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FOOD HABITS OF SOME ARCTIC BIRDS  
AND MAMMALS

BY CLARENCE COTTAM<sup>1</sup> AND HAROLD C. HANSON<sup>2</sup>

During the summer of 1936, under the leadership of Captain R. A. Bartlett, an expedition sponsored by the Chicago Zoological Society, with the junior author as ornithologist and mammalogist, sailed from New York on June 23 and returned September 4, after visiting Newfoundland, Labrador, and Greenland. During this expedition the stomachs of 98 birds of 23 species and of eight mammals of five species were collected. These have been carefully analyzed in the Food Habits Laboratory of the United States Biological Survey. Notes were made of other species encountered. Although the number of stomachs is limited, the results of their examination given in the present paper may be of more than ordinary interest since they concern a phase of far northern ornithology, of which, current information is extremely meager. Laboratory analysis in the Biological Survey had never before been made of alimentary material of a number of the species here treated. A report on the food of certain birds and mammals collected by attendants of the Bartlett expeditions of 1931, 1932, and 1933 (Cottam, 1936, pp. 165-177) seems to be the only other publication devoted to similar material.

Grateful acknowledgment is made to Messrs. Clarence F. Smith, F. H. May, Leon H. Kelso, A. L. Nelson, C. S. Williams, F. M. Uhler, A. C. Martin, J. R. Malloch, and the Misses Alma M. Swords and Phoebe Knappen, members of the Food Habits Staff of the Biological Survey, for assisting either in actual stomach examinations or in the identification of certain food items. Dr. Waldo Schmitt, Mr. Clarence Shoemaker, and Dr. Harold Rehder of the United States National Museum also assisted in identifying certain crustacean and molluscan food items. The junior author is especially

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Natural History

indebted to Mr. Rudyerd Boulton, Curator of Birds in Field Museum, for aid in studying the birds, as well as to Captain Bartlett, his crew, and the students who accompanied the expedition for assistance in collecting.

## BIRDS

### ***Puffinus griseus*** (Gmelin). SOOTY SHEARWATER.<sup>1</sup>

Three Sooty Shearwaters were observed on June 25, a few miles south of the Bay of Fundy. At the halfway mark between Labrador and Greenland a few other individuals were seen. A large dark shearwater, probably of this species, was also noted off the Greenland coast about 66° N. Lat., July 20. Unfortunately, no collections of this or of the Greater Shearwater were made.

### ***Puffinus gravis*** (O'Reilly). GREATER SHEARWATER.

Greater Shearwaters were first observed when the expedition crossed the Bay of Fundy, but they did not occur in abundance until Cape Race, Newfoundland, was reached on June 30. Their largest concentration was off the Funk Islands, July 5, where flocks of 50 to 100 in number were common and the total population probably exceeded 2,000. In these waters small crustaceans commonly called "whale bait" were plentiful and undoubtedly served as the attraction for such large numbers. Field observation seemed to support this conclusion.

While crossing from Indian Harbor, Labrador, to Cape Farewell, Greenland, and up the coast to 62° N. Lat., this shearwater was occasionally seen, but quickly disappeared in an area of a thin ice-pack. On the return trip, August 12, when the ship was outside Angmagsalik, these birds once more appeared and were somewhat common down the coast.

### ***Fulmarus glacialis glacialis*** (Linnaeus). ATLANTIC FULMAR.

Fulmars first appeared as the ship approached the Funk Islands and the following day they were very numerous when the first icebergs were reached. Their marked preference for colder water shows a definite correlation with their southern distribution. "Whale bait" crustaceans being abundant here, it seemed to form an important food item. The birds were very cannibalistic, immediately falling upon their own kind or upon other birds when found wounded. This trait was especially apparent along the ice-pack in Greenland, where

<sup>1</sup> Unless otherwise noted, nomenclature and sequence of species conform with the A. O. U. Checklist, 1931.



food was scarce. The species was present in small numbers from Labrador to Greenland and then common up the coast to Franz Josef Fjord, the most northern point visited. The center of abundance, however, was in south Greenland outside the ice-pack, which they seemed to shun.

