The Food Habits of Polar Bears of James Bay and Southwest Hudson Bay in Summer and Autumn

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ABSTRACT. A study of summer and autumn food habits of polar bears (*Ursus maritimus* Phipps) on some islands of James Bay and the coastal mainland of southwest Hudson Bay was conducted in 1968 and 1969. Analyses were made of 233 scats collected from islands in James Bay and 212 scats gathered on the southwest coast of Hudson Bay. Birds, primarily Anatidae, were the most commonly used summer and autumn food of bears in James Bay. Marine algae and grasses were the foods most often eaten by bears on the mainland. The diet of the bears from James Bay probably provides a better preparation for winter than the diet of those from the mainland, but evidence suggests that bears in both regions are generally in good physical condition.

RÉSUMÉ. *Les habitudes alimentaires des ours polaires de la baie de James et du sud-ouest de la mer d'Hudson en été et en automne.* En 1968 et 1969, on a mené une étude sur les habitudes alimentaires estivales et automnales des ours polaires (*Ursus maritimus* Phipps) dans quelques îles de la baie de James et sur la terre ferme du sud-ouest de la mer d'Hudson. On a analysé 233 fèces ramassées dans les îles et 212 provenant de la côte. Les oiseaux, surtout les Anatidés, sont la nourriture préférée des ours polaires de la baie de James en été et en automne. Les algues marines et les herbages sont les aliments consommés le plus souvent sur la terre ferme. Le régime des ours polaires de la baie de James devrait normalement les préparer mieux à l'hiver que celui des ours de la terre ferme, mais il semble que les ours des deux régions sont généralement en bonne condition physique.

РЕЗЮМЕ. *Зимний и осенний рационы питания полярного медведя в районе залива Джемса и в юго-западной части Гудзонова залива.* В 1968-1969 гг. проводилось изучение зимнего и осеннего рационов питания полярного медведя /Ursus maritimus Phipps/ на нескольких островах в заливе Джемса и на юго-западном побережье Гудзонова залива. Был произведен анализ 233 проб медвежьего помета, собранного на островах залива Джемса, и 212 проб помета, собранного на западном побережье Гудзонова залива. Наиболее характерной пищей медведей, обитающих на островах залива Джемса, в летний и осенний период являются птицы, преимущественно отряда гусиных. Медведи на материке питаются, главным образом, морскими водорослями и травами. С точки зрения подготовки к зимовке рацион медведей на островах лучше рациона медведей на континенте, однако, имеющиеся данные свидетельствуют о хорошей физической форме животных в обоих районах.

INTRODUCTION

Data on summer and autumn food habits of polar bears (*Ursus maritimus* Phipps) were gathered between 1 July and 1 November in 1968 and 1969 in conjunction with studies on polar bears in James Bay (53°N, 80°W) and Hudson Bay (59°N, 85°W) undertaken by the Canadian Wildlife Service (Jonkel 1970). When the sea ice melts in James Bay and Hudson Bay, bears are land-bound on the mainland

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or islands for three to five months between mid-July and mid-December, depending upon latitude and annual fluctuations in climate. This situation does not occur on a large scale elsewhere.

Data on tagged bears suggest that ones inhabiting islands in the James Bay Region comprise a subpopulation which is distinct from that of bears living along the southwest side of Hudson Bay (C. Jonkel, personal communication). The polar bears of James Bay tend to spend the warm season on some of its islands, whereas the bears of southwest Hudson Bay move to the mainland when the sea ice melts. The objective of this study was to describe and compare the summer and autumn food habits of these bears.

STUDY AREA

The study area lies within the James Bay and Hudson Bay basins (Fig. 1). Marine clay and beach sand deposits overlying Palaeozoic sedimentary bedrock extend from the middle of James Bay and the southwest side of Hudson Bay north to Cape Churchill. The topography is flat and drainage poor throughout (Rowe 1959).

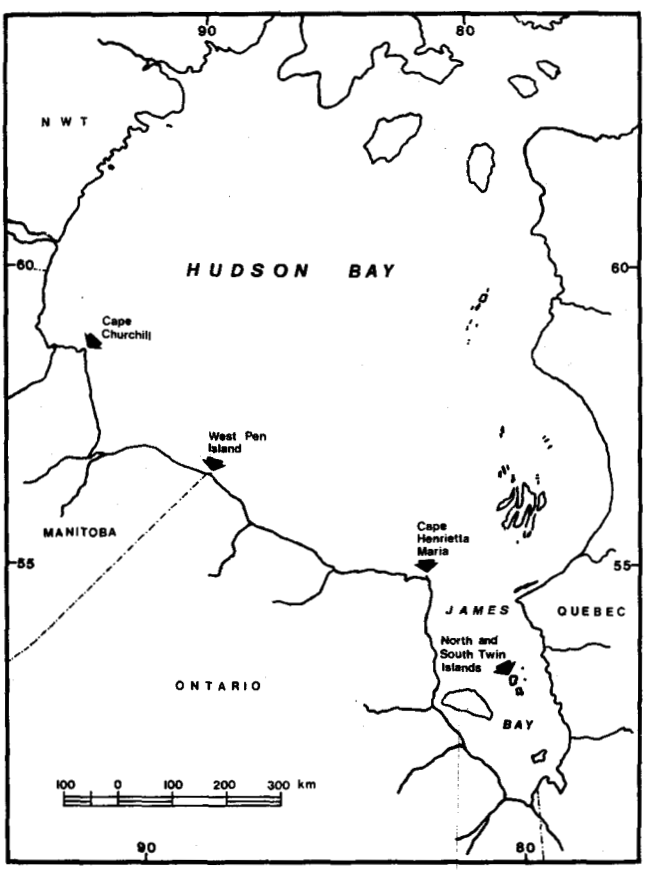

FIG. 1. Four major sites of collections of polar bear scats (indicated by arrows) in James Bay and Hudson Bay.

Though southern in latitude compared with polar bear habitat elsewhere, the area is strongly influenced by both arctic and maritime climates. The vegetation reflects the degree of exposure to winds, low air temperature, and unstable soil conditions related to permafrost (Rowe 1959). Hustich (1957) has described the areas immediately around Cape Henrietta Maria and Cape Churchill as "arctic barrens". Most of the coastline between the two sites belongs to a very narrow "hemi-arctic" region (Sjörs 1963) or transition zone (Dutilly *et al.* 1954). For the most part the treeline is between two and twenty kilometres of the coast, although at both Cape Churchill and Cape Henrietta Maria tundra extends 35-50 km inland. Coombs (1954) described this treeless area as the "coastal zone" and distinguished it physiographically from inland subdivisions of the Hudson Bay lowlands.

Cape Churchill and Cape Henrietta Maria are characterized by low ridges of sand and alluvium with adjacent marshy marine flats. Sand dunes, partially stabilized by plants, are prominent on the perimeter of West Pen Island, which is an island only in the strictest sense; at high tide it is separated from the mainland by a channel 3-6 m wide. For purposes of this study it was considered part of the mainland.

North Twin Island (200 km^2) appears to be typical of islands used by polar bears in James Bay. Physiographically it falls between the "arctic barrens" and "hemi-arctic" woodland tundra region. Vegetation consists mainly of tundra species with small sparsely scattered groves of conifers. The flat relief of the island is broken by a ridge rising to a maximum of 80 m above sea level and extending northward 1-3 km inland along the east side of the island.

METHODS

A total of 445 scats of polar bears were collected and analysed: 233 from James Bay islands and 212 from the coastal mainland of Manitoba and Ontario. Scats were collected during the summers and autumns of 1968 and 1969.

The study area extended 1,150 km from central James Bay to Cape Churchill, Manitoba. On the mainland, data were gathered in the vicinities of Cape Henrietta Maria, Ontario; West Pen Island, Ontario; and Cape Churchill, Manitoba (Fig. 1). In James Bay all data were collected from North and South Twin Islands, and associated smaller islands (Fig. 1). The data were obtained from over the entire islands, with the most intensive search conducted along a strip 2 km x 10 km on the east side of North Twin Island.

All scats found were collected regardless of age or condition. Some samples from drier sites may have been several years old. Entire scats were collected in all cases. Care was used to ensure that a minimum of extraneous material adhered to them. Most scats were air-dried and stored in paper bags until analysed. Some fresh droppings were collected in plastic bags and frozen.

Prior to analysis dried scats were soaked overnight in water. The softened material was washed through a series of rumen screens. The screenings were placed in trays and immersed in water. The material was examined macroscopically with the aid of bright illumination and specimens removed. Identifica-

tions were confirmed by comparison with available keys (Glass 1951; Hultén 1968; Porsild 1964) or with reference collections from the area, housed at the Canada National Museum of Natural Sciences.

