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Summer Diet of the Bearded Seal (*Erignathus barbatus*) in the Canadian High Arctic

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ABSTRACT. Stomach contents of 34 bearded seals taken in three High Arctic localities (Grise Fiord, Pond Inlet and Clyde) during the summers from 1978-1980 were examined. At least 12 species of fish were present but sculpins (Cottidae) and arctic cod (*Boreogadus saida*) comprised the bulk of the diet. Eelpouts (*Lycodes* spp.) and polar cod (*Arctogadus glacialis*) were also ingested in considerable amounts. In 15 of 19 stomachs containing > 1 kg food, fish contributed >90% of the wet weight. The whelk *Buccinum* and the shrimp *Sclerocrangon boreas* accounted for most of the invertebrate component of the diet. Clams, cephalopods, anemones, sea cucumbers, polychaete worms and other invertebrates occurred in small amounts. The largest measured weight of stomach contents was 7.6 kg from a seal that had fed heavily on arctic cod. There were no significant differences amongst the three localities in the amount of food ingested; however, the proportions of arctic cod and sculpins varied considerably among localities. Bearded seals fed on the available size range of arctic cod but were limited to the smaller sculpins (<200 g), eelpouts (<200 g) and polar cod (<350 g).

Key words: bearded seals, Canadian High Arctic, diet

RÉSUMÉ. On a examiné le contenu de l'estomac de 34 phoques barbus pris à trois centres du nord de l'Arctique (Grise Point, Pond Inlet et Clyde) au cours des étés de 1978 à 1980. Au moins douze espèces de poissons s'y trouvaient mais le chabot (Cottidae) et le saida (*Boreogadus saida*) formaient la majeure partie du régime alimentaire. Les lycodes (*Lycodes* spp.) et la "morue polaire" (*Arctogadus glacialis*) furent aussi consommées en quantité considérable. Le poisson comptait pour >90% du poids mouillé dans 15 des 19 estomacs contenant plus de 1 kg de nourriture. Le buccin *Buccinum* et la crevette *Sclerocrangon boreas* comportaient la majeure partie des invertébrés du régime. Les clams, les céphalopodes, les anémones, les concombres de mer, les vers polychètes et d'autres invertébrés s'y trouvaient aussi en petites quantités. Le poids maximal mesuré pour le contenu d'un estomac était de 7.6 kg pour un phoque qui s'était gavé de saida. L'étude n'a indiqué aucune différence marquée dans la quantité de nourriture consommée entre les trois centres. Cependant, la proportion de saida et de chabot variait de façon importante entre les trois centres. Les phoques barbus s'étaient nourris de saidas de la taille disponible mais avaient dû se satisfaire de mets de taille inférieure quant aux chabots (<200 g), aux lycodes (<200 g) et aux "moreus polaires" (<350 g).

Mots clés: phoques barbus, nord de l'Arctique canadien, régime alimentaire

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INTRODUCTION

The bearded seal, *Erignathus barbatus*, is a large, solitary seal with continuous circumpolar distribution in arctic and subarctic waters (Mansfield, 1967; Benjaminsen, 1973). It is most abundant in areas where it can reach the sea bottom to feed (i.e. generally <200 m — Burns and Frost, 1979) and where it has access to ice pans upon which to haul out (Fig. 1). Since the bearded seal has only a limited capability to maintain breathing holes in solid ice, it is excluded from areas of fast ice and is found among pack ice where openings are continually formed (Burns *et al.*, 1981). In many areas, bearded seals are quite sedentary and undertake only local movements in response to ice conditions (Vibe, 1950; McLaren, 1962; Fedoseev, 1973) although in the Bering Sea, bearded seals undertake considerable north-south movements in response to seasonal changes in ice conditions (Burns and Frost, 1979).

The bearded seal is primarily a benthic feeder with a diverse diet that varies with location and time of year (for reviews see Chapskii, 1938; Kosygin, 1971; Davis *et al.*, 1980; Lowry *et al.*, 1980). Most studies of the diet of bearded seals have been conducted in the shallow Bering and Chukchi seas which provide "the largest continuous area of favorable bearded seal habitat in the world" (Burns and Frost, 1979:12). In a comprehensive study and review of the diet of the bearded seal in the Bering and Chukchi seas, Lowry *et al.* (1980) found that it consisted mainly of crabs, shrimps and clams. Fish, they concluded, were of minor importance in the diet.