Only a single stomach of the Atlantic form had previously been examined in the laboratory of the Biological Survey (Cottam, 1936, p. 167). Consequently, it was gratifying to obtain 13 stomachs and gullets for the present study. All but one were full or nearly so, and all were taken from birds collected at sea during the latter half of July off the south and east coasts of Greenland, from about 64° to 67° N. Lat. and 39° W. Long. The birds are omnivorous feeders, accepting carrion, fish, squids, polychaete worms, or steamer refuse with almost equal relish. A summary of the food, expressed in percentage,<sup>1</sup> of 12 Atlantic Fulmars, is as follows:

Stomach number (adults)	Animal food	Vegetable food	Gravel †	Fish	Crustacea	Squid, etc.	Other Mollusca	Nereidae, etc.	Carrion	Misc.-animal	Misc.-vegetable
210826.....	93	7	2	10	..	34	..	34	15*	....	7
210827.....	100	..	..	5	5	..	..	..	90†	....	..
210828.....	100	..	..	99	..	..	..	1	..	....	..
210830.....	98	2	5	5	..	1	..	32	60†	....	2
210831.....	92	8	35	10	37	20	..	20	5†	....	8
210842♂.....	99	1	4	58	4	33	..	4	..	....	1
210843♀.....	100	trace	5	20	..	15	5	60	..	....	trace
210844♀.....	98	2	2	8	2	15	..	8	65†	....	2
210845♀.....	79	21	6	18	7	23	4	13	8†	6‡	21
210846♂.....	83	17	6	10	1	10	2	60	..	....	17
210847♂.....	83	17	20	17	3	55	..	8	..	....	17
210893♂.....	100	..	..	..	2	..	..	..	98†	....	..
Average											
per cent..	93.75	6.25	..	21.67	5.08	17.17	0.92	20.00	28.41	0.50	6.25

† Gravel is computed as a per cent of the stomach content but is not considered a part of the food percentage.

\* Bird. † Mammal. ‡ Sand dollar.

From the table, it is apparent that the Atlantic Fulmar consumes a wide variety of pelagic life. Its chief role seems to be that of a scavenger, as carrion aggregated 28.41 per cent of the total food consumption, and occurred in seven of the 12 birds examined. Little preference appeared to be shown for the type of carrion ingested, as seals, birds, and terrestrial mammals were all recognized in the stomach contents. Fish foods aggregated 21.67 per cent of the

<sup>1</sup> Laboratory analysis is based on volumetric method, which is the standard long used by the United States Biological Survey.

total and consisted entirely of non-commercial species. Gadids, including pollacks (*Pollachius virens*), lings (*Urophycis* sp.), and another species that may have been a scombrid, were noted in one or more stomachs, although fish of some species formed a part of each of the twelve meals.

Polychaete worms, probably nereids, which formed one-fifth of the food consumed, are obviously sought after, as these entered into the diet of 10 of the 12 birds examined and formed 60 per cent of the meal of two of them. No fewer than 91 pairs of the characteristically serrate mandibles were taken from a single stomach.

Cephalopods, apparently squids, were next in order of importance and entered into the bill-of-fare of nine of the birds, amounting to 17.17 per cent of the total, and forming more than one-half the meal of one. In this case, beaks of 10 small squid were noted. Fragments of molluscan egg-cases were also found in three stomachs.

Varying amounts of soft-bodied crustaceans in the form of isopods, amphipods, schizopods, and cumaceans, are consumed. In one form or another, they were obtained by eight of the 12 birds; yet, in the aggregate, they comprised only 5.08 per cent of the total food content. One bird, however, had drawn more than a third of its meal from these small inconspicuous creatures. Because such delicate and readily digested matter passes so quickly through the stomach, it is probable that their importance as food is much greater than the above small percentage would indicate.

A large number of miscellaneous items are usually consumed by such omnivorous feeders. This, undoubtedly, would be found to be the case if a larger and more representative series of birds was collected. One of the birds here considered had made 6 per cent of its meal on a sand dollar.

Vegetable material consumed was largely unidentifiable, as it consisted mainly of drifting wood-pulp, although a limited amount of brown algae (mostly *Ascophyllum nodosum*), smartweed (*Polygonum viviparum*), and cinquefoil (*Potentilla* sp.) were identified. It is possible that all of this was taken accidentally.

Numerous parasitic nematode worms were noted in all but two of the gullets or stomachs.

#### **Oceanites oceanicus** (Kuhl). WILSON'S PETREL.

Wilson's Petrels were first observed in Long Island Sound on June 24, and were extremely abundant off the Bay of Fundy on June 26. Here the rough water and strong winds seemed to make

their flying so much easier that they were constantly present, while in calm weather they appeared to be totally absent. They occurred sparsely on the Labrador coast and a few were seen outside Indian Harbor on July 12. When the ship returned to Newfoundland on August 12, this species again became common about a hundred miles offshore. No specimens were secured for studies of food habits.

**Moris bassana** (Linnaeus). GANNET.

During both voyages past Cape Race, Newfoundland, about a dozen individuals of this species were noted. They were also observed in Conception Bay, Newfoundland, and off the Funk Islands, where they were present in small numbers. No collections were made.

**Phalacrocorax carbo carbo** (Linnaeus). EUROPEAN CORMORANT.

The stomach and gullet of the only cormorant examined was taken June 28, 1931, by Capt. Bartlett, at Bjortonga, Brede Bugt, Iceland, on a previous expedition. Like others of its tribe, this bird apparently had fed on the most easily obtainable fish. Ninety-six per cent of its meal consisted of six of the common arctic sculpin (*Myoxocephalus* sp.). A pair of spider crabs (*Hyas araneus*) comprised the other 4 per cent, although fragments of a polychaete worm, two thais shells (*Thais* sp.), and one limpet (*Acmaea* sp.) were also present but formed only a trace each of the total stomach contents of the bird.

**Cygnus columbianus** (Ord). WHISTLING SWAN.

The junior author examined a skin of the Whistling Swan at Angmagsalik, Greenland, that was taken from a flock of four near the settlement in May, 1935. We are unaware of other specimens of this bird from east Greenland.

**Branta leucopsis** (Bechstein). BARNACLE GOOSE.

Fifteen Barnacle Geese were observed at Musk-ox Fjord, Hudson Land, Greenland. They were the only ones seen, but at Ymer Island a large flock was heard honking far away in the fog. These geese are known to nest near a fresh-water lake a few miles back from the coast of this island. No specimens were obtained on this expedition although one was taken on a previous Bartlett Expedition to north Greenland and its stomach contents analyzed (Cottam, 1936, p. 167).

**Anser brachyrhynchus** Baillon. PINK-FOOTED GOOSE.

The Pink-footed Goose is a rather common resident in Greenland (Løppenthin, 1932, pp. 33-38, 120), at least in the northeast part. On the 1936 expedition, the junior author collected an adult male in full eclipse plumage at Musk-ox Fjord, North Greenland, on July 31. Another specimen not previously recorded was obtained by Captain Bartlett at Clavering Island, east-central Greenland, on August 6, 1931.

Both these birds had well-filled stomachs and since they are the only ones of this species in the files of the Biological Survey dealing with stomach examinations, it is to be regretted that more material is not available. From the limited data at hand, it appears that this species, like others of its genus, is almost entirely herbivorous. Like many other geese, it seems to be somewhat of a browser, feeding within limits on those plant species most available and most abundant. Thus, the Hudson Land specimen had made 65 per cent of its meal on plant fiber and floral heads of *Poa* sp. and undetermined grasses, while 16 per cent consisted of *Carex* sp. plant fiber and seeds. Fragments of bulblets, rachis, and other vegetative material of the arctic smartweed (*Polygonum viviparum*) comprised 4 per cent, three species of moss 5 per cent, and undetermined plant fiber 10 per cent. The Clavering Island bird had had a similar meal, with 93 per cent consisting of *Carex* sp. plant fiber and seeds. *Polygonum viviparum* formed 2 per cent; undetermined plant fiber made up the remaining 5 per cent. Both birds had consumed a trace of animal matter, one a scale insect, and the other an amphipod.

John Cordeaux (Bent, 1925, p. 202) writes: "When, through the depth of snow on the high wolds, food is not to be got, geese entirely change their habits, loafing about on the coast and sand banks during the day, and in the evening flying and dropping anywhere in the low country where they can get green food; the snow seldom lies long in coast districts, and there are always places which the winds have left bare, and the ground is more or less uncovered. I have often seen their paddlings and droppings in pasture, corn and turnip fields near the coast."

**Clangula hyemalis** (Linnaeus). OLD-SQUAW.

While the Old-Squaw is generally regarded as a common circum-polar species, occurring as a winter visitor in temperate climates, a single specimen, a female, taken at Musk-ox Fjord, was the only individual of this species observed during the entire voyage. Through-

out its range the bird seems to have much the same feeding preferences. The stomach obtained on the 1936 expedition seems typical of many others that have been examined from more southern lands. Following is a summary of its food content: fragments of six or more sculpins (Cottidae), and undetermined bone fragments, including 44 otoliths (probably Cottidae), 6 per cent; fragments of many mysids (*Mysis relicta*), 83 per cent; fragments of undetermined soft-bodied crustacea, 10 per cent; fragments of undetermined bivalve, 1 per cent. Feather fragments from the bird's own body were also noted.

**Somateria mollissima** subsp.<sup>1</sup> NORTHERN(?) EIDER.

Less is known of the food tendencies of the Northern Eider than of perhaps any other native North American duck. It is, therefore, gratifying to add a little to the limited data already extant. Judging by other reports on the birds of east Greenland, eiders appeared to be unusually scarce in 1936. Besides those collected, a flock of five noted on the Liverpool coast were the only representatives of the species encountered during the entire voyage. The stomachs examined support the conclusion previously reached that the Northern Eider has more piscatorial tendencies than most of the other Anatidae, except the Merginae. The stomachs of an adult and a downy young here discussed were collected in North Fjord, Andree Land, on August 1, and showed a higher fish content than those obtained on the previous Bartlett expeditions (Cottam, 1936, p. 168).

The adult bird had consumed 17 sculpins (Cottidae), mostly *Myoxocephalus* sp., which amounted to 74 per cent of the meal. The northern astarte (*Astarte* sp.) was next in order of importance, with 23 per cent. A fragment of a gastropod added but a trace to the molluscan diet. Soft-bodied crustacea in the form of both amphipods and schizopods supplied the remaining 3 per cent. The downy young had made 92 per cent of its meal of fish, most of which were identified as Cottidae. Fragments of *Fucus* sp. and undetermined plant fiber supplied the remaining 5 and 3 per cent, respectively.

**Lagopus mutus captus**<sup>2</sup> Peters. GREENLAND ROCK PTARMIGAN.

Alimentary material was obtained from seven ptarmigan of two subspecies, the one under discussion and the following variety. One

<sup>1</sup> The A. O. U. Checklist does not list typical *mollissima* from North America and includes southern Greenland in the range of *borealis*. Peters (1931, p. 179) restricts *borealis* to west Greenland and includes east Greenland doubtfully in the range of *mollissima*. For the present we use the name *mollissima*.

<sup>2</sup> For proper nomenclature and distribution of Greenland Rock Ptarmigan see Peters, 1934, p. 35, and Salomonsen, 1926, p. 33.

*Lagopus mutus captus* was collected on Ymer Island, and it had made 88 per cent of its meal of twigs and leaves of *Salix* and 12 per cent of *Carex* sp.

Both subspecies fed exclusively on vegetable material, including twigs, leaves, bulblets, and fruits. From this small series, it seems that when a bird finds an acceptable food, the entire meal may be made from it. While all the stomachs were full, material of only two, or at most three, species per bird were found.

**Lagopus mutus rupestris** (Gmelin). HUDSON BAY ROCK PTARMIGAN.

The six ptarmigan from Angmagsalik had fed predominantly on fruit of crowberry (*Empetrum nigrum*) and none had obtained any willow. A summary average of the six stomachs follows: fruit debris of *Empetrum nigrum*, 81.5 per cent; bulblets and vegetable debris of *Polygonum viviparum*, 18 per cent; seeds and plant fiber of *Carex* sp., 17 per cent; fruit debris of *Vaccinium vitis-idaea*, 33 per cent; seeds of *Pedicularis* sp., trace; undetermined vegetable debris, trace.

One bird had consumed more than 1,300 fruits of the crowberry, while two others had each taken more than 1,000 of these fruits. One of the Angmagsalik birds had also consumed more than 500 bulblets of the arctic smartweed (*Polygonum viviparum*).

On a lowland area near Angmagsalik harbor, on August 11, Hanson discovered a flock of 25 ptarmigan feeding on berries. Previous to this time, they had been reported up in the mountains but apparently had come down to partake of the abundant food. Though they were still mainly in summer plumage, the under parts had already whitened considerably. The large majority were immature; of eight birds collected only one was an adult.

**Charadrius hiaticula psammodroma** Salomonsen.<sup>1</sup> GREENLAND RINGED PLOVER.

The ringed plover was an abundant nesting bird on a long graveled slope at Musk-ox Fjord, Hudson Land. On July 31, a young bird nearly fully feathered was collected. Feigning injury is as characteristic of this species as it is of killdeers.

Five adult plover stomachs provide convincing evidence that this species, like its American relatives, is insectivorous in its food tendencies. Lepidopterous larvae, mostly Vanessidae, supplied more than four-fifths (82.8 per cent) of the entire food consumed.

<sup>1</sup> See Peters, 1934, p. 247.

Spiders of several species had been taken by all of the birds and in the aggregate comprised 10.2 per cent of the total. One bird had drawn upon these creatures to the extent of 43 per cent of its meal. The remaining 7 per cent of the diet was made up of wasps and bees, insects that are predominantly parasitic upon other insects, and, consequently, are considered to be beneficial. Other groups of insects comprised only a trace of the stomach contents and only a trace of vegetable matter had been consumed.

**Charadrius semipalmatus** Bonaparte. SEMIPALMATED PLOVER.

Perhaps no better means of obtaining a cross section of the relative abundance of the insect and other small animal life could be found than through an examination of the alimentary content of a few shore birds frequenting a given territory. The following shows the wide variety of life occurring near a tidal pool, as shown by the stomach contents of one of a nesting pair of Semipalmated Plover, taken July 8, at Indian Harbor, Labrador: 42 larvae of *Cidaria* sp. (Geometridae) and fragments of many others, 35 per cent; 1 larva of *Colias* sp., 4 per cent; 1 larva of an undetermined Noctuidae, 4 per cent; 1 other undetermined lepidopterous larva, 7 per cent; 5 *Curtanotus* sp., 7 per cent; fragments of two *Cryobius mandibularis*, 4 per cent; 7 Elateridae, 8 per cent; fragments of other Coleoptera, 6 per cent; fragments of two or more species of spiders, 5 per cent; fragments of seven *Camponotus* sp. and other Formicidae, 6 per cent; fragments of undetermined Hymenoptera, 2 per cent; fragments of two *Acalypta* sp., 1 per cent; fragments of *Pachyrrhina* sp., 3 per cent; fragments of one *Sciara* sp., 1 per cent; fragments of undetermined Diptera, 1 per cent; fragments of seven *Littorina* sp., 5 per cent; seed fragments of *Carex* sp., 1 per cent.

Obviously, the stomach was gorged.

**Arenaria interpres interpres** (Linnaeus). EUROPEAN TURNSTONE.

Two stomachs from a pair of European Turnstones, taken on Hudson Land, July 31, show results that confirm previous studies (Cottam, 1936, p. 170 and Løppenthin, 1932, p. 55) of birds collected in this same general area. Insect life in particular seems to be taken in approximate proportion to availability. The 1936 birds had both fed extensively on lepidopterous larvae, which made up more than half their meals. The average of the two stomachs was as follows: lepidopterous larvae, including Nymphalidae and Noctuidae, 56.5 per cent; spiders of two or more species, 7.5 per cent; dipterous larvae

and adults, 5.5 per cent; Hymenoptera, 2 per cent; Coleoptera, 1 per cent; undetermined insects, 3.5 per cent; leafy fragments of *Dryas* sp., 4.5 per cent; algae, 2 per cent; undetermined plant debris, 17.5 per cent.

**Pisobia minutilla** (Vieillot). LEAST SANDPIPER.

Only one partly filled stomach of the Least Sandpiper was available, obtained at Indian Harbor, Labrador, early in July. Food items in their relative proportions were as follows: fragments of midges (*Chironomus* sp.) and undetermined Diptera, 45 per cent; fragments of three ground beetles (Carabidae), 40 per cent; fragments of other Coleoptera, 5 per cent; undetermined plant fiber, 10 per cent.

The stomach was much less than half full and the small bits of food items were finely comminuted.

**Lobipes lobatus** (Linnaeus). NORTHERN PHALAROPE.

The single stomach of a Northern Phalarope collected July 8, at a tidal pool near Indian Harbor, Labrador, where it was found nesting, was too nearly empty to give more than a suggestion of the bird's normal food tendencies. The following items were recorded from laboratory analysis: fragments of undetermined Hymenoptera, 3 per cent; fragments of many *Pogonomyia* sp. (Diptera) pupae cases, 77 per cent; fragments of five Dytiscidae, 10 per cent; undetermined plant fiber, 10 per cent. This species was frequently seen migrating at sea from Newfoundland to Cape Cod during the latter part of August.

**Stercorarius pomarinus** (Temminck). POMARINE JAEGER.

There is much in common in the food of the jaegers and a number of the gulls that feed in similar situations. To some degree, the jaegers are parasitic in robbing the gulls of their food; consequently, many of the food items are of the same species. Fishes are commonly consumed and seem to be taken in proportion to their availability. Unfortunately, only a single Pomarine Jaeger was collected, and that was taken July 27, at Davy Sound, northeast Greenland, while the bird was pursuing Kittiwakes. The stomach contained only the remains of three small pollack fish (*Pollachius virens*).

This is the most dashing of the jaegers, showing marvelous agility on the wing and is, by far, the most aggressive and persistent in its attacks upon other birds. In east Greenland, from all evidence, it is outnumbered by the Long-tailed Jaeger by at least ten to one. A



good share of its diet is probably carrion, as birds were often seen feeding upon seal carcasses left by the Norwegian sealers.

### *Stercorarius parasiticus* (Linnaeus). PARASITIC JAEGER.

The single specimen of the Parasitic Jaeger taken August 3, on Ymer Island, suggests food habits similar to the Pomarine Jaeger, as its stomach also contained only the remains of four pollack fish (*Pol-lachius virens*). This bird is probably the rarest of the jaegers in northeast Greenland as evidenced by the fact that a pair seen at Ymer Island were the only individuals of the species encountered.

### *Stercorarius longicaudus* Vieillot. LONG-TAILED JAEGER.

It was perhaps fortunate that as many as an even dozen stomachs of the Long-tailed Jaeger were collected on their breeding grounds, as their examination considerably modifies our conception of the feeding habits of this bird during the nesting season. The birds were all taken by Hanson at Musk-Ox Fjord, Hudson Land, northeast Greenland, on July 31.

This jaeger is very common in northeast Greenland. Flocks of eight and ten trailing after Kittiwakes were of frequent occurrence while the expedition was cruising along the coast. In the northern fjords, perhaps because of the absence of Kittiwakes, these birds forage a great deal for themselves. It was a common sight to see them hunting lemmings by hovering over the tundra, much in the manner of sparrow hawks. Three young in full plumage were collected on July 31, one of which was an example of the light phase.

A summary of the food of the 12 birds collected follows:

Stomach number	Animal food	Vegetable food	<i>Dicercotonyx groenlandicus</i>	Lepidopterous larvae	Miscellaneous insects	Birds	<i>Arctostaphylos alpina</i>	<i>Vaccinium uliginosum</i>	Miscellaneous and undetermined plants
210833.....	100	..	100	..	..	..	..	..	..
210834.....	80	20	5	55	10	10	..	..	20
210835.....	96	4	..	96	tr	..	..	2	2
210868*.....	100	..	100	..	..	..	..	..	..
210869*.....	70	30	70	..	..	..	..	..	30
210870*.....	92	8	92	..	..	..	..	8	..
210871.....	5	95	..	..	5	..	95	..	..
210872.....	100	..	100	..	..	..	..	..	..
210873.....	75	25	60	15	..	..	..	25	..
210874.....	92	8	..	81	9	..	..	..	10
210875.....	97	3	48	49	..	..	..	..	3
210876.....	100	..	100	..	..	..	..	..	..
Average per cent	83.92	16.08	56.25	24.67	2.00	.83	8.75	2.92	5.41

\* Fully fledged immature.

Both field observation and laboratory analysis show that the bird is a predatory forager of more than ordinary skill, and is by no means compelled by nature to obtain its food second-hand from what might appear to be its more successful congeners. This limited study indicates that at least during the nesting season it can subsist quite independent of the gulls that it commonly parasitizes during other periods of the year. Of the 12 stomachs examined, not one showed any evidence that the food had been obtained indirectly.

It was somewhat surprising to find that the Greenland Collared Lemming (*Dicrostonyx groenlandicus*) supplied more than half (56.25 per cent) of the food for this series and that it entered into the diet of nine of the 12 birds, forming the sole item of food for four of them. In one case, the remains of no fewer than seven lemmings were found in the stomach. It was perplexing to find that several of the rodents had been entirely decapitated before being swallowed. Løppenthin (1932, pp. 85-99) reports that the Long-tailed Jaeger breeds only in great numbers when and where small rodents are numerous. He writes that when the lemmings occur in small numbers, the birds stay in the country, but most of the pairs do not produce a brood, and in very, very bad lemming years, the jaegers disappear completely from their breeding haunts. He further remarks that the jaeger does not breed in southeast Greenland and in Iceland owing to the lack of lemmings there.

That the species purposely forages for insects is shown by the fact that five of the 12 birds had fed on lepidopterous larvae and four had fed on other insects. The lepidopterous insects averaged 24.67 per cent of all food consumed, while the miscellaneous insects, mostly flies (*Phaonia frenata* and other Diptera), bees and wasps (largely Ephialtinae), comprised an even 2 per cent. The lepidopterous larvae consisted of several varieties, including one of the cutworms (*Agrotis* sp. and Nymphalidae), and represented the principal food item for four of the birds. The unidentifiable remains of a bird comprised 10 per cent of one partly filled stomach, yet it could not be determined whether this represented carrion or a kill.

As astonishing as it was to find that the Long-tailed Jaeger had become a proficient mouser and an insectivorous feeder, it was still more surprising to find that four of the 12 birds had also become expertly frugivorous, and four others had consumed undetermined or miscellaneous vegetable material in quantity. One bird had made 95 per cent of its meal on the fruits of the bearberry (*Arctostaphylos*

*alpina*), while three others had fed extensively on the fruits of bog bilberry (*Vaccinium uliginosum*).

#### **Catharacta skua** Brünnich. NORTHERN SKUA.

Four individuals of the Northern Skