi	1
Tharyx ? acutus	1
Trochochaeta carica	1
Genus "A" (Ampharetidae)	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Maldanidae	1

SMG 967 Station WBS-30/CG-63
70°43.0'N 149°00.0'W
23m 7 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	3
Anaitides groenlandica	1
Antinoella sarsi	1
Capitella capitata	5
Chone murmanica	7
Cossura longocirrata	7
Dexiospira spirillum	1
Eteone flava	1
Heteromastus filiformis	10
Lumbrineris fragilis	4
Lumbrineris impatiens	4
Minuspio cirrifera	4
Ophelina cylindricaudatus	3
Parheteromastus sp. A	1
Pholoe minuta	5
Schistomeringos caecus	1
Spirorbis granulatus	4
Tharyx ? acutus	21

UNIDENTIFIED POLYCHAETA

Dorvilleidae	1
Spionidae	1

SMG 968 Station WBS-33/CG-71
71°04.1'N 151°22.3'W
20m 9 September
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Anaitides groenlandica	1
Antinoella badia	1
Apistobranchus tullbergi	1
Chaetozone setosa	1
Chone murmanica	18
Cistenides hyperborea	1
Clymenura polaris	1
Cossura longocirrata	13
Eteone longa	2
Micronephthys minuta	12
Minuspio cirrifera	3
Nephtys ciliata	1
Ophelina cylindricaudatus	24
Pholoe minuta	6
Prionospio steenstrupi	6
Scoloplos acutus	1
Sternaspis fossor	1
Terebellides stroemi	1

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Sphaerodoridae	1
Spionidae	2

SMG 969 Station WBS-33/CG-71
71°04.1'N 151°22.2'W
21m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	2
Anaitides groenlandica	1
Barantolla americana	1
Capitella capitata	2
Chone duneri	1
Cossura longocirrata	2
Eteone flava	1
Eteone longa	1
Heteromastus filiformis	1
Micronephthys minuta	10
Minuspio cirrifera	4
Nephtys ciliata	1
Ophelina cylindricaudatus	8
Ophelina acuminata	1
Paraonis sp. A	1
Pholoe minuta	3
Prionospio steenstrupi	2
Scalibregma inflatum	3
Scoloplos acutus	1

SMG 970 Station WBS-33/CG-71
71°04.1'N 151°22.1'W
21m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	1
Ampharete vega	1
Chaetozone setosa	1
Cistenides hyperborea	17
Cossura longocirrata	7
Eteone longa	1
Heteromastus filiformis	1
Micronephthys minuta	21
Minuspio cirrifera	3
Nephtys ciliata	1
Ophelina acuminata	1
Ophelina cylindricaudatus	12
Pholoe minuta	9
Scalibregma inflatum	1
Sternaspis fossor	1
Tauberia gracilis	1
Terebellides stroemi	1

SMG 971 Station WBS-33/CG-71
71°04.1'N 151°21.6'W
21m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Allia sp. A	2
Apistobranchus tullbergi	2
Capitella capitata	2
Chone murmanica	1
Cistenides hyperborea	1
Cossura longocirrata	3
Micronephthys minuta	12
Minuspio cirrifera	2
Nephtys ciliata	2
Ophelina cylindricaudatus	11
Pholoe minuta	2
Prionospio steenstrupi	2
Scalibregma inflatum	1
Scoloplos acutus	2
Sternaspis fossor	2
Terebellides stroemi	2
Tharyx ? acutus	2

SMG 972 Station WBS-33/CG-71
71°04.1'N 151°21.5'W
21m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	1
Apistobranchus fullbergi	1
Capitella capitata	1
Chaetozone setosa	1
Clymenura polaris	1
Cossura longocirrata	5
Heteromastus filiformis	1
Lysippe labiata	1
Micronephthys minuta	8
Ophelina acuminata	1
Pholoe minuta	3
Prionospio steenstrupi	1
Scoloplos acutus	4
Sternaspis fossor	3
Tauberia gracilis	4
Terebellides stroemi	3
Tharyx ? acutus	3

UNIDENTIFIED POLYCHAETA

Maldanidae	4
Spionidae	1

SMG 973 Station WBS-34/CG-72
71°10.1'N 151°08.9'W
45m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	2
Autolytus fallax	1
Barantolla americana	2
Chaetozone setosa	5
Chone murmanica	9
Clymenura polaris	2
Eteone longa	1
Heteromastus filiformis	7
Lumbrineris impatiens	3
Lumbrineris minuta	25
Lysippe labiata	4
Maldane sarsi	10
Micronephthys minuta	18
Nephtys ciliata	1
Ophelina cylindricaudatus	3
Onuphis quadricuspis	5
Parheteromastus sp. A	1
Pholoe minuta	1
Polydora caulleryi	4
Praxillella praetermissa	1
Prionospio steenstrupi	8
Proclea graffii	2
Scalibregma inflatum	4
Scoloplos acutus	7
Sphaerodoridium claparedii	1
Tauberia gracilis	10
Terebellides stroemi	5
Tharyx ? acutus	14
Typosyllis fasciata	1
Genus "A" (Ampharetidae)	5

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Polynoidae	1

SMG 974 Station WBS-34/CG-72
71°10.0'N 151°09.0'W
45m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Anaitides groenlandica	1
Barantolla americana	5
Chaetozone setosa	7
Chone murmanica	11
Cistenides hyperborea	1
Cossura longocirrata	1
Heteromastus filiformis	5
Laphania boecki	3
Lumbrineris impatiens	9
Lumbrineris minuta	25
Lysippe labiata	4
Maldane sarsi	12
Micronephthys minuta	12
Minuspio cirrifera	1
Ophelina cylindricaudatus	1
Paraonis sp. A	1
Pholoe minuta	1
Prionospio steenstrupi	7
Proclea graffii	2
Schistomeringos caecus	1
Scoloplos acutus	15
Sternaspis fossor	1
Tauberia gracilis	6
Terebellides stroemi	7
Tharyx ? acutus	35
Typosyllis cornuta	2
Genus "A" (Ampharetidae)	7

UNIDENTIFIED POLYCHAETA

Maldanidae	2
Spionidae	1

SMG 975 Station WBS-34/CG-72
71°09.9'N 151°09.1'W
45m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	4
Allia sp. A	1
Anaitides groenlandica	1
Antinoella sarsi	1
Autolytus fallax	2
Barantolla americana	9
Capitella capitata	1
Chaetozone setosa	9
Chone murmanica	3
Cossura longocirrata	1
Eteone longa	1
Exogone dispar	3
Heteromastus filiformis	5
Laphania boecki	1
Lumbrineris fragilis	1
Lumbrineris impatiens	5
Lumbrineris minuta	14
Lysippe labiata	2
Magelone longicornis	1
Maldane sarsi	11
Micronephthys minuta	20
Minuspio cirrifera	1
Onuphis quadricuspis	8
Ophelina cylindricaudatus	4
Paraonis sp. A	1
Pholoe minuta	3
Prionospio steenstrupi	6
Proclea graffii	1
Schistomeringos caecus	1
Scoloplos acutus	7
Spiochaetopterus typicus	2
Sternaspis fossor	2
Tauberia gracilis	10
Tharyx ? acutus	43
Terebellides stroemi	4
Genus "A" (Ampharetidae)	5

UNIDENTIFIED POLYCHAETA

Lumbrineridae	1
Maldanidae	2

SMG 976 Station WBS-34/CG-72
71°09.9'N 151°09.3'W
45m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	2
Antinoella sarsi	1
Barantolla americana	7
Chaetozone setosa	5
Chone murmanica	5
Clymenura polaris	7
Cossura longocirrata	1
Diplocirrus longisetosus	2
Euchone papillosa	1
Exogone naidina	1
Lumbrineris fragilis	1
Lumbrineris impatiens	3
Lumbrineris minuta	16
Lysippe labiata	9
Maldane sarsi	8
Micronephthys minuta	7
Onuphis quadricuspis	13
Ophelina cylindricaudatus	1
Pholoe minuta	1
Polydora caulleryi	2
Prionospio steenstrupi	6
Proclea graffii	4
Scalibregma inflatum	1
Scoloplos acutus	9
Tauberia gracilis	11
Terebellides stroemi	1
Tharyx ? acutus	30
Genus "A" (Ampharetidae)	9

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 977 Station WBS-34/CG-72
71°09.8'N 151°09.4'W
45m 9 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Ampharete acutifrons	1
Antinoella badia	1
Capitella capitata	1
Chaetozone setosa	9
Chone murmanica	3
Cossura longocirrata	3
Eteone flava	1
Euchone papillosa	1
Lagisca extenuata	1
Lumbrineris fragilis	1
Lumbrineris impatiens	5
Lumbrineris minuta	15
Lysippe labiata	4
Maldane sarsi	6
Micronephthys minuta	26
Nephtys ciliata	1
Onuphis quadricuspis	4
Ophelina cylindricaudatus	1
Pholoe minuta	1
Polydora caulleryi	1
Prionospio steenstrupi	8
Scalibregma inflatum	1
Scoloplos acutus	21
Spiochaetopterus typicus	1
Sternaspis fossor	1
Tauberia gracilis	8
Terebellides stroemi	12
Tharyx ? acutus	51
Typosyllis cornuta	9
Genus "A" (Ampharetidae)	4

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Sphaerodoridae	1

SMG 983 Station WBS-36/CG-75
71°14.8'N 150°27.6'W
132m 10 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	5
Ampharete acutifrons	4
Antinoella sarsi	1
Autolytus alexandri	1
Barantolla americana	4
Chaetozone setosa	14
Chone murmanica	10
Clymenura polaris	1
Cossura longocirrata	1
Diplocirrus hirsutus	1
Diplocirrus longisetosus	1
Eteone longa	4
Gattyana cirrosa	1
Heteromastus filiformis	3
Laphania boecki	1
Laonice cirrata	1
Lumbrineris impatiens	1
Lumbrineris minuta	32
Lysippe labiata	37
Micronephthys minuta	49
Myriochele heeri	14
Paraonis sp. A	1
Parheteromastus sp. A	1
Pholoe minuta	6
Proclea graffii	1
Scoloplos acutus	7
Spiochaetopterus typicus	28
Sternaspis fossor	1
Terebellides stroemi	7
Tharyx ? acutus	32
Trochochaeta carica	3
Typosyllis cornuta	2

UNIDENTIFIED POLYCHAETA

Maldanidae	10
Opheliidae (Travisia sp.)	1

SMG 984 Station WBS-36/CG-75
71°14.8'N 150°27.6'W
134m 10 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	4
Ampharete acutifrons	1
Barantolla americana	3
Chaetozone setosa	9
Chone murmanica	3
Enipo gracilis	2
Glycinde wireni	1
Heteromastus filiformis	1
Lumbrineris impatiens	3
Lumbrineris minuta	18
Lysippe labiata	29
Magelona longicornis	1
Maldane sarsi	3
Melinna cristata	1
Micronephthys minuta	15
Myriochele heeri	12
Nephtys ciliata	1
Onuphis quadricuspis	1
Owenia fusiformis	1
Pholoe minuta	8
Scoloplos acutus	7
Spiochaetopterus typicus	24
Tauberia gracilis	1
Terebellides stroemi	4
Tharyx ? acutus	32
Typosyllis cornuta	5

UNIDENTIFIED POLYCHAETA

Maldanidae	5
Opheliidae (Travisia sp.)	1
Spionidae	1

SMG 985 Station WBS-36/CG-75
71°14.8'N 150°27.6'W
137m 10 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Allia sp. A	2
Ampharete acutifrons	2
Anaitides groenlandica	1
Arcteobia anticostiensis	1
Barantolla americana	6
Chaetozone setosa	18
Diplocirrus longisetosus	1
Enipo gracilis	2
Eteone longa	2
Euchone papillosa	4
Glycinde wireni	1
Heteromastus filiformis	8
Lumbrineris impatiens	1
Lumbrineris minuta	40
Lysippe labiata	41
Maldane sarsi	1
Melinna cristata	2
Micronephthys minuta	24
Myriochele heeri	12
Nephtys ciliata	1
Nothria conchylega	2
Onuphis quadricuspis	15
Parheteromastus sp. A	2
Pholoe minuta	10
Scalibregma inflatum	1
Scoloplos acutus	3
Spiochaetopterus typicus	31
Spirorbis granulatus	1
Tauberia gracilis	1
Terebellides stroemi	3
Tharyx ? acutus	39
Typosyllis cornuta	4

UNIDENTIFIED POLYCHAETA

Maldanidae	12
Opheliidae (Travisia sp.)	1
Spionidae	1
Terebellidae	1

SMG 986 Station WBS-36/CG-75
71°14.8'N 150°27.6'W
139m 10 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	1
Ampharete acutifrons	3
Ampharete arctica	1
Anaitides groenlandica	1
Antinoella sarsi	1
Chaetozone setosa	21
Cossura longocirrata	3
Eteone longa	1
Euchone papillosa	6
Heteromastus filiformis	1
Lumbrineris impatiens	1
Lumbrineris minuta	36
Lysippe labiata	23
Maldane sarsi	2
Melinna cristata	1
Micronephthys minuta	12
Minuspio cirrifera	1
Myriochele heeri	13
Nephtys ciliata	2
Nothria conchylega	1
Onuphis quadricuspis	7
Parheteromastus sp. A	1
Pholoe minuta	7
Proclea graffii	2
Scoloplos acutus	2
Sphaerodorum gracilis	1
Spiochaetopterus typicus	21
Tauberia gracilis	2
Terebellides stroemi	2
Tharyx ? acutus	35
Trichobranchus glacialis	1
Typosyllis cornuta	5

UNIDENTIFIED POLYCHAETA

Maldanidae	5
Opheliidae	2

SMG 987 Station WBS-36/CG-75
71°14.8'N 150°27.6'W
140m 10 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Ampharete acutifrons	1
Barantolla americana	4
Chaetozone setosa	9
Cistenides hyperborea	2
Cossura longocirrata	1
Eteone longa	2
Euchone papillosa	8
Glycinde wireni	1
Heteromastus filiformis	1
Laphania boecki	1
Lumbrineris impatiens	2
Lumbrineris minuta	36
Lysippe labiata	56
Maldane sarsi	1
Melinna cristata	1
Micronephthys minuta	21
Myriochele heeri	2
Nephtys ciliata	1
Nothria conchylega	3
Onuphis quadricuspis	3
Ophelina cylindricaudatus	1
Owenia fusiformis	4
Paraonis sp. A	1
Petaloproctus tenuis	1
Pholoe minuta	6
Polydora caulleryi	1
Scalibregma inflatum	1
Scoloplos acutus	3
Sphaerodorum gracilis	1
Spiochaetopterus typicus	19
Tauberia gracilis	1
Terebellides stroemi	3
Tharyx ? acutus	34
Typosyllis cornuta	1

UNIDENTIFIED POLYCHAETA

Maldanidae	9
Opheliidae (Travisia sp.)	2

SMG 994 Station WBS-38/CG-78
70°58.1'N 149°59.1'W
28m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Ampharete acutifrons	1
Antinoella sarsi	3
Brada villosa	1
Capitella capitata	19
Chone murmanica	14
Eteone longa	2
Exogone naidina	1
Micronephthys minuta	7
Minuspio cirrifera	40
Nereimyra aphroditoides	3
Ophelina cylindricaudatus	4
Pholoe minuta	1
Scalibregma inflatum	1
Tharyx ? _acutus_	9
Trochochaeta carica	1

UNIDENTIFIED POLYCHAETA

Dorvilleidae	1

SMG 993 Station WBS-38/CG-78
70°58.1'N 149°59.1'W
28m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Anaitides groenlandica	2
Antinoella sarsi	3
Brada villosa	1
Capitella capitata	2
Chone murmanica	3
Micronephthys minuta	1
Minuspio cirrifera	24
Nereimyra aphroditoides	3
Ophelina cylindricaudatus	1
Pholoe minuta	5
Scalibregma inflatum	1
Tharyx ? _acutus_	2

UNIDENTIFIED POLYCHAETA

Terebellidae	1

SMG 995 Station WBS-38/CG-78
70°58.1'N 149°59.1'W
28m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia sp. A	10
Anaitides groenlandica	3
Antinoella sarsi	2
Barantolla americana	5
Capitella capitata	16
Chaetozone setosa	2
Chone murmanica	24
Cossura longocirrata	51
Eteone longa	2
Heteromastus filiformis	2
Lumbrineris minuta	1
Minuspio cirrifera	63
Nereimyra aphroditoides	3
Ophelina acuminata	1
Pholoe minuta	3
Scalibregma inflatum	1
Scoloplos acutus	1
Sternaspis fossor	1
Tauberia gracilis	8
Tharyx ? acutus	25
Genus "A" (Ampharetidae)	1

UNIDENTIFIED POLYCHAETA

Dorvilleidae	1

SMG 996 Station WBS-38/CG-78
71°58.0'N 149°59.1'W
27m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Anaitides groenlandica	1
Antinoella sarsi	1
Capitella capitata	8
Chaetozone setosa	2
Chone murmanica	5
Nereimyra aphroditoides	1
Scalibregma inflatum	1
Tharyx ? acutus	2

SMG 997 Station WBS-38/CG-78
70°50.8'N 149°59.1'W
27m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Capitella capitata	4
Chaetozone setosa	2
Chone murmanica	8
Tharyx ? acutus	1

SMG 1003 Station WBS-40/CG-82
71°08.3'N 149°47.7'W
45m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	7
Ampharete acutifrons	4
Autolytus fallax	2
Barantolla americana	11
Capitella capitata	9
Chaetozone setosa	12
Chone murmanica	5
Cistenides hyperborea	1
Clymenura polaris	5
Cossura longocirrata	1
Diplocirrus hirsutus	1
Diplocirrus longisetosus	1
Eteone longa	1
Exogone naidina	8
Glycinde wireni	1
Laonice cirrata	1
Heteromastus filiformis	6
Lumbrineris fragilis	1
Lumbrineris impatiens	2
Lumbrineris minuta	17
Lysippe labiata	3
Magelona longicornis	1
Maldane sarsi	18
Micronephthys minuta	38
Myriochele heeri	1
Mysta barbata	1
Nephtys ciliata	1
Nereimyra aphroditoides	1
Nicolea zostericola	1
Onuphis quadricuspis	3
Paraonis sp. A	3
Pholoe minuta	5
Polydora caulleryi	2
Prionospio steenstrupi	11
Proclea graffii	3
Scalibregma inflatum	1
Scoloplos acutus	14
Spiochaetopterus typicus	1
Tauberia gracilis	12
Terebellides stroemi	5
Tharyx ? acutus	31
Genus "A" (Ampharetidae)	1

Unidentified Polychaeta

Maldanidae	2
Terebellidae	1

SMG 1004 Station WBS-40/CG-82
71°08.3'N 149°47.7'W
45m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Ampharete acutifrons	5
Ampharete arctica	1
Barantolla americana	5
Chaetozone setosa	8
Chone duneri	1
Chone murmanica	8
Cistenides hyperborea	1
Cossura longocirrata	38
Diplocirrus hirsutus	1
Eteone flava	1
Eteone longa	2
Exogone naidina	3
Heteromastus filiformis	5
Lumbrineris minuta	17
Lysippe labiata	5
Maldane sarsi	11
Micronephthys minuta	69
Nereimyra aphroditoides	2
Nephtys ciliata	2
Onuphis quadricuspis	4
Paraonis sp. A	1
Parheteromastus sp. A	4
Pholoe minuta	15
Polydora caulleryi	2
Prionsopio steenstrupi	16
Proclea graffii	1
Scalibregma inflatum	2
Schistomeringos caecus	2
Scoloplos acutus	22
Tauberia gracilis	32
Terebellides stroemi	12
Tharyx ? acutus	87
Trochochaeta carica	1
Typosyllis cornuta	1
Genus "A" (Ampharetidae)	2

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Opheliidae (Travisia sp.)	1
Terebellidae	1

SMG 1005 Station WBS-40/CG-82
71°08.3'N 149°47.7'W
44m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	13
Ampharete acutifrons	10
Antinoella sarsi	2
Apistobranchus tullbergi	1
Autolytus fallax	1
Barantolla americana	4
Brada villosa	2
Capitella capitata	1
Chaetozone setosa	6
Clymenura polaris	3
Chone duneri	1
Chone murmanica	5
Cossura longocirrata	2
Diplocirrus hirsutus	1
Eteone longa	2
Heteromastus filiformis	12
Laonice cirrata	1
Lumbrineris minuta	16
Lysippe labiata	10
Maldane sarsi	15
Micronephthys minuta	31
Myriochele heeri	1
Mysta barbata	1
Nephtys ciliata	1
Nereimyra aphroditoides	1
Onuphis quadricuspis	2
Paraonis sp. A	4
Parheteromastus sp. A	1
Pholoe minuta	4
Polydora caulleryi	4
Prionospio steenstrupi	11
Proclea graffii	2
Scoloplos acutus	22
Tauberia gracilis	15
Terebellides stroemi	6
Tharyx ? acutus	37
Trochochaeta carica	2
Genus "A" (Ampharetidae)	4

UNIDENTIFIED POLYCHAETA

Maldanidae	3

SMG 1006 Station WBS-40/CG-82
71°08.3'N 149°47.7'W
44m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	9
Ampharete acutifrons	10
Anaitides groenlandica	3
Barantolla americana	9
Chaetozone setosa	7
Chone duneri	3
Chone murmanica	3
Clymenura polaris	2
Eteone longa	4
Exogone naidina	1
Heteromastus filiformis	6
Lumbrineris minuta	20
Lysippe labiata	2
Maldane sarsi	12
Micronephthys minuta	24
Mysta barbata	1
Nephtys ciliata	1
Onuphis quadricuspis	6
Paraonis sp. A	3
Parheteromastus sp. A	5
Pholoe minuta	5
Polydora caulleryi	1
Prionospio steenstrupi	8
Proclea graffii	1
Scalibregma inflatum	2
Scoloplos acutus	12
Spiochaetopterus typicus	1
Tauberia gracilis	12
Terebellides stroemi	8
Tharyx ? acutus	33
Trochochaeta carica	3
Typosyllis cornuta	1
Genus "A" (Ampharetidae)	1

UNIDENTIFIED POLYCHAETA

Maldanidae	3
Spionidae	1
Terebellidae	1

SMG 1007 Station WBS-40/CG-82
71°08.3'N 149°47.7'W
44m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Ampharete acutifrons	1
Barantolla americana	7
Capitalla capitata	2
Chaetozone setosa	7
Chone murmanica	5
Euchone papillosa	1
Glycinde wireni	1
Heteromastus filiformis	4
Laphania boecki	1
Lumbrineris minuta	9
Lysippe labiata	4
Maldane sarsi	17
Micronephthys minuta	23
Mysta barbata	1
Nereimyra aphroditoides	4
Nephtys ciliata	2
Nephtys paradoxa	1
Onuphis quadricuspis	2
Paraonis sp. A	3
Parheteromastus sp. A	3
Pholoe minuta	3
Polydora caulleryi	6
Prionospio steenstrupi	10
Proclea graffii	2
Sabellides borealis	2
Scalibregma inflatum	1
Scoloplos acutus	19
Sphaerodorum gracilis	1
Tauberia gracilis	5
Terebellides stroemi	6
Tharyx ? acutus	24
Trochochaeta carica	2
Genus "A" (Ampharetidae)	1

UNIDENTIFIED POLYCHAETA

Maldanidae	2
Spionidae	1

SMG 1008 Station WBS-41/CG-83
71°12.2'N 149°44.8'W
169m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	7
Ampharete arctica	1
Anaitides groenlandica	1
Antinoella badia	1
Antinoella sarsi	1
Artacama proboscidea	1
Barantolla americana	3
Chaetozone setosa	5
Heteromastus filiformis	1
Laphania boecki	1
Lumbrineris minuta	22
Lysippe labiata	4
Micronephthys minuta	29
Nereimyra aphroditoides	1
Onuphis quadricuspis	1
Owenia fusiformis	2
Prionospio steenstrupi	5
Scoloplos acutus	20
Sphaerodoridium sp. A	1
Spiochaetopterus typicus	5
Tauberia gracilis	6
Terebellides stroemi	5
Tharyx ? acutus	77

UNIDENTIFIED POLYCHAETA

Chaetopteridae	1

SMG 1009 Station WBS-41/CG-83
71°12.2'N 149°44.8'W
189m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	19
Antinoella sarsi	1
Apistobranchus tullbergi	1
Artacama proboscidea	1
Barantolla americana	3
Chaetozone setosa	11
Cossura longocirrata	4
Eteone longa	3
Laphania boecki	1
Lumbrineris minuta	13
Lysippe labiata	5
Maldane sarsi	1
Micronephthys minuta	44
Nephtys ciliata	1
Nereimyra aphroditoides	1
Prionospio steenstrupi	8
Procela graffii	2
Scoloplos acutus	27
Spiochaetopterus typicus	1
Tauberia gracilis	12
Terebellides stroemi	2
Tharyx ? acutus	47

UNIDENTIFIED POLYCHAETA

Maldanidae	2

SMG 1010 Station WBS-41/CG-83
71°12.2'N 149°44.8'W
204m 11 September 1971
R/V GLACIER WEBSEC-71
Seive mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	54
Barantolla americana	1
Chaetozone setosa	18
Cossura longocirrata	72
Eteone longa	3
Heteromastus filiformis	1
Laphania boecki	2
Lumbrineris minuta	13
Lysippe labiata	3
Micronephthys minuta	125
Myriochele heeri	1
Nephtys ciliata	5
Onuphis quadricuspis	1
Praxillella praetermissa	1
Prionospio steenstrupi	17
Scoloplos acutus	46
Sternaspis fossor	2
Tauberia gracilis	42
Terebellides stroemi	3
Tharyx ? acutus	94

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Spionidae	1

SMG 1011 Station WBS-41/CG-83
71°12.2'N 149°44.8'W
216m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	56
Anaitides groenlandica	1
Artacama proboscidea	2
Barantolla americana	1
Chaetozone setosa	21
Cossura longocirrata	4
Eteone longa	4
Heteromastus filiformis	1
Lumbrineris minuta	21
Lysippe labiata	7
Micronephthys minuta	63
Nephtys ciliata	7
Onuphis quadricuspis	2
Prionospio steenstrupi	18
Proclea graffii	8
Scoloplos acutus	41
Sphaerodoridium sp. A	1
Spiochaetopterus typicus	5
Tauberia gracilis	27
Terebellides stroemi	8
Tharyx ? acutus	86

UNIDENTIFIED POLYCHAETA

Maldanidae	3

SMG 1012 Station WBS-41/CG-83
71°12.2'N 149°44.8'W
232m 11 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	32
Antinoella sarsi	2
Artacama proboscidea	1
Barantolla americana	3
Chaetozone setosa	31
Cistenides hyperborea	1
Cossura longocirrata	20
Eteone longa	8
Heteromastus filiformis	1
Lumbrineris minuta	29
Lysippe labiata	6
Maldane sarsi	2
Micronephthys minuta	41
Minuspio cirrifera	1
Myriochele heeri	3
Nephtys ciliata	2
Prionospio steenstrupi	8
Proclea graffii	5
Scoloplos acutus	46
Tauberia gracilis	36
Terebellides stroemi	4
Tharyx ? acutus	103

UNIDENTIFIED POLYCHAETA

Chaetopteridae	1
Dorvilleidae	1
Terebellidae	1

SMG 1013 Station WBS-42/CG-84
71°18.3'N 150°21.6'W
540m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	1
Anaitides groenlandica	1
Barantolla americana	8
Capitella capitata	1
Chaetozone setosa	2
Chone murmanica	1
Cossura longocirrata	8
Eteone longa	1
Laonice cirrata	7
Lumbrineris minuta	14
Maldane sarsi	47
Micronephthys minuta	1
Munispio cirrifera	221
Ophelina cylindricaudatus	4
Owenia fusiformis	16
Scoloplos acutus	10
Sphaerodoridium sp. A	4
Sphaerodoropsis sp. B	4
Spiochaetopterus typicus	3
Tauberia gracilis	7

UNIDENTIFIED POLYCHAETA

Maldanidae	4

SMG 1014 Station WBS-42/CG-84
71°17.9'N 150°20.9'W
678m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	2
Barantolla americana	4
Chaetozone setosa	3
Eteone longa	1
Laonice cirrata	6
Lumbrineris minuta	11
Maldane sarsi	50
Minuspio cirrifera	139
Ophelina cylindricaudatus	1
Scoloplos acutus	6
Sphaerodoridium sp. A	1
Sphaerodoropsis sp. B	1
Spiochaetopterus typicus	2
Tauberia gracilis	10

UNIDENTIFIED POLYCHAETA

Maldanidae	4

SMG 1015 Station WBS-42/CG-84
71°17.5'N 150°20.0'W
676m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	2
Barantolla americana	9
Capitella capitata	1
Chaetozone setosa	4
Chone murmanica	5
Cossura longocirrata	9
Eteone longa	3
Laonice cirrata	13
Lumbrineris minuta	19
Maldane sarsi	231
Micronephthys minuta	1
Minuspio cirrifera	116
Onuphis quadricuspis	3
Owenia fusiformis	433
Petaloproctus tenuis	2
Pholoe minuta	2
Prionospio steenstrupi	1
Scoloplos acutus	6
Sphaerodoridium sp. A	4
Sphaerodoropsis sp. B	3
Spiochaetopterus typicus	2
Tauberia gracilis	10
Trochochaeta carica	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Maldanidae	10

SMG 1016 Station WBS-42/CG-84
71°17.3'N 150°19.5'W
759m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia sp. A	3
Barantolla americana	2
Capitella capitata	2
Chaetozone setosa	1
Chone murmanica	3
Clymenura polaris	1
Eteone longa	1
Heteromastus filiformis	1
Laonice cirrata	2
Lumbrineris minuta	21
Maldane sarsi	40
Minuspio cirrifera	245
Ophelina cylindricaudatus	1
Owenia fusiformis	50
Scoloplos acutus	8
Sphaerodoridium sp. A	2
Sphaerodoropsis sp. B	4
Tauberia gracilis	3

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Opheliidae (Travisia sp.)	1

SMG 1017 Station WBS-42/CG-84
71°16.8'N 150°18.5'W
831m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture - 1.00mm

POLYCHAETA

Allia sp. A	6
Antinoella sarsi	1
Barantolla americana	1
Capitella capitata	17
Chaetozone setosa	1
Chone murmanica	9
Cossura longocirrata	12
Eteone longa	3
Laonice cirrata	4
Lumbrineris minuta	10
Maldane sarsi	22
Micronephthys minuta	1
Minuspio cirrifera	131
Nephtys ciliata	1
Ophelina cylindricaudatus	2
Owenia fusiformis	51
Scoloplos acutus	7
Sphaerodoridium sp. A	4
Sphaerodoropsis sp. B	1
Tauberia gracilis	5

UNIDENTIFIED POLYCHAETA

Maldanidae	14
Opheliidae (Travisia sp.)	

SMG 1018 Station WBS-43/CG-85
71°22.0'N 150°38.0'W
821m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	1
Capitella capitata	3
Chaetozone setosa	1
Chone murmanica	1
Cossura longocirrata	1
Eteone longa	1
Laonice cirrata	4
Minuspio cirrifera	124
Owenia fusiformis	26
Scoloplos acutus	2
Sigambra tentaculata	1
Tauberia gracilis	24
Terebellides stroemi	1

UNIDENTIFIED POLYCHAETA

Maldanidae	4

SMG 1019 Station WBS-43/CG-85
71°22.0'N 150°38.0'W
795m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	3
Barantolla americana	1
Laonice cirrata	6
Lumbrineris minuta	3
Maldane sarsi	21
Minuspio cirrifera	72
Ophelina cylindricaudatus	1
Sigambra tentaculata	5

UNIDENTIFIED POLYCHAETA

Maldanidae	6

SMG 1020 Station WBS-43/CG-85
71°22.0'N 150°38.0'W
887m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia suecica	7
Antinoella sarsi	2
Barantolla americana	2
Chaetozone setosa	1
Heteromastus filiformis	1
Laonice cirrata	5
Lumbrineris minuta	7
Maldane sarsi	6
Minuspio cirrifera	85
Ophelina cylindricaudatus	1
Owenia fusiformis	10
Scoloplos acutus	6
Sphaerodoropsis sp. A	1
Tauberia gracilis	1

UNIDENTIFIED POLYCHAETA

Maldanidae	1

SMG 1021 Station WBS-43/CG-85
71°22.0'N 150°38.0'W
923m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Allia suecica	3
Capitella capitata	6
Laonice cirrata	6
Lumbrineris minuta	6
Maldane sarsi	6
Minuspio cirrifera	109
Ophelina cylindricaudatus	1
Owenia fusiformis	16
Scoloplos acutus	5
Sigambra tentaculata	1
Sphaerodoropsis sp. B	1

UNIDENTIFIED POLYCHAETA

Maldanidae	5

SMG 1022 Station WBS-43/CG-85
71°22.0'N 150°38.0'W
997m 12 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture - 1.00mm

POLYCHAETA

Allia suecica	3
Capitella capitata	3
Cossura longocirrata	1
Laonice cirrata	7
Lumbrineris minuta	3
Maldane sarsi	11
Micronephthys minuta	1
Minuspio cirrifera	311
Ophelina cylindricaudatus	3
Owenia fusiformis	4
Scoloplos acutus	2
Tauberia gracilis	11

UNIDENTIFIED POLYCHAETA

Maldanidae	4

SMG 1024 Station WBS-44/CG-86
71°46.0'N 150°35.0'W
2204m 14 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Antinoella badia	1
Cossura sp. A	2
Lumbrineris minuta	4
Ophelina sp. A	1
Owenia fusiformis	1
Sigambra tentaculata	2
Tharyx ? acutus	20

UNIDENTIFIED POLYCHAETA

Terebellidae	1

SMG 1023 Station WBS-44/CG-86
71°45.1'N 150°35.0'W
2139m 14 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Lumbrineris minuta	7
Minuspio cirrifera	1
Ophelina abranchiata	1
Owenia fusiformis	1
Sigambra tentaculata	3
Tharyx ? acutus	7

SMG 1025 Station WBS-44/CG-86
71°46.8'N 150°35.0'W
2461m 14 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Lumbrineris minuta	7
Minuspio cirrifera	1
Ophelina abranchiata	1
Ophelina sp. A	1
Sigambra tentaculata	11
Tharyx ? acutus	11

SMG 1026 Station WBS-44/CG-86
71°47.4'N 150°35.0'W
2400m 14 September 1971
R/V GLACIER WEBSEC-71
Sieve mesh aperture = 1.00mm

POLYCHAETA

Aglaophamus malmgreni	1
Capitella capitata	1
Cossura sp. A	5
Heteromastus filiformis	1
Lumbrineris minuta	9
Nicon sp. A	1
Ophelina abranchiata	1
Ophelina sp. A	6
Sigambra tentaculata	30
Tharyx ? acutus	24

SMG 1530
72°23.7'N 154°37.2'W
2470m 9 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia abranchiata	3
Capitella capitata	1
Lumbrineris minuta	4
Lumbrineris sp. A	3
Myriochele heeri	5
Nicon sp. A	1
Ophelina abranciata	7
Ophelina sp. A	4
Sigambra tentaculata	3
Terebellides stroemi	1
Tharyx ? acutus	15

UNIDENTIFIED POLYCHAETA AND OLIGOCHAETA

Maldanidae	1
Oligochaeta	2

SMG 1539
72°21.5'N 153°37'W
2840m 10 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Cossura sp. A	1
Parheteromastus sp. A	1

SMG 1540
72°21.2'N 153°45.2'W
2650m 10 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42

POLYCHAETA

Aglaophamus malmgreni	1
Chaetozone setosa	2
Myriochele heeri	1
Ophelina sp. A	1
Sphaerodorum gracilis	1
Terebellides stroemi	1
Tharyx ? acutus	1

SMG 1599
72°53.5'N 146°31'W
3750m 20 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Nereimyra aphroditoides	1
Ophelina sp. A	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	2
Spionidae	2

SMG 1600
72°53.8'N 146°27'W
3841m 20 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Lumbrineris minuta	1
Tharyx ? acutus	3

UNIDENTIFIED POLYCHAETA

Ampharetidae	3
Orbiniidae	1
Spionidae	1
Terebellidae	1

SMG 1601
72°56'N 146°34'W
3511m 20 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia suecica	1

UNIDENTIFIED POLYCHAETA

Spionidae	1
Terebellidae	1

SMG 1602
72°58'N 146°29'W
3576m 20 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia abranchiata	2
Tharyx ? acutus	2

UNIDENTIFIED POLYCHAETA

Ampharetidae	2
Spionidae	1
Terebellidae	1

SMG 1603
72°55.8'N 146°36'W
3843m 21 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia abranchiata	1
Tharyx ? acutus	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Spionidae	1

SMG 1604
72°56.5'N 146°30'W
4200m 21 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Lumbrineris minuta	1
Tharyx ? acutus	2

UNIDENTIFIED POLYCHAETA

Ampharetidae	2
Spionidae	2

SMG 1605
72°49'N 146°25'W
3566m 21 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Ophelina sp. A	1
Tharyx ? acutus	2

UNIDENTIFIED POLYCHAETA

Ampharetidae	1

SMG 1606
72°48'N 146°24'W
3569m 22 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Tharyx ? acutus	1

UNIDENTIFIED POLYCHAETA

Spionidae	1

SMG 1607
72°46.5'N 146°23'W
3570m 22 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia abranchiata	1
Ophelina sp. A	1
Tharyx ? acutus	2

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Spionidae	2

SMG 1608
72°42'N 143°40'W
3336m 22 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia abranchiata	1
Lumbrineris minuta	2
Ophelina sp. A	1
Terebellides stroemi	1

UNIDENTIFIED POLYCHAETA

Ampharetidae	3
Orbiniidae	1

SMG 1609
72°55'N 142°05'W
3475m 23 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia abranchiata	1
Aricidea tetrabranchia	3

UNIDENTIFIED POLYCHAETA

Ampharetidae	1

SMG 1610
70°51'N 141°36.8'W
1958m 24 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia abranchiata	6
Aricidea tetrabranchia	5
Chaetozone setosa	26
Ophelina sp. A	1
Tachytrypane sp. A	2
Genus "B" (Capitellidae)	3

UNIDENTIFIED POLYCHAETA AND OLIGOCHAETA

Spionidae	2
Family unknown	1
Oligochaeta	3

SMG 1611
70°51'N 141°41'W
1976m 24 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aricidea tetrabranchia	4
Chaetozone setosa	1
Ophelina sp. A	1

UNIDENTIFIED POLYCHAETE

Family unknown	5

SMG 1612
70°52.8'N 141°46'W
2048m 24 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aricidea tetrabranchia	2
Chaetozone setosa	13
Terebellides stroemi	1
Genus "B" (Capitellidae)	4

UNIDENTIFIED POLYCHAETA AND OLIGOCHAETA

Ampharetidae	2
Sabellidae	1
Spionidae	5
Terebellidae	1
Oligochaeta	6

SMG 1613
70°52.8'N 141°46.5'W
2086m 24 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia abranchiata	1
Aricidea tetrabranchia	8
Chaetozone setosa	22
Lumbrineris latreilli	1
Ophelina sp. A	3
Sigambra tentaculata	1
Tachytrypane sp. A	2
Terebellides stroemi	1
Genus "B" (Capitellidae)	6

UNIDENTIFIED POLYCHAETA AND OLIGOCHAETA

Ampharetidae	2
Spionidae	7
Family unknown	2
Oligochaeta	3

SMG 1614
70°40'N 141°35.5'W
1097m 24 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia abranchiata	11
Allia suecida	1
Aricidea ushakovi	1
Chaetozone setosa	48
Lumbrineris minuta	5
Maldane sarsi	3
Minuspio cirrifera	10
Ophelina abranchiata	4
Sigambra tentaculata	2
Sphaerodoropsis biserialis	3
Terebellides stroemi	4
Genus "B" (Capitellidae)	1

UNIDENTIFIED POLYCHAETA

Spionidae	2

SMG 1615
70°40.5'N 141°38'W
997m 25 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	3
Allia abranchiata	13
Aricidea ushakovi	2
Chaetozone setosa	36
Lumbrineris minuta	5
Minuspio cirrifera	5
Myriochele heeri	2
Scalibregma inflatum	1
Sigambra tentaculata	2
Terebellides stroemi	6
Genus "B" (Capitellidae)	1

UNIDENTIFIED POLYCHAETA

Maldanidae	6

SMG 1616
70°40.6'N 141°41.1'W
686m 25 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Allia abranchiata	12
Amage auricula	1
Aricidea ushakovi	1
Chaetozone setosa	11
Eclysippe sp. A	32
Lumbrineris latreilli	2
Lumbrineris minuta	1
Maldane sarsi	9
Minuspio cirrifera	14
Myriochele heeri	20
Nereimyra aphroditoides	3
Notoproctus oculatus var. arctica	4
Schistomeringos sp. A	2
Sigambra tentaculata	1
Sphaerodoropsis biserialis	2
Terebellides stroemi	3
Genus "B" (Capitellidae)	3

UNIDENTIFIED POLYCHAETA

Ampharetidae	1
Terebellidae	1

SMG 1617
70°42'N 141°41.1'W
640m 25 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	2
Allia abranchiata	7
Allia suecica	3
Amage auricula	2
Ampharete acutifrons	1
Aricidea ushakovi	2
Chaetozone setosa	2
Eclysippe sp. A	15
Eteone flava	2
Heteromastus filiformis	1
Laonice cirrata	1
Lumbrineris impatiens	1
Maldane sarsi	14
Melinna cristata	1
Minuspio cirrifera	15
Myriochele heeri	2
Nereimyra aphroditoides	2
Ophelina sp. A	1
Scalibregma inflatum	1
Schistomeringos sp. A	4
Sigambra tentaculata	4
Sphaerodoropsis biserialis	2
Terebellides stroemi	1
Tharyx ? acutus	28

UNIDENTIFIED POLYCHAETA AND OLIGOCHAETA

Maldanidae	3
Terebellidae	5
Oligochaeta	2

SMG 1618
70°42.5'N 141°38.5'W
644m 25 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia abranchiata	1
Allia suecica	14
Amage auricula	2
Chaetozone setosa	11
Eclysippe sp. A	15
Eteone flava	1
Heteromastus filiformis	2
Jasmineira schaudinni	1
Laonice cirrata	3
Lumbrineris minuta	1
Lumbrineris sp. B	1
Maldane sarsi	16
Minuspio cirrifera	12
Myriochele heeri	2
Nereimyra aphroditoides	4
Ophelina abranchiata	5
Scalibregma inflatum	1
Schistomeringos sp. A	3
Sigambra tentaculata	6
Sphaerodoropsis biserialis	2
Sphaerodorum gracilis	1
Terebellides stroemi	3
Tharyx ? acutus	46
Genus "B" (Capitellidae)	2

UNIDENTIFIED POLYCHAETA

Maldanidae	1
Terebellidae	1

SMG 1619
70°40.6'N 141°43'W
659m 25 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia abranchiata	5
Allia suecica	3
Aricidea ushakovi	1
Eclysippe sp. A	11
Eteone flava	1
Heteromastus filiformis	1
Laonice cirrata	1
Lumbrineris minuta	2
Lumbrineris sp. B	2
Maldane sarsi	6
Minuspio cirrifera	20
Myriochele heeri	1
Nereimyra aphroditoides	1
Ophelina abranchiata	2
Scalibregma inflatum	1
Schistomeringos sp. A	3
Sigambra tentaculata	2
Sphaerodoropsis biserialis	2
Sphaerodorum gracilis	1
Terebellides stroemi	1
Tharyx ? acutus	26
Genus "B" (Capitellidae)	1

UNIDENTIFIED POLYCHAETA AND OLIGOCHAETA

Maldanidae	1
Oligochaeta	1

MG 1620
70°42.8'N 141°39.5'W
659m 25 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	3
Allia abranchiata	3
Allia suecica	16
Antinoella sarsi	1
Aricidea ushakovi	1
Chaetozone setosa	2
Eclysippe sp. A	13
Jasmineira schaudinni	1
Laonice cirrata	1
Maldane sarsi	38
Minuspio cirrifera	23
Nereimyra aphroditoides	2
Ophelina abranchiata	3
Ophelina cylindricaudatus	1
Schistomeringos sp. A	3
Sigambra tentaculata	2
Sphaerodoropsis biserialis	3
Terebellides stroemi	4
Tharyx ? acutus	46

UNIDENTIFIED POLYCHAETA AND OLIGOCHAETA

Chaetopteridae	7
Mandanidae	1
Oligochaeta	1

SMG 1622
70°41'N 141°27'W
1025m 25 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Amage auricula	1
Allia abranchiata	13
Aricidea ushakovi	2
Chaetozone setosa	1
Eclysippe sp. A	43
Lumbrineris latreilli	2
Lumbrineris minuta	5
Minuspio cirrifera	4
Myriochele heeri	2
Nereimyra aphroditoides	3
Sigambra tentaculata	19
Terebellides stroemi	2
Tharyx ? acutus	25
Genus "B" (Capitellidae)	3

UNIDENTIFIED POLYCHAETA

Maldanidae	5

SMG 1661
71°12'N 145°35'W
2104m 30 August 1977
10 R/V GLACIER (CS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia abranchiata	15
Chaetozone setosa	1
Lumbrineris minuta	2
Lumbrineris sp. A	2
Minuspio cirrifera	1
Myriochele heeri	4
Ophelina sp. A	1
Sigambra tentaculata	41
Tharyx ? acutus	14

UNIDENTIFIED POLYCHAETA AND OLIGOCHAETA

Lumbrineridae	2
Spionidae	2
Family unknown	1
Oligochaeta	

SMG 1663
71°05'N 146°33'W
1144m 31 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia suecica	8
Chaetozone setosa	1
Laonice cirrata	21
Maldane sarsi	5
Minuspio cirrifera	28
Ophelina cylindricaudatus	1
Scalibregma inflatum	2
Sigambra tentaculata	2
Sphaerodoropsis biserialis	1
Tharyx ? acutus	1

SMG 1664
71°05'N 146°33'W
1144m 31 August 1977
R/V GLACIER OCS-7
Sieve mesh aperture = .42mm

POLYCHAETA

Allia abranchiata	2
Allia suecica	4
Aricidea ushakovi	2
Eteone flava	1
Lumbrineris minuta	7
Minuspio cirrifera	7
Myriochele heeri	11
Sigambra tentaculata	16

UNIDENTIFIED POLYCHAETA

Serpulidae	1
Terebellidae	1

OTB 419 Station WBS-31/CG-64
70°43'N 149°02'W
50m 6 September 1971
R/V GLACIER WEBSEC-71

POLYCHAETA

Aglaophamus malmgreni	2
Cistenides hyperborea	16
Euchone papillosa	1

OTB 420 Station WBS-32/CG-66
70°43'N 149°06'W
31m 7 September 1971
R/V GLACIER WEBSEC-71

POLYCHAETA

Cistenides hyperborea	1
Lumbrineris fragilis	14

OTB 445 Station WBS-1/CG-1
70°14.1'N 143°23.5'W
37m 4 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Cistenides hyperborea	1
Sabellides borealis	1

OTB 446 Station WBS-1/CG-1
70°14.1'N 143°23.5'W
28m 4 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Euchone papillosa	2

OTB 447 Station WBS-2/CG-2
70°22.9'N 143°30.1'W
51m 4 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Gattyana cirrosa	2
Lagisca extenuata	1

OTB 449 Station WBS-3/CG-4
70°43.1'N 143°42.8'W
464m 5 August 1972
R/VGLACIER WEBSEC-72

POLYCHAETA

Apomatus globifer	11
Branchiomma infarcta	1
Maldane sarsi	13
Nothria conchylega	8

OTB 450 Station WBS-5/CG-9
70°34.8'N 144°23.1'W
71m 7 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Aglaophamus malmgreni	8
Amage auricula	4
Ampharete acutifrons	1
Ampharete arctica	2
Amphicteis gunneri	14
Anaitides citrina	4
Anaitides groenlandica	4
Axionice flexuosa	3
Eclysippe sp. A	3
Glyphanostomum pallescens	9
Lumbrineris fragilis	15
Melinna cristata	8
Nereis zonata	9
Nothria conchylega	15
Paranaitis wahlbergi	2
Polyphysia crassa	1
Scalibregma inflatum	1

UNIDENTIFIED POLYCHAETA

Opheliidae (Travisia spp.)	1

OTB 452 Station WBS-6/CG-10
70°20'N 144°40'W
41m 7 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Bradia inhabilis	1

OTB 453 Station WBS-7/CG-11
70°10.9'N 144°30.5'W
27m 8 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Antinoella sarsi	2
Brada incrustata	1
Brada inhabilis	1
Brada villosa	2
Euchone papillosa	1
Eunoe oerstedi	1
Harmothoe imbricata	2
Melaenis loveni	6
Polyphysia crassa	1
Sabellides borealis	9
Scalibregma inflatum	5

OTB 454 Station WBS-8/CG-12
70°18.7'N 145°13'W
30m 8 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Nereis zonata	1
Polyphysia crassa	1

OTB 455 Station WBS-9/CG-15
70°33'N 145°40'W
50m 9 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Axionice flexuosa	4
Brada inhabilis	3
Nereis zonata	1
Nicolea zostericola	1
Nothria conchylega	1

OTB 456 Station WBS-10/CG-16
70°40.8'N 145°24.9'W
79m 9 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Nereis zonata	1
Nothria conchylega	8

OTB 457 Station WBS-11/CG-17
70°51.5'N 145°17'W
57m 9 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Amphicteis gunneri	2

OTB 459 Station WBS-13/CG-24
70°35.1'N 146°35.3'W
48m 13 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Aglaophamus malmgreni	3

OTB 460 Station WBS-14/CG-25
70°20'N 146°28'W
34m 14 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Aglaophamus malmgreni	5
Anaitides groenlandica	2
Cistenides hyperborea	3
Euchone papillosa	12
Eunoe oerstedi	2
Polyphysia crassa	1

OTB 461 Station WBS-15/CG-26
70°21.7'N 146°32.7'W
27m 14 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Cistenides hyperborea	5
Euchone papillosa	1

OTB 463 Station WBS-17/CG-28
70°31.5'N 147°32'W
29m 15 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Cistenides hyperborea	22
Melaenis loveni	1
Nereis zonata	2

OTB 466 Station WBS-21/CG-36
71°11.6'N 148°32.1'W
159m 18 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Nereis zonata	5

OTB 467 Station WBS-22/CG-37
71°05.7'N 148°41'W
55m 19 August 1972
R/V GLACIER WEBSEC-72

POLYCHAETA

Aglaophamus malmgreni	4
Amphicteis gunneri	3
Anaitides groenlandica	1
Nephtys ciliata	1
Nereis zonata	6
Onuphis quadrucuspis	1
Typosyllis cornuta	1

BxC 048
71°44'N 151°45'W
1738m 29 August 1976
R/V GLACIER OCS-4
Sieve mesh aperture = .42mm

POLYCHAETA

Capitella capitata	2
Heteromastus filiformis	8
Laonice cirrata	1
Minuspio cirrifera	45
Myriochele heeri	22
Sigambra tentaculata	4

UNIDENTIFIED POLYCHAETA

Maldanidae	1

BxC 049
71°43.6'N 151°46.5'W
1643m 29 August 1976
R/V GLACIER OCS-4
Sieve mesh aperture = .42mm

POLYCHAETA

Antinoella sarsi	1
Capitella capitata	1
Heteromastus filiformis	10
Laonice cirrata	4
Lumbrineris minuta	3
Minuspio cirrifera	21
Myriochele heeri	11

UNIDENTIFIED POLYCHAETA

Maldanidae	3

BxC 050
71°43.6'N 151°46.5'W
1659m 29 August 1976
R/V GLACIER OCS-4
Sieve mesh aperture = .42mm

POLYCHAETA

Aglaophamus malmgreni	1
Capitella capitata	6
Heteromastus filiformis	10
Laonice cirrata	3
Lumbrineris minuta	2
Minuspio cirrifera	145
Myriochele heeri	16
Sigambra tentaculata	7

UNIDENTIFIED POLYCHAETA

Flabelligeridae	1
Maldanidae	3

VII. Discussion

From the data accumulated during the past year, it is evident that there are seasonal, offshore-onshore, and geographic patterns in the structure of the southwestern Beaufort Sea benthic infaunal communities.

Perhaps the most significant and surprising finding is the seasonality observed in the outer continental shelf communities. The abundant fauna appears to have a significant increase in numerical abundance in May (>1.0 mm in size) and in August for the smaller macro-infauna (0.5-1.0 mm in size). At the present stage of analysis, it is difficult to determine the underlying causes for these trends. Species population size structure and abundance data are necessary for the small fauna (e.g. harpacticoid copepods and nematode worms) and for the large macrofauna (e.g. polychaete worms and gammarid amphipods). The population size structure of dominant species should be defined throughout the year to determine patterns of life history in the southwestern Beaufort Sea continental shelf. It is evident that at the three stations on the inner, mid and outer shelf, there are some major differences in reproduction and community structure.

The implications to be derived from these results describing a biologically active fauna in an arctic region with low primary production are intriguing. These results imply a more productive Beaufort Sea ecosystem than previously thought. The average results point to the need for detailed life history studies of the most abundant species now on hand. Further field research to describe these seasonal changes in more detail and to measure usable carbon inputs to the ecosystem are also called for. Ice algae production and tundra peat detritus inputs are potential sources that should be defined throughout the year; these inputs are likely to vary at varying distances from the coastline.

The abundance patterns of the larger benthic infauna (>1.0 mm) in the coastal zone demonstrate a nearshore maximum in numerical density with an intermediate low and an offshore maximum. Hypotheses for processes that maintain these patterns are suggested by the bimodality of numerical density and correlations with environmental features. The abundance peak nearshore may be caused by inputs of detrital peat from coastal erosion and river run-off, while that near the edge of the shelf may be the region where the lower current energies allow oceanic detritus and fine sedimentary particles to settle out. The abundance low is strongly correlated with the sea ice shear zone region. It is not known how long-lasting the destructive effects of ice scour are; it is possible that such scours would take a long time to recover previous sedimentary cover and characteristics owing to the low sedimentation rates on the arctic Alaskan shelf. It is also evident from the distribution-abundance patterns of the dominant bivalve and polychaete species across the shelf that species are adapted to live in narrow to broad environmental ranges. Some live on the inner shelf, some on the mid-shelf and some at the shelf edge. Others can be distributed across the entire shelf from 5 to 100 meters depth.

Preliminary analysis of the distribution and abundance of polychaete species indicate that the eastern and western regions of the research area are different ecologically. The numbers of species and number of specimens at each station along the 3 transects summarized to date demonstrate a striking similarity between the 2 eastern transects and the contrast in pattern of the transect off Cape Halkett. Previous research (Carey 1977 Final Rpt. T.O. #4) has shown the uniqueness of the Barter Island area. The zoogeographic analyses indicate that the continental shelf fauna is relatively young and depauperate in species and ubiquitous in distribution. The deep fauna contains more endemic species and ones that have North Atlantic affinities.

VIII. Conclusions

1. The benthic communities (>0.5 mm in size) on the outer continental shelf undergo seasonal changes in numerical density and biomass. (Reasonably Firm)

2. The benthic infauna (>1.0 mm) are at maximum abundance nearshore and on the outer shelf with a minimum at 15-25 meters depth. (Reasonably Firm)

3. Gammarid amphipod species are influenced by depth; an inner, middle, and outer shelf fauna can be distinguished across the continental shelf off Pitt Point. (Reasonably Firm)

4. Polychaete worms are more abundant nearshore near the Barter Island region, and offshore to the west near Cape Halkett. (Reasonably Firm)

5. Environmental features most influencing the benthic invertebrate communities on the Beaufort Sea continental shelf include sediment type, depth, nearshore salinity, river and lagoon detritus export, organic inputs, ice gouging, and predation. (Preliminary)

6. The small benthic macro-infauna (0.5-1.0 mm) form a major portion of the infaunal community across the Beaufort Sea continental shelf on the OCS Pitt Point Transect station line.

IX. Summary of January-March Quarter (RU #6 and #6W)

A. Field Trip Activities
1. Field trip schedule
a. Dates: (1) 8-15 Mar. 1979: (2) 24 Mar-2 Apr. 1979: cancelled
b. Name of vessel
c. Aircraft: helicopter
d. NOAA
2. Scientific Party
a. Andrew G. Carey, Jr.: 8-15 Mar. 1979
School of Oceanography
Oregon State University
Corvallis, Oregon 97331
b. Kenneth Dunten and divers: 8-15 Mar. 1979
Department of Zoology
Western Washington State University
Bellingham, Washington
c. Bryan Mathews and divers: cancelled because of bad weather
Institute of Marine Science
University of Alaska
Fairbanks, Alaska 99701
3. Methods

IX. Summary of January-March Quarter (RU #6 and #6W) (continued)

3 a. Field Sampling (NOAA-OCSEAP Boulder Patch Ice Community-Benthos)

1. Priorities - a) ice cores
   b) sediment cores - fauna
   c) sediment traps (5-day deployment preferred)
   d) vertical migration traps (5-day deployment preferred)
      1. large
      2. small
   e) handnet sweeps (2 each)
      1. ice-water interface
      2. sediment-water interface
   f) sediment cores - environmental data
   g) water samples - environmental data

2. Schedule - (to be changed as necessary)
   a) First OSU Benthos dive day
      1. ice cores (20)
      2. deployment of traps
         a. sediment traps (2 frames) (caps left on the 8 cylinders)
         b. small migration trap (upper and lower corks left inserted)
         c. large migration trap (upper and lower corks left inserted)
      3. sediment cores - fauna collected as possible
      4. removal of caps and corks on traps

   b) Second OSU Benthos dive day (4 intervening days)
      1. cap and cork traps
      2. sediment cores - fauna (20 or remainder).
      3. sediment core - environment
      4. water samples - environment
         a. ice-water interface
         b. bottom water
      5. thermometer readings
         a. ice-water interface
         b. bottom water
      6. handnet sweeps
         a. ice-water interface (2)
         b. sediment-water interface (2)
      7. retrieval of traps
         a. small vertical migration trap
         b. large vertical migration trap
         c. sediment traps (2 frames)

3. Preparation for fieldwork

a. Ice cores

1. Check cores for cleanliness and for clarity of numerical markings.
2. Put 20 cores (+ extras) plus 40 no. 8 rubber corks (+ extras) plus 40 red plastic core caps (+ extras) in field box.
3. Fill out field sheets as far as possible.

b. Sediment cores

1. Check cores for cleanliness and for clarity of numerical markings.
2. Put 20 50cc syringe core tubes (+ extras) plus 40 no. 5 rubber corks plus plastic electrical tape into field box.
3. Fill out field sheets as far as possible.
4. Check on availability of core extruders and sample jars.

c. Sediment traps

1. Check on cleanliness of cylinders and caps and on tightness of cylinder parts and the quadrupod frame.
2. Obtain 5 plastic 2-1/2 collapsible carboys of sea water.
3. Filter approximately 10 gallons of sea water and fill cylinders to top. Use Nuclepore and pre-filter (see processing for set-up).
4. Cap plus securely seat rubber cork in vent hole.
5. Make sure salt blocks are available.

d. Vertical migration traps (LVMT+SVMT)

1. Check that all pieces of traps are present and assembled for field. The taped jar trap units should be clean and should not have been used for formaldehyde.
2. Check bridle and float length-height and adjust to ambient field conditions.
3. Fill trap jar units with filtered sea water and place corks securely in mouth of funnels.

e. Miscellaneous

1. Check general supplies for fieldwork.
2. Fully brief divers and outline the next day's diving program.
3. Place collectors outside early enough before helo flight so water inside cools down.

4. Sampling

a. Ice cores (ICB) - 20
   1. 20 3.5 cm diameter plastic core tubes plus 40 rubber corks (no. 8's) in diver carry bag.
   2. A diver or divers should scout area for appropriate soft ice to sample. The undersurface of the ice should be soft, but thin enough so that the tube penetrates soft ice completely to hard ice above.
   3. Divers to work in pairs with one pushing open core tubes through soft ice on undersurface of sea ice. The 2nd diver should hand an open core tube to the 1st diver, then corks, and finally should take corked core tube and place in carrying bag. A new open tube should be handed to 1st diver for a repeat of the operation.
   4. Coring
      a. Each open core tube should be pushed slowly through soft ice and should be seated firmly at soft ice-hard ice interface.
      b. A cork should be firmly pushed into lower open end of tube.
      c. The top end of the tube should be temporarily closed with a heavy duty small spatula (on a thong) or a gloved hand. It may be necessary to dig ice away from side of table to do this.
      d. The tube is removed from ice and a cork pushed solidly into the top open end.
      e. The filled core tubes should be placed in a carry bag for return to the surface.
      f. Observations should be made about the ice, associated animals, environment in general and the quality of the coring. These should be reported to the biologist.
      g. The ice cores should be taken at random in an appropriate soft ice environment on the undersurface of the sea ice
   5. The 20 ice cores should be taken the first Benthos Dive Day but can be split between the two days.

b. Sediment cores - fauna (SCB's)
   1. 20 50-cc plastic syringe core tubes plus 40 rubber corks (no. 5's) in diver carry bag.
   2. A diver or divers should scout area for appropriate soft sediment to sample. Patches of mud are present in the Boulder Patch near boulders and in depressions.
   3. Divers should work in pairs in a similar fashion to the ice coring. One diver should push open core tube into sediment, and the 2nd diver should hand him corks, and finally take the corked tube from the 1st diver and place in plastic rack. (TUBES SHOULD REMAIN UPRIGHT)
   4. Coring
      a. Open small sediment core tube should be firmly pushed into sediment with heel of diver's hand. Penetration is difficult in these sediments, but should be at least 3 cm.
      b. A cork should be firmly pushed into open upper end of tube.
      c. The lower end of the core tube should be temporarily but carefully closed with the heavy duty small spatula (on a thong on a wrist). It may be necessary to remove some sediment from side of tube to push spatula flat underneath coring tube.
      d. A cork should be firmly placed in lower open end of core tube.

e. The corked sample tube should be carefully stored vertically in plastic core bute rack sitting on the sediment surface. It should be carried carefully back to dive hole in vertical position.
f. Observations should be made about sediments, sediment distribution, associated large animals and should be reported to the biologist upon return to surface.
g. The sediment cores should be taken at random within the softer sediment patches.

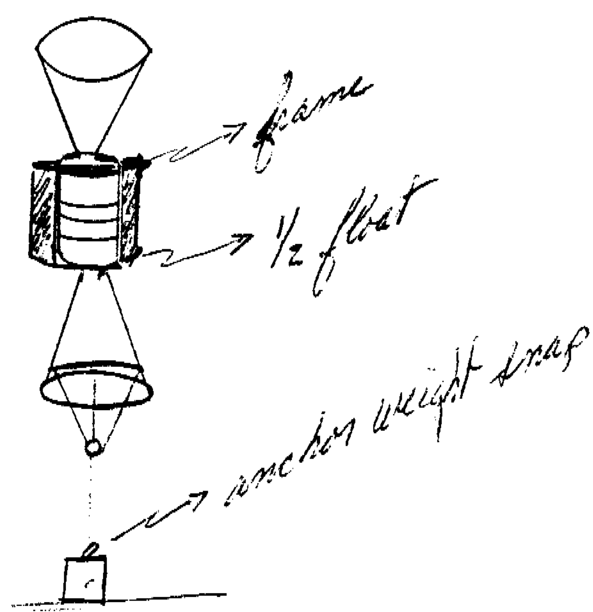
5. These samples should not be allowed to freeze.

c. Sediment Traps (STB)

1. The 2 bottom racks with 4 capped cylindrical particle traps each should be transported to the dive site as complete units. Each one will be filled with nuclepore-filtered water.
2. The divers should have scouted the area and planned to locate these and the vertical migration traps in a location typical of the site with soft ice but away from all the coring (and current meter servicing activities).
3. The sediment trap frames can be transported one at a time with the bridle; 1 (perhaps 2) small buoys will be needed for flotation.
4. The traps should be placed about 10 feet apart and left with caps on until the end of the day's diving.
5. The bridle can be left clipped to one frame for retrieval.
6. The floats should be returned to the dive hut for attachment to the vertical migration trap anchor weights to facilitate transporting to the trap area.
7. These samples should not be allowed to freeze.

d. Vertical Migration Traps (VMTB)

1. The 2 Vertical Migration Traps should be transported to the dive site as assembled units and each trap chamber filled with water. Corks should be seated firmly into the funnel throats. The Large Vertical Migration Trap (LVMTB) should be lashed together for transport with the trap chambers and funnels stabilized by appropriate lines.
2. These VMT's should be located under typical soft underice environmental conditions and near the sediment traps in an undisturbed area.
3. Deployment
   a. Small vertical migration trap.
      (1) The Small VMT (SVMT) should be deployed first for practice. Its anchor should be heavier than the thick-walled aluminum pipe section and may need a float for buoyant transport to location.

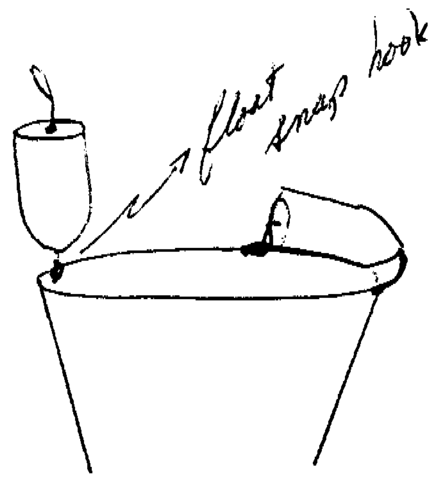


(2) The flotation on the unit is self-contained.
(3) The trap should be rigged to be oriented halfway between the ice undersurface and the sediment surface.

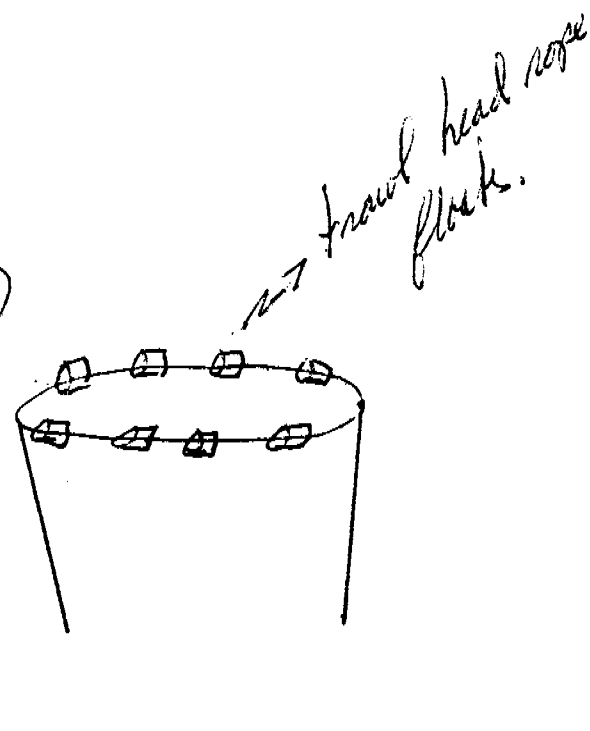
b. Large Vertical Migration Trap (LVMT)

(1) The anchor weight should be located first; 3-4 buoys should be snapped on for ease in diver handling.
(2) The trap unit should be carried to the study site by a diver. A contrasting polypropylene line should be used to temporarily lash the two 1-meter rings together for ease in handling.
(3) The trap should be placed in proper orientation, the lashing removed, and the anchor snapped onto lower bridle. One float at a time should be unsnapped from the anchor weight and should be snapped onto the upper 1-meter ring. Two floats on the ring at 180° to one another are adequate for floatation.
(4) The corks protecting the trap chambers should be carefully kept in place during deployment and until any suspended sediment settles or is moved away by currents.
(5) The lower bridle, the floats and the next extensions should be adjusted if necessary and made true so that the unit is oriented correctly.
(6) If the height between the underice surface and the sediment is less than necessary for the present trap rig, the floats should be repositioned around the upper ring in horizontal position (a) or the small trawl head rope floats should be placed on the upper net lashing for flotation with less vertical height.
(7) These samples should not be allowed to freeze.

(a)



(b)



e. Handnets (2)
1. Two separate sweeps with the two nets should be made of the underice surface. The nets should be used to just scrape the ice surface so it doesn't rapidly clog with slush ice. Preferably tracklines several meters long should be made to maximize animal collection. If necessary, hunt out individual larger animals, e.g. amphipods, mysids, fishes, and polychaetes.
2. Two separate sweeps with the two nets should be made at the sediment-water interface. Just the very surface sediment should be allowed to enter net. Tracklines at least several meters long should be made, but hunting of individual specimens may be necessary.
3. When sampling with a net is completed the bag (0.5 mm NYTEX mesh) should be folded back over the stainless steel rod frame to prevent animal excapement.
4. These samples cannot be frozen.

f. Sediment cores - environmental
1. 3 large cores (3.5 cm diameter) should be taken of the sediments in the areas previously sampled for particle size and organic analyses.
2. The coring procedure should be the same as with the small faunal sediment cores.

g. Water samples
1. A salinity bottle should be filled at the ice-water interface and at the water-sediment interface.
2. These cannot be frozen.
3. An _in situ_ salinometer should be used for a continuous profile when an instrument is available.

h. Water temperatures
1. Thermometer readings should be made at the ice-water interface and at the water-sediment interface.
2. A continuous profile should be made and readings recorded every meter of water depth when an appropriate instrument is available.

5. Sample Processing

a. Field
   1. Ice cores
      a. Cap with red plastic caps upon retrieval to surface.
      b. Note condition of cores and ice within each numbered core tube.
      c. Note diver observations about ice conditions, coring success and problems.
      d. These samples should not be allowed to freeze solid.
   2. Sediment cores
      a. Tape corks on core tubes
      b. Note diver observations of cores and sediment sampled, including patchiness.
         NOTE: Core tubes should be kept upright.
      c. These samples should not be allowed to freeze.
   3. Sediment traps
      a. The caps should be checked upon retrieval for firm seating and to ensure that the corks are firmly in place.
      b. The quadrupod frames and collectors should be transported to the laboratory as an assembled unit for protection of the samples.
      c. These samples should not be allowed to freeze.
   4. Vertical migration traps
      a. Upon retrieval, corks should be immediately checked for firm seating.
      b. The upper and lower chambers should alternately be preserved and capped securely.
      c. New jars should then be used for each deployment and should be firmly taped together with duct tape. (The formalin may have effect on the later trapping efficiency of the units.)
      d. The trap jar units should be removed from the VMT's and placed in field box for transport to the laboratory.
      3. These samples should not be allowed to freeze.
   5. Handnet samples
      a. Upon retrieval by the divers the handnets should be washed down and the samples washed out into sample jars.
      b. Samples to be preserved with neutralized 10% formalin.
      c. These samples should not be allowed to freeze.

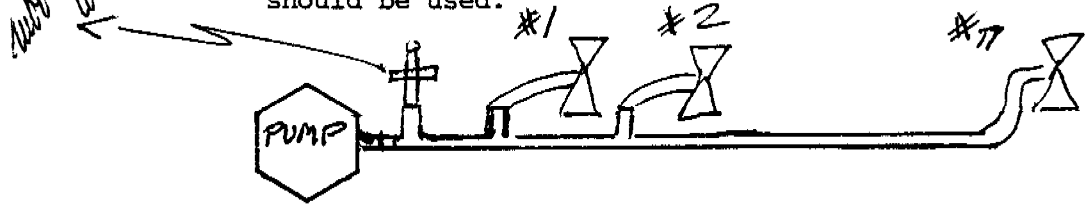
b. Laboratory
   1. Ice Cores (ICB)
      a. ICB's should be allowed to melt and then should be concentrated through 63 µm small diameter sieve.
      b. The screen should be carefully flushed and backwashed into sample jar with filtered seawater from wash bottle.
      c. Preserve sample with buffered formalin to make 10% concentration.
      d. Double label - inside plus outside.
      e. Complete field sheets.
      f. Screen should be rinsed in fresh water between samples.
      g. Cores should be rinsed in fresh water before storage.
   2. Sediment Cores (SCB)
      a. Any pertinent observations on sediment and core samples should be made.
      b. SCB's should be extruded in 1 cm increments into sample jars (2 oz.). Rinse of extruder into last jar with wash bottle.
      c. The overlying water should be decanted off and preserved in separate jar before extruding sediment.
      d. Preserve sample with buffered formalin to make 10% concentration.

e. Double label - inside and outside jar.
f. SCB's should be washed and cleaned in fresh water before storage.

3. Vertical migration traps
   a. Carefully transfer contents of trap jar units to storage jars.
   b. Double label - inside and outside.
   c. Add any further pertinent notes to field sheets.
   d. Two new jar units should be taped together for the next deployment.

c. Sediment Traps - Benthos (STB)

1. The STB cylinders should remain undisturbed in the laboratory for 2 hours to allow particles to settle.
2. Set up filtration units and vacuum pump with a protective plastic sheet hood over the sink area. A vacuum bypass should be build into the system with a T-connector and screw clamp to provide control over vacuum intensity. 3-4 filter units can be used to maximize efficiency. 1 liter vacuum flasks with volumetric markings should be used.



3. After the initial period for particle settling in the cylinders, carefully siphon off upper 36 cm's or so of water down to about 10 cm's. Filter upper water through nuclepore filter(s) and freeze in labeled jar with dividing plastic circles.
4. Filter remaining water and particles through nuclepore filter in 100 ml aliquots. Gently mix sample before each sample transfer to equalize particle concentrations. NB - Each filter should be a collection from a measured volume of water; they should be equal if possible.
5. The filtration volume, rate, number of filter units, etc. may have to be adjusted to best suit the sample conditions. This will be true when glass fiber filters are added to the procedure for OCS-11.
6. The filters should remain frozen at Prudhoe Bay and during transport to OSU. Dry ice (snow) and insulated box can be ordered from NARL [Charlotte Schneider, Stockroom].

B. Laboratory Analysis

1. Scientific Personnel

a. Andrew G. Carey, Jr. Principal Investigator
Associate Professor
Responsibilities: coordination, evaluation, analysis, and reporting

b. James Keniston Research Assistant (part-time)
Responsibilities: data management, statistical analysis

c. Paul Montagna Research Assistant
Responsibilities: sample processing, biomass measurements, harpacticoid copepod and crustacean systematics, and field collection

d. R. Eugene Ruff Research Assistant
Responsibilities: species list compilation, sample processing, reference museum curation, polychaete systematics, field collection, and laboratory management

e. Paul Scott Research Assistant
Responsibilities: sample processing, data summary, molluscan systematics and sample collection.

2. Methods: laboratory analyses

a. Ice epontic community and benthic community - Boulder Patch, Stefannson Sound.

1. New separation techniques have been tested to separate the smaller fauna, including the indicator group of meiofaunal organisms, Harpacticoid Copepoda. A suspension of colloidal silica (LUDOX) is used with centrifugal forces to separate the fauna from the sedimentary debris. The technique has proven to be effective and efficient.

2. Identification of the indicator organisms, Harpacticoida Copepoda, by Paul Montagna continues on schedule.

b. The small macro-infauna (0.5-1.0 mm in size)

1. Standard picking techniques under the dissecting microscope have been utilized to pick and sort this fraction of samples collected from the OCS Pitt Point Station Transect Line and other pertinent areas.

3. Sample localities

a. Stefannson Sound Boulder Patch
b. OCS lease area - Beaufort Sea
c. OCS Transect Line - Pitt Point (PPB).

B. Laboratory Analysis (continued)

4. Data collected and analyzed
   a. The small macro-fauna (0.5-1.0 mm in size) have been picked and sorted to major taxonomic category from 60 PPB seasonal samples (Tables 8-20).

   b. Pelecypod molluscs (Bivalvia)
   The pelecypods in all samples sorted to date have been identified by Paul Scott with the aid of Frank Bernard of the Fisheries Research Board of Canada, Nanaimo.

   c. Harpacticoid Copepoda
   Identifications continue by Paul Montagna.

   d. Polychaeta
   Identifications of the coastal (5-25 meters depth) continue by R.E. Ruff.

Table 8 : Total infaunal densities per 1 m^2 on the Pitt Point seasonal transect line.

		PPB-25	PPB-55	PPB-100
OCS-1 Nov. 75	1.00 mm	700	2,470	2,700
	0.50 mm	8,000	19,300	9,630
	Total	8,700	21,770	12,330
OCS-2 Mar. 76	1.00 mm	1,200	2,900	4,460
	0.50 mm	2,260	12,400	8,620
	Total	3,460	15,300	13,080
OCS-3 May 76	1.00 mm	540	5,720	8,000
	0.50 mm	3,820	6,110	8,100
	Total	4,360	11,830	16,100
OCS-4 Jul. 76	1.00 mm	754	2,250	4,400
	0.50 mm	7,100	17,700	25,200
	Total	7,854	19,950	29,600
OCS-6 Nov. 76	1.00 mm	500	1,690	3,150
	0.50 mm	5,510	12,100	12,800
	Total	6,010	13,790	15,950

Table 9: Animal densities for PPB-25 (OCS-1) 0.50 mm fraction, collected 26 October 1975. Each sample is a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	Grab Number 1082S	1083S	1084S	1085S	1087S	Total m^2	% of Fauna
Nematoda			247	231	324	206	214	2444	30.6
Nemertinea			2	2	1	1	1	14	0.2
Kinoryncha			1	1	8	3	1	28	0.4
Annelida:	Polychaeta		109	159	135	83	44	1060	13.3
Sipunculida			-	-	-	-	2	4	0.1
Arthropoda:	Crustacea:	Amphipoda	73	14	8	16	27	276	3.5
		Harpacticoida	198	72	87	61	97	1030	12.9
		Isopoda	8	1	1	-	-	20	0.3
		Ostracoda	461	302	314	93	107	2554	31.9
		Tanaidacea	35	8	4	22	32	202	2.5
		Cumacea	5	4	-	-	-	18	0.2
Mollusca:	Pelecypoda		57	30	31	3	36	314	3.9
	Gastropoda		2	2	9	2	1	32	0.4
TOTAL			1198	826	922	490	562	7996	100.0

Table 10: Animal densities for PPB-25 (OCS-2) 0.50 mm fraction, collected 12 March 1976. Each sample is from a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	Grab Number 1099S	1100S	1101S	1106S	1107S	Total m^2	% of Fauna
Nematoda			55	18	2	78	67	440	19.5
Nemertinea			5	1	-	4	-	20	0.9
Annelida:	Polychaeta		143	108	51	66	95	926	41.0
Arthropoda:	Crustacea:	Amphipoda	-	1	-	-	-	2	0.1
		Harpacticoida	35	3	-	-	2	80	3.5
		Isopoda	6	-	-	-	1	14	0.6
		Ostracoda	254	38	11	24	20	694	30.7
		Tanaidacea	8	2	1	-	2	26	1.2
		Cumacea	4	-	-	-	-	8	0.4
Mollusca:	Pelecypoda		8	-	-	6	-	28	1.2
	Gastropoda		7	2	-	-	2	22	1.0
TOTAL			525	173	65	178	189	2260	100.0

Table 11: Animal densities for PPB-25 (OCS-4) 0.50 mm fraction, collected 1 September 1976. Each sample is from a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	Grab Number 1360S	1361S	1362S	1363S	1364S	Total m^2	% of Fauna
Porifera			-	1	-	-	-	2	<0.1
Nematoda			147	74	205	66	240	1464	20.6
Nemertinea			4	1	3	2	4	28	0.4
Annelida:	Polychaeta		235	245	227	172	169	2096	29.5
Sipunculida			-	1	1	-	-	4	0.1
Echiuroidea			-	-	-	-	1	2	<0.1
Arthropoda:	Crustacea:	Amphipoda	8	18	28	12	13	158	2.2
		Harpacticoida	142	68	99	73	142	1048	14.8
		Isopoda	5	2	12	2	2	46	0.6
		Ostracoda	164	158	209	197	159	1774	25.0
		Tanaidacea	19	5	47	9	4	168	2.4
		Cumacea	5	-	10	3	3	42	0.6
	Arachnida:	Acarina	-	1	-	-	-	2	<0.1
Mollusca:	Pelecypoda		11	17	32	11	17	176	2.5
	Gastropoda		15	3	9	1	7	70	1.0
Echinodermata:	Holothuroidea		-	1	9	-	1	22	0.3
TOTAL			755	595	891	548	762	7102	100.0

Table 12: Animal densities for PPB-25 (OCS-6) 0.50 mm fraction, collected 11 November 1976. Each sample is from a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	Grab Number 1500S	1501S	1502S	1503S	1504S	Total m^2	% of Fauna
Cnidaria:	Anthozoa		-	1	1	-	-	4	0.1
Nematoda			363	244	184	104	288	2366	42.9
Nemertina			4	2	5	1	-	24	0.4
Kinoryncha			-	-	-	1	-	2	<0.1
Annelida:	Polychaeta		285	181	206	159	151	1964	35.6
Sipunculida			-	1	-	-	-	2	<0.1
Arthropoda:	Crustacea:	Amphipoda	21	6	7	9	4	94	1.7
		Harpacticoida	32	18	19	6	5	160	2.9
		Isopoda	9	2	5	2	1	38	0.7
		Ostracoda	55	43	38	20	29	370	6.7
		Tanaidacea	54	18	40	17	19	296	5.4
		Cumacea	15	4	1	2	-	44	0.8
Mollusca:	Pelecypoda		8	4	3	4	2	42	0.8
	Gastropoda		8	8	9	11	16	104	1.9
Hemichordata			-	2	-	-	-	4	0.1
TOTAL			854	534	518	336	515	5514	100.0

Table 13: Animal densities for PPB-55 (OCS-1) 0.50 mm fraction, collected 28 October 1975. Each sample is 1/4 of a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	Grab Number 1088A	1089A	1090A	1091A	1092A	Total m^2	% of Fauna
Nematoda			106	27	78	65	52	2624	13.6
Nemertinea			6	2	7	5	2	176	0.9
Kinorhyncha			-	-	-	2	-	16	0.1
Annelida:	Polychaeta		96	19	82	67	53	2536	13.2
Sipunculida			1	-	-	4	-	40	0.2
Arthropoda:	Crustacea:	Amphipoda	70	14	27	38	20	1352	7.0
		Harpacticoida	44	12	22	28	13	848	4.4
		Isopoda	4	3	6	2	-	120	0.6
		Ostracoda	294	114	306	257	181	9216	47.9
		Tanaidacea	59	11	49	49	10	1424	7.4
		Cumacea	12	2	6	5	5	240	1.2
	Arachnida:	Acarina	1	-	-	-	4	40	0.2
Mollusca:	Pelecypoda		17	-	7	10	8	336	1.7
	Gastropoda		6	-	1	1	2	80	0.4
Echinodermata:	Ophiuroidea		4	-	-	-	-	32	0.2
	Holothuroidea		-	-	-	-	8	64	0.3
Hemichordata			-	-	-	1	-	8	<0.1
TOTAL			720	204	591	534	358	19256	100.0

Table 14: Animal densities for PPB-55 (OCS-2) 0.50 mm fraction, collected 18 March 1976. Each sample is 1/4 of a 0.1 m^2 Smith-McIntyre grab.

			Grab Number					Total	% of
Phylum:	Class:	Order	1121A	1123A	1126A	1128A	1130A	m^2	Fauna
Porifera			-	-	1	-	-	8	0.1
Nematoda			70	71	21	10	45	1736	14.0
Nemertinea			2	1	2	-	1	48	0.4
Kinoryncha			-	-	-	-	1	8	0.1
Annelida:	Polychaeta		42	23	45	10	27	1176	9.5
Sipunculida			-	4	1	1	1	56	0.5
Arthropoda:	Crustacea:	Amphipoda	42	19	19	-	5	680	5.5
		Harpacticoida	12	9	6	1	12	320	2.6
		Isopoda	4	1	-	-	-	40	0.3
		Ostracoda	224	262	245	9	139	7032	56.9
		Tanaidacea	23	42	17	2	18	816	6.6
		Cumacea	8	1	4	-	1	112	0.9
	Arachnida:	Acarina	1	-	3	-	1	40	0.3
Mollusca:	Pelecypoda		20	8	1	-	3	256	2.1
	Gastropoda		2	-	-	-	-	16	0.1
Echinodermata:	Holothuroidea		-	-	1	-	-	8	0.1
Hemichordata			-	-	-	-	2	16	0.1
TOTAL			450	441	366	33	256	12368	100.0

Table 15: Animal densities for PPB-55 (OCS-4) 0.50 mm fraction, collected 31 August 1976. Each sample is 1/4 of a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	Grab Number					Total	% of
			1330A	1335A	1336A	1340A	1341A	m^2	Fauna
Nematoda			141	152	63	180	161	5576	31.6
Nemertinea			3	1	2	2	3	88	0.5
Kinoryncha			1	-	-	1	-	16	0.1
Annelida:	Polychaeta		79	74	52	80	50	2680	15.2
Sipunculida			4	6	1	3	1	120	0.7
Echiuroidea			-	-	-	9	-	72	0.4
Arthropoda:	Crustacea:	Amphipoda	15	24	20	13	17	712	4.0
		Harpacticoida	13	10	10	21	25	632	3.6
		Isopoda	5	6	8	4	4	216	1.2
		Ostracoda	134	123	159	187	135	5904	33.4
		Tanaidacea	17	19	11	22	21	720	4.1
		Cumacea	12	11	4	4	9	320	1.8
Mollusca:	Pelecypoda		16	7	7	15	14	472	2.7
	Gastropoda		1	4	-	3	1	72	0.4
Echinodermata:	Ophiuroidea		1	-	-	1	-	16	0.1
	Holothuroidea		-	-	-	-	1	8	<0.1
Hemichordata			2	1	-	-	-	24	0.1
Chordata:	Ascidacea		-	1	-	-	-	8	<0.1
TOTAL			444	439	337	545	442	17656	100.0

Table 16: Animal densities for PPB-55 (OCS-6) 0.50 mm fractions, collected 4 November 1976. Each sample is from a 0.1 m^2 Smith-McIntyre grab.

Grab Number Sample Size			1495A 1/4	1496A 1/4	1497A 1/4	1498A 1/4	1499S whole	Total m^2	% of Fauna
Phylum:	Class:	Order							
Cnidaria:	Anthozoa		-	1	-	-	1	10	0.1
Nematoda			66	74	43	106	104	1965	16.0
Nemertinea			2	1	1	2	1	35	0.3
Kinoryncha			-	-	-	-	1	5	<0.1
Annelida:	Polychaeta		57	64	56	64	85	1630	13.4
Sipunculida			1	2	-	-	-	15	0.1
Arthropoda:	Crustacea:	Amphipoda	24	36	-	8	12	400	3.3
		Harpacticoida	10	13	7	15	14	295	2.4
		Isopoda	2	2	-	1	-	25	0.2
		Ostracoda	389	297	83	254	313	6680	55.0
		Tanaidacea	13	17	6	22	23	405	3.3
		Cumacea	5	6	2	5	7	125	1.0
Arthropoda:	Arachnida:	Acarina	4	7	4	-	-	75	0.6
Mollusca:	Pelecypoda		11	16	5	5	2	195	1.6
	Gastropoda		8	12	10	8	16	270	2.2
Hemichordata			-	-	1	-	-	5	<0.1
TOTAL			592	548	218	490	579	12135	100.0

Table 17: Animal densities for PPB-100 (OCS-1) 0.50 mm fraction, collected 30 October 1975. Each sample is from a 0.1 m^2 Smith-McIntyre grab.

Grab Number Sample Size			1093A 1/4	1094S Whole	1095A 1/4	1096A 1/4	1097S Whole	Total m^2	% of Fauna
Phylum:	Class:	Order							
Nematoda			282	170	182	134	58	5240	54.4
Nemertinea			2	2	3	2	1	62	0.6
Annelida:	Polychaeta		59	69	36	54	23	1376	14.3
Arthropoda:	Crustacea:	Amphipoda	26	14	2	11	8	356	3.7
		Harpacticoida	77	30	7	10	11	834	8.7
		Isopoda	9	6	4	15	-	236	2.5
		Ostracoda	60	54	21	30	12	1020	10.6
		Tanaidacea	16	11	3	8	-	238	2.5
		Cumacea	2	2	-	4	-	52	0.5
		Nebaliacea	-	1	-	-	-	2	<0.1
	Arachnida:	Acarina	1	-	-	-	-	8	0.1
Mollusca:	Pelecypoda		2	12	2	8	-	120	1.2
	Gastropoda		2	3	-	1	-	30	0.3
	Aplacophora		-	-	1	-	-	8	0.1
Echinodermata:	Ophiuroidea		2	-	-	-	-	16	0.2
Hemichordata			1	1	2	1	-	34	0.4
TOTAL			541	375	263	278	113	9632	100.0

Table 18: Animal densities for PPB-100 (OCS-2) 0.50 mm fraction, collected 19 March 1976. Each sample is 1/4 of a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	Grab Number 1131A	1133A	1134A	1139A	1140A	Total m^2	% of Fauna
Cnidaria:	Anthozoa		-	-	-	2	-	16	0.2
Nematoda			42	70	2	19	17	1200	13.9
Nemertinea			1	1	-	-	-	16	0.2
Annelida:	Polychaeta		33	40	10	48	44	1400	16.2
Sipunculida			1	1	-	4	1	56	0.6
Arthropoda:	Crustacea:	Amphipoda	30	48	2	57	16	1224	14.2
		Harpacticoida	7	4	1	1	2	120	1.4
		Isopoda	13	14	-	10	4	328	3.8
		Ostracoda	86	89	35	138	93	3528	40.9
		Tanaidacea	12	21	-	10	2	360	4.2
		Cumacea	6	4	2	13	2	216	2.5
Mollusca:	Pelecypoda		3	2	5	6	1	136	1.6
	Gastropoda		1	1	-	-	-	16	0.2
TOTAL			235	295	57	308	182	8616	100.0

Table 19: Animal densities for PPB-100 (OCS-4) 0.50 mm fraction, collected 30 August 1976. Each sample is 1/4 of a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	Grab Number 1318A	1319A	1320A	1322A	1323A	Total m^2	% of Fauna
Porifera			-	-	1	1	-	16	0.1
Cnidaria:	Anthozoa		1	3	3	2	2	88	0.3
Nematoda			216	366	165	362	323	11456	45.4
Nemertinea			3	6	4	5	1	152	0.6
Annelida:	Polychaeta		72	98	33	64	70	2696	10.7
Sipunculida			1	1	-	1	1	32	0.1
Echiuroidea			1	-	-	-	-	8	<0.1
Arthropoda:	Crustacea:	Amphipoda	71	81	49	59	62	2576	10.2
		Harpacticoida	10	27	6	20	13	608	2.4
		Isopoda	12	7	1	5	4	232	0.9
		Ostracoda	121	108	139	94	206	5344	21.2
		Tanaidacea	4	21	6	8	23	496	2.0
		Cumacea	20	28	16	7	29	800	3.2
	Arachnida:	Acarina	-	2	1	3	3	72	0.3
Mollusca:	Pelecypoda		9	12	20	6	8	440	1.7
	Gastropoda		1	-	-	-	2	24	0.1
	Aplacophora		-	-	-	1	2	24	0.1
Brachiopoda			-	-	-	-	1	8	<0.1
Echinodermata:	Ophiuroidea		1	2	1	-	-	32	0.1
	Holothuroidea		-	6	-	4	2	96	0.4
Hemichordata			-	-	-	1	-	8	<0.1
TOTAL			543	768	445	643	752	25208	100.0

Table 20: Animal densities for PPB-100 (OCS-6) 0.50 mm fraction collected 3 November 1976. Each sample is 1/4 of a 0.1 m^2 Smith-McIntyre grab.

Phylum:	Class:	Order	1490A	1491A	1492A	1493A	Total m^2	% of Fauna
Porifera			1	-	-	-	10	0.1
Nematoda			64	74	102	81	3210	25.0
Nemertinea			2	1	1	-	40	0.3
Annelida:	Polychaeta		42	62	64	47	2150	16.8
Sipunculida			1	2	3	-	60	0.5
Arthropoda:	Crustacea:	Amphipoda	42	48	74	36	2000	15.6
		Harpacticoida	4	6	14	7	310	2.4
		Isopoda	3	6	13	3	250	1.9
		Ostracoda	88	86	94	52	3200	24.9
		Tanaidacea	7	4	14	3	280	2.2
		Cumacea	12	35	22	6	750	5.8
	Pycnogonida		-	-	-	1	10	0.1
	Arachnida:	Acarina	-	1	2	-	30	0.2
Mollusca:	Pelecypoda		4	1	4	2	110	0.9
	Gastropoda		8	11	11	9	390	3.0
	Aplacophora		-	-	-	1	10	0.1
Echinodermata:	Ophiuroidea		-	1	-	1	20	0.2
TOTAL			278	338	418	249	12830	100.0

X. Auxiliary Material

A. References Used (Bibliography)

See Reference Lists at end of each report section.

B. Papers in Preparation or in Print

a. Oregon State University Publications

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Contract 03-5-022-81
Research Unit 356
April 1, 1979 to March 31, 1979
9 pages plus 180 appended pages

ANNUAL REPORT

ENVIRONMENTAL ASSESSMENT OF SELECTED HABITATS IN THE BEAUFORT AND CHUKCHI LITTORAL SYSTEM

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I. Summary of objectives, conclusions and implications with respect to oil and gas development.

A. Objectives for 1978. Our objectives for the calandar year, 1978, are paraphrased from our fiscal 1978 and 1979 proposals.

1. To characterize the infaunal, benthic biota and to identify the major elements of the motile, epibenthic fauna of the Beaufort inshore zone.

2. To investigate populations in the nearshore region of the Alaskan Beaufort Sea with particular reference to stability and to such dynamic factors as reproduction, recruitment, growth, migrations and predation.

3. To investigate and characterize the biota of the Stefansson Sound Boulder Patch and to initiate ecological studies of the biotic community.

4. To continue the identification of items of diet of major inshore animals and to assess the possible contribution of terrestrial detritus (peat from eroding shorelines) to food webs in the nearshore and inshore systems.

5. To determine the resilience of Arctic salt marshes subjected to several environmental stresses and, in light of this, to assess salt marshes as ecosystems.

6. To determine benzopyrene hydroxylase activity levels in Beaufort Sea fishes.

7. To investigate metabolic activities and physiological responses of winter-conditioned, Beaufort Sea invertebrate species in order to initiate assays of effects of crude petroleum on these forms in winter acclimatized conditions.

B. Conclusions. Most of the objectives outlined above are dealt with in separate, appended reports. Major conclusions from these sections are abstracted below.

1. The infaunal benthos of the Beaufort Sea inshore region is uniformly sparce and patchily distributed from about 2 m depth to at least 10 m.

2. The principal infaunal elements of the Beaufort inshore benthos are polychaete worms and bivalve molluscs. The most abundant species have been identified, and these seem uniformly distributed.

3. The mobile, crustaceans that comprise virtually all of the Beaufort nearshore and inshore epibenthic invertebrate biota have been identified. The major species are two mysid shrimps with many species of gammarid amphipods, the large marine isopod, _Saduria entomon_, and the calanoid copepod, _Calanus hyperboreus_ also abundant.

4. During the summer season, the nearshore infaunal biota is fairly stable with trends in number and average size that may reflect movement into the nearshore zone in early summer, recruitment, growth and either predation or emigration in late summer. The mobile crustaceans are least abundant early in the ice-free season and reach a population peak in mid summer, possibly reflecting movement into the nearshore region followed by emigration in late summer.

5. The biota of the Stefánsson Sound Boulder Patch is unlike that of those marine communities previously known from the Beaufort Sea and, while the individual species are not new, the association of them in a sessile, kelp-dominated community has not been reported before.

6. Many marine invertebrates of the Beaufort Sea ingest peat, but seem to derive no nutritional benefit from it. Gammarus setosus, however, does assimilate some of the organic content of ingested peat and is able to assimilate part of Laminaria as well.

7. Arctic salt marshes are sensitive to oil, cover by sand, or physical disturbance, and marshes in the north (Beaufort coast) are several times moe suceptible to damage (or are damaged by less of any stressor) than are marshes near the Arctic circle (Chukchi coast).

C. Implications.

1. Except for the Stefansson Sound Boulder Patch, there is no known unique or unusual benthic habitat in the Beaufort, inshore or nearshore regions. The implication for exploration and development is that, from the viewpoint of the benthic biologist, no part of the nearshore or inshore zones is preferrable to any other--except for Stefansson Sound. Data previously reported by us and those reported here for Nuvagapak Lagoon, indicate that the benthonic biomass of lagoon systems and that, in general, alteration of a unit area of lagoon bottom will have a greater overall effect on benthos than will comparable alteration of a similar area of open sea bottom.

2. The Stefansson Sound region is a biological habitat that, for practical purposes, may be considered unique and, at least until this community and its overall contribution to the Beaufort Sea are better known than now is the case, should not be disturbed.

3. Carbon from detritus of terrestrial origin enters the Beaufort marine food web through Gammarus setosus and, possibly other species. The full importance of this contribution is yet to be evaluated, but there are implications for attempts at shoreline stabilization and, interference with currents that transport materials alongshore. We have data that indicate a relationship between the presence of peat and the abundance of

benthos. Peat enters the system as material of large particle size and, in time, breaks down possibly as a result of being ingested by animals. The organic content of peat of small particle size is reduced over that of the larger sized (and, presumably, younger) peat. Directly or indirectly, this organic material becomes available to the marine biotic community. Because developments which may require shoreline stabilization and interference with longshore transport are imminent and because this same development may introduce into the marine environment materials that can affect the avilability of detrital carbon to the marine biota, it is important that the extent of this contribution and the pathways by which it occurs are known at the earliest possible date.

5. Arctic salt marshes are important in the feeding of geese and brant as well as other animals. These marshes are sensitive to oil, and those on the Beaufort coast especially so. Barring accidents during exploration, development and production, these marshes, which are usually above water level, are not threatened by petroleum development per se, but this sensitivity should be borne in mind and contingency plans for protection of marshes is the event of accidents should be made.

II. Introduction:

This report consists of five, separate appended sections or chapters. Each is intended to be complete in itself, and each either deals independently with introductory material including sections on state of knowledge, the study area, sources and rationale of data collection, methods, presentation of results, conclusions, and discussion--or such has already been presented in previous annual reports.

The first section deals with the inshore benthic and epibenthic fauna, and is the result of the 1977 Beaufort Sea cruise of the RV ALUMIAK. Now being processed in our laboratory are samples from the 1978 ALUMIAK Beaufort cruise in which some of the same stations were revisited, and more thorough coverage of the current lease zone was possible.

The second section is a presentation of data obtained in repetitive, nearshore samples of Beaufort Sea sites made in 1977. Awaiting laboratory analysis are comparable samples from the Chukchi coast made in 1978.

In the third section of the report, a description of the Stefansson Sound Boulder Patch based on field work carried out in 1978 and part of 1979 is given. Field work in Stefansson Sound is continuing.

The fourth section describes experiments done on feeding of *Gammarus setosus* and other nearshore species during the summer of 1978. These experiments will continue in 1979.

The fifth section of this report is a brief presentation of some of the effects of perturbation of Arctic salt marshes in 1977 and 1978 and updates a comparable treatment made a year ago. It is noteworthy that effects of oil added to marshes in 1977 were intensifying in 1978. Subsequently, we will present results of the use of marsh invertebrates to assay for oil (or effects of oil on marsh invertebrates) and results of a study of black brant dependence on marshes.

Not dealt with further in this report is the measurement of benzopyrene hydroxylase activity. Fishes collected during the 1978 summer thawed in transit to Bellingham, casting doubt upon the negative results obtained. Additional fish were obtained in 1979, but these have not yet been analyzed. Since these were collected prior to drilling, we still should obtain activity levels that precede any petroleum activity in the Alaskan Beaufort Sea.

Finally, physiological experiments in progress are described briefly in the report of fourth quarter activities.

Summary of Fourth Quarter Operations

I. Field and laboratory activities.

A. Field work

1. At NARL, Barrow: physiological investigations.
   a. D. E. Schneider - January 10 to March 15
   b. J. Hanes - January 16 to end of quarter
   c. W. Pounds - February 16 to end of quarter
2. At Deadhorse and Stefansson Sound Dive Site: K. Dunton and dive team (J. Olsen, P. Plesha, G. Smith)
   a. February 21 to March 15.

B. Scientific Party (except as noted, all of Western Washington University)

1. A. C. Broad, Principal Investigator (half time)
2. D. E. Schneider, Associate Investigator
3. Ken Dunton, Assistant Investigator
4. Helmut Koch, Laboratory Supervisor
5. James Hanes, Marine Technician (after January 16)
6. Mark Childers, Research Aide
7. Wendy Pounds, Research Aide (after February 16)
8. Susan Schonberg, Research Aide (half time)
9. Alexander Benedict, Computer Programmer (hourly wages)
10. Laboratory Assistants (hourly wages)
    a. Dawn Christman
    b. Neil Safrin
    c. Russell Thorsen
    d. Jon Zehr
11. Work-study students (no cost to contract)
    a. Ron Adams
    b. Robert Crugger
    c. Philip Denny
    d. Bruce Fletcher
    e. Gary Smith
    f. Russell Wellington
12. Contracted services (not University employees)
    a. John Olson, diver
    b. Paul Plesha, mechanic and technician
    c. Gary F. Smith, diver

C. Methods -- see text of appropriate sections of annual report.

D. Sample localities -- see sections 3 and 4 of annual report.

E. Data collected or analyzed.

1. See sections 3 and 4 of annual report
2. Laboratory work continued on analysis of 1978 ALUMIAK samples.

F. Milestone chart update: none required.

II. Results:

The investigation of physiological responses of arctic shallow-water marine animals to winter conditions was continued during the second quarter. Major emphasis was placed upon determining tolerance levels to salinity extremes and the effect of salinity upon determining tolerance levels to salinity extremes and the effect of salinity upon respiration. The following experiments were either completed or initiated:

Acute salinity tolerance. Animals were transferred directly from their normal field salinity of about 32‰ to a stress salinity. Experiments were carried out in pint plastic freezer boxes containing about 400 ml of the desired salinity and 5 animals. At least 10 animals were exposed to each stress salinity. The animals were checked daily for mortality and a subjective rating of their activity level was made. Experiments were terminated after 7 days. Table Q-1 lists the acute salinity tolerance experiments run.

Table Q-1. Acute Salinity Tolerance Experiments

Species	Location	Salinity Range
Anonyx nugax	NARL	10 - 70‰
Boeckosimus affinis	Elson Lagoon	10 - 70‰
Mysis litoralis	NARL	5 - 70‰

Gradual salinity tolerance. Animals were transferred from their normal field salinity of about 32‰ to either higher or lower salinities in 5‰ increments every 2 days. Mortality and subjective rating of their activity level was recorded daily. Table Q-2 lists the gradual salinity tolerance experiments run.

Table Q-2. Gradual Salinity Tolerance Experiments

Species	Location	Salinity range
Anonyx nugax	NARL	32 - 10‰
Anonyx nugax	NARL	32 - 60‰
Mysis litoralis	NARL	32 - 0.25‰
Mysis litoralis	NARL	32 - 65‰
Saduria entomon	NARL	32 - 75‰

Crude Oil Toxicity: Preliminary experiments were begun to assess the toxicity of sea water--crude oil emulsions to some of the common species. Prudhoe Bay crude oil was agitated with sea water for one hour on a mechanical shaker. The emulsions were transferred to sepratory funnels and allowed to settle for 3 hours before being directly used in tolerance experiments. Animals were exposed to emulsions for 4 days and fresh emulsions were prepared daily. The animals were checked for mortality and a subjective rating of their activity was made daily. Anonyx nugax and Mysis litoralis were tested at 32‰ salinity and oil concentrations of 25, 250, and 1000 μl/50ml sea water. Anonyx nugax was tested under double stress conditions of 32‰ and 40‰ with an oil concentration of 25 μl/500ml sea water.

Respiration measurements. The rate of O_2 consumption was determined as a function of salinity for Anonyx nugax, Boeckosimus affinis and Mysis litoralis. Measurements were made using a Gilson Differential Respirometer with 15 ml flasks. Single animals were placed in 5 ml of the appropriate salinity sea water and run for at least 6 hours. Bath temperature was maintained at -1.0°C and the room was darkened to simulate winter light conditions. Animals were transferred from their field salinity of 32‰ to the test salinity in 5‰ increments every 2 days. They were maintained at the test salinity for 6 days prior to determination of their respiration rates. At least 16 animals were run at each test salinity. Anonyx nugax was run at 15, 20, 32, 40, 45, and 50‰. Boeckosimus affinis was run at 10, 15, 20, 32, 40, 45, 50, and 55‰. Mysis litoralis was run at 10, 15, 20, 32, 40, 45, and 50‰.

Experiments on the effect of crude oil - sea water emulsions on the respiration of the above species were initiated but not completed during this quarter.

The results of the physiological studies will be presented in a later report when a full data set is available for interpretation. Analysis of the existing data indicates that Anonyx nugax is the least euryhaline of the 3 species studied and does not tolerate salinities out of the range 15 - 45‰ very well. Boeckosimus affinis is the most euryhaline species and tolerates salinities in the range of < 10‰ to 65‰ successfully. Mysis litoralis is intermediate and survives well at salinities ranging from about 5 - 45‰.

The investigation of the trophic relationships of the Arctic shallow-water marine animals continued with the collection and preservation of freshly produced fecal pellets for later analysis. Some of these pellets have been analyzed during this quarter as time permits. A single peat assimilation experiment was performed under winter conditions with Mysis litoralis. The results of this experiment have been included in the annual report, section 4.

Activities of the team working in Stefansson Sound have been incorporated in section 3 of the annual report.

III. Estimate of funds expended.

	Amount Budgeted[1]	Amount Spent[2]		Amount Remaining
Salary PI	58,558	53,577		4,981
Salaries Associates	72,707	103,023	(23,586)	-30,316
Salaries, other	169,892	164,062	(6,472)	5,830
Fringe	45,182	44,346	(7,516)	836
Travel & Freight	40,825	41,544		-719
PI Logistics	92,451	37,045		55,406
Supplies & Contracts	9,000	30,620	(11,950)	-21,620
Equipment	17,265	19,220		-1,955
Computer Costs	7,800	5,441		2,359
Overhead	138,633	122,940	(16,622)	15,693
Totals	$652,313[1]	621,818	(66,146)	30,495

[1]Includes basic contract for fiscal 1979 plus Western Washington University contribution. Does not include funds for winter process studies requested in supplemental proposal for fiscal 1979 for which contract ammendment has not been received.

[2]Estimated as of March 31, 1979 and includes $66,146 (amounts shown in parentheses) already spent for winter process studies.

A further contribution to knowledge of the benthic and epibenthic fauna of the Beaufort Sea inshore region.

A. C. Broad

Previously, we have reported that the Beaufort Sea nearshore[1] (less than 2 m deep) fauna is poor in species, number of individuals, diversity, and biomass, and that the Chukchi coast north of Point Hope does not differ from the Beaufort littoral in these parameters. The Beaufort inshore (2 to 20 m) benthic infauna differs from that of the nearshore region in that it is both richer and more diverse. These same differences do not obtain when the motile, epibenthic animals of the Beaufort nearshore and inshore zones are compared, and our data indicate that the same population of motile organisms is sampled in the Beaufort nearshore and inshore and in the Chukchi nearshore north of Point Hope. There are real differences in biomass and number of species of infaunal animals in the Chukchi Sea north and south of Point Hope. A comparison of diversity, however, does not indicate the same differences. The number of motile, epibenthic species found south of Point Hope exceed those north of that point, but the data on diversity and biomass do not indicate that the populations are different.[2]

Data collected in 1977 during the cruise of RV ALUMIAK from Barrow eastward to Tapkaurak Entrance (at which point further progress was impeded by ice) add to our understanding of the fauna of the inshore region and are reported in this section.

Methods

RV ALUMIAK sailed from Barrow on August 2, and returned on August 26, 1977. During the cruise 17 transects were made of the inshore region of the Beaufort Sea and 44 stations were sampled. The number and type of samples made at each station and the location of all stations are given in appended table 1.1.

The sampling protocol at each station was:

A. For infaunal benthos samples a 0.1 m^2 Smith-McIntyre grab was employed. With few exceptions, three grab samples were made at each station. The samples were washed on board in a cascading, multiple seive system in which the controlling (lower) mesh size was of 0.423mm NITEX. The larger stones retained in the coarser seives were inspected and, unless harboring sessile animals, discarded. All other retained material was bagged on board, preserved in hexamine-buffered formalin, and shipped to Bellingham for analysis.

B. Motile, epibenthic animals were sampled by towing a WILDCO scrape/skid dredge (Cat. No. 171) with 1.05mm mesh net for five minutes. To assure that this net actually sampled at the bottom, approximately 2 kg of lead weights were attached to the towing bridle about 45 cm ahead of the net itself. Samples were preserved on board in buffered formalin.

C. Surface plankton was sampled by towing a 20.3 cm diameter, conical plankton net of 153μm nylon mesh for five minutes. The samples were preserved immediately in hexamine buffered formalin.

D. A sample for sediment analysis was taken with either the Smith-McIntyre or with a 0.1m^2 Van Veen grab. A sample of approximately 500 ml was preserved for subsequent analysis.

E. A temperature-salinity profile was made by means of a Yellow Springs Instrument model 33 SCT meter. A Secchi disc reading was made, and the depth was measured by means of a lead line.

F. In Bellingham, all dredge and grab samples were soaked to remove formalin and sorted under 2x magnification (Luxo illuminated magnifier). In most instances, the samples were stained with a rose bengal solution. All organisms were removed, identified, counted and weighed to the nearest mg by species (wet weight taken immediately after blotting dry), and then preserved in 35% propanol or 70% ethanol.

G. Plankton samples are not treated further in this report.

H. Sediment samples were dry-sieved with a U.S. standard seive series using a mechanical sorter or, for finer particle sizes, wet seived in comparable seives. Particles of phi sizes -2 to -4 were considered gravel. Phi sizes -1 to +3 were called course sand. Fine sand was phi size +4, and smaller particles were classified as mud. Sediment data are referred to below but will be reported elsewhere.

Results

Salinity and temperature at each benthic station and characterization of major substrate types are given in appended Table 1.1. Species of all animals captured in the grabs and dredge are listed in appended Table 1.2. Data on animals taken in grabs are found in appended Tables 1.3 to 1.46. The catches of motile epibenthic organisms are summarized in appended Table 1.47.

Due possibly to rain and the resultant difficulty in keeping the SCT meter dry, we sometimes found salinity and temperature readings to be erratic. Those of questionable validity are marked with an asterisk in Table 1.1

Discussion

Each transect was sampled at depths of approximately 5 and 10 m, and some were continued shoreward to a 2 m sample. In order to test whether there were important faunistic differences between these depths, the data were grouped around three class intervals (2 - 3.5 m, 5 - 6 m, and 9 - 11.5 m) for comparison. The result of 3-way analyses of variance and, where indicated, Newman-Keuls multiple range tests, are given in Table 1.48. What differences are revealed by these tests do not support the notion of depth-dependent, faunistic differences. Instead, it is most reasonable to accept a general notion of patchy uniformity in the 2 - 10 m depth region of the Beaufort shelf of Alaska.

When the infaunal data are grouped by depth intervals, the variances of sample populations are high, and standard deviations are usually larger than sample means. Ranges of both biomass and number of animals grouped

Table 1.48. ANOVAs of Smith-McIntyre grab samples made at three depth intervals: 2 = 2-3.5m; 5 = 5-6m; 10 - 9-11.5m (See Table 1.1 for depth at each station). For each analysis there are 122 degrees of freedom within the three populations, and 2 between them. Where F values indicate that the three samples were not from a single population ($p < 0.05$), a Newman-Keuls multiple range test was run to identify differences.

	F	p	Differences
No. Animals	0.702	0.524	
Mass Animals	2.861	0.054*	2 ≠ 10
No. Polychaetes	7.945	0.940	
Mass Polychaetes	1.348	0.281	
No. Oligochaetes	9.824	0.00001**	2 ≠ 5, 10
Mass Oligochaetes	4.444	0.008**	2 ≠ 5, 10
No. Gastropods	9.558	0.00001**	2, 5 ≠ 10
Mass Gastropods	0.422	0.668	
No. Bivalves	1.761	0.183	
Mass Bivalves	3.853	0.017**	2 = 5 = 10
No. Isopods	0.223	0.785	
Mass Isopods	1.831	0.170	
No. Amphipods	3.672	0.021**	5 ≠ 2, 10
Mass Amphipods	2.206	0.113	

by taxonomic category are great at all depths. In a few instances adjacent samples made at the same station differ from one another by orders of magnitude. In general, the variation between biomass samples at single stations exceeds that between numbers of animals. These differences may be attributed in part to large individuals which, although not numerous, account for sometimes large portions of biomass samples. Noteworthy are the polychaetes Arenicola glacialis and Sternaspis scutata, the isopod Saduria entomon, and the bivalves Astarte borealis, Macoma loveni, and Macoma calcarea. Grabs do not always penetrate uniformly due to substrate differences, and substrates do not accommodate the same populations of animals. Still, despite these inherent sampling errors, the data indicate a patchy distribution of animals in the inshore zone of the Beaufort Sea.

Of the 44 benthic stations sampled for infauna, 32 have peat in the substratum, and 12 did not (see Table 1.1). Not only was peat not noted on board ship at these 12 stations, it was not found in the material returned to our laboratory. There are fewer total animals and smaller biomass, and comparable differences in both polychaetes and bivalve mollusks and in the biomass of amphipods, in the no-peat stations as shown in Table 1.49, but the significance of this may have less to do with the peat than with other factors. Absence of peat from a station in a region in which it usually is found, implies some reason why peat does not settle or remain, and this rather than the lack of peat may affect the settling of larvae or survival of infaunal species.

Table 1.49. ANOVA of Smith McIntyre grab samples made at stations where peat was found and at stations where peat was lacking. For each analysis there are 122 degrees of freedom within the two populations and 1 between them. The 12 stations at which peat was lacking are indicated on Table 1.1.

	F	p
No. Animals	14.600	0.00002**
Mass Animals	13.445	0.00004**
No. Polychaetes	21.411	0.0000002**
Mass polychaetes	12.233	0.00009**
No. Oligochaetes	0.954	0.353
Mass Oligochaetes	0.263	0.609
No. Gastropods	0.881	0.373
Mass Gastropods	1.382	0.256
No. Bivalves	7.266	0.003**
Mass Bivalves	15.563	0.000008**
No. Isopods	3.665	0.047*
Mass Isopods	0.666	0.440
No. Amphipods	2.407	0.119
Mass Amphipods	5.498	0.012**

Analysis of the peat-free stations shows that 6 are at depths of 2-3m, 3 at 5-6m and 3 at 9-10m. This represents 55% of the 2-3m stations and much lower proportions (19 and 18% respectively) of the intermediate and deeper stations, but it does not relate the lack of peat to depth alone. At the stations where peat was not found, bottom sediments were taken. Nine had less than 4% mud (phi size $\leqslant + 4$), but two had more than 50% (54 and 56%) mud. Of the 32 stations where peat was found, one was not sampled for substrate analysis; 18 had more than 50% mud (average 77.2%), 10 had from 8 to 48% mud (average 28.4%), and 3 had only 1 to 3%

mud). The species most abundant at the stations where peat was not found were essentially the same as those found elsewhere.

Tables 1.3 to 1.46 list the infaunal species considered most abundant at each station. A species was included if it were present in a quantity equal to either 1 gram of wet weight per m^2 or 100 individuals per m^2 in at least one sample. This evaluation, therefore, is a subjective one, but results in listing species that may be numerous but individually small and those that are large but occur less often. Clearly, the characteristic infaunal organisms of the Beaufort inshore region are polychaetes and bivalves. Those polychaetes that were most frequently encountered in a sequence of roughly declining abundance are: Prionospio cirrifera, Tharyx spp., Chone sp., Terebellides stroemi, Ampharete vega, Scolecolipides arctius, Melanis loveni, Spio filicornis, Praxillella praetermissa, Scoloplos armiger, Sternaspis scutata, Nephtys caeca, and Sphaerodoropsis minuta. The most abundant bivalves, again in a descending sequence of frequency of appearance in the tables, are: Portlandia arctica, Liocyma fluctuosa, Portlandia intermedia, Boreacola vadosa, Macoma loveni, Macoma calcarea, Cytodaria kurriana, Astarte borealis, and Axinopsida orbiculata. These polychaete and bivalve species comprise most of the characteristic, infaunal benthos of the Beaufort inshore zone.

We have been unable to detect variations in the composition of this characteristic fauna with depth, presence or absence of peat, or substrate type. In stations nearest beaches, bivalves usually are absent, possibly because the stress of ice gouging is too great, and there appears to be an increase in bivalve biomass with increasing depth, but our data do not support this statistically.

Previously, we have reported that the numerous (although individually very small) enchytraeid worms found in the nearshore zone do not occur in the inshore region. Our Tables 1.3 to 1.46 show Oligochaetes in several of our 5 and 10 m stations. With the exception of station C1B, at the eastern extremity of our sampling and possibly under some influence from the MacKenzie River, all of these oligochaetes are tubificids instead of enchytraeids.

The motile, epibenthic fauna of the Beaufort inshore region as revealed by sampling with a small epibenthic sled net with 1.05 mm mesh is summarized in Table 1.47. In every instance some usually very minor part of the catch is not listed because the unlisted animals were generally insignificant in number and in biomass but included a large variety of animals that would have made the species column needlessly long. Most of these animals were polychaetes or other infaunal organisms that indicated that the net, instead of sliding along the bottom on its runners, sometimes was digging in. This was particularly evident at stations with especially soft substrates. The efficiency of the net in sampling epibenthic organisms, therefore, varied with firmness of the bottom. Divers have noted avoidance of nets of this type by mysids and other crustaceans[3] which is also reason to question whether catches reported are always comparable to quantities otherwise sampled or even to other samples made with the same gear.

With these qualifications, it is still evident that the epibenthic fauna of the Beaufort inshore region consists of, in a sequence of decreasing abundance: Mysis littoralis; several species of amphipods, especially Acanthostepheia behringiensis, Onisimus glacialis, Rozinante fragilis, Gammarus zaddachi, Boekosimus affinis and B. plautus, Monoculopsis longicornis, Monoculodes sp., Apherusa megalops and A. glacialis, Halirages sp., Weyprechtia pinguis, Acanthostepheia incarinata, and Gammaracanthus loricatus; Mysis relicta; Saduria entomon; Colanus hyperboreus; and Thysanoessa raschii. All are crustaceans. Gammarus setosa and Onisimus litoralis, probably the most abundant epibenthic crustaceans of the nearshore zone, were less numerous in our samples from the inshore region than the species named above. Parathemisto libellula, while present, was not abundant, but this may reflect the efficiency of a net fishing near the bottom instead of the actual abundance of this important food species.

Finally, six of the stations sampled in 1977 also were sampled in 1976. A comparison of these stations for the two years is given in Table 1.50. At these six stations, and generally otherwise in 1977, amphipods accounted for a smaller proportion of the benthic infaunal biota than was so in 1976. In both years, polychaetes and bivalves were the more consistent infaunal elements with both showing usually a higher proportion of totals in 1977.

Table 1.50. Comparison of infaunal benthos at six Beaufort Sea inshore stations sampled in 1976 and 1977. Data are in percent of total for both number/m^2 and wet weight biomass/m^2.

STATION	C4F				HØA				HØB				N1A				P2D				P2E			
Index/m^2	No.		Mass		No.		Mass		No.		Mass		No.		Mass		No.		Mass		No.		Mass	
Year	76	77	77	76	76	77	76	77	76	77	76	77	76	77	76	77	76	77	76	77	76	77	76	77
POLYCHAETES	92	86	57	38	3	47	6	41	35	67	17	51	79	39	40	10	2	0	0	1	36	66	11	36
OLICOCHAETES					7	2	1														19	11	0	1
GASTROPODS										2		0		1		4						2		3
BIVALVES		8		12	11	8	28	38	2	21	4	44	15	54	27	72					13	15	20	12
ISOPODS	1	0	36	40	0	0	15	19					0	0	27	13					0	1	49	23
AMPHIPODS	7	5	7	6	78	41	50	1	62	7	78	1	1	0	0	1	98	1	100	13	30	5	19	18
OTHER	0	1	0	4	1	2	0	1	1	3	1	4	5	6	6	0		99		86	2	0	1	7

NOTES

[1]In our prior reports we have referred to the region from 2 to 5 m deep as "nearshore" and have used "littoral" for depths of less than 2 m. More recently (see Weller, G. et al., 1978. Environmental Assessment of the Alaskan Continental Shelf: Interim Synthesis: Beaufort/Chukchi. N.O.A.A. Environmental Research Laboratories, Boulder, Colorado, August, 1978) a convention has been adopted by OCSEAP workers that synonomizes "nearshore" and "littoral" as we formerly used the word.

[2]Broad, A. C., et al., 1978. In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the year ending March, 1978. N.O.A.A., Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. In press.

[3]Weller, G. et al., l c.

Table 1.1. Summary of Benthic and Related Samples made by RU356 from ALUMIAK, 1977

SUBSTRATE
St= Stones
P = Peat
S = Sand
G = Gravel
Cl= Clay
M = Mud

TRANSECT NAME	STATION NO.	POSITION N.LAT	POSITION W.LONG.	DEPTH M	BOTTOM SAL.1/100	BOTTOM TEMP.°C	NO GRAB SAMPLES	NO SEDIMENT SAMPLES	NO EPIBENTHIC DREDGE SAMPLES	NO SURFACE PLANKTON SAMPLES	SUBSTRATE
Pt. Barrow	P2D	71°23'	156°27'	2	27.0	6.0	3	–	1	1	G, S
	P2E	71°23'	156°27'	6	26.5	5.0	3	1	–	–	S, G
	P2F	71°25'	156°27'	10	25.0	4.3	2	1	1	1	S, Cl
Cooper Island	O4C	71 14	155 40	2	13.0	5.5	3	1	1	1	S
	O4D	71 15	155 40	5	26.0	3.0	3	1	1	1	Cl, M, P
	O4E	71 19	155 40	10	28.1*	8.9*	3	1	1	1	M, Cl, P
Cape Simpson	N4A	71 04	154 41	5	28.5*	8.0*	3	1	1	1	M, Cl, P, St
	N4B	71 05	154 36	10	29.8*	5.5*	3	1	1	1	Cl, M
Smith Bay	N1A	70 55	154 13	5	29.0*	5.5*	3	1	1	1	M, P
	N1C	71 01	154 10	10	31.6*	1.9*	3	1	1	1	M, P
Pitt Point	M1E	70 55	153 15	3	30.2*	4.9*	3	1	1	1	M, Cl, P
	M1D	70 56	153 15	5	30.0*	4.0*	3	1	1	1	M, Cl, P
	M1C	71 00	153 15	10	31.9*	2.1*	3	1	1	1	Cl, M, P
Cape Halkett	L1A	70 51	152 15	2	30.7*	1.9*	1	1	1	1	Cl
	L1B	70 58	152 14	5	33.9*	2.0*	1	–	1	1	Cl, P, M
	L0A	70 53	152 09	10	36.8*	2.2*	3	1	1	1	Cl, M, S, P
Kogru River	K4A	70 34	151 40	2	30.5*	4.1*	3	1	1	1	M, Cl, P
	K3A	70 37	151 33	5	28.4	1.8	3	1	1	1	M, S, P
	K2A	70 39	151 27	10	28.3	0.5	3	1	1	1	M, P
Colville River	J2A	70 33	150 25	2	26.9	2.5	3	1	1	1	S, P, M
	J2B	70 33	150 25	5	27.7	2.3	3	1	–	–	M, P, Cl
	J2C	70 35	150 25	10	29.3	2.2	3	1	1	1	Cl, M, P
Pingok Island	I3H	70 34	149 30	5	31.5	1.5	3	1	1	1	S, M, G
	I3G	70 34	149 30	10	33.9	1.5	3	1	1	1	Cl, M, P

Table 1.1 Continued

SUBSTRATE
St= Stones
P = Peat
S = Sand
G = Gravel
Cl= Clay
M = Mud

TRANSECT NAME	STATION NO.	POSITION N.LAT	POSITION W.LONG.	DEPTH M	BOTTOM SAL.1/100	BOTTOM TEMP.°C	NO GRAB SAMPLES	NO SEDIMENT SAMPLES	NO EPIBENTHIC DREDGE SAMPLES	NO SURFACE PLANKTON SAMPLES	SUBSTRATE
Prudhoe	H3B	70 23	148 32	2	26.0	1.5	3	1	1	1	M, Cl, P
Bay	H3G	70 25	148 32	5	26.8	0.8	3	1	1	1	S, M, P
	H3H	70 30	148 32	11.5	27.2	-1.0	3	1	1	1	S, M, P
Heald	HØA	70 22	148 08	2	34.3*	1.5*	3	1	1	1	S, P
Point	HØB	70 25	148 06	5	27.0	0.9	3	1	1	1	S, G, Sh(Shell)
	HØC	70 30	148 01	10	27.5	-1.1	3	1	1	1	M, Cl, S, P
Foggy	G3B	70 14	147 37	2	34.2*	1.7*	3	1	1	1	S
Island	G3C	70 16	147 38	5	29.6*	6.8*	3	1	1	1	Cl, G, M, P
Bay	G3D	70 25	147 36	9	-	-	3	1	1	1	Cl, M, P
Flaxman	FØA	70 11	146 00	3	27.6	2.2	3	1	-	-	S
Island	FØB	70 12	146 00	5	31.1	1.5	3	1	1	1	S, Cl, P
	FØC	70 12	146 00	10	28.0	0.5	3	1	1	1	M, S, G
Simpson	D5A	70 00	144 54	5	27.6	2.2	3	1	1	1	S, P
Cove	D5B	70 03	144 54	10	27.7	-.02	3	1	1	1	Cl, S, M, P
Hulahula	DØA	70 06	144 05	5	28.1	0.1	3	1	1	1	M, S, P
River	DØB	70 07	144 05	10	33.2	-0.2	3	1	1	1	S, M, G, P
Barter	C4F	70 08	143 41	5	28.0	0.2	3	1	1	1	S, M, P
Island	C4G	70 09	143 41	10	39.2*	-0.5*	3	1	1	1	Cl, M, P
Tapkaurak	C1A	70 08	143 11	3.5	27.4	0.1	1	1	1	1	S,
Entrance	C1B	70 09	143 08	10	28.2	0.4	3	1	1	1	S, M,
Total Samples							125	42	41	41	

* probably instrumental error

Table 1.2. Animal species captured in bottom grabs and sled nets (see text for description of equipment) at Beaufort Sea stations between 2 and 11.5m deep from R/V ALUMIAK, 1977. Unk. after a family name or the name of a higher taxon implies unknown member(s) of that family or group. The sequence of species in the table is that of the NODC taxonomic code.

1. FORAMINIFERANS

Cornuspira sp.
Cornuspira foliacea
Cornuspira involvens
Quinqueloculina sp.
Dentalina sp.
Guttulina sp.
Elphidiella sp.

2. HYDROZOANS

Perigonimus yoldia-arcticae
Calycopsis birulai
Rathkea sp.
Corymorpha flammea
Tubularia sp.
Sertularia tolli
Aglantha digitale
Aeginopsis laurentii

3. ANTHOZOANS

Eunephthya fructosa

4. NEMERTEANS

Rhynchocoela unk.

5. NEMATODES

Nematoda unk.

6. POLYCHAETA

Antinoella sarsi
Melaenis loveni
Pholoe minuta

POLYCHAETA (continued)

Spinther oniscoides
Anaitides groenlandica
Eteone longa
Nereimyra aphroditoides
Autolytus alexandri
Exogone naidina
Nephtys sp.
Nephtys ciliata
Nephtys caeca
Nephthys paradoxa
Sphaerodoropsis minuta
Lumbrinereis sp.
Lumbrinereis minuta
Schistomeringos caeca
Haploscoloplos elongatus
Scoloplos armiger
Orbinia sp.
Aricidea suecica
Cirrophorus sp.
Apistobranchus tullbergi
Prionospio cirrifera
Scolecolepides arctius
Spio filicornis
Pseudopolydora kempi
Trochochaeta carica
Cirratulidae unk.
Cirratulus cirratus
Tharyx spp.

Table , continued

Chaetozone setosa

Cossura longocirrata

Brada villosa

Diplocirrus sp.

Scalibregma inflatum

Ammotrypane (=Ophelina) cylindricaudatus

Travisia forbesii

Sternaspis scutata

Capitellidae unk.

Capitella capitata

Heteromastus filiformis

Mediomastus sp.

Arenicola glacialis

Praxillella praetermissa

Pectinaria (Cistenides) hyperborea

Ampharetidae unk.

Ampharete sp.

Ampharete acutifrons

Ampharete vega

Amphicteis sundevalli

Terebellidae unk.

Terebellides stroemi

Chone sp.

Euchone analis

Potamilla neglecta

Laonome kroyeri

Spirorbis granulatus

Dexiospira spirillum

7. OLIGOCHAETES

Enchytraeidae unk.

Tubificidae unk.

8. GASTROPODS

Margarites sp.

Solariella varicosa

Lacuna sp.

Amauropsis purpurea

Natica sp.

Polinices sp.

Admete couthouyi

Oenopota sp.

Cylichna occulta

Cylichna alba

Retusa obtusa

Limacina helicina

Clione limacina

Nudibranchia unk.

9. BIVALVES

Nucula bellotti

Portlandia arctica

Portlandia intermedia

Musculus sp.

Musculus discors

Musculus corrugatus

Delectopecten greenlandicus

Axinopsida serricata

Axinopsida orbiculata

Boreacola vadosa

Astarte sp.

Astarte borealis

Cardiidae unk.

Clinocardium ciliatum

Macoma sp.

Macoma calcarea

Table , continued

Macoma moesta moesta
Macoma moesta alaskana
Macoma loveni
Liocyma fluctuosa
Mya sp.
Mya truncata
Cyrtodaria kurriana
Pandora glacialis
Lyonsia sp.
Lyonsia arenosa
Thracia sp.
Thracia myopsis

10. PYCNOGONIDS

Nymphon longitarse

11. OSTRACODS

Ostracoda unk.

12. COPEPODS

Calanoida unk.
Calanus sp.
Calanus hyperboreus
Euchaeta polaris
Augaptilus glacialis
Harpacticoida unk.

13. MYSIDS

Acanthomysis pseudomacropsis
Mysis sp. (juveniles)
Mysis litoralis
Mysis oculata
Mysis relicta

14. CUMACEANS

Lamprops sarsi
Diastylis sp.
Diastylis glabra
Diastylis nucella
Diastylis sulcata
Brachydiastylis resima
Campylaspis umbensis

15. TANAIDACEANS

Leptognatha sp.
Leptognatha gracilis

16. ISOPODS

Saduria entomon
Saduria sibirica
Saduria sabini
Munnopsis typica

17. AMPHIPODS

Amphipoda unk.
Ampelisca macrocephala
Byblis sp.
Byblis gaimardi
Haploops tubicola
Atylus carinatus
Apherusa megalops
Apherusa glacialis
Calliopius behringi
Halirages sp.
Halirages nilsoni
Corophium sp.
Rhachotropis inflata
Rozinante fragilis
Gammaridae unk. (juveniles)
Gammaracanthus loricatus
Gammarus sp. (juveniles)
Gammarus setosa

Table , continued

Gammarus zaddachi
Melita formosa
Weyprechtia pinguis
Pontoporeia femorata
Pontoporeia affinis
Priscillina armata
Hyalella sp.
Protomedeia sp.
Protomedeia stephenseni
Ischyrocerus sp.
Anonyx nugax
Boeckosimus affinis
Boeckosimus plautus
Hippomedon sp.
Onisimus sp.
Onisimus glacialis
Onisimus litoralis
Orchomene minuta
Tryphosella rusanovi
Tryphosella schneideri
Acanthostepheia behringiensis
Acanthostepheia incarinata
Aceroides latipes
Monoculodes spp.
Monoculodes packardi
Monoculopsis longicornis
Paroediceros lynceus
Paroediceros propinquus
Pleusymtes sp.
Pleusymtes karianus
Dulichia arctica
Stenothoidae unk.
Metopa sp.
Hyperia galba
Hyperoche medusarum
Parathemisto libellula

18. EUPHAUSIIDS

Thysanoessa inermis
Thysanoessa longipes
Thysanoessa raschii

19. DECAPODS

Decapoda unk.
Alpheus sp.
Eualus gaimardii belcheri
Crangon sp.
Crangon intermedia
Paguridae unk. (zoea)
Pagurus sp.
Hyas sp. (zoea)

20. CHIRONOMIDS

Chironomidae unk.

21. SIPUNCULANS

Golfingia margaritacea

22. ECHIURANS

Echiurus echiuris alaskanus

23. PRIAPULIDS

Priapulus caudatus
Halicryptus spinulosus

24. BRYOZOANS

Ectoprocta unk.
Alcyonidium disciforme
Eucratea loricata
Flustra sp.
Flustra serrulata

Table , continued

25. ASTEROIDS

Asteroidea unk.

Leptasterias arctica

26. OPHUROIDS

Ophiuroidea unk.

27. CHAETOGNATHS

Sagitta elegans

29. ASCIDIANS

Ascidiacea unk.

Pelonaia corrugata

Molgula sp.

Molgula griffithsii

Molgula retortiformis

30. LARVACEANS

Oikopleura vanhoeffeni

31. FISH

Cottidae unk.

Myoxocephalus quadricornis

Agonidae unk.

Liparis sp.

TABLE 1.3. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION C1A (70°08.1'N, 143°11.4'W, 3.5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
	g/m^2			
POLYCHAETES		0		
OLIGOCHAETES		0		
GASTROPODS		0		
BIVALVES		0		
ISOPODS		0		
AMPHIPODS		0		
OTHER		0		
Σ		0		
	n/m^2			
POLYCHAETES		0		
OLIGOCHAETES		0		
GASTROPODS		0		
BIVALVES		0		
ISOPODS		0		
AMPHIPODS		0		
OTHER		0		
Σ		0		

TABLE 1.4. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION C1B (70°09.4'N, 143°08.4'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	4.49	0.94	19.45	8.29	43	Nephytys caeca! Melanis loveni! Anaitides groenlandica, Terebellidae unk., Scolecolepides arctius, Prionospio cirrifera
OLIGOCHAETES	0.03	0.03		0.02	0	
GASTROPODS	0.14	0.00	3.35	1.16	6	Oenopota sp.
BIVALVES	20.54	4.37	2.47	9.13	47	Liocyma fluctuosa! Macoma loveni
ISOPODS						
AMPHIPODS	0.04	0.01	0.01	0.02	0	
OTHER	0.10		1.91	0.67	3	Molgula sp.
Σ	25.34	5.34	27.19	19.28	99	
			n/m^2			
POLYCHAETES	1219	439	1660	1106.00	59	Prionospio cirrifera, Scolecolepides arctius, Terebellides stroemi
OLIGOCHAETES	440	410		283.33	15	Enchytraidae unk!
GASTROPODS	30	20	30	26.67	1	
BIVALVES	630	60	190	293.33	16	Liocyma fluctuosa, Boreacola vadosa, Axinopsida orbiculata
ISOPODS						
AMPHIPODS	50	20	10	26.67	1	
OTHER	210		190	133.33	7	Leptognatha gracilis
Σ	2579	949	2080	1869.33	99	

TABLE 1.5. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION C4F (70°08.3'N, 143°41.0'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	6.08	5.40	10.06	7.18	38	Ampharete vega, Scoloplos armiger, Arenicola glacialis
OLIGOCHAETES						
GASTROPODS						
BIVALVES	3.27	3.48	0.15	2.30	12	Macoma sp., Cyrtodaria kurriana
ISOPODS			22.6	7.53	40	Saduria entomon
AMPHIPODS	0.01	0.62	2.86	1.17	6	Atylus carinatus
OTHER	1.74	0.00	0.71	0.82	4	Alcyonidium disciforme
Σ	11.1	9.50	36.38	19.00	100	
			n/m^2			
POLYCHAETES	1537	1679	1932	1716.00	86	Chone sp., Prionospio cirrifera, Sphaerodoropsis minuta, Ampharete vega, Scoloplos armiger
OLIGOCHAETES						
GASTROPODS						
BIVALVES	150	140	190	160.00	8	Cyrtodaria kurriana
ISOPODS			10	3.33	0	
AMPHIPODS	40	20	250	103.33	5	Atylus carinatus
OTHER	10	10	40	20.00	1	
Σ	1737	1849	2422	2002.66	100	

TABLE 1.6. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION C4G (70°09.0'N, 143°41.0'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	15.60	0.26	4.33	6.73	33	Melanis loveni, Praxillella praetermissa, Ampharete sp.
OLIGOCHAETES			0.07	0.02	0	
GASTROPODS	0.22	0.02	0.46	0.23	1	
BIVALVES	12.14	0.19	19.66	10.66	52	Portlandia arctica, Liocyma fluctuosa Axinopsida orbiculata, Macoma loveni, Pandora glacialis
ISOPODS						
AMPHIPODS			.67	0.22	1	
OTHER	.07		8.41	2.83	14	Ascidiacea unk.
Σ	28.03	0.47	33.60	20.69	101	
			n/m^2			
POLYCHAETES	164	161	1154	493.00	53	Praxillella praetermissa, Arcidea suecica, Chaetozone setosa, Tharyx sp.
OLIGOCHAETES			50	16.67	2	
GASTROPODS	40	40	40	40.00	4	
BIVALVES	310	70	640	340.00	37	Liocyma fluctuosa, Axinopsida orbiculata
ISOPODS						
AMPHIPODS			10	3.33	0	
OTHER	10		80	30.00	3	
Σ	524	271	1974	923.00	99	

TABLE 1.7. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION DØA (70°05.7'N, 144°05.0'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	20.46	14.69	21.42	18.86	62	Scolecolepides arctius, Prionospio cirrifera, Terebellides stroemi, Ampharete vega, Scoloplos armiger, Chone sp.
OLIGOCHAETES						
GASTROPODS						
BIVALVES	25.95	1.05	7.99	11.67	38	Cyrtodaria kurriana
ISOPODS						
AMPHIPODS	0.05			0.02	0	
OTHER	0.04		0.09	0.04	0	
Σ	46.50	15.74	29.50	30.59	100	
			n/m^2			
POLYCHAETES	3611	2457	4511	3526.33	99	Chone sp., Prionospio cirrifera, Ampharete vega, Scoloplos armiger, Sphaerodoropsis minota
OLIGOCHAETES						
GASTROPODS						
BIVALVES	20	30	20	23.33	1	
ISOPODS						
AMPHIPODS	10			3.33	0	
OTHER	10		20	10	0	
Σ	3651	2487	4551	3562.99	100	

TABLE 1.8. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION DØB (70°07.5'N, 144°05.0'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	7.36	13.92	5.20	8.83	22	Anaitides groenlandica, Nephtys caeca, Melanis loveni, Travisia forbesii
OLIGOCHAETES	0.00		0.00			
GASTROPODS	2.74	1.00		1.25	3	
BIVALVES	29.49	18.22	19.52	22.41	57	Portlandia arctica, Liocyma fluctuosa Boreacola vadosa, Astarte borealis, Musculus corrugatus, Macoma moesta alaskana
ISOPODS						
AMPHIPODS		.01			0	
OTHER	11.68	6.72	1.93	6.78	17	Priapulus caudatus, Ascidiacea unk, Pelonaia corrugata
Σ	51.27	39.87	26.66	39.27	99	
			n/m^2			
POLYCHAETES	529	876	686	697.00	27	Terebellides stroemi, Chaetozone setosa
OLIGOCHAETES	30		20	16.67	1	
GASTROPODS	60	60		40.00	2	
BIVALVES	2430	2390	480	1766.67	68	Liocyma fluctuosa, Boreacola vadosa
ISOPODS						
AMPHIPODS		10	10	6.67	0	
OTHER	90	150	10	83.33	3	
Σ	3139	3486	1206	2610.33	101	

TABLE 1.9. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION D5A (70°00.4'N, 144°54.4'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	6.59	5.75	5.35	5.90	46	Orbinia sp., Ampharete vega, Chone sp. Scolecolepides arctius
OLIGOCHAETES						
GASTROPODS		0.02		0.01	0	
BIVALVES	11.99	1.87	1.29	5.05	39	Liocyma fluctuosa!
ISOPODS		4.94		1.65	13	Saduria entomon!
AMPHIPODS	0.28	0.17	0.08	0.18	1	
OTHER	0.20	0.00	0.11	0.10	1	
Σ	19.06	12.75	6.83	12.89	100	
			n/m^2			
POLYCHAETES	2691	2426	1797	2304.67	68	Orbinia sp., Prionospio cirrifera, Chone sp., Ampharete vega, Chaetozone setosa, Spio filicornis, Scolecolepides arctius
OLIGOCHAETES						
GASTROPODS		10		3.33	0	
BIVALVES	990	1020	580	863.33	26	Boreacola vadosa! Liocyma fluctuosa
ISOPODS		8		2.67	0	
AMPHIPODS	80	340	100	173.33	5	Corophium sp!
OTHER	30	10	20	20	1	
Σ	3791	3814	2497	3367.33	100	

TABLE 1.10. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION D5B (70°02.8'N, 144°54.4'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	9.58	10.11	20.53	13.41	20	Amphicteis sundevalli, Scoloplos armiger, Praxillella praetermissa, Sternaspis scutata, Anaitides groenlandica
OLIGOCHAETES	0.01	0.01		0.01	0	
GASTROPODS	0.31	1.39		0.57	1	Oenopota sp.
BIVALVES	51.87	43.38	50.60	48.62	73	Macoma calcarea! Liocyma fluctuosa, Astarte borealis, Portlandia arctica, Macoma moesta alaskana
ISOPODS		0.09		0.03	0	
AMPHIPODS	0.22	0.45	0.78	0.48	1	
OTHER	10.42	0.14	0.53	3.70	6	Golfingia margaritacea!
Σ	72.41	55.57	72.44	66.82	101	
			n/m^2			
POLYCHAETES	2849	2147	2030	2342.00	80	Cirrophorus sp., Tharyx sp., Exogone naidina, Praxillella praetermissa, Prionospio cirrifera, Chaetozone setosa
OLIGOCHAETES	50	120		56.67	2	Tubificidae!
GASTROPODS	10	20		10.00	0	
BIVALVES	110	90	100	100.00	3	
ISOPODS		10		3.33	0	
AMPHIPODS	20	30	20	23.33	1	
OTHER	370	410	390	390.00	3	Leptognatha gracilis!
Σ	3409	2827	2540	2925.33	99	

TABLE 1.11. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION FØA (70°11.5'N, 146°00.0'W, 3 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	0.24	0.04	0.1	0.13	67	
OLIGOCHAETES						
GASTROPODS						
BIVALVES						
ISOPODS						
AMPHIPODS		0.1	.07	0.06	30	
OTHER			.02	0.01	3	
Σ	0.24	0.14	0.10	0.19	100	
			n/m^2			
POLYCHAETES	69	5	10	28.00	68	
OLIGOCHAETES						
GASTROPODS						
BIVALVES						
ISOPODS						
AMPHIPODS		10	10	6.67	16	
OTHER	10		10	6.67	16	
Σ	79	15	30	41.34	100	

TABLE 1.12. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION FØB (70°11.6'N, 146°00.0'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	8.11	5.43	2.94	5.49	51	Ampharete vega, Scolecolepides arctius, Prionospio cirrifera
OLIGOCHAETES						
GASTROPODS			0.7	0.23	2	
BIVALVES	0.24	.11		0.12	1	
ISOPODS			14.67	4.89	45	Saduria entomon
AMPHIPODS			0.01	0.00	0	
OTHER	0.27	0.03	0.07	0.12	1	
Σ	8.62	5.57	18.39	10.86	100	
			n/m^2			
POLYCHAETES	2634	2659	1760	2351	92	Ampharete vega, Chone sp., Tharyx sp., Prionospio cirrifera
OLIGOCHAETES						
GASTROPODS			10	3.33	0	
BIVALVES	20	50	10	26.67	1	
ISOPODS			10	3.33	0	
AMPHIPODS			20	6.67	0	
OTHER	380	30	100	170	7	Halicryptus spinulosus
Σ	3034	2739	1910	2561	100	

TABLE 1.13. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION FØC (70°12.4'N, 146°00.0'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	SAMPLE B	SAMPLE C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	2.79	7.38	2.57	4.25	29	Prionospio cirrifera, Brada villosa
OLIGOCHAETES						
GASTROPODS	0.45	0.37	0.37	0.40	3	
BIVALVES	1.59	3.52	2.64	2.58	18	Macoma loveni!
ISOPODS						
AMPHIPODS	0.02	0.13	0.02	0.06	0	
OTHER	10.84	0.40	10.87	7.37	50	Anthozoa! Priapulus caudatus!
Σ	15.69	11.80	16.47	14.66	100	
			n/m^2			
POLYCHAETES	890	2121	770	1260.33	79	Nereimyra aphroditoides, Chone sp., Prionospio cirrifera, Tharyx sp. Brada villosa
OLIGOCHAETES						
GASTROPODS	130	60	60	83.33	5	
BIVALVES	100	110	80	96.67	6	
ISOPODS						
AMPHIPODS	30	30	10	23.33	1	
OTHER	50	200	140	130.0	8	Anthozoa
Σ	1200	2521	1060	1593.67	99	

TABLE 1.14. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION G3B (70°13.6'N, 147°36.8'W, 2 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	5.53	2.31	3.52	3.79	25	Orbinia sp., Travisia forbesii
OLIGOCHAETES	0.23	0.35	0.26	0.28	2	
GASTROPODS						
BIVALVES	9.04	10.35	11.33	10.24	68	Cyrtodaria kurriana!
ISOPODS						
AMPHIPODS	0.90	0.23	0.42	0.52	3	
OTHER	0.61	0.35		0.32	2	
Σ	16.31	13.60	15.53	15.14	100	
			n/m^2			
POLYCHAETES	330	351	420	367.00	15	Spio filicornis, Chone sp.
OLIGOCHAETES	1360	1990	1200	1516.67	63	Enchytraeidae!
GASTROPODS						
BIVALVES	210	260	230	233.33	10	Cyrtodaria kurriana!
ISOPODS						
AMPHIPODS	280	290	250	273.33	11	Priscillina armata!
OTHER	40	10		16.67	1	
Σ	2220	2901	2100	2407	100	

TABLE 1.15. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION G3C (70°16.0'N, 147°38.0'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF 0.1m^2 SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	3.76	3.70	5.42	4.29	41	Prionospio cirrifera, Chone sp.
OLIGOCHAETES						
GASTROPODS		0.18	0.15	0.11	1	
BIVALVES	4.70	2.93	0.32	2.65	25	Liocyma fluctuosa!
ISOPODS	4.57			1.52	15	Saduria siberica
AMPHIPODS	1.49	0.67	1.23	1.13	11	Haploops tubicola!
OTHER	0.05	0.23	1.88	0.72	7	Halicryptus spinulosus!
Σ	14.58	7.71	9.0	10.43	100	
			n/m^2			
POLYCHAETES	3811	4961	6701	5157.67	94	Sphaerodoropsis minuta, Aricidea suecica, Pionospio cirrifera, Chone sp. Tharyx sp., Lumbrinereis minuta, Cirrophorus sp.
OLIGOCHAETES						
GASTROPODS	10	10	10	10	0	
BIVALVES	50	80	130	86.67	2	
ISOPODS	40			13.33	0	
AMPHIPODS	320	100	53	157.76	3	Haploops tubicola!
OTHER	20	80	100	66.67	1	
Σ	4251	5231	6994	5492.00	100	

TABLE 1.16. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m² AT STATION G3D (70°24.8'N, 147°35.6'W, 9 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF 0.1m² SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m² IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	SAMPLE B	SAMPLE C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	6.22	7.54	7.17	6.98	62	Anaitides groenlandica, Praxillela praetermissa, Prionospio cirrifera
OLIGOCHAETES						
GASTROPODS	0.33	0.09	0.80	0.41	4	
BIVALVES		5.87	3.03	2.97	26	Portlandia arctica!
ISOPODS						
AMPHIPODS	0.04	1.35	0.81	0.73	6	
OTHER	0.03	0.05	0.50	0.19	2	
Σ	6.61	14.90	12.31	11.27	100	
			n/m^2			
POLYCHAETES	2194	2150	2345	2229.67	83	Ampharete acutifrons, Prionospio cirrifera Terebellides stroemi, Chone sp., Tharyx sp., Nereimyra aphroditoides, Chaetozone setosa, Diplocirrus sp.
OLIGOCHAETES						
GASTROPODS	30	20	70	40	1	
BIVALVES		30	50	26.67	1	
ISOPODS						
AMPHIPODS	70	640	90	266.67	10	Pontoporeia femorata!
OTHER	130	110	130	123.33	5	
Σ	2424	2950	2685	2686.33	100	

TABLE 1.17. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION HØA (70°22.5'N, 148°07.8'W, 2 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	4.17	6.85	3.95	4.99	41	Scolecolepides arctius, Orbinia sp! Terebellides stroemi
OLIGOCHAETES	0.01			0.00	0	
GASTROPODS						
BIVALVES		13.39	0.44	4.61	38	Portlandia arctica, Cyrtodaria kurriana
ISOPODS		6.88		2.29	19	Saduria entomon!
AMPHIPODS	0.19	0.22	0.07	0.16	1	
OTHER	0.34	0.04		0.13	1	
Σ	4.71	27.38	4.47	12.18	100	
			n/m^2			
POLYCHAETES	342	435	240	339.00	47	Orbinia sp., Spio filicornis
OLIGOCHAETES	50			16.67	2	
GASTROPODS						
BIVALVES		150	30	60.00	8	
ISOPODS		10		3.33	0	
AMPHIPODS	270	400	220	296.67	41	Pontoporeia femorata, Priscillina armata
OTHER	20	10		10.00	1	
Σ	682	1005	490	725.67	99	

TABLE 1.18. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION HØB (70°24.3'N, 148°06.6'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	10.62	13.00	5.26	9.63	51	Anaitides groenlandica, Travisia forbesii, Scolecolepides arctius
OLIGOCHAETES						
GASTROPODS	0.23	0.01	0.03	0.09	0	
BIVALVES	12.95	2.57	9.57	8.36	44	Macoma loveni, Astarte borealis! Liocyma fluctuosa
ISOPODS						
AMPHIPODS	0.07	0.02	0.33	0.14	1	
OTHER	0.21	1.39	0.37	0.66	3	Rhynchocoela!
Σ	24.08	16.99	15.56	18.87	99	
			n/m^2			
POLYCHAETES	721	1041	770	844.00	67	Prionospio cirrifera, Scolecolepides arctius, Ampharete vega
OLIGOCHAETES						
GASTROPODS	50	20	10	26.67	2	
BIVALVES	410	190	210	270.00	21	Boreacola vadosa
ISOPODS						
AMPHIPODS	80	90	90	86.67	7	
OTHER	10	60	40	36.67	3	
Σ	1271	1401	1120	1264.00	100	

TABLE 1.19. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION HØC (70°29.8'N, 148°01.2'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	8.82	30.55	23.43	20.93	29	Haploscoloplos elongatus, Heteromastus filiformis, Praxillella praetermissa, Melanis loveni, Nephty sp., Ampharete vega, Anitoella sarsi
OLIGOCHAETES		0.01		0.00	0	
GASTROPODS	1.29	0.28	1.19	0.92	1	Natica sp!
BIVALVES	62.49	22.24	29.42	38.05	53	Portlandia arctica, Nucula bellotti, Liocyma fluctuosa, Macoma calcarea! Lyonsia arenosa, Macoma loveni, Axinopsida orbiculata
ISOPODS		1.73		0.58	1	Saduria sabini
AMPHIPODS	0.89	3.60	6.20	3.56	5	Pontoporeia femorata, Melita formosa
OTHER	0.04	7.79	17.04	8.29	11	Priapulus caudatus!
Σ	73.53	66.19	77.28	72.33	100	
			n/m^2			
POLYCHAETES	2052	1430	1844	1775.33	51	Tharyx spp., Prionospio cirrifera, Haploscoloplos elongatus, Arcidea suecica, Heteromastus filiformis
OLIGOCHAETES		20		6.67	0	
GASTROPODS	40	40	10	30.00	1	
BIVALVES	750	1270	1100	1040.00	30	Portlandia intermedia, Portlandia arctica, Axinopsida orbiculata
ISOPODS		10		3.33	0	
AMPHIPODS	130	460	900	496.67	14	Pontoporeia femorata, Melita formosa
OTHER	50	300	100	150.00	4	Leptognatha sp.
Σ	3022	3530	3954	3502	100	

TABLE 1.20. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION H3B (70°24.0'N, 148°32.4'W, 2 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	SAMPLE B	SAMPLE C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	5.96	9.43	6.33	7.24	29	Ampharete vega, Tharyx spp., Scolecolepides arctius
OLIGOCHAETES						
GASTROPODS						
BIVALVES	22.45	5.91	19.05	15.80	64	Cyrtodaria kurriana!
ISOPODS	1.50			0.50	2	Saduria entomon!
AMPHIPODS	0.59	0.18	0.13	0.30	1	
OTHER	0.71	0.03	2.09	0.94	4	Diastylis sulcata!
Σ	31.21	15.55	27.60	24.87	100	
			n/m^2			
POLYCHAETES	1254	2292	1482	1676.00	80	Scolecolepides arctius, Ampharete vega, Tharyx spp., Prionospio cirrifera, Eteone longa
OLIGOCHAETES						
GASTROPODS						
BIVALVES	100	70	50	76.67	4	
ISOPODS	10			3.33	0	
AMPHIPODS	190	190	150	176.67	8	Pontoporeia femorata
OTHER	50	10	440	166.67	8	Diastylus sulcata!
Σ	1614	2562	2122	2099.33	100	

TABLE 1.21. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION H3G (70°25.7'N, 148°32.4'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	2.69	22.54	30.36	18.53	91	Ampharete vega! Scolecolepides arctius
OLIGOCHAETES						
GASTROPODS						
BIVALVES	1.41	0.03	0.10	0.51	3	Liocyma fluctuosa!
ISOPODS						
AMPHIPODS	0.01	0.03	0.02	0.02	0	
OTHER		0.14	3.60	1.25	6	Molgula griffithsii
Σ	4.11	22.74	34.08	20.31	100	
			n/m^2			
POLYCHAETES	665	1362	1592	1206.33	96	Prionospio cirrifera, Chone sp. Ampharete vega
OLIGOCHAETES						
GASTROPODS						
BIVALVES	30	10	20	20.00	2	
ISOPODS						
AMPHIPODS	40	20	30	30.00	2	
OTHER		10	10	6.67	1	
Σ	735	1402	1652	1263.00	101	

TABLE 1.22. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION H3H (70°30.2'N, 148°32.4'W, 11 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	7.18	4.96	3.95	5.36	32	Nephtys ciliata, Praxillella praetermissa, Nephtys sp.
OLIGOCHAETES						
GASTROPODS	0.15	0.64	0.28	0.36	2	
BIVALVES	13.68	12.43	0.00	8.70	53	Portlandia arctica!
ISOPODS						
AMPHIPODS	0.01	0.01	0.00	0.01	0	
OTHER	3.39	2.12	0.70	2.07	13	Ascidiacea!
Σ	24.41	20.16	4.93	16.50	100	
			n/m^2			
POLYCHAETES	1037	304	801	714.00	78	Diplocirrus sp., Prionospio cirrifera
OLIGOCHAETES						
GASTROPODS	30	50	20	33.33	4	
BIVALVES	160	80	30	90.00	10	
ISOPODS						
AMPHIPODS	10	10	10	10.00	1	
OTHER	90	40	60	63.33	7	
Σ	1327	484	921	910.67	100	

TABLE 1.23. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION I3G (70°34.5'N, 149°30.0'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	4.87	9.32	9.04	7.74	42	Prionospio cirrifera, Ampharete vega
OLIGOCHAETES		0.00	0.01		0	
GASTROPODS	0.11	0.70		0.27	1	
BIVALVES	5.00	3.36	9.62	5.99	33	Portlandia arctica, Portlandia intermedia
ISOPODS		8.05		2.68	15	Saduria entomon!
AMPHIPODS	2.41	0.01	0.92	1.11	6	Boekosimus affinis
OTHER	0.67	0.20	0.65	0.51	3	
Σ	13.06	21.63	20.24	18.31	100	
			n/m^2			
POLYCHAETES	4915	7993	5798	6235.33	84	Prionospio cirrifera, Cossura longocirrata, Chone sp., Sphaerodoropsis minuta, Tharyx sp., Trochochaeta carica
OLIGOCHAETES		10	20	10.00	0	
GASTROPODS	10	120		43.33	1	
BIVALVES	720	650	1240	870.00	12	Portlandia arctica, Portlanda intermedia, Axinopsida orbiculata
ISOPODS		10		3.33	0	
AMPHIPODS	220	20	30	90.00	1	Boekosimus affinis
OTHER	400	40	100	180.00	2	Rhynchocoela, Diastylis sulcata
Σ	6265	8843	7188	7432.00	100	

TABLE 1.24. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION I3H (70°33.8'N, 149°30.0'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	3.03	0.48	4.56	2.69	9	Scolecolepides arctius, Ampharete vega
OLIGOCHAETES						
GASTROPODS		0.01		0.00	0	
BIVALVES						
ISOPODS		76.18		25.39	88	Saduria entomon!
AMPHIPODS	0.00	0.01	0.04	0.02	0	
OTHER	0.02	0.02	2.00	0.68	2	Molgula griffithsii
Σ	3.05	76.68	6.60	28.78	99	
			n/m^2			
POLYCHAETES	194	107	230	177.00	72	Prionospio cirrifera
OLIGOCHAETES						
GASTROPODS		10		3.33	1	
BIVALVES						
ISOPODS		10		3.33	1	
AMPHIPODS	10	20	20	16.67	7	
OTHER	20	30	90	46.67	19	
Σ	224	177	340	247.00	100	

TABLE 1.25. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION J2A (70°32.7'N, 150°25.0'W, 2 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF 0.1m^2 SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	0.09	0.22	0.78	0.36	73	
OLIGOCHAETES	0.04	0.08	0.02	0.05	9	
GASTROPODS						
BIVALVES						
ISOPODS						
AMPHIPODS		0.02		0.01	1	
OTHER	0.08	0.17	0.00	0.08	17	
Σ	0.21	0.49	0.80	0.50	100	
			n/m^2			
POLYCHAETES	110	100	264	158.00	26	Scolecolepides arctiuis!
OLIGOCHAETES	450	520	350	440.00	72	Enchytraidae!
GASTROPODS						
BIVALVES						
ISOPODS						
AMPHIPODS		10		3.33	1	
OTHER	20	10	10	13.33	2	
Σ	580	640	624	614.67	101	

TABLE 1.26. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION J2B (70°33.5'N, 150°25.0'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	SAMPLE B	SAMPLE C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	20.15	27.18	17.09	21.47	54	Prionospio cirrifera, Scolecolepides arctius, Terebellides stroemii
OLIGOCHAETES			0.01	0.00	0	
GASTROPODS						
BIVALVES	16.49	3.68	14.33	11.50	29	Portlandia arctica, Cyrtodaria kurriana
ISOPODS	0.69		17.97	6.22	16	Saduria entomon!
AMPHIPODS	0.38	0.36	0.09	0.28	1	
OTHER	0.11	0.81	0.04	0.32	1	
Σ	37.82	32.03	49.53	39.79	101	
			n/m^2			
POLYCHAETES	3935	4839	2472	3838.67	96	Prionospio cirrifera, Scolecolepides arctius, Chone sp., Terebellides stroemi, Tharyx sp.
OLIGOCHAETES			40	13.33	0	
GASTROPODS						
BIVALVES	60	80	90	76.67	2	
ISOPODS	10		10	6.67	0	
AMPHIPODS	40	60	20	40.00	1	
OTHER	40	30	40	36.67	1	
Σ	4085	5009	2942	4012.00	100	

TABLE 1.27. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION J2C (70°35.5'N, 150°25.0'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	3.80	3.35	2.77	3.31	11	Prionospio cirrifera
OLIGOCHAETES						
GASTROPODS	1.26	0.15	0.18	0.53	2	Oenopota sp!
BIVALVES	35.93	12.78	19.62	22.78	78	Portlandia intermedia, Portlandia arctica!
ISOPODS	5.35	0.13	0.14	1.87	6	Saduria sabini
AMPHIPODS	0.56	1.23	0.02	0.60	2	Boekosimus affinis
OTHER		0.88		0.29	1	
Σ	46.90	18.52	22.73	29.38	100	
			n/m^2			
POLYCHAETES	2735	4200	2054	2996.33	62	Chone sp., Tharyx spp., Prionospio cirrifera
OLIGOCHAETES	120	50	10	60.00	1	Oenopota sp!
GASTROPODS	2140	1310	590	1346.67	28	Portlandia intermedia, Axinopsida orbiculata, Portlandia arctica
BIVALVES						
ISOPODS	20	10	10	13.33	0	
AMPHIPODS	60	10	10	26.67	1	
OTHER		1090		363.33	8	Ascidiacea!
Σ	5075	6670	2674	4806.33	100	

TABLE 1.28. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION K2A (70°39.2'N, 151°27.2'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	11.31	9.46	17.56	12.78	53	Sternaspis scutata, Prionospio cirrifera, Scolecolepides arctius
OLIGOCHAETES						
GASTROPODS	0.14	0.05	0.08	0.09	0	
BIVALVES	2.15	8.41	23.18	11.25	46	Portlandia arctica! Macoma calcarea
ISOPODS						
AMPHIPODS	0.00	0.17	0.40	0.19	1	
OTHER	0.04		0.07	0.04	0	
Σ	13.64	18.09	41.29	24.34	100	
			n/m^2			
POLYCHAETES	3977	3977	4664	4206.00	81	Prionospio cirrifera! Chone sp.
OLIGOCHAETES						
GASTROPODS	60	20	20	33.33	1	
BIVALVES	210	660	1910	926.67	18	Portlandia arctica! Portlandia intermedia
ISOPODS						
AMPHIPODS	3	10	60	24.33	0	
OTHER	20		10	10.00	0	
Σ	4270	4667	6664	5200.33	100	

TABLE 1.29. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION K3A (70°36.7'N, 151°33.5'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF 0.1m^2 SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	9.38	14.55	4.70	9.54	18	Scolecolepides arctius, Prionospio cirrifera
OLIGOCHAETES						
GASTROPODS	0.01		0.95	0.32	1	
BIVALVES	5.43	0.14	3.49	3.02	6	Portlandia arctica!
ISOPODS	56.73	66.85		41.19	76	Saduria entomon!
AMPHIPODS			0.06	0.02	0	
OTHER	0.15	0.44	0.37	0.32	1	
Σ	71.70	81.97	9.57	54.41	102	
			n/m^2			
POLYCHAETES	3057	3250	2187	2831.33	83	Chaetozone setosa, Ampharete vega, Scolecolepides arctius, Prionospio cirrifera, Tharyx sp., Chone sp.
OLIGOCHAETES						
GASTROPODS	10		60	23.33	1	
BIVALVES	180	180	1070	476.67	14	Axinopsida serricata! Portlandia arctica, Boreacola vadosa
ISOPODS	100	10		36.67	1	Saduria entomon!
AMPHIPODS			60	20.00	1	
OTHER	40	20	60	40.00	1	
Σ	3387	3460	3437	3428.00	101	

TABLE 1.30. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION K4A (70°34.0'N, 151°40.1'W, 2 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	37.98	34.72	17.05	29.92	49	Ampharete vega, Tharyx sp., Scolecolepides arctius, Terebellides stroemi
OLIGOCHAETES	0.65	1.03	0.13	0.60	1	Tubificidae!
GASTROPODS						
BIVALVES	29.63	31.39	19.61	26.88	44	Cyrtodaria kurriana!
ISOPODS	0.13	1.40	0.48	0.67	1	Saduria entomon!
AMPHIPODS	0.74	0.54	0.46	0.58	1	
OTHER	4.59	0.87	0.96	2.14	4	Halicryptus spinulosus!
Σ	73.72	69.95	38.69	60.79	100	
			n/m^2			
POLYCHAETES	16,885	15,061	9,597	13,847.67	86	Tharyx sp! Ampharete vega, Scolecolepides arctius, Chone sp.
OLIGOCHAETES	1,620	3,000	480	1,700.00	11	tubificidae!
GASTROPODS						
BIVALVES	170	260	200	210.00	1	Cyrtodaria kurriana!
ISOPODS	10	30	30	23.00	0	
AMPHIPODS	190	160	170	173.33	1	Pontoporeia femorata!
OTHER	180	180	290	216.67	1	Halicryptus spinulosus! Diastylis sulcata
Σ	19,055	18,691	10,767	16,171.00	100	

TABLE 1.31. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION LØA (70°53.5'N, 152°08.7'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	SAMPLE B	SAMPLE C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	8.18	14.50	11.10	11.26	38	Sternaspis scutata, Praxillella praetermissa, Prionospio cirrifera, Nephtys caeca
OLIGOCHAETES						
GASTROPODS			0.07	0.02	0	
BIVALVES	4.29	2.66	21.67	9.54	33	Portlandia arctica! Macoma calcarea!
ISOPODS		6.59	0.94	2.51	9	Saduria sabini
AMPHIPODS	1.44	1.36	1.52	1.44	5	Pontoporeia femorata
OTHER		0.42	13.32	4.58	16	Priapulus caudatus!
Σ	13.91	25.53	48.62	29.35	101	
			n/m^2			
POLYCHAETES	2456	3099	3521	3025.33	84	Chone sp., Prionospio cirrifera! Capitella capitata, Cossura longocirrata
OLIGOCHAETES						
GASTROPODS			10	3.33	0	
BIVALVES	450	230	410	363.33	10	Portlandia arctica! Axinopsida orbiculata
ISOPODS		10	10	6.67	0	
AMPHIPODS	130	250	150	176.67	5	Melita formosa, Pontoporeia femorata
OTHER		20	30	16.67	0	
Σ	3036	3609	4131	3592.00	99	

TABLE 1.32. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION L1A (70°50.8'N, 152°15.5'W, 2 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
	g/m^2			
POLYCHAETES	1.37	1.37	20	
OLIGOCHAETES				
GASTROPODS				
BIVALVES				
ISOPODS	5.22	5.22	77	Saduria entomon
AMPHIPODS	0.08	0.08	1	
OTHER	0.12	0.12	2	
Σ	6.79	6.79	100	
	n/m^2			
POLYCHAETES	427	427.00	74	
OLIGOCHAETES				
GASTROPODS				
BIVALVES				
ISOPODS	30	30.00	5	
AMPHIPODS	100	100.00	17	
OTHER	20	20.00	3	
Σ	577	577.00	99	

TABLE 1.33. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION L1B (70°51.3'N, 152°14.0'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
	g/m^2			
POLYCHAETES	7.87	7.87	56	Prionospio cirrifera
OLIGOCHAETES				
GASTROPODS				
BIVALVES	5.30	5.30	38	Portlandia arctica
ISOPODS				
AMPHIPODS	0.44	0.44	3	
OTHER	0.41	0.41	3	
Σ	14.02	14.02	100	
	n/m^2			
POLYCHAETES	3344	3344.00	80	Sphaerodoropsis minuta, Nereimyra aphroditoides, Spio filicornis, Tharyx spp., Prionospio cirrifera
OLIGOCHAETES				
GASTROPODS				
BIVALVES	290	290.00	7	Portlandia intermedia
ISOPODS				
AMPHIPODS	70	70.00	2	
OTHER	480	480.00	11	Rhynchocoela
Σ	4184	4184.00	100	

TABLE 1.34. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION M1C (71°00.0'N, 153°15.3'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	2.75	3.91	12.73	6.46	33	Prionospio cirrifera, Sternaspis scutata, Praxillella praetermissa, Terebellides stroemi
OLIGOCHAETES	0.77		0.36	0.38	2	
GASTROPODS	0.05		0.01	0.02	0	
BIVALVES	4.54	9.39	3.26	5.73	29	Portlandia arctica! Macoma loveni
ISOPODS	5.39		9.19	4.86	25	Saduria siberica, Saduria sabini!
AMPHIPODS	4.97	0.27	0.58	1.94	10	Melita formosa!
OTHER		0.33		0.11	1	
Σ	18.47	13.90	26.13	19.50	100	
			n/m^2			
POLYCHAETES	2640	1025	1566	1743.67	58	Cirrophorus sp., Cossura longocirrata, Prionospio cirrifera, Capitella capitata, Chone sp.
OLIGOCHAETES	810		750	520.00	17	Tubificidae!
GASTROPODS	10	10	10	10	0	
BIVALVES	420	790	380	530.00	17	Portlandia arctica! Portlandia intermedia
ISOPODS	30		40	23.33	1	
AMPHIPODS	460	70	70	200.00	7	Melita formosa!
OTHER		10		3.33	0	
Σ	4370	1905	2816	3030.33	100	

TABLE 1.35. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION M1D (70°56.6'N, 153°15.3'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF 0.1m^2 SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
		g/m^2			
POLYCHAETES	10.49	14.18	12.34	8	Terebellides stroemi, Scoloplos armiger, Ampharete vega, Ampharete acutifrons
OLIGOCHAETES					
GASTROPODS	0.31		0.16	0	
BIVALVES	46.99	49.26	48.13	30	Cyrtodaria kurriana, Portlandia arctica, Liocyma fluctuosa, Axinopsida orbiculata, Boreacola vadosa, Macoma loveni, Portlandia intermedia
ISOPODS	193.34		96.67	61	Saduria entomon!
AMPHIPODS	0.09		0.05	0	
OTHER	0.23	0.81	0.52	0	
	Σ 251.45	64.25	157.87	99	
		n/m^2			
POLYCHAETES	3302	3184	3243.00	37	Prionospio cirrifera, Spio filicornis, Chone sp., Ampharete vega, Terebellides stroemi, Scoloplos armiger, Eteone longa Ampharete acutifrons
OLIGOCHAETES					
GASTROPODS	30		15.00	0	
BIVALVES	9140	1430	5285.00	60	Portlandia arctica, Liocyma fluctuosa, Axinopsia orbiculata, Boreacola vadosa, Macoma loveni, Cyrtudaria kurriana
ISOPODS	40		20.00	0	
AMPHIPODS	10		5.00	0	
OTHER	380	30	205.00	2	Harpacticoida!
	Σ 12902	4644	8773.00	99	

TABLE 1.36. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION M1E (70°55.3'N, 153°15.3'W, 3 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	18.93	21.01	25.09	21.68	46	Scolecolepides arctius, Ampharete vega, Scoloplos armiger, Terebellides stroemi
OLIGOCHAETES						
GASTROPODS	1.79	3.39	1.79	2.32	5	Admete couthouyi, Natica sp., Oenopota sp.
BIVALVES	18.24	28.91	12.00	19.72	42	Portlandia arctica, Boreacola vadosa, Liocyma fluctuosa, Portlandia intermedia, Cyrtodaria kurriana
ISOPODS						
AMPHIPODS	0.03	2.42	3.43	1.96	4	Atylus carinatus, Acanthostepheia behringiensis
OTHER	2.95	0.75	0.04	1.25	3	Rhynchocoela!
Σ	41.94	56.48	42.35	46.93	100	
			n/m^2			
POLYCHAETES	2384	4306	2535	3075.00	63	Sphaerodoropsis minuta, Prionospio cirrifera, Chone sp., Ampharete vega, Scoloplos armiger, Spio filicornis, Capitella capitata, Terebellides stroemi, Eteone longa
OLIGOCHAETES						
GASTROPODS	110	110	80	100.00	2	
BIVALVES	1480	2600	750	1610.00	33	Boreacola vadosa, Liocyma fluctuosa Portlandia intermedia
ISOPODS						
AMPHIPODS	20	80	90	63.33	1	
OTHER	40	100	10	50.00	1	
Σ	4034	7196	3465	4898.33	100	

TABLE 1.37. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION N1A (70°55.2'N, 154°13.5'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	1.53	14.89	1.59	6.00	10	Prionospio cirrifera, Melanis loveni
OLIGOCHAETES			0.00	0.00	0	
GASTROPODS	0.15	5.80	0.47	2.14	4	Natica sp!
BIVALVES	28.63	65.37	37.07	43.69	72	Portlandia intermedia, Macoma loveni Portlandia arctica, Astarte borealis Liocyma fluctuosa
ISOPODS	23.67	0.10		7.92	13	Saduria sabini!
AMPHIPODS		0.01	1.85	0.62	1	Atylus carinatus!
OTHER	0.01	0.53	0.16	0.23	0	
Σ	53.99	86.70	41.14	60.60	100	
			n/m^2			
POLYCHAETES	682	2482	1304	1489.33	39	Ampharete vega, Prionospio cirrifera, Tharyx sp., Chone sp., Terebellides stroemi, Spio filicornis, Cirratulidae, Sphaerodoropsis minuta
OLIGOCHAETES			30	10.00	0	
GASTROPODS	40	110	10	53.33	1	
BIVALVES	1870	2220	2220	2103.33	54	Portlandia intermedia, Portlandia arctica, Axinopsida orbiculata, Liocyma fluctuosa, Boreacola vadosa
ISOPODS	10	10		6.67	0	
AMPHIPODS		20	20	13.33	0	
OTHER	10	540	20	190.00	5	Halicryptus spinulosus
Σ	2612	5382	3604	3866.00	99	

TABLE 1.38. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION N1C (71°00.6'N, 154°10.5'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	6.33	82.03	91.05	59.80	47	Nephtys ciliata, Sternaspis scutata! Terebellidae unk., Terebellides stroemi, Ammotrypane cylindricaudatus, Prionospio cirrifera
OLIGOCHAETES						
GASTROPODS	1.46	4.03		1.83	1	Natica sp!
BIVALVES	39.90	48.07	21.39	36.45	28	Portlandia arctica, Portlandia intermedia, Macoma calcarea, Liocyma fluctuosa, Macoma loveni
ISOPODS	30.38	52.79	1.01	28.06	22	Saduria sabini!
AMPHIPODS	1.54	2.04	1.93	1.84	1	Pontoporeia femorata!
OTHER	0.11		0.01	0.04	0	
Σ	79.72	188.96	115.39	128.02	99	
			n/m^2			
POLYCHAETES	1612	1401	2286	1766.33	39	Nephtys paradoxica, Prionospio cirrifera, Cossura longocirrata, Aricidea suecica, Cirrophorus sp., Sternaspis scutata
OLIGOCHAETES						
GASTROPODS	60	140		66.67	1	
BIVALVES	2230	2750	1580	2186.67	48	Portlandia intermedia, Portlandia arctica, Macoma moesta
ISOPODS	40	40	20	33.33	1	
AMPHIPODS	500	500	470	490.00	11	Pontoporeia femorata!
OTHER	30		20	16.67	0	
Σ	4472	4831	4376	4559.67	100	

TABLE 1.39. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION N4A (71°04.0'N, 154°41.5'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	4.50	9.84	6.71	7.02	32	Ampharete acutifrons, Melanis loveni, Scoloplos armiger
OLIGOCHAETES						
GASTROPODS						
BIVALVES	15.02	19.13	6.40	13.52	62	Portlandia arctica!
ISOPODS						
AMPHIPODS	0.08	0.19	1.69	0.65	3	Boeckosimus affinis
OTHER	1.30	0.81	0.04	0.72	3	Echiurus echiurus alaskensis
Σ	20.90	29.97	14.84	21.91	100	
			n/m^2			
POLYCHAETES	1090	1742	1215	1349.00	76	Chone sp., Prionospio cirrifera, Tharyx sp., Cirrophorus sp.
OLIGOCHAETES						
GASTROPODS						
BIVALVES	300	340	130	256.67	15	Portlandia arctica!
ISOPODS						
AMPHIPODS	40	50	60	50.00	3	
OTHER	20	30	290	113.33	6	Rhynchocoela!
Σ	1450	2162	1695	1769.00	100	

TABLE 1.40. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION N4B (71°05.5'N, 154°35.7'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	40.12	10.81	0.14	17.02	29	Sternaspis scutata! Terebellidae
OLIGOCHAETES						
GASTROPODS	0.28	0.13		0.14	0	
BIVALVES	5.42	75.20	34.31	38.31	66	Portlandia arctica! Lyonsia arenosa Macoma calcarea
ISOPODS			5.88	1.96	3	Saduria siberica!
AMPHIPODS		0.93	1.77	0.90	2	Protomedia stephenseni
OTHER		0.10	0.14	0.08	0	
Σ	45.82	87.17	42.24	58.41	100	
			n/m^2			
POLYCHAETES	1224	1015	274	837.67	42	Sternaspis scutata, Cossura longocirrata, Cirrophorus sp., Arcidea suecica
OLIGOCHAETES						
GASTROPODS	20	90		36.67	2	
BIVALVES	370	1810	740	973.33	49	Portlandia arctica, Portlandia intermedia
ISOPODS			40	13.33	1	
AMPHIPODS		60	80	46.67	2	
OTHER		160	30	63.33	3	Rhynchocoela!
Σ	1614	3135	1164	1971.00	99	

TABLE 1.41. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION 04C (71°14.3'N, 155°40.5'W, 2 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	SAMPLE B	SAMPLE C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	0.64	0.51	0.21	0.45	25	
OLIGOCHAETES		0.01			0	
GASTROPODS						
BIVALVES	0.02	0.05		0.02	1	
ISOPODS						
AMPHIPODS	0.09	0.03	0.01	0.04	2	
OTHER		1.57	2.27	1.28	71	Rhynchocoela!
Σ	0.74	2.17	2.50	1.80	99	
			n/m^2			
POLYCHAETES	900	510	260	556.65	75	Spio filicornis!
OLIGOCHAETES		100		33.33	5	Enchytraeidae!
GASTROPODS						
BIVALVES	30	20		16.67	2	
ISOPODS						
AMPHIPODS	140	40	20	66.67	9	Monoculopsis longicornis
OTHER		20	180	66.67	9	Rhynchocoela!
Σ	1070	690	460	740.00	100	

TABLE 1.42. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION 04D (71°14.7'N, 155°40.5'W, 5 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	5.86	21.99	2.17	10.01	59	Scoloplos armiger, Terebellides stroemi, Arenicola glacialis! Nephtys caeca
OLIGOCHAETES						
GASTROPODS						
BIVALVES	3.17	11.33	1.22	5.24	31	Portlandia arctica!
ISOPODS						
AMPHIPODS		2.90	1.74	1.55	9	Acanthostepheia behringiensis, Boekosimus affinis!
OTHER	0.07	0.03	0.10	0.07	0	
Σ	9.10	36.25	5.23	16.87	99	
			n/m^2			
POLYCHAETES	1390	2611	1609	1870.00	86	Terebellides stroemi, Chone sp., Prionospio cirrifera, Spio filicornis
OLIGOCHAETES						
GASTROPODS						
BIVALVES	230	550	50	276.67	13	Portlandia arctica, Axinopsida orbiculata
ISOPODS						
AMPHIPODS		50	20	23.33	1	
OTHER	20	20	10	16.67	1	
Σ	1640	3231	1689	2186.67	101	

TABLE 1.43. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION 04E (71°17.2'N, 155°40.5'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	14.53	3.90	4.62	7.68	16	Chone sp., Nephtys caeca, Terebellidae
OLIGOCHAETES	0.10	0.02	0.07	0.06	0	
GASTROPODS	0.16	0.13	0.03	0.11	0	
BIVALVES	9.51	8.55	5.70	7.92	16	Portlandia arctica, Macoma calcarea, Lyonsia arenosa
ISOPODS		99.13		33.04	67	Saduria entomon!
AMPHIPODS	0.03	0.25	0.93	0.40	1	
OTHER	0.76	0.05	0.07	0.29	1	
Σ	25.08	112.03	11.41	49.50	101	
			n/m^2			
POLYCHAETES	5675	2981	2896	3850.67	80	Aricidea suecica, Cossura longocirrata, Chone sp., Chaetozone setosa, Spio filicornis, Nephtys paradoxa, Tharyx sp., Cirrophorus sp.
OLIGOCHAETES	290	240	270	266.67	6	Tubificidae!
GASTROPODS	10	10	10	10.00	0	
BIVALVES	300	610	270	393.33	8	Portlandia arctica, Macoma calcarea, Macoma loveni
ISOPODS		11		3.67	0	
AMPHIPODS	30	460	190	226.67	5	Pontoporeia femorata!
OTHER	50	80	30	53.33	1	
Σ	6355	4392	3666	4804.33	100	

TABLE 1.44. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION P2D (71°23.3'N, 156°27.1'W, 2 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES		0.04		0.01	1	
OLIGOCHAETES						
GASTROPODS						
BIVALVES						
ISOPODS						
AMPHIPODS	0.31	0.10	0.00	0.14	13	
OTHER	1.60	0.26	0.92	0.92	86	Rhynchocoela!
Σ	1.90	0.40	0.92	1.07	100	
			n/m^2			
POLYCHAETES		21		7.00	0	
OLIGOCHAETES						
GASTROPODS						
BIVALVES						
ISOPODS						
AMPHIPODS	285	30	10	108.33	1	Gammarus zaddachi
OTHER	35041	2130	10360	15843.67	99	Rhynchocoela!
Σ	35326	2181	10370	15959.00	100	

TABLE 1.45. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION P2E (71°23.4'N, 156°27.0'W, 6 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	2.80	2.14	0.91	1.95	36	Nephtys ciliata
OLIGOCHAETES		0.11		0.04	1	
GASTROPODS	0.38		0.08	0.15	3	
BIVALVES	1.44	0.11	0.36	0.64	12	Clinocardium ciliatum
ISOPODS			3.84	1.28	23	Saduria entomon!
AMPHIPODS	0.00	2.97		0.99	18	Acanthostepheia behringiensis
OTHER	1.25			0.42	8	Rhynchocoela!
Σ	5.87	5.33	5.19	5.47	101	
			n/m^2			
POLYCHAETES	317	271	226	271.33	66	Nephtys ciliata
OLIGOCHAETES		130		43.33	11	Tubificidae!
GASTROPODS	20		10	10.00	2	
BIVALVES	70	40	70	60.00	15	
ISOPODS			10	3.33	1	
AMPHIPODS	10	50		20.00	5	
OTHER	10			3.33	1	
Σ	427	491	316	411.33	101	

TABLE 1.46. WET WEIGHT BIOMASS AND NUMBER OF INDIVIDUALS OF SIX CATEGORIES OF MACROBENTHONIC ANIMALS PER m^2 AT STATION P2F (71°25.8'N, 156°27.2'W, 10 m, depth) IN AUGUST, 1977. DATA ARE DERIVED FROM CATCH OF $0.1m^2$ SMITH-MCINTYRE GRAB SCREENED THROUGH 0.423mm NITEX. PRINCIPAL SPECIES ARE THOSE REPRESENTED BY EITHER 1.0g OF WET WEIGHT BIOMASS OR 100 INDIVIDUALS PER m^2 IN AT LEAST ONE SAMPLE. IF FOLLOWED BY !, THE SPECIES ACCOUNTED FOR VIRTUALLY ALL OF THE NUMBER OR MASS OF THAT TAXONOMIC CATEGORY IN AT LEAST ONE SAMPLE.

TAXONOMIC CATEGORY	SAMPLE A	B	C	$\bar{X}$	% OF TOTAL	PRINCIPAL SPECIES
			g/m^2			
POLYCHAETES	4.61	0.25	0.03	1.63	66	Pectinaria (Cystenides) hyperborea, Anaitides groenlandica
OLIGOCHAETES		0.01			0	
GASTROPODS			0.06	0.02	1	
BIVALVES	1.30	0.02		0.44	18	Thracia sp.
ISOPODS						
AMPHIPODS	0.01	0.72	0.39	0.37	15	
OTHER						
Σ	5.92	1.00	0.48	2.47	100	
			n/m^2			
POLYCHAETES	602	80	4	228.67	90	Prionospio cirrifera, Pectinaria (Cystenides) hyperborea
OLIGOCHAETES		10		3.33	1	
GASTROPODS			20	6.67	3	
BIVALVES	10	10		6.67	3	
ISOPODS						
AMPHIPODS	10	10	10	10.00	4	
OTHER						
Σ	622	110	34	255.33	101	

TABLE 1.47: Catch of epibenthic sled net at several Beaufort Sea stations in 1977. See text for discussion of net and technique. Locations of stations are given in tables 1.3 to 1.46. Data are standardized for a 50 m tow and are comparable to sled net data reported previously by RU-356, but should not be used in direct comparison to data from bottom grabs. Wet weight biomass in grams appears in columns g and numbers of animals in columns n.

STATION	C1A		C1B		C4E		C4G		DØA		DØB		D5A	
	g	n	g	n	g	n	g	n	g	n	g	n	g	n
ALL ANIMALS	6.33	2834	8.64	240	12.24	2508	1.42	139	19.24	274	0.32	12	9.33	754
Mysis littoralis	1.63	618	7.86	157	1.88	206	0.51	16	0.50	62	0.12	3	4.83	674
Mysis relicta	3.81	1441												
Saduria entomon					9.03	1			18.27	4			4.25	1
Calanus hyperboreus	0.37	657			1.02	2274	0.11	80	0.33	201			0.11	61
Thysanoessa raschii							0.47	12						
Amphipods and other crustacea	0.49	113	0.58	20	0.19	21	0.16	5			0.05	2	0.09	8
See footnote			0.02[1]	49[1]							0.13[2]	1[2]		
% of total	99	99	98	94	99	99	88	81	99	97	94	50	99	99

Table 1.47, continued

STATION	D5B		FØB		FØC		G3B		G3C		G3D		HØA	
	g	n	g	n	g	n	g	n	g	n	g	n	g	n
ALL ANIMALS	1.28	89	17.58	376	1.80	87	0.82	251	3.66	456	2.69[5]	101[5]	24.31	4124
Mysis littoralis	0.23	27	6.34	183	0.12	29	0.27	87	1.84	250			21.57	3354
Mysis relicta							0.30	49						
Saduria entomon			7.54	3					0.85	1				
Calanus hyperboreus			0.10	129					0.12	167			0.34	295
Thysanoessa raschii	0.31	7	0.40	8										
Amphipods and other crustacea	0.12	7	1.97	49	1.33	39	0.18	57	0.02	17	0.34	58	0.26	45
See footnote	0.21[3]	40[3]	1.18[4]	1[4]			0.06[1]	50[1]			1.31[6]	2[6]	1.36[7]	314[7]
% of total	68	91	99	99	81	78	99	97	77	95	61	59	97	97

Table 1.47, continued

STATION	HØB		HØC		H3B		H3G		H3H		I3H		J2A	
	g	n	g	n	g	n	g	n	g	n	g	n	g	n
ALL ANIMALS	0.17	42	1.07	112	90.79	8420	14.69	152	0.36	49	16.40	1113	3.42	382
Mysis littoralis					9.43	993					9.46	999	1.88	84
Mysis relicta					63.11	6645								
Saduria entomon					12.99	16	12.83	9			5.89	2		
Calanus hyperboreus			0.15	58					0.03	10			0.32	202
Thysanoessa raschii														
Amphipods and other crustacea	0.13	31	0.12	36	2.10	47	0.66	68	0.30	30	0.69	84	0.77	69
See footnote			0.30[8]	21[8]	2.90[9]	632[9]	1.16[10]	64[10]						
% of total	76	74	53	94	99	99	99	93	92	82	98	97	87	93

Table 1.47, continued

STATION	J2C		K3A		K4A		LØA		L1A		L1B		M1C	
	g	n	g	n	g	n	g	n	g	n	g	n	g	n
ALL ANIMALS	1.06	221	1.95	212	5.19	648	3.85	325	5.74	734	7.93	502	1.03	153
Mysis littoralis	0.18	5	1.14	132	1.93	198	1.48	157	3.85	465	2.24	150		
Mysis relicta					1.13	117			0.58	70	0.56	38		
Saduria entomon											2.79	1		
Calanus hyperboreus	0.50	171	0.17	33					0.10	79				
Thysanoessa raschii														
Amphipods and other crustacea	0.09	7	0.02	4	0.10	38	0.45	30	1.09	113	0.69	136	0.24	22
See footnote	0.19[7]	31[7]	0.57[11]	40[11]	1.88[12]	279[12]	1.86[11]	130[11]			0.87[13]	8[13]	0.69	122
% of total	91	97	97	99	97	98	98	98	98	99	90	66	90	94

Table 1.47, continued

STATION	M1D		M1E		N1A		N1C		N4A		N4B		O4C	
	g	n	g	n	g	n	g	n	g	n	g	n	g	n
ALL ANIMALS	8.23	776	5.10	274	10.75	775	8.41	734	5.81	331	10.78	1180	3.04	424
Mysis littoralis	4.91	524	1.39	64	1.12	159	2.92	156	0.37	71	7.28	760		
Mysis relicta			1.92	84										
Saduria entomon	1.03	1	1.05	1					1.47	1				
Calanus hyperboreus														
Thysanoessa raschii														
Amphipods and other crustacea	1.15	123	0.62	121	0.95	230	2.30	296	0.35	38	0.70	154	0.11	34
See footnote	0.45[14]	115[14]			8.55[11]	370[11]	3.04[11]	266[11]	3.33[7,11,13]	181[7,11,13]	1.91[11]	253[11]	2.82[7,11,13]	357[7,11,13]
% of total	92	98	98	99	99	98	98	98	95	88	92	99	96	92

Table 1.47, continued

STATION	04D		04E		P2D		P2F	
	g	n	g	n	g	n	g	n
	1.01	100	0.27	15	0.49	97	0.10	36
Mysis littoralis	0.15	27			0.20	48		
Mysis relicta								
Saduria entomon								
Calanus hyperboreus							0.01	12
Thysanoessa raschii								
Amphipods and other crustacea	0.45	19	0.15	13	0.07	4		
See footnote	0.41[11,15]	45[11,15]	0.10[16]	1[16]	0.21[11,17]	43[11,17]	0.06[11,17]	21[11,17]
% of total	100	91	93	93	98	98	70	92

Footnotes

1. Calanoida
2. Delectopecten groenlandicus
3. Calanus sp.
4. Liparis sp.
5. 43 species total
6. Eualus gaimardii belcheri
7. Limacina helicina
8. Mollusca
9. Onisimus glacialis
10. Mysis sp.
11. Sagitta elegans
12. Diastylis sulcata
13. Portlandia arctica
14. Apherusa glacialis
15. Aglantha digitale
16. Myoxocephalus quadricornis
17. Oikopleura vanhoffeni

Repetitive Sampling of the Beaufort Nearshore Region in 1977

A. C. Broad

Introduction

In 1977, repetitive sampling at selected Beaufort and Chukchi shore stations was begun. This program was designed to yield data on composition of nearshore biota, whether this structure is stable or subject to seasonal variation, annual and seasonal reproductive events, immigration to or emigration from the nearshore region, and other events that might contribute to ecological assessment. In this report, we deal with eastern Beaufort Sea stations sampled three times during the 1977 summer.

Methods

Beach transects and extensions of transects were made at Nuvagapak Point in the Arctic Wildlife Range, at Barter Island, Prudhoe Bay and in the Colville River delta. The locations of stations sampled are given in appended tables 2.1 to 2.7. The methods employed in sampling are those that have been reported previously. Infaunal benthos was sampled with a pole-mounted Ekman grab ($0.0231 m^2$) and washed in the field in a 0.516 mm screen-bottomed pail. Motile, epibenthic organisms were sampled with a Wildco (Cat. No. 171) scrape/skid dredge with 1.05 mm mesh bag. Salinity and temperature data with a YS1 Model 33 SCT meter, surface plankton samples and substrate samples for bottom analyses were taken and will be dealt with in a future report.

All samples were preserved in the field in 10% formalin and shipped to Bellingham where they were sorted, weighed, and subsequently preserved in alcohol.

Results

Infaunal benthos at depths of less than about 0.5 m yielded virtually no animals during the 1977 sampling of selected stations. The yields of

Ekman grabs, expressed in grams of wet weight biomass per m^2 and number of individuals per m^2 of several taxonomic categories of animals, percentage composition of the fauna in both mass and numbers, and average weights of individuals are given in Tables 2.1 to 2.7 appended to this section. Tables 2.8 to 2.14 give comparable data for motile, epibenthic animals taken in the scrape/skid dredge or sled net. Those wet weight biomass data expressed as "K" values are in grams rounded to the nearest 100 mg. When large catches of mysids were made, the total biomass so far exceeded that of other animals that errors introduced by this abreviation are negligible.

Discussion

In Nuvagapak Lagoon, Prudhoe Bay, and the Colville River delta (Tables 2.2, 2.5 and 2.7), infaunal biomass was greater than at other stations which probably reflects not only the larger number of samples and the greater depth of the collections but also a stability based on that depth and the larger biomass. The shallower stations sometimes showed marked variation between sampling periods attributable to motile isopods and amphipods included in the samples and to generally low numbers of individuals and, possibly, to patchy distribution. Nevertheless, the infaunal benthos was, throughout, more stable than was the epibenthos (Tables 2.7 to 2.14).

The samples made with the sled net must not be compared directly with those taken with the Ekman grab. While the latter are quantitative, the sled net, at best, is approximately so. The area covered by the net during a 50 m tow is approximately 19 m^2, but the net does not behave in a standard manner when towed, sometimes digging in and sometimes skimming the surface. Animals may avoid the net which, when full or partially so, tends to push water away from its mouth. The sled net data, therefore, are used only in comparison within that group, but trends shown in the epibenthos may be considered along with trends in the infaunal benthos.

While the benthos was generally stable, the catches of the epibenthic sled net varied widely in numbers and in biomass during the summer. The samples from the deeper stations (Tables 2.9, 2.12, and 2.14) were generally larger than those from the shallower ones, especially when comparisons were made between locations close to one another, but, as noted elsewhere by us, the differences between nearshore and inshore epibenthic crustacean samples is not as striking as is the difference between the infaunal populations of the two regions.

A reasonably consistent trend in the samples of both motile, epibenthic animals and infauna is an increase in the number of individuals in midsummer over that in the earliest samples. In part, this may be the result of immigration into the nearshore region following melting of the shorefast ice, but this would hardly obtain for oligochaetes and polychaetes. Despite the increase in number, there is usually a decrease in polychaete biomass in midsummer, and this is reflected in a smaller average size of individuals. A decrease in average size of infaunal amphipods also is shown in the Ekman grab data, but generally (Table 2.8 provides an exception) epibenthic amphipods and mysids increased in number and biomass in midsummer and, hence, in average size of individuals.

These observations are consistent with early summer recruitment of young (following late winter or spring reproduction) polychaetes and infaunal (burrowing) amphipods which begin to enter catches by midsummer. If the same recruitment obtains for mysids, our data do not illustrate it.

In a most general way, our data for polychaetes, mysids, and Saduria entomon show a larger average size of individuals in late summer than in midsummer and, often, a decrease in both number and biomass. Such trends are consistent with growth and predation during the summer. Our infaunal amphipod data also show that larger individuals were caught late in the summer. The sled net, however, which should be less effective in sampling burrowing forms (but Pontoporeia affinis was abundant in these catches) caught usually smaller amphipods at the summer's end than it had earlier. Whether this apparent decrease in average size is the result of recruitment of young later in the season, we are not prepared to say.

It should be stressed that the data on which this brief discussion was based are quotients of biomass of samples divided by number of individuals. Such statistics may suggest dynamics of populations and, thereby, indicate the desirability of studies, but can not, in themselves, establish recruitment, predation or growth rates. The trends noted could also have resulted from different mobility of different sizes of the more active animals.

TABLE 2.1. NUVAGAPAK POINT - BENTHIC FAUNA IN 1977. DATA ARE FROM EKMAN GRAB SAMPLES TAKEN ON: A = 7/29,30, B = 8/15,16, AND C = 9/1, AND WASHED THROUGH A 0.516mm SCREEN. NUMBER OF SAMPLES IS: A = 11, B = 7, C = 4. SAMPLES WERE TAKEN AT:

STATION	N. LATITUDE	W. LONGITUDE	DEPTH (m)
B16	69°54.4'	142°16.8'	0.5
B17	69°53.3'	142°18.0'	0.5

TAXONOMIC CATEGORY	BIOMASS						NUMBER						mg/INDIVIDUAL		
	g/m^2			%			n/m^2			%					
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
POLYCHAETES															
OLIGOCHAETES															
ISOPODS[1]	17.24	0.02		95	2		42	7		43	3		410.48	2.86	
AMPHIPODS	0.94	0.83	7.54	5	89	100	56	137	368	57	62	100	16.79	6.06	20.49
OTHER		0.08			9			76			35			1.05	
Σ	18.18	0.93	7.54	100	100	100	98	220	368	100	100	100			

[1]Saduria entomon

TABLE 2.2. NUVAGAPAK LAGOON - BENTHIC FAUNA IN 1977. DATA ARE FROM EKMAN GRAB SAMPLES TAKEN ON: A = 7/28, B = 8/14, AND C = 9/1, AND WASHED THROUGH A 0.516mm SCREEN. NUMBER OF SAMPLES IS: A = 18, B = 18, C = 17. SAMPLES WERE TAKEN AT:

STATION	N. LATITUDE	W. LONGITUDE	DEPTH (m)
B1F	69°53.4'	142°18.0'	1.0
B1G	69°53.6'	142°17.5'	3.0
B1H	69°53.8'	142°15.8'	2.5

TAXONOMIC CATEGORY	BIOMASS						NUMBER						mg/INDIVIDUAL		
	g/m			%			n/m			%					
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
POLYCHAETES	11.95	11.88	7.78	30	40	26	1366	2640	1754	48	39	59	8.75	4.50	4.44
OLIGOCHAETES	0.56	0.45	0.18	1	2	1	714	724	402	25	11	14	0.78	0.62	0.45
ISOPODS	3.72	1.56		9	5	0	29	24		1	0	0	128.28	65.00	
AMPHIPODS	3.42	2.64	2.39	9	9	8	291	534	308	10	8	10	11.75	4.94	7.76
OTHER[1]	20.23	12.82	20.13	51	44	66	416	2902	499	15	43	17	48.63	4.42	40.34
Σ	39.89	29.34	30.49	100	100	101	2816	6824	2963	99	101	100			

[1]Molgula griffithsii

TABLE 2.3. BARTER ISLAND - BENTHIC FAUNA IN 1977. DATA ARE FROM EKMAN GRAB SAMPLES TAKEN ON: A = 7/24,25, B = 8/13, and C = none, AND WASHED THROUGH A 0.516mm SCREEN. NUMBER OF SAMPLES IS: A = 12, B = 3, C = 0. SAMPLES WERE TAKEN AT:

STATION	N. LATITUDE	W. LONGITUDE	DEPTH (m)
C38	70°06.2'	143°38.1'	0.4
C39	70°08.1'	143°39.2'	0.5

TAXONOMIC CATEGORY	BIOMASS g/m²			BIOMASS %			NUMBER n/m²			NUMBER %			mg/INDIVIDUAL		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
POLYCHAETES	0.04	0.03		1	6		7	43		0	4		5.71	0.70	
OLIGOCHAETES	0.49	0.35		18	69		649	909		42	91		0.76	0.39	
ISOPODS	0.02			1			14			1			1.43		
AMPHIPODS	1.08	0.01		39	2		101	14		7	1		10.69	0.71	
OTHER	1.12	0.12		41	24		757	29		50	3		1.48	4.14	
Σ	2.75	0.51		100	101		1528	995		100	99				

TABLE 2.4. PRUDHOE SHORE - BENTHIC FAUNA IN 1977. DATA ARE FROM EKMAN GRAB SAMPLES TAKEN ON: A = 7/19, B = 8/8, AND C = 8/21, AND WASHED THROUGH A 0.516mm SCREEN. NUMBER OF SAMPLES IS: A = 3, B = 3. C = 3. SAMPLES WERE TAKEN AT:

STATION	N. LATITUDE	W. LONGITUDE	DEPTH (m)
H28	70°18.5'	148°28.8'	0.5

TAXONOMIC CATEGORY	BIOMASS						NUMBER						mg/INDIVIDUAL		
	g/m^2			%			n/m^2			%					
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
POLYCHAETES															
OLIGOCHAETES	0.06	0.00	0.10	67		10	115	87	173	89	86	48	0.52	0.00	0.58
ISOPODS		0.01	0.36		99	37		14	72		14	20		0.71	5.00
AMPHIPODS			0.52			53			115			32			4.52
OTHER	0.03			33			14			11			2.14		
Σ	0.09	0.01	0.98	100	99	100	129	101	360	100	100	100			

TABLE 2.5. PRUDHOE BAY - BENTHIC FAUNA IN 1977. DATA ARE FROM EKMAN GRAB SAMPLES TAKEN ON: A = 7/29, B = 8/21, AND C = NONE, AND WASHED THROUGH A 0.516mm SCREEN. NUMBER OF SAMPLES IS: A = 12, B = 10, C = 0. SAMPLES WERE TAKEN AT:

STATION	N. LATITUDE	W. LONGITUDE	DEPTH (m)
H2G	70°18.8'	148°27.3'	0.65
H2H	70°18.8'	148°23.7	2.0

TAXONOMIC CATEGORY	BIOMASS						NUMBER						mg/INDIVIDUAL		
	g/m^2			%			n/m^2			%					
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
POLYCHAETE	0.62	3.95		12	53		462	1736		71	82		1.34	2.28	
OLIGOCHAETES	0.11	0.11		2	1		112	126		17	6		0.98	0.87	
ISOPODS	0.05			1			4			1			12.50		
AMPHIPODS	0.04	0.18		1	2		7	138		1	7		5.71	1.30	
OTHER	4.34	3.22		84	43		65	108		10	5		66.77	29.81	
Σ	5.16	7.46		100	99		649	2108		100	100				

TABLE 2.6. COLVILLE SHORE - BENTHIC FAUNA IN 1977. DATA ARE FROM EKMAN GRAB SAMPLES TAKEN ON: A=7/14, B = 8/5, and C = 8/23, AND WASHED THROUGH A 0.516 mm SCREEN. NUMBER OF SAMPLES IS: A = 6, B = 5, C = 5. SAMPLES WERE TAKEN AT:

STATION	N. LATITUDE	W. LONGITUDE	DEPTH (m)
J22	70°26.6'	150°22.1'	0.5

TAXONOMIC CATEGORY	BIOMASS						NUMBER						mg/INDIVIDUAL		
	g/m²			%			n/m²			%					
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
POLYCHAETES		0.58	0.19		38	10		113	18		52	7		5.13	10.56
OLIGOCHAETES															
ISOPODS	0.14	0.75	0.83	82	49	45	7	43	18	50	20	7	20.00	17.44	46.11
AMPHIPODS	0.03	0.20	0.81	18	13	44	7	61	216	50	28	86	4.29	3.28	3.75
OTHER															
Σ	0.17	1.53	1.83	100	100	99	14	217	252	100	100	100			

TABLE 2.7. COLVILLE DELTA - BENTHIC FAUNA IN 1977. DATA ARE FROM EKMAN GRAB SAMPLES TAKEN ON: A = 7/15, B = 8/4,5, AND C = 8/25, AND WASHED THROUGH A 0.516mm SCREEN. NUMBER OF SAMPLES IS: A = 38, B = 28, C = 28. SAMPLES WERE TAKEN AT:

STATION	N. LATITUDE	W. LONGITUDE	DEPTH (m)
J2D	70°26.3'	150°22.0'	2.0
J2E	70°26.3'	150°21.8'	3.0
J2F	70°26.3'	150°21.7'	2.5
J2G	70°28.8'	150°24.5'	2.0
J2H	70°29.0'	150°25.5'	3.0
J2I	70°29.2'	150°26.0'	2.0

TAXONOMIC CATEGORY	BIOMASS						NUMBER						mg/INDIVIDUAL		
	g/m^2			%			n/m^2			%					
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
POLYCHAETES	3.44	3.19	6.60	43	54	67	1625	2150	2492	80	62	80	2.12	1.48	2.65
OLIGOCHAETES	0.35	1.26	0.48	4	22	5	322	1204	505	16	35	16	1.09	1.05	0.95
ISOPODS	3.81	1.22	2.36	48	21	24	44	47	23	2	1	1	86.59	25.96	102.61
AMPHIPODS	0.27	0.10	0.36	3	2	4	27	46	80	1	1	3	10.00	2.17	4.50
OTHER	0.04	0.09	0.01	1	2	0	13	17	2	1	0	0	3.08	5.29	5.00
Σ	7.91	5.86	9.81	99	101	100	2031	3464	3102	100	99	100			

Table 2.8. Nuvagapak Point epibenthic fauna in 1977. Data are from 50 m tows of the sled net (see text for description of net) taken on: A = 7/29, 30, B = 8/15,16; and C = 9/1. Number of samples is: A = 2, B = 2, C = 2. Samples were taken at stations B16 and B17 (see Table 2.1).

TAXONOMIC CATEGORY	BIOMASS (mg)			NUMBER			mg/individual		
	A	B	C	A	B	C	A	B	C
MYSIS LITORALIS	12K	1	59	1827	1	8	6.57		
MYSIS RELICTA	20K	7177	2358	1378	1524	215	14.51	4.71	10.97
CALANOIDA		6	17		31	4			
SADURIA ENTOMON	84	55		24	1				
AMPHIPODS[1]	610	733	3191	112	161	453	5.26	4.55	7.04
OTHER		41	2		1	4			
Σ	32.7K	8013	5627	3341	1719	684			

1. Mainly Monoculodes packardi, Onisimus glacialis, Gammarus zaddachi, G. setosus, Monoculopsis longicornis, Halirages sp., and Gammaracanthus loricatus.

Table 2.9. Nuvagapak Lagoon epibenthic fauna in 1977. Data are from 50 m tows of the sled net (see text for description of net) taken on A = 7/29, 30; B = 8/15,16; and C = 9/1. Number of samples is A = 3, B - 3, C = 3. Samples were taken at stations B1F, B1G and B1H (see Table 2.2).

TAXONOMIC CATEGORY	BIOMASS (mg)			NUMBER			mg/individual		
	A	B	C	A	B	C	A	B	C
MYSIS LITORALIS	7270	22.6K	2141	1542	2710	188	4.71	8.34	11.39
MYSIS RELICTA	3425	34.9K	18.8K	723	3658	2413	4.74	9.56	7.78
CALANOIDA	2	140	85	15	279	84			
SADURIA ENTOMON	17	20	25	13	5	5			
AMPHIPODS[1]	681	5420	3344	240	1184	1005	2.84	5.39	2.82
OTHER	1686[2]	93.6K[3]	5839[4]	52	305	248			
Σ	13.1K	156.7K	30.2K	2585	8141	3943			

1. Mainly Monoculodes packardi, Onisimus glacialis, Gammarus zaddachi, G. Setosus, Monoculopsis longicornis, Halirages sp., and Gammaracanthus loricatus.

2. Alcyonidium diciforme

3. Eucratia loricata

4. Molgula griffithsii

Table 2.10. Barter Island epibenthic fauna in 1977. Data are from 50 m tows of the sled net (see text for description of net) taken on: A = 7/24, 25; B = 8/13; and C = 8/30. Number of samples is: A = 2, B = 2, C = 2. Samples were taken at stations C38 and C39 (see Table 2.3).

TAXONOMIC CATEGORY	BIOMASS (mg)			NUMBER			mg/individual		
	A	B	C	A	B	C	A	B	C
MYSIS LITORALIS	3541	2205	2387	1184	299	176	2.99	7.37	13.56
MYSIS RELICTA	1341	5969	1800	388	812	133	3.46	7.35	13.53
CALANOIDA		3133[3]	128[2]		780[3]	14			
SADURIA ENTOMON	237	78	305	88	16	40			
AMPHIPODS[1]	1157	738	1038	862	131	305	1.34	5.63	3.40
OTHER	158	3788[2,4,5,6]	272	54	1713[2,4,5]	182			
Σ	6434	15.9K	4930	2576	3751	850			

1. Mainly Monoculodes packardi, Onisimus glacialis and Gammarus setosus

2. Enchytraidae

3. Calanus hyperboreus

4. Limacina helcina

5. Aglanthe digitale

6. Clione limacina

Table 2.11. Prudhoe shore epibenthic fauna in 1977. Data are from 50 m tows of the sled net (see text for description of net) taken on : A = 7/19; B = 8/8; and C = 8/21. Number of samples is: A = 1, B = 1, C = 1. Samples were taken at station H28 (see Table 2.4).

TAXONOMIC CATEGORY	BIOMASS (mg)			NUMBER			mg/individual		
	A	B	C	A	B	C	A	B	C
MYSIS LITORALIS	23	33		5	3		4.6	11.0	
MYSIS RELICTA	60	40	80	13	16	12	4.62	2.5	6.66
CALANOIDA									
SADURIA ENTOMON	1	90	154	1	29	29			
AMPHIPODS[1]	1	151	502	1	18	44	1.0	8.39	11.41
OTHER	6	31	6	8	1	11			
Σ	91	345	742	28	67	96			

1. Gammaracanthus loricatus and Pontoporeia affinis

Table 2.12. Prudhoe Bay epibenthic fauna in 1977. Data are from 50 m tows of the sled net (see text for description of net) taken on: A = 7/19; and B = 8/21. Number of samples is: A = 2, and B = 2. Samples were taken at stations H2G and H2H (see Table 2.5).

TAXONOMIC CATEGORY	BIOMASS (mg)			NUMBER			mg/individual		
	A	B	C	A	B	C	A	B	C
MYSIS LITORALIS	76	1515		10	105		7.6	14.43	
MYSIS RELICTA	4813	8501		1006	701		4.78	12.13	
CALANOIDA	31	107		22	47				
SADURIA ENTOMON	15	2		1	1				
AMPHIPODS[1]	116	68		49	16		2.37	4.25	
OTHER	761[2]	164		27	36				
	Σ 5812	10.4K		1115	906				

1. Mainly Pontoporeia affinis, Gammaracanthus loricatus and Monoculodes packardi

2. Eucratia loricata

Table 2.13. Colville Shore epibenthic fauna in 1977. Data are from 50 m tows of the sled net (see text for description of net) taken on: A = 7/14; B = 8/5; and C = 8/23. Number of samples is: A = 1, B = 1, C = 1. Samples were taken at station J22 (see Table 2.6).

TAXONOMIC CATEGORY	BIOMASS (mg)			NUMBER			mg/individual		
	A	B	C	A	B	C	A	B	C
MYSIS LITORALIS									
MYSIS RELICTA	69	343	1063	2	55	40	34.5	6.24	26.58
CALANOIDA									
SADURIA ENTOMON	58	26	118	7	5	7			
AMPHIPODS[1]	112	49	51	26	9	12	4.31	5.44	4.25
OTHER		71			1				
Σ	239	489	1232	35	70	59			

1. Mainly Pontoporeia affinis, Gammaracanthus loricatus and Onisimus litoralis.

Table 2.14. Colville delta epibenthic fauna in 1977. Data are from 50 m tows of the sled net (see text for description of net) taken on: A = 7/15; B = 8/4,5; and C = 2/25. Number of samples is: A = 6, B = 6, C = 6. Samples were taken at stations J2D, J2E, J2F, J2G, J2H, and J2I (see Table 2.7).

TAXONOMIC CATEGORY	BIOMASS (mg)			NUMBER			mg/individual		
	A	B	C	A	B	C	A	B	C
MYSIS LITORALIS		80			16				
MYSIS RELICTA	467	4440	2961	62	820	191	7.53	5.41	15.50
CALANOIDA									
SADURIA ENTOMON	699	6229	1097	117	324	15	5.97	19.23	73.13
AMPHIPODS[1]	72	888	315	18	102	52	4.0	8.71	6.06
OTHER	13	37		12	28				
Σ	1251	11.7K	4373	209	1290	258			

1. Mainly Gammaracanthus loricatus, Onisimus litoralis and Ponotporeia affinis

An Arctic Kelp Community in Stefansson Sound, Alaska: A Survey of the Flora and Fauna

Ken Dunton and Susan Schonberg

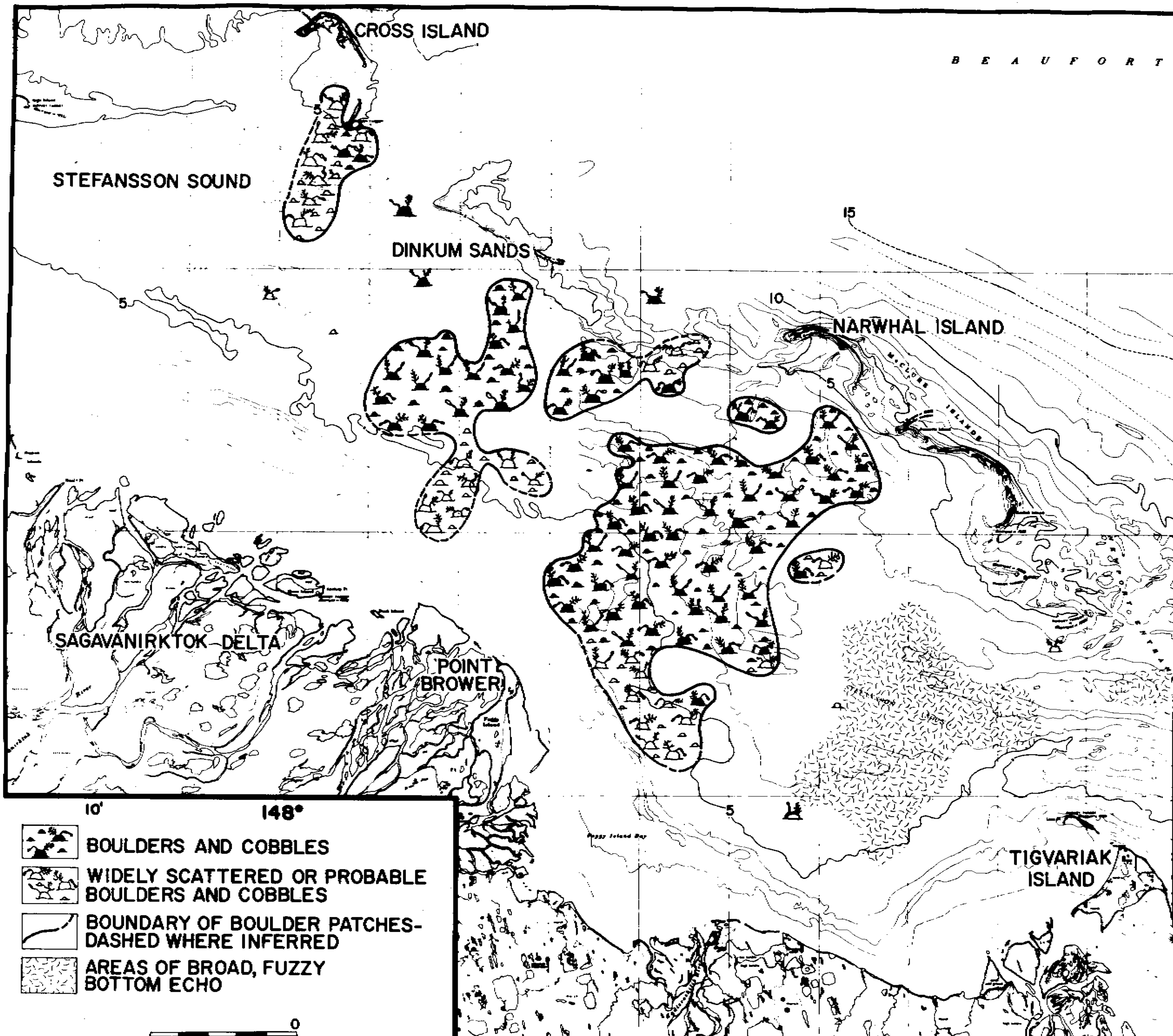
INTRODUCTION

In 1971, 1972, and 1976 the presence of a rich marine fauna associated with a "boulder patch" was reported in Stefansson Sound, Beaufort Sea, Alaska (Reimnitz and Toimil, 1976). This discovery subsequently led to a marine biological investigation of the area by divers in the summer of 1978 (Broad, 1978). During that expedition the existence of an Arctic kelp community was confirmed and a comprehensive survey of the flora and fauna conducted. The results of that survey, along with preliminary investigations of current growth and productivity experiments is the subject of this report.

The size and configuration of the boulder patch was charted by Erk Reimnitz (RU-205) of the United States Geological Survey in September, 1978 (Fig. 3.1). For the most part, this chart agrees with the diving observations made by us in Stefansson Sound during the same summer. A major part of our study, however, is now concentrated in one area of the boulder patch where the cover of rocks and kelp on the sea floor approaches 100% in places. This diving site, known as DS-11, is the focus of ecological studies being conducted by this group and has become a principal sampling site in the integrated OCSEAP winter effort.

Kelp beds, along with their associated invertebrate fauna, are rare features of the Alaskan Beaufort Sea. Recent sampling efforts in this region have revealed a faunal assemblage of polychaetes, tiny crustaceans, and molluscs (Dunton, 1979a; Broad et al., 1978; Feder and Schamel, 1976; Crane and Cooney, 1974) but little in the way of algae. This is probably due to the nature of the bottom, which is almost entirely soft and fine grained in nature. This fact cannot be over emphasized--Kjellman (1883) in his treatise on Arctic algae states, "it is certain and undeniable that the growth of marine algae, their distribution, richness, variety, and luxuriancy, are essentially connected with and dependent upon the physical

Fig. 3.1. The location of the boulder patch. From Reimnitz and Ross (1978).


CROSS ISLAND
BEAUFORT
STEFANSSON SOUND
DINKUM SANDS
NARWHAL ISLAND
SAGAVANIRKTOK DELTA
POINT BROWER
TIGVARIAK ISLAND
15
10
5
25'
20'
70°15'
10'
148°
50'
40'
147°30'
20'
10'
BOULDERS AND COBBLES
WIDELY SCATTERED OR PROBABLE BOULDERS AND COBBLES
BOUNDARY OF BOULDER PATCHES-DASHED WHERE INFERRED
AREAS OF BROAD, FUZZY BOTTOM ECHO
0

nature of the bottom" and "wherever the bottom is very loose, i.e. formed of mud, sand, and clay, algae are wanting, because there are here no larger solid objects to afford that foothold which they need, at least during some part of their existence, in order to attain full and normal development." Nevertheless, kelp occur as drift and kelp beds have been occasionally documented in the Alaskan Arctic. Mohr, et al. (1953) dredged in a kelp bed just east of Barrow near Peard Bay in the Chukchi Sea and found abundant laminarioids along with red algae but "relatively few" invertebrates. Laminarioids were also collected off Tigvariak Island and Spy Island by the Canadian Arctic Expedition 1913-1918 (Collins, 1927). Fragments of kelp have been reported in Harrison Bay, Western Simpson Lagoon, offshore of Jones Island, west of Narwhal, west of Flaxman and in Camden Bay (Wilimousky, cited in Mohr, 1953) by various U.S. Arctic expeditions.

Perhaps the first diver to observe the kelp beds off Point Barrow was Stewart Grant (pers. comm.) who photographed them in 1970. His pictures show a bottom littered with laminarioids attached to shells, pebbles and small rocks but devoid of attached invertebrate life. Presumably, a combination of limited substrate and the unstable nature of the bottom prohibited the colonization and establishment of sessile marine invertebrates. The recent discovery of a large boulder patch associated with much kelp and a rich marine fauna and flora was therefore noteworthy, environmentally in terms of industrial development, and ecologically in terms of pure scientific interst.

As a result of this discovery and the subsequent SCUBA observations by Reimnitz and Toimil (1976), a comprehensive biological survey on the diversity and abundance of biota and extent of the boulder patch was completed in the summer of 1978. Since then the emphasis has been on learning more about the ecology of the community. Long term <u>in situ</u> experiments initiated in August, 1978, were designed to provide information on; (1) sedimentation rates, (2) the growth rates of algae and (3) the rate and time of colonization, growth, and establishment of animals and algae on bare rock surfaces. Such information, along with baseline summer and winter data, will hopefully reveal the age and health of the community, its importance in the Arctic ecosystem in terms of energetics and organic productivity, and its resilience to physical disturbance.

The Stefansson Sound kelp community consists almost entirely of organisms that are sessile, and they must either cope with or succumb to unfavorable environmental conditions created by offshore industrial activities. Two problems which benthic organisms in this community are most likely to face as a result of these activities are, (1) chemical contamination of their environment, and (2) physical disturbance. This study is not concerned with the effects of contaminants on marine organisms.

The potential physical effects of offshore oil and gas exploration may well deserve the greatest consideration with regard to the Stefansson Sound kelp community. The proximity of the boulder patch to already existing drill sites (e.g. Exxon Duck Island, six miles) and its presence within a lease area might further endanger a community which is already considered rare. These physical effects could be either direct or indirect. A direct effect would involve an actual spatial conflict between industrial equipment and the benthic community itself. Increased rates of sedimentation (smothering the organisms) and higher water turbidity (decreasing the amount of light available for the algae) as a result of bottom disturbances upstream from the community are examples of possible indirect physical effects. A knowledge of the organisms and the process of community development through creation of artificial disturbances should provide some insight with respect to management of the region.

STUDY AREA

The diving effort was carried out in the region of Stefansson Sound located between Foggy Island Bay to the south and the McClure Islands on the north (Fig. 3.1). The Sagavanirktok River discharges into Stefansson Sound about six miles southwest of the principal diving sites. Water depths ranged between 6 and 9 meters at all dive locations and the composition of the sea floor varied considerably.

Cobbles and boulders covered with marine growth were found in only 7 of 16 locations examined (Table 3.1). Of these seven, six were located within a two square mile area (Fig. 3.2). Most of the sea bottom in this region consisted of scattered pebbles, cobbles, and boulders on a base of soft mud or hard, compacted clay. Boulders up to two meters across and a meter high were sometimes observed. At DS-11 the sea floor was littered

TABLE 3.1. Location of dive sites in Stefansson Sound during the 1978 Summer field season.

Dive Site	Latitude	Longitude	Kelp Transect	Occurrence of Kelp	Comments
DS-1	70°20.5'	147°34.8'	X	X	
DS-2	70°20.8'	147°44.5'			
DS-3	70°20.4'	147°38'	X	X	
DS-4	70°21'	147°38.6'			
DS-5	70°21.4'	147°39.3'			
DS-6	70°21.8'	147°39.8'			
DS-7	70°22.4'	147°40.8'			
DS-8	70°23.1'	147°41.8'		X	
DS-9	70°20.4'	147°35.6'		X	
DS-10	70°20.2'	147°35.3'		X	
DS-11	70°19.5'	147°34.5'	X	X	Winter site pinger deployed
DS-12	70°20.8'	147°36.2'		X	Pinger deployed
DS-13	70°21'	147°34.3'			
DS-14	70°21.2'	147°42.7'			
DS-15	70°20.8'	147°40.3'			
DS-16	70°20.6'	147°39'			

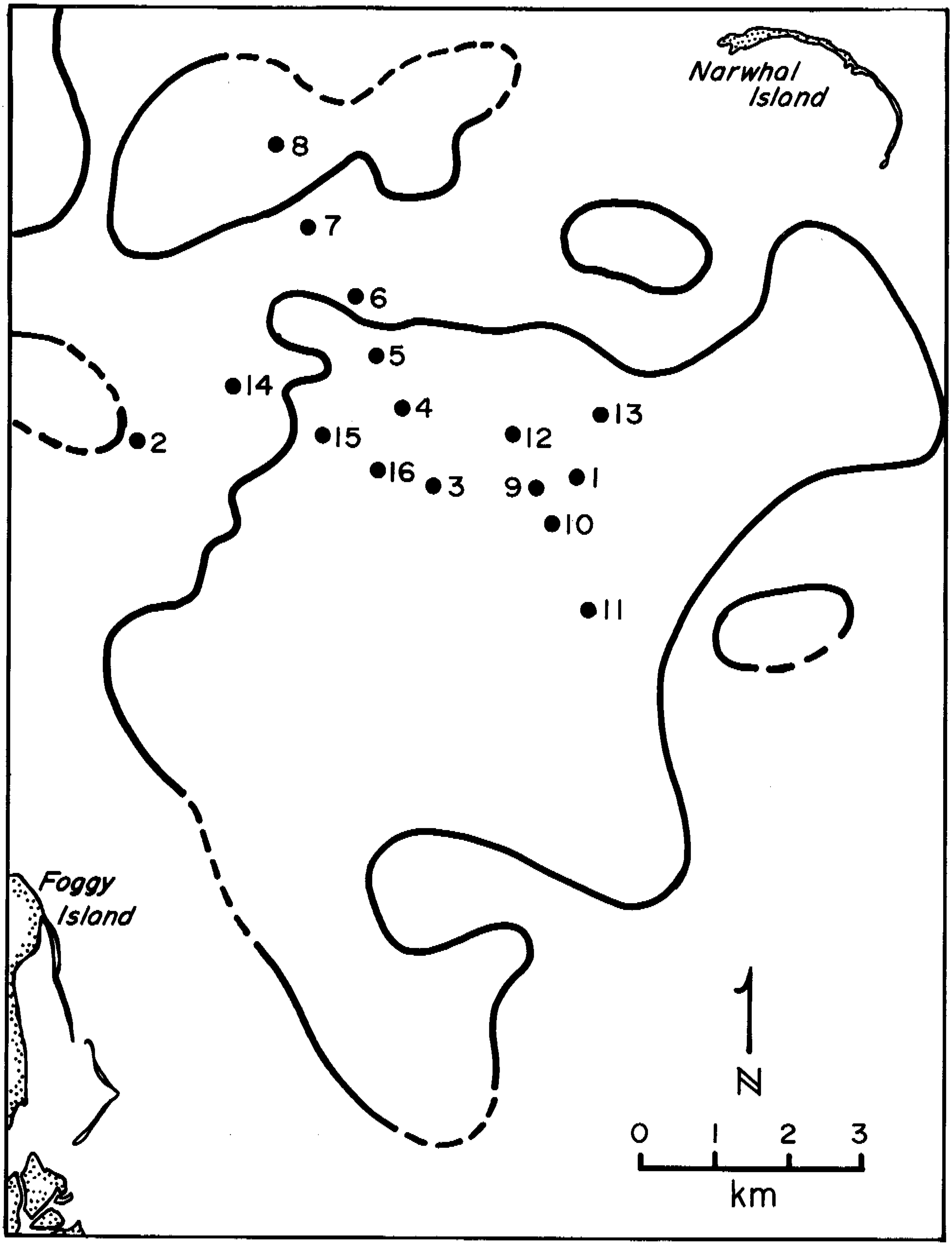


Fig. 3.2. The location of the dive sites in Stefansson Sound in relation to the boulder patch as mapped by Reimnitz and Ross (1978).

with rocks and supported an extensive kelp community of unknown size. This site became the focus of the winter sampling program. A layer of silt, which varied in thickness during the year, was usually observed on algae and rock surfaces.

Reimnitz and Ross (1978) believe the gravel, cobbles, and boulders in Stefansson Sound are lag deposits resulting from the erosion of boulder-rich portions of the Gubic formation. These rocks are thought to be part of the Flaxman formation (Leffingwell, E. de K., 1919) which were believed to have been ice rafted into the area and became part of the Gubic Formation at an earlier time. The existence of this boulder bed, in what appears from its close proximity to the Sagavanirktok River to be a depositional environment, raises important questions yet to be answered.

METHODS

Summer Field Sampling and Logistics

The field team for this project consisted of a team leader/diver, two SCUBA divers, and a marine technician. During the summer we operated from Narwhal Island, about five miles from the principal dive sites in Stefansson Sound. Facilities were provided by the Naval Arctic Research Laboratory which maintains a camp on the island. Other field support including NOAA helicopter assistance, housing facilities in Deadhorse, and a 21 foot Boston Whaler were provided by OCSEAP. The Boston Whaler was used in transportation to and from the dive sites for ten day periods between July 20 and August 21, 1978. For a more detailed account of the field activities of this group during the 1978 summer field season see Dunton (1979b).

Exploration of the Stefansson Sound boulder patch was accomplished by a diving survey during the summer of 1978 which involved spot diving along transects of known degree bearings. Occasionally a Ross SL 500 recording fathometer was used in such exploratory work, but its effectiveness as a tool to delineate the presence or absence of boulders varied. Typically, following the successful location of a kelp bed, the site was marked with buoys and a 50 meter transect line (marked in meters) set on the bottom. Once in the water, divers used an underwater communications system to coordinate work efforts and relayed data to a surface tape recorder. Based on visual observations while swimming the transect line, divers reported information (and responded to inquiries from the surface) on:

1. The physical environment, which included data on approximate water turbidity and visibility, and currents.
2. The sea floor, which included comments on the nature of the sediments, topographical features, surface detritus, and quantitative data on rock and algal cover.
3. The biota, which involved a description of the organisms seen, collected, or photographed, and any notes on their respective density, location or behavior.

In addition to the visual observations and collections made by divers, an attempt was made to obtain quantitative data on the biota without using destructive sampling techniques. This was accomplished by mounting a camera on an apparatus which framed pictures into either a 1/4 or 1/20 m^2 format (Fig. 3.3). These photographs were taken on various rock substrata at random and were used to obtain density estimates of many invertebrate species (Fig. 3.4). A Nikonas III camera equipped with a 15 mm Nikkor wide angle lens and Nautilus YS-35 and YS-150 strobes was used in all the underwater photography. To aid in laboratory identification, close-up pictures of the organisms were taken with extension tubes on a 28 mm Nikkor lens to obtain a 1:2 reproduction ratio.

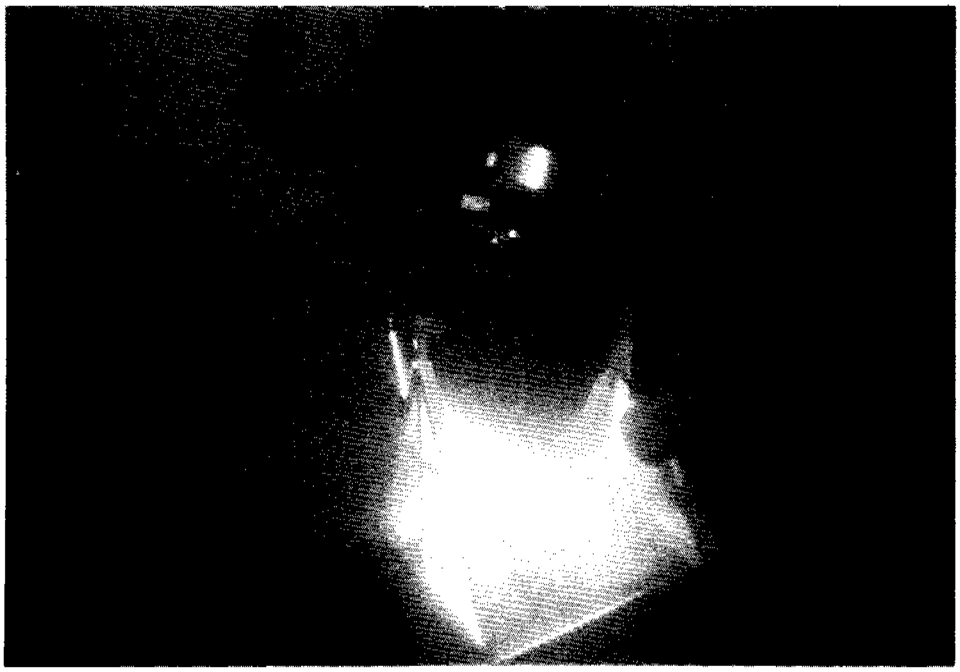
Winter Field Sampling and Logistics

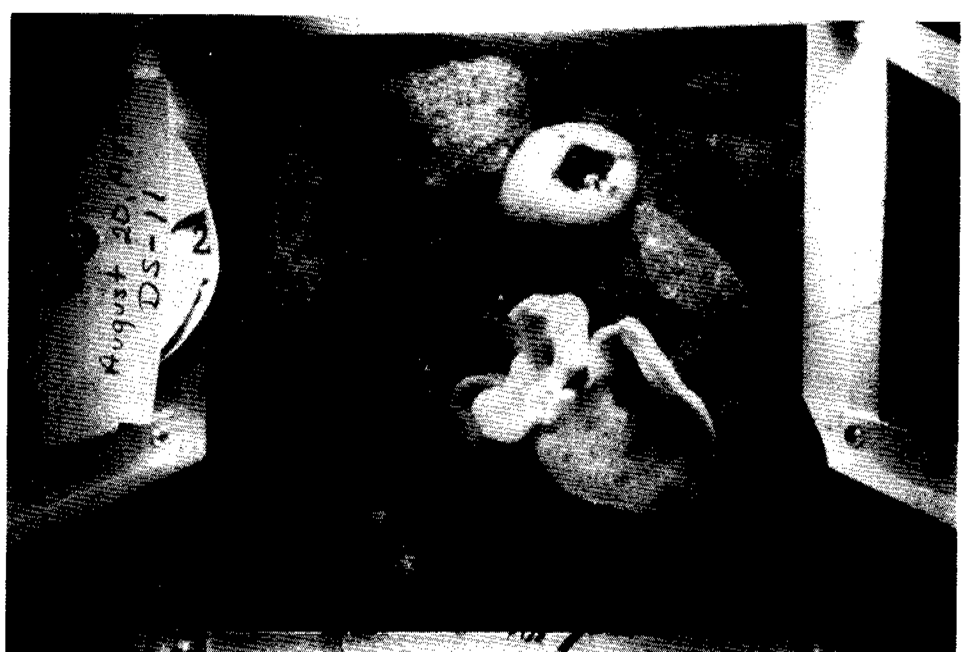
Data from in situ experiments initiated in August, 1978, were collected at Dive Site 11 in November, 1978 and March 1979. A Helle pinger receiver was used to locate a pinger marking the dive site under the ice. Divers worked from a dive hole located inside a heated 16 x 20 foot NARL parcoll. OCSEAP provided field logistic support, lodging in Deadhorse and NOAA helicopter assistance.

Because floculent sediment was easily stirred up by turbulence, sampling was done by one person at a time in November. A second person remained on standby and rotated with the first between active and standby duty. The divers were tethered to the surface and equipped with a complete back-up air support system. Each of the two divers made two dives per day, working in total darkness under extremely turbid conditions.

Fig. 3.3. Feet high to avoid stirring bottom sediments, a diver photographs the boulder patch benthic community using a 1/4 m^2 framer. The headphones are used in underwater communications.

Fig. 3.4. A close-up of the benthic community using a 1/20 m^2 camera framer reveals an assortment of sponges, red algae, and hydroids. The sponge near the top of the framer is Choanites lutkenii; below it are two sponges of Phakettia cribrosa. Hydroids are scattered, but one clump can be seen on the top left. The red algae include Lithothamnium (encrusting), Rhodomela subfusca (filamentous, to the right of the sponges), and Phycodrys rubens (clump to the left of the sponges).




August 20,
DS-11

The following tasks were completed in both November and March.

1. Analyze and/or photograph experimental plots used in recolonization studies. Denude new plots where designated by team leader.
2. Measure tagged kelp to obtain new growth increments. Tag and punch additional individuals.
3. Measure sediment depth in trays and install new trays.
4. Record physical measurements on visibility, ice thickness, currents, water temperature, salinity; note changes in the physical environment.
5. Photograph the community.
6. Collect new or uncommon organisms.
7. Note changes in the biotic components.
8. Sample the benthic infauna using an airlift (March).
9. Determine algal biomass per m^2 (March).
10. Assist Schneider (RU-356), Schell (RU-537) and Horner (RU-359) in underwater sampling.
11. Study underice features with Reimnitz (RU-205) in March. This team also retrieved equipment for Matthews (RU-526), and assisted in underwater studies for LGL (RU-467) and Carey (RU-6) under additional OCS contract funding.

RESULTS AND DISCUSSION

The Nature of the Boulder Patch and the Physical Environment

The Stefansson Sound boulder patch includes two types of habitats; (1) dense rocky areas, rich in flora and fauna and extensive in nature (Fig. 3.5), and (2) regions of scattered rocks characterized by isolated patches of marine life (Fig. 3.6). Several kelp beds were found by this team in Stefansson Sound, three of which (DS-1, DS-3, and DS-11) were studied and sampled. Kelp and attached animal life were also observed at DS-8, DS-9, DS-10, and DS-12. All sites in which kelp were reported lie within the confines of the boulder patch as mapped by Reimnitz (Fig. 3.2). Dive Site 11 was the only area that had a densely covered rock bottom with an extensive and abundant flora and fauna.

Regions characterized by cobbles or boulders were usually associated with a hard bottom consisting of either stiff silty clays, or well consolidated coarse materials (e.g., gravels and sands). At DS-8 the bottom consisted entirely of coarse sands which were probably transported from

Fig. 3.5. A view of the kelp community at DS-11. A light patch or sorus (the fertile portion of the plant) appears on many of the *Laminaria* blades. The sponge in the center is *Choanites lutkenii*.

Fig. 3.6. Our transect line intersects a patch of rocks with attached plant and animal life at DS-1. The area around the rocks is mud and silt.

nearby barrier islands. At other areas examined, the bottom consisted of soft muds and silts. Silt was present at all sites examined and was particularly evident on lighter rock surfaces. It was easily thrown into suspension by the divers and was the primary cause of poor underwater visibility. A summary of the physical characteristics of each dive site including data on the nature and content of the sea floor is presented in Table 3.2. Dive Site 11 had the densest rock (41.7%) and algal cover (37.3%), was the shallowest of the dive sites and was the most extensive in terms of rock cover. A diving survey showed boulders and cobbles covering at least 40,000 square meters of sea floor in the area.

Salinity and temperature data were recorded through the summer at various diving sites (Table 3.3). Water temperatures rose 4.7 degrees to a high of 7.9°C in early August, as salinities dropped 4.5 ppt to a low of 22.4 ppt. By late August temperatures had dropped to less than 1°C and salinities had risen to 26.3 ppt. Salinities were generally higher and temperatures lower at the bottom than at the surface, the difference being on the order of 0.2 -2.5 ppt and 0.5 - 2 degrees respectively.

The Flora and Fauna of the Stefansson Sound Boulder Patch

The Stefansson Sound boulder patch supports a well established kelp community characterized by several species of red and brown algae, and a diverse assortment of invertebrate life reporesenting every major taxonomic group. The most conspicuous and dominant member of the community is the brown alga, Laminaria solidungla which is exclusively circumpolar in distribution. Two other kelp species, Laminaria saccharina and Alaria esculenta appear occasionally and together with L. solidungla from a brown algal overstory. In areas where kelp cover was reduced or absent, another floral assemblage, typified by several species of filamentous and bladed red algae, dominated (Figs. 3.4, 3.7 and 3.8). These species included Phycodrys rubens, Neodilsea integra, Phyllophora truncata, Rhodomela subfusca and to a lesser extent, Odonthalia dentata and Ahnfeltia plicata. These red algal species, along with Lithothamnium, a widespread encrusting red algae, comprised a patchy algal understory.

TABLE 3.2. Summary of the dive sites in Stefansson Sound. Rock and algal covers at DS-1, DS-3, and DS-11 are mean scores calculated from at least 23 one m^2 quadrats. In all other cases, with the exception of water depth and current direction, the data represent independent estimates made by the divers.

Dive Site	Date	Depth (m)	Visibility (m)	Current (knots) and Direction	Rock Cover %	Algal Cover %	Description of Sea Floor
1	7/23, 24,25	6.4-7.3	3.5	0	6.5	6.8	Mud and hard clay with cobbles and boulders in scattered patches; much silt, some pebbles. Abundant marine life in rock patches.
2	7/22	6.7	2.5	0	<1	<1	Soft mud; scattered buried pebbles with attached kelp (probably drift). Isopods and <u>Ampharete</u> worm tubes common. Peat ledges (?) observed.
3	8/3, 4,5	6.4-7.6	3.0	ENE @ $\frac{1}{4}$ on 8/4	19.4	21.6	Clay (?) overlayed by thin layer of mud and scattered patches of cobbles and boulders. Bottom not penetrable more than a few cm. Abundant marine life in rock patches.
4	8/7	8.1	3.5	W @ <$\frac{1}{4}$	<1	<1	Mud and silt; scattered pebbles with attached kelp (probably drift) on surface and buried. Attached invertebrate life rare. (sites 4–6)
5	8/7	8.5	2.5	W @ <$\frac{1}{4}$	<1	<1	
6	8/7	8.5	0.5	0	<1	<1	
7	8/7	8.5	1.0	W @ <$\frac{1}{4}$	<1	<1	Mud; peat and terrestrial debris.
8	8/7	8.5	3.0	W @ <$\frac{1}{4}$	5	5-10	Sand; ripple marks 1 foot apart and 3 inches high, no silt, clean bottom. Pebbles and small cobbles with attached kelp.
9	8/7	7.6	2.5	E @ <$\frac{1}{4}$	1	<1	Hard impenetrable clay overlayed by thin (1 cm) layer of soft mud. Pebbles and cobbles scattered with attached kelp, boulders rare.