In the Kara and Barents seas of the western Soviet Arctic, Chapskii (1938) concluded that shrimp, particularly *Sclerocrangon boreas*, and molluscs were the basic food of the bearded seal, though fish, particularly arctic cod (*Boreogadus saida*), were thought to be important when they occurred in

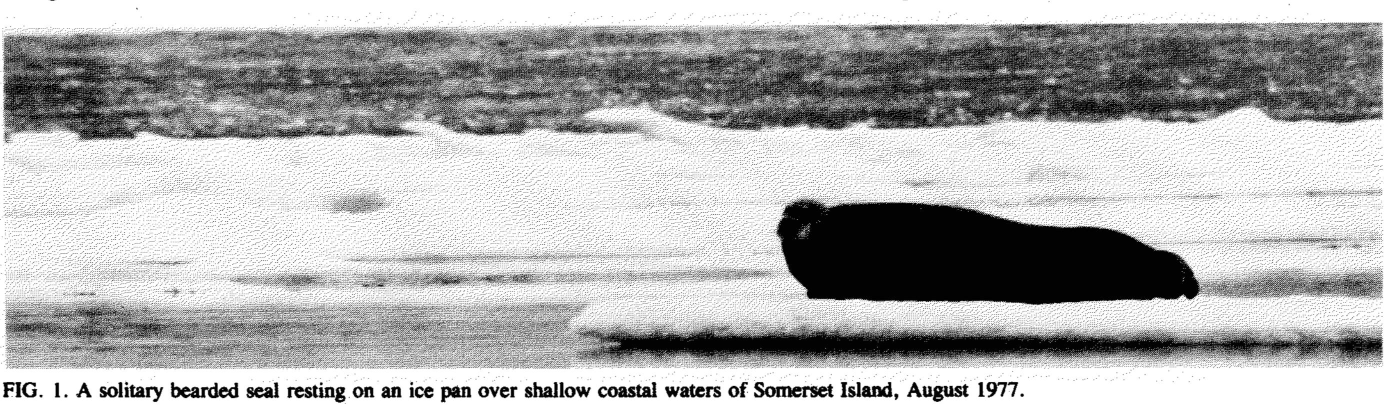

FIG. 1. A solitary bearded seal resting on an ice pan over shallow coastal waters of Somerset Island, August 1977.

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large concentrations. Pikharev (1941) found that bearded seals of the Sea of Okhotsk fed on fish when they could not reach the bottom. Vibe (1950) stated that arctic cod were of major importance in areas of NW Greenland where bearded seals could not reach the bottom; in coastal waters they fed on various benthic fishes, crustaceans, gastropods, holothurians, gephyreans, cephalopods and polychaetes. Like Chapskii (1938), Vibe (1950) noted the preference of bearded seals for whelks, *Buccinum* spp.; he and others wondered how the bearded seal managed to remove the snails from the shells without ingesting the shells.

Very little is known about the bearded seal in the Canadian Arctic (Davis *et al.*, 1980). It is taken in relatively small numbers in virtually all coastal communities and is thought to be most abundant in Hudson Strait, Foxe Basin and along the west coast of Hudson Bay (Mansfield, 1967). Bearded seals are excluded by fast ice from large areas of the High Arctic Archipelago during much of the year, but during the summer they are found widely distributed in small numbers throughout much of the archipelago. In the eastern Canadian High Arctic, bearded seals are hunted in fiords, primarily from July to October. The feeding habits of these seals are examined in this paper.

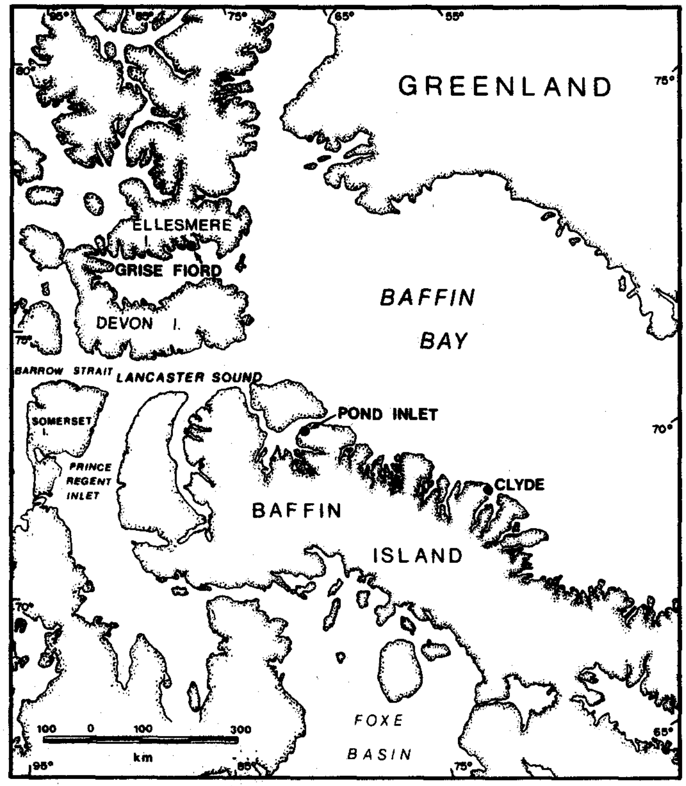

FIG. 2. The study area showing the locations of three settlements where stomachs of bearded seals were collected.

METHODS

Stomachs were obtained from 36 bearded seals taken by hunters from the communities of Grise Fiord, Pond Inlet and Clyde (Fig. 2) during 1978-80. Hunters provided the stomachs along with jaws, reproductive organs and a tag with the date and location of each seal kill. Most seals were taken from July to October (Table 1) and almost all were taken within fiords near the communities.

The stomachs were weighed on a triple-beam balance and all contents were removed and frozen for later processing. In the laboratory all whole organisms were individually weighed and measured. The remaining digested material was sorted into fish, crustaceans, gastropods, cephalopods, clams, etc., and these components, along with whole specimens, were weighed in order to determine composition by weight. Digested material was then further sorted by differential specific gravity in a water bath. Food items were sorted to the lowest possible taxonomic level using published keys and reference collections. In many cases, the number of individuals in each taxon was determined from counts of characteristic hard parts such as the otoliths of fish, beaks of cephalopods, jaws of polychaetes, carapaces of shrimps, and opercula of gastropods.

Fish otoliths are valuable in the interpretation of feeding habits of marine mammals (Fitch and Brownell, 1968; Frost and Lowry, 1981; Finley and Gibb, 1982; in press). Otoliths reveal the identity of the taxon ingested; since the teleost fish has two sagittal otoliths, the number of fish ingested can be estimated as half the number of otoliths within mm length categories. Length distributions of otoliths for certain fish were sometimes determined from subsamples (of one quarter) when the numbers of otoliths in a stomach exceeded 500. Because there are close relationships among otolith length,

TABLE 1. Number of bearded seal stomachs collected from hunters in three communities during 1978-1980

	Pond Inlet	Grise Fiord	Clyde
June	1		
July	3 (1)[a]		
August	1	5	2
September	4	5	
October	3 (1)	2	4
November	1		
All months	13 (2)	12 + 2[b]	6 + 1[b]

[a] Numbers in parentheses represent empty stomachs.
[b] Additional seals killed in unknown months (probably August-October).

fish length and fish weight it is possible to estimate the size and weight of fish ingested. Such equations have been developed for *Boreogadus saida* and *Arctogadus glacialis* from the Canadian High Arctic (Finley and Gibb, in press) but are not known for most benthic species of fish that were consumed by bearded seals.

The percent occurrence of food organisms is of limited value in understanding their dietary importance. However, back calculation of weights from diagnostic hard parts provides an important means of estimating the actual biomass contribution of a particular species consumed, particularly since percent occurrence values, as used in many studies of marine mammal diets, are often quite misleading (Frost and Lowry, 1980; Finley and Gibb, in press). The differential retention and digestion of calcareous (otoliths) or chitinous (beaks, operculae) material poses some problems in terms of reconstruction of the recent dietary intake. Finley and Gibb (1982) conducted simple experiments to demonstrate the resistance and retention of chitinous parts. They and Frost and Lowry (1980) considered that otoliths were indicative of food (fish) intake within the previous 24-h period, whereas chitinous beaks were probably retained and were not necessarily indicative of recent ingestion (see also Pitcher, 1980). To compensate for the differential retention Finley and Gibb (1982) included only identifiable remains of cephalopods or beaks with attached flesh as being representative of recent intake. We have taken the same approach in evaluating the relative biomass contribution of various taxa in the bearded seal diet. In addition, we have used the actual wet weight composition of major taxa (i.e. fish, crustaceans, gastropods, clams) to evaluate their relative biomass.

Our samples were too small to permit detailed analysis of food habits by sex and age classes for each of the three areas. Lowry *et al.* (1980) found no differences in the diets of male and female bearded seals but found that older seals (i.e. ≥3 yr) consumed more clams than did younger seals. Our samples consisted of equal numbers of males (18) and females (18). Reproductive organs indicated that 66% of the seals were mature (maturity is reached at about age 5-6 yr in females and 6-7 yr in males — McLaren, 1958; Burns, 1967). Variability in diet is probably more a function of locality than of sex or age (Lowry *et al.*, 1980), so we combined all ages and both sexes for each of the three localities (Table 1).

RESULTS

Diet Composition

All except two of the 36 stomachs contained food, often in considerable amounts. The diet included a remarkable variety of fishes and invertebrates. The following presentation of data is organized by general categories of food organisms; detailed information on species composition is given in Tables 2 and 3.

Fish. Fishes were found in most of the bearded seal stomachs and comprised 85% of all organisms ingested. At least 12 species of fishes, mostly benthic inhabitants, were identified from whole specimens or characteristic remains in the seal stomachs. Arctic cod, *Boreogadus saida*, were especially abundant (52% of all organisms) in the diet of seals from Grise Fiord, whereas sculpins were the most frequent items (49% and 44%, respectively) at Pond Inlet and Clyde. Many of the sculpin otoliths and identifiable remains appeared to be those of *Myoxocephalus scorpius* and *Gymnocanthus tricuspis*. Eelpouts, particularly *Lycodes polaris*, were also found frequently in the stomachs and comprised 6% of all organisms ingested. Polar cod, *Arctogadus glacialis*, comprised 4% of all organisms ingested. Other fish were, in decreasing order of abundance, seapoachers (*Agonus decagonus*), fish doctors (*Gymnelis* sp.), and seasnails (*Liparis* sp.). Fish constituted >90% of the weight in 15 of 19 stomachs that contained >1 kg of food.

Crustaceans. At least 10 species of benthic shrimps were found in the stomachs of bearded seals but the crangonids, especially *Sclerocrangon boreas*, predominated. Crustaceans comprised only 3% of all organisms ingested (Table 3). Their

TABLE 2. Occurrence and numbers of fish in bearded seal stomachs from three locations in the eastern Canadian High Arctic, 1978-1980

	Percent occurrence in stomachs			Number of each food item in all stomachs			Percent of food items[a]		
	Grise Fiord $n = 14$	Pond Inlet $n = 13$	Clyde $n = 7$	Grise Fiord	Pond Inlet	Clyde	Grise Fiord	Pond Inlet	Clyde
FISH	100	92	100	4510	2046	1699	86	81	89
Gadidae	100	85	100	2836	527	487	54	21	26
Boreogadus saida	100	85	100	2734	405	310	52	16	16
Arctogadus glacialis	36	46	71	102	122	177	2	5	9
Cottidae[b]	79	92	100	1297	1240	847	25	49	44
Zoarcidae	86	77	100	219	141	252	4	6	13
Lycodes polaris	86	69	86	175	95	197	3	4	10
Lycodes mucosus	50	54	43	29	21	16	<1	<1	<1
Gymnelis sp.	21	31	43	15	25	39	<1	<1	2
Agonidae									
Agonus decagonus	21	38	29	3	45	31	<1	2	2
Cyclopteridae[c]	29	38	43	5	21	11	<1	<1	<1
Unidentified fish	36	31	57	150	72	71	3	3	4

[a] The denominator is the total number of fish plus the total number of invertebrates listed in Table 3.
[b] Mainly *Myoxocephalus scorpius* and *Gymnocanthus tricuspis*. Also a few identifiable specimens of *Artediellus uncinatus* and *Icelus spatula* and probable remains of *Triglops pingeli*, *M. scorpioides* and *M. quadricornis*.
[c] Mainly *Liparis* sp. and three *Careproctus reinhardti*.

TABLE 3. Occurrence and numbers of invertebrates in bearded seal stomachs from three locations in the eastern Canadian High Arctic, 1978-1980