Volumetric analyses, similar to those employed by Clark (1957) for Kodiak bears (*Ursus arctos*) and Tisch (1961) for black bears (*Ursus americanus*), were used. The volume of each food item was estimated visually and placed in one of six categories: 100-96 per cent; 95-76 per cent; 75-51 per cent; 50-26 per cent; 25-6 per cent; and 5 per cent to trace. A weakness in this method lies in the fact that the relative amounts of undigested food items found in scats are not always indicative of the amounts ingested by the animal; for example, muscle and fat tissues are more completely digested than most vegetation. However, there appears to be no more suitable method for analysing the present data.

Average per cent volume and frequency of occurrence were calculated for each food item. The data from scats collected in 1968 and 1969 were combined because of the difficulty in determining time lapse from evacuation.

RESULTS AND DISCUSSION

The numbers of polar bears frequenting the islands of James Bay and the southwest coast of Hudson Bay increase through summer and autumn and are at their greatest just prior to the freezing over of the bays in November. The maximum numbers of bears observed in the vicinities of sites of scat collection during aerial surveys in 1968, 1969 and 1970 were: Cape Churchill, 122 bears; Pen Islands, 68; Cape Henrietta Maria, 58; and Twin Islands, 81 (Russell 1971).

TABLE 1. Animal food items identified in 233 and 212 polar bear scats from some islands (I) of James Bay and the southwest coastal mainland (M) of Hudson Bay, respectively, 1968-69.

Food items	Frequency (%)		Volume (%)	
	I	M	I	M
Birds				
Clangula hyemalis	34	1	31	tr
Somateria spp.	9	—	7	—
Branta canadensis	4	—	3	—
Larus argentatus	1	—	1	—
Others	3	tr	3	tr
Egg shells	5	—	tr	—
Indeterminable	22	—	13	—
Mammals				
Phoca hispida and *Erignathus barbatus*	9	9	3	6
Microtus pennsylvanicus	—	16	—	2
Ondatra zibethicus	—	4	—	2
Ursus maritimus	10	30	1	2
Marine Invertebrates				
Mytilus edulis	10	7	2	tr
Strongylocentrotus droehbachiensis	6	—	1	—
Indeterminable	—	9	—	tr
Insects	tr	4	tr	tr
Fishes	—	tr	—	tr

TABLE 2. Plant food items identified in 233 and 212 polar bear scats from some islands (I) of James Bay and the southwest coastal mainland (M) of Hudson Bay, respectively, 1968-69.

Food items	Frequency (%)		Volume (%)	
	I	M	I	M
Lichens	18	3	tr	tr
Mosses	24	12	2	2
Mushrooms	8	2	tr	tr
Marine algae				
Fucus spp.	11	61	2	13
Laminaria spp.	9	33	1	6
Sphacelaria spp.	tr	30	tr	2
Desmarestia aculeata	tr	9	tr	tr
Neodilsea integra	tr	20	tr	14
Rhodymenia palmata	—	7	—	2
Others	2	2	tr	tr
Club-mosses				
Lycopodium spp.	3	—	tr	—
Horsetails				
Equisetum spp.	tr	—	tr	—
Grasses				
Elymus arenarius	7	41	4	20
Other Gramineae	19	39	8	21
Rushes				
Juncaceae	2	2	tr	1
Eel grass				
Zostera marina	—	8	—	tr
Sedges				
Cyperaceae	5	tr	1	tr
Berries and other fruits				
Empetrum nigrum	34	2	12	tr
Others	9	tr	1	tr
Indeterminable	1	tr	tr	tr
Leaves and stems of shrubs and broadleaved herbs				
Salix spp.	43	9	tr	tr
Betula glandulosa	19	—	tr	—
Empetrum nigrum	32	2	1	tr
Others	31	5	tr	tr
Indeterminable	11	8	tr	tr
Debris				
Sand	2	tr	1	tr
Woodchips	3	12	tr	1
Other	2	9	tr	1

Results of analyses of 233 scats collected in James Bay are presented in Tables 1 and 2 and summarized in Fig. 2. Bird remains dominated the sample, both in frequency of occurrence (69 per cent) and in volume (58 per cent). Oldsquaw ducks (*Clangula hyemalis*) represented 53 per cent by volume of all scats in which remains of birds were found.