TABLE 3.2 continued

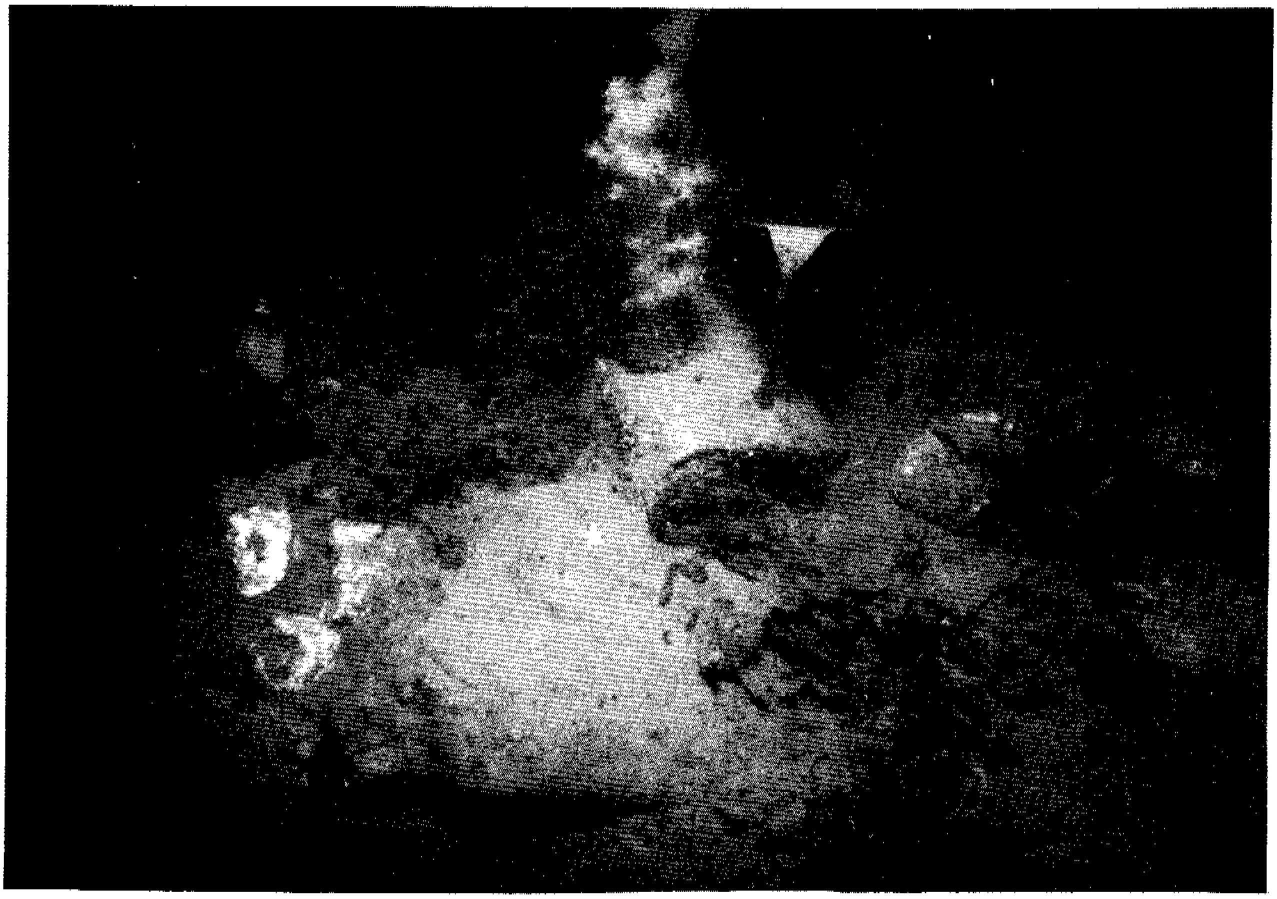
Dive Site	Date	Depth (m)	Visibility (m)	Current (knots) and Description	Rock Cover %	Algal Cover %	Description of Sea Floor
10	8/7	7.6	3.5	0	5	5-10	Thin mud and silt layer (1 cm) overlays penetrable gravel-mud matrix. Cobbles frequent with kelp. Boulders rare.
11	8/7, 17,18, 19,20	5.4-6.4	3.0	W @ 1-2 on 8/17-8/20	41.7	37.3	Rocky, cobbles and boulders common, underlayed by penetrable gravel-mud matrix or unpenetrable clay. Kelp and invertebrate life abundant.
12	8/20	6.4	3.0	0	2-3	2-3	Mud, scattered cobbles and boulders with attached kelp and marine life.
13	7/23	6.4	2.5	0	<1	<1	Mud, bottom soft. Scattered buried pebbles with attached kelp (probably drift). Ampharete worm tubes common.
14	8/3	6.7	1	0	0	0	Mud; very soft bottom.
15	8/3	6.7	1.5	0	0	0	Mud and silt; bottom hard but penetrable. Ampharete worm tubes common.
16	8/3	6.7	2.0	0	<1	<1	Mud and silt; bottom soft. Scattered pebbles with kelp attached (probably drift) on surface and buried.

TABLE 3.3. Average salinity and temperature values at some of the diving sites in July and August. There was little variation in salinity and temperature between the surface and the bottom at any of the sites.

Date	Salinity	Temperature	Dive Site
July 22	26.9	3.2	DS-2
23	25.1	5.0	DS-1
24	26.0	6.5	DS-1
25	24.9	7.0	DS-1
August 3	25.8	6.7	DS-3
4	24.3	7.0	DS-3
5	22.4	7.9	DS-3
18	24.7	0.4	DS-11
19	26.3	0.8	DS-11

Fig. 3.7. Rocks and algae smothered with silt characterize the bottom at DS-11 in November, 1978. The pink soft coral Eunephytes rubiformis (top center) stands next to Laminaria solidungla. To the right of the seastar is the eelpout, Gymnelis viridis. An encrusting sponge is attached to Phycodrys (left middle).

Fig. 3.8. A close-up of the bottom at DS-11 shows a community dominated by the red encrusting alga Lithothamnium, and the bladed alga Phycodrys rubens. Other algae include Rhodomela subfusca (top) and Phyllophora truncata (bottom).



To a large degree, the diverse and rich assemblage of invertebrate and vertebrate animals is dependent on the microhabitats and additional substrate space afforded to them by the algae community.

A complete list of the fauna collected at the three principal dive sites (DS-1, DS-3, and DS-11) is presented in Table 3.4A. This table includes previously unencountered species collected by divers at DS-11 in November, 1978, and those reported living in the soft underice environment in March, 1979. In the context of this study a species was considered: widespread (W), if it was continually observed by a diver as he swam; common (C) if it was frequent in occurrence but not widespread; and rare (R) if it was encountered only occasionally. The species of algae taken by divers at the three sites are listed in Table 3.4B. The densities of large epilithic species and some of the motile invertebrates are depicted in Table 3.5A. Percent cover of the primary understory species--red algae, hydrozoans, and encrusting sponges are listed in Table 3.5B. The densities and percent covers were calculated from a total of 54 photographs of 1/20 m^2 quadrats taken at DS-1, DS-3, and DS-11. The densities and percent covers are based on areas of 40% rock cover or better.

Of the invertebrate phyla, the sponges and the cnidarians were the most conspicuous. This was due to the large size of some species, a high abundance, and their striking shapes and colors. Phakettia cribrosa and Choanites lutkenii (Fig. 3.4, 3.5) were abundant and had a combined density of 5.5/m^2. The delicate pink soft coral Eunephtyes rubiformis (Fig. 3.7) was the most photographed organism of the boulder patch. It was widespread (4.8/m^2) and individuals from 2 cm in size to two feet in height were observed. At least four different colorful sea anenomes (order Actinaria) were photographed and collected, but remain unidentified. Cerianthus, an anenome-like anthozoan, was observed frequently but not collected. Tubularia, a stalked hydrozoan, was abundant at DS-1 and DS-3 but infrequent at DS-11. Its mean density of 2.6/m^2 is considered high for all three dive sites. Other hydrozoans formed a turf like covering on rocks in company with small sponges, bryozoans, Rhodomela (a filamentous red alga), and stringy masses of the red alga Phycodrys (Fig. 3.4).

TABLE 3.4A. An annotated list of the fauna collected at three dive sites in the Stefansson sound boulder patch in July and August, 1978. "N" or "M" denote organisms collected in November, 1978 or March 1979 respectively. Frequency estimates are denoted as: W = widespread, C = common, or R = rare (see text) and are presented where possible.

ORGANISM	DS 1	DS 3	DS 11	Fre- quency	Comments
INVERTEBRATA					
PORIFERA					
Haliclona gracilis	X	X	X	C	
Halichondria panicea	X	X	X	W	Found on rocks, common on stems of hydroids & bryzoans
Phakettia cribrosa	X	X	X	W	See Fig. 4
Choanites lutkenii	X	X	X	W	See Fig. 4, 5
Suberites montiniger	X				
Suberites sp.	X	X	X		
CNIDARIA					
THECATE HYDROZOA					
Abietinaria abietina	X	X		C	
Sertularia cupressoides		X	X	W	
Thuiaria sp.		X	X	W	
ATHECATE HYDROZOA					
Corymorpha sp.		X		R	
Tubularia indivisa	X		X	C	
Tubularia regalis	X			R	
Hydractinia carica				C	Found on Neptunea heros
Hydractinia sp.	X				Found on Neptunea borealis
ANTHOZOA					
ACTINARIA	X	X	X	C	
ALCYONARIA					
Eunephtyes rubiformis	X	X	X	W	See Fig. 7
SCYPHOZOA					
Lucernaria infundibulum		X		R	
NEMERTEA			X		

Table 3.4A, continued

ORGANISM	DS 1	DS 3	DS 11	Fre-quency	Comments
<u>NEMATODA</u>	X	X	X		
<u>ANNELIDA</u>					
POLYCHAETA					
Cirratulus cirratus	X		X		
Brada sachalina	X				
Anaitides groenlandica		X	X	C	Two specimens collected in August were gravid.
Harmothoe imbricata		X			
Gattyana cirrosa	X				
Melaenis loveni		X			
Antinoella sarsi			X(M)		Gravid, collected in soft ice
Exogone verugera	X				
Nereis zonata	X				
Spinther alaskensis		X	X	C	
Potamilla neglecta	X		X	C	Lives in membranous tube
Spirorbis granulatus	X	X	X	W	Lives in calcareous tube (both Spirorbis entries)
Spirorbis sp.	X	X	X	W	
<u>MOLLUSCA</u>					
POLYPLACOPHORA					
Amicula vestita	X	X	X	W	
Ischnochiton albus			X	R	
GASTROPODA					
PROSOBRANCHIA					
Onchioiopsis borealis	X			R	
Margarites vorticifera	X	X	X	C	
Natica clausa	X	X		C	
Buccinum angulosum			X	C	
Beringius beringii			X	R	
Plicifusus kroyeri	X	X	X	C	
Colus spitzbergensis		X	X(N)	R	
Neptunea heros			X	C	

Table 3.4A, continued

ORGANISM	DS 1	DS 3	DS 11	Frequency	Comments
Neptunea borealis	X			C	
Oenopota harpa		X		R	
GASTROPOD EGGS					
Neptunea sp.	X				
Buccinum sp.	X		X	C	Found on stems of <u>Laminaria solidungla</u>
Polinices sp.	X				An egg collar
Unknown		X			
NUDIBRANCHIA	X	X	X	C	
PELECYPODA					
Musculus discors		X		R	
Musculus niger	X			R	
Astarte borealis		X		R	Many empty valves of this species were collected
Astarte montagui	X			R	
Mya pseudoarenaria			X(N)	R	
<u>PYCNOGONIDA</u>					
Nymphon grossipes	X		X	C	
<u>ARTHROPODA</u>					
CRUSTACEA					
ISOPODA					
Saduria entomon		X	X	R	Not common at DS-11
AMPHIPODA					
Halirages sp.			X		
Acanthostephia behregensis	X		X	C	
Atylus carinatus	X		X		
Onisimus glacialis	X		X	C	
Gammaracanthus loricatus		X	X	C	Specimens collected under soft ice in Nov. & March (gravid)
Weyprechtia hueglini			X(M)		Collected under soft ice--some gravid
Gammarus setosus			X(M)		
Melita formosa			X(M)		

Table 3.4A, continued

ORGANISM	DS 1	DS 3	DS 11	Frequency	Comments
DECAPODA					
Pagurus trigonocheirus	X	X	X	C	In Neptunea shells
Hyas coarctatus alutaceus	X	X	X(N)	C	
BRYOZOA					
Alcyonidium disciforme	X			R	
Alcyonidium gelatinosum			X	R	
Flustrella gigantea		X	X	C	
Flustrella sp.	X			C	
Flustra carbasea	X	X		R	
Eucratea loricata	X		X		
Bugulopsis peachi			X		Attached to live Neptunea
Callopora lineata		X			On Phycodrys and Phakettia stems
Hippothoa hyalina	X	X	X		On Phyllophora and hydroid stems.
Umbonula arctica	X	X	X		Found on hydroid stems
Cauloramphus intermedius	X	X	X		Found on hydroid stems
Cellepora nordenskjoldi	X				In form of round ball
ECHINODERMATA					
ASTEROIDEA					
Crossaster papposus			X(N)	R	10 rays
Pedicellasteridae	X			R	
Leptasterias groenlandica	X	X	X	C	5 rays
Leptasterias polaris	X	X			6 rays
CHORDATA					
ASCIDIACEA					
Mogula griffithsii		X		R	Translucent--attached to Rhodomela
Dendrodoa aggregata			X	R	
Chelyosoma macleayanum		X		R	

Table 3.4A, continued

ORGANISM	DS 1	DS 3	DS 11	Frequency	Comments
VERTEBRATA					
OSTEICHTHYES					
Boreogadus saida			X(N)	C	
Gymnelis viridis			X(N)	C	See Fig. 7
Myoxocephalus quadricornis			X(N)	R	
Liparis cyclostigma			X(N)	R	Juveniles
Liparis herschelinus (?)			X	W	Adults and juveniles
OSTEICHTHYES EGGS					
Species A			X	C	Eggs are 4 mm D and bright yellow
Species B		X	X	C	Eggs are 2.5 mm D and brownish-tan
Species C			X(M)	W	Eggs are 1-2 mm D and whitish-tan

TABLE 3.4B. Algae collected at the three dive sites in the Stefansson Sound boulder patch during July and August, 1978.

ORGANISM	DS 1	DS 3	DS 11	Frequency	Comments
PHAEOPHYTA					
LAMINARIALES					
Laminaria solidungla	X	X	X	W	
Laminaria saccharina	X	X	X	C	
Alaria esculenta	X		X	R	
RHODOPHYTA					
CRYPTONEMIALES					
Neodilsea intergra	X	X	X	C	
Lithothamnium sp.	X	X	X	W	
GIGARTINALES					
Ahnfeltia plicata			X	R	
Phyllophora truncata	X	X	X	C	
CERIAMELES					
Phycodrys rubens	X	X	X	C	Epiphytic on Phyllophora, Neodilsea and Odonthalia
Rhodomela subfusca	X	X	X	C	
Odonthalia dentata	X	X	X	C	

TABLE 3.5A. Mean densities (n/m^2) of large epilithic and some non-epilithic invertebrates in the boulder patch based on 54 photographed 1/20 m^2 quadrats. Densities are based on a minimum of 40% rock cover. Hydrozoans and small sponge species are treated in Table 3.5B.

Species or Group	n/m^2
Spirorbis sp.	10.4
Eunephtyes rubiformis	4.8
Phakettia cribrosa	2.9
Choanites lutkenii	2.6
Tubularia sp.	2.6
Cerianthes sp.	1.2
Asteridae	0.9
Actinaria	0.6
Nudibranchia	0.3
Nymphon grossipes	0.3
Anaitides groenlandica	0.3
Pagurus sp.	0.3
Potamilla neglecta	0.3
Alcyonidium gelatinosum	0.3
Flustrella sp.	0.2
Ascidiacea	0.2

TABLE 3.5B. Percent cover (%) of various red algal species, hydrozoans, and small sponges attached to rocks in the kelp community understory. Covers are based on 54 photographed 1/20 m^2 quadrats and a minimum of 40% rock cover.

Species or Group	Percent Cover (%)
Lithothamnium sp.	11.5
Phycodrys rubens	8.9
Phyllophera truncata	5.5
Hydrozoa (excepting *Tubularia*)	5.4
Neodilsea integra	2.4
Rhodomela subfusca	2.1
Porifera (excepting *Phakettia* and *Choanites*)	1.5
Odonthalia dentata	0.3

Polychaetes, nematodes, and nemerteans were usually collected in the soft sediment between the boulders and cobbles. Some of these worms made tracks in the top soft layer of sediment which were distinguishable from the wider tracks made by gastropods. The tubicolous polychaete Spirorbis granulatus formed small (to 4 mm) spiralled tubes found on rocks, algae, hydroids and snail shells. Its calculated density of $10.4/m^2$ is probably low. The fanworm Potamilla neglecta was less abundant but larger, its membranous tube having a length of 8 cm or better. In March, 1979 gravid polychaete scaleworms (Antinoella sarsi) were found living in the soft underice environment. Divers estimated their numbers at $0\text{-}3/m^2$.

Molluscs, particularly the gastropods Buccinum, Neptunea, Natica, Margarites, and Plicifusus were collected frequently. Natica clausa was usually found on the blades of Laminaria as were about five different types of Nudibranchs. Egg clusters belonging to Buccinum were common on the stipes of Laminaria solidungla at several dive sites including DS-8. Pelecypods were not collected in abundance although many shells of Astarte borealis were scattered on the sea floor at the principal dive sites.

The largest mobile invertebrate was the crustacean Hyas coarctatus alutaceus. Divers frequently came across this animal and the hermit crab, Pagurus trigonocheirus, while working in thick kelp, but seldom saw them on kelp free bottoms. Other mobile crustaceans included numerous mysids (not collected), amphipods and rarely, isopods. In March, 1979 a number of amphipods were collected moving in and around the soft underice environment. Four species are listed in Table 3.4A.

Several five and six rayed seastars, Leptasterias spp. and one ten rayed sunstar, Crossaster papposus, were collected in this study. These seastars were found attached to rocks, Laminaria fronds, or lying on the sea floor. Only two feeding observations were recorded on these animals underwater. One seastar was seen eating a polychaete worm in August and three were feeding on the remains of a fish (Liparis) in March, 1979.

Sea spiders, bryozoans, and ascidians were some of the more unusual animals that fascinated the divers underwater. The sea spider (Pycnogonid) Nymphon grossipes, a bizarre looking animal underwater (a photograph appears in Dunton, 1979b) was occasionally seen scavenging around rocks beneath the kelp canopy. Bryozoans were found attached to rocks, on hydroids, and to the red algal species Phycodrys, Odonthalia, and Phyllophora. One translucent ascidian, Mogula griffithsii, was attached to the red alga Rhodomela.

Five species of fish were collected at DS-11. These included two species of the sucker fish Liparis, the arctic cod (Boreogadus saida), the eelpout (Gymnelis viridis), and the four-horned sculpin (Myoxocephalus quadricornis). Fish eggs were collected in August and again in March, 1979. In March, thousands of eggs were found attached to kelp stipes, wire flags, and anchor lines. As numerous tiny liparid like fish were also observed, these eggs might have been laid by adult Liparis females. The greater number of fish species collected in November is more likely a reflection of an improved and concentrated collection effort than an actual absence of these fish in August.

Taxonomic Discussion

In the following section the major sources used to identify the organisms are listed and some taxonomic problems relevant to this study are discussed.

PORIFERA

Koltun, V. M. 1959b. Siliceous-horny sponges of the Northern and Far Eastern Seas of the USSR; Order Cornacuspongida. Akademiia Nauk SSSR. Zoologicheskii Institut. Opredeliteli po Faune SSSR 67:1-235.

DeLaubenfels, M. 1953. Sponges of the Alaskan Arctic. Smithsonian Misc. Collections 121(6):1-22.

Choanites lutkenii was not included in Koltun's work, although it is one of the most common species found in this study. However, DeLaubenfels does describe it well in his paper. A sponge similar in character to the genus Suberites was collected frequently off rocks and algae yet did not key out. The megascleres are of one type and rounded on both ends, one end being larger than the other. There are no microscleres present.

CNIDARIA

Hydrozoans

Naumov, D. V. 1960. Hydroids and Hydromedusae of the USSR. Akademiia Nauk SSSR. Zoologicheskii Institut. Opredeliteli po Fauna SSSR. 70 p.

Calder, D. R. 1970. Thecate Hydroids from the shelf water of Northern Canada. J. Fish. Res. Bd. Can. 27(9):1501-1547.

Calder, D. R. 1972. Some Athecate Hydroids from the shelf water of Northern Canada. J. Fish. Res. Bd. Can. 29(3):217-288.

A frequently collected hydroid keyed out very well to *Thuiaria uschakovi* in Naumov's Key. However, this species is only know from the Western Russian Arctic and thus has been listed here as *Thuiaria sp*. A single specimen of *Corymorpha* keys out perfectly to *C. nutans* in Naumov but again, its known distribution does not include the Beaufort Sea area so is listed as *Corymorpha sp*. Several specimens of what Calder calls *Tubularia regalis* were collected. These specimens are very similar to *Tubularia indivisa* but have distinctly ridged gonopores. These ridges are also visible in a close-up underwater photograph when the animal was alive.

Anthozoans
(Actinaria)

Carlgren, O. H. 1949. A survey of the Ptychodactiaria, Corallimorpharia, and Actinaria; with preface by T. A. Stephenson. Svenska Vetenskaps-Akademien Handlingar, Ser. 4, 1(1).

Carlgren, O. H. 1940. Actinaria from Alaska and Arctic Waters. J. Wash. Acad. Sci. 30(1):21-27.

Carlgren, O. H. 1934. Some Actinaria from Bering Sea and Arctic Waters. J. Wash. Acad. Sci. 24:348-353.

Verrill, A. E. 1922. Alcyonaria and Actinaria. Canadian Arctic Expedition, 1913-1918. Report. Vol. 8: Mollusks, Echinoderms, Coelenterates, etc. Pt. G. King's Printer, Ottawa. 164 p.

Listed above are the sources used in an attempt to identify the numerous actinarians collected and photographed. After a careful study of the source descriptions and the samples we did not feel qualified to identify any of the animals. This group needs further taxonomic study before these organisms can be correctly identified.

(Alcyonaria)

Verrill, A. E. 1922. Alcyonaria and Actinaria. Rept. Can. Arctic Exped., 1913-1918. Vol. 8: Mollusks, Echinoderms, Coelenterates, etc. Pt. G. King's Printer, Ottawa. 164 p.

Scyphozoa

Mayer, A. G. 1910. Medusae of the World. Vol. III. The Scyphomedusae. Carnegie Inst. Wash. Publ. 109:499-735.

ANNELIDA

Polychaeta

Ushakov, P. V. 1955. Polychaeta of the Far Eastern Seas of the USSR. Azdatel 'stvo Akademiia Nauk SSSR. Moskva-Leningrad. 419 p.

Fauchauld, K. 1977. The Polychaete Worms. Definitions and Keys to the Orders, Families and Genera. The Allan Hancock Foundation. Univ. of Southern Calif. 188 p.

Banse, K. and Hobson, K. 1974. Benthic Errantiate Polychaetes of British Columbia and Washington. Fish. Res. Bd. Can., Bulletin 185. 111 p.

Banse, K. and Hobson, K. Benthic Sedentariate Polychaetes of British Columbia and Washington. Unpublished.

Spirorbis are very common on the rocks in this study areay. The calcareous tubes of several animals were dissolved in order to key them out to Spirorbis granulatus. It is very probable that other species are represented in the boulder patch region.

MOLLUSCA

Polyplacophora

Yakouleva, A. M. 1952. Shell-bearing mollusks (Loricata) of the Seas of the USSR. Izdatel 'stvo Akademic Nauk SSSR. Moskva-Leningrad.

Gastropoda

MacGinitie, N. 1959. Marine mollusca of Point Barrow, Alaska. U.S. Nat. Mus. Proc. 109.

Keen, M. A. and Coan, E. 1974. Marine molluscan genera of Western North America. Stanford Univ. Press.

MacIntosh, R. A. 1976. A guide to the identification of some common Eastern Bering Sea snails. Northwest Fisheries Center. NOAA. Kodiak, Alaska.

Nora Foster from the University of Alaska's Institute of Marine Science in Seward, determined the names *Margarites vorticifera*, *Neptunea borealis* and *Onchioiopsis borealis* when shown the respective animals.

Nudibranchia

No comprehensive works covering Arctic species were found for this group with which taxonomic identifications could be made.

Pelecypoda

Bernard, F. R. Bivalve mollusks of the Western Beaufort Sea. Unpublished.

MacGinitie, N. 1959. Marine mollusca of Point Barrow Alaska. U.S. Nat. Mus. Proc. 109.

PYCNOGONIDA

Hedgpeth, J. W. 1963. Pycnogonida of the North American Arctic. J. Fish. Res. Bd. Can. 20(5):1315-1348.

CRUSTACEA

Isopoda

Richardson, H. 1905. Monograph on the Isopods of North America. Bull. U.S. Nat. Mus. 54:727.

Amphipoda

These identifications were made by Hal Koch and Mark Childers at Western Washington University's Arctic Marine Laboratory.

Decapoda

Rathbun, M. J., H. Richardson, S. J. Holmes, and L. J. Cold. 1910. Harriman Alaska Expedition. Vol. 10. Crustacea. Smithsonian Institution Wash. D.C. No. 1997, 337 p.

BRYOZOA

Kliuge, G. A. 1962. Bryozoa of the Northern Seas of the USSR. Sharma, B. R. (Trans.) 1975. Smithsonian Institute, Washington, D.C. 735 p.

Osburn, R. C. 1950. Bryozoa of the Pacific Coast of America. Part 1, Cheilostomata--Anasca. Allan Hancock Pac. Exped. 14(1):1-269.

Osburn, R. C. 1952. Bryozoa of the Pacific Coast of America. Part 2, Cheilostomata--Ascophora. Allan Hancock Pac. Exped. 14(2):271-611.

George Meuller at the University of Alaska's Institute of Marine Science in Seward, worked with us in identifying many of the bryozoans collected.

The species listed as Flustrella sp. did not key out with the above literature. Each colony is 9-11 cm tall and 4-5 mm in diameter. They are dark brown, very rough, and occur in groups.

ECHINODERMATA

Asteroidea

D'yakonov, A. M. 1950. Sea Stars of the USSR Seas. Izdatel 'stvo Akademii Nauk SSSR. Moskva-Leningrad.

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Two specimens of a particular sea star were collected, but identified only to Pedicellasteridae. They were small, had a very open skeleton, straight and crossed pedicellaria, but only two rows of tubefeet the whole arm length.

CHORDATA

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VERTEBRATA

Osteichthyes

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A key from the University of Alaska's Institute of Marine Science on the species of Liparis. Unpublished.

The species Liparis herschelinus and several other species (L. bristolense, L. lapteria, L. dubins) have not been adequately worked out. They are very similar to each other with unclear taxonomic differences.

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Wilce, R. T. 1959. The marine algae of the Labrador Peninsula and northwest Newfoundland (ecology and distribution). National Museum of Canada, Bulletin 158. 103 p., 11 pls.

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Zinova, A. D. 1955. [Determination book of red algae of the norther seas of the USSR]. Leningrad and Moscow. (Original in Russian.) 219 p.

Listed above are the sources used in identifying the red and brown algae collected in this study. Our appreciation to Dr. Maurice Dube of the Department of Biology at Western Washington University who provided some taxonomic assistance and to Dr. Robert T. Wilce of the Department of Botany at the University of Massachusetts who confirmed several of our identifications.

Kjellman's (1883) description and illustration of Rhodomela lycopodioides f. flagellaris fits our specimen closely. However, Rosenvinge (1923-24) treats this species and two others, R. virgata and R. subfusca, as forms of one species, R. subfusca. This view is presently accepted by Dr. Wilce, an authority on Arctic algae, thus our determination, R. subfusca f. lycopodioides.

Several Laminaria specimens were collected with a branched holdfast and occasionally one or two constrictions in the frond. These specimens were determined as L. saccharina by Dr. Wilce who explained that the constrictions were probably a result of the growth habit of the plant. From our recent observations on the growth of L. solidungla and L. saccharina we are inclined to agree. We also have collected specimens of both species which possessed a branched stipe that gave rise to two fronds.

Ecology of the Stefansson Sound Kelp Community: Preliminary Results of Winter Studies

At the close of the 1978 summer field season several in situ biological experiments were initiated at DS-11. These experiments were to be monitored through the 1978-1979 winter and were designed to: (1) determine the seasonal growth rates of Laminaria, (2) determine the amount of organic matter these plants contribute to the Arctic environment, (3) determine the species composition and rate of recolonization on denuded rock surfaces, and (4) to observe patterns of development or "succession" on denuded rock surfaces. In conjunction with this work we collected quantitative data on algal and attached invertebrate biomass, sedimentation rates, benthic infaunal densities and biomass, and made qualitative observations on the physical and biological environment during each sampling period. In the following discussion the preliminary results of the experiments and observations made by the divers are reported.

The biggest surprise of this study to date was the substantial growth of Laminaria solidungla between November, 1978 and February, 1979. This was unexpected since the plants were in complete darkness and had grown very little during the previous fall when light was believed to be available. The average growth of Laminaria from mid August to mid November, 1978, was 1.5 cm (ranges were from 0 to 2 cm from 20 plants) compared to an average growth of 7 to 10 cm (ranges were from 5 to 22 cm from 60 plants) between mid November, 1978 and early March, 1979. A new constriction was also produced in the frond during this period. It is believed that the constrictions in this plant are produced once a year, and that the area between constrictions represent a year's growth. This winter growth occurred in virtual darkness since DS-11 is characterized by an extremely thick and dirty ice cover which is almost impenetrable to light. This suggests these algae either; (1) are growing from stored nutrient reserves, or (2) are assimilating sources of carbon in their surrounding environment, i.e., are heterotrophic. New experiments, initiated in May and carried through the following winter, should answer this question. Finally in view of the stable nature of the community, a net export of organic matter to the marine environment equal to the production of new algal biomass should be considered.

In March, 1979 the biomass of the attached plant and animal biota was determined by denuding several 1/4 m^2 quadrats using a diver operated airlift. The kelps Laminaria solidungla and L. saccharina constituted over 95% of the total biomass. The biomass of Laminaria, corrected to 100 percent cover, was calculated at 3.287 ± .588 kg/m^2 (N=4). In Table 3.6 this figure is compared to the biomass of Laminaria in kelp communities on the northeast and west coasts of North America and to the biomass found in other Beaufort Sea nearshore regions.

The underice cover at DS-11 was unique in comparison to the underice features seen by the divers in other locations. It was characterized by a rough and dirty layer of soft slushy ice, ranging from .5 to 2 meters in thickness (Fig. 3.9). In March, 1979 many amphipods and scaleworm polychaetes, and some Arctic cod were seen in close association with this underice cover. No organisms were seen associated with the common smooth, hard underice regions. The structure and appearance of this slushy ice has prompted much speculation that the formation could be a result of anchor ice formation (for a discussion see Reimnitz and Dunton, 1979).

A comparably low amount of sediment accumulated between November and early March, 1979 compared to the August to November period. Sediment accumulations averaged 1-2 mm this winter compared to 2.5 - 5 mm last fall (Fig. 3.10). Water visibility increased from less than 2 meters in November to over 7 meters in March. Slight water currents were also observed in March.

TABLE 3.6. Comparison of the Stefansson Sound kelp community to kelp communities on the east and west coasts of North America and to other Beaufort Sea regions.

Location	Depth (m)	Mean Biomass kg/m^2	Benthic Community Components	Equipment	Source
Stefansson Sound, AK, DS-11	5.5	3.287	*L. solidungla* *L. saccharina*	SCUBA	This study
Coast of Nova Scotia, Canada	3-13	16.012	*L. digitata* *L. longicruris*	SCUBA	Mann, 1972
Puget Sound, WA	4-6	1.5-3.5	*L. saccharina* *Alaria spp.*	SCUBA	Webber & Smith, unpub.
Foggy Bay, Stefansson Sound, AK Station G3C	5	.0104	Polychaetes Molluscs Crustaceans	Smith-McIntyre grab	Broad, et al., 1979
West Stefansson Sound, AK Station HØB	5	.0189	Polychaetes Molluscs Crustaceans	Smith-McIntyre grab	Broad, et al., 1979
Prudhoe Bay, AK	3.7	.0158	Polychaetes Molluscs	SCUBA	Dunton, 1979a
Prudhoe Bay, AK	1.7	.0019	Polychaetes Molluscs	SCUBA	Feder and Schamel, 1976

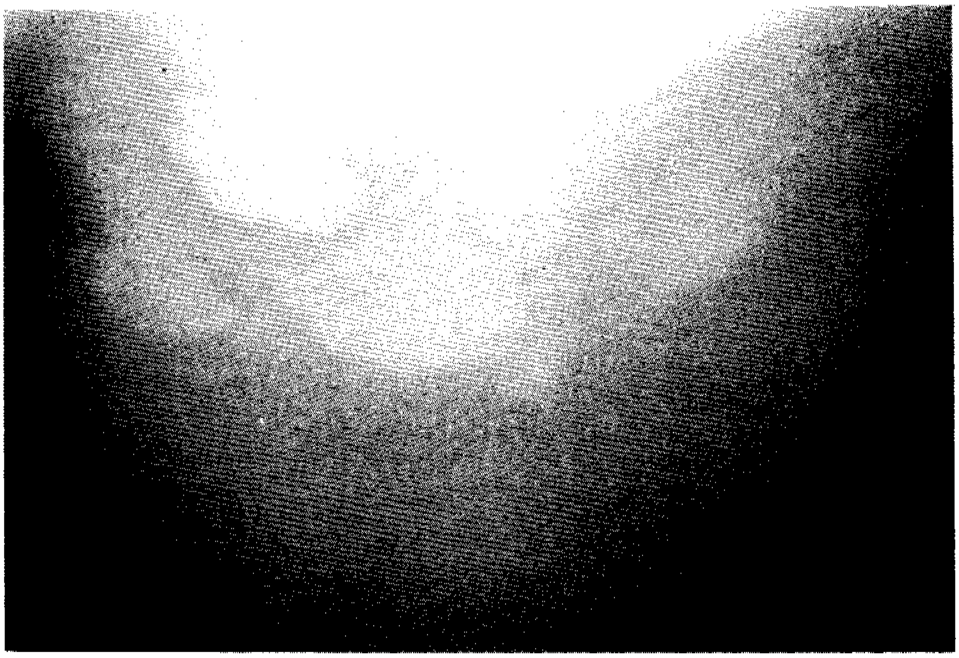

Fig. 3.9. A photograph of the underice surface at DS-11 showing a rough and dirty ice undersurface.

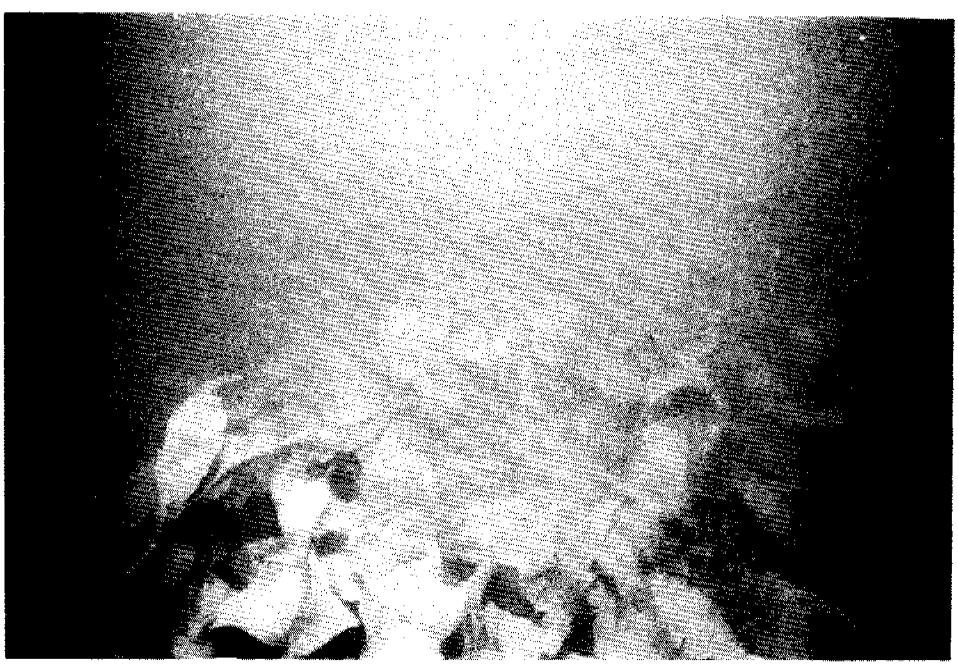

Fig. 3.10. A photograph taken at DS-11 in November showing the sediment accumulation on the kelp and poor visibility.

Hydroids appear to be the first colonizers on experimental plots denuded in August, 1978. They were small (to 1 cm high) and scattered on the rock surfaces, but absent in areas of remaining Lithothamnium cover. Lithothamnium is widespread in the community and appears to force most algae and invertebrates into competition for small pockets of unused rock substrate (Fig. 3.4 and 3.8).

CONCLUSIONS

The Stefansson Sound kelp community appears to be similar in many respects to kelp communities at more temperate latitudes. It is characterized by; (1) an abundant and diverse flora and fauna, (2) a high utilization of the rock substrate and competition between species for space, (3) a kelp overstory of high biomass consisting of Laminaria spp., (4) an algal understory of several red algal species and attached invertebrate species, and (5) an apparently productive kelp community with an unknown export of an organic matter to the marine ecosystem.

The list of animal and plant species of the Stefansson Sound kelp community is by no means complete. New species are continually being found as taxonomic problems are worked out and collection techniques on rock surfaces improve. Much remains to be learned in regard to the growth of the algae in the spring and summer period, their means of growth, and times of reproductivity. In the next year recolonization studies should provide data on the ability of the community to re-establish itself following physical disturbances at different times. Finally, it is hoped that answers to questions involving the trophic structure and the overall importance (or non-importance) of this community to the Arctic ecosystem are reached.

SUMMARY OF 4th QUARTER

A. Field Activities

1. Field Trip Schedule

a. February 21: Dive team arrives in Deadhorse.

b. February 22-25: Locate DS-11, cut dive hole. NARL airlift of parcoll and field supplies on February 24. Parcoll installation completed on February 25. Travel by NOAA and ERA (206) helicopter.

c. February 26-27: Conduct benthic and underice sampling program for LGL (RU-467) on additional OCS contract funding. Travel by NOAA helicopter.

d. February 28-March 1: Divers collect mysids and amphipods for Dave Schneider (RU-356) for laboratory studies. Travel by NOAA helicopter.

e. March 2-6: Extremely cold and windy weather. No field work conducted.

f. March 7-8: Divers work with Dr. Erk Reimnitz (USGS RU-205) on ice features, and collect data on in situ benthic experiments.

g. March 9: Collect benthic and underice samples and deploy experimental equipment for Dr. Andrew Carey (RU-6) on contract funding. Travel by NOAA helicopter.

h. March 10-13: Divers continue benthic ecological work--collect data on sedimentation, recolonization and growth experiments. Travel by NOAA helicopter.

i. March 14: Complete sampling for Carey (RU-6) and retrieve experimental equipment (on contract funding). Retrieve sampling bottles for Don Schell (RU-537). Release bottom current drifters for Reimnitz (RU-205). Terminate dive program. Dismantle and pack parcoll for NARL. Travel by NOAA helicopter.

j. March 15: Dive team departs Deadhorse for Bellingham, Washington.

2. Scientific Party

a. Assistant Investigator and Team Leader: Ken Dunton, on salary.

b. Marine Technician* and SCUBA divers:

John R. Olson, on contract
*Paul D. Plesha, on contract
Gary Frederick Smith, on contract

3. Methods

See text of annual report.

4. Sample Localities

See text of annual report.

5. Data Collected

See text of annual report.

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Trophic Relationships of the Arctic Shallow Water Marine Ecosystem

by

D. E. Schneider and H. Koch

Introduction

The continued investigation of the trophic relationships of the shallow water Beaufort Sea ecosystem by RU-356 during 1978 employed two approaches. In 1977 we collected data on the composition of fecal pellets and gut contents of some of the common species. This approach was continued in 1978 to provide data on species not studied in 1977 and to provide more complete data on species that were only briefly studied previously. The 1977 investigations also suggested that some species, particularly the amphipod Gammarus setosus, might utilize terrestrial plant detritus that erodes into the marine ecosystem as peat. In 1978 we conducted a series of experiments to assess the ability of selected species to derive nutrition from peat.

Methods

Composition of Fecal Pellets and Gut Contents

The following uniform procedure was used for all of the observations of fecal pellet composition and gut contents. A single pellet or gut contents was thoroughly teased apart on a microscope slide and covered with a cover slip. Four complete, non-overlapping traverses of the slide were made at 400x magnification and all identifiable structures were counted. Following this, the entire slide was examined at 100x to note structures not seen in the traverses.

Peat Particle Size Fractionation

Peat used in this study was collected at Brant Point in Elson Lagoon near Barrow, Alaska. The samples were wet sieved in Millipore filtered (0.45μ) sea water through a graded series of nitex screens to provide the particle size fractions used in experiments. The following screen sizes were used: 63μ, 102μ, 202μ, 425μ, and 1050μ, or 1163μ. Sieved samples were stored in Millipore filtered seawater in a 4°C incubator under a 24 hour photoperiod until used.

Assimilation Experiments

All of the assimilation experiments employed the following procedure. The quantity of food ingested during the experimental feeding period was estimated by determining the difference in dry weight between initial and recovered food. Dry weights for initial food could not be directly determined without destroying the natural microflora associated with the food. Instead two different procedures were used to estimate the initial amount of food offered to each animal. In experiments where a small food particle size was used, a fixed volume of a constantly stirred heavy suspension of the particles was delivered to each experimental chamber with a wide bore automatic pipette. At least 10 control samples were delivered into separate containers for immediate dry weight and ash weight analysis to provide an estimate of the amount of food delivered to the experimental chambers. In experiments where a coarse peat particle size was used, a small quantity of peat (about 40-50 mg damp weight) was rolled into a ball and pressed between two sheets of Whatman No. 1 filter paper for one minute using the two halves of a petri dish. The blotted samples were then rapidly weighed to the nearest 0.1 mg and were placed in the experimental chambers. At least 10 control samples were similarly prepared for direct dry weight and ash weight analysis. The control samples were used to provide a damp to dry weight conversion factor to allow estimates of the dry weights placed in each chamber.

Animals that had been starved long enough to allow complete evacuation of their guts were individually placed in separate experimental chambers containing the initial food ration and Millipore filtered sea water. Experiments on fine peat particle sizes were carried out in 100 ml beakers containing about 70 ml of sea water. The chambers used for large food particle sizes were 250 ml beakers containing about 200 ml of Millipore filtered seawater with a 1163μ nitex screen shelf about halfway up the beaker.

This arrangement allowed fecal pellets to fall through the screen to the bottom of the beaker where they could be more easily separated from food particles. After a known period of exposure to the food, the animals were removed to clean Millipore filtered seawater and allowed to remain there for 24 hours to clear their guts. Fecal pellets were removed from the feeding and gut clearance chambers with a Pasteur pipette, transferred to a thin strip of 121μ nitex screen. The screen and pellets were blotted on filter paper and briefly rinsed three times with distilled water. Pellets were then transferred to a pre-ashed and tared aluminum foil pan, dried at 60°C for at least 12 hours, and weighed to the nearest 0.01 mg on a Cahn model DTL electrobalance. Dry pellets and pans were then ashed in a muffle furnace at 500°C for either 2 or 24 hours and reweighed. It was found that there was no further decrease in weight when a 2 hour ashed sample was further ashed for 24 hours. Food remaining after the feeding period was recovered by suction filtration (< 1/3 atmosphere) on pre-ashed (475°C for 30 minutes) and tared 2.4 cm Whatman GF/c glass fiber filters, rinsed twice with 2 ml of distilled water, dried for at least 12 hours at 60°C, and weighed on a Cahn model DTL electrobalance. Dry filters and food were then ashed in a muffle furnace at 500°C for either 2 or 24 hours, and reweighed.

Food ingested was calculated as the difference in dry weights of the initial and recovered food. Percent organic content of initial food and recovered fecal pellets was calculated from the ash-free weights and the unashed dry weights. These values were then used to calculate two different assimilation efficiencies. Gravimetric assimilation efficiency was calculated using the relationship

$$U = \left(\frac{I - N}{I}\right) \times 100$$

where U is the percentage of assimilation, I is the dry weight ingested, and N is the dry weight excreted as feces. This efficiency measures total assimilation which includes both organic matter and ash. Organic assimilation was calculated using Conover's (1966) equation.

$$U' = \left(\frac{(F' - E')}{(1 - E')\,F'}\right) \times 100$$

where U' is the percentage of assimilation, and F' and E' are the ash-free dry weight : dry weight ratios for ingested food and feces produced respectively.

ATP Content of Peat and Fecal Pellets

ATP was extracted from peat samples and fecal pellets by immersion in 5 ml of sterile 0.02M Tris buffer pH 7.75 in a boiling water bath for 5 minutes. Extracts were frozen if they were not to be assayed immediately. Assay of the ATP content of the extracts was made by measuring the light output from a firefly luciferin-luciferase enzyme system with a liquid scintillation counter as the photodetection device.

The enzyme preparation was made by suspending 50 mg of firefly lantern extract (Sigma FLE-50) in 5 ml of sterile 0.02M Tris buffer pH 7.75. The suspension was allowed to stand at room temperature for 2-3 hours, centrifuged in a clinical centrifuge for 10 minutes and the supernatent was decanted into a clean vial. ATP standards were made by dilution of a stock solution of 10μg ATP (Sigma Na Salt) per ml of 0.02M Tris buffer pH 7.75. Final concentrations of the standard solutions were 2×10^{-2}, 1×10^{-2}, 1×10^{-3}, and 1×10^{-4}, μg ATP/0.1 ml.

Assays were carried out in liquid scintillation vials containing a total of 2.0 ml of fluid. Each vial contained 0.1 ml of extract or standard solution, 0.1 ml of enzyme suspension, and 1.8 ml of 0.02M Tris buffer pH 7.75. The enzyme suspension was added last to initiate the reaction. A Nuclear Chicago model 6848 liquid scintillation counter, set in a non-coincidence mode (Stanley and Williams, 1969) was used to detect the light output from the reaction. Channel A was set at zero attenuation and a 2 to 10% window was used. Upon addition of the enzyme, the vial was rapidly capped, swirled to mix the solution, and placed on the sample elevator. Counting commenced as soon as the vial reached the counting chamber and the first 0.1 minute count was used. Standard curves were run approximately every 30 minutes while processing samples.

Specific details of individual experiments are presented in the following section along with the results.

Results and Discussion

Fecal Pellet Composition

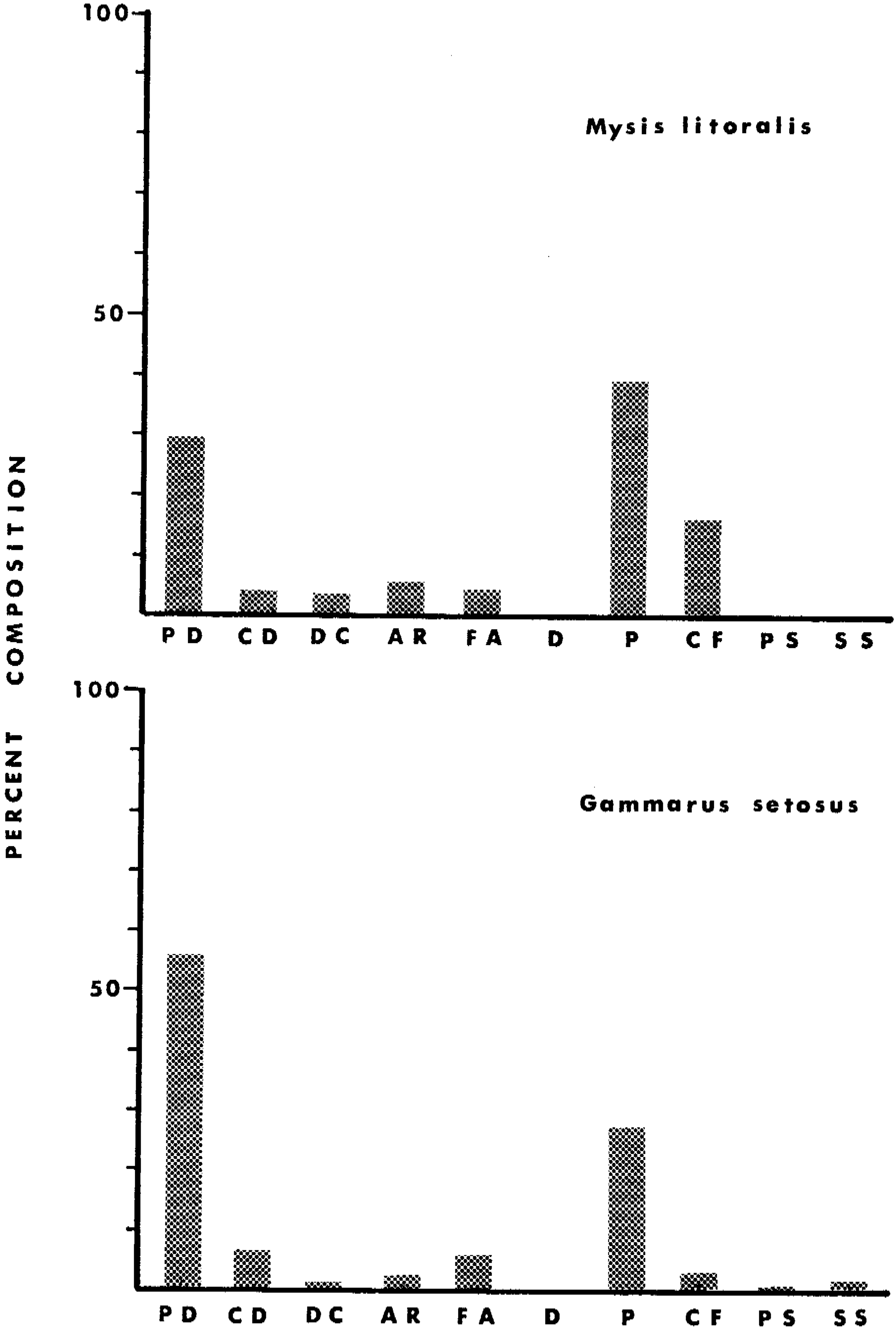
The composition of freshly collected fecal pellets was examined using the standardized observation procedure described in the methods section. The mean number of items was computed for each recognizable food category. These values were then used to calculate the percent composition of the fecal pellets. The results for those species in which five or more pellets were examined are presented in Figs. 4.1 to 4.8. For those species in which fewer than five pellets were examined, the results appear in Table 4.1.

Most of the species studied ingest substantial numbers of diatoms and at least some peat. Since many of the diatoms observed are benthic and most of the pellets contained a high proportion of mineral grains, deposit feeding may be important in a number of these species. A smaller proportion of the species ingest crustaceans (53%) and polychaetes (32%), however most of these appear to be omnivorous because diatoms and peat are often major dietary components. Whether those crustaceans and polychaetes that were ingested were captured alive or as detritus is not known. Observations of mysids and many of the amphipods under laboratory feeding situations indicate that these species will readily consume dead animal tissue. The most striking feature of these data is that there is considerable dietary overlap between the species. None of the species studied appear to be trophic specialists. However there is some indication of different patterns of food selection. For instance, *Mysis littoralis*, *Gammarus setosus* and perhaps *Haploscoloplos elongatus* appear to ingest substantially more peat than the other species studied. *Mysis littoralis*, *Onisimus litoralis*, *Acanthostephia behringensis*, *Gammaracanthus loricatus*, and *Myoxocephalus quadricornis* all ingest more crustaceans than the other species. *Saduria entomon*, *Myoxocephalus quadricornis*, and perhaps *Haploscoloplos elongatus* feed heavily on polychaetes. The high proportion of diatoms ingested indicates that primary production of the benthic microalgae is an important source of energy input for the arctic shallow water marine ecosystem, at least during the summer when these pellets were collected.

Fig. 4.1. Fecal pellet composition of the mysid Mysis litoralis. The percent composition is based upon the mean number of recognizable food items observed in 34 fecal pellets.

PD = Pennate diatoms
CD = Centric diatoms
DC = Diatom chains
AR = Amphipleura rutilans - a colonial benthic diatom
FA = Filamentous algae
D = Dinoflagellates
P = Peat including plant fibers
CF = Crustacean fragments
PS = Polychaete setae
SS = Sagitta (Chaetognath) setae

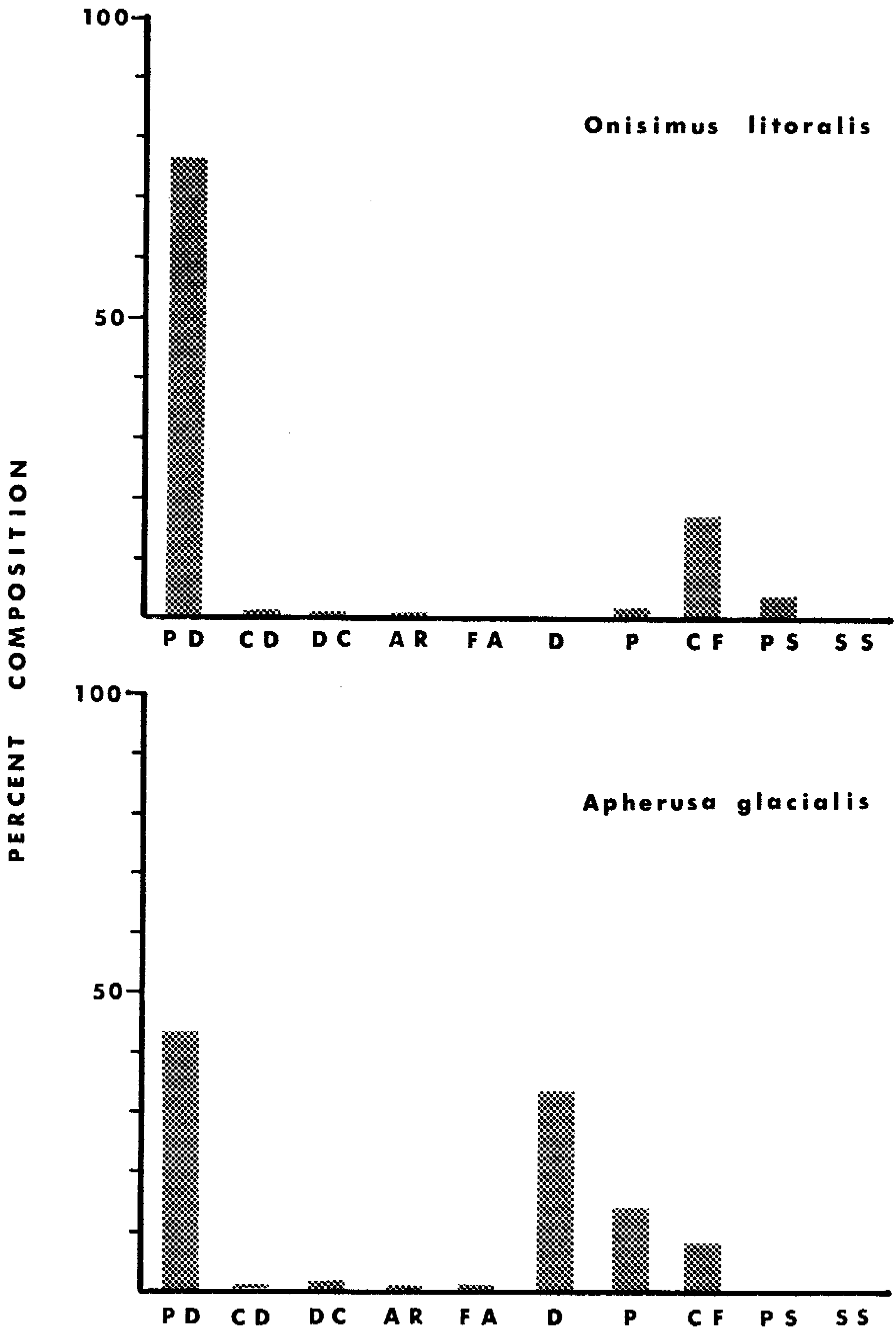
Fig. 4.1. Fecal pellet composition of the amphipod Gammarus setosus. The percent composition is based upon the mean number of recognizable food items observed in 24 fecal pellets. Figure labels as in Fig. 4.1.



PERCENT COMPOSITION
100
50
Mysis litoralis
PD CD DC AR FA D P CF PS SS
100
50
Gammarus setosus
PD CD DC AR FA D P CF PS SS

Fig. 4.3. Fecal pellet composition of the amphipod *Onisimus litoralis*. The percent composition is based upon the mean number of recognizable food items observed in 17 fecal pellets. Figure labels as in Fig. 4.1.

Fig. 4.4. Fecal pellet composition of the amphipod *Apherusa glacialis*. The percent composition is based upon the mean number of recognizable food items observed in 19 fecal pellets. Figure labels as in Fig. 4.1.



100
50
Onisimus litoralis
PD CD DC AR FA D P CF PS SS
100
50
Apherusa glacialis
PD CD DC AR FA D P CF PS SS
PERCENT COMPOSITION

Fig. 4.5. Fecal pellet composition of the isopod Saduria entomon. The percent composition is based upon the mean number of recognizable food items observed in 15 fecal pellets. Figure labels as in Fig. 4.1.

Fig. 4.6. Fecal pellet composition of the polychaete Terebellides stroemi. The percent composition is based upon the mean number of recognizable food items observed in 12 fecal pellets. Figure labels as in Fig. 4.1.

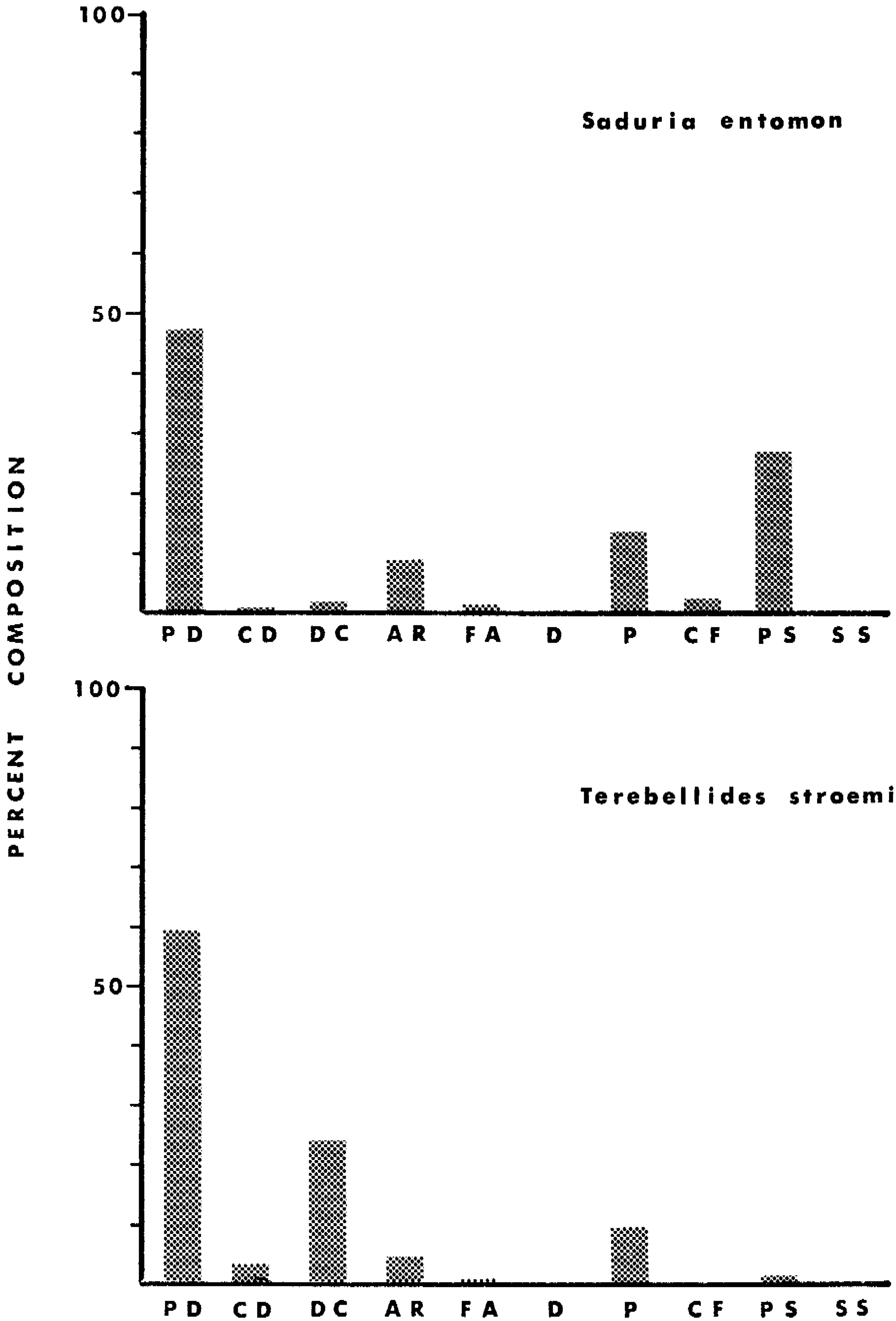
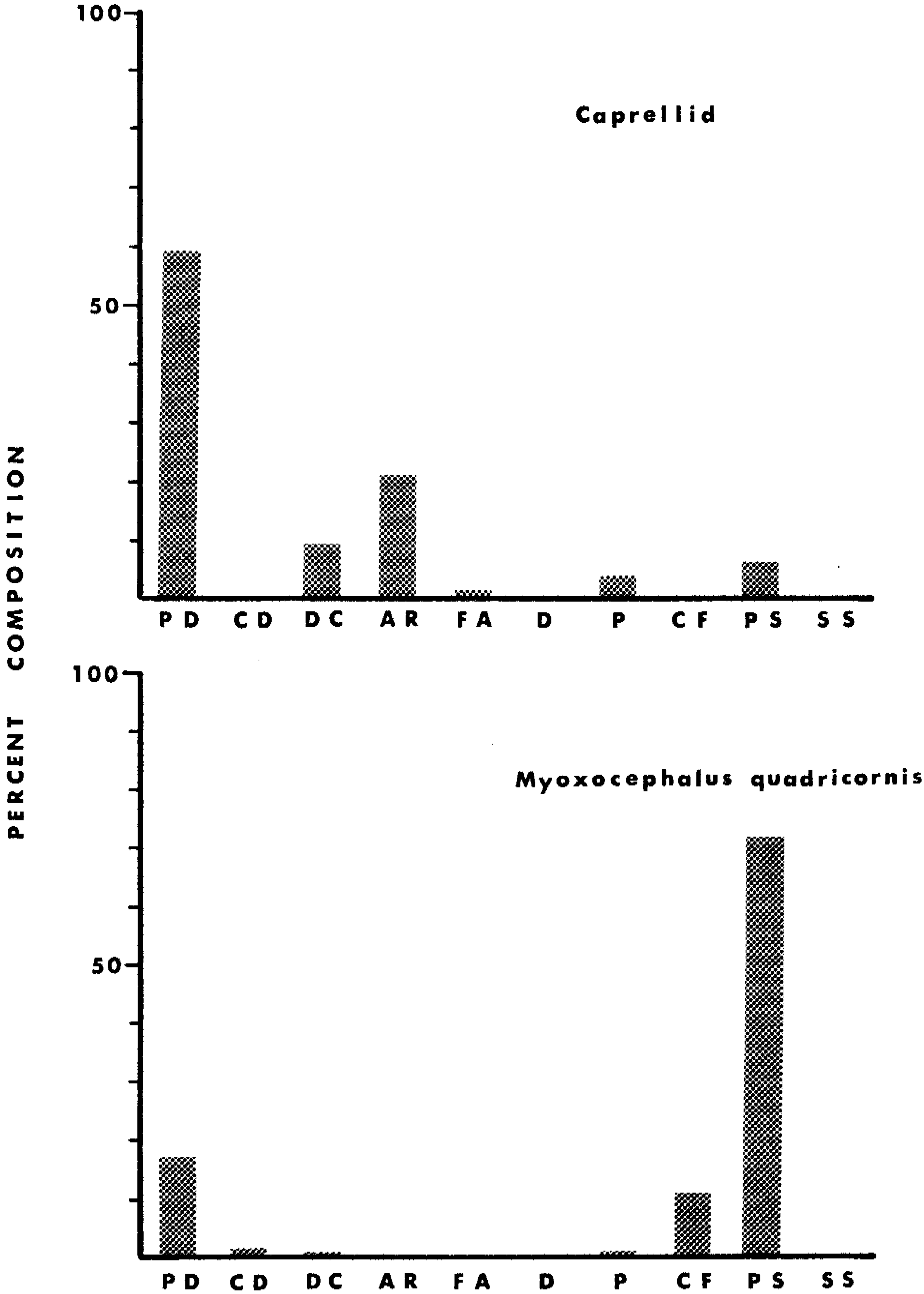

PERCENT COMPOSITION
100
50
Saduria entomon
P D
C D
D C
A R
F A
D
P
C F
P S
S S
100
50
Terebellides stroemi
P D
C D
D C
A R
F A
D
P
C F
P S
S S

Fig. 4.7. Fecal pellet composition of the caprellid Caprella sp. The percent composition is based upon the mean number of recognizable food items observed in 5 fecal pellets. Figure labels as in Fig. 4.1.

Fig. 4.8. Fecal pellet composition of the fish Myoxocephalus quadricornis. The percent composition is based upon the mean number of recognizable food items observed in 17 fecal pellets. Figure labels as in Fig. 4.1.



PERCENT COMPOSITION
100
50
Caprellid
P D
C D
D C
A R
F A
D
P
C F
P S
S S
100
50
Myoxocephalus quadricornis
P D
C D
D C
A R
F A
D
P
C F
P S
S S

Table 4.1. Percent of Recognizable Food Items in Fecal Pellets. Percentages are based upon the mean number of food items identified per pellet using the standardized observation technique.

	Atylus carinatus	Acanthostephia behringensis	Gammaracanthus loricata	Pagurus trigonocheirus	Harmothoe imbricata	Pectinaria granulata	Haploscoloplos elongatus	Scolecolepides arctius	Priapulus caudatus	Saduria sabini
Pennate Diatoms	81.6	59.1	0	84.0	81.5	91.0	34.6	28.8	48.1	50.0
Centric Diatoms	0	1.0	0	0.5	3.3	3.0	0	0.1	0	10.0
Diatom Chains	0	0	0	0	0	3.0	0	67.3	0	0
Filamentous Algae	0	0	0	0	0	1.5	0	0	0	0
Peat	10.0	4.0	11.2	0.5	0	1.5	34.6	0.7	16.2	40.0
Crustacean Fragments	8.4	35.9	88.8	15.0	5.3	0	0	0.1	0	0
Polychaete setae	0	0	0	0	0	0	30.8	3.0	35.7	0
Total Mean No. Items	20.0	99.0	15.0	103.0	151.0	33.5	26.0	339.3	210.0	18.0
Total Pellets Examined	3	2	1	2	1	2	1	3	1	1

Gut Clearance Times

In animals that produce discrete fecal pellets, the quantitative collection of these may often be a better index of feeding activity than attempting to estimate the amount of food actually ingested. As we intended to quantitatively collect fecal pellets in some of our experiments it was necessary to determine the gut clearance times for the species used.

An experiment was set up to determine the gut clearance time for the amphipod Gammarus setosus using freshly collected specimens. Twenty-four G. setosus were placed individually in compartments of a plastic box immediately after they were collected. Each compartment contained about 50 ml of Millipore filtered sea water. Fecal pellet production was monitored at 30 minute intervals for 9.5 hours. After about 6.5 hours there was no significant increase in the number of pellets produced. The mean clearance time, calculated by averaging the times of last pellet production for each animal, was 4.9 hours and a mean of 9.2 pellets was produced during this period. In a later feeding experiment with G. setosus it was noted that fecal pellets began to be released about 4.5 hours after the starved animals were presented with food. These data suggest that this species requires about 4.5 to 4.9 hours to pass food completely through the gut. The design of subsequent feeding experiments took the above information into account.

A similar gut clearance experiment was set up using the amphipod Onisimus litoralis. Gut clearance for this species appears to be much slower than that for G. setosus. After 72 hours, when the experiment was terminated, only 4 animals out of 24 appeared to have cleared their guts and fecal pellets were still being slowly produced. It was concluded that O. litoralis was not ideal for egestion rate studies and no further experiments were planned for this species using this technique.

Sediment Feeding Experiments

Casual observations of the behavior of Gammarus setosus suggested that this species may ingest fine silty sediments. During the period of ice cover a layer of silt is deposited among the coarser gravel of the nearshore sediments. As the ice begins to melt away from the shore, G. setosus is extremely abundant in this area, often entering the interstices of the gravel sediments. Animals collected with silt laden water from this area produced large numbers of fecal pellets over a several day period. Several experiments were designed to examine the ability of this species to ingest sediments. Fine sediments contain large populations of diatoms as well as adsorbed organic material.

Unfiltered sea water containing suspended sediment that had been stirred up from the nearshore gravel was used to fill a compartmented plastic box. Individual G. setosus that had been starved for 24 to 30 hours prior to the experiment were introduced into each of the 24 compartments of the box. The box was held in a lighted incubator at 5°C during the experiment. Fecal pellet production was monitored at hourly intervals for 14 hours. After an initial lag of about 3-4 hours, pellet production was nearly linear for the duration of the experiment. At 14 hours the mean ± S.E. number of fecal pellets produced per animal was 13.0 ± 1.7.

An experiment was designed to provide information on the range of particle sizes that can be ingested by G. setosus. Silty sea water (salinity <5%) was collected by mechanically stirring up the sediments prior to taking the water sample. Small volumes of this water were passed through one of the following graded series of sieves to provide a series of solutions from which particles of different sizes had been selectively removed: (a) unsieved silty water; (b) 202μ Nitex screen; (c) 121μ Nitex screen; (d) 62μ Nitex screen; (e) 8μ Nuclepore polycarbonate membrane; and (f) 0.45μ Millipore filter. The 8μ Nuclepore membrane tended to clog so rapidly that it was necessary to prefilter this solution through Whatman No. 5 filter paper before passing it through the membrane. Even with this treatment it was necessary to change the Nuclepore membrane every 75 - 100 ml, indicating that particles >8μ were passed by the Whatman No. 5 filter.

Twelve G. setosus were placed individually in compartments of a plastic box containing about 50 ml of the above solutions. Fecal pellet production was recorded at hourly intervals for 11 hours. At each observation the pellets were removed to a second compartmented box. The accumulated pellets were briefly rinsed in distilled water and dried at 60°C for 12 hours. Pellet dry weights were determined to the nearest 0.1 mg on a Cahn DTL electrobalance. The amphipods used in this experiment were also rinsed in distilled water and dried at 60°C for 48 hours prior to weighing.

Fig. 4.9 shows the cumulative dry weight of fecal pellets produced in each sieved solution during the 11 hour feeding period. G. setosus is apparently capable of ingesting and forming fecal pellets from particles down to <62μ in diameter, but not those particles <8μ or the <0.45μ fractions. After the experimental period, those amphipods used in the smallest two size fraction were offered unfiltered silty water to verify that they were capable of producing pellets. All of these animals produced numberous pellets except for one individual in the <8μ group. An analysis of variance was performed on the data from those treatments in which fecal pellets were produced. None of these sievings above the 8μ level resulted in a significant effect on cumulative fecal pellet weight.

During the above experiment it became obvious that the largest individuals were producing fewer fecal pellets than the small amphipods. The relationship between body size and fecal pellet production is presented in Fig. 4.10 for the unfiltered and 202μ filtered treatments. A log transformation of the data results in a better straight line fit than an arithmetic plot, indicating that fecal pellet production on this food source is exponentially related to body size. It is obvious that small individuals produce a greater quantity of feces than the large animals. This may indicate that large G. setosus are not predominantly sediment feeders, while small individual can rely on this resource. Another factor that may be partially responsible for this relationship is the well known effect of body size on metabolism in which the metabolic rate of small individuals is higher on a per gram basis than that of large individuals. However the slope of the metabolism--weight regression is usually close to -0.27 whereas that of the above fecal production--weight regression is much higher; -0.67 and -1.0 for the two data sets presented.

Peat Feeding Experiments

A series of experiments was set up to assess the role of terrestrial plant detritus (peat) in the trophic relationships of the shallow water marine ecosystem. Information relating to the following major questions was sought by these experiments:

1) Do animals that ingest terrestrial plant detritus derive any nutrition from this material?

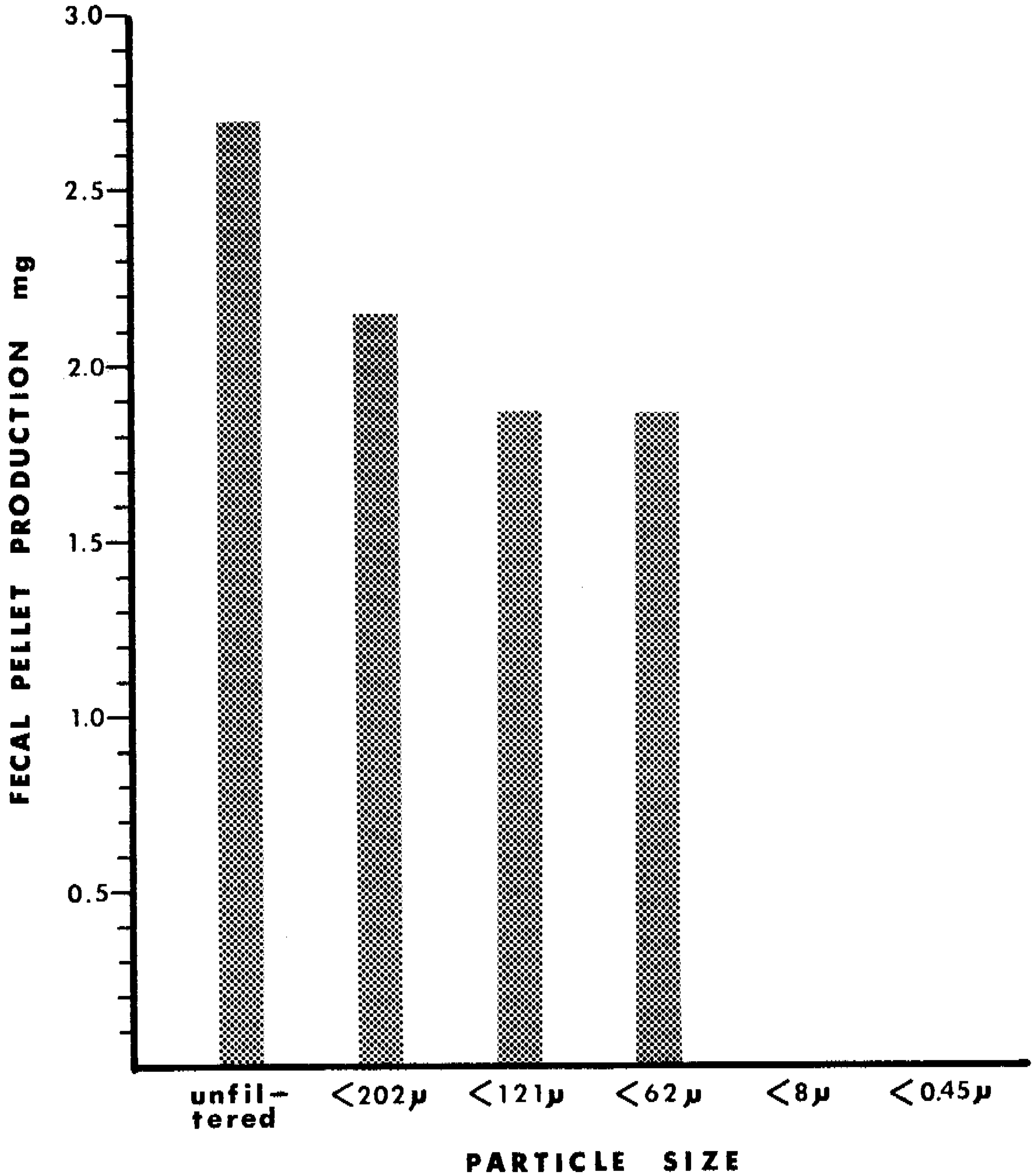


Fig. 4.9. Fecal pellet production by Gammarus setosus fed on different particle sizes derived from suspended sediments. The quantity shown is the cumulative dry weight of fecal pellets produced during an 11 hour feeding period.

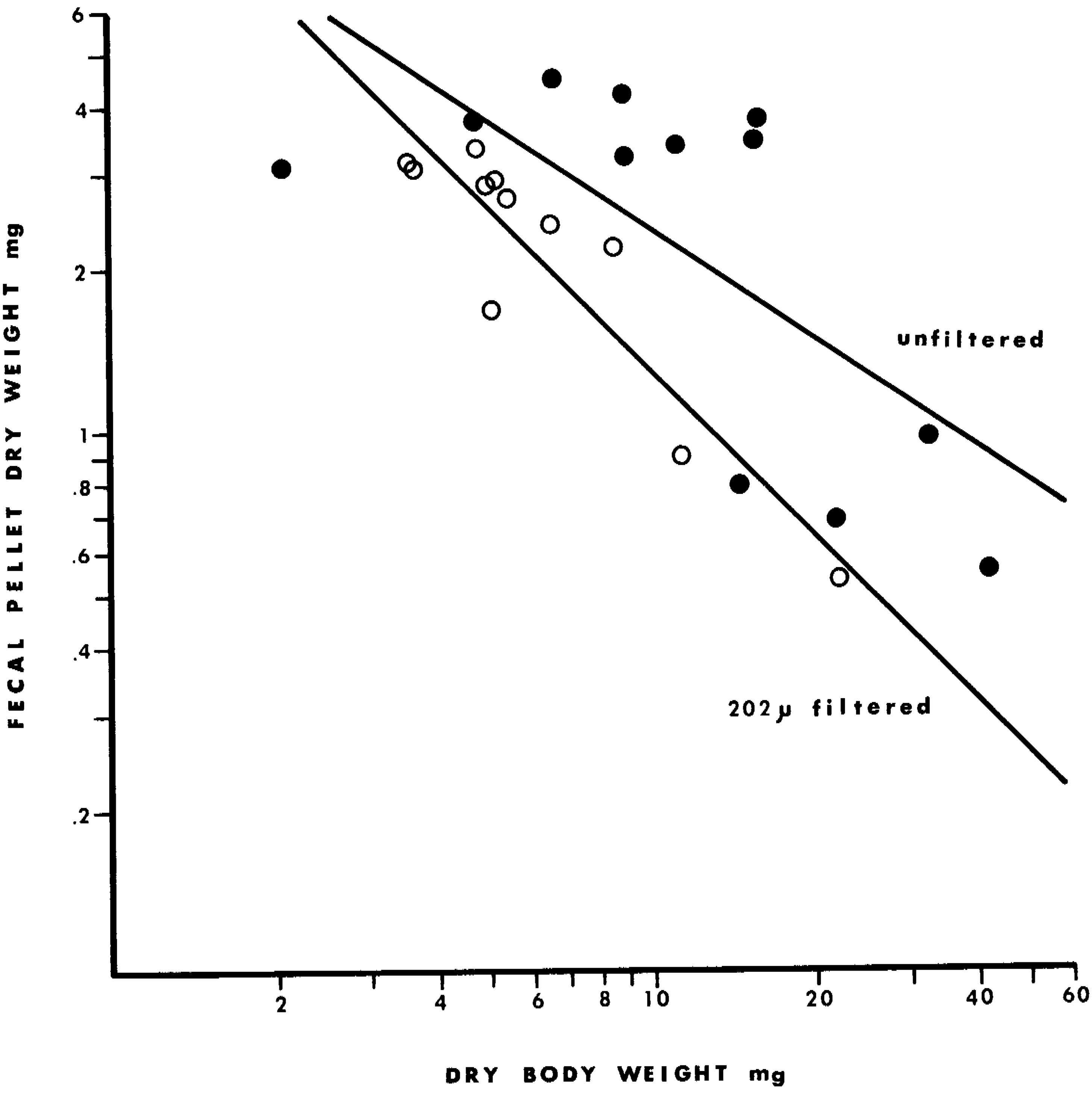


Fig. 4.10. The relationship between fecal pellet production and body size in Gammarus setosus fed on suspended sediment particles. The 202μ filtered fraction contained only particles smaller than this size.

2. If these species derive nutrition from this detritus, are they able to utilize the material directly or are they digesting the microorganisms that may be the primary agents of decomposition?
3. Do the species that utilize terrestrial plant detritus prefer a particular size fraction? In other words, is there a hierarchy of species required to utilize this material fully, some dealing with fairly large particles and reducing them to smaller sizes while other species only operate on small particle sizes?

Studies conducted during the summer of 1977 suggest that the abundant amphipod Gammarus setosus actively ingests large peat particles and in the process breaks them down into small size pieces. None of the other species investigated that summer even approached the ability of G. setosus to process peat particles. For this reason, the majority of the experiments were designed using this species as the test organism.

Organic content of peat size fractions. Peat enters the Arctic Marine ecosystem primarily as a result of erosion of receding coastlines. During this process, several stages can be recognized. First, undercutting of an eroding bluff by wave action causes a slumping of surface layers of sod and peat towards the active beach region. Further erosion causes pieces of this surface layer to fall onto the wave swept position of the beach. Breakup of these consolidated pieces is not immediate though and recognizable clumps can be observed in the shallow water for some time. Finally the wave action and currents completely disperse the clumps and distribute the peat particles throughout the marine system. The changes in organic content of peat as it progresses through this erosional process are of some interest since the peat may serve as a potential nutritional source.

Peat samples from three different stages in the above erosional process were obtained near Brant Point in Elson Lagoon. A portion of each sample was wet sieved through a graded series of nitex screens to yield six different particle size classes. Samples of each size class were then analyzed for organic content using the weight loss upon ignition in a muffle furnace.

The results of these analyses are shown in Table 4.2. Shallow water peat that has been in the marine system for some time has the lowest organic content. The peat from the clump on the beach and the eroding tundra that has not yet entered the marine system are quite similar in organic

Table 4.2. Organic Content of Peat Particle Size Fractions. Derived from several different sources.

Peat Size Fraction	Shallow Water Peat	Clump on Beach	Eroding Tundra
> 1050μ	76.1*	86.2*	84.1
425 < x < 1050μ	67.1*	81.1	85.2
202 < x < 425μ	55.0	81.0	81.1
102 < x < 202μ	53.9	81.3	84.8
63 < x < 102μ	47.2*	74.5*	84.4
< 63μ	29.6*	36.4*	68.4*

*Significantly different from all other means of the same peat source at the 95% confidence level according to a Newman-Keuls multiple range test. Those means not asterisked are not significantly different from each other.

content except for the smallest size fraction. In most cases the smaller size fractions have a lower organic content than the larger particle sizes. Both of these trends may be the result of biological decomposition processes. Small sized particles in both terrestrial and the marine ecosystem may be formed as decomposer organism utilize the detritus. Microscopic examination of the size fractions of the shallow water peat suggest that a high proportion of the material in the two smallest size classes may be derived from fecal pellets of amphipods and other shallow water marine animals. The material in the $63 < x < 102\mu$ size fraction was in clumps that teased apart in a similar manner as the amphipod fecal pellets. The $<63\mu$ fraction contained a high proportion of material that looked identical to a fecal pellet that had been already teased apart. If this suggestion is correct, the lower organic content of the small particle sizes may be the result of utilization of the less refractory organic material by shallow water organisms. Some of the decline in organic content after the peat enters the marine ecosystem may be the result of leaching of organic material from the particles.

Peat particle size fraction feeding experiment. An experiment was set up to determine the capabilities of *G. setosus* to feed upon and assimilate organic material from different particle sizes of peat. The peat used in the experiment was derived from the same sample that was used for organic content analysis of shallow water peat presented in Table 4.2. Size fractions were also the same as used in the organic content analysis. Eight replicate samples of each size fraction were introduced into compartmented polystyrene boxes by pipetting 2 ml aliquots of a constantly stirred heavy suspension into each compartment with a large bore automatic pipette. Each compartment contained about 50 ml of Millipore filtered sea water (31% salinity). The $>1050\mu$ fraction could not be pipetted and instead 5 mg damp weight was placed in each compartment. One *G. setosus*, previously starved for several days, was introduced into each compartment. Fecal pellet production was monitored over a 10.5 hour period and pellets were removed to another container at approximately 1 hour intervals. At the end of 10.5 hours amphipods were removed to clean boxes to allow gut clearance. All fecal pellets from each animal were pooled for dry weight and organic content determination.

Fecal pellet production was much higher when the amphipods were feeding on the smallest size fraction, <63μ, than when larger particles were offered (Fig. 4.11). A 1-way analysis of variance followed by a Newman-Keuls multiple range test indicate that there is a significant effect of particle size on fecal pellet production ($p < .01$) but that only the <63μ size fraction treatment was significantly different from the others ($p < .05$). Assimilation efficiencies were calculated from the organic contents of peat and feces using Conover's (1966) equation and these values are presented in Table 4.3. Assimilation of organic matter is inversely related to peat particle size. Substantial assimilation only occurred when G. setosa was feeding on the largest size fraction. Assimilation was still positive but not high with the $425 < x < 1050\mu$ fraction and became increasingly negative with smaller size fractions. Since the organic content of the peat is also inversely correlated with particle size (Table 4.3) it is possible that the high feeding rate with the smallest particle size is a response to the decreased organic content of this fraction. If so, the increased feeding rate is of no apparent benefit to the amphipod with this food source since the assimilation is so negative (-40.9%). On another food source with less refractory organic matter this behavior could have adaptive significance. Further experiments are necessary to determine whether feeding rates are actually related to organic content of food.

Peat assimilation experiments with Gammarus setosus. A more detailed series of experiments was designed to investigate the ability of G. setosus to assimilate organic material from peat and other terrestrial plant detritus. The general procedures followed in all of these experiments were those described earlier in the methods section. An estimate was made of the initial dry weight of food presented to each animal and the final amount of food following feeding was quantitatively collected for dry weight analysis. The difference between these two values provided an estimate of the dry weight of the food ingested. This value was used along with the dry weight of fecal pellets produced to calculate the gravimetric

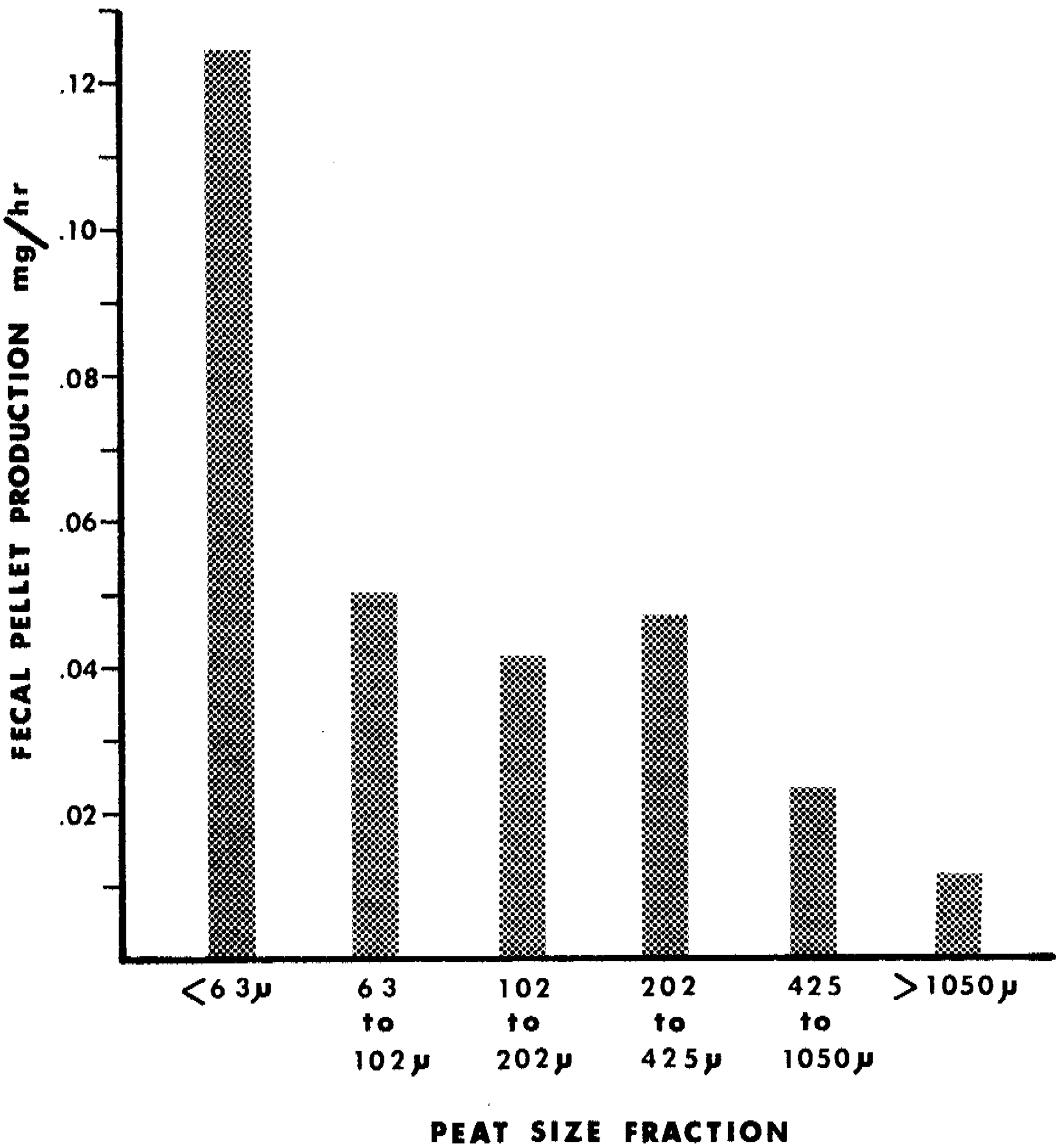


Fig. 4.11. Fecal pellet production rate by Gammarus setosus fed on different particle sizes of peat.

Table 4.3. Gammarus setosus Peat Size Fraction Feeding Experiment

Peat Size Fraction	Fecal Pellet Production mg/hr	Peat % Organic	Fecal Pellet % Organic	Conover's % Assimilation
> 1050μ	0.011	76.1	43.4	75.9
425 < x < 1050μ	0.023	67.1	62.1	19.7
202 < x < 425μ	0.047	55.0	58.2	-13.9
102 < x < 202μ	0.042	53.9	59.2	-24.1
63 < x < 102μ	0.050	47.2	56.4	-44.7
< 63μ	0.124	29.6	37.2	-40.9

assimilation efficiency for the food used. In addition, the organic content of both food and feces was determined so that the percent assimilation based upon Conover's (1966) equation could be calculated.

In view of the large discrepancies between the gravimetric and Conover's assimilation efficiencies in the experiments about to be described, a discussion of the relative reliability of these measurements seems in order. Of the two efficiencies, the gravimetric assimilation is probably most prone to experimental error. To calculate this assimilation an accurate estimate of dry weights of food ingested and feces produced must be obtained. Unfortunately the peat could not be dried to provide an accurate measure of the amount of food offered to each animal without destroying the natural microflora associated with the peat. Instead an indirect measure of the initial amount of peat had to be used. In the case of small particle sizes, replicate aliquots were directly filtered on tared glass fiber filters for dry weight analysis. The pipetting of suspensions of particles cannot be absolutely precise and in some cases the total range of weights was as much as 6-7% of the total weight delivered to the experimental containers. Experiments with coarse fractions of peat necessitated the use of a standard blotting technique and the determination of a damp dry weight for the initial peat offered to each animal. Dry weight values were estimated by using a damp dry to dry weight conversion factor derived by directly determining the dry weight of damp-dried portions of the same peat. The errors associated with blotting to a consistant damp weight can be considerable even when care is taken to use a standardized procedure. Finally, the quantitative collection of fecal material can be a problem. Fecal pellets produced on small particle size fractions of peat tend to be well formed and are easily recognizable from the food particles. However, the pellets formed while feeding on coarse peat particles, although initially well formed, tend to fragment easily. Although an effort was made to preserve the integrity of these pellets by letting them fall through a screen to separate them from the food and animal, there still may have been some loss of fecal material. A low estimate of food production would bias the assimilation efficiency upwards.

The sources of experimental error associated with the Conover's assimilation efficiency are fewer. As long as an adequate sample of food and feces can be obtained, the primary source of error is associated with the actual dry weighings and ashing process. There are, however, two assumptions that are made when this equation is used. First, the food sample taken for organic analysis must be identical in composition to the material actually ingested. Second, it is assumed that there is no ash assimilation and that the dry weight of ash in the feces is the same as the ash dry weight ingested. The first assumption is probably correct for G. setosus as long term peat feeding experiments conducted during the summer of 1977 showed that this species would eventually ingest nearly all of the coarse peat offered. The second assumption may not be correct. Ash assimilation has been found to be substantial in other studies of aquatic animals (Lasenby and Langford, 1973; Pavlyutin, 1970) and in the present experiments the ash content of the feces was frequently lower than the estimate of ash ingested. It should be pointed out though that the estimate of ash ingestion by gravimetric methods is confounded by the same errors encountered in the estimation of total food ingestion. If there is significant ash assimilation, the estimate of organic assimilation by Conover's equation will be low. Conover's equation therefore provides a conservative estimate of organic assimilation. In the present study where we are interested in determining whether animals are capable of deriving nutrition from specific food items, use of the method of calculating assimilation efficiencies that is most conservative and least subject to experimental error seems preferable. For this reason, the majority of the conclusions will be based upon the Conover assimilation efficiencies.

Two experiments were run using small sized peat particles from shallow marine water as food. The $<63\mu$ fraction was used in the first experiment and the $63 < x < 102\mu$ fraction in the second. The results of these experiments are shown in Table 4.4. When the $<63\mu$ was used as food the gravimetric assimilation was very low. A paired sample t-test comparing the dry weight ingested with the dry weight of the feces indicated no significant difference ($p > .05$) between the means. Therefore the gravimetric

Table 4.4. Terrestrial Plant Detritus Feeding Experiments with <u>Gammarus setosus</u>.

Food Type	Exp. duration	n	mg Ingested	mg Feces	Gravim. Assim. %	Food % Organic	Feces % Organic	Conover's Assim. %
Peat < 63μ	12 hr	6	3.08	2.96	3.9	32.6	34.9	-10.8
Peat 63 < x < 102μ	35 hr	12	1.28	0.88	31.2	35.7	41.1	-25.7
Peat >1.168mm	10 hr	19	0.9	0.79	12.2	70.4	45.1	65.4
Peat >1.168mm	24 hr	10	1.08	0.79	26.9	75.4	43.3	75.1
Peat >1 mm	24 hr	12	5.11	1.44	71.8	79.0	56.7	65.2
Eroding Tundra Peat >1mm not presoaked	24 hr	12	3.5	1.16	66.9	84.0	82.2	12.0
Eroding Tundra Peat >1mm presoaked in raw sea water	23.5 hr	12	0.6	0.80	-33.3	83.5	84.3	-6.1
Dried Tundra Vegetation not presoaked	50 hr	12	3.0	0.91	69.7	93.1	82.1	66.0
Dried Tundra Vegetation presoaked in raw sea water	42 hr	12	5.34	1.34	74.9	88.5	81.9	41.2

assimilation of 3.9% should not be considered different from zero. The organic content of the fecal pellets was found to be significantly higher (t-test $p < .05$) than that of the food. This caused the assimilation efficiency based upon Conover's (1966) equation to be negative. Similar trends were found when the $63 < x < 102\mu$ fraction was used, except that the dry weight of the food ingested was significantly higher (t-test $p < .05$) than the dry weight of feces produced. This indicates that the gravimetric assimilation of 31.2% is greater than zero. However the Conover assimilation was negative as a result of a significantly greater percent organic (paired sample t-test $p < .05$) in the feces than in the food. It is concluded from these experiments that G. setosus does not derive any nutrition from peat particles smaller than 102μ.

Three experiments were set up using a coarse fraction of peat >1mm particle size. The peat was collected in the shallow water of Elson Lagoon and had been exposed to marine conditions for an undetermined amount of time. Table 4.4 shows the results of these experiments. The gravimetric assimilation values are widely divergent among the three experiments, although the mean dry weights ingested are in all cases significantly higher than the mean dry weights of all the feces (t=tests $p < .05$). Errors in estimating the initial food offered and the fecal material produced are suspected as a contributing factor to this variation. The Conover assimilation efficiencies are surprisingly high and reasonably consistent. Considering the refractory nature of the organic material left in the peat, assimilation efficiencies as high as 65-75% were not anticipated. Although peat that has been exposed to marine conditions develops a microflora of bacteria, diatoms, and filamentous algae, microscopic examination of this material suggests that these components comprise a very small fraction of the peat by weight. The only other reasonable conclusion is that G. setosus is somehow able to digest and assimilate the refractory organic materials that comprise the terrestrial plant detritus. Other animals that utilize cellulose and other plant structural organic compounds usually must do so with the help of symbiotic microorganisms. The enzymes necessary for the digestion of these materials are rare in animals. Whether this is true in G. setosus must await further experimentation.

Since *G. setosus* can apparently utilize a coarse fraction of peat that has been soaking in sea water for some period, its ability to utilize plant detritus that has just entered the marine system became of interest. Two experiments were set up to examine the assimilation of peat from an eroding tundra bank. The peat was collected from a slumped surface slab of tundra near Brant Point in Elson Lagoon. The material had not yet entered the marine system but was in the process of eroding into the active beach. The peat was sieved to retain the >1mm fraction of particles. Two different procedures were employed in the experiments. The first experiment used peat that had been soaked in Millipore filtered sea water for 2 days. This procedure was employed to soften the peat and allow clumps to be broken up without exposing the material to marine microbes. The second experiment used peat that had been soaked in raw unfiltered sea water for one week at 5°C in a lighted incubator. Presumably this treatment allowed some marine microbes to develop on the peat.

The results of these experiments are presented in Table 4.4. Again the gravimetric assimilation efficiencies are widely divergent. In the first experiment where the peat was not presoaked in raw sea water there is a significant difference between the mean dry weight of food ingested and fecal pellets produced (paired sample t-test $p < .05$). However in the second experiment these values are not significantly different (paired sample t-test $p > .05$). This suggests that the assimilation efficiency of -33.3% is not really different from zero. Errors in estimating the initial dry weight of peat in this second experiment were apparent as several of the animals showed negative ingestion but produced at least 1 mg of fecal pellets. The true gravimetric assimilation has probably been underestimated in this case. The percent organics for food and feces are not significantly different for either experiment (t-test $p > .05$). Therefore the low values for the Conover organic assimilation efficiency are not significantly different from zero. This indicates that *G. setosus* apparently cannot derive nutrition from peat that has recently entered the marine ecosystem. Even after the eroding tundra peat has soaked in raw sea water for a week there is no change in the ability of

G. setosus to assimilate the peat. Apparently a longer residence time in the marine system is necessary before the material can be used. Exactly what changes take place to make the peat more easily assimilated is not clear at this point.

As tundra surface material erodes into the marine system it is inevitable that freshly killed vegetation will also become available as a potential food item. It was of interest to contrast the assimilation of this fresh material with that of the older more completely decomposed terrestrial peat. Two experiments were set up using dried tundra vegetation as the food. Only the above ground leaves were used and these were dried in the laboratory at 20°C before use. Control and experimental portions of the dried material were weighed out and introduced into the chambers. The control portions were allowed to soak in Millipore filtered sea water for the same length of time as the experimental portions to allow a correction for loss due to leaching. Two different soaking procedures were employed in the experiments. In the first experiment the dried vegetation was placed directly into the experimental chamber without any presoaking. In the second experiment, the dried material was soaked in raw sea water for 10 days prior to being offered to the amphipods. The control portions for this second experiment also underwent a 10 day soaking in raw sea water to correct for leaching.

The results of these experiments appear in Table 4.4. Gravimetric assimilation efficiency is high in both experiments and the mean dry weights of ingested food and feces produced are significantly different (paired t-test $p < .05$). In these experiments the estimate of the initial amount of food offered is more reliable than in the previous experiments because the material was dried before the portions were weighed out. The Conover assimilation efficiencies are high for both experiments and the percent organics for food and feces are significantly different (t-test $p < .05$). There is a suggestion that the assimilation of the grass soaked in raw sea water is lower than that of freshly immersed grass. This trend could be the result of loss of easily assimilated organic material by leaching. During the soaking process there was an obvious loss of some material into the water and tiny oil droplets appeared in the chambers. Although the assimilation of dried tundra grass is similar to peat from shallow marine waters, the material being removed in each case may be quite different. The dried grass should still contain a high proportion of fairly easily digested organic compounds whereas these less refractory components should have disappeared from the peat that has soaked in the marine ecosystem for some time.

In summary, the results of the peat feeding experiments with G. setosus indicate that this amphipod can assimilate organic matter from a coarse particle size fraction of peat provided it has been in the marine ecosystem for a period of time. G. setosus does not assimilate organic matter from fine particulate fractions of marine peat nor from coarse fractions of peat freshly eroded into the marine ecosystem. This species can assimilate organic matter from dried fresh tundra vegetation that has freshly entered the marine ecosystem.

Laminaria assimilation by Gammarus setosus. Fragments of the kelp. Laminaria are frequently found in the shallow waters during the summer months. Apparently these plants are only found growing in those areas where boulders or cobbles provide the necessary attachment for their holdfasts. Although these areas are not abundant along the Beaufort Sea coast, there is enough release of material from these algal communities to provide a potential supplemental nutritional source for shallow water organisms. An experiment was set up to examine the ability of G. setosus to assimilate pieces of Laminaria detritus. The Laminaria pieces were cut into equal sized small squares, damp dried by pressing between sheets of Whatman No. 1 filter paper with a petri dish, and weighed before placing them in the experimental chambers. Control squares were damp dried using the same technique, weighed, fried at 60°C for at least 12 hours and reweighed to provide a dampdry to dry weight conversion for the experimental squares. The remaining procedures were the same as described in the Methods section for the coarse peat feeding experiments.

The results for this experiment are shown in Table 4.5. There was good agreement between the gravimetric and Conover assimilations for this experiment. Estimates of the initial amounts of food presented are fairly

Table 4.5. *Laminaria* detritus feeding experiment with *G. setosus*.

Food Type	Exp. duration	n	mg ingested	mg feces	Gravim. Assim. %	Food % Organic	Feces % Organic	Conover's Assim. %
Laminaria pieces	10 hr	10	1.85	0.54	70.8	79.2	51.9	71.7

Table 4.6. *Mysis litoralis* Peat Feeding Experiments.

Food Type	Date	Exp. duration	n	mg Ingested	mg Feces	Grav. Assim. %	Food % Organic	Feces % Organic	Conover's Assim. %
Peat < 63μ	8/78	24 hr	10				35.3	32.6	11.3
Peat < 63μ	8/78	24 hr	9	4.96	4.72	7.81	19.2	18.9	1.9
Peat 63 < x < 102μ	2/79	24 hr	11				35.4	36.0	-2.6

reliable due to the consistancy with which this material could be blotted to a damp dry weight. The results indicate that G. setosus can successfully use drifting Laminaria pieces as food. Microscopic examination of fecal pellets produced on this food source indicated that the contents of most of the cells were digested.

Mysis littoralis peat feeding experiments. Mysis littoralis is a common shallow water species that has been frequently observed in areas rich in peat. Experiments during the summer of 1977 with mysids feeding upon a coarse peat fraction were inconclusive. There was some indication of a low level of feeding on these large particles, but the results were not statistically significant. Preliminary observations with this species indicate that a wide range of particle sizes of peat can be ingested and fecal pellets are produced. The ability of Mysis littoralis to assimilate fine particulate fractions of peat was investigated in three experiments. Two experiments were run during August 1978, the third was run in February 1979 under winter conditions of temperature, salinity and photoperiod. In the first and third experiment food ingestion and fecal pellet production were not quantitatively estimated. Samples of food and feces were processed for organic content analysis so that Conover's assimilation could be calculated. In the second experiment food ingestion and fecal pellet production was quantitatively measured to allow gravimetric assimilation to be calculated.

The results of the Mysis peat assimilation experiments appear in Table 4.6. The gravimetric assimilation for the second experiment is low but may be considered greater than zero because the dry weight ingested is significantly greater than the dry weight of feces produced (paired t-test $p < .05$). The percent organic for food is not significantly different from the percent organic for feces in any of the experiments (t-tests $p > .05$). This indicates that none of the Conover assimilation efficiencies are different from zero. Although Mysis littoralis will ingest small peat particles, it appears that they do not derive any nutrition from them.

ATP analysis of food and feces. ATP content has been used as a measure of microbial biomass in ecological studies (Holm-Hansen and Booth, 1966; Lopez et. al., 1977). Studies have shown that ATP does not occur free from living cells and the ATP content of living cells is fairly constant. The determination of ATP content per unit of biomass for a number of diatoms and bacteria in pure culture has provided a basis for estimating microbial biomass. A C:ATP ratio of 285:1 has been suggested as an average value (Holm-Hansen, 1973) and that value is used in this study. Several experiments were set up to measure the ATP content of food and of fecal pellets egested after feeding on the food. The procedure used in these experiments was identical to that used in the assimilation experiments except that the food and fecal pellets were subjected to the ATP extraction procedure described in the methods. The eroding tundra peat had been soaked in a container of raw unfiltered sea water in a lighted incubator at 5°C prior to use in the experiment. Technical difficulties were encountered in these experiments and only those determinations in which 0.1 ml of extract was assayed provided reliable results. These results are shown in Table 4.7. The three size fractions of peat from marine waters show similar ATP levels (mean 0.00877 mg ATP/mg dry wt) suggesting that the microbial populations are similar. In contrast the ATP level of the eroding tundra peat was only 23% of the mean value for marine peats. This indicates a greatly reduced microbial population is present on peat that has not yet aged in the marine ecosystem. The ATP levels in fecal pellets from animals that have been ingesting peat in these experiments is higher than the levels in food. *Mysis littoralis* feeding on <63μ marine peat had about 5 times as high an ATP level as was found in the peat, the same comparison for *Gammarus setosus* feeding on >1mm eroding tundra peat indicates a 3 fold increase. In view of the fact that neither the gravimetric nor the organic assimilation efficiencies for the corresponding peat assimilation experiments were positive (Tables 4.4 and 4.6) the increase in ATP concentration suggests that the microbial populations on these types of peat are not being assimilated.

Table 4.7. ATP Content of Peat and Fecal Pellets. An estimate of microbial living carbon is obtained by multiplying the ATP values by 285 and converting from μg to mg.

	n	ATP μg/mg dry wt.	Living Microbial Carbon mg/mg dry wt.
Marine Peat < 1mm	10	0.00879	0.00251
Marine Peat 63 < x < 102μ	10	0.00825	0.00235
Marine Peat < 63μ	12	0.00926	0.00264
Mysis fecal pellets	12	0.0470	0.01339
Eroding Tundra Peat > 1mm	12	0.00202	0.00056
Gammarus fecal pellets	12	0.00599	0.00171

General Discussion

Primary production, particularly of benthic microalgae, appears to be one of the major sources of energy input to the shallow water Arctic marine ecosystem during the ice free period. Analysis of the composition of fecal pellets and gut contents indicates that the majority of epibenthic and benthic species studied feed at least in part on benthic microalgae. Matheke and Horner (1974) found that the benthic microalgae become the most important source of primary productivity after breakup of the shorefast ice and that productivity of these organisms exceeds that of the phytoplankton by a factor of 2 and that of the ice algae by a factor of 8. The results of our fecal pellet analysis during the summer of 1977 indicate that planktonic diatoms can also be important when they are available. The view that is emerging from these studies is that many of the species are opportunistic feeders that make use of whatever resource is currently abundant.

Terrestrial plant detritus in the form of peat may be an important input of carbon for this ecosystem, especially during periods of low primary productivity. At present our information only indicates that a few species utilize significant quantities of peat. Gammarus setosus is able to ingest and assimilate large quantities of coarse peat particles, but does not derive nutrition from small sized particles. Analysis of fecal pellets and feeding experiments conducted during the summer of 1977 indicate that Saduria entomon and Mysis litoralis may also ingest peat. At present we only know that Mysis does not assimilate small particles of peat. Further experiments with coarse peat fractions are necessary to determine the importance of peat for these latter two species.

Our results suggest that Gammarus setosus can directly utilize the refractory organic matter found in peat. Most studies of benthic detritus feeding communities indicate that the animals that ingest detrital particles are actually deriving their nutrition from the microorganisms that grow upon these particles (Hargrave, 1970, 1976; Fenchel and Harrison, 1976; Mann, 1978). Thus the entry of detrital carbon into the detritivores is a 2-step process in these systems. Direct transfer of detrital carbon to the detritivore would provide a more efficient energy flow (Foulds and

Mann, 1978). If this capability is widespread in the Arctic shallow-water marine ecosystem, it could provide a significant increase in efficiency in this low energy input system. Several recent studies have indicated that direct transfer of detrital carbon to the detritivores is possible (Kofoed, 1975; Foulds and Mann, 1978). The presence of cellulase activity in marine invertebrates is widespread (Yokoe and Yasumasu, 1964; Elyakova, 1972) and has been reported for the genus Gammarus (Halcrow, 1971). We plan to conduct further experiments using radioactively labelled cellulose to more fully assess the possibility of direct transfer of detrital carbon in the Arctic marine ecosystem. Further experiments are also needed with meiofauna, particularly oligochaete and small polychaete worms to determine their importance in the decomposition of peat. It seems unlikely that these small organisms could directly utilize large peat particles and a 2-step transfer through microorganisms seems more likely.

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ANNUAL REPORT

Contract #: 03-78-B01-6
Research Unit #: 359
Reporting Period: 1 Apr 1978-31 Mar 1979
Number of Pages: 96

Beaufort Sea Plankton Studies

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31 March 1979

I. Summary of objectives, conclusions and implications with respect to OCS oil and gas development

The objectives of this project are to assess the winter density distribution of zooplankton and phytoplankton in Steffanson Sound and to analyze samples collected during the 1978 icebreaker cruise in the western Beaufort Sea.

Information concerning the abundance and distribution of phytoplankton and zooplankton and primary productivity in the western Beaufort Sea in summer (August and September) is now available. Some information will be available concerning the winter abundance and distribution of plankton at the end of the FY 79 winter field season. Still unavailable, however, is information from the spring, April through June, and including the underice community.

The winter information is important because of the State of Alaska regulation limiting drilling to the winter and there are indications that some biological activity occurs in winter, *i. e.*, spawning of Arctic cod (*Boreogadus saida* Lepechin) in Russian waters (Rass 1968).

II. Introduction

A. General nature and scope of study

As primary producers and primary and secondary consumers, phytoplankton and zooplankton are important in the Beaufort Sea ecosystem. R.U. 359 will provide information on the winter populations of phytoplankton and zooplankton in the nearshore area of Steffanson Sound.

B. Specific objectives

The specific objectives of this project are to assess the winter density distribution and environmental requirements of zooplankton and phytoplankton in the nearshore areas of the Beaufort Sea in an integrated sampling effort with other Research Units and to analyze samples collected during the 1978 icebreaker cruise in the Beaufort Sea.

C. Relevance to problems of petroleum development

Basic background information on standing stock, species composition, community structure, distribution, and primary production of plankton communities in the Beaufort Sea lease area in winter is generally not known. This kind of information is necessary in order to assess damage in case of a spill. Knowledge of winter biological activity is especially important in light of the State of Alaska draft regulations that limit exploratory drilling to the winter.

III. Current state of knowledge

The literature pertaining to plankton studies in the Beaufort Sea has been reviewed (English and Horner 1977) and summarized (Horner 1978).

Recent papers not previously summarized include Hsiao *et al.* (1977), Hsiao *et al.* (1978), and Hsiao (1978). Hsiao *et al.* (1977) determined phytoplankton standing stock and primary production in the southern Beaufort Sea during the summers of 1973, 74, and 75. They found the phytoplankton community to be dominated by diatoms in coastal waters and by flagellates farther offshore. Productivity and standing stock decreased with increasing distance from shore.

Hsiao *et al.* (1978) studied the effects of crude oils and the oil dispersant Corexit on primary production of Arctic marine phytoplankton and seaweeds. These authors found that the production rate varied with concentrations and types of oil, method of preparation of oil-seawater mixtures, species compositon, and environmental conditions. Inhibition of production generally increased with increasing oil concentration in samples with the same species concentration. Mixtures of crude oil and Corexit were more toxic than crude oil or Corexit alone. Production of *Laminaria saccharina* and *Phyllophora truncata* was inhibited by all types and concentrations of oil tested.

Hsiao (1978) studied the effects of four crude oils on the growth of three diatoms and one green flagellate isolated from Beaufort Sea plankton. He found the green flagellate, *Chlamydomonas pulsatilla*, to be the most tolerant species, with none of the oils being lethal at any of the concentrations, temperatures, and exposure times tested. In fact, at lower temperatures and oil concentrations, growth was slightly stimulated. The growth of diatoms, *Chaetoceros septentrionalis*, *Navicula bahusiensis*, and *Nitzschia delicatissima*, was inhibited by all oils tested after ten days' exposure at 0°C, 5°C, and 10°C and concentration of 10 ppm. *Nitzschia delicatissima* was the most sensitive of the three diatoms, followed by *Navicula bahusiensis* and *Chaetoceros septentrionalis*.

The author points out possible consequences of an oil spill in Arctic waters, suggesting that a spill in open water could result in a shading effect on the phytoplankton that would inhibit growth or the persistence of the non-volatile, water soluble aromatic hydrocarbons that might inhibit growth. If a spill happened under the ice, the oil could affect the ice algae by coating it causing direct physical damage, by producing a shading effect, and by inhibiting growth due to the persistence of more toxic volatile components. The composition of the phytoplankton community could change to one dominated by flagellates because of differential growth and sensitivity to oils and this could lead to altered zooplankton communities as well.

Perhaps the most important contribution of these papers is that the experiments were performed on species that were isolated from the Beaufort Sea. While the phytoplankton species are not usually dominant species in the phytoplankton community of the western Beaufort Sea, *Chaetoceros septentrionalis* and *Nitzschia delicatissima* are nearly always present in the water column and *Ch. septentrionalis* may also be a component of the ice algae community.

IV. Study area

The study area and sampling stations during the August-September 1978 cruise of CGC *Northwind* are shown in Fig. 1.

The winter sampling site was in Steffanson Sound at 70°19'N, 147°34.4'W.

V. Sources, methods and rationale of data collection

Phytoplankton samples were collected with 5-ℓ Niskin bottles. Subsamples of the water were taken for salinity, standing stock, primary productivity, and plant pigment determinations. Standing stock samples were preserved with 5-10 ml of 4% formalin buffered with sodium acetate. Primary productivity measurements were made in 60 ml reagent bottles. Two light and one dark bottle were used for each depth. Two ml of $NaH^{14}CO_3$ solution were added to each bottle, aluminum foil was wrapped around the dark bottle and the samples were incubated in a laboratory sink under a bank of cool white fluorescent lights. Light levels were measured at the beginning and end of the incubation period with a Gossen Super Pilot photographic light meter. Low temperature was maintained by running seawater and was monitored throughout the incubation period. Following a 3 to 4 hr incubation period, the samples were filtered onto 25 mm HA (0.45 μm) Millipore filters, rinsed with 5 ml filtered seawater and 5 ml 0.01 N HCl, and placed in liquid scintillation vials.

Water for plant pigment determinations was filtered through 47 mm HA (0.45 μm) Millipore filters. A few drops of a saturated $MgCO_3$ solution were added near the end of the filtration and the filter was rinsed with filtered seawater. The filters were folded into quarters, placed in labeled glassine envelopes, and frozen.

Salinity was determined on board using a Beckman Industrial Instruments Model RS-7A portable induction salinometer. "Copenhagen" water was used as the standard. Temperatures, measured with deep sea reversing thermometers were corrected using calibration factors provided by the Coast Guard and following the procedure outlined in the U.S. Naval Oceanographic Office Publ. 607 (1968). Water transparency was measured with a Secchi disc.

Zooplankton samples were collected with bongo nets having mesh sizes of 333 and 500 μm, mouth openings of 60 cm, and areas of 0.2827 m^2. A TSK model 313 flowmeter (InterOcean Systems, Inc.) was mounted in the mouth of each net. A 45 kg rectangular weight was attached to the net frame. Tows were double oblique with the net lowered at *ca.* 40-50 m/min to a depth *ca.* 10 m from the bottom at shallow stations or to 200 m at deep stations, soaked for 30 sec, and retrieved at *ca.* 20 m/min.

The samples were concentrated by gently swirling in a net collection cup to remove excess water. The samples were poured into jars and preserved

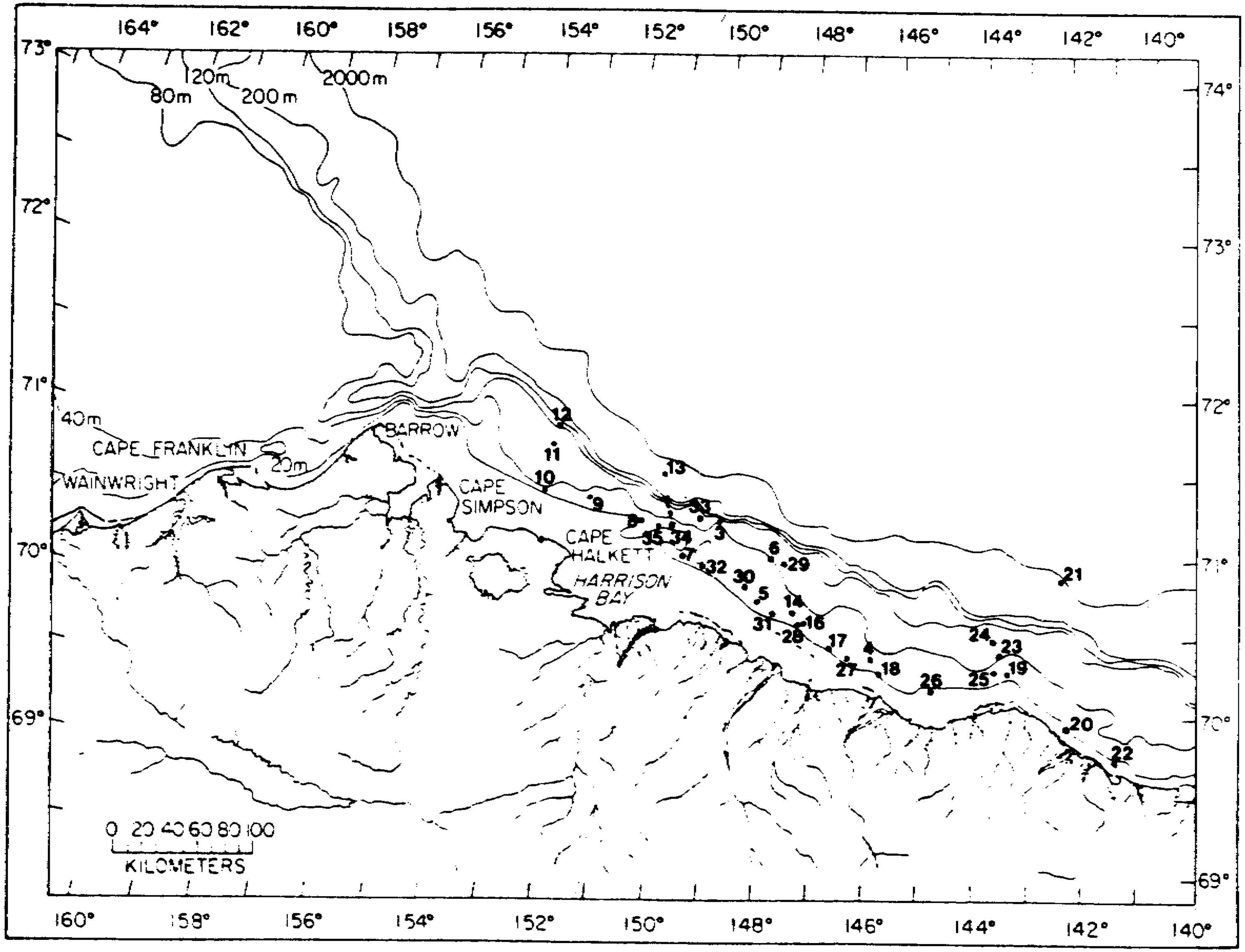


Fig. 1. Study area and station locations, USCGC *Northwind*, 15 Aug to 15 Sep 1978.

with 37% formalin and saturated sodium acetate solution. The amount of formalin and buffer depended on the jar size. A label containing collection data was put in the jar, seawater added if necessary to fill the jar, and the jar was capped for storage.

During the 1978 icebreaker cruise, stations 1-6 were collected in areas where Alaska Department of Fish and Game personnel were hunting seals (R. U.'S 230 and 232). Stations 10-12 were collected along the Pitt Point transect (R. U. 6). Other stations were taken at locations east of Prudhoe Bay where microbiologists (R. U.'s 29 and 190) needed samples, and at locations to repeat stations taken in 1976 and 1977, and to fill in gaps.

VI. Results

A. CGC *Northwind* cruise

1. Hydrography

Hydrographic data for stations taken in the Beaufort Sea are given in Table 1; vertical profiles of temperature and salinity are given in Fig. 2.

2. Phytoplankton standing stock

Phytoplankton standing stock samples have been analyzed for eight stations (68 samples). No new organisms have occurred in the 1978 samples, but all the diatoms are weakly silicified, to the extent that identification is often difficult.

The number of phytoplankton cells ranged from $< 2 \times 10^5$ to *ca.* 3×10^6 cells per liter. As in 1976 and 1977, small *Chaetoceros* spp. and unidentified flagellates were the most abundant organisms.

3. Primary productivity and plant pigment concentrations

Primary productivity and plant pigment concentrations are listed in Table 1 and vertical profiles are shown in Fig. 2. Integrated values for carbon assimilation and chlorophyll *a* are given in Figs. 3 and 4.

Primary productivity ranged from 0.01 to 2.93 mg C m^{-3} hr^{-1} with integrated productivity ranging from 1.25 mg C m^{-2} at station 7 to 32.05 mg C m^{-2} at station 29.

Chlorophyll *a* ranged from 0.01 to 6.11 mg m^{-3}; integrated chlorophyll *a* ranged from 4.63 mg m^{-2} at station 22 to 37.35 mg m^{-2} at station 16.

4. Zooplankton

Sixty-one categories of zooplankton have been identified from 16 net hauls, including 27 species and 34 other categories such as larval stages and categories where identification was made to some taxonomic rank higher than species (Table 2). Greatest emphasis has been placed on

Table 1. Summary of station locations, hydrography, ice cover, chlorophyll *a* and phaeopigment concentrations, and primary productivity, USCGC *Northwind*, 15 Aug to 15 Sep 1978.

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/₀₀	Chl *a* (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
01	17 Aug	71°11'	150°14'	8	∿ 1	005	-0.01*	24.16	0.13	0.05	
						015	2.55*	30.19	0.23	0.05	0.02
						025	1.95†	31.16	0.56	0.30	0.22
						035	2.39	31.55	0.40	0.17	0.17
						045	1.57†	32.08	0.21	0.20	0.05
03	18 Aug	70°58.5'	149°17'	7	4-5	003	-0.27	15.93	0.18	0.06	0.01
						010	-1.03	29.11	0.27	0.07	0.01
						015	-0.45*	29.88	0.40	0.05	0.06
						020	-0.71	30.73	0.34	0.05	0.07
						025	2.80	31.52	0.26	0.18	0.11
						030	2.40	31.68	0.38	0.20	0.17
						035	2.17	31.68	0.32	0.19	0.18
04	19 Aug	70°19.8'	146°05'	5	1	000	-0.36	28.86	0.17	0.16	0.04
						005	-0.42	29.30	0.21	0.16	0.08
						010		31.82	0.24	0.30	0.11
						015	-1.16	32.15	0.24	0.31	0.05
						020	-1.64	32.17	0.31	0.20	0.09
						025	-1.64	32.22	0.33	0.34	0.06
05	21 Aug	70°36.2'	148°20.2'	5	3-4	000	-0.08	22.36	0.16	0.10	0.03
						003	-0.20	26.20	0.17	0.07	
						006	-0.84	31.31	1.30	0.05	0.27
						009	-1.52	32.06	0.70	0.24	0.27
						012	-1.45*	32.09	0.81	0.36	0.23
						015	-1.52	32.10	0.49	0.91	0.21
						020	-1.53	32.08	1.05	0.68	0.24

* Temperature based on only one thermometer
† Temperature values questionable
Where no value is present, no data are available

Table 1. (continued)

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/°°	Chl *a* ($mg\ m^{-3}$)	Phaeo ($mg\ m^{-3}$)	Prim Prod ($mg\ C\ m^{-3}\ hr^{-1}$)
06	22 Aug	70°55'	148°11'	5	∿ 5	000	0.56*	9.46	0.33	0.02	
						005	-1.13	28.38	0.38	0.10	0.04
						010	-1.42	29.80	0.27	0.07	0.04
						015	-1.39	30.12	0.36	0.04	0.07
						020	-0.17*	31.05	0.34	0.08	0.12
						025	-0.64	31.32	0.24	0.08	0.06
						030	-0.64*	31.60	0.14	0.08	0.01
						035	0.18	31.87	0.29	0.30	0.07
07	23 Aug	70°05.9'	149°54'	8	0	000	0.56	24.90	0.15	0.08	
						005	0.49	25.16	0.16	0.08	0.03
						010	0.79	27.93	0.26	0.12	0.05
						015	3.46	29.97	0.57	0.20	0.08
						020	2.12	30.58	0.38	0.26	0.21
08	23 Aug	71°03.6'	150°52.9'	9	0	000	0.89	25.33	0.25	0.08	0.01
						005	0.92	25.65	0.23	0.07	0.03
						010	3.34	28.87	0.48	0.16	0.08
						015	3.60	29.69	0.54	0.20	0.13
						020	3.54	29.77	0.55	0.37	0.13
09	24 Aug	71°11.1'	151°51.3'	10	0	000	1.77*	25.76	0.21	0.19	0.02
						005	1.84	26.31	0.29	0.05	0.08
						010	1.73	28.73	0.29	0.22	0.05
						015	4.81	29.30	0.28	0.42	0.17
						020	3.51	29.93	0.27	0.40	0.05

Table 1. (continued)

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/₀₀	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
10	24 Aug	71°05'	152°51'	7	0	000	1.76*	25.46	0.14	0.07	0.02
						005	2.22	27.94	0.25	0.09	0.11
						010	2.68	30.24	0.96	0.27	0.23
						015	2.33	31.09	1.78	0.67	0.45
						020	2.38	31.13	1.69	0.72	0.60
11	24 Aug	71°19.8'	152°47.7'	10	0	000	1.96*	26.02	0.25	0.08	
						005	1.75	26.06	0.32	0.08	
						010	5.12	28.64	0.53	0.17	0.18
						015	4.91	29.23	0.32	0.08	0.09
						020	3.91*	29.72	0.44	0.16	0.16
						030	2.12	31.26	0.52	0.20	0.15
						040	2.07*	31.34	0.47	0.21	0.17
						050	1.27	31.52	0.33	0.18	0.13
12	24 Aug	71°21.6'	152°41.1'	10		000	2.88*	26.11	0.29	0.08	0.02
						005	3.31	26.83	0.41	0.12	0.04
						010	4.59	28.90	0.72	0.25	0.15
						015	5.74	29.19	1.03	0.29	0.09
						020	5.88	29.22	0.69	0.17	0.09
						030	5.44	29.65	0.23	0.12	0.05
						045	2.07*	31.21	0.43	0.16	0.49
						060	0.72	31.60	0.30	0.11	0.05
						075	-1.03	31.88	0.12	0.10	0.04
						090	-1.24	32.47	0.15	0.18	

Table 1. (continued

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S‰	Chl *a* (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
13	26 Aug	71°33.5'	150°27.0'	10	2	000	0.08*	23.40	0.09	0.04	0.23
						005	0.21	24.14	0.11	0.07	0.06
						010	0.30	27.54	0.22	0.05	0.05
						015	0.62	28.80	0.27	0.05	0.06
						020	0.87	30.61	0.22	0.05	0.02
						030	-0.45	31.13	0.26	0.08	0.07
						045	-1.01*	31.72	0.14	0.09	0.04
						060	-1.43	31.98	0.06	0.06	
						075	-1.20*	32.16	0.04	0.08	0.03
						100	-1.16	32.41	0.02	0.08	
						125	-1.30	32.67	0.03	0.09	
						150	-1.12*	32.98	0.02	0.10	
						175	-0.96	33.62	0.03	0.08	
						200	-0.30	34.09	0.01	0.03	
						1800	-0.36	34.52	0.02	0.03	
14	28 Aug	70°36'	147°38.7'	7	∿ 4	000	-0.69*	21.29	0.23	0.10	0.02
						003	-0.79	27.81	1.31	0.23	0.07
						006	-1.20	29.92	2.86	0.49	0.29
						009	-1.26	30.55			0.47
						012	-1.43	31.76	1.40	1.01	0.32
						015	-1.44	31.81	1.11	0.62	0.30
						018	-1.48	31.84	0.94	0.50	0.35
16	29 Aug	70°29'	147°23'	7	∿ 4	000	-0.33*	21.11	0.18	0.09	
						003	-0.80	26.37	0.65	0.16	
						006	-1.10	29.88	2.37	0.39	0.32
						009	-1.15	34.37	1.76	0.46	0.89
						012	-1.45	31.75	1.92	0.72	0.90
						015	-1.36*	31.79	1.76	0.57	0.78
						018	-1.46*	31.79	2.86	1.11	0.72
						021	-1.49	31.80	2.08	0.54	0.85

Table 1. (continued)

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/oo	Chl *a* (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
17	30 Aug	70°21.9'	146°51.7'	7		000	-0.15	22.47	0.25	0.12	0.01
						003	-0.73	26.01	0.49	0.15	0.03
						006	-0.94*	29.05	1.76	0.23	0.18
						009	-1.28	30.60	1.51	0.32	0.39
						012	-1.38†	31.45	3.12	0.59	0.88
						015	-0.99*	31.66	2.68	0.80	1.05
						018	-1.16	31.63	3.45	0.98	1.02
18	31 Aug	70°34'	145°51.7'	5	1-2	000	0.44	23.65	0.24	0.13	0.01
						003	-0.20	27.14	0.29	0.18	0.03
						006	-0.63*	29.37	0.36	0.19	0.10
						009	-0.99†	30.73	1.01	0.35	0.20
						012	-0.87*	31.74	4.03	1.04	1.93
						015	-1.37†	31.75	3.53	1.01	1.75
						018	-1.04	31.75	4.42	1.30	1.63
19	01 Sep	70°12.7'	143°22.6'	11	0	000	2.63	26.28	0.16	0.05	
						003	-0.12	30.10	0.21	0.05	0.05
						006	-0.54*	30.59	0.12	0.05	0.04
						009	-0.42	31.06	0.28	0.20	0.16
						012	-0.90†	31.62	0.08	0.44	0.50
						015	-0.41	32.05	2.65	0.66	1.52
						018	-1.21	32.07	2.41	1.01	1.32
20	02 Sep	69°58.5'	142°15'	5	0	000	4.07	28.51	0.20	0.07	0.06
						003	1.97†	30.09	0.16	0.44	0.04
						006	1.88	31.00	0.53	0.12	0.44
						009	0.43†	31.02	0.60	0.81	0.25
						012	0.32	31.05	1.58	0.36	0.49
						015	0.28	31.08	2.03	0.84	0.90

Table 1. (continued)

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/∘∘	Chl *a* (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
21	03 Sep	70°57.8'	142°20.8'		0	000	-1.38	27.69	0.19	0.05	0.03
						005	-1.29	30.27	0.14	0.05	0.07
						010	-1.19	30.26	0.21	0.11	0.03
						015	-1.12	30.88	0.17	0.14	0.09
						020	-1.28	31.12	0.18	0.14	0.05
						025	-1.33	31.32	0.20	0.21	
						030	-1.33	31.59	0.26	0.14	0.11
						045	-1.53	31.83	0.25	0.23	0.11
						2400	-0.39	35.01			
22	05 Sep	69°45'	141°17.5'	10	0	000	3.44	29.42	0.20	0.08	
						003	2.12	30.96	0.22	0.08	0.07
						006	1.79	31.30	0.21	0.08	
						009	0.93	31.79	0.29	0.08	0.11
						012	0.12*	31.85	0.55	0.06	0.15
						015	0.10	31.85	0.47	0.08	0.28
23	06 Sep	70°28.0'	143°33.0'		0	000	4.36	25.60	0.12	0.06	0.01
						005	3.34	28.03	0.18	0.07	
						010	0.13	30.22	0.12	0.07	0.03
						015	-1.03*	31.41	0.08	0.03	0.02
						020	-1.28*	31.87	0.14	0.05	0.12
						025	-1.24*	32.26	0.11	0.14	
						030	-1.45	32.32	0.21	0.14	0.07
						035	-1.61	32.34	0.27	0.15	0.14

Table 1. (continued)

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/°°	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
24	06 Sep	70°28.6'	143°42.3'	15	0	000	4.18*	26.25	0.13	0.09	0.05
						005	3.02*	30.33	0.18	0.05	0.10
						010	1.75	31.08	0.16	0.05	0.01
						015	-1.11	31.34	0.13	0.05	0.02
						020	-1.26*	31.52	0.15	0.06	0.01
						030	-1.48	31.81	0.23	0.13	0.16
						045	-1.56	32.11	0.12	0.15	0.06
						055	-1.33	32.42	0.10	0.21	0.04
25	07 Sep	70°15.1'	143°40.0'			000	2.93*	27.35	0.09	0.06	0.02
						003	2.18	27.94	0.12	0.05	0.03
						006	-0.18	30.43	0.21	0.16	0.11
						009	-0.54	31.27	0.37	0.16	0.11
						012	-1.14*	31.85	0.26	0.07	0.17
						015	-1.43*	32.21	3.78	0.66	1.63
						020	-1.47	32.23	5.46	0.23	2.18
						025	-1.51	32.23	4.16	1.11	2.16
26	08 Sep	70°07.7'	144°48.4'		0	000	2.33	25.13	0.28	0.07	0.02
						003	1.13	26.36	0.16	0.07	0.07
						006	0.23	28.09	0.18	0.10	0.06
						009	-0.37	30.32	0.10	0.07	
						012	-1.24*	31.63	0.53	0.53	0.17
						015	-1.33	31.82	0.92	0.92	0.28

Table 1. (continued)

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/₀₀	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
27	08 Sep	70°17.8'	146°30.8'	8	∿ 6	000	-1.01	26.08	0.21	0.08	0.07
						003	-0.97	27.40	0.24	0.12	0.04
						006	-0.92	28.93	0.34	0.11	0.10
						009	-1.12	30.03	0.47	0.08	0.22
						012	-1.27	30.39	0.56	0.08	0.29
						015	-1.38*	31.28	3.90	0.72	1.49
						018	-1.40	31.32	6.11	1.64	2.56
28	09 Sep	70°28.0'	147°25.7'	8	2	000	-0.24*	15.93	0.43	0.09	0.07
						003	-0.77	25.60	0.22	0.08	0.09
						006	-1.01	28.30	0.42	0.06	0.10
						009	-1.06*	29.44			0.21
						012	-0.74*	29.84	0.69	0.03	0.30
						015	-0.65	30.37	1.01	0.18	0.35
						018	-1.16*	30.82	2.55	0.63	1.04
						021	-1.09	30.85	3.35	0.72	1.50
29	09 Sep	71°01'	147°56.5'	10	2-3	000	-0.05	24.40	0.22	0.06	0.01
						005	0.21	27.28	0.49	0.16	0.12
						010	4.88	29.16	0.54	0.16	0.04
						015	4.86	29.80	0.94	0.27	0.34
						020	4.22	30.19	0.31	0.75	0.60
						025	4.48	30.58	0.74	0.20	0.31
						030	2.63*	30.83	0.70	0.17	0.30
						045	0.42	31.54	0.25	0.10	2.93

Table 1. (continued)

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/∘∘	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
30	10 Sep	70°44.9'	148°34'		2–3	000	0.12	10.35	0.31	0.07	0.08
						003	-0.89	25.92	0.25	0.08	0.11
						006	-0.98	28.33	0.38	0.11	0.13
						009	-1.17*	29.65	0.65	0.09	0.19
						012	-0.91*	29.93	0.75	0.22	0.28
						015	1.89*	31.16	0.82	0.20	0.32
						018	1.28*	31.39	1.27	0.37	0.62
						021	1.11	31.39	2.34	0.27	1.08
31	11 Sep	70°35.5'	148°00.0'	10	3–4	000	-0.49*	16.94	0.33	0.07	0.06
						003	-0.68	27.98	0.46	0.11	0.16
						006	0.02	30.35	0.64	0.14	0.26
						009	0.07	30.58	0.31	0.92	0.46
						012	-0.41*	31.20	2.10	0.51	0.76
						015	-0.27	31.42			1.09
						018	-0.84	31.49	2.28	0.59	1.04
32	12 Sep	70°46.6'	149°30.4'	5	6–7	000	-0.55	10.48	0.53	0.14	0.08
						003	-0.82	28.54	0.44	0.16	0.15
						006	-0.82	29.61	0.37	0.08	0.10
						009	-0.56†	30.31	0.70	0.14	0.24
						012	0.45†	31.00	1.30	0.30	0.66
						015	0.26†	31.10	1.76	0.43	0.79
						018	0.79	31.10	1.68	0.62	0.98

Table 1. (continued)

Sta	Date (1978) (GMT)	Latitude (N)	Longitude (W)	Secchi Depth (m)	Ice Cover (oktas)	Sample Depth (m)	Temp (°C)	S°/₀₀	Chl *a* (mg m^{-3})	Phaeo (mg m^{-3})	Prim Prod (mg C m^{-3} hr^{-1})
33	13 Sep	71°12.6'	149°38.4'	7	0-1	000	1.44*	27.26	0.47	0.13	0.03
						005	1.43	27.26	0.47	0.11	0.08
						010	1.54	27.35	0.46	0.13	0.09
						015	1.72†	27.50	0.47	0.09	0.08
						020	2.59*	30.48	0.51	0.59	0.24
						030	1.68*	31.61	0.21	0.19	0.07
						045	1.27*	31.47	0.13	0.18	0.07
						060	1.08	31.64	0.14	0.20	0.11
34	13 Sep	70°52'	150°16'	8	< 1	000	-0.63	25.66	0.40	0.15	0.09
						003	-0.59	26.17	0.43	0.16	0.15
						006	-0.17	28.58	0.47	0.18	0.16
						009	0.41†	29.60	0.70	0.10	0.18
						012	2.29†	30.51	0.88	0.31	0.36
						017	1.66†	30.53	1.17	0.34	0.32
						022	1.66	30.53			0.68
35	14 Sep	71°01'	150°25'	7	1-2	000	-0.98*	26.57	0.33	0.17	0.09
						003	-0.92*	27.35	0.39	0.14	0.10
						006	-0.95	27.39	0.44	0.13	0.15
						009	-0.53	28.11	0.59	0.26	0.15
						012	2.37*	29.98			0.44
						015	3.62	30.17	0.89	0.34	0.40
						018	3.59*	30.18	0.98	0.34	0.49
						021	3.58	30.17	0.95	0.45	0.48

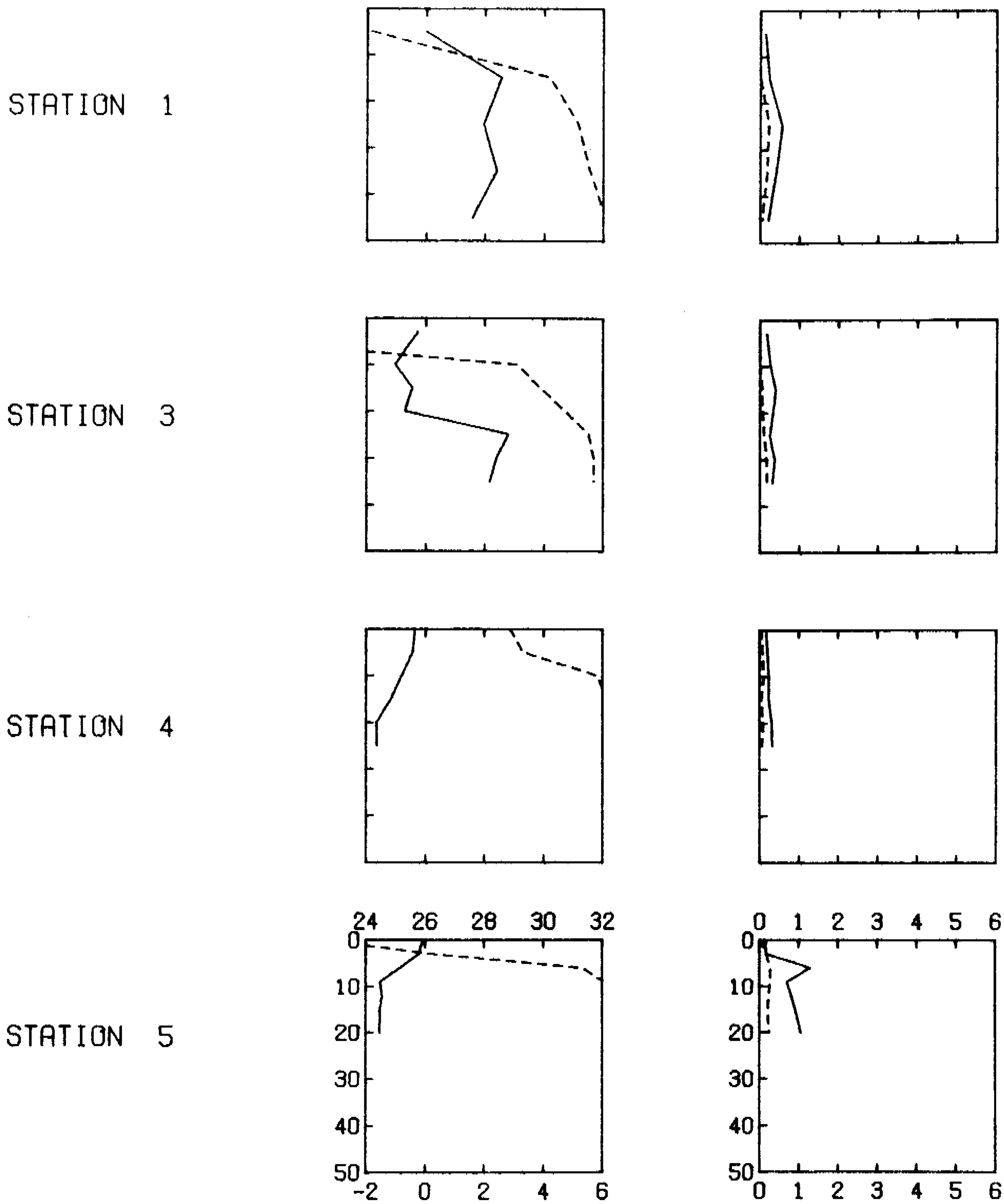


Fig. 2. Depth profiles of temperature-salinity and chlorophyll *a*-^{14}C assimilation in the Beaufort Sea, August-September 1978. Salinity (°/$_{\circ\circ}$) ----; temperature (°C) ——; ^{14}C assimilation (mg C m^{-3} hr^{-1}) ----; chlorophyll *a* (mg m^{-3}) ——.

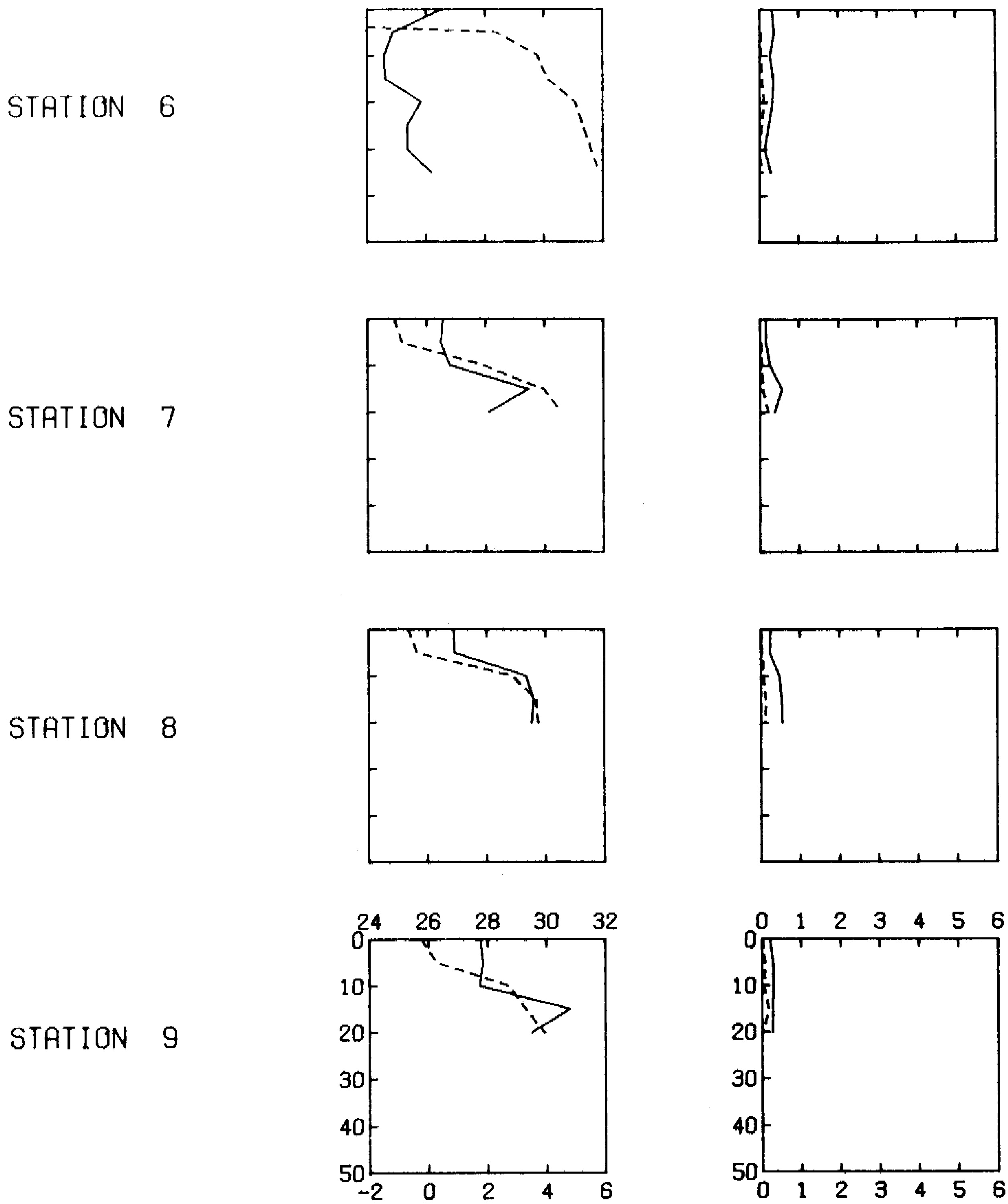


Fig. 2 (continued)

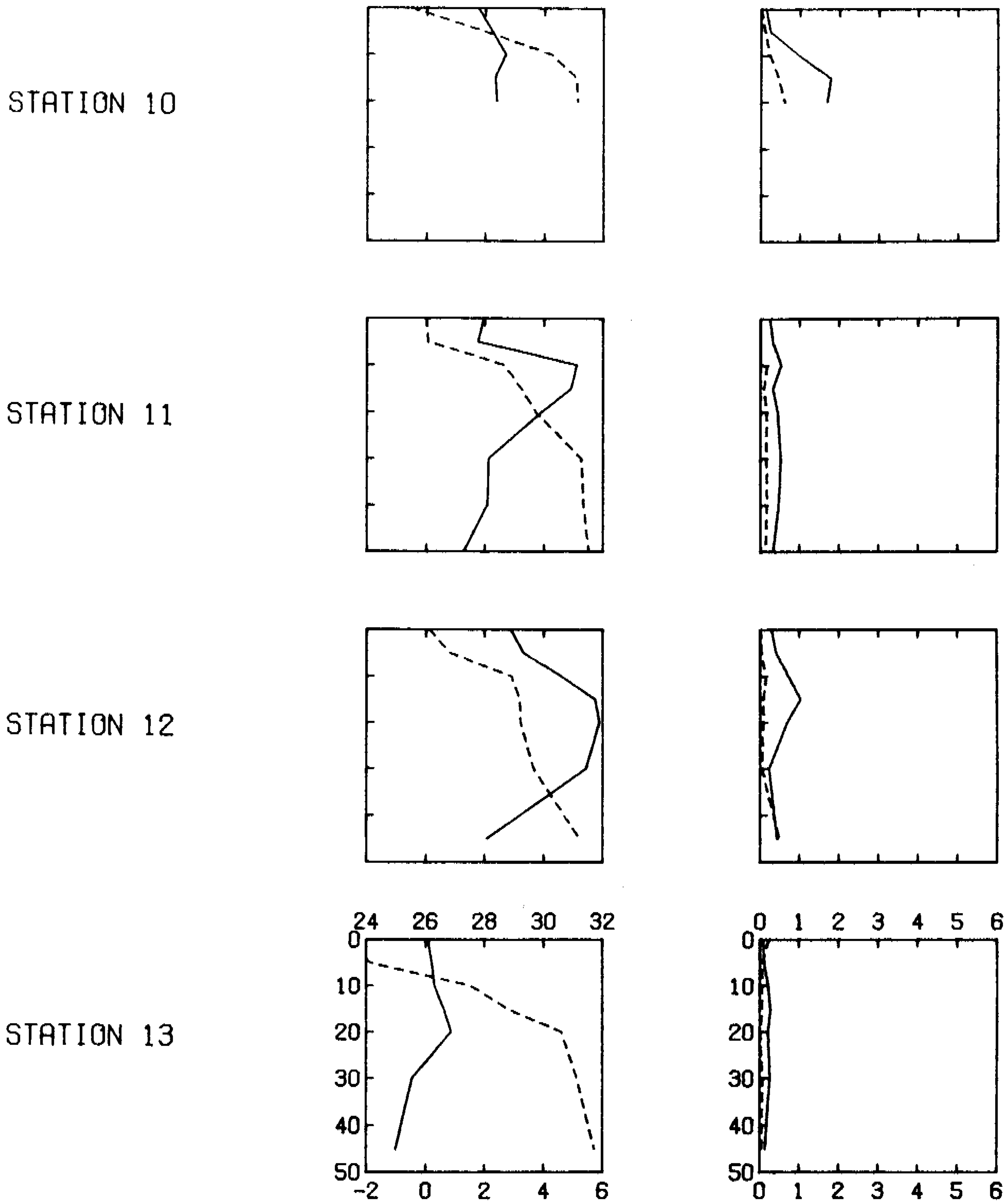


Fig. 2. (continued)

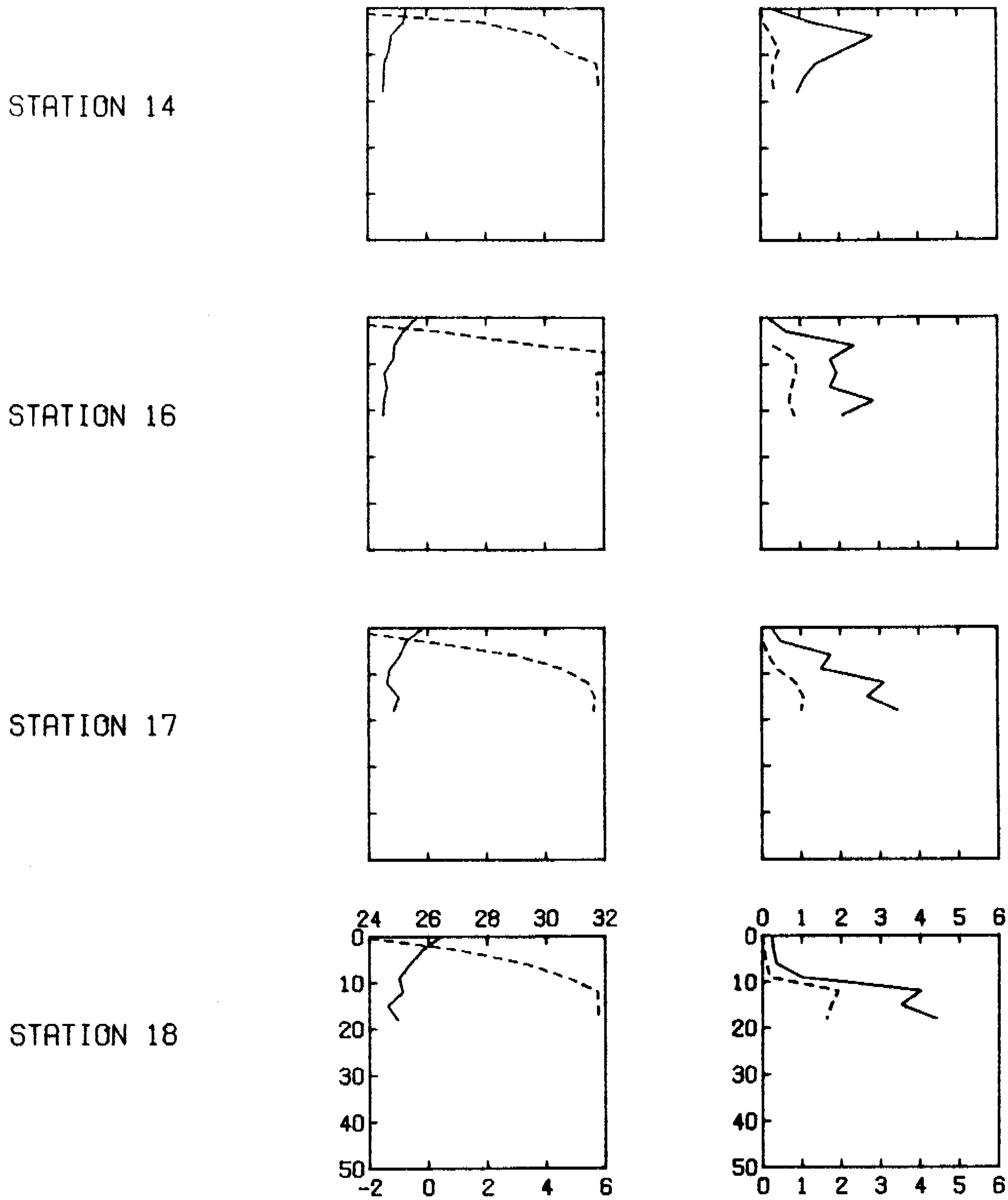


Fig. 2. (continued)

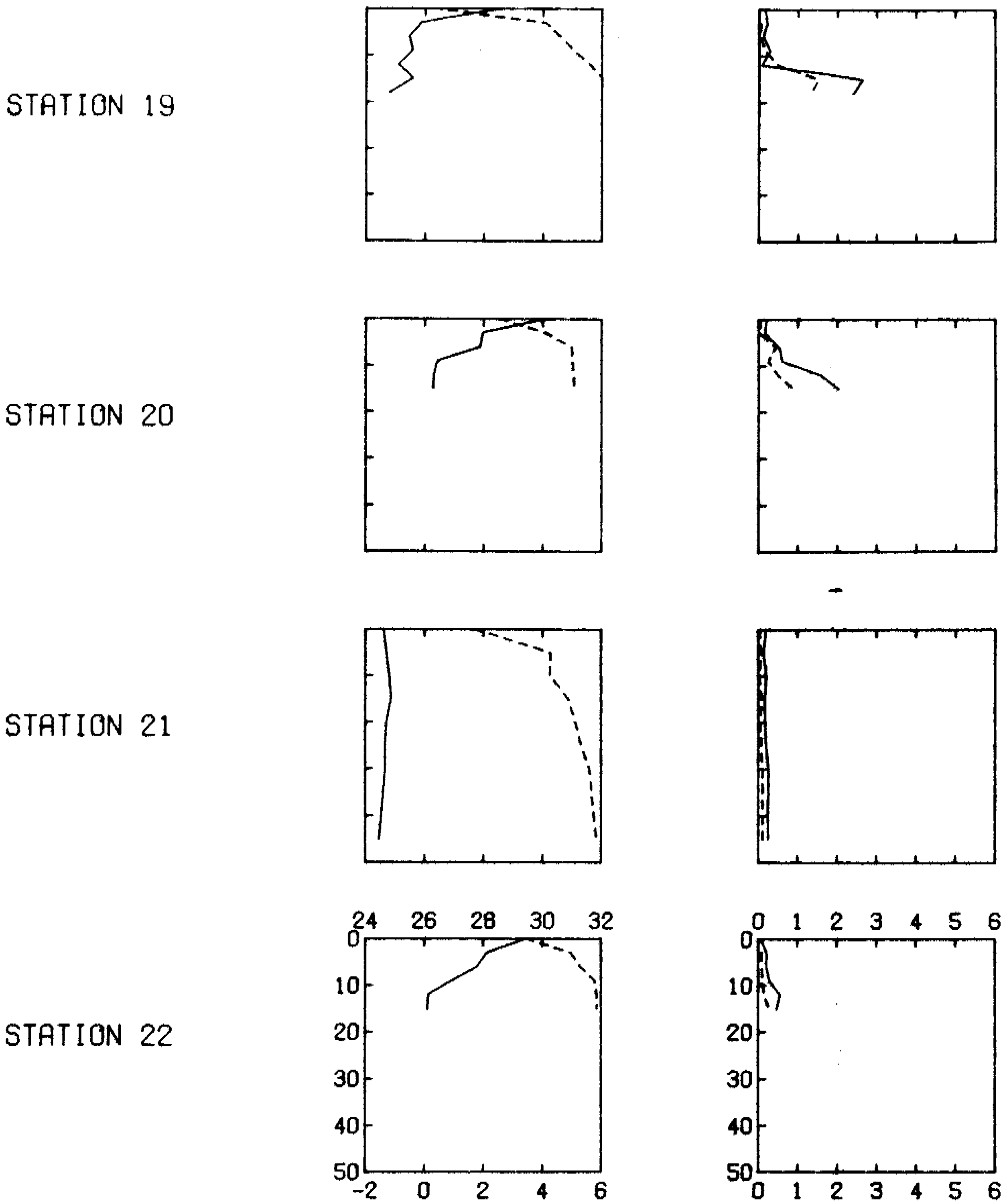


Fig. 2. (continued)