	Percent occurrence in stomachs			Number of each food item in all stomachs[a]			Percent of food items[b]		
	Grise Fiord $n=14$	Pond Inlet $n=13$	Clyde $n=7$	Grise Fiord	Pond Inlet	Clyde	Grise Fiord	Pond Inlet	Clyde
INVERTEBRATES	97	100	100	734	468	199	14	19	11
Snail	71	85	100	313	208	141	6	8	7
Buccinum spp.	71	77	100	300(740)	193(1317)	141(1041)	6	8	7
Other[c]	21	54	14	13 (43)	15 (146)	(1)	<1	<1	<1
Shrimp	71	100	100	111	130	41	2	5	2
Crangonidae[d]	57	92	71	76	105	14	1	4	<1
Hippolytidae[e]	14	31	43	22	19	19	<1	<1	<1
Other[f]	0	8	14	0	2	1	0	<1	<1
Unidentified shrimp	29	38	43	13	4	7	<1	<1	<1
Clam	29	31	14	305	2	15	6	<1	<1
Serripes groenlandicus	7	23	14	305	2	15	6	<1	<1
Other[g]	29	23	14	(5)	(5)	(1)	<1	<1	<1
Cephalopod	79	92	71	3	8	2	<1	<1	<1
Bathypolypus arcticus	64	85	57	2 (28)	5 (61)	2 (29)	<1	<1	<1
Gonatus sp.	71	77	57	1 (38)	3 (35)	(21)	<1	<1	<1
Anemone	7	8	0	2	11	0	<1	<1	0
Sea Cucumber[h]	0	8	0	0	109	0	0	4	0
Polychaete[i]	29	62	29	(18)	(57)	(7)	<1	<1	<1
Miscellaneous[j]	36	8	29	—	—	—	<1	<1	<1

[a] Numbers in parentheses indicate indigestible material such as squid beaks that were not considered representative of recent intake.
[b] Denominator also includes fish in Table 2.
[c] Includes *Colus* spp. and a few *Acmaea* sp.
[d] Primarily *Sclerocrangon boreas*; also *S. ferox*, *Sabinea septemcarinata* and *Argis dentata*.
[e] Includes *Lebbeus polaris*, *Spirontocaris spinus* and *Eualus fabricii*.
[f] *Hymenodora* sp. and one pandalid.
[g] *Clinocardium ciliatum*, *Astarte borealis*, *A. montagui*, *Mya truncata*, *Musculus niger*, *Macoma* sp. and *Mytilus* sp. from whole specimens or shell fragments.
[h] Probably *Thyonidium* sp.
[i] Genus *Harmothoë*.
[j] Includes various amphipods, one brittlestar, one lampshell, one leech and algae in trace (—) amounts.

wet weight contribution to the stomach contents was always <200 g and in stomachs with >1 kg of food, crustaceans always accounted for <10% of the weight.

Snails. The operculae of snails, particularly *Buccinum* spp., were found in almost all bearded seal stomachs but this indigestible material probably was retained and was not necessarily representative of recent intake. Counts of identifiable bodies of snails showed that they comprised at least 7% of all recently-ingested organisms. Their wet weight contribution never exceeded 200 g in any stomach and comprised <10% of the weight in all 19 stomachs containing >1 kg of food.

Clams. Clams were infrequent in bearded seal stomachs (Table 3). Almost all of the clams enumerated in Table 3 were from a seal taken at Grise Fiord; this individual had fed almost exclusively (600+ g) on *Serripes groenlandicus*.

Cephalopods. Chitinous beaks of the octopod *Bathypolypus arcticus* and an unidentified squid of the genus *Gonatus* were found in many bearded seal stomachs but this indigestible material probably was retained and was not representative of recent intake (*cf.* Finley and Gibb, 1982). Small amounts of soft tissue and a few semi-intact specimens of cephalopods were found in 24% of the stomachs. They comprised <1% of all organisms ingested (Table 3) and <5% of the weight in all 19 stomachs that contained >1 kg of food.

Polychaetes. Small numbers of chitinous jaws of polychaetes, all *Harmothoë*, were found in 41% of the stomachs. The chitinous jaws may not be representative of recent ingestion as no other identifiable remains of polychaetes were found.

Sea cucumbers and anemones. All 109 sea cucumbers found were in the stomach of a single bearded seal, an adult female taken at the Pond Inlet floe edge in July 1979. In this individual, they comprised 34% of the weight of the stomach contents (3.3 kg). Thirteen anemones were found in two stomachs.

Feeding Capacity

The feeding rate of bearded seals is unknown. If the rate is 3-8% of body weight per day, as in some other phocid seals (Sergeant, 1973; Parsons, 1977; Ashwell-Erickson and Elsner, 1981), then an average adult bearded seal (240 kg

— Burns and Frost, 1979) would ingest about 7-19 kg of food per day. The maximum weight of stomach contents that we recorded was 7.6 kg, found in an immature male from Grise Fiord which had fed almost exclusively on arctic cod.