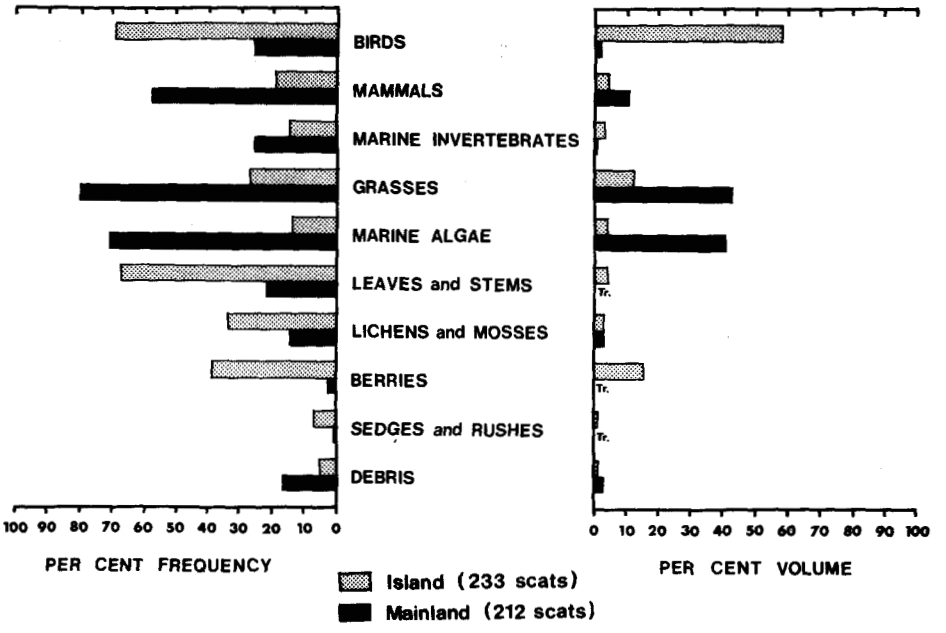

FIG. 2. Percentage volume, and percentage of frequency of occurrence, of food items in polar bear scats from some islands of James Bay and the southwest coastal mainland of Hudson Bay, 1968-69.

Results of analyses of 212 scats collected along the coast of Manitoba and Ontario are also presented in Tables 1 and 2 and summarized in Fig. 2. In contrast to James Bay, birds along this coast made up only a minor portion of the diet: 26 per cent by frequency of occurrence, and 2 per cent by volume. Two plant types were well represented: grasses were identified in 80 per cent of the sample by frequency and made up 41 per cent of the total by volume; while combined species of marine algae totalled 71 per cent by frequency and 38 per cent by volume.

The consumption of birds, mammals, marine algae, grasses, and berries by bears on the mainland differed considerably, both in frequency and volume, from consumption of the same foods by bears frequenting the islands of James Bay. These food items occurred in amounts greater than 10 per cent by volume, either in scats from islands or in scats from the coastal mainland, or from both.

Birds

Feeding on birds to the extent shown in the James Bay sample (Table 1 and Fig. 2) has not been documented elsewhere. The relative frequency of occurrence of remains of birds was three times as great in scats from the islands than from the mainland, and 29 times more abundant by volume. Polar bears in Svalbard (79°N, 17°E) take adult seabirds, young, and eggs when the opportunity arises, mainly during the nesting season, but birds are not regarded as a major source of food (Lønø 1957; Pedersen 1962). Birds have also been recorded as an occasional food source in the Canadian Arctic (Harington 1965). Doutt (1967) found several

scats containing feathers while on an expedition to South Twin Island (53°N, 79° 52′W) in 1935.

The differences between foods of animal and plant origin, in terms of protein, fat and carbohydrate content, are considerable. A diet of sea-fowl provides roughly four times as much protein and eight to ten times as much fat per unit weight as most grasses (D.N.H.W. 1960; McDonald *et al.* 1966). By contrast, carbohydrates are low in sea-fowl, but substantial amounts are available in grasses (D.N.H.W. 1960; Crampton and Lloyd 1959). The calorific content of birds is two to three times greater per unit than that of most plants available to polar bears.