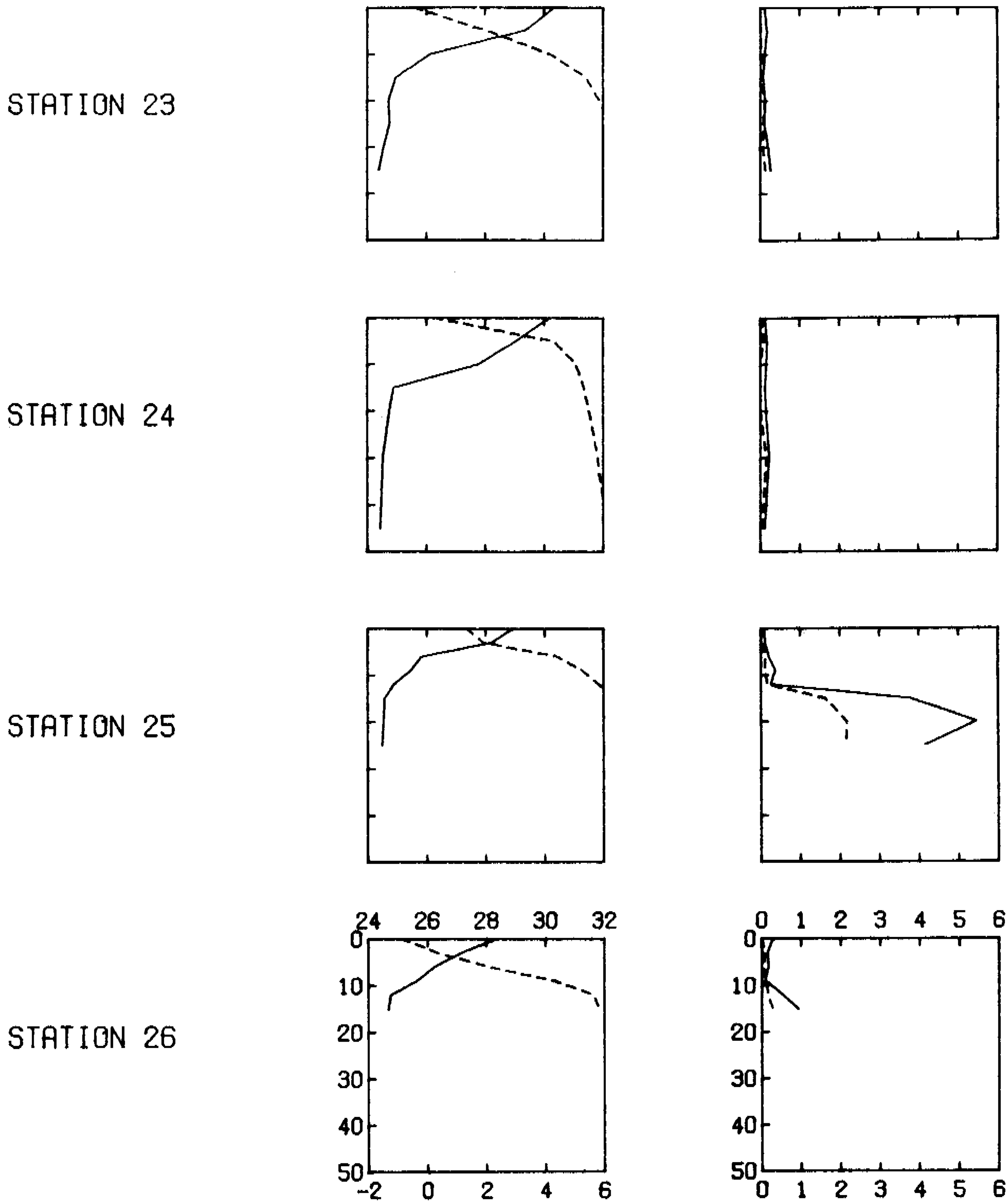


Fig. 2. (continued)

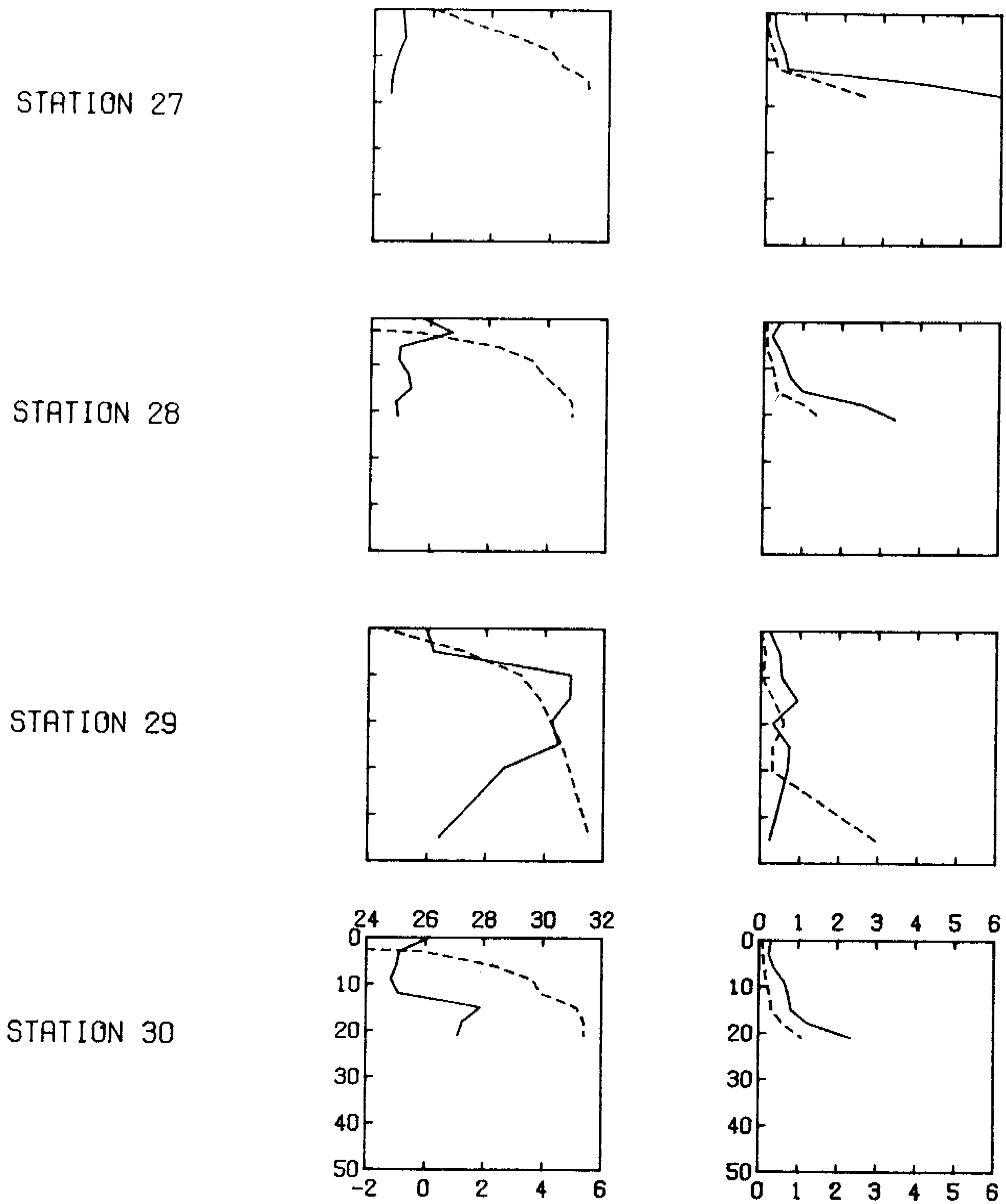
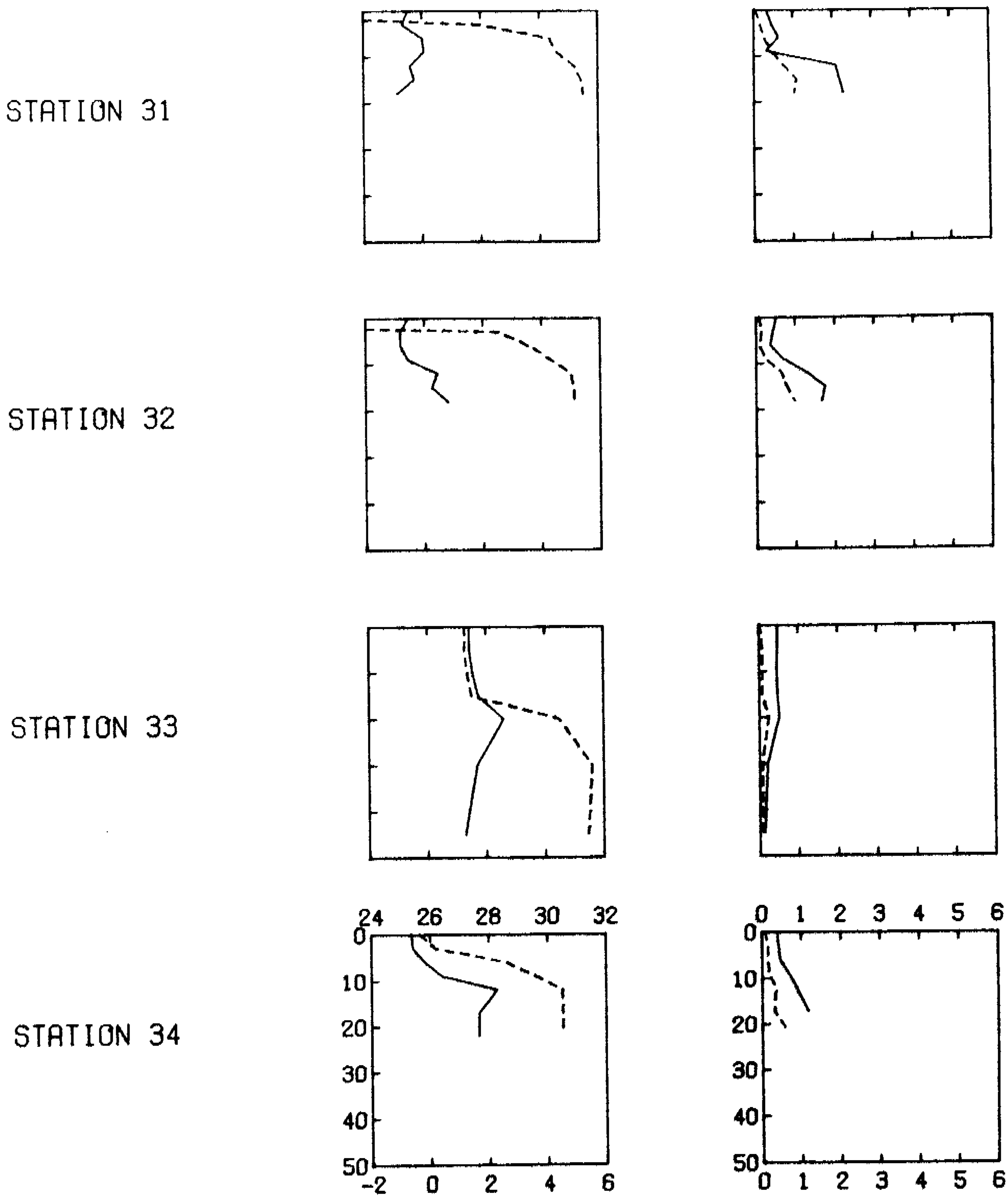


Fig. 2. (continued)



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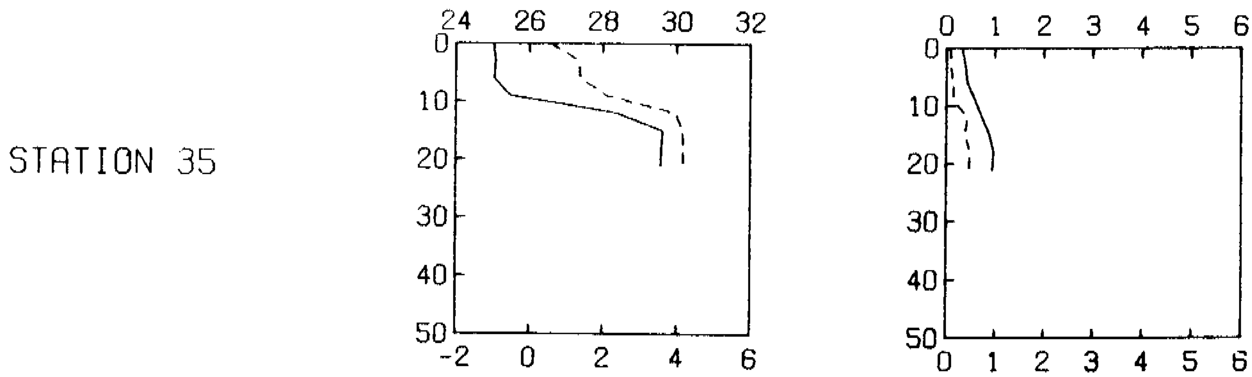

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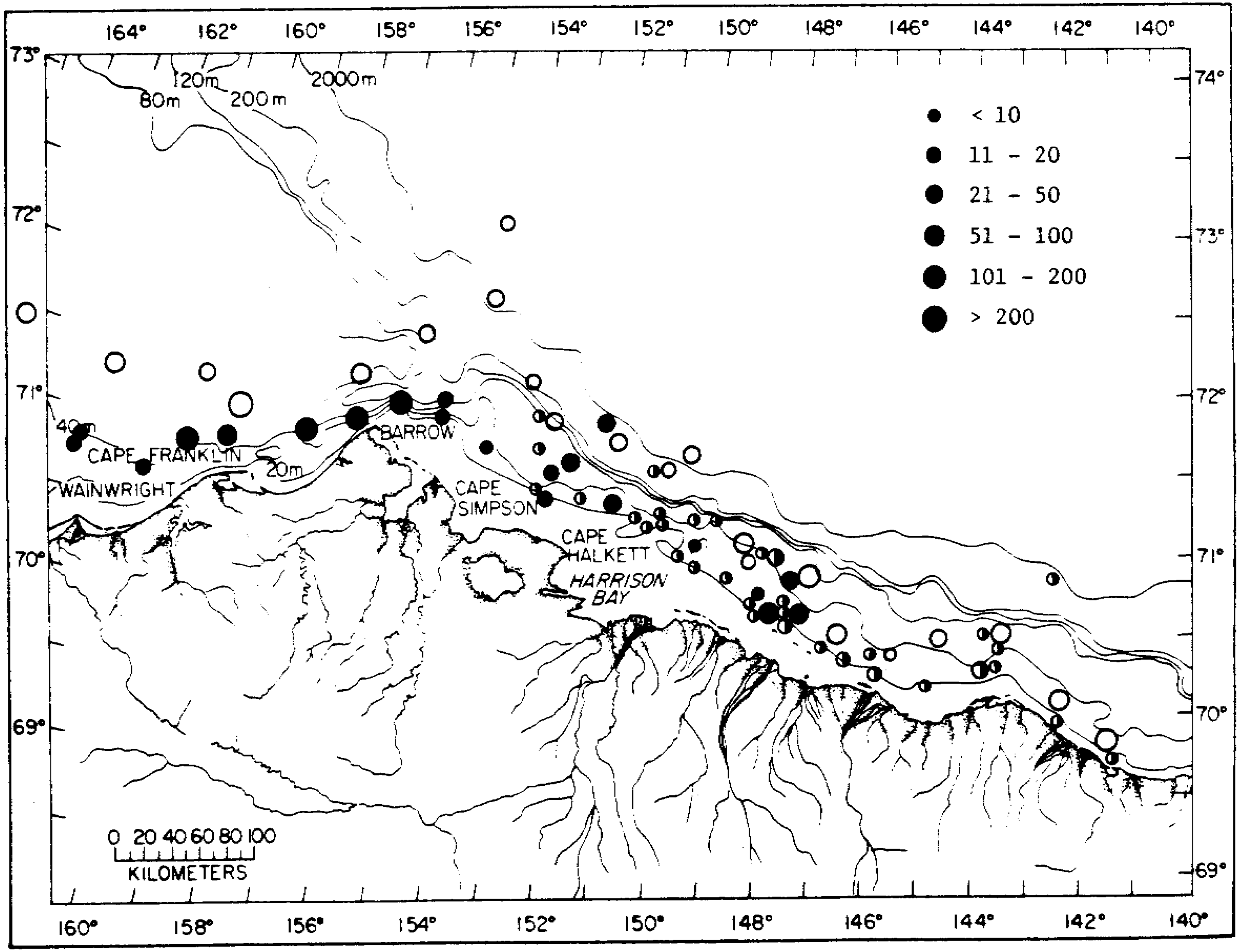

Fig. 3. Integrated ^{14}C assimilation (mg C m^{-2} hr^{-1}) for all stations in the Chukchi and Beaufort seas, August-September 1976, 1977, 1978. ● = 1976, ○ = 1977, ◑ = 1978.

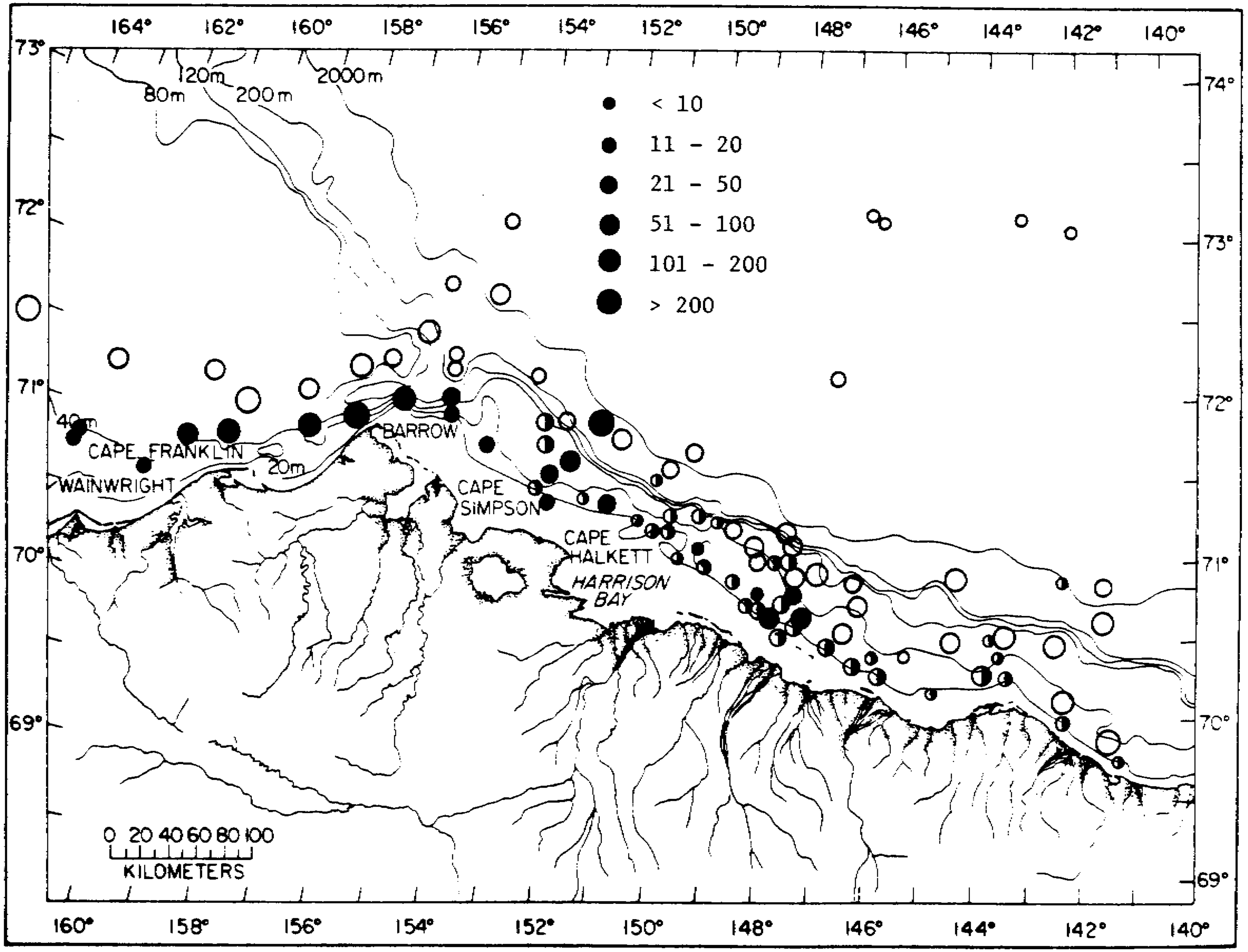

Fig. 4. Integrated chlorophyll *a* (mg m^{-2}) for all stations in the Chukchi and Beaufort seas, August-September 1976, 1977, 1978. ● = 1976, ○ = 1977, ◑ = 1978.

Table 2. Abundance (number per 1000 m^3) of zooplankton taxa found in net hauls from the Beaufort Sea. All samples were collected with bongo nets, mesh size 500 μm. Where no number is present, no animals were found.

	Station Numbers							
Taxon	4	5	7*	8*	16	17	18	20
Coelenterata								
Hydrozoa								
Aeginopsis laurentii	470	230	600	980	230	380	1120	810
Aglantha digitale	3510	2280	15930	23120	2230	520	80	1220
Bougainvillia superciliaris								
Calycopsis birulai		30				50		60
Corymorpha flammea	40	70					80	30
Coryne tubulosa	20						40	
Cuspidella sp. *cf.*								
Perigonimus vesicarius	130	200	50		90	280	230	410
Perigonimus yoldia-arcticae cf.								
Perigonimus spp.			50	100			80	60
Plotocnide borealis cf.	150	170			270	140	190	
Unidentified medusae	110			50	550	140	80	
Siphonophora - unidentified	20							
Ctenophora								
Pleurobrachia pileus cf.		400	270	150	230	50		
Polychaeta - unidentified	170	130	50	100	140		120	90
Mollusca								
Gastropoda - Pteropoda								
Clione limacina			50	50	90	140	80	
Spiratella helicina	150	30	380	730	140		120	30
Unidentified mollusc larvae	230	70			180		40	

* Volume of tow estimated (ship speed x mouth area of net x duration of tow).

Table 2. (continued)

Taxon	Station Number 4	5	7*	8*	16	17	18	20
Crustacea								
Copepoda								
Calanoida - adults	61020	12050	660	150	21450	54460	19770	61100
Calanoida - juveniles	45190	20000	74400	1800	41090	109300	209420	47300
Cyclopoida				50				
Harpacticoida								
Unidentified nauplii							80	90
Cirripedia								
Nauplii			110		320	330	310	
Cyprids								
Mysidacea								
Mysis litoralis					50			380
Mysis oculata	20	100			50			60
Mysis relicta								140
Mysis spp.								960
Cumacea								
Unidentified cumacea								30
Amphipoda								
Gammaridea								
Apherusa glacialis	40		50	490	50	50	80	170
Apherusa glacialis cf.			50					
Onisimus glacialis							120	60
Onisimus glacialis cf.	90							
Onisimus nanseni								
Onisimus sp.								

Table 2. (continued)

Taxon	Station Number 4	5	7*	8*	16	17	18	20
Hyperiidae								
Hyperia galba	40	100	160	50				120
Parathemisto abyssorum	40	300		100	90	50	150	90
Parathemisto abyssorum cf.								
Parathemisto libellula	110	170			270	330	230	170
Unidentified Hyperiidea		70						
Unidentified Amphipoda					50			
Euphausiacea								
Thysanoëssa inermis						50		
Thysanoëssa longipes cf.		30						
Unidentified furcilia	20		50					30
Decapoda								
Anomura - unidentified larvae	20	30			90	50		30
Brachyura - unidentified larvae		70	160	440				
Caridae - unidentified larvae	130	100		100	270	230	390	90
Echinodermata								
Unidentified larvae								
Appendicularia (Larvacea)								
Fritillaria borealis	1450	70	16480	32880	3360	15020	7950	10780
Fritillaria spp.	90	1850	550	930	2050	2160	230	4700
Oikopleura labradoriensis					500			
Oikopleura vanhöffeni	510		110		230	470	1540	1970
Oikopleura spp.	1020	70	1100	100	410	1690	4940	15300

Table 2. (continued)

Taxon	Station Number							
	4	5	7*	8*	16	17	18	20
Chaetognatha								
Eukrohnia hamata	170				50		80	
Sagitta elegans	470	5000	7580	5320	7180	850	390	460
Unidentified chaetognaths	90		4290	9370	50		120	
Pisces								
Unidentified larvae			50			50	150	
Other organisms								
Unidentified animals	40		330	240			190	
Unidentified Nematoda	20							
Unidentified Foraminifera								

Table 2. (continued)

Taxon	Station Number 22	25	27	28	30	31	34	35
Coelenterata								
Hydrozoa								
Aeginopsis laurentii	900	380	930	240	660	30	740	640
Aglantha digitale	6390	4080		320	1500	870	144980	303400
Bougainvillia superciliaris								40
Calycopsis birulai								
Corymorpha flammea	180							
Coryne tubulosa								
Cuspidella sp. *cf.*		30						
Perigonimus vesicarius			130	40		30		
Perigonimus yoldia-arcticae cf.		30						
Perigonimus spp.			100			60	250	
Plotocnide borealis cf.		30						
Unidentified medusae	180		370	20			490	380
Siphonophora - unidentified								
Ctenophora								
Pleurobrachia pileus cf.	120	130		120	210		60	40
Polychaeta - unidentified							280	340
Mollusca								
Gastropoda - Pteropoda								
Clione limacina						30		
Spiratella helicina	1510	470	30	40	210	120	310	110
Unidentified mollusc larvae							60	

Table 2. (continued)

Taxon	Station Number							
	22	25	27	28	30	31	34	35
Crustacea								
Copepoda								
Calanoida - adults	5180	13480	1060	3330	6110	3830	3450	2720
Calanoida - juveniles	32710	138370	28570	112480	78080	77370	75320	48910
Cyclopoida		60					180	
Harpacticoida							30	
Unidentified nauplii				80		240		
Cirripedia								
Nauplii		30	170	20	30	210	90	
Cyprids					30	120		
Mysidacea								
Mysis litoralis								
Mysis oculata		30			30			40
Mysis relicta		30						
Mysis spp.		220			30			
Cumacea								
Unidentified cumacea								
Amphipoda								
Gammaridea								
Apherusa glacialis		60	30		60		60	
Apherusa glacialis cf.								
Onisimus glacialis	60	30						
Onisimus glacialis cf.			30					
Onisimus nanseni	60							
Onisimus sp.						30		

Table 2. (continued)

Taxon	Station Number							
	22	25	27	28	30	31	34	35
Hyperiidea								
Hyperia galba	60		30	40	120		30	
Parathemisto abyssorum		560	30	80	120	420	120	260
Parathemisto abyssorum cf.				40				
Parathemisto libellula	60	90	330	510	30	360	120	110
Unidentified Hyperiidea							30	
Unidentified Amphipoda								40
Euphausiacea								
Thysanoëssa inermis								
Thysanoëssa longipes cf.								
Unidentified furcilia					30		30	
Decapoda								
Anomura - unidentified larvae					270		30	
Brachyura - unidentified larvae				20	150	120		
Caridea - unidentified larvae	480	90	170	60	360	480	30	
Echinodermata								
Unidentified larvae		30						
Appendicularia (Larvacea)								
Fritillaria borealis	840	3010	10370	5940	1560	6410	10090	8450
Fritillaria spp.	60	1380	2590		480	15390	740	600
Oikopleura labradoriensis								
Oikopleura vanhöffeni	7590	8030	4190	280	1260	120	2220	910
Oikopleura spp.	19160	16740	8370	3090	2750	6230	5170	910

Table 2. (continued)

Taxon	Station Number							
	22	25	27	28	30	31	34	35
Chaetognatha								
Eukrohnia hamata		380	30					
Sagitta elegans	360	440	800	630	10120	5750	37690	48910
Unidentified chaetognaths	60	190	330	2060	1860	8380	12060	9060
Pisces								
Unidentified larvae			30	20	30	30		
Other organisms								
Unidentified animals	120				90		890	300
Unidentified Nematoda		30						
Unidentified Foraminifera						30		

those organisms known to be important prey species for birds and mammals. Copepods have been separated into adults and juveniles and counted; they are not being identified to species.

Distribution and abundance of some zooplankton categories for 1976 and 1977 are given in Figs. 5-56.

B. Winter sampling in Steffanson Sound

1. November 1978

a. Phytoplankton standing stock and plant pigments

Few phytoplankton cells were found in samples collected in November 1978. Unidentified flagellates, mostly < 6 μm in diameter, were the most common organisms. A few *Chaetoceros* spp. spores were found along with a few pennate diatoms, primarily *Nitzschia* spp. and *Navicula* spp. The diatoms contained chloroplasts, but did not appear to be healthy cells.

Plant pigments are given in Table 3.

b. Zooplankton standing stock

Zooplankton standing stock is given in Table 4. Based on the total number of animals, calanoid copepods, primarily juveniles, comprised > 99.5% of the population.

2. February 1979

Because of logistic and weather problems, phytoplankton standing stock and plant pigment samples were collected once. Zooplankton standing stock samples were not collected. The phytoplankton standing stock samples contained a few unidentified small flagellates and a few pennate diatoms. There were many small detritus particles in the sample collected near the underside of the ice which made phytoplankton counting difficult. Not as much detritus was present in the sample collected near the sea floor. Ken Dunton (pers. comm.) indicated that the underside of the ice consisted of a thick, brashy, dirty layer in some areas near the sampling site which probably accounted for the detritus in the samples.

The plant pigment samples have not been analyzed.

3. March 1979

a. Phytoplankton standing stock and plant pigments

Phytoplankton samples collected 12 and 16 March have been enumerated. Small unidentified flagellates were the most abundant organisms, averaging about 44,000 cells per liter. A few unidentified choano-flagellates were found along with a few diatoms. The number of individual diatom cells and the number of diatom species increased from February to March with species such as *Cylindrotheca closterium* (Ehrenb.) Reimann and

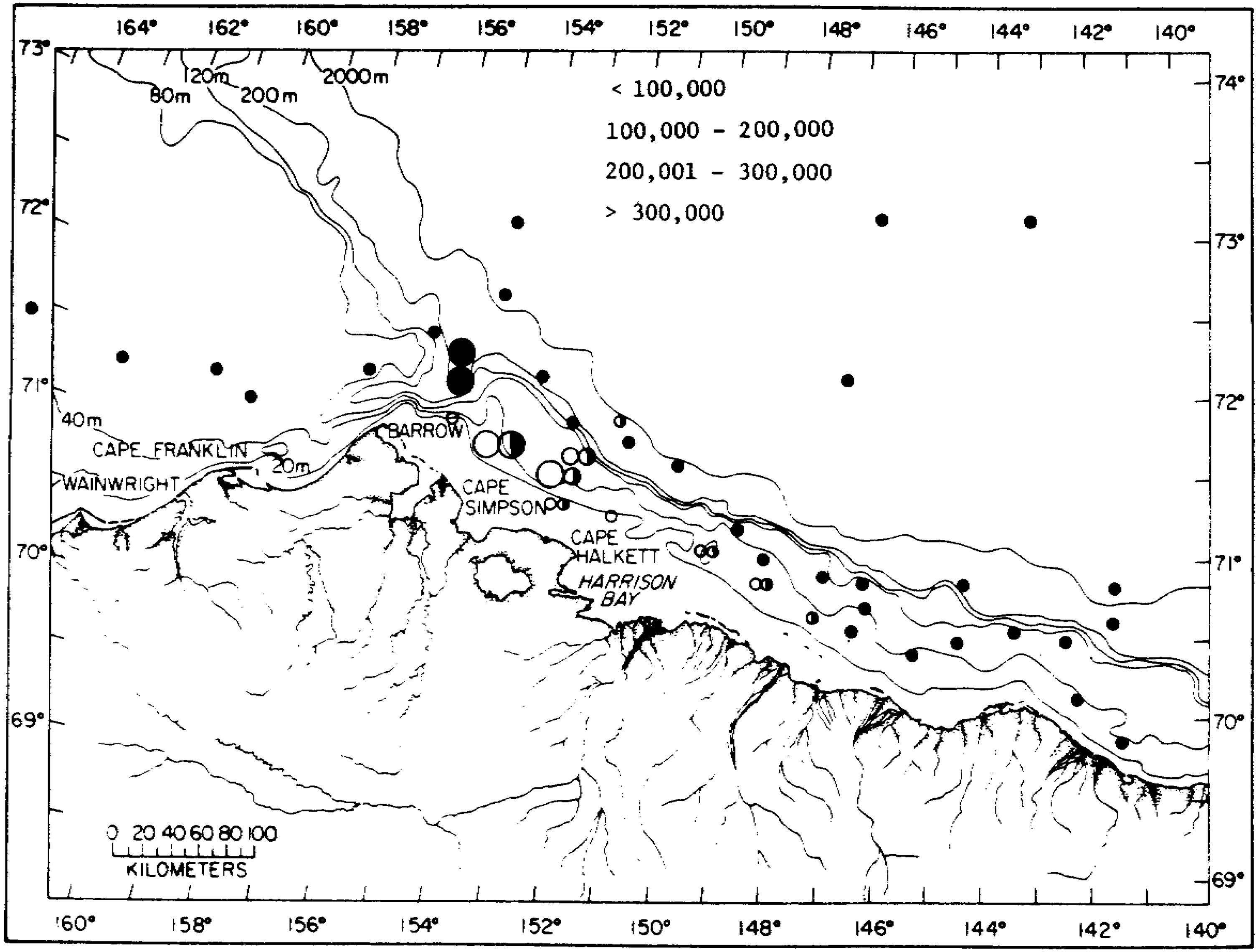

Fig. 5. Abundance (number per 1000 m^3) of *Aglantha digitale* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

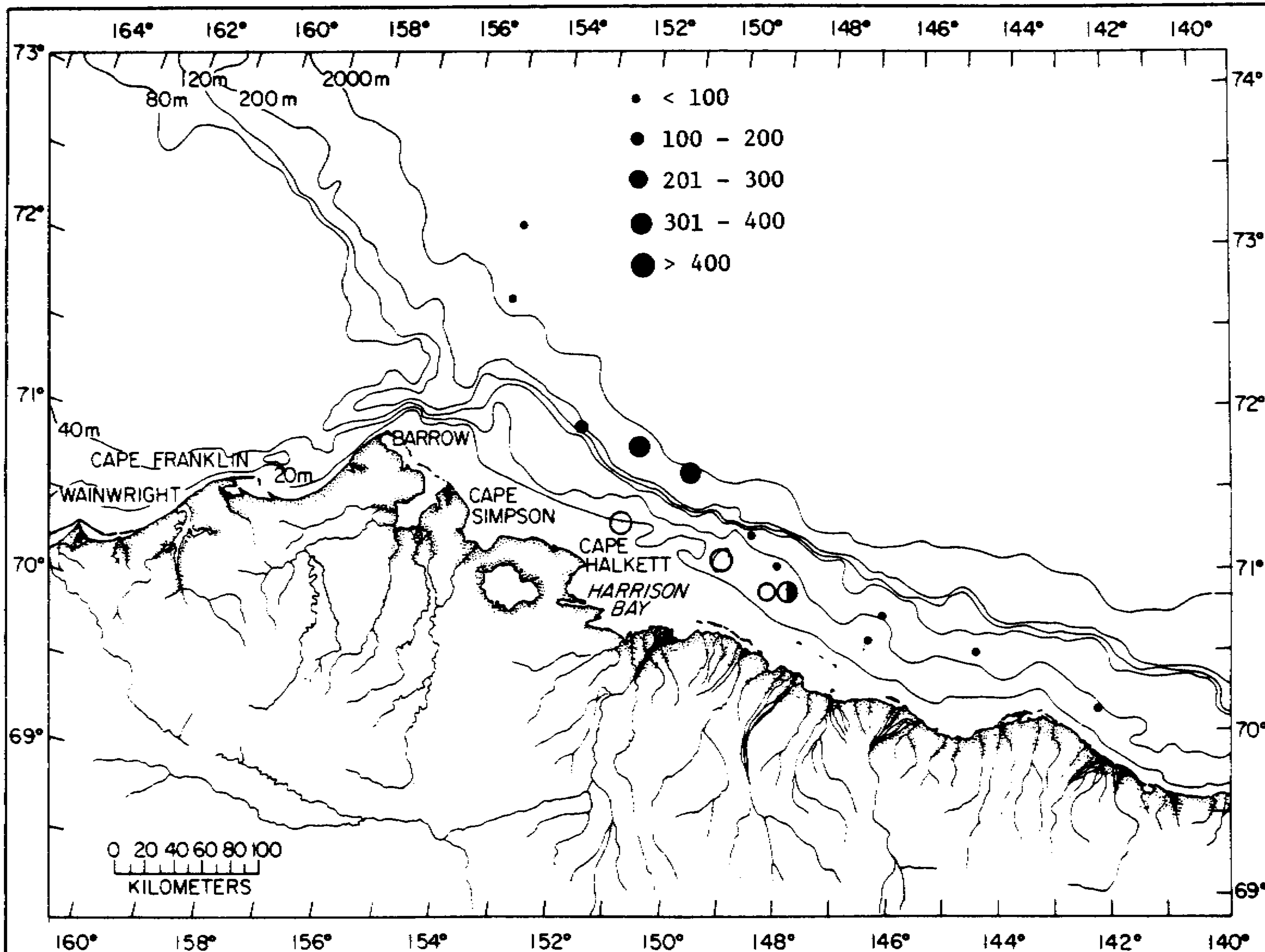

Fig. 6. Abundance (number per 1000 m^3) of *Perigonimus* spp. at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

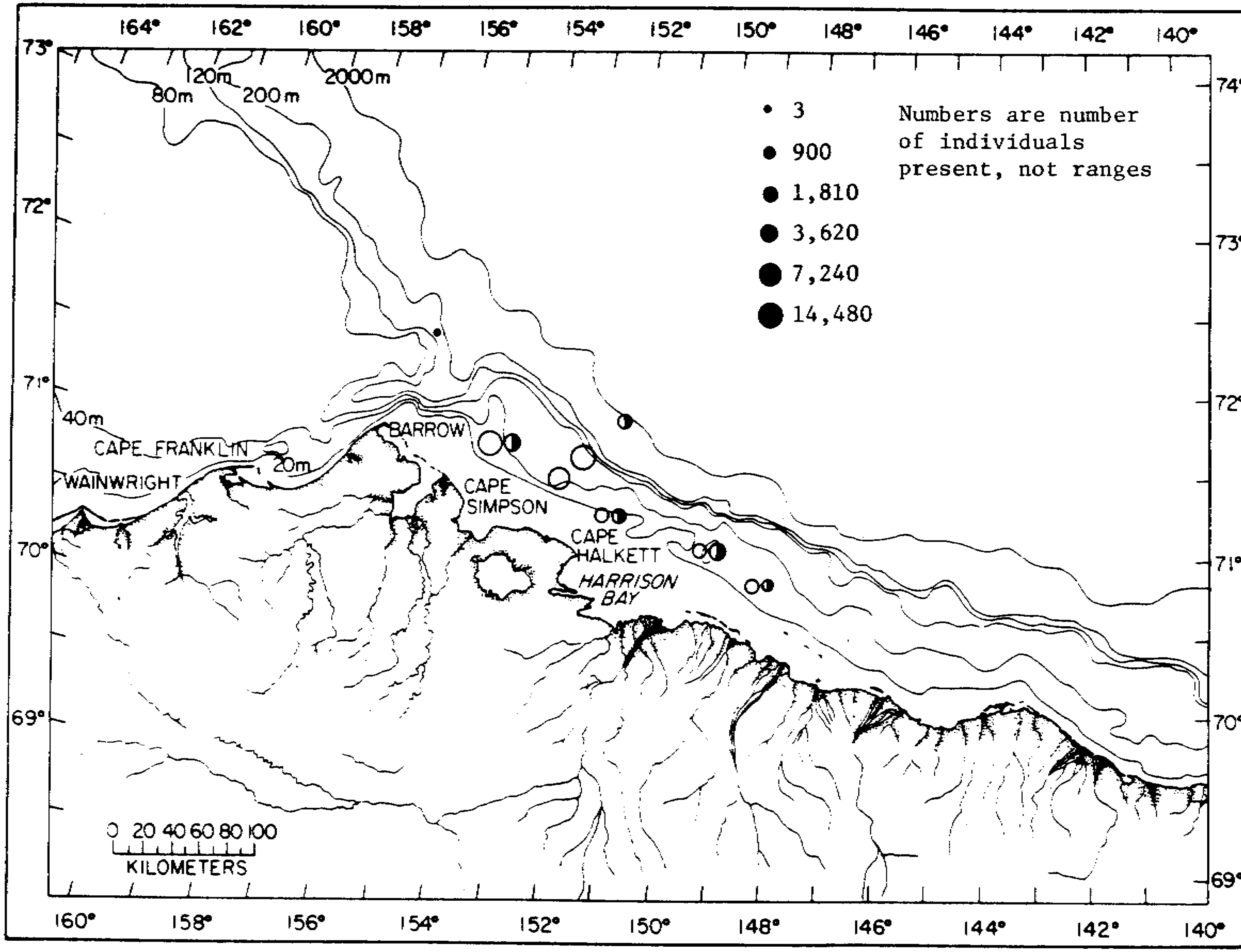

Fig. 7. Abundance (number per 1000 m^3) of *Rathkea* spp. at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

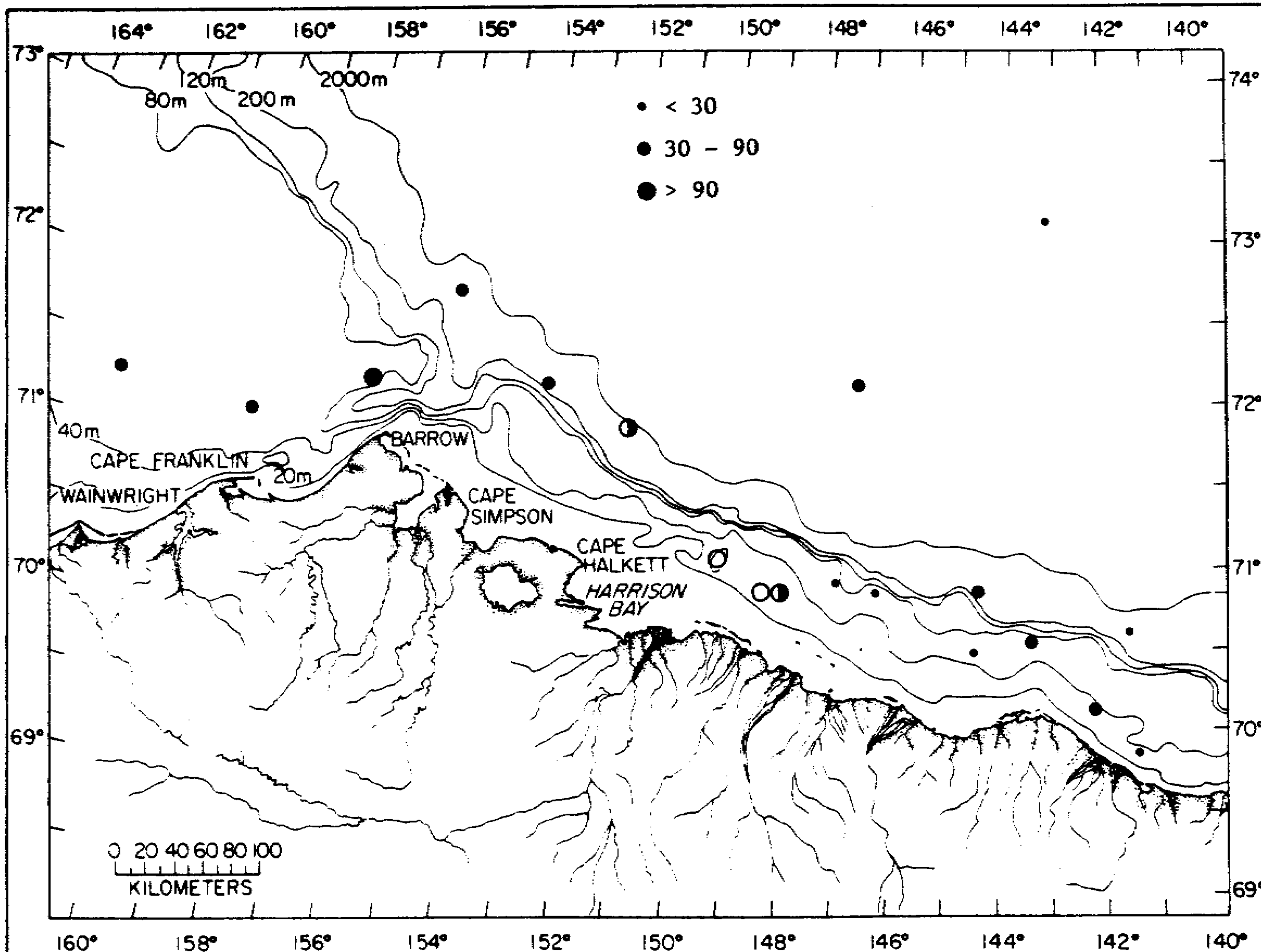

Fig. 8. Abundance (number per 1000 m^3) of ctenophores at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

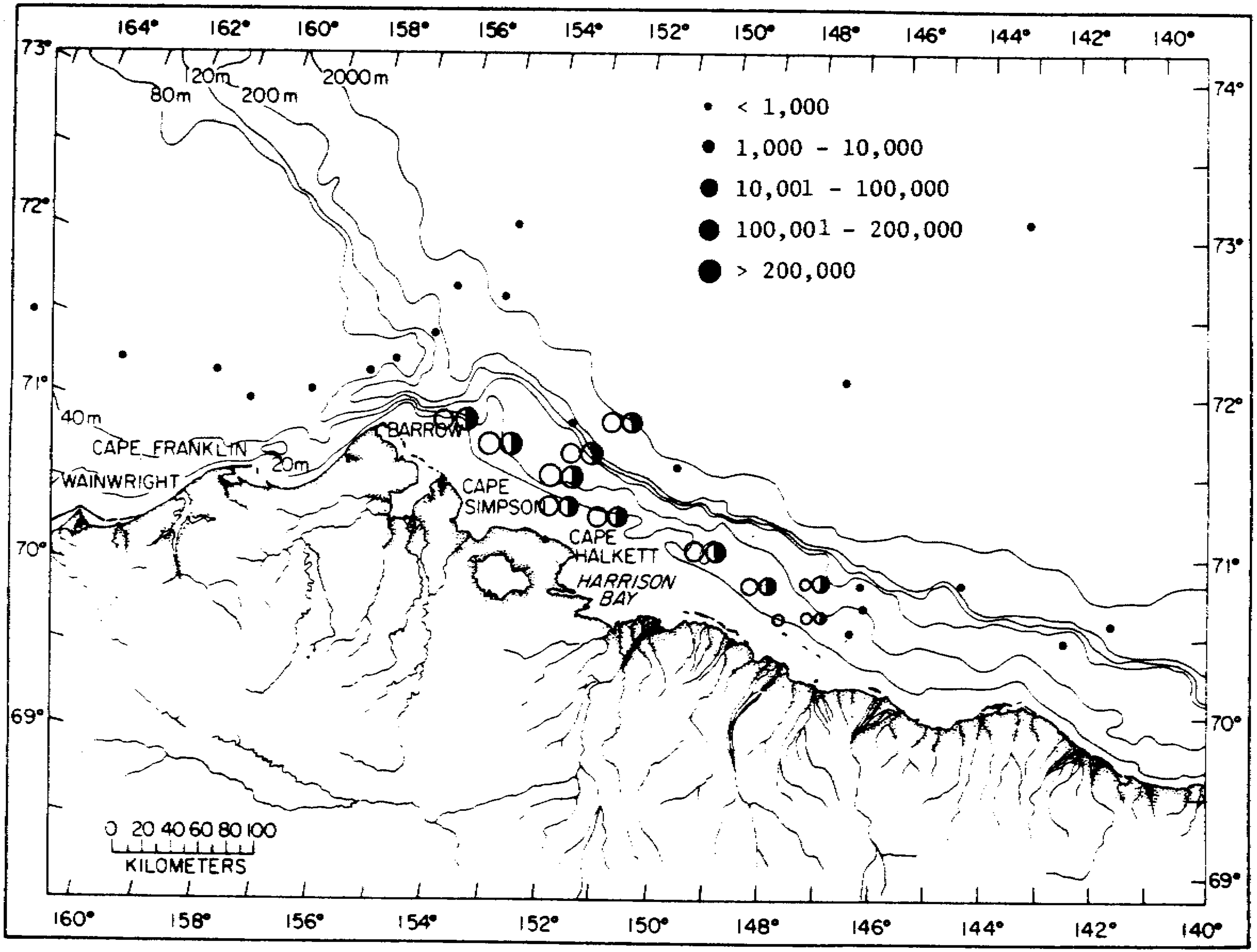

Fig. 9. Abundance (number per 1000 m^3) of polychaetes at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net 20-0 m 1976; ● = bongo net 1977.

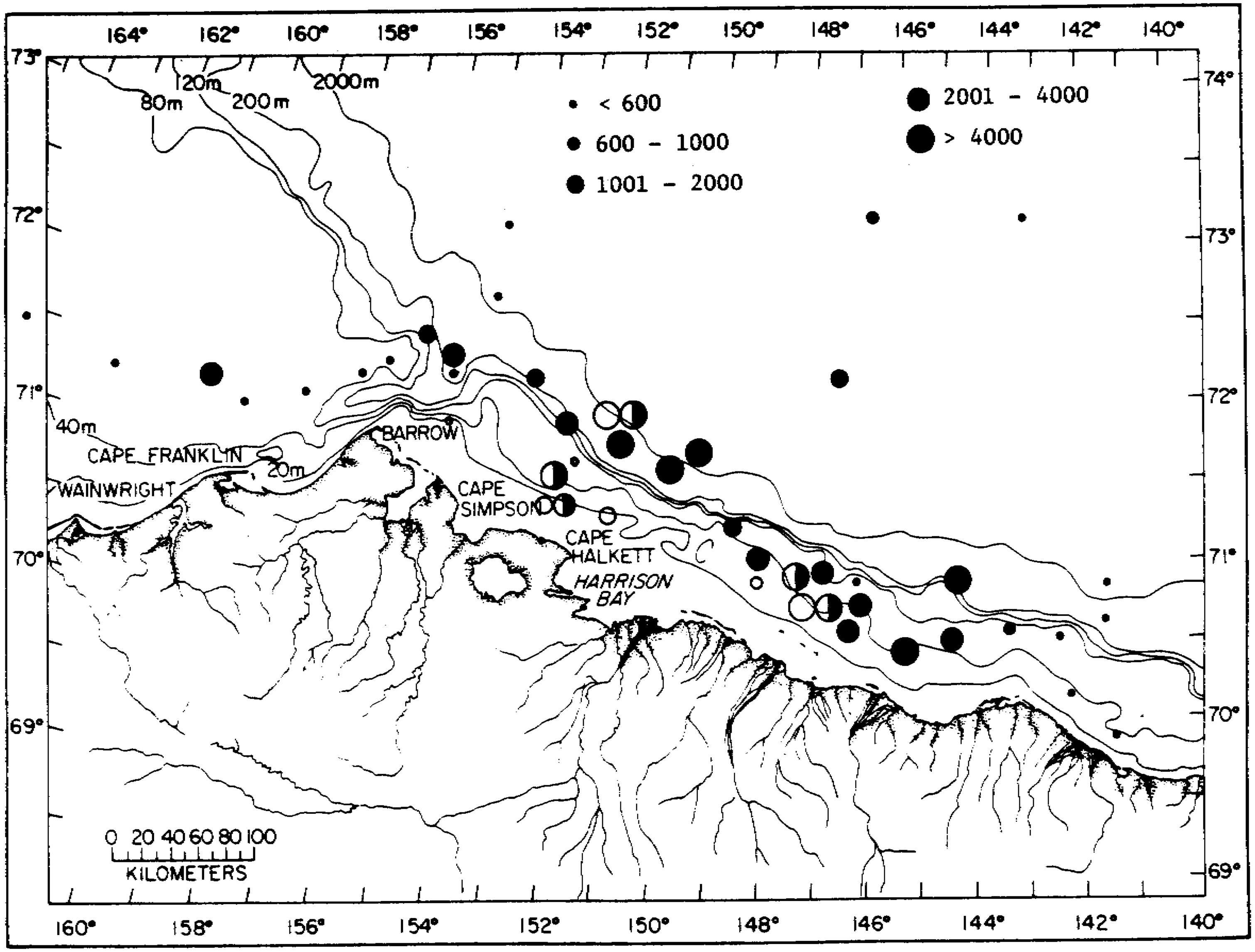

Fig. 10. Abundance (number per 1000 m^3) of all pteropods at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1977; ● = bongo net 1977.

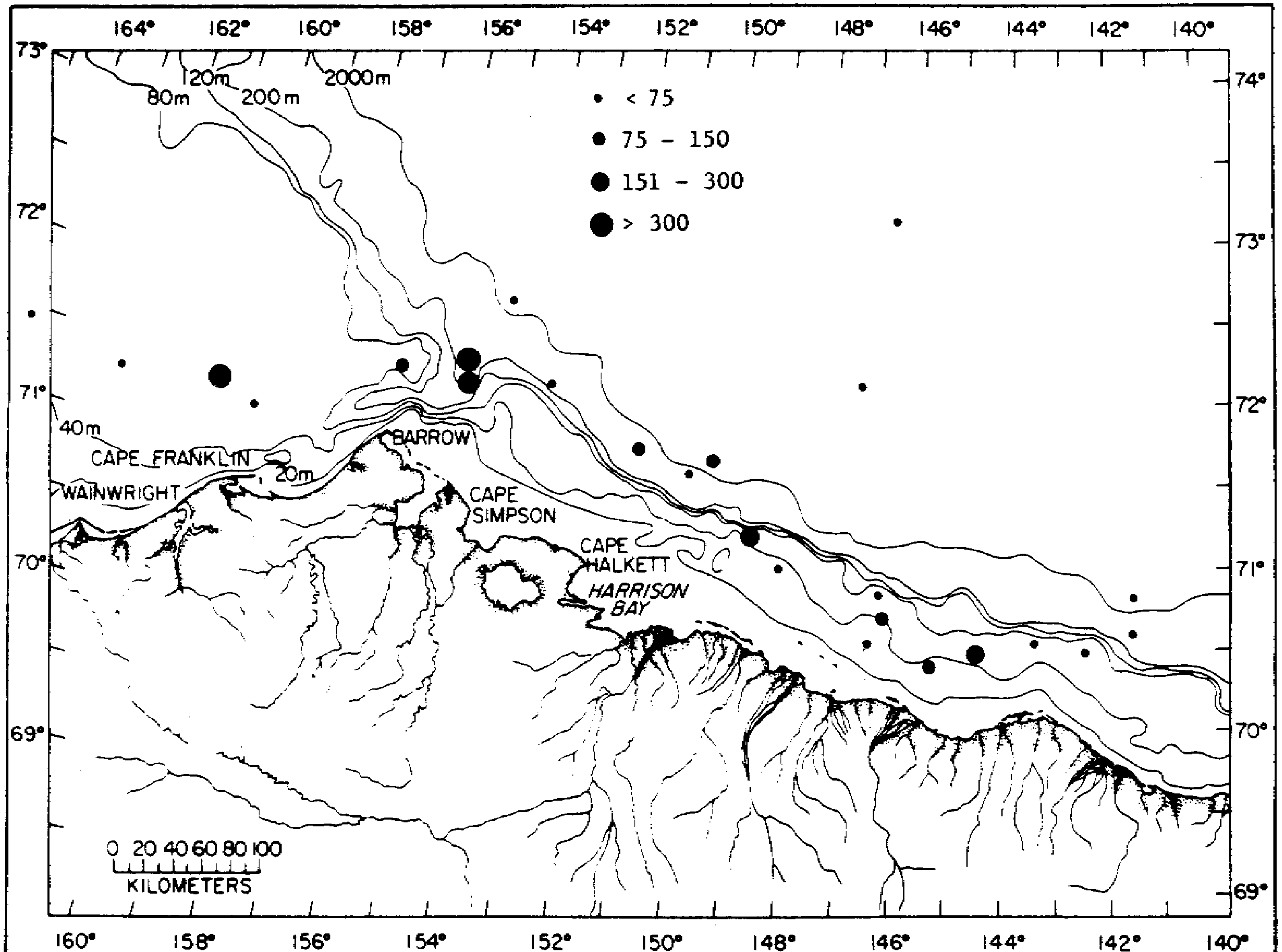

Fig. 11. Abundance (number per 1000 m^3) of *Clione limacina* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

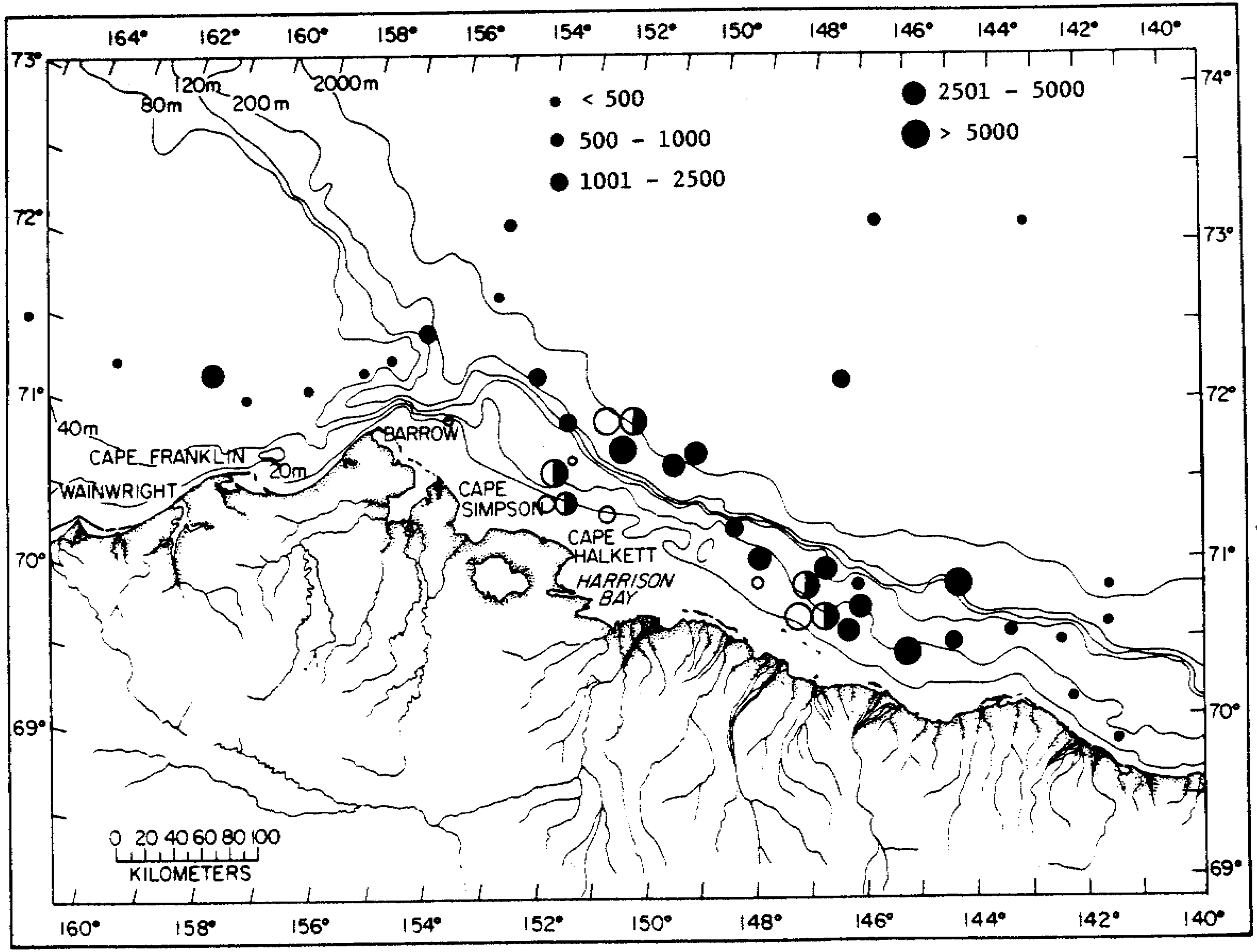

Fig. 12. Abundance (number per 1000 m^3) of *Spiratella helicina* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◐ = ring net, 20-0 m 1976; ● = bongo net 1977.

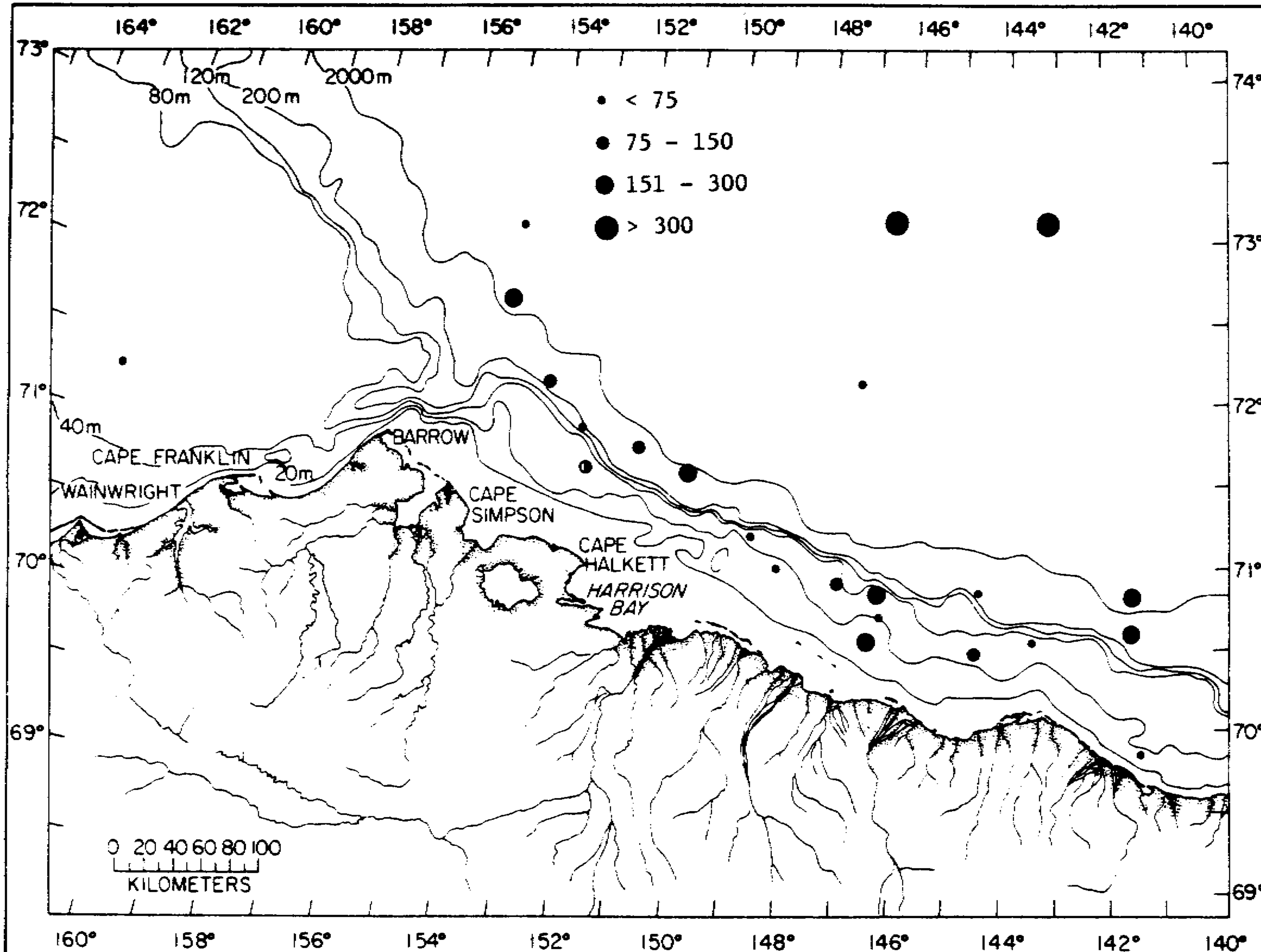

Fig. 13. Abundance (number per 1000 m^3) of ostracods at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

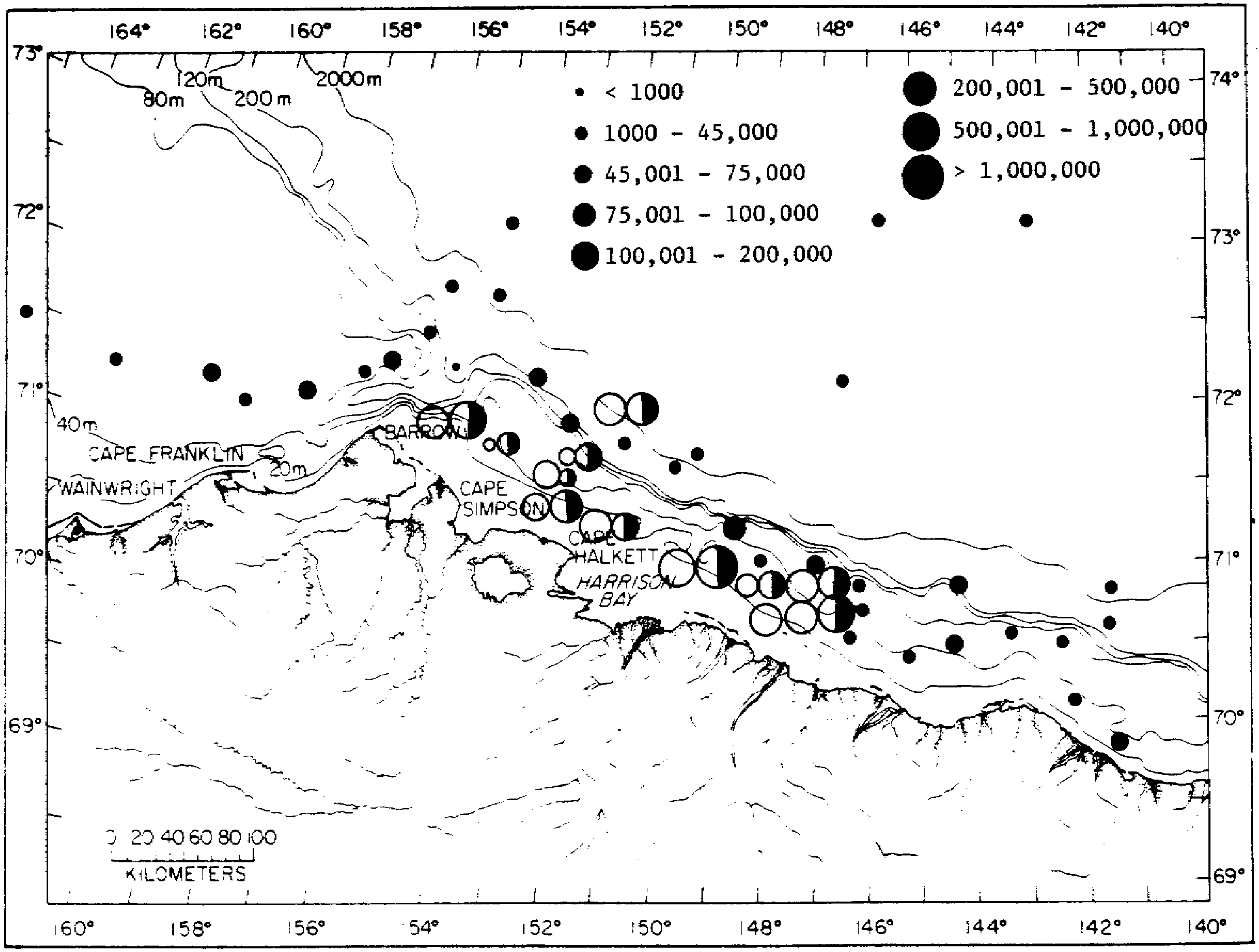

Fig. 14. Abundance (number per 1000 m^3) of all copepods at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

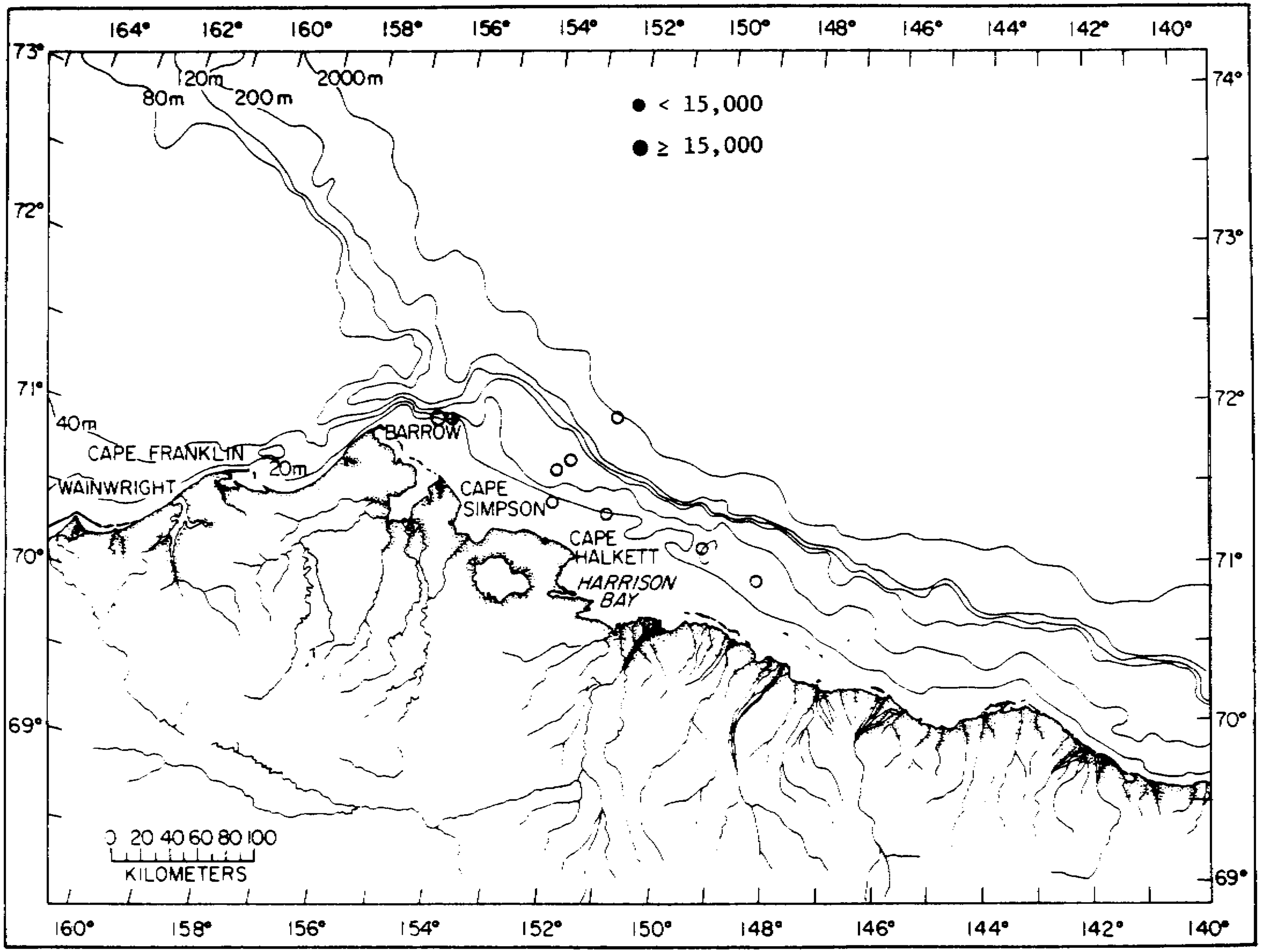

Fig. 15. Abundance (number per 1000 m^3) of *Acartia* spp. at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

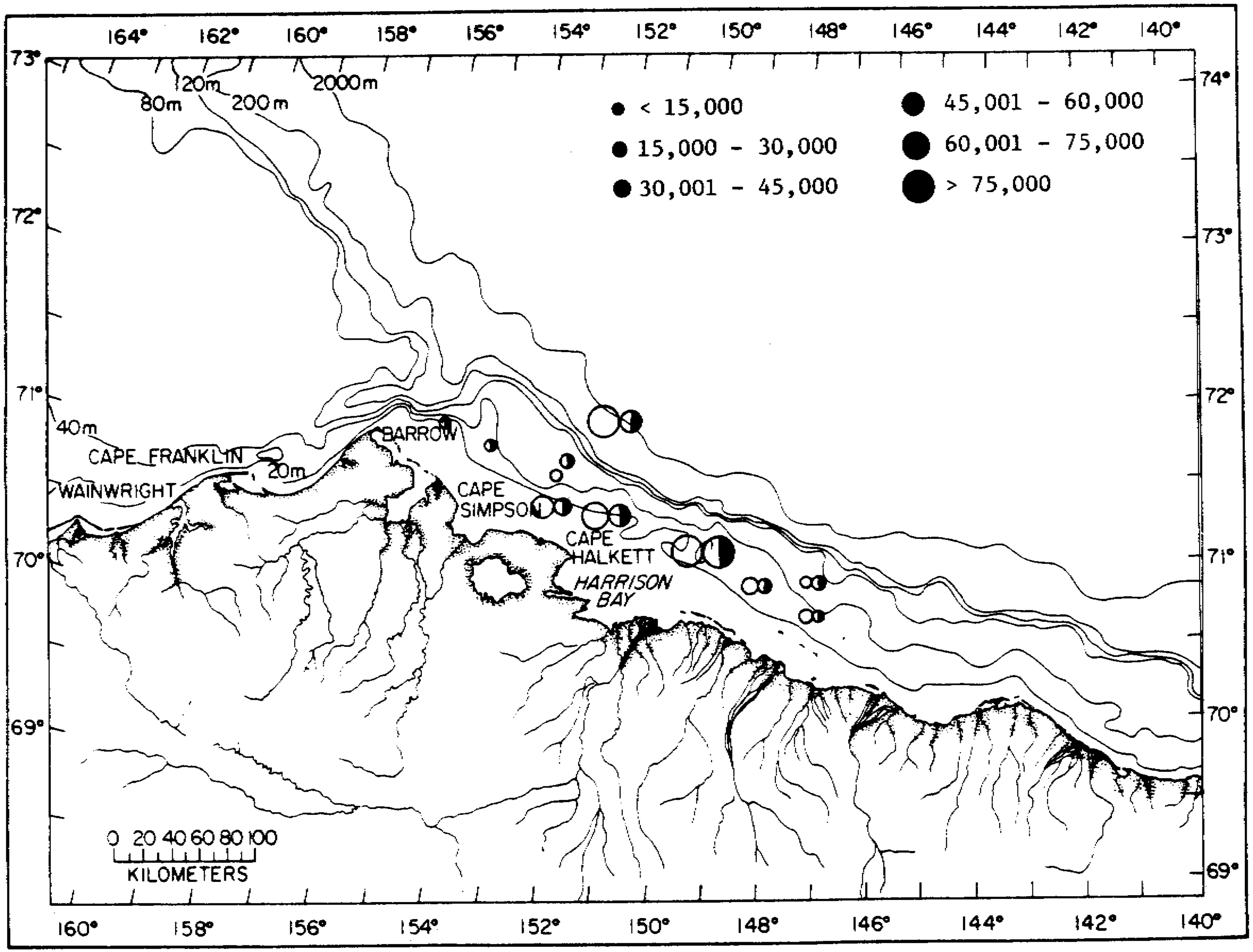

Fig. 16. Abundance (number per 1000 m^3) of *Calanus glacialis* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

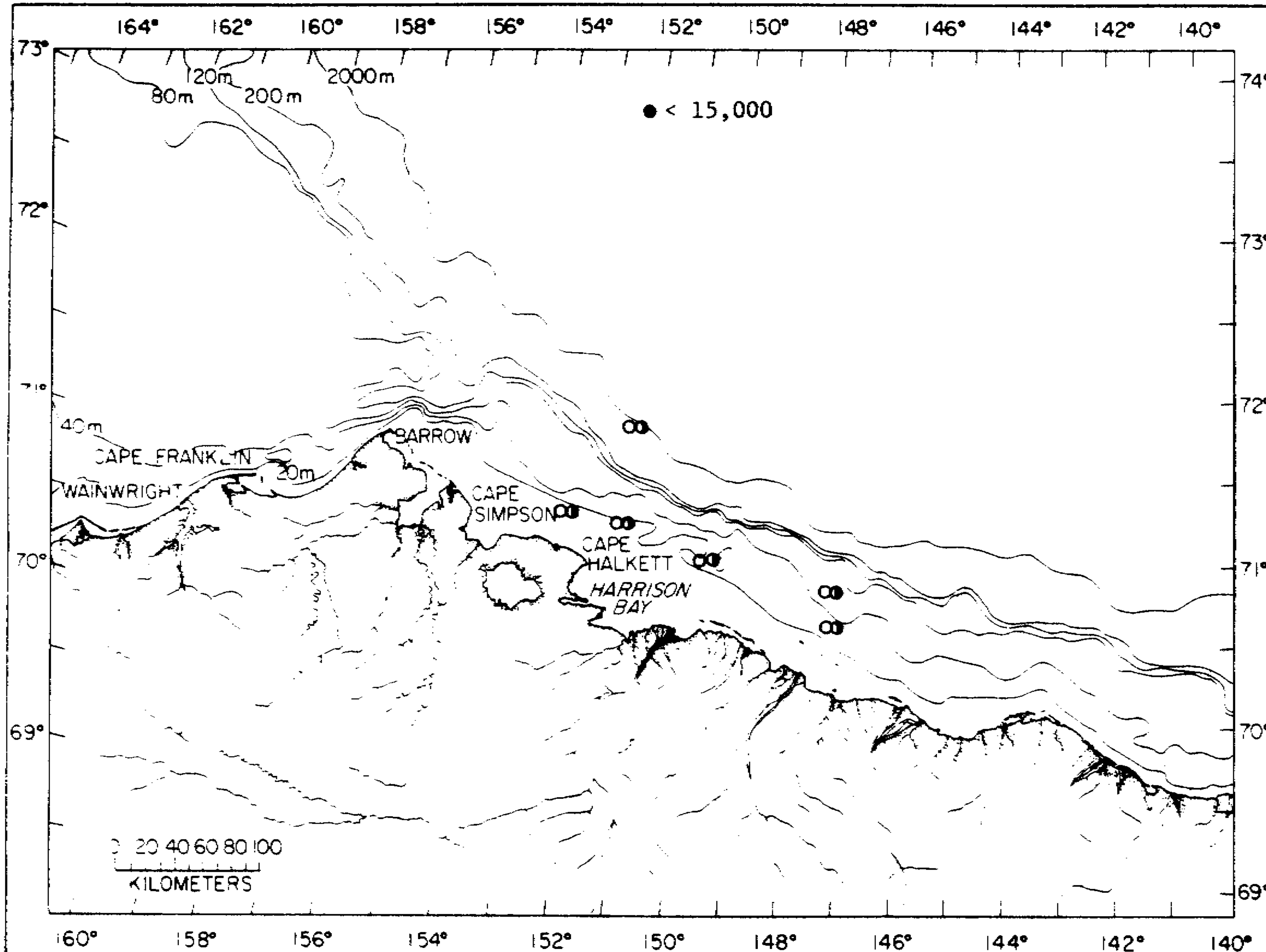

Fig. 17. Abundance (number per 1000 m^3) of *Calanus hyperboreus* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

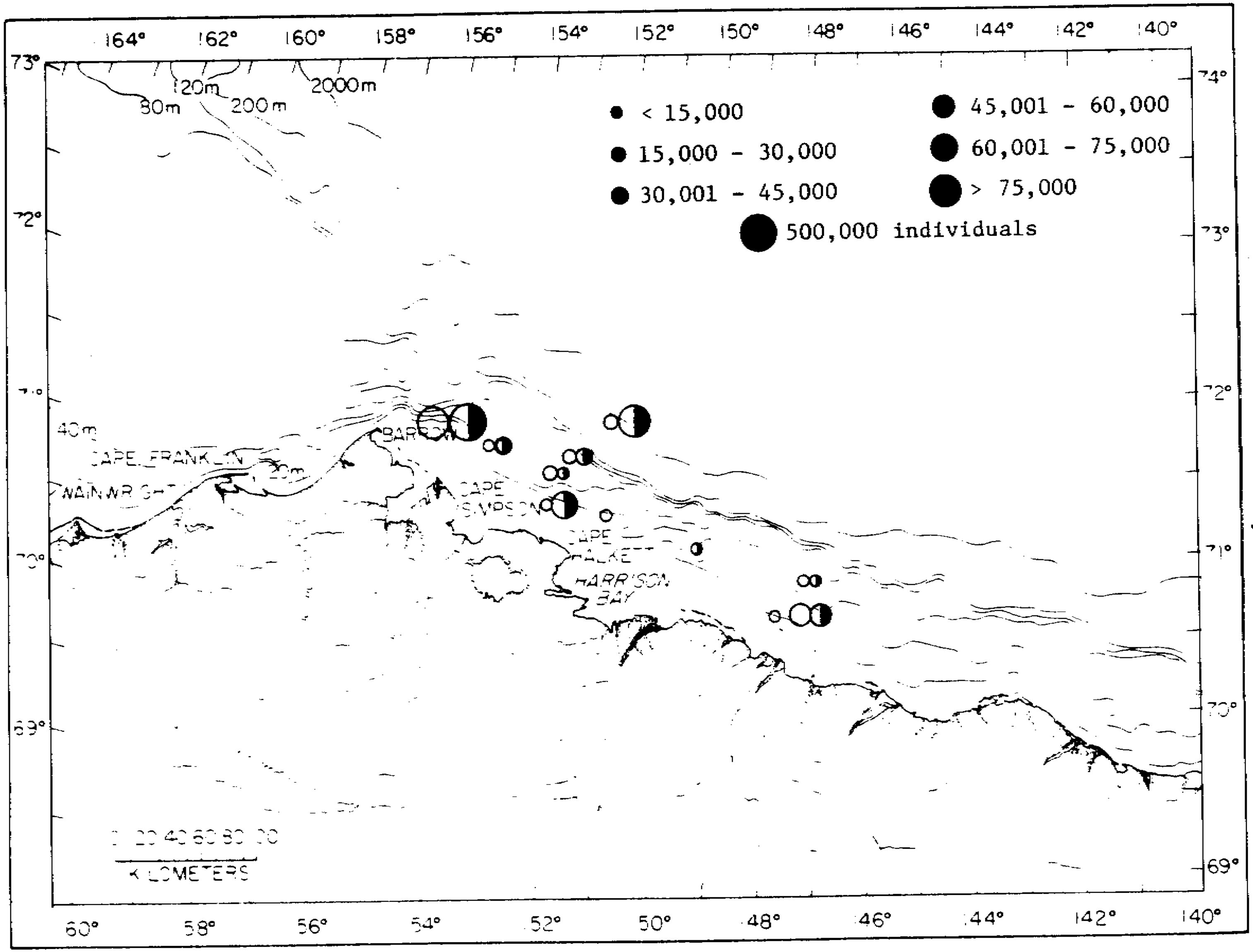

Fig. 18. Abundance (number per 1000 m^3) of *Oithona similis* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

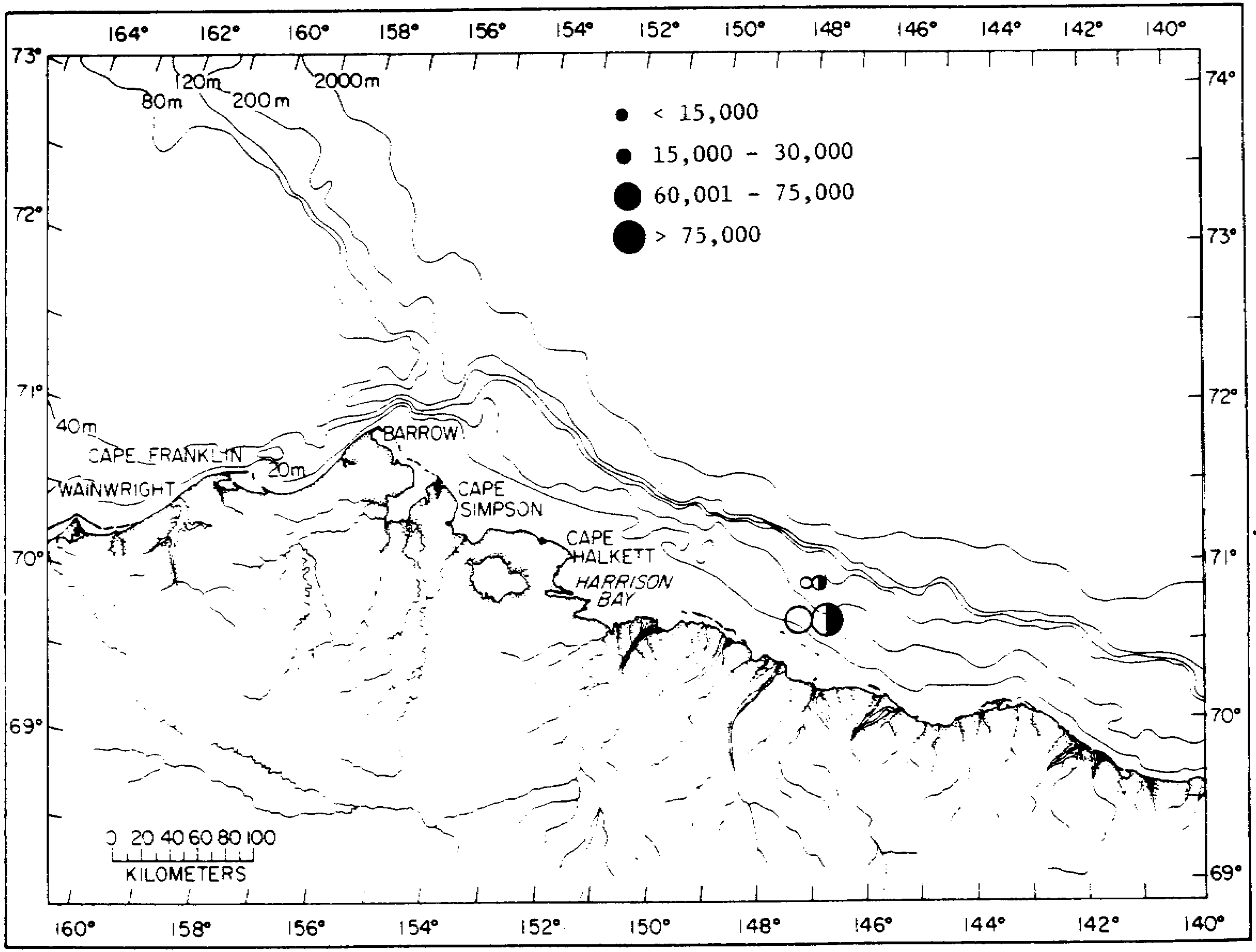

Fig. 19. Abundance (number per 1000 m^3) of *Microcalanus pigmaeus* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

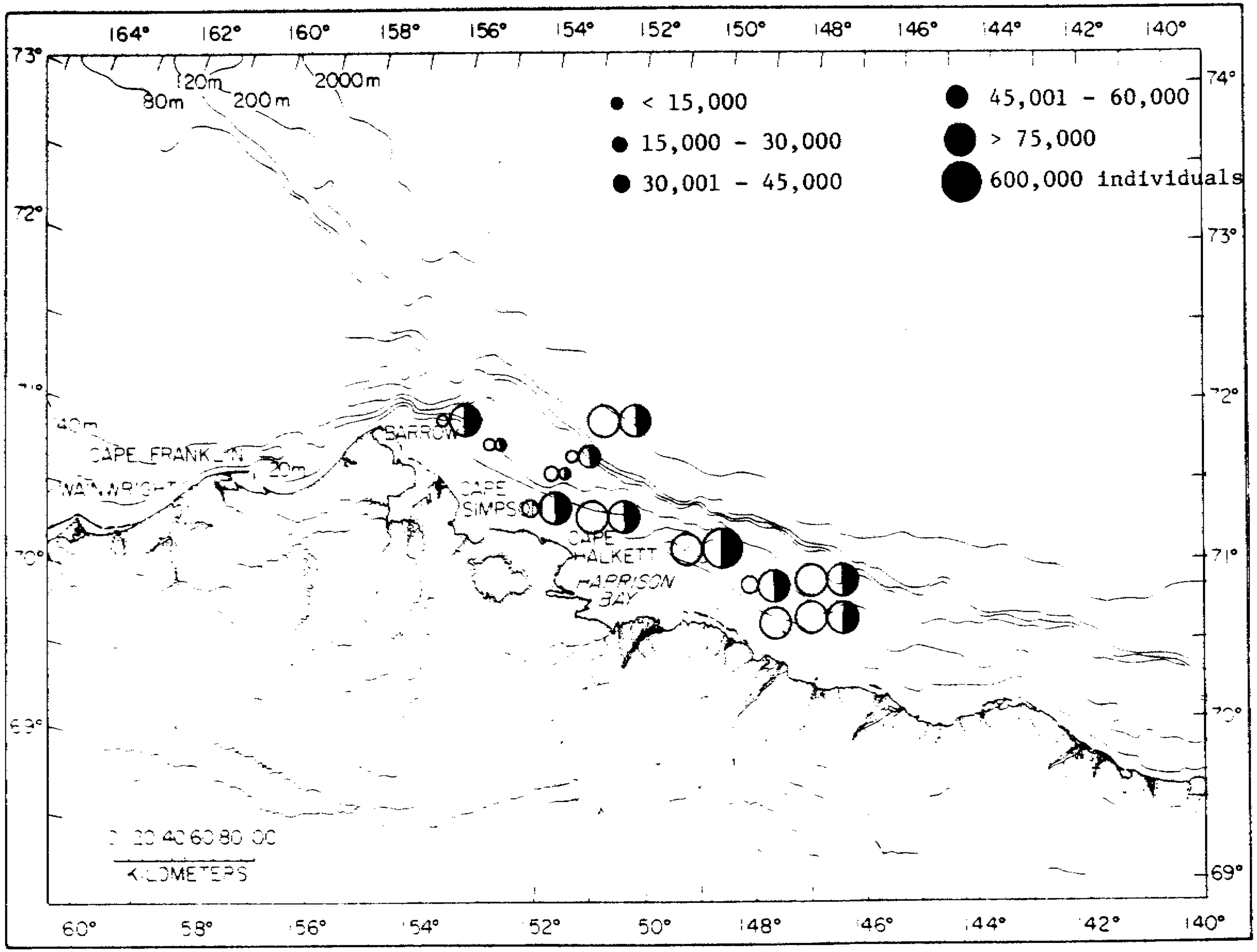

Fig. 20. Abundance (number per 1000 m^3) of *Pseudocalanus* spp. at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

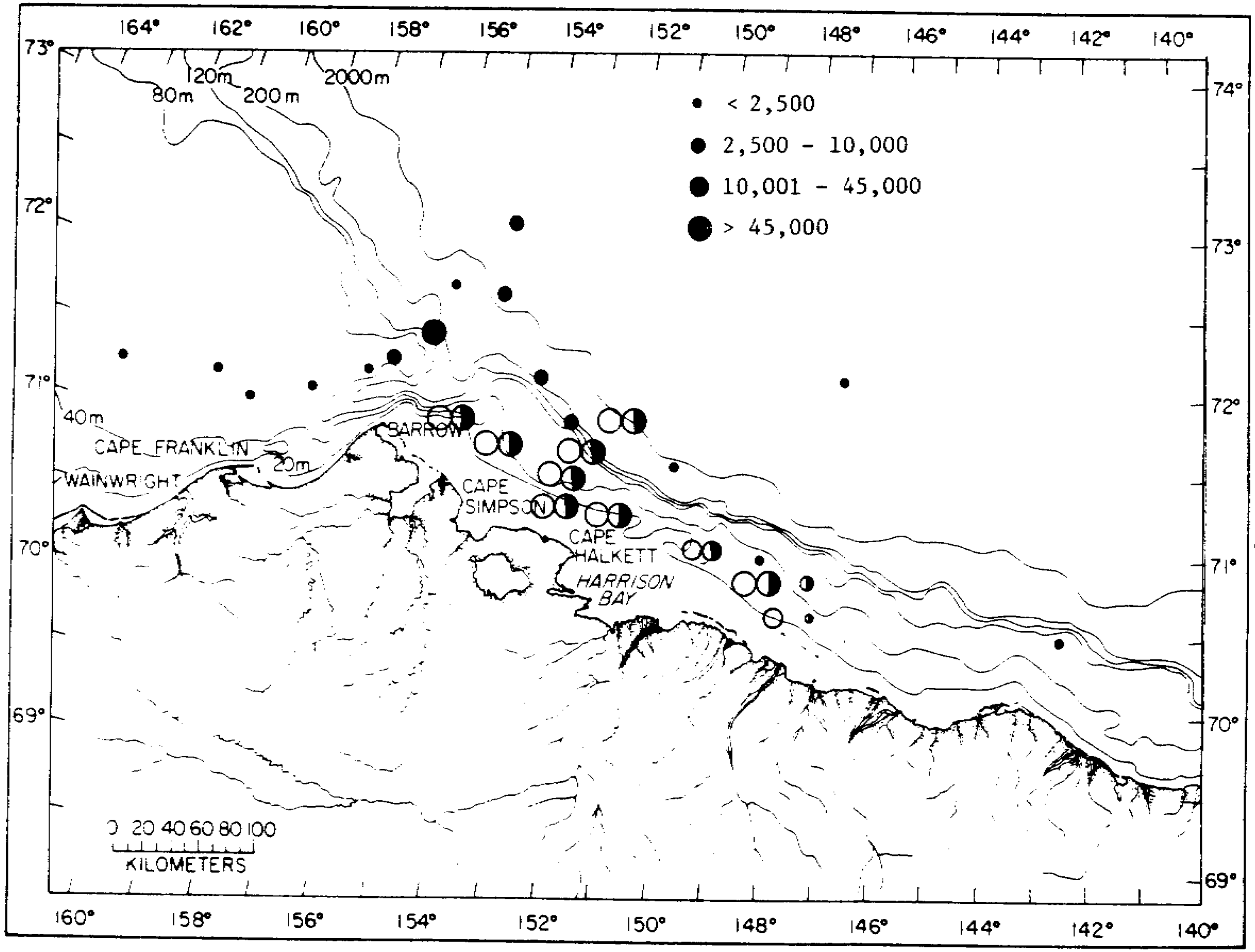

Fig. 21. Abundance (number per 1000 m^3) of barnacle larvae at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10 - 0 m 1976; ◑ = ring net, 20 - 0 m 1976; ● = bongo net 1977.

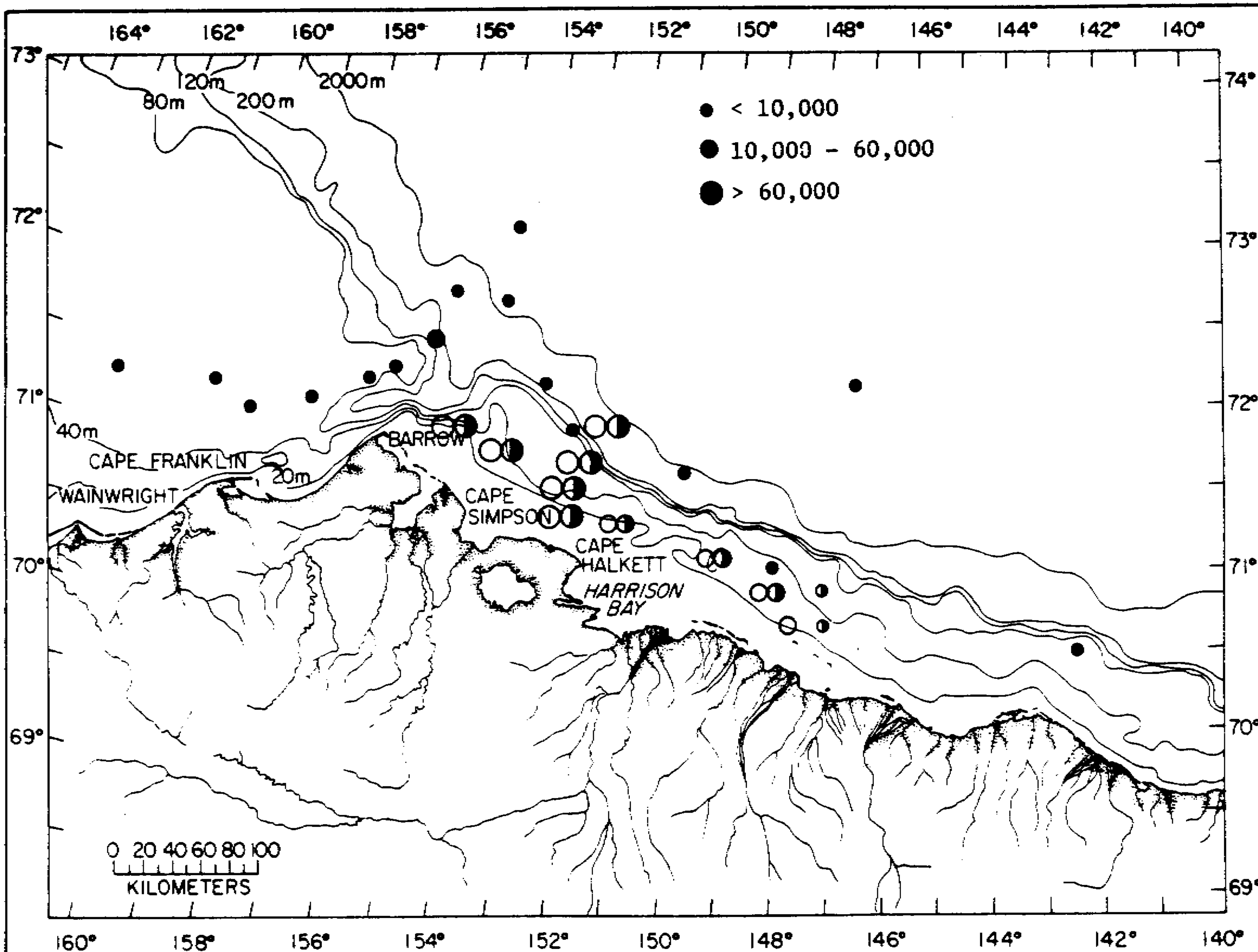

Fig. 22. Abundance (number per 1000 m^3) of barnacle nauplii at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

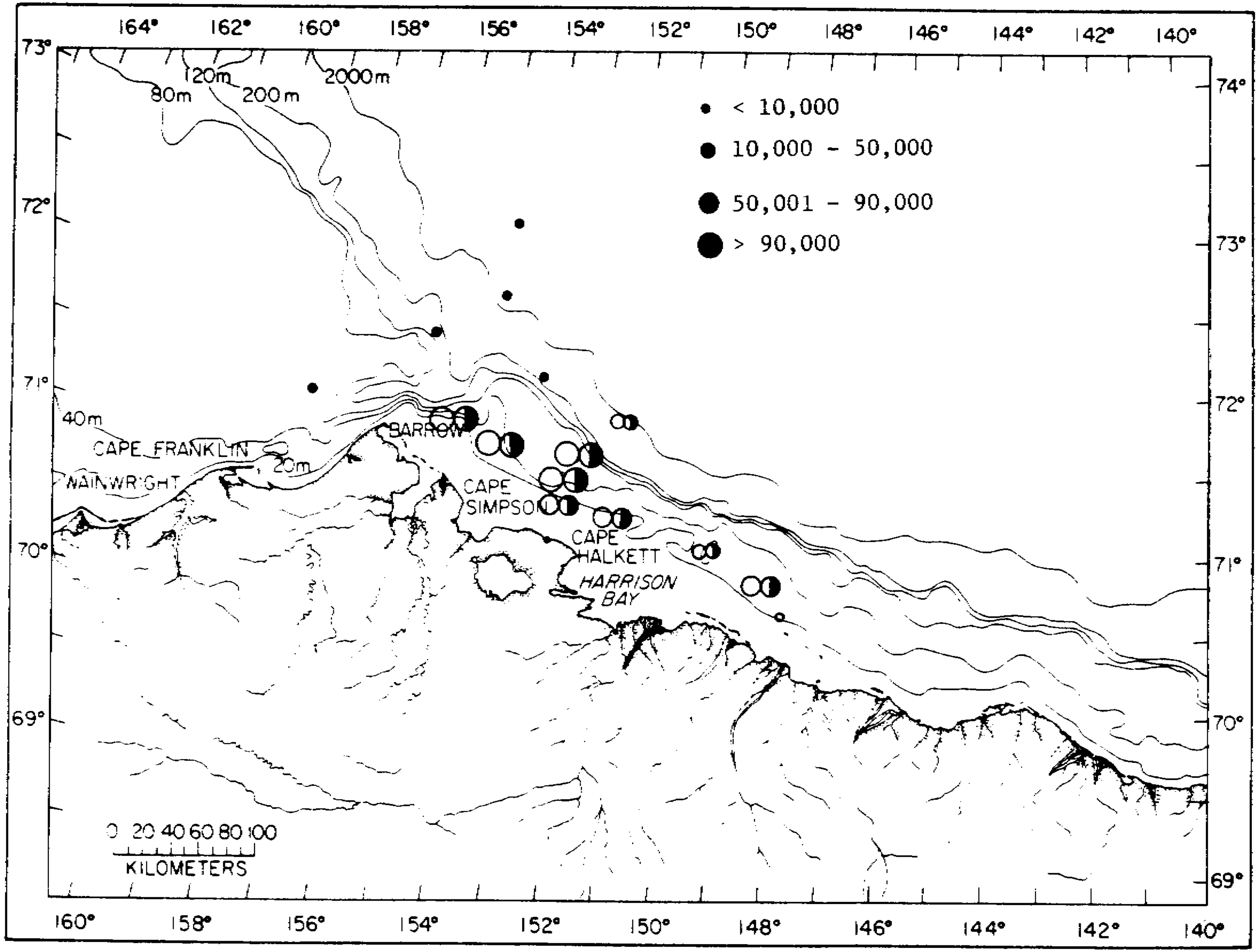

Fig. 23. Abundance (number per 1000 m^3) of barnacle cyprids at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

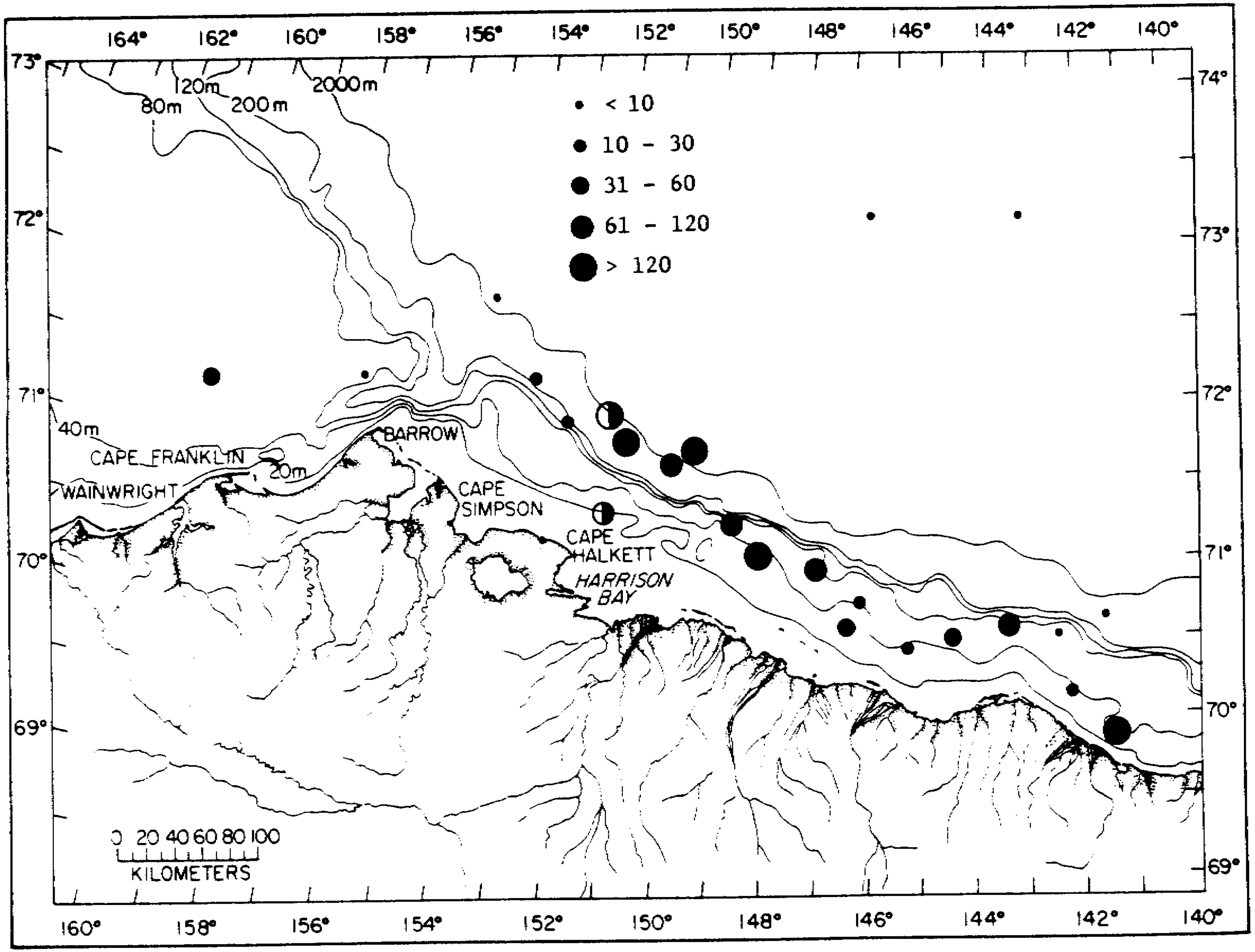

Fig. 24. Abundance (number per 1000 m^3) of all mysids at station in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◐ = ring net, 20-0 m 1976; ● = bongo net 1977.

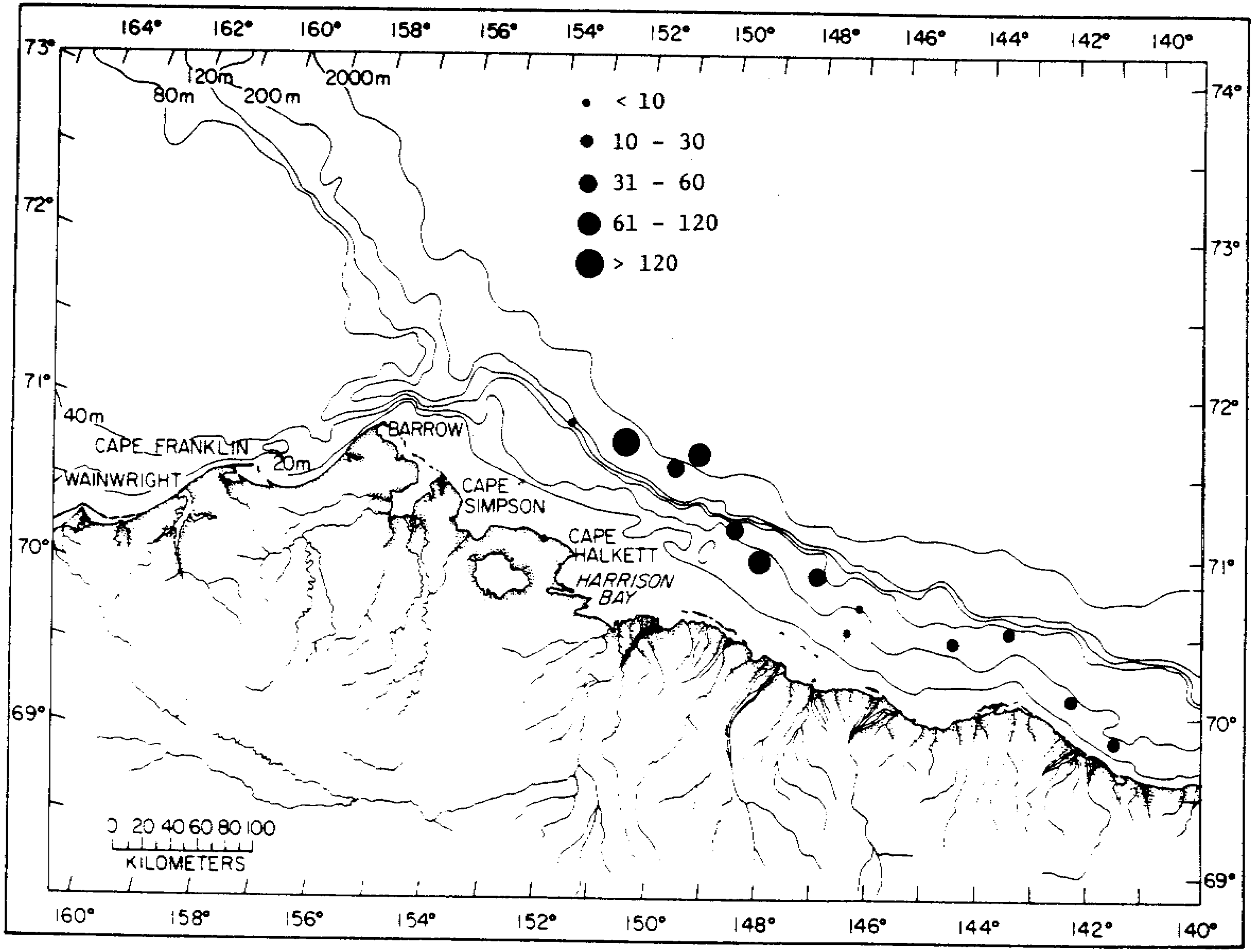

Fig. 25. Abundance (number per 1000 m^3) of *Mysis litoralis* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

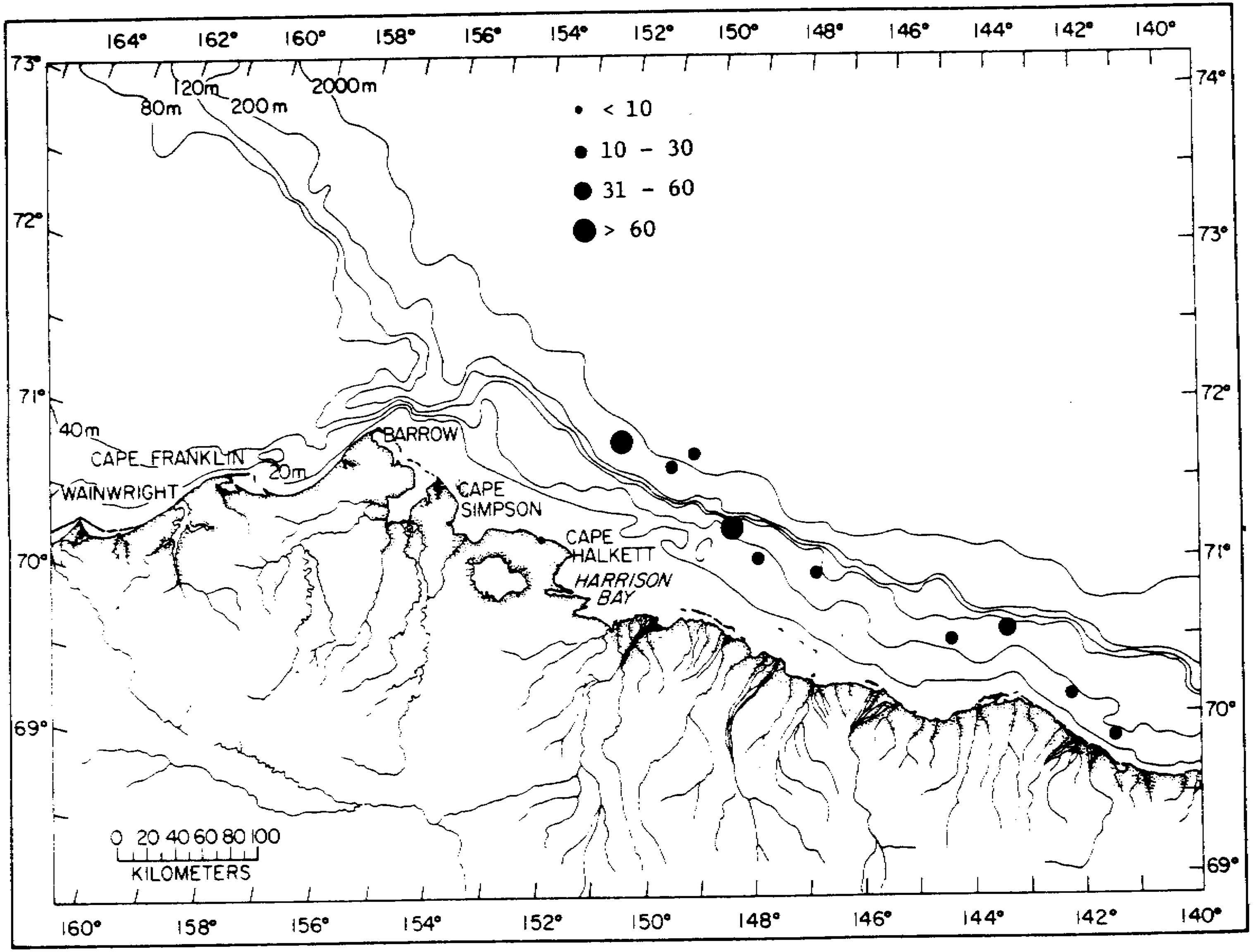

Fig. 26. Abundance (number per 1000 m^3) of *Mysis oculata* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◐ = ring net, 20-0 m 1976; ● = bongo net 1977.

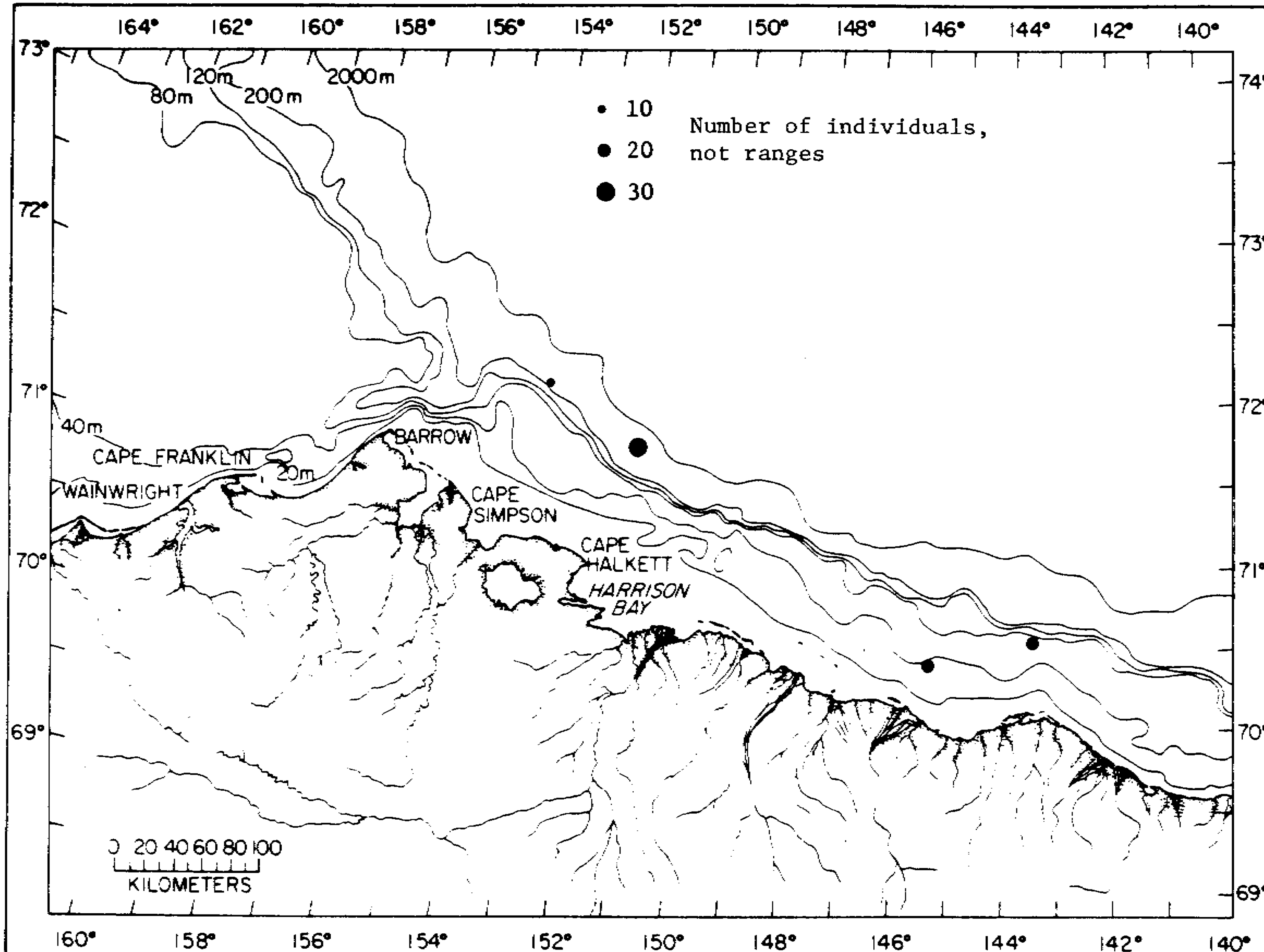

Fig. 27. Abundance (number per 1000 m^3) of *Mysis relicta* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

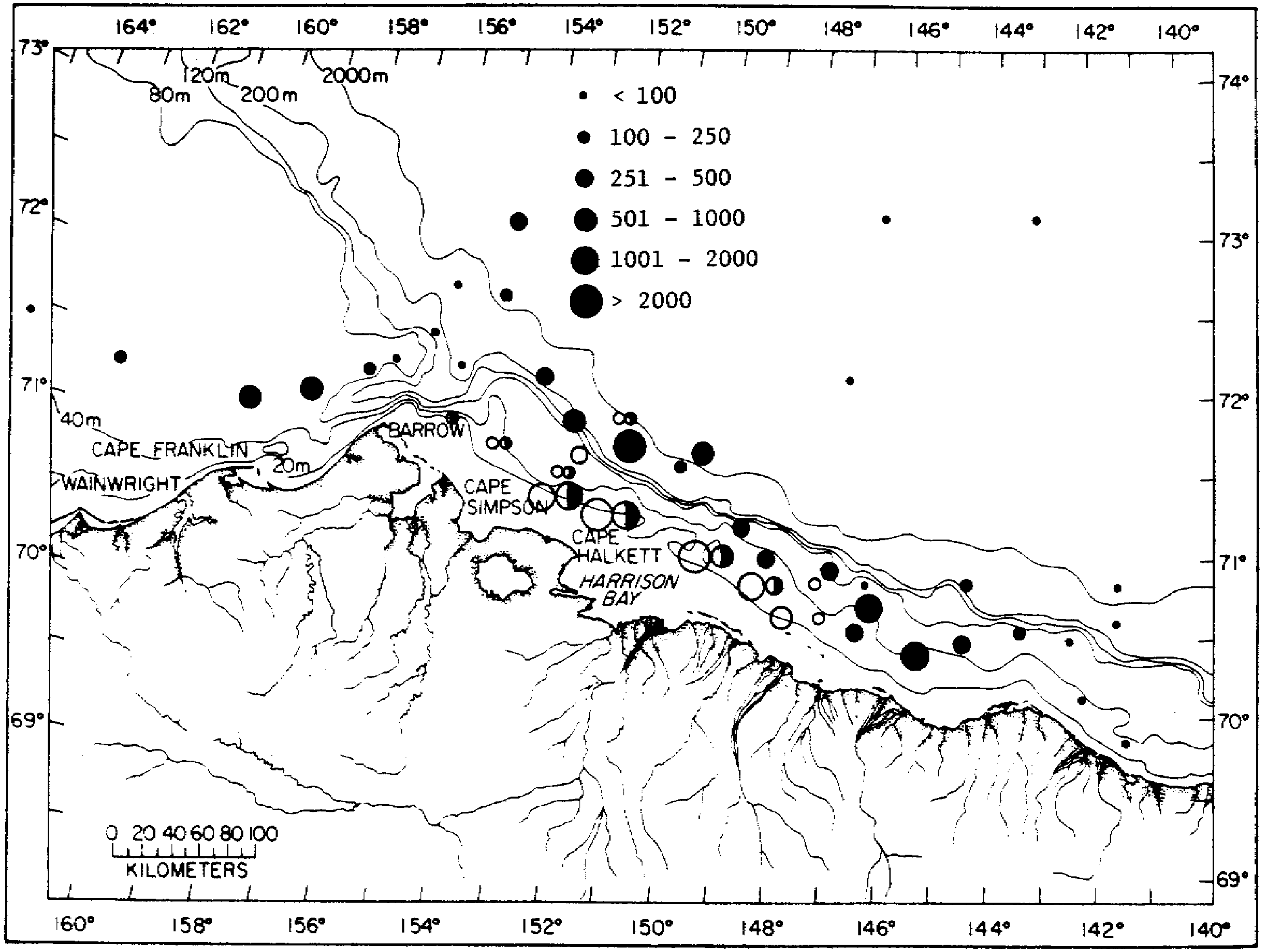

Fig. 28. Abundance (number per 1000 m^3) of all gammarid amphipods at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

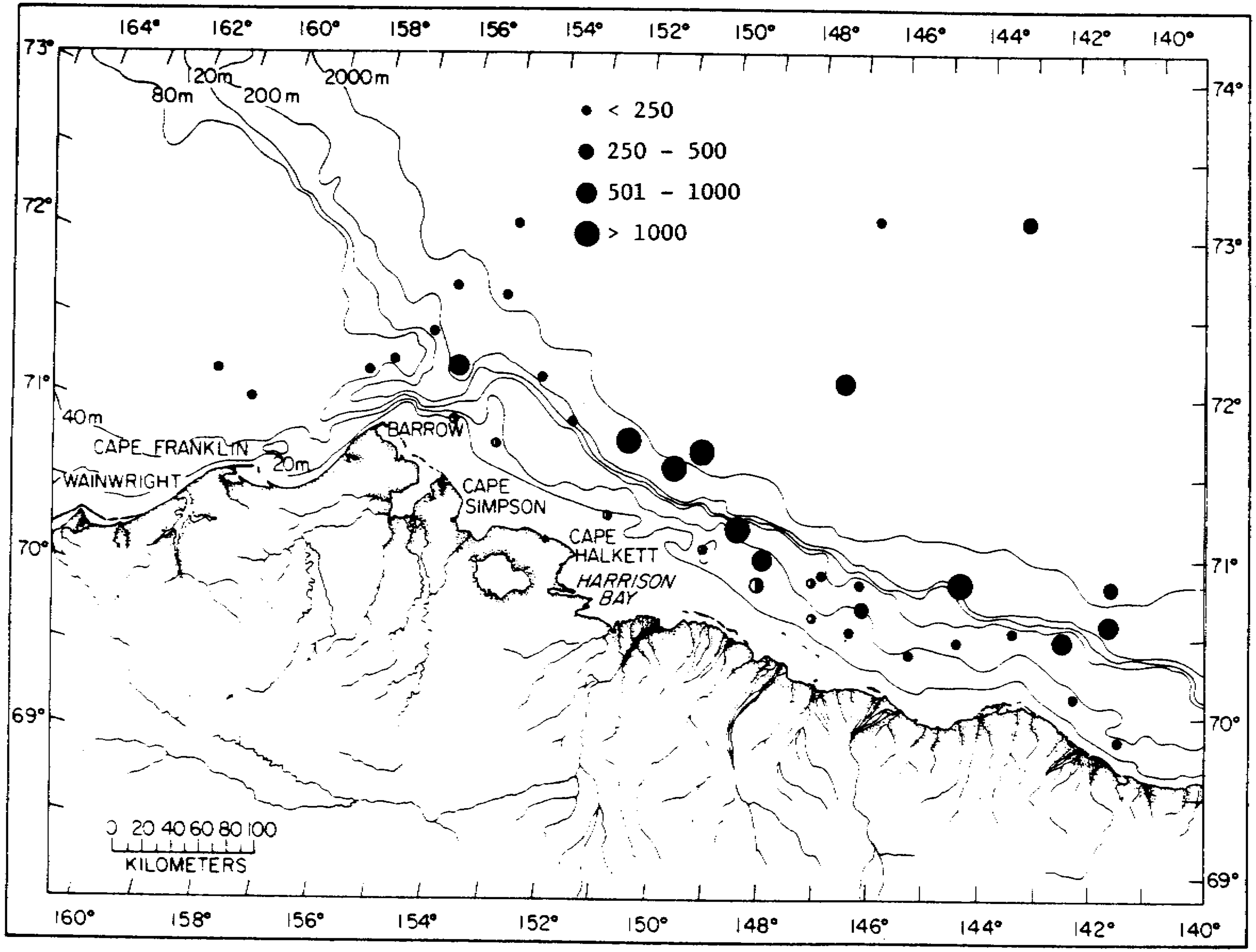

Fig. 29. Abundance (number per 1000 m^3) of all hyperiid amphipods at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

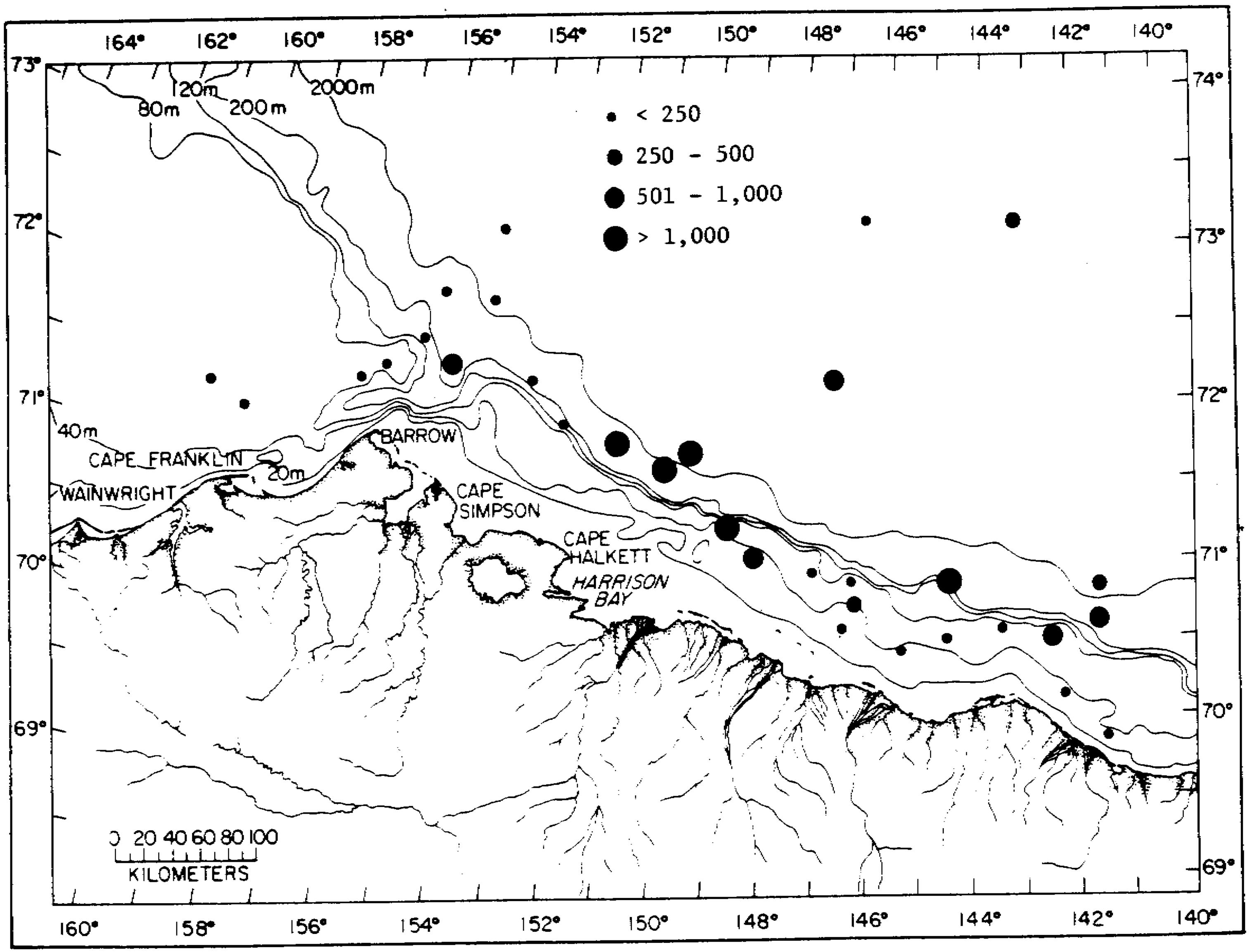

Fig. 30. Abundance (number per 1000 m^3) of all *Parathemisto* spp. at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

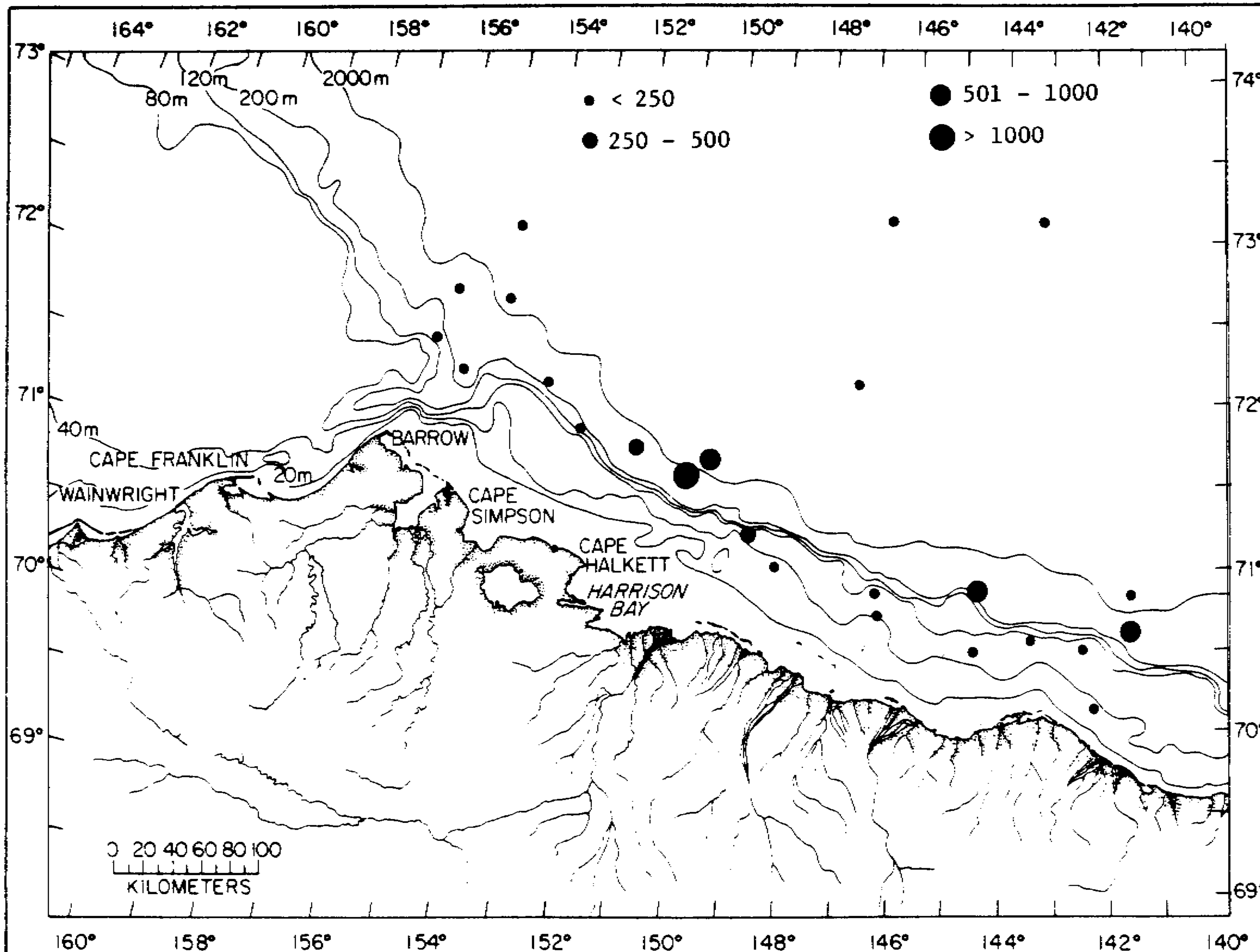

Fig. 31. Abundance (number per 1000 m^3) of *Parathemisto abyssorum* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

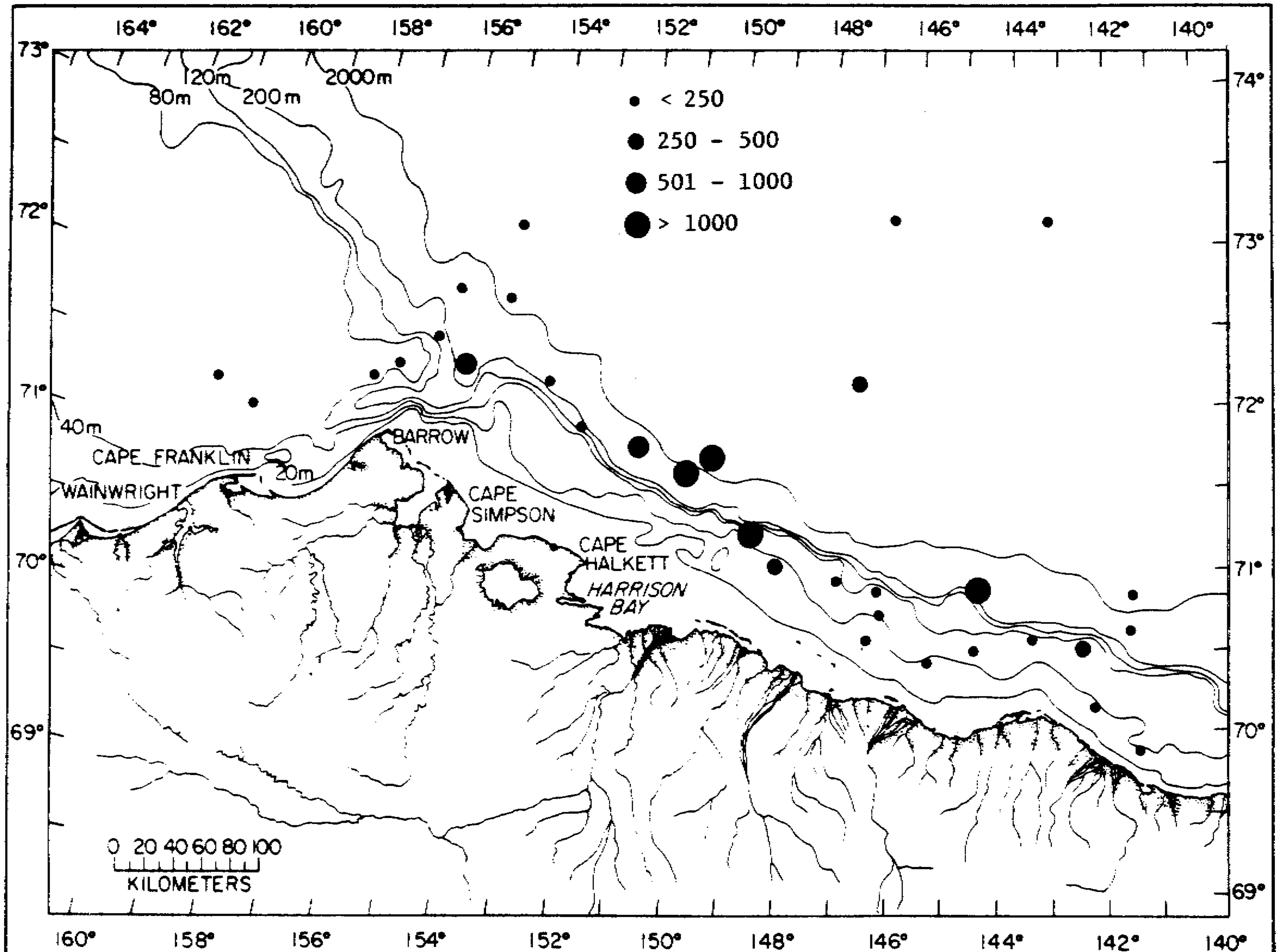

Fig. 32. Abundance (number per 1000 m^3) of *Parathemisto libellula* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

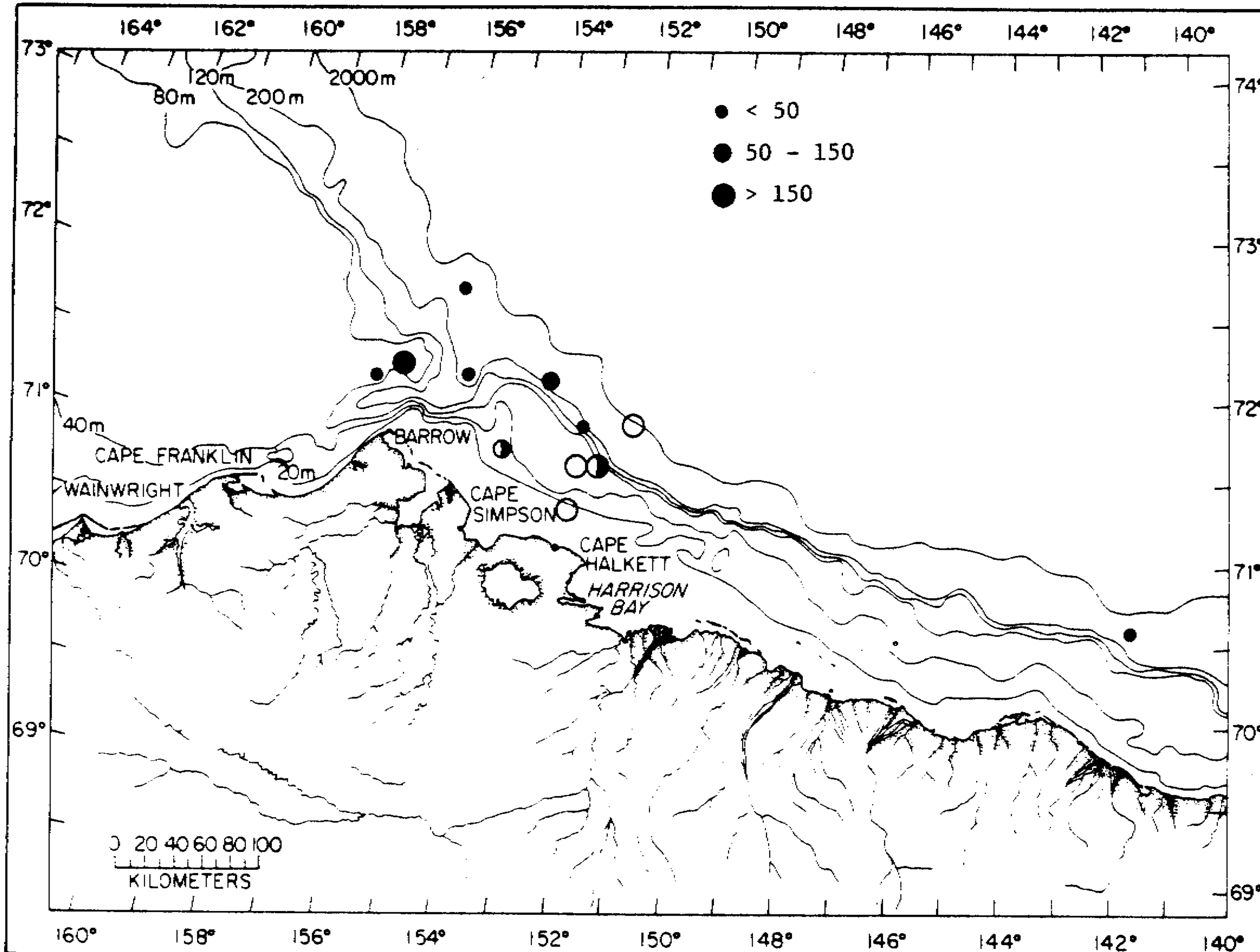

Fig. 33. Abundance (number per 1000 m^3) of all euphausid larvae at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

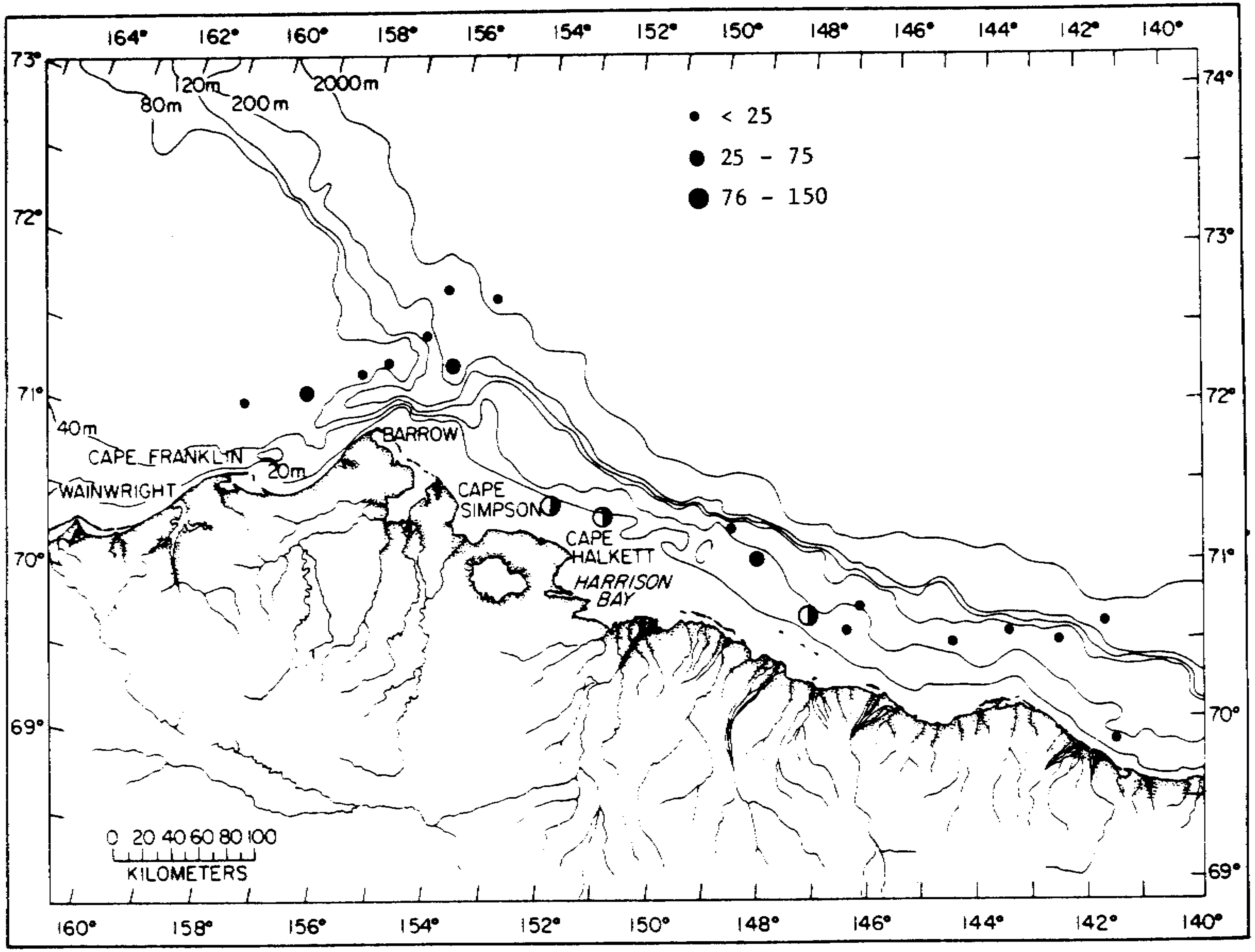

Fig. 34. Abundance (number per 1000 m^3) of *Thysanoëssa inermis* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

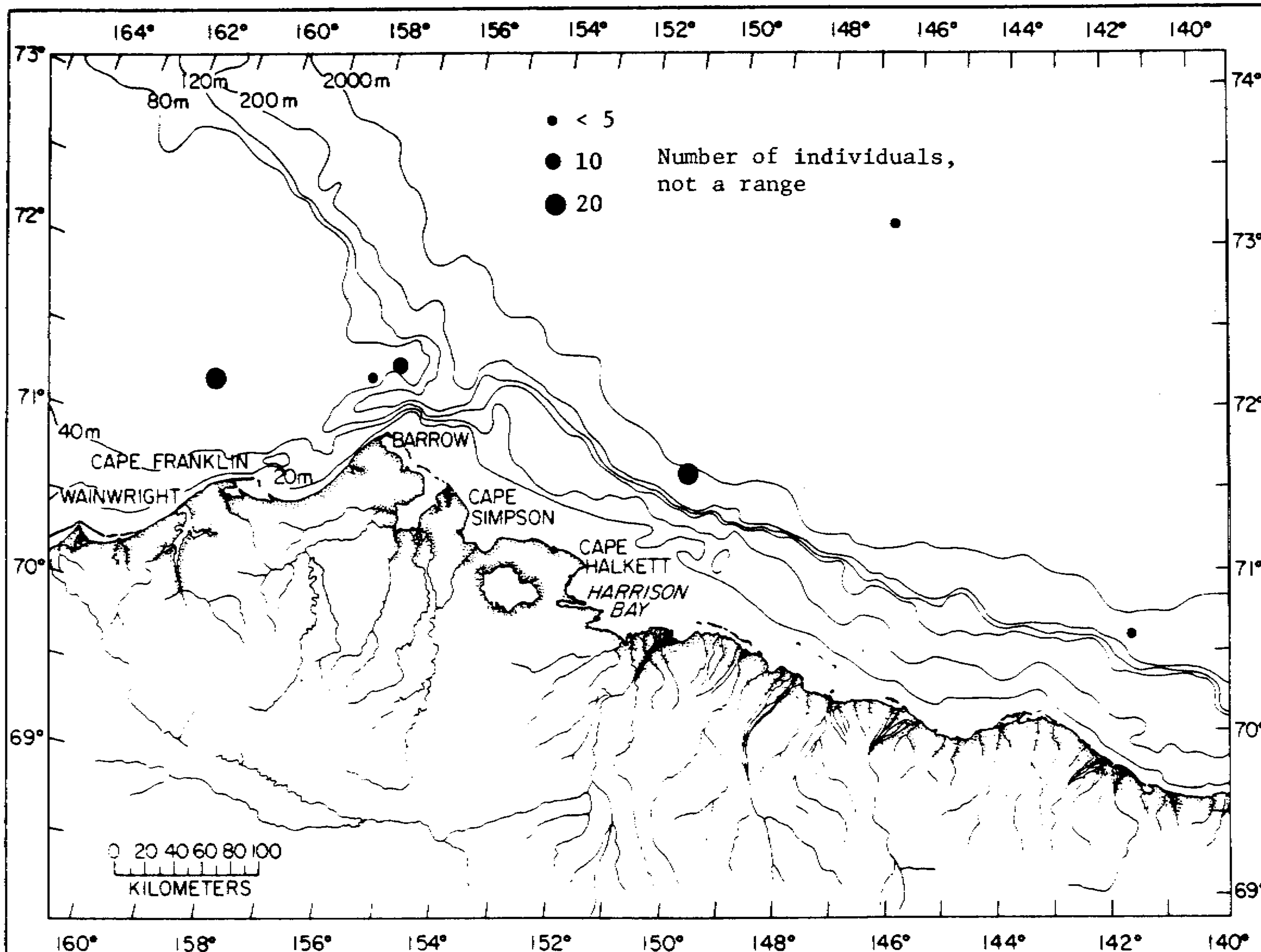

Fig. 35. Abundance (number per 1000 m^3) of *Thysanoëssa longipes* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

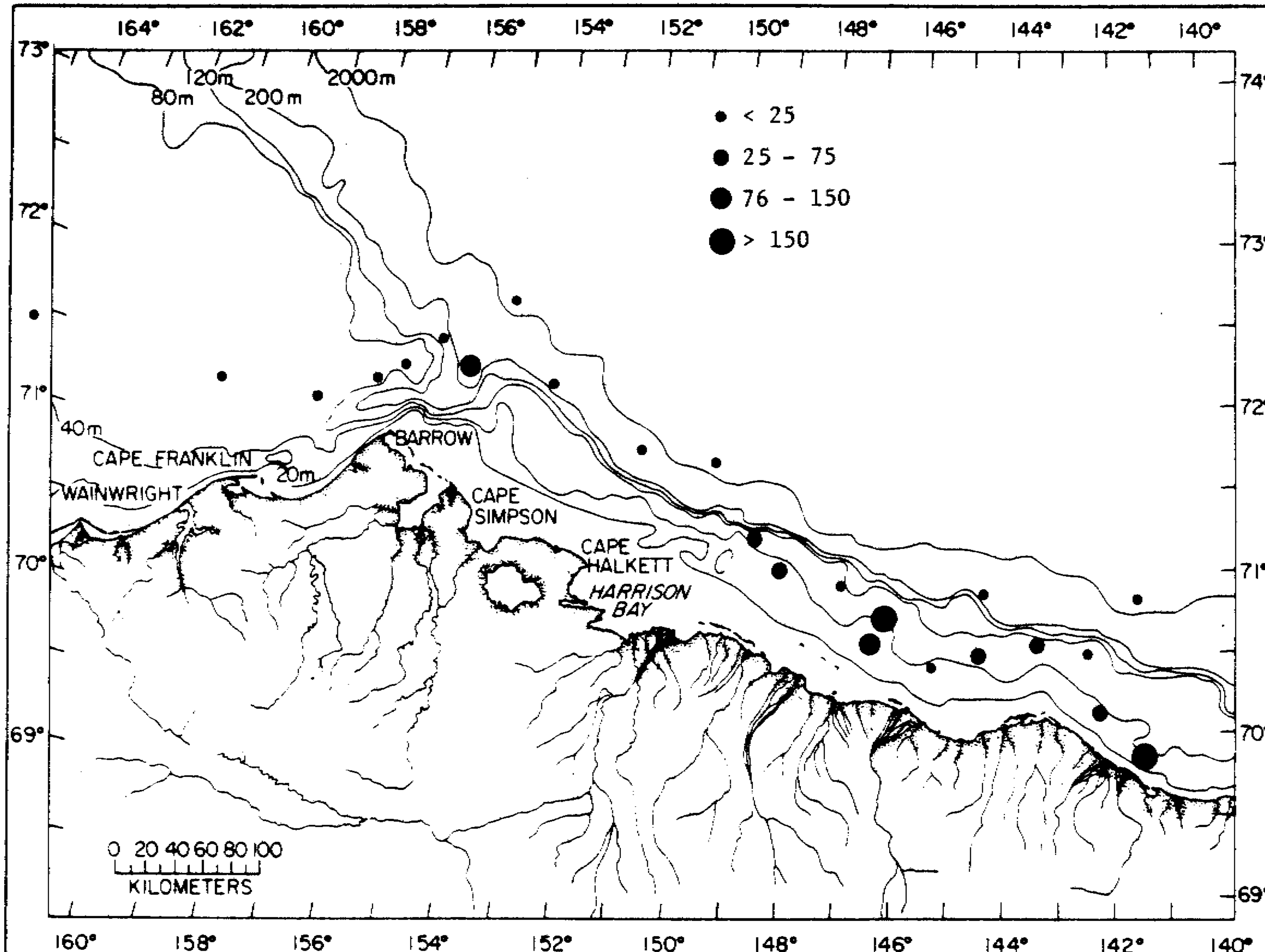

Fig. 36. Abundance (number per 1000 m^3) of *Thysanoëssa raschii* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

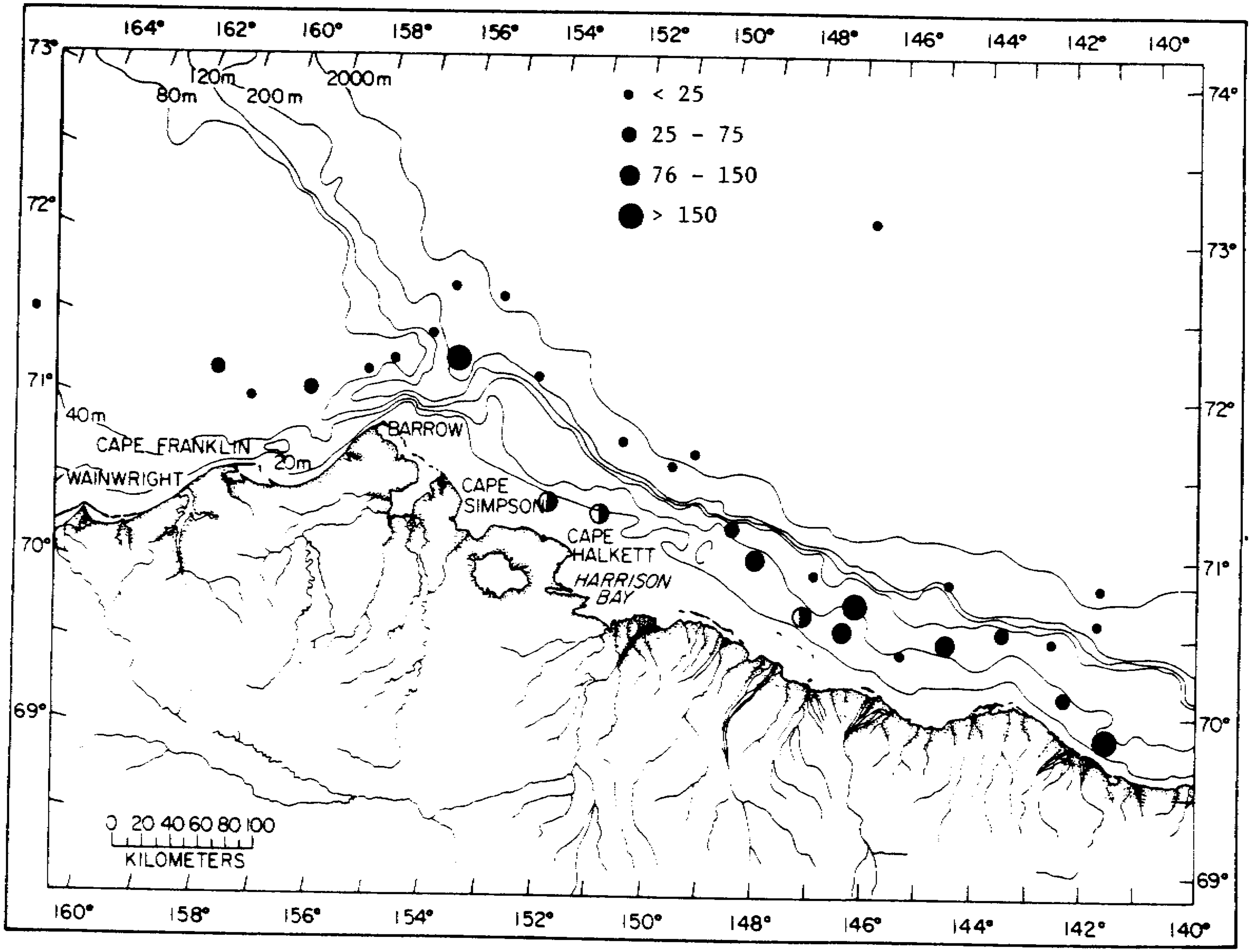

Fig. 37. Abundance (number per 1000 m^3) of all *Thysanoëssa* spp. (excluding larvae) at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net 20-0 m 1976; ● = bongo net 1977.

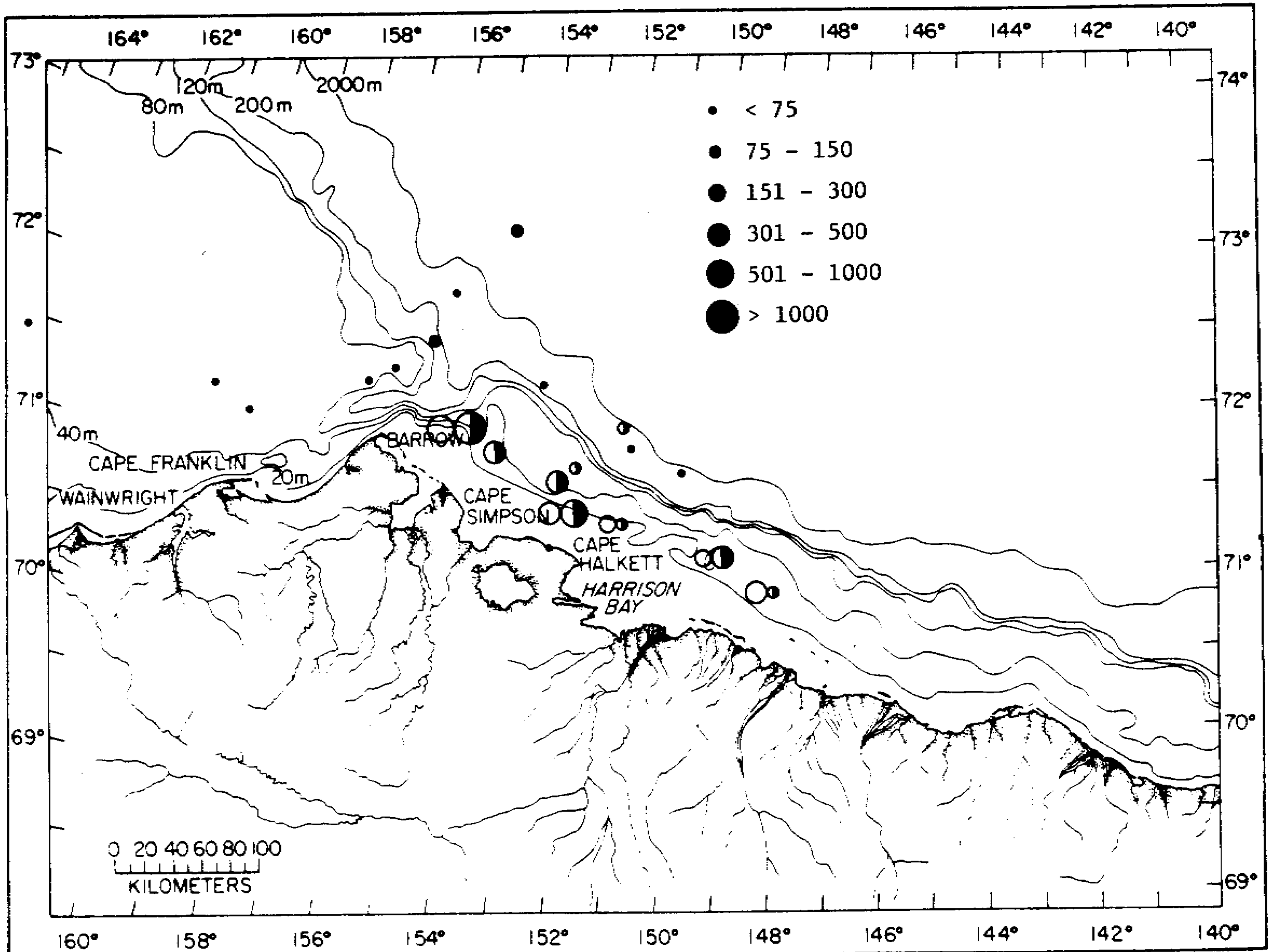

Fig. 38. Abundance (number per 1000 m^3) of anomuran larvae at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

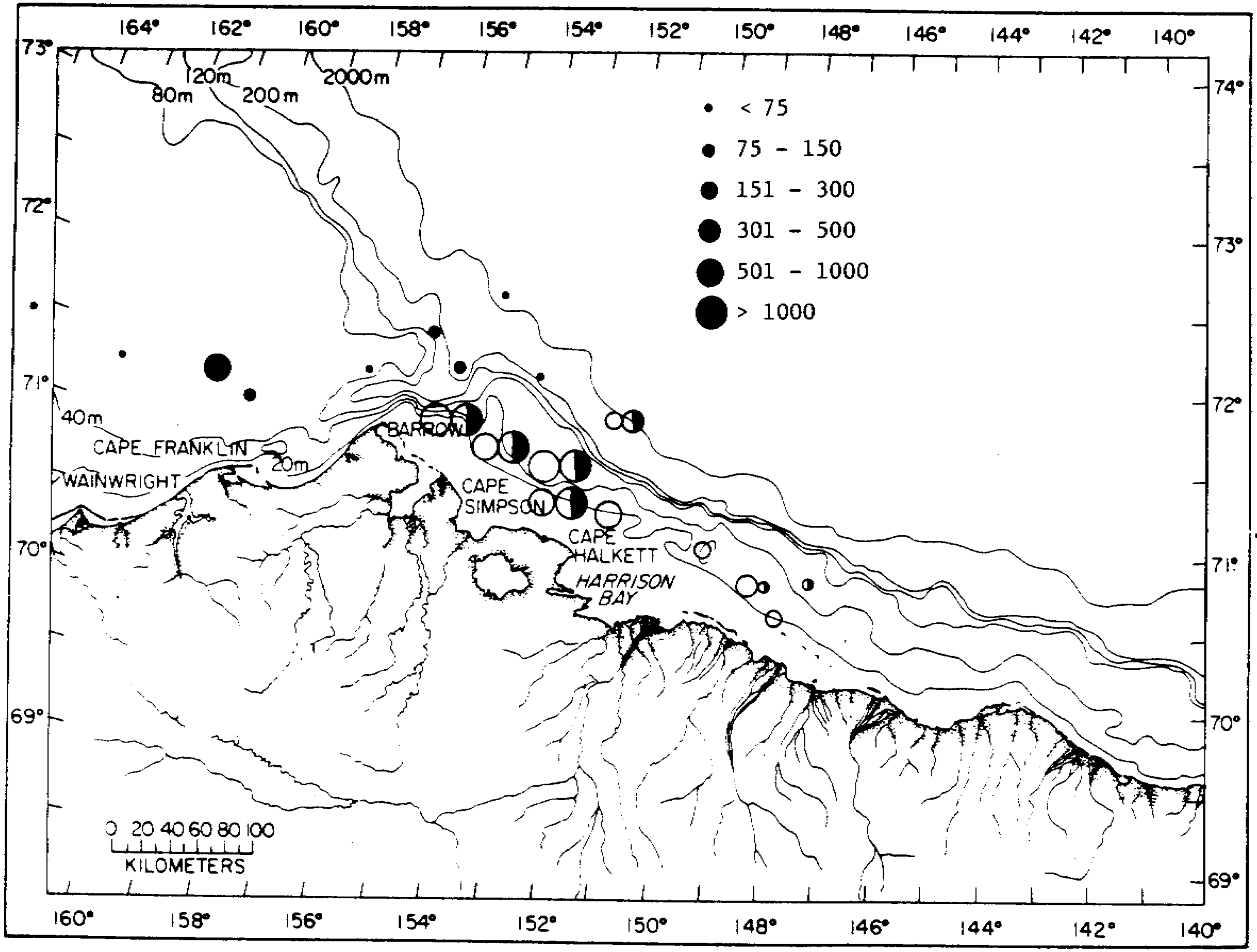

Fig. 39. Abundance (number per 1000 m^3) of brachyuran larvae at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

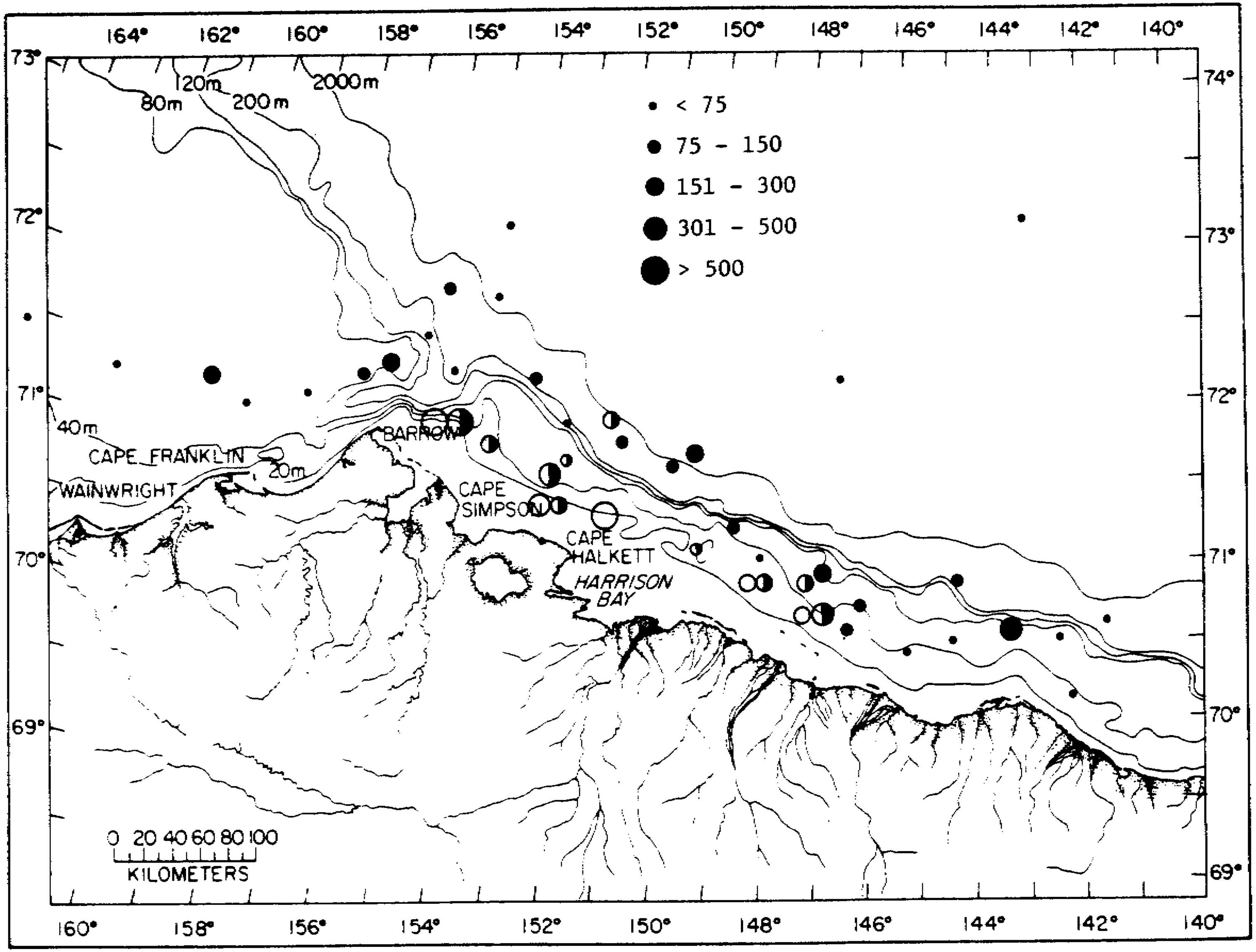

Fig. 40. Abundance (number per 1000 m^3) of Caridea at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

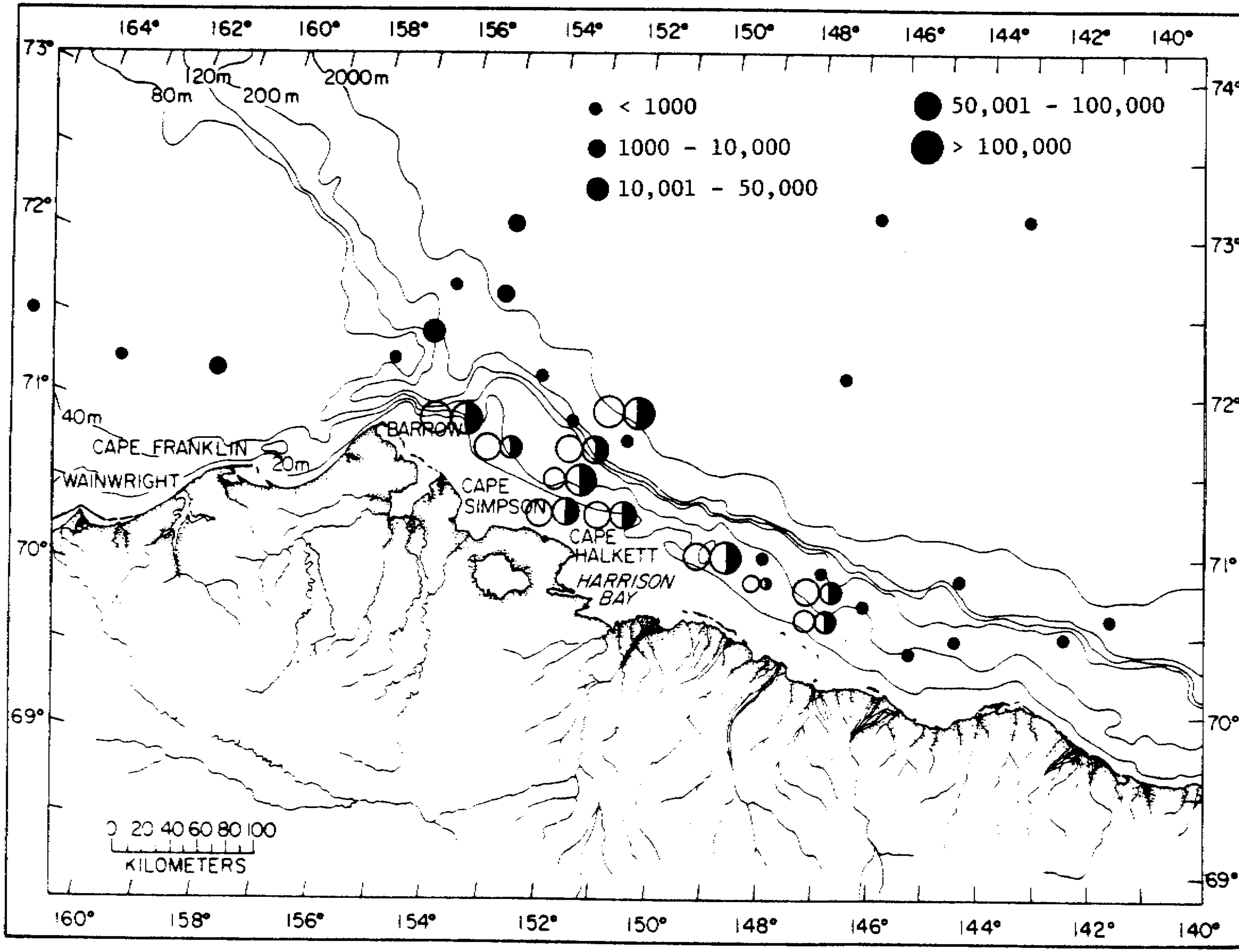

Fig. 41. Abundance (number per 1000 m^3) of *Fritillaria* spp. at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

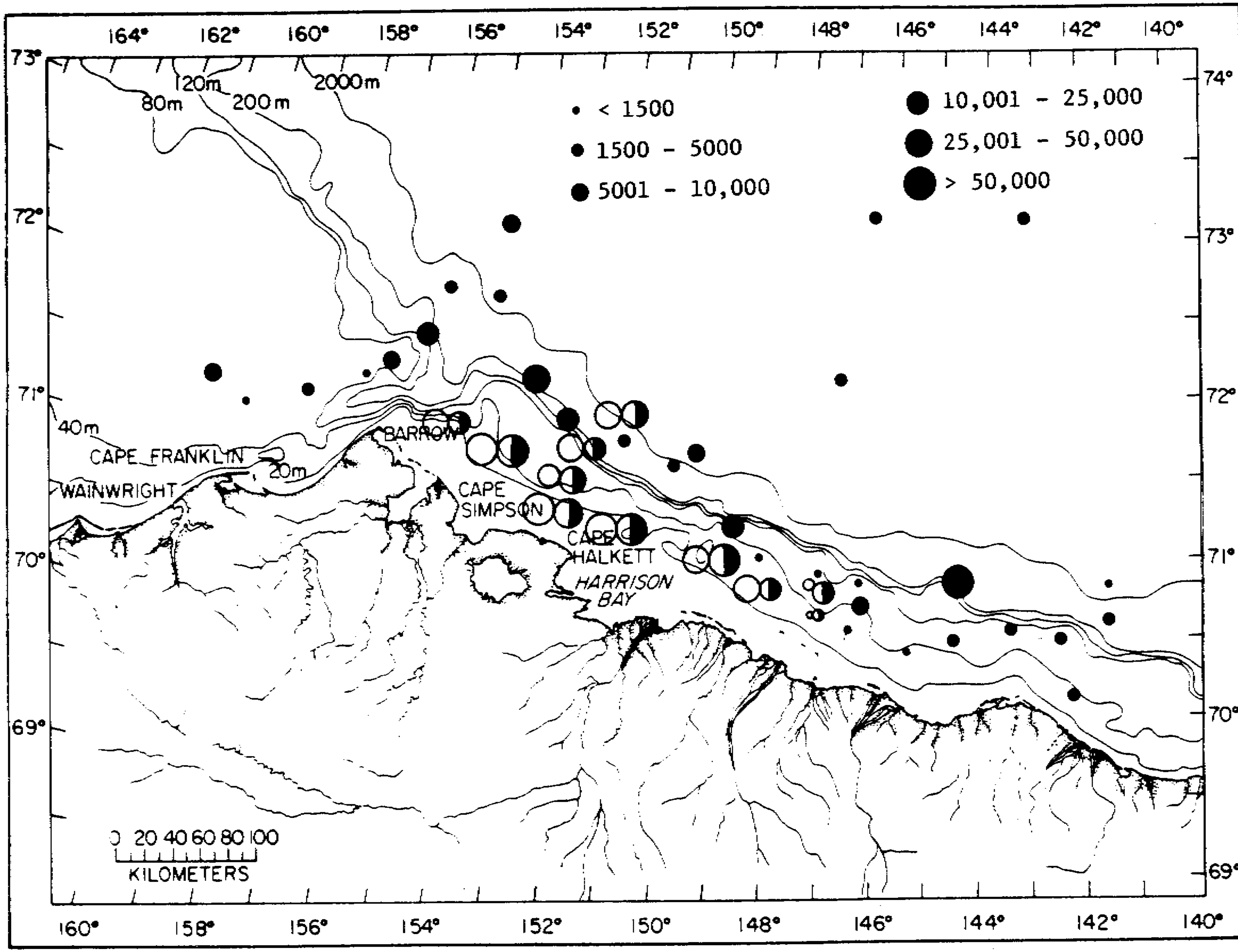

Fig. 42. Abundance (number per 1000 m^3) of all *Oikopleura* spp. at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

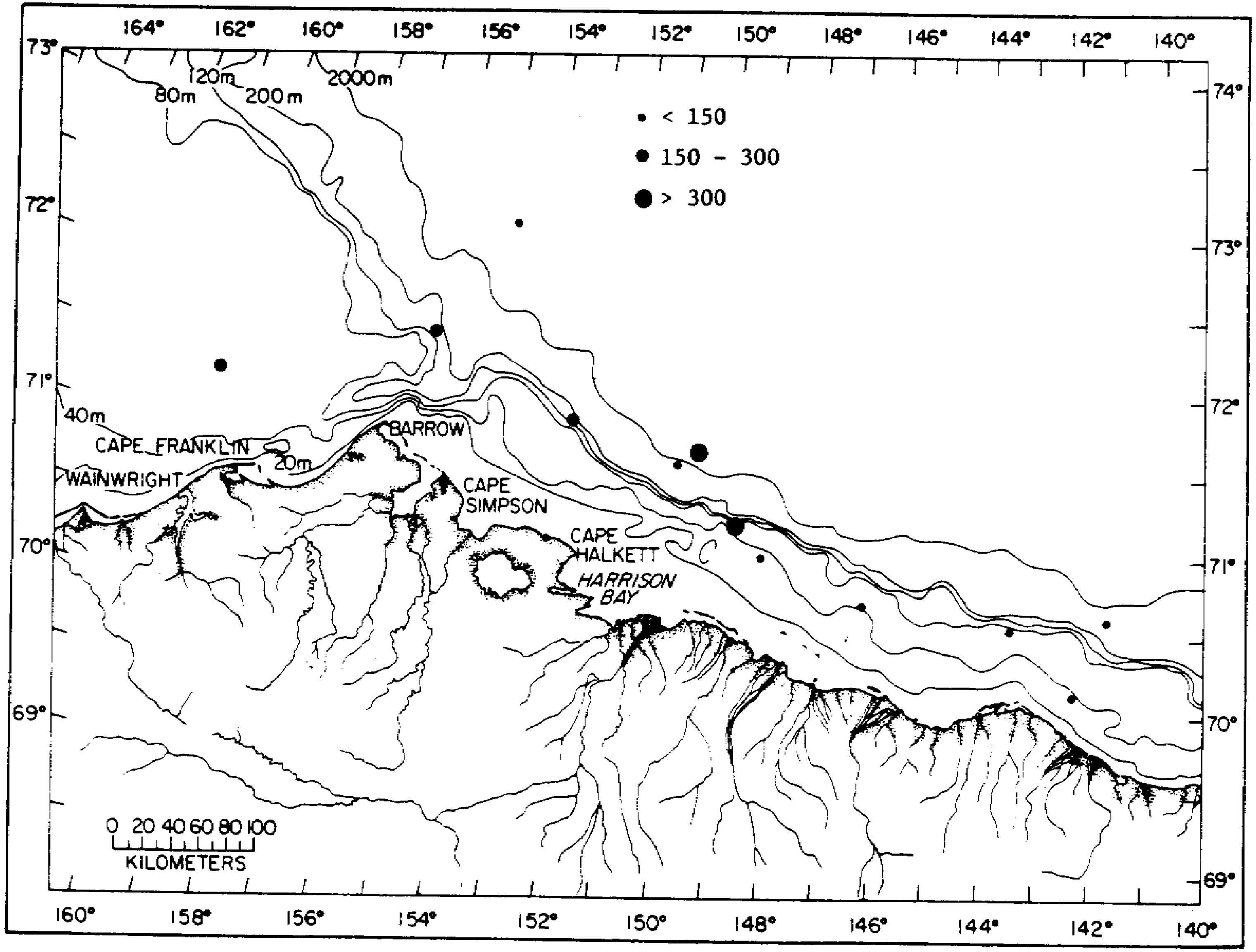

Fig. 43. Abundance (number per 1000 m^3) of *Oikopleura labradoriensis* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

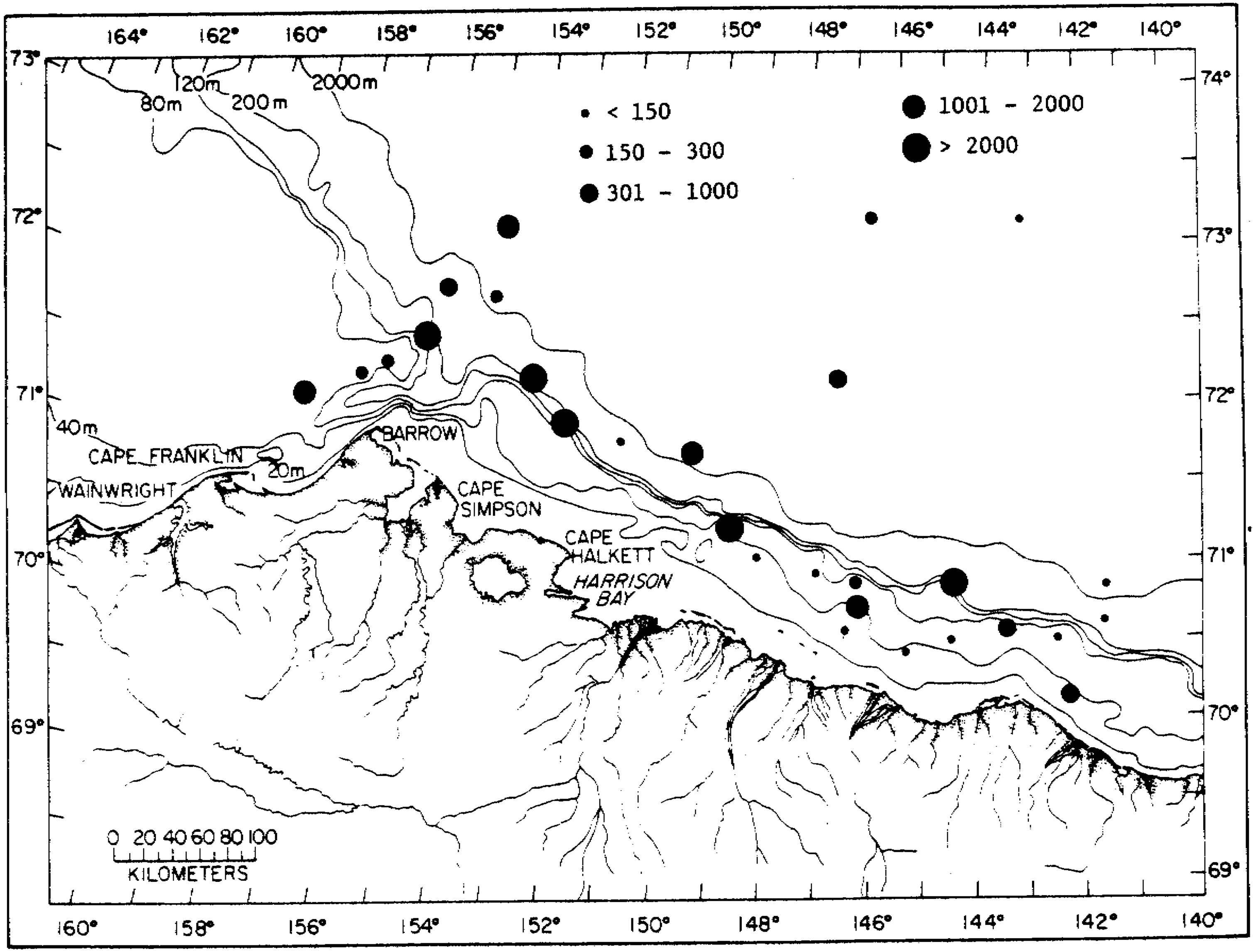

Fig. 44. Abundance (number per 1000 m^3) of *Oikopleura vanhöffeni* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◐ = ring net, 20-0 m 1976; ● = bongo net 1977.

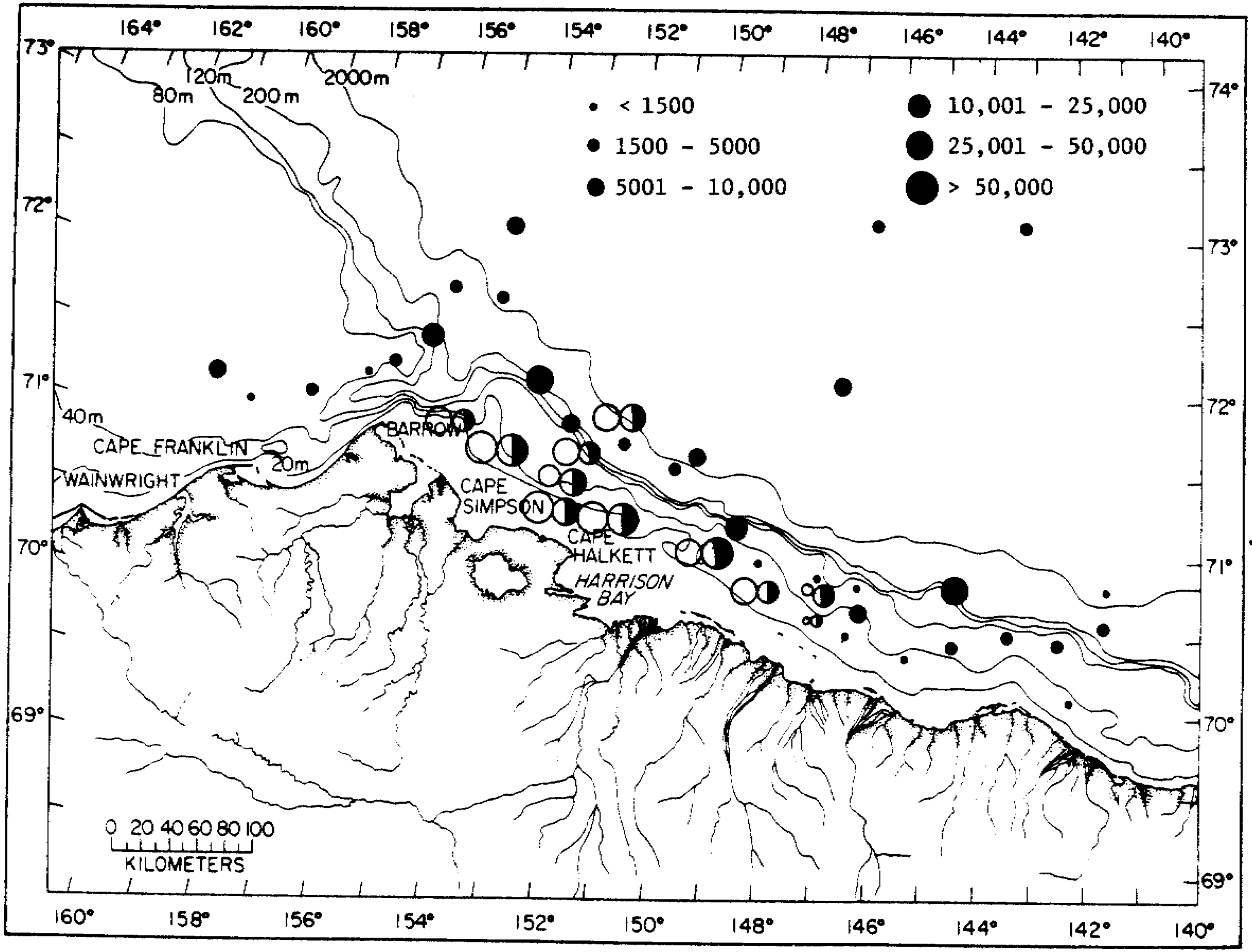

Fig. 45. Abundance (number per 1000 m^3) of unidentified *Oikopleura* species at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

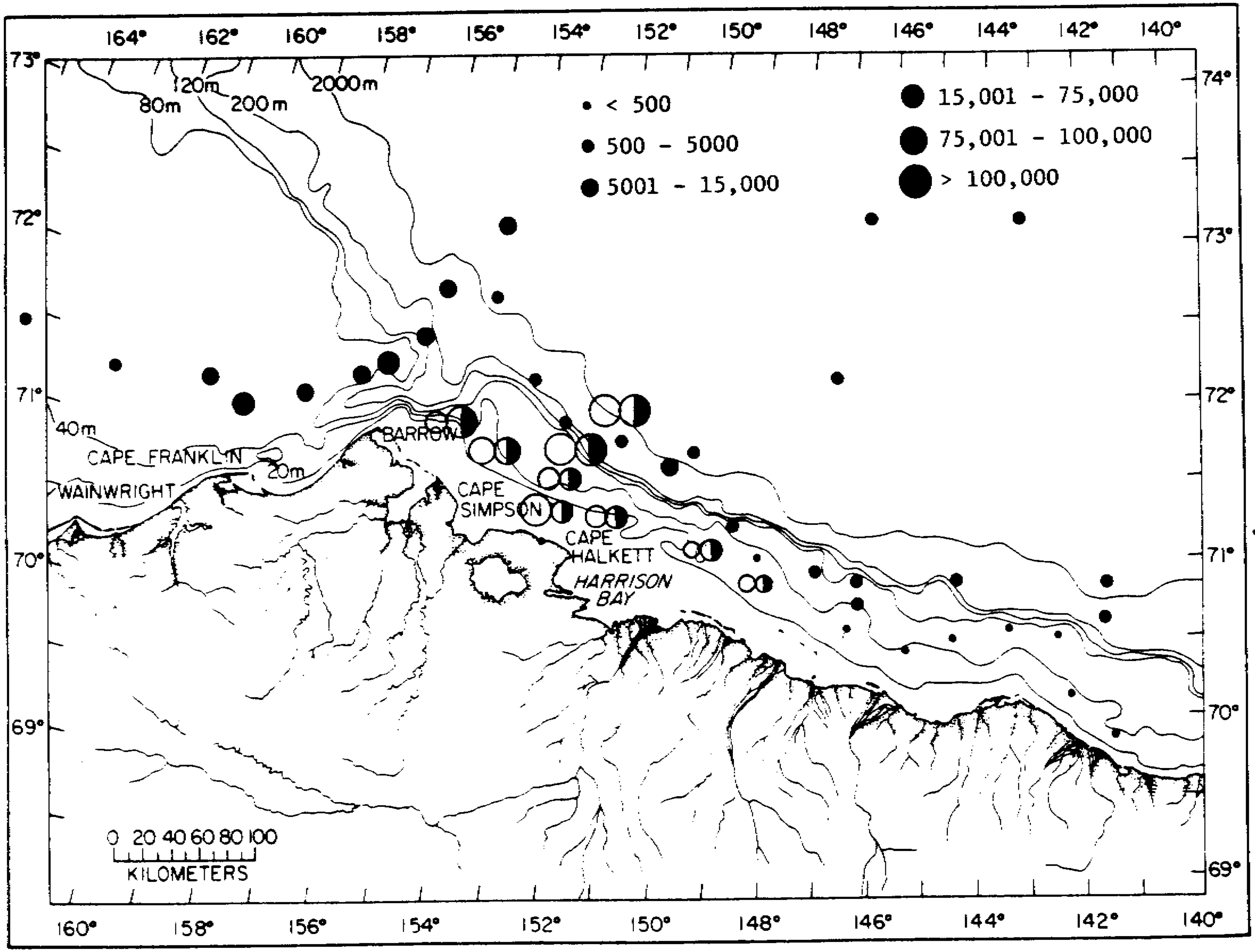

Fig. 46. Abundance (number per 1000 m^3) of all chaetognaths at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

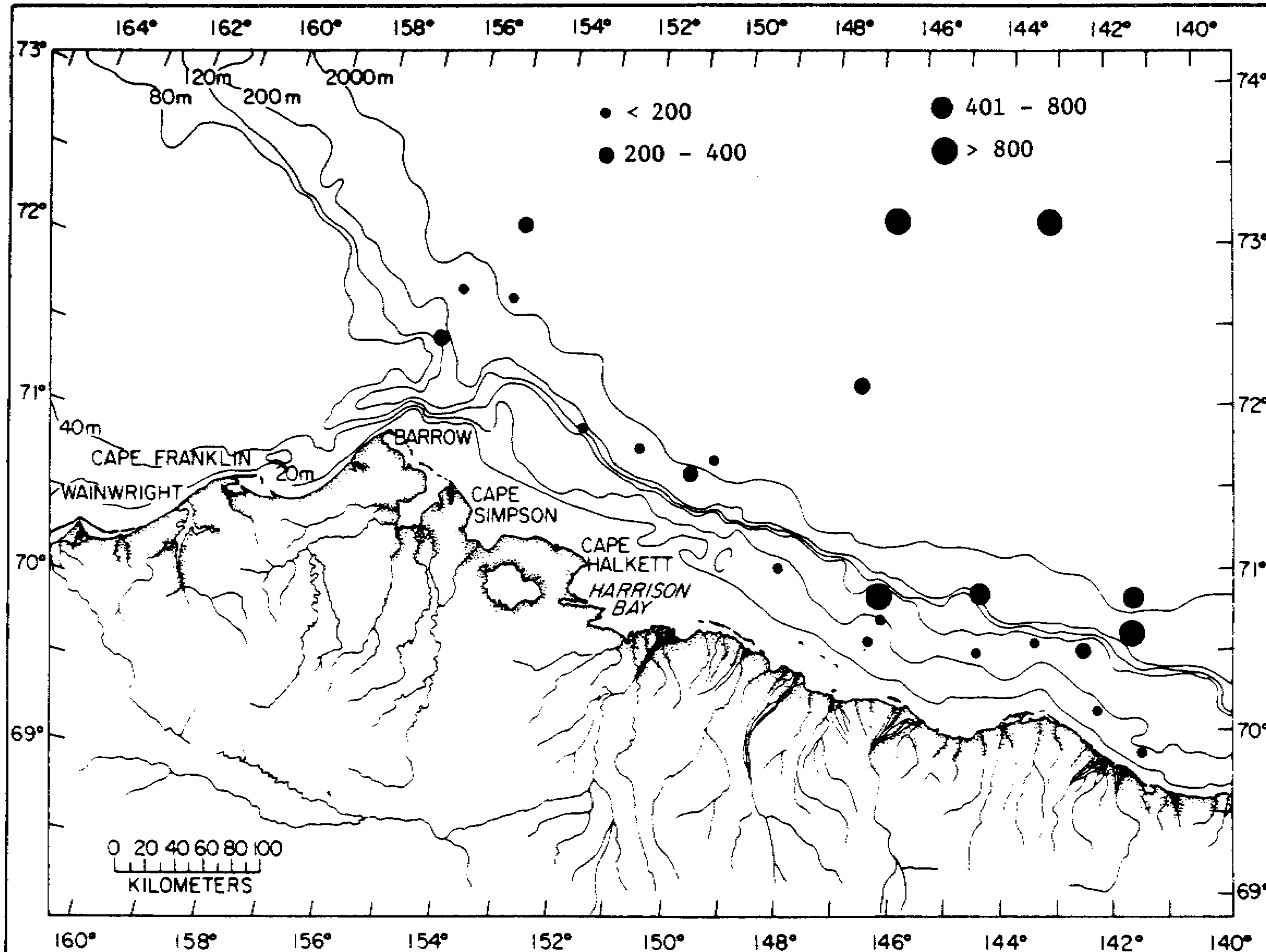

Fig. 47. Abundance (number per 1000 m^3) of *Eukrohnia hamata* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◐ = ring net, 20-0 m 1976; ● = bongo net 1977.

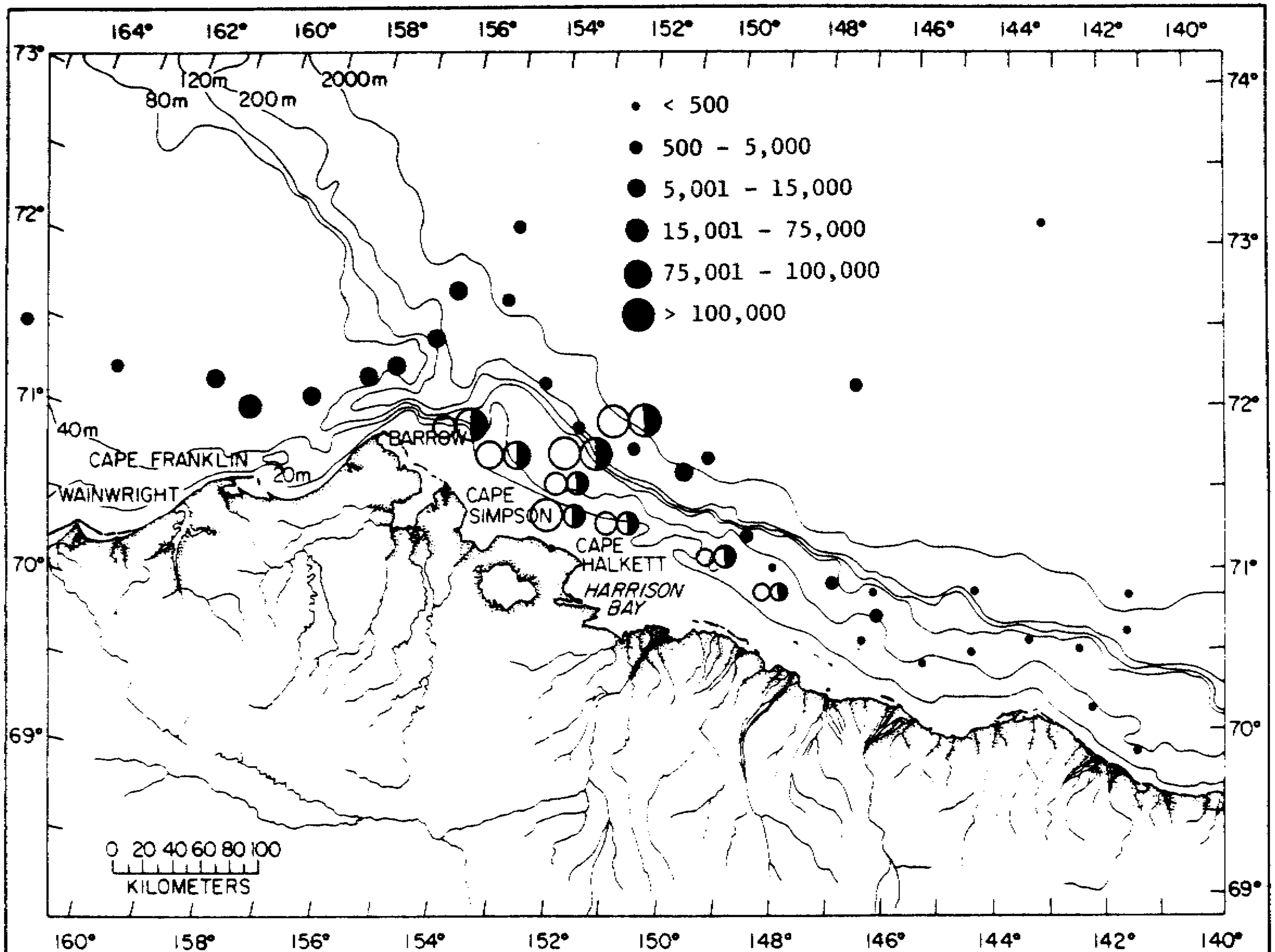

Fig. 48. Abundance (number per 1000 m^3) of *Sagitta elegans* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

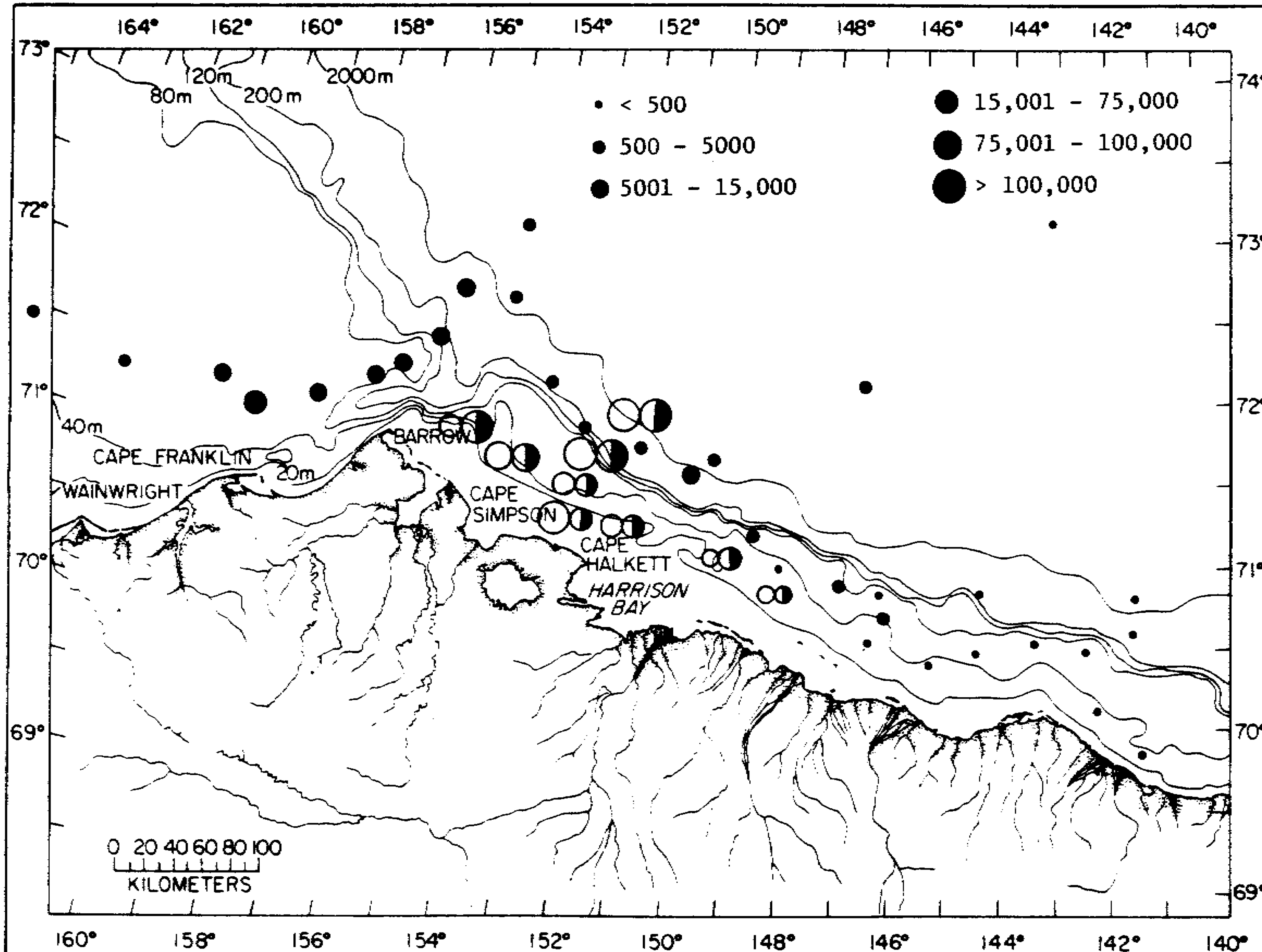

Fig. 49. Abundance (number per 1000 m^3) of *Sagitta* spp. at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

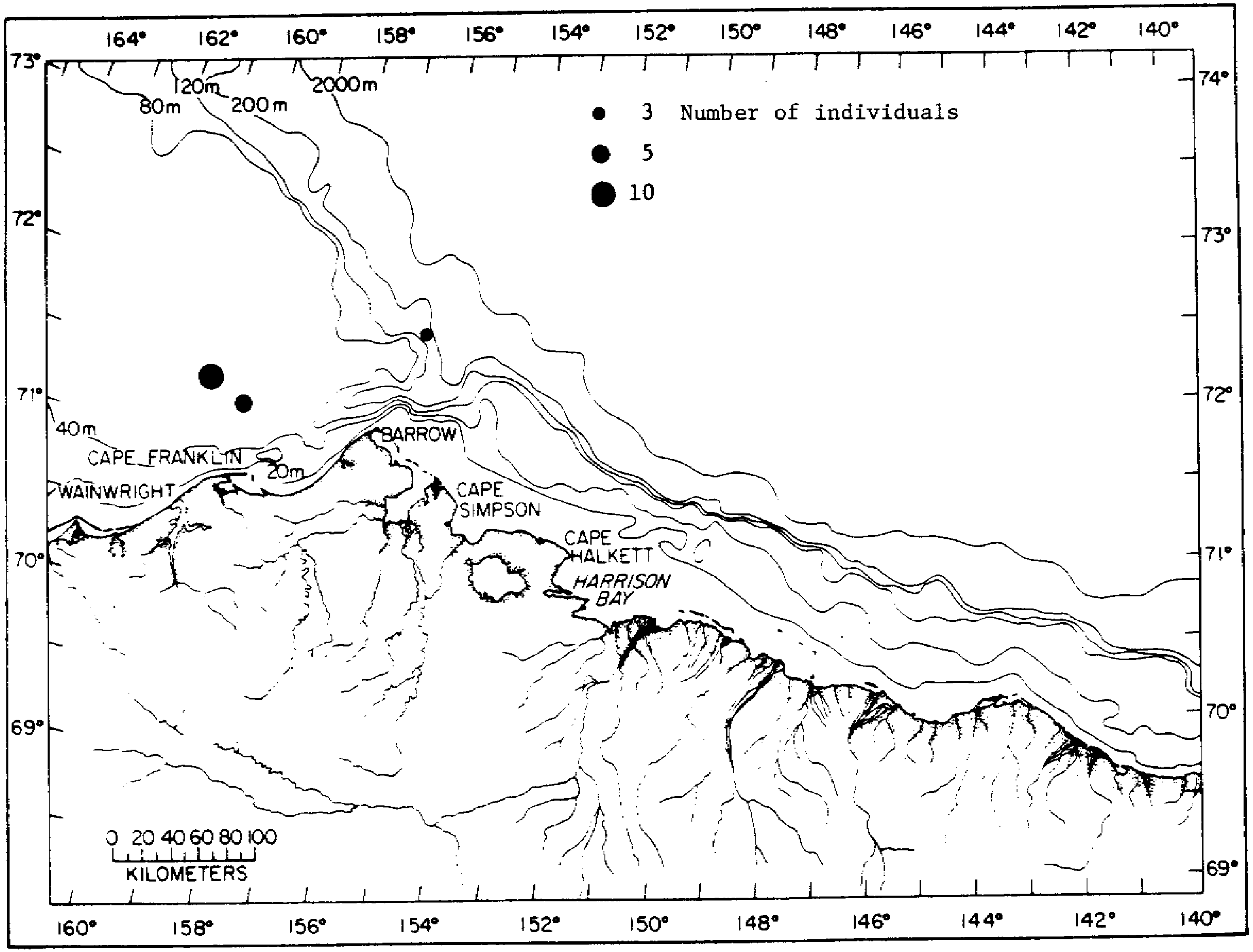

Fig. 50. Abundance (number per 1000 m^3) of fish eggs collected in bongo nets at stations in the Chukchi Sea, August-September 1977.

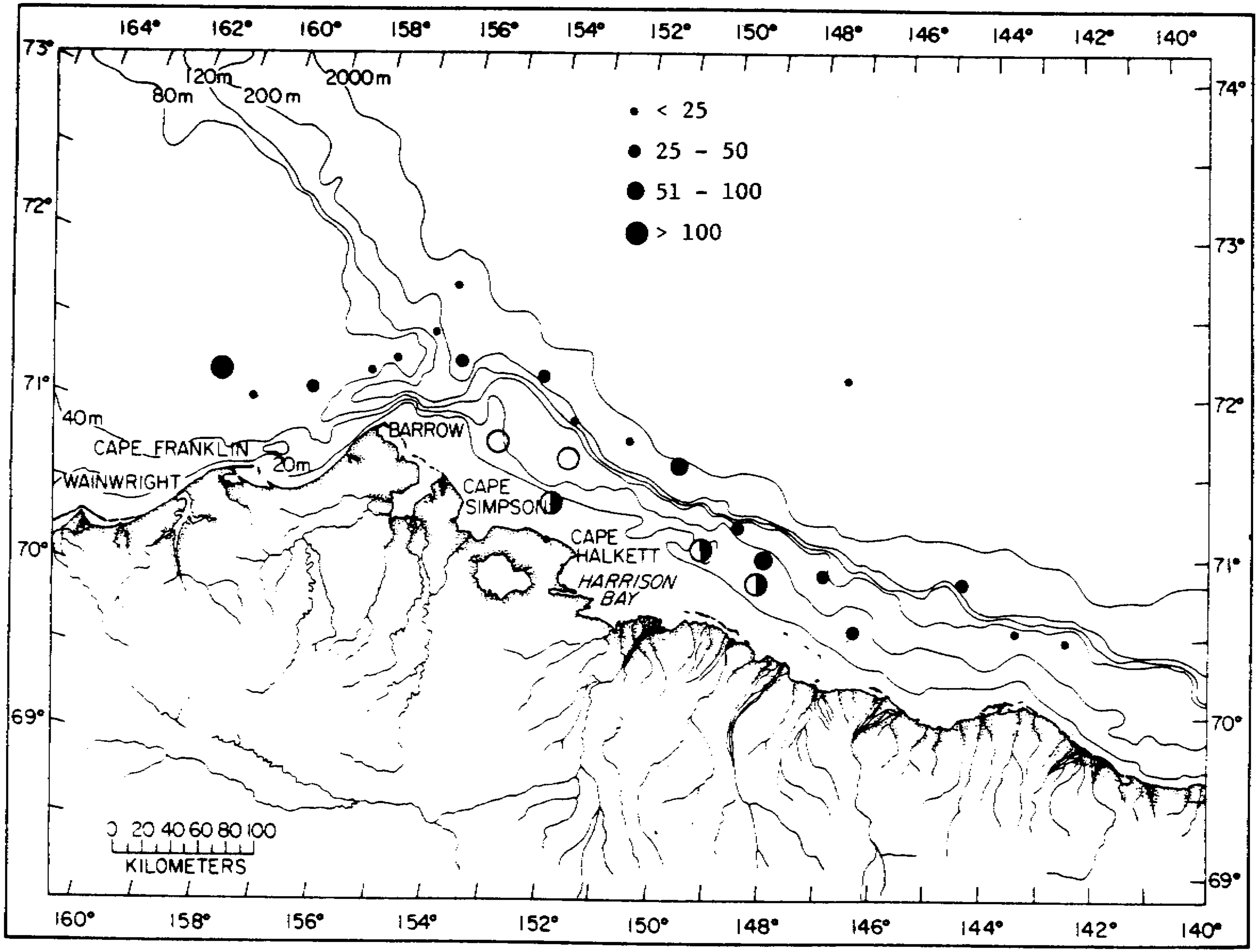

Fig. 51. Abundance (number per 1000 m^3) of all fish larvae at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

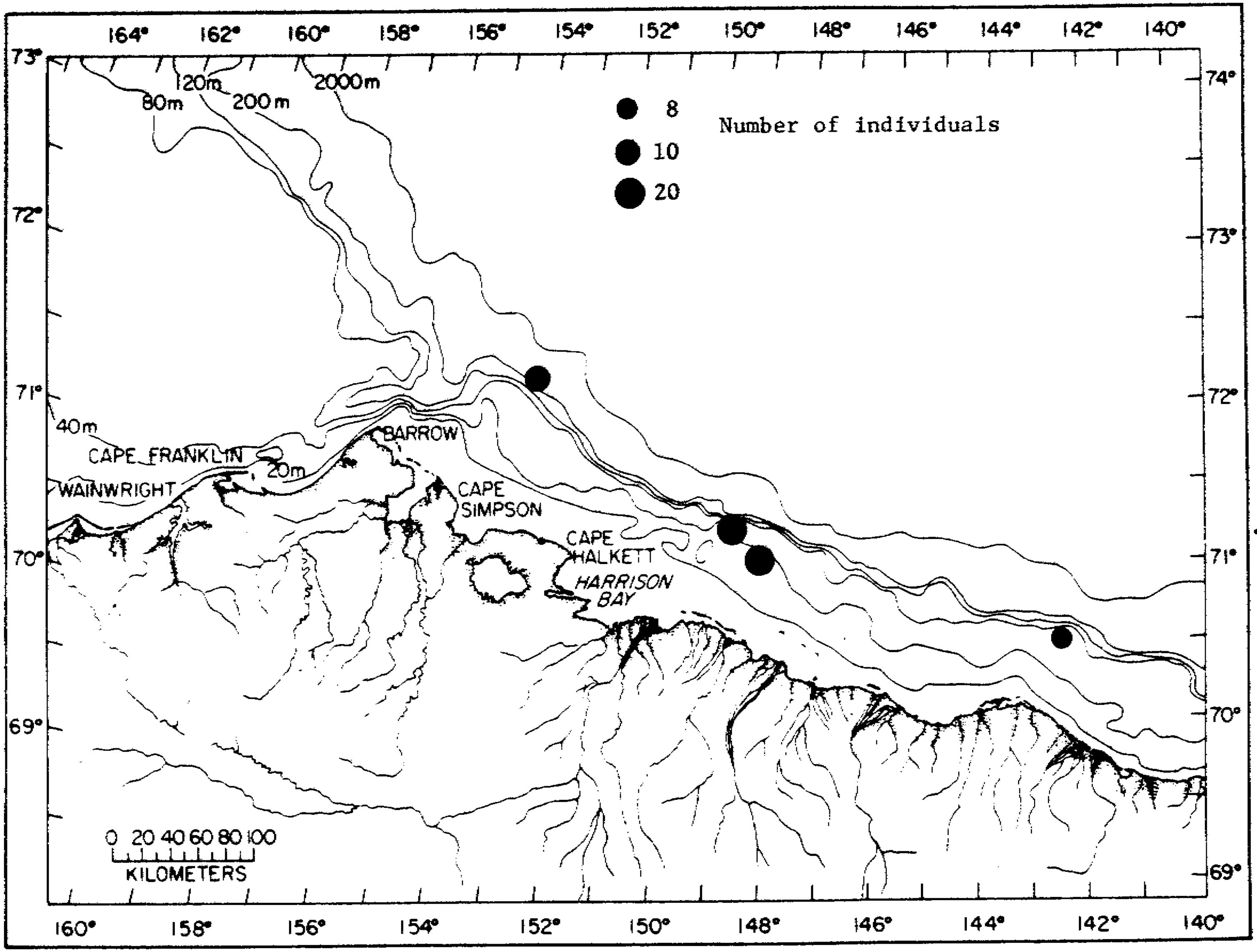

Fig. 52. Abundance (number per 1000 m^3) of cottids at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

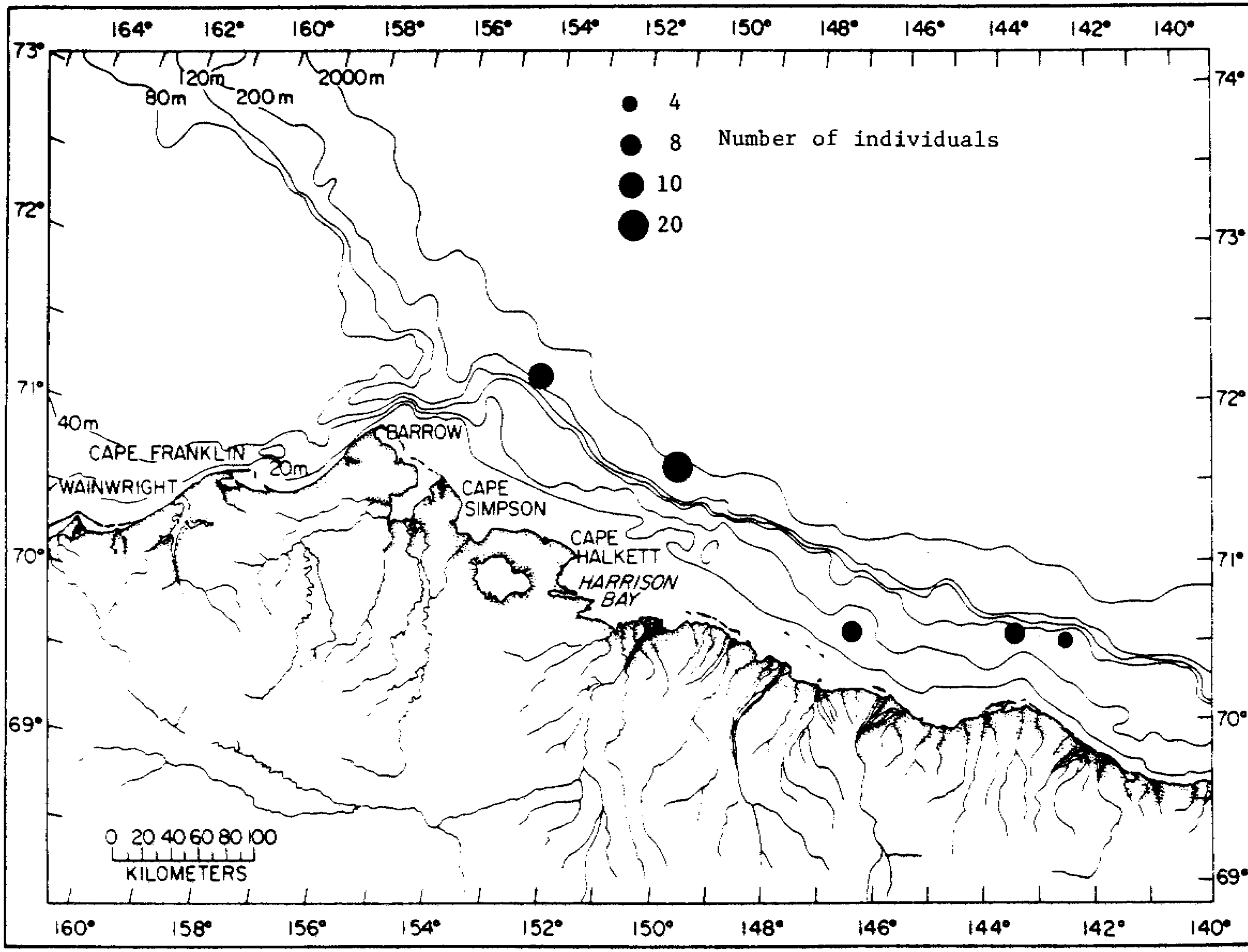

Fig. 53. Abundance (number per 1000 m^3) of cyclopterid larvae at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

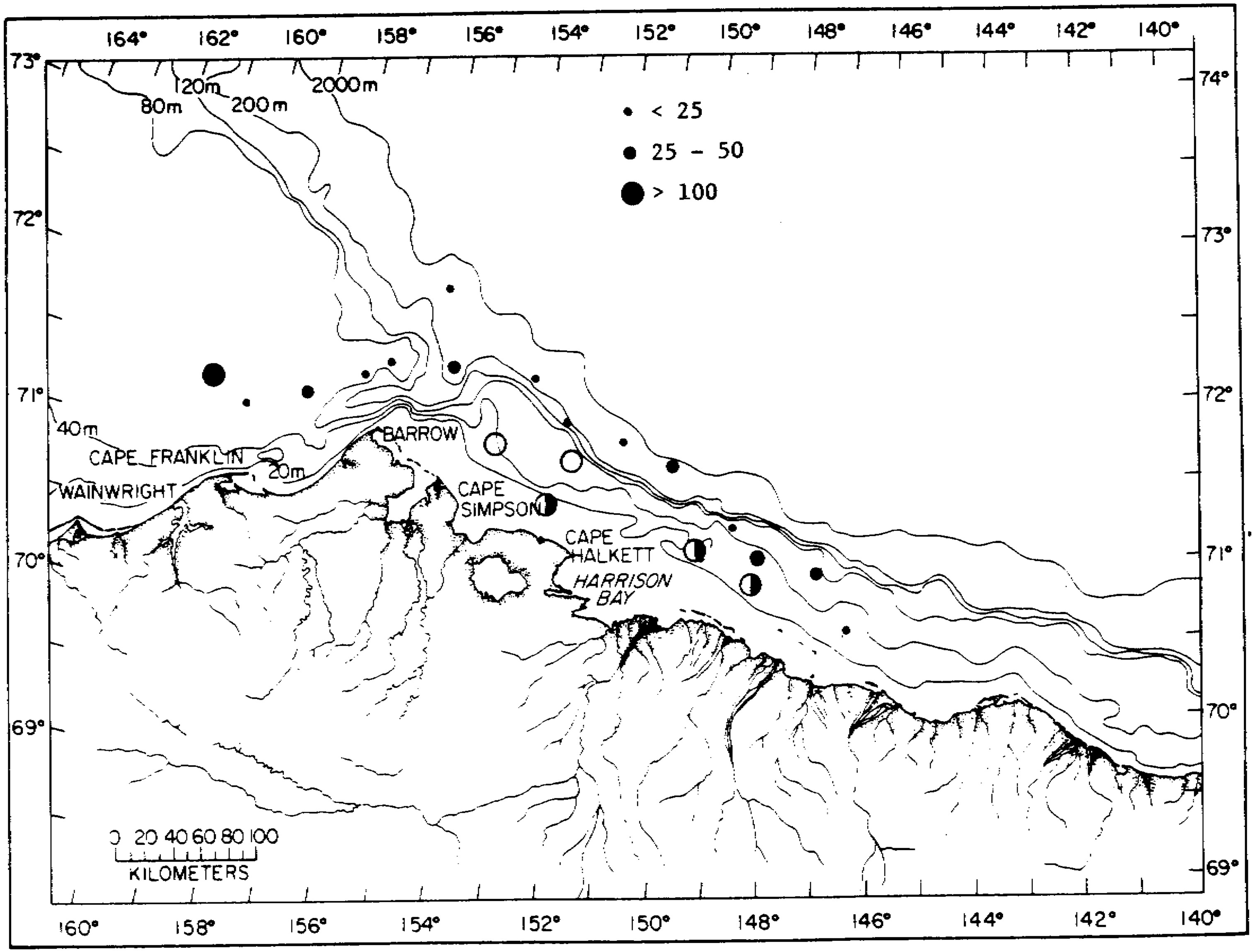

Fig. 54. Abundance (number per 1000 m^3) of gadid larvae at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

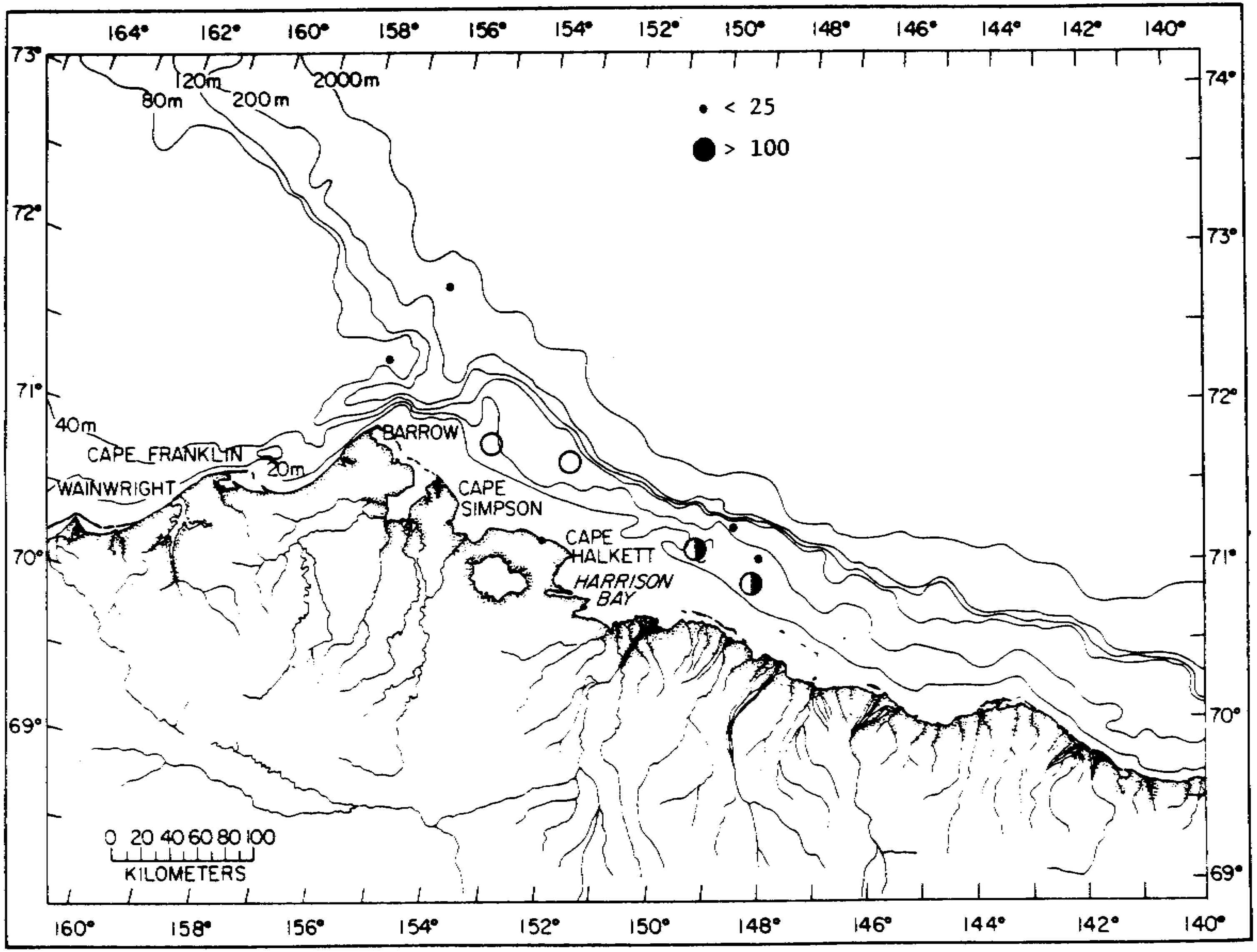

Fig. 55. Abundance (number per 1000 m^3) of *Boreogadus saida* at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

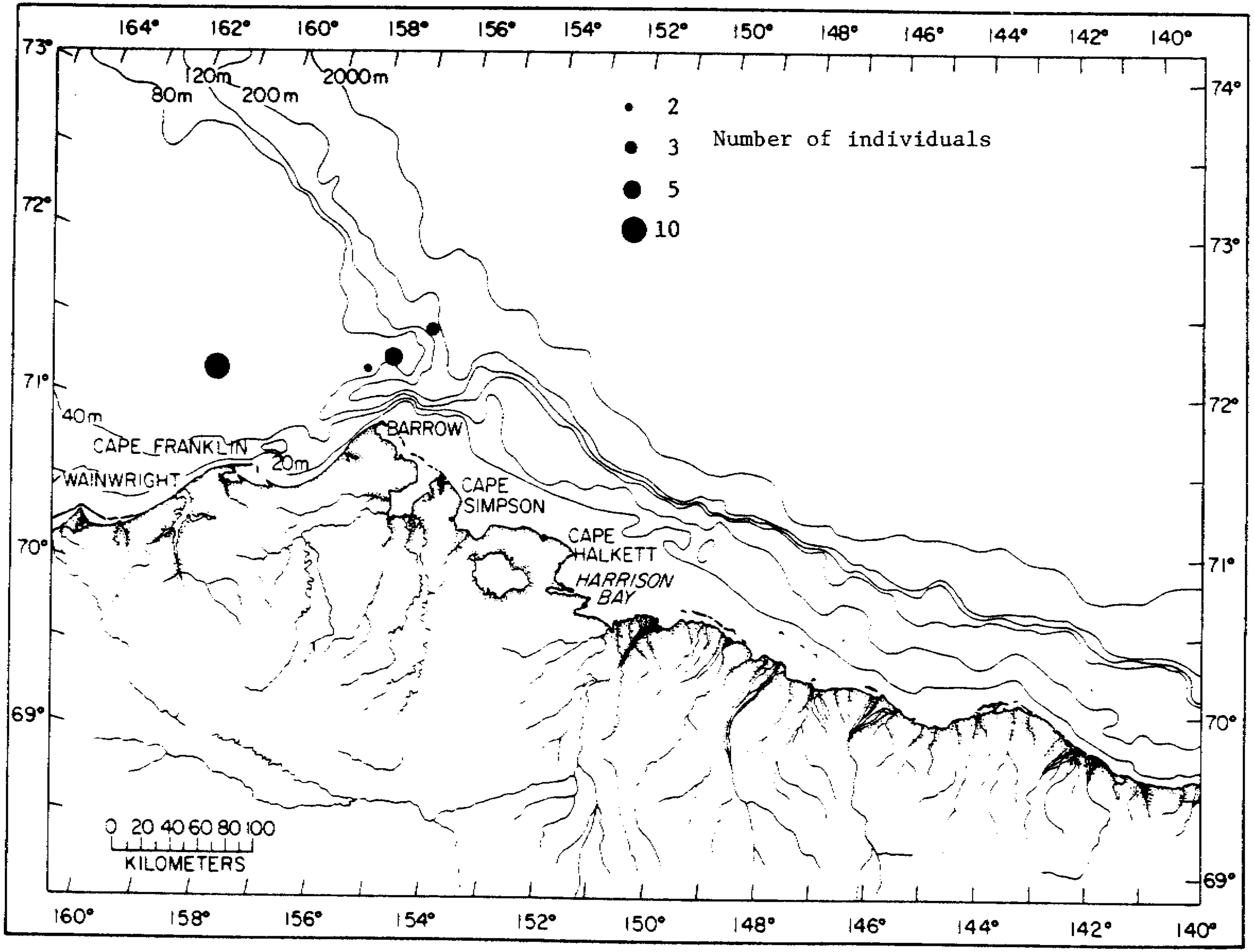

Fig. 56. Abundance (number per 1000 m^3) of stichaeid larvae at stations in the Chukchi and Beaufort seas, August-September 1976, 1977. ○ = ring net, 10-0 m 1976; ◑ = ring net, 20-0 m 1976; ● = bongo net 1977.

Table 3. Chlorophyll *a* and phaeopigment concentrations, Steffanson Sound, 8-11 Nov 1978.

Date (Nov 1978)	Depth (m)	Chl *a* ($mg\ m^{-3}$)	Phaeo ($mg\ m^{-3}$)
08	0	0.06	0.07
09	0	0.02	0.12
	4.5	0.02	0.12
10	0	0.06	0.06
	4.5	0.06	0.08
11	0	0.05	0.04
	4.5	0.05	0.05
12	0	0.06	0.07
	4	0.04	0.06
13	0	0.06	0.05
	4	0.04	0.06
14	0	0.07	0.05
	4	0.04	0.05
15	0	0.05	0.06
	4	0.06	0.06
16	0	0.06	0.05
	4	0.06	0.05

Table 4. Abundance (number per 1000^3) of zooplankton taxa found in net hauls from Steffanson Sound (Boulder Patch). All samples were collected with a 0.75 m ring net, mesh size 308 μm. Where no number is present, no animals were found. Tows are vertical unless otherwise noted.

Taxon	Date 8 Nov	10 Nov	14 Nov	16 Nov*
Crustacea				
Copepoda				
Calanoida - adults	474070	263370	188240	242530
Calanoida - juveniles	6505350	9692180	3742990	5107690
Cyclopoida			1360	680
Harpacticoida	410		450	230
Cirripedia				
Cyprids		820	2710	
Mysidacea				
Mysis litoralis			450	
Mysis relicta		410		
Mysis spp.	820	410	1810	
Amphipoda				
Gammaridea				
Calliopiidae *cf.*				230
Eusiridae *cf.*				450
Gammaridae				
Gammarus wilkitzkii				230
Lysianassidae *cf.*			1360	
Euphausiacea				
Thysanoessa raschii				230
Unidentified calyptopis	410			
Chaetognatha				
Sagitta elegans	820	410	1360	230
Other organisms				
Unidentified animals	410	410	450	
Unidentified invertebrate eggs			7690	8370

* Horizontal tow

Lewin and *Chaetoceros wighami* Brightwell that are common in the spring and summer beginning to appear.

One ice core sample, core # 8 collected 14 March, has also been analyzed. The core was about 30 cm in length and about 2.5 cm in diameter and was collected from the brash ice layer near the dive hole. About 38,000 cells per liter were found, including *Navicula* sp., *Nitzschia* spp., unidentified small pennate diatoms, and *ca.* 18,000 cells per liter of *Thalassiosira*, some of which were probably *Th. antarctica* Comber. The *Thalassiosira* cells were difficlut to identify with certainty because of the large amount of detrital material associated with them.

Plant pigment samples have not been analyzed.

b. Zooplankton standing stock

Three zooplankton samples have been analyzed. Copepods, primarily juvenile calanoids, were the most abundant organisms, although cyclopoid copepods were also common. A few other organisms were present, including hydrozoans, polychaete larvae, isopods, amphipods, and chaetognaths (Table 5).

VII. Discussion

Phytoplankton standing stock, chlorophyll *a*, and primary productivity were considerably lower than in 1976 and 1977. Reasons for this are unclear. Sampling in the area between Harrison and Prudhoe bays started about the same time, mid-August, in 1977 and 1978, and about a week later in 1976. Ice cover was somewhat heavier in 1976 and 1978 then in 1977. The same species were present all years, although diatoms in the 1978 samples were weakly silicified and *Ebria tripartita* (Schumann) Lemmermann, a silicoflagellate with a skeleton composed of silicon, often did not have skeletons, suggesting low silicon concentrations. Unfortunately, no nutrient samples were collected.

In both 1977 and 1978, highest primary productivity in the western Beaufort Sea occurred off Prudhoe Bay between the 40 and 80 m isobaths, moving inshore between the 2C and 40 m isobaths eastward to Barter Island in 1978 and to Demarcation Point in 1977 (Fig. 3).

Small species of the genus *Chaetoceros*, approximately 6 μm along the apical axis, *Thalassiosira* spp., including *Th. nordenskioeldii* Cleve and *Th. gravida* Cleve, and *Nitzschia grunowii* Hasle are the major diatoms present in the 1978 samples. Small flagellates, usually < 10 μm in diameter, are also common. These species were also the most abundant in 1976 and 1977.

Species that were relatively common in 1977 that have not been seen in the 1978 samples include the diatom *Thalassiosira antarctica* Comber and the silicoflagellate *Dictyocha speculum* Ehrenberg. *Dictyocha speculum* is not usually common in nearshore waters, so perhaps its occurrence there in 1977 was anomaous and its absence in 1978 represents the usual situation.

Table 5. Abundance (number per 1000 m^3) of zooplankton taxa found in net hauls from Steffanson Sound (Boulder Patch) in March 1979. All samples were collected with a 0.75 m ring net, 216 μm mesh. Where no number is present, no animals were found. All tows were vertical.

	Date		
Taxon	13 Mar	14 Mar	16 Mar
Coelenterata			
Hydrozoa			
Coryne tubulosa	450		
Perigonimus yoldia-arcticae	450		
Perigonimus spp.		910	
Polychaeta - unidentified larvae	450		
Crustacea			
Copepoda			
Calanoida - adults	1360	910	450
Calanoida - juveniles	74240	268450	90540
Cyclopoida	62020	53420	38930
Harpacticoida	2720	2260	1810
Unidentified nauplii	12220	14490	4980
Isopoda - unidentified isopod	450	450	
Amphipoda			
Gammaridea			
Onisimus glacialis		450	
Onisimus spp. *cf.*	450	450	
Chaetognatha			
Sagitta elegans			910

Zooplankton standing stock and species present were similar to 1977. From preliminary comparison of the two years, it appears that more hydrozoans were present in 1978, with *Aglantha digitale* being the major species both years. Fewer pteropods were present in 1978. Copepods were abundant both years. Slightly fewer crustaceans of all kinds were present in 1978, although when all the 1978 samples are analyzed, this difference may not remain. There were more appendicularians and chaetognaths, especially *Sagitta elegans* in 1978. About the same number of fish larvae were present both years.

By November, few phytoplankton cells were present in the lagoon system and those that were present, mostly small flagellates, were probably not photosynthetic. The chlorophyll *a* concentration was very low. Juvenile and adult calanoid copepods were present in large numbers, while a few mysids, amphipods, euphausids, and chaetognaths were also present.

In March more phytoplankton cells were beginning to appear, including diatom species that are common in the spring and summer plankton. Few cells were present in the water samples however. The sediment-laden brashy layer of ice contained some cells, but will probably not have much of an ice algae community because of the large amount of sediment that reduces light. Juvenile calanoid copepods were the most abundant animals present in the system. Other organisms present included hydrozoans, polychaete larvae, isopods, amphipods, and chaetognaths.

VIII. Conclusions

No new conclusions can be suggested based on the 1978 icebreaker samples collected in August and September.

Annual production for the western Beaufort Sea for 1978 has been estimated. This estimate assumes 24 hr days in June and July, 20 hr days in August, and 15 hr days in September. It is also assumed that twice as much production occurs in June during the spring bloom as occurs at other times during the summer and that no production occurs at other times of the year. Annual production was estimated to be *ca.* 2 g C m^{-2} yr^{-1}. This is considerably lower than the 9 g C m^{-2} yr^{-1} estimated for 1976 and 14 g C m^{-2} yr^{-1} estimated for 1977. Low chlorophyll *a* concentrations and cell numbers indicate that the low production in real.

IX. Needs for further study

There are two major data gaps with regard to plankton distribution and abundance and primary productivity in the western Beaufort Sea. One is the area between the barrier islands and the 20 m (10 ftm) isobath. R.U.'s 172, 356, and 467 have, as part of their programs, studied zooplankton inside the barrier islands. No OCSEAP project studied the phytoplankton although there was some earlier work on phytoplankton and zooplankton from the lagoon areas (Alexander 1974; Horner *et al.* 1974). R.U. 359 has studied the phytoplankton and zooplankton in the area outside the 20 m isobath. One reason for this data gap is the lack of an adequate sampling platform.

The second major gap now that winter studies are being done in FY79, is the spring in all areas, although the lagoon system is the most important for the upcoming lease sale. The gap here is not just for zooplankton and phytoplankton data, but also for the ice algae community which is probably a major component of the ecosystem during April and May.

X. Summary of January-March quarter

A. Ship or laboratory activities

1. Ship or field trip schedule

a. Dates

1. 12-18 February 1979
2. 11-16 March 1979

b. No vessel

c. Aircraft - helicopters

d. NOAA or chartered

1. February - chartered Seair Bell Jet Ranger II
2. March - NOAA Bell 205

2. Scientific party

Thomas Kaperak, Assistant Oceanographer

3. Methods

a. Field sampling

1. February

There was only one sampling day in February because of logistic and weather problems. The sampling hole was too small to accomodate the 0.75 m ring net, so only water samples were collected. Samples were collected just beneath the ice, 0 m, and about 1 m above the bottom, 4 m, with a PVC water sampling bottle. A 250 ml portion was preserved with 4% formalin buffered with sodium acetate for a phytoplankton standing stock sample. Another portion of the sample was drained into a 4-ℓ polyethylene bottle and returned to the shore laboratory to be filtered through 47 mm, 0.45 μm Millipore filters for plant pigment determinations. A few drops of saturated $MgCO_3$ solution were added near the end of the filtration and the filter tower was rinsed with Millipore-filtered seawater. The filters were frozen in a dessicator for later processing.

2. March

Sampling, done on 5 days, was accomplished using the dive hole cut by R.U. 356 personnel. Water temperature was measured by suspending a laboratory thermometer at the water surface for about 5 min.

Phytoplankton standing stock and plant pigment samples were collected just beneath the bottom of the ice, 0 m, and at 4 m with a PVC sampling bottle. Water for the standing stock sample was preserved with 4% formalin buffered with sodium acetate. Water for pigment determinations was stored in 4-ℓ polyethylene bottles and returned to the shore laboratory where it was filtered through 47 mm, 0.45 μm Millipore filters. A few grains of $MgCO_3$ were added to the last few milliliters of water filtered and the filter tower was rinsed with filtered seawater. The filters were frozen in a dessicator for later processing.

Zooplankton was sampled with a 0.75 m ring net having a mesh size of 216 μm. The net was lowered to the bottom and vertically hauled to the surface by hand. Hauls were timed using a stopwatch to obtain an approximate speed of tow. The net was washed by raising and lowering it in the hole several times and the sample was drained into a plastic bucket. The samples were warmed slowly when necessary to melt ice. The samples were concentrated by gently swirling in a net collection cup and preserved in 250 ml jars with 10 ml 37% formalin and buffered with 5 ml each of saturated sodium acetate and sodium borate solutions.

Two individual amphipods were collected on 12 March, one from under the ice by a diver using a small hand net and one dipped from the surface of the hole with a 250 ml jar. These animals were placed in Millipore filtered seawater and kept in a laboratory refrigerator for 4 days before being preserved. The seawater will be examined microscopically for fecal pellets to try to determine what the animals were eating.

Two ice cores were collected by divers using plastic corers, *ca.* 30 cm long and 2.5 cm wide. The cores were thawed and preserved with 10 ml 4% formalin buffered with sodium acetate.

b. Laboratory analysis

Phytoplankton standing stock samples are being analyzed using a Zeiss phase-contrast inverted microscope and Zeiss 5 and 50 ml counting chambers. Rare and large organisms (> 100 μm) are counted at 125 X magnification in 50 ml chambers and abundant, small organisms (< 100 μm) are counted at 312 X magnification in 5 ml chambers. For the March 1979 samples, all cells seen in the 50 ml chambers were counted regardless of size. The ice core sample was settled the same way, but only the 5 ml chamber was counted because of the large amount of sediment in the 50 ml chamber.

All organisms in the zooplankton samples are being identified and counted using a dissecting microscope. Voucher specimens have been kept for all taxa.

4. Sample locations

a. February - the LGL site approximately 300 yds south of the Western Washington State University dive site at the boulder patch.

b. March - 70°19'N, 147°34.4'W, the Western Washington dive site.

5. Data collected and analyzed

	February		March	
	No. Coll.	No. Anal.	No. Coll.	No. Anal.
Plant pigments	2	0	10	0
Phytoplankton standing stock	2	2	10	4
Zooplankton standing stock				
0.75 m ring net, 308 μm				
0.75 m ring net, 216 μm			10	3
Individual amphipods			2	0
Ice cores			2	1

XI. Auxiliary material

A. References cited

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B. Papers in preparation or print: None

C. Oral presentations: Outside Review Panel
Santa Cruz, CA.
17-20 Apr 78

☆ U. S. GOVERNMENT PRINTING OFFICE: 1979-0-677-096/1217