The mean weight of contents for 29 stomachs was 2.0 kg; there were no significant differences in amounts in seals from the three localities (Table 4, Kruskal-Wallis H ≥ 0.30, df = 2, $p > 0.8$). Six of 29 stomachs contained >3 kg of food; in contrast, Kosygin (1971) reported a maximum weight of 2.7 kg in a sample of 565 seals from the Bering Sea, and Lowry *et al.* (1980) recorded an average volume of 670 ml (essentially equivalent to wet weight in g — Pitcher, 1981) in a sample of 50 adult seals from the Bering Sea.

TABLE 4. Average and maximum weights of stomach contents from bearded seals from three arctic localities, 1978-1980[a]

	Grise Fiord $n = 12$	Clyde $n = 7$	Pond Inlet $n = 10$
Range of weights (kg)	0.3 - 7.6	0.6 - 4.1	0.3 - 3.7
Average weights (kg) ± SD	2.18 ± 2.10	2.00 ± 1.17	1.56 ± 1.31

[a] Five of the 34 stomachs that contained food also contained considerable amounts of blood or sea water that had been ingested at the time of death. These were excluded.

Prey Size and Estimated Biomass Contribution

The teeth of the bearded seal are too degenerate to be used for shearing/biting, so the species is limited to prey that it can swallow whole (Vibe, 1950; Burns, 1967). Bearded seals are able, however, to remove the shells of clams and snails before ingesting them. Lowry *et al.* (1980) thought that the bearded seal grasped the exposed foot of a *Serripes* clam in its mouth and somehow tore it from the shell. Vibe (1950) believed that the bearded seal removed *Buccinum* snails from their shells by a sucking action, removing the body along with the opercula. Indeed, freshly-ingested snails do retain the opercula, but our frequent finding of the columella within the snail body suggests that the seal removed the shell by crushing it and ejecting the fragments. The shells of both *Buccinum* snails and *Serripes* clams can be crushed easily with hand pressure. Whatever the means, the energetic return to the bearded seal is not large; the maximum weight of a shelled snail was only 8 g, and that of a clam was only 6 g.

The largest whole fish that we found in bearded seal stomachs were sculpins, *Myoxocephalus scorpius*; the largest individual weighed 190 g. The average weight of 17 *M. scorpius* from seal stomachs was 73 g and that of nine *Gymnocanthus tricuspis* was 69 g. *M. scorpius* is highly sexually dimorphic; for example, a netted sample of 11 females averaged 470 g ± SD 180, whereas 12 males averaged 182 g ± SD 57 (Pond Inlet, 23 December 1979). It is apparent that bearded seals were feeding on the smaller individuals of the sculpin population, and a disproportionate fraction of these probably were males. It appears that the seals would be physically unable to swallow the larger spiny females. A maximum of 1717 otoliths representing at least 858 small sculpins were found in the stomach of one seal.

The frequency distribution of otolith sizes indirectly reveals the size range of arctic cod that were ingested by bearded seals (Fig. 3). The average otolith size (5.5 mm ± SD 1.80) of arctic cod ingested by bearded seals corresponded to a 13.2-cm fish (calculated as per Finley and Gibb, in press). The average wet weight of ingested arctic cod was 30 g. The largest calculated wet weight intake of *B. saida* was estimated at 18.9 kg from 1740 otoliths in the stomach of a bearded seal from Grise Fiord. The size range (maximum size about 22 cm and 80 g) of arctic cod ingested by bearded seals encompassed the size range of arctic cod found around N. Baffin Island (Finley, pers.obs.) and other arctic localities (Hognestad, 1968; Frost and Lowry, 1981; Craig *et al.*, 1982) and the size distribution shows emphasis on the 12-16 cm fish — also the sizes most commonly taken in nets in nearshore areas (Craig *et al.*, 1982; Finley, pers.obs.).