It seems unlikely that scavenging alone could account for the high percentage of sea-fowl in the sample from James Bay, since few dead birds were found on the beaches and interior of the islands. It appears most likely that some polar bears have learned to prey on birds. In two incidents on North Twin Island during late August and early September 1969, bears were observed stalking and killing adult Canada geese (*Branta canadensis*) on the ground in areas of low shrubs, 40-60 cm high (B. Knudsen, personal communication). In 1972, C. Jonkel (personal communication) observed a sub-adult male bear killing an immature flightless Canada goose on Cape Churchill. These observations, however, do not explain the high incidence of sea-fowl, especially oldsquaws, found in faeces. Some bears have apparently learned to capture sea ducks on the open sea, probably during the moult. Sheaths of moulting feathers were found in 50 per cent of scats which contained the remains of birds. Polar bears are excellent swimmers, and can dive and swim for considerable distances underwater. A bear could dive and rise under a bird resting on the surface, particularly in stormy weather when the shallow seas are roiled, or in the presence of large breakers.

On several occasions in July 1968, the present author watched polar bears swimming among sea-fowl in the shallow waters off North Twin Island. Their pattern of swimming suggested that they were hunting the birds which were numerous in the water at the time.

In May 1962, D. Nasogaluak, an Inuit hunter (personal communication) observed a young male polar bear causing a commotion among king eiders (*Somateria spectabilis*) in a lead near Banks Island, N.W.T. (72°N, 125°W). The bear dived repeatedly, swam underwater, and surfaced in the midst of the flock. Nasogaluak shot the bear and, upon examining the stomach, he found the remains of three king eiders. C. Vibe (personal communication) observed two polar bears on some isolated ice floes approximately 80 km off East Greenland (70°N, 22°W) in September, 1964. One of the bears caught sight of a dovekie (*Plautus alle*) about 30 m from the ice floe. The bear slid into the water and swam at a depth of about half a metre below the surface up to and under the dovekie and suddenly emerged, evidently with the intention of seizing it from below, but the bird made a narrow escape. Since no other predators are known to attack birds from the sea in James Bay, it is likely that sea-fowl on the water may be unwary of attack from below.

The data from the present study suggest that raiding of nests by polar bears is not common (Table 1). This may be because the bears are on the ice pack at the peak periods of hatch. Loughrey (1956) reported observing a polar bear walking through a colony of nesting snow geese (*Anser caerulescens*) without paying any

attention to the birds and without disturbing a nest. However, on Baffin Island an Inuit hunter once killed a bear whose stomach was full of eider duck eggs (Simonie, 1968, personal communication).

Canada geese, oldsquaws, and eiders are common both in James Bay and along the coasts of Manitoba and Ontario. Approximately 200-300 breeding pairs of Canada geese nest annually on North Twin Island. Large colonies of nesting snow geese and blue geese occur near Cape Churchill (Jehl and Smith 1970) and Cape Henrietta Maria (Cooch 1963), the areas where mainland bears reach their greatest numerical density. Both oldsquaws and eiders were also sighted offshore, though they appeared in greater numbers adjacent to islands in James Bay. It may be concluded, therefore, that the better conditions for hunting sea-fowl around islands, and retention of acquired behaviour by island-dwelling bears, explain the great difference in frequency and volume of birds consumed in James Bay as opposed to on the mainland (Table 1 and Fig. 2).

Mammals

Frequencies of occurrence and abundances by volume of mammalian remains as between scats from the coastal mainland and scats from the islands were in a three-to-one ratio (Table 1 and Fig. 2).

Microtine rodents were found in 20 per cent of samples collected on the mainland, but were absent from scats gathered in James Bay (Table 1). There are no rodents on the central islands of James Bay (T. Manning, 1973, personal communication).

Polar bear remains occurred three times more frequently and twice as abundantly in scats from the mainland than in scats from the James Bay islands. Small amounts of polar bear hair in the scats were probably derived from grooming (Table 1). In these instances, the hairs were distributed evenly among other food materials. Two scats from each area, composed entirely of polar bear remains (the claws of cubs were recovered from one scat in each sample), suggest scavenging or intraspecific predation. Adult male polar bears occasionally kill females and cubs (Russell 1971). Such cannibalism may be brought about by a high density of polar bears on the Manitoba coast in summer and autumn, as suggested by Jonkel (1970).

Ringed seals (*Phoca hispida*) and bearded seals (*Erignathus barbatus*) are the staple diet of polar bears year-around in the High Arctic and during winter elsewhere (Koettlitz 1898; Tsalkin 1936; Lønø 1957, 1970). The minor importance of seals as a prey item in this study has most likely resulted from the disadvantage that polar bears have when attempting to kill seals in open water. In the present analyses it was common to find vegetation — usually grass — mixed in with remains of seal, suggesting that the seals eaten in summer were probably carrion.

The frequencies of occurrence of seal remains in scats from the mainland and from the islands were similar, suggesting that both groups of bears ate seal carrion when available; however, the volume consumed was twice as great in mainland scats.

Marine invertebrates

Marine invertebrates were identified in 15 per cent of James Bay scats and 26 per cent of those from the coast (Table 1 and Fig. 2). Average volumes were not appreciable in either case, though 6 scats from James Bay contained at least 50 per cent marine invertebrates by volume. Mussels (*Mytilus edulis*) and sea urchins (*Strongylocentrotus droehbachiensis*) were common in James Bay scats, whereas tunicates (Ascidiacea) were most often eaten by mainland bears. Most of these items become available when swept onto shore by violent storms. Bears possibly retrieve marine invertebrates by diving for them, as they sometimes do for marine algae.

Grasses

Grasses are common throughout both regions, but the frequency of consumption of them by polar bears in James Bay was about one third of that by bears on the mainland (Table 2 and Fig. 2). The volume of grass in the latter collection was over three times that in the former (Table 2 and Fig. 2). *Elymus arenarius,* a large coarse grass, occurred most often in the scats. Five scats collected on the mainland were composed solely of spikes of this species, apparently eaten just prior to maturation of the seeds. Nutrients occur in much higher concentration in seeds than in the culm and leaves of grass, and bears may have selected the spikes for this reason (Crampton and Lloyd 1959).

Lønø (1957) documented the occasional occurrence of grasses in 172 stomach samples taken in Svalbard. Loughrey (1956) and Pedersen (1962) also mention grasses as a source of food for polar bears. On several occasions on both North Twin Island and the mainland the present author has observed bears feeding on grass.

Polar bears may seek grasses or other vegetation, even when animal foods are plentiful. Koettlitz (1898) observed a bear which, after feeding on a seal, immediately travelled five kilometres to eat grass. He also examined the contents of 30 stomachs and recorded grasses in eight, two of which contained grass in combination with remains of seal.

Marine algae

Marine algae were found to be widely eaten by polar bears, particularly on the mainland where they consumed ten times more seaweed than their counterparts in James Bay (Table 2 and Fig. 2). This general difference in food habits as between the bears of James Bay and Hudson Bay cannot be attributed to availability of marine algae, as the most commonly eaten species are *Fucus* spp. and *Laminaria* spp., which are abundant throughout both areas. It may be that the greater consumption of birds by James Bay bears makes it unnecessary for them to rely as much on seaweed and grass for food.

Greater volumes of brown algae were consumed than red and green algae. Red algae are scarce in James Bay waters (R. K. S. Lee, 1970, personal communication) — a fact which is reflected by their absence from the James Bay scat collection.

Use of marine algae by polar bears has also been recorded in the High Arctic. Tsalkin (1936) found *Laminaria* spp. in 3 out of 145 stomachs collected on the Franz Josef Archipelago. On Svalbard, Lønø (1970) witnessed a female and a yearling dive from an ice floe into 3-4 m of water; they hauled large quantities of seaweed onto the ice, picked through it, and ate only certain parts. In August 1970, J. Craighead (personal communication) observed a large male diving for *Fucus* spp. in open water off North Twin Island. The bear was in shallow water and could stand on the sea floor. It held food in its forepaws and ate the thalli, casting away the stipes.

Much of the seaweed eaten may have been obtained by the bears diving and pulling it from the substrate. This is especially probable when *Neodilsea integra* and *Rhodymenia palmata* are consumed, both of which are sub-tidal. Most specimens of marine algae picked from scats appeared to have been eaten in fresh condition, as they did not show any abrasion resulting from being washed up on the beach.

Macroscopically, most marine algae found in the scats appeared relatively unaltered by digestion. Marine algae are rich in trace elements and vitamins, but are very low in carbohydrates and proteins (McInnes 1955; Stephenson 1968). Therefore, it is possible they were eaten as a source of vitamins and minerals, or merely as bulk.

Leaves and stems of shrubs and broad-leaved herbs

These items occurred with a relatively high frequency, but were low in volume (Table 2 and Fig. 2). Leaves and stems of shrubs and herbs, other than crowberries (*Empetrum nigrum*), were found in trace amounts only. The greater frequency (3 to 1) and volume (4 to 1) of leaves and stems in scats from islands (Table 2 and Fig. 2) probably resulted from incidental intake in association with berrying, although it is possible that they may have been consumed during grooming, or they may have adhered to the scat after deposition.

Mosses

Mosses are occasionally consumed in large quantities, perhaps in the spring of the year. One scat containing a large amount of moss had been deposited on top of the snow on North Twin Island in April. Mosses comprised over one-third the volume of eight fresh faeces collected at maternity dens of polar bears near York Factory, Manitoba (Russell 1971). The moss had been consumed soon after the bears emerged from their dens in March. Mosses are possibly a source of vitamins and minerals — substances deficient in bears after the denning period.

Berries

The relative difference in frequency of occurrence and abundance by volume of berries (Table 2 and Fig. 2) suggests that berries which are rich in carbohydrates are a preferred forage of polar bears. Berries occurred about 13 times more often in scats from the islands than in scats from the mainland, and were 15 times greater by volume (Table 2 and Fig. 2). Crowberries, which accounted for most of the berries in the scats (Table 2), are abundant in the islands, as are cranberries

(*Vaccinium* spp.) and juniper berries (*Juniperus communis*). B. Knudsen (personal communication) observed polar bears foraging intensively for berries on North Twin Island in September 1970.

Berries are noticeably lacking from much of the immediate mainland coast. The sand dunes and low marshy tide flats are unsuitable sites for most berry-producing species of plants. Further inland the present author has observed polar bears feeding intensively on both crowberries and cranberries.

MISCELLANEOUS

Remains of fish were found in one scat. Only in Labrador have polar bears been known to consume fish in quantity. In 1778, the British explorer and trader, Captain George Cartwright observed 32 bears preying on Atlantic salmon (*Salmo salar*) on the Eagle River, Labrador (Townsend 1911). Insects — most commonly horseflies (*Tabanus* spp.) — found in a few scats were probably licked from the fur at the peak of the fly season. The present author has observed heavy horsefly activity around polar bears in mid-August. Jonkel *et al.* (1972) have suggested that one function of the summer dens constructed by polar bears is a means of escape from insect harassment.

Surprisingly, sedges were not conspicuous in scats, though they grow abundantly in the study area. Clark (1957) considered sedges the most common food of Kodiak bears and Tisch (1961) also found them to be extensively consumed by black bears in Montana. Similarly, Tisch (1961) found horsetails (*Equisetum* spp.) to be an important component of black bear diet, though they are rarely eaten by polar bears. The trace amounts of lichens and club moss in scats most likely resulted from accidental ingestion during periods of grooming. Mushrooms were usually found with crowberries: a typical scat contained 5-10 per cent mushrooms with the remainder crowberries, which suggests that they were consumed on the same site.

Debris such as sand was present in substantial portions of five scats from James Bay which were analysed. Three of these scats were collected at the entrance to a polar bear den. The bear had probably licked the sand from its coat during or after digging the den, or consumed it accidentally while tearing roots from the den. Why bears should ingest styrofoam (6 scats) or chips from driftwood (31 scats) is difficult to understand.

CONCLUSIONS

Whether bears obtain food of sufficiently high quality in summer and autumn could affect the physical condition in which they enter winter — especially juveniles and lactating females. However, bears from both groups were in good physical condition for the season of the year. Apparently supplies of summer and autumn foods do not adversely affect condition or numbers of bears in either region.

Five major food items were eaten by bears on either James Bay islands or the coastal mainland of Manitoba and Ontario: birds, mammals, marine algae, grasses,

and berries. Only the greater intake of berries on the islands, and small mammals on the mainland, can be explained by relative abundances of those food items on island or mainland sites.

Marine algae and grasses are abundant and equally available on and around both island and mainland habitats. The greater use of these plants by bears from the mainland may compensate for their lower protein intake from avian prey. That relationship contrasts with the high intake of sea-fowl and low intake of marine algae and grasses by the bears from islands of James Bay. The turbidity of waters and abundance of oldsquaw and eider ducks around the islands of James Bay has apparently created a situation in which bears can be highly successful in the capture of sea-fowl.

Polar bears probably learn food-getting methods from experience and the example of the female. C. Jonkel (personal communication) has suggested, on the basis of records of marked animals, that bears in James Bay and Hudson Bay exhibit strong fidelity to summering areas. Under such conditions it is possible that a tradition of predation on birds could be formed and maintained on the islands while bears on the mainland use birds very little.

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