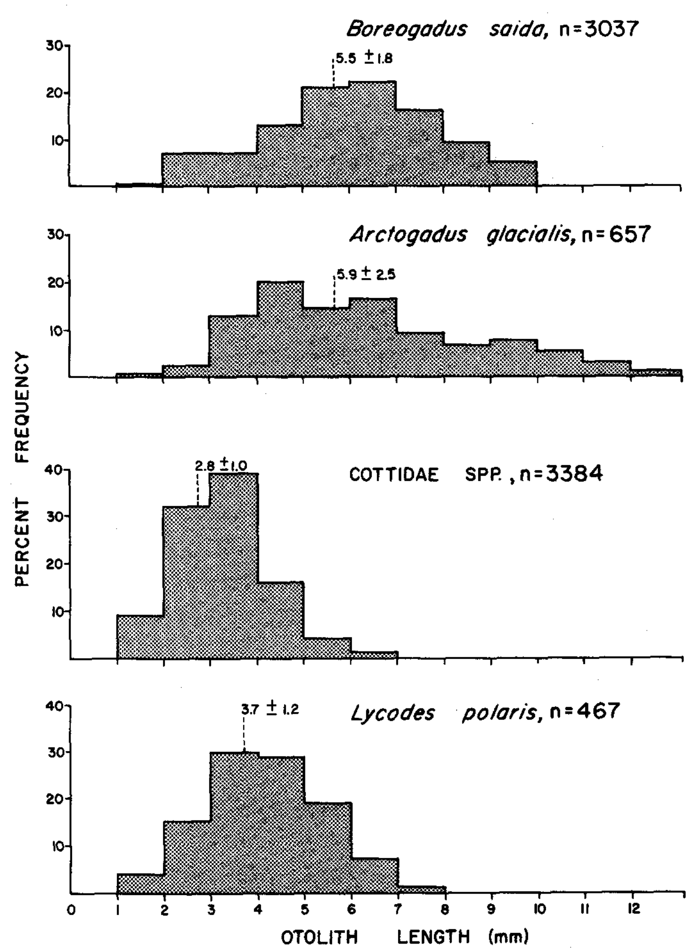

FIG. 3 Frequency distribution of otolith sizes of important fishes found in bearded seals taken in three arctic localities. Sample sizes, means and standard deviations of otolith lengths are given.

Bearded seals ingested a large size range of polar cod (Fig. 3); the average otolith size (5.9 mm ± SD 2.5) corresponded to a 14-cm fish. The average wet weight of an ingested polar cod was 85 g and the largest otoliths indicated that bearded seals had ingested a few individuals up to 340 g in weight (calculated as per Finley and Gibb, in press). The polar cod taken by bearded seals were considerably smaller than those (373 g ± SD 121, $n = 110$ — Finley and Gibb, in press) taken by hook in coastal waters of N. Baffin Island.

Only one intact specimen (108 g) of eelpout (*Lycodes polaris*) was found in a bearded seal stomach. The otoliths of this fish were 5-6 mm long, which is above the average size of eelpout otoliths that we found in bearded seal stomachs (Fig. 3). There are no otolith length-to-wet-weight conversion equations for eelpouts in the Canadian Arctic, but application of a conversion equation developed for the similarly-shaped *L. palearis* in Alaskan waters (Frost and Lowry, 1980) to the otolith size of our specimen shows good agreement between the actual (108 g) and estimated (118 g) weight. From this it appears that the largest specimens of eelpouts (otolith size 7-8 mm, Fig. 3) would not exceed about 200 g wet weight. Bearded seals would be unable to ingest some of the larger specimens of eelpouts such as a 510-g *Lycodes mucosa* that we collected near Pond Inlet in August 1978. A maximum of 234 otoliths representing at least 117 eelpouts were found in a bearded seal stomach.

Other fish in the bearded seal diet were small benthic species such as seasnails, seapoachers and fish doctors. Of these, the seapoachers, *Agonus decagonus*, were the largest specimens (maximum 12 g) that we found in the stomachs. An adult male bearded seal taken in late July at Pond Inlet contained fresh remains of many seapoachers and otoliths that represented at least 112 individuals. The presence of many ripe eggs with the fish bodies indicated that this particular seal had encountered a spawning aggregation.

The invertebrates consumed by bearded seals were generally small. The bottom-dwelling crangonid shrimps *Sclerocrangon boreas* were the largest crustaceans (maximum 30 g) ingested by bearded seals but it should be noted that a proportion of the weight consists of indigestible chitinous exoskeleton. The largest measurable cephalopod, *Bathypolypus arcticus*, weighed about 50 g.

It has already been shown that fish were the major component by weight of the semi-digested stomach contents of the bearded seal, but it is not evident which species or groups dominated. By back calculation from otolith size to wet weight it is possible to derive the wet weight composition of certain species (Frost and Lowry, 1980; Finley and Gibb, in press) but such conversion equations are not available for some species (e.g., sculpins and eelpouts) ingested by bearded seals. However, by substituting average weights of ingested organisms it is possible to roughly approximate the relative composition by weight of the various food organisms (Table 5). This exercise again demonstrates the importance of fish relative to invertebrates in the bearded seal diet, and it emphasizes the greater relative biomass contribution of larger fish such as polar cod and eelpouts (Table 5).

TABLE 5. Summary of occurrence and estimated wet weight of food items from 34 bearded seals taken in the Canadian High Arctic

	Percent occurrence (/34 stomachs)	Percent of food items	Average weight of ingested item (g)[a]	Percent estimated wet weight[b]
Fish	97	85	—	98
Arctic cod	94	36	30	24
Polar cod	47	4	85	8
Sculpin	88	35	70	55
Eelpout	82	6	80	11
Fish doctor	29	<1	5	<1
Seapoacher	29	<1	8	<1
Seasnail	35	<1	10	<1
Unidentified	97	3	10	<1
Invertebrates	100	15	—	2
Snail	82	7	3	<1
Shrimp	88	3	17	1
Clam	26	3	3	<1
Cephalopod	82	<1	20	<1
Polychaete	41	<1	1	<1

[a] Average weights were determined from otolith length - fish weight conversion equations (Frost and Lowry, 1980; Finley and Gibb, in press) or were approximated from actual weights of whole or partial organisms taken from seal stomachs.

[b] Approximate values only.

DISCUSSION

The results of this study provide further documentation of the diverse diet of the bearded seal within its large circumpolar range. Few other seals exhibit such a degree of consumer opportunism. Although bearded seals feed on a wide variety of benthic (both epifaunal and infaunal) invertebrates and demersal fish, they are also capable of exploiting schooling (pelagic and demersal) fish such as arctic cod. This ability to switch from benthic to pelagic feeding was noted by Vibe (1950) in northern Baffin Bay. Recent aerial surveys in late winter showed that some bearded seals do occupy offshore pack ice over deep water (>500 m) in northern Baffin Bay (Finley and Renaud, 1980) and other aerial surveys conducted in association with this study found bearded seals widely distributed in low densities over much of the offshore pack ice of Baffin Bay in June (Koski and Davis, 1979). Presumably they depend on a pelagic food source in Baffin Bay when they are excluded by fast ice from coastal areas.

In coastal waters of the Canadian High Arctic where the bearded seal can reach the bottom, it feeds heavily on benthic fish such as sculpins or takes advantage of schooling fish such as arctic cod. This stands in marked contrast to the situation in the Bering and Chukchi seas where fish are of minor importance in the bearded seal diet (Lowry *et al.*, 1980). Whether this reflects differences in prey availability or in predator selection cannot be evaluated since little is known about the abundance of fish and invertebrates in arctic epibenthic communities.

Most species of arctic fish are found in close association with the bottom. They are generally found under rocks, in macrophyte beds, or partly buried in soft substrate; they are rarely found on exposed bottom away from cover (Thomson and Cross, 1980). Remotely-employed sampling devices such as otter trawls provide only a rough approximation of the abundance of some species. Trawl sampling and SCUBA diver collections in coastal areas of northern Baffin Island produced 14 species of fish of which the two sculpins, *Myoxocephalus scorpius* and *Gymnocanthus tricuspis*, were the most common species (Thomson and Cross, 1980). The two sculpins were also the most common species found in bearded seal stomachs from northern Baffin Island. Although lumpsuckers (*Eumicrotremus* spp.) were taken in trawl collections they were not found in bearded seal stomachs. Seapoachers (*Agonus decagonus*) were not found in diver and trawl collections. Gill-net catches, although highly selective, also indicate that sculpins, particularly *M. scorpius*, are a dominant component of High Arctic benthic communities. For example, a 24 h set of a 30 m gill-net in 10 m of water at Grise Fiord in September 1979 produced 88 sculpins, primarily *M. scorpius*. A 24 h set of a 50 m gill-net in 40 m of water at Pond Inlet in December 1978 produced 14 *M. scorpius*, 2 *M. scorpioides* and 2 *G. tricuspis* (Finley, pers.obs.).

Burns and Frost (1979) believed that geographic variation in the diet of bearded seals in the Bering and Chukchi seas was a reflection of local faunal differences. This variation was apparent only in the relative amounts of shrimp, crabs and clams that were ingested; fish were always of minor importance. Qualitatively, our results most closely resemble those of Vibe (1950) from nearby NW Greenland, and suggest that the food of bearded seals in these areas reflects the importance of benthic fishes in the composition of benthic communities. An experienced hunter from Grise Fiord, formerly from Port Harrison on Hudson Bay, commented that one of the major differences that he noted in bearded seals from the two areas was that those in Hudson Bay fed on shrimps and clams almost exclusively. Further regional studies on the diet of the bearded seal may provide interesting insight into the composition, distribution and utilization of arctic epibenthic communities.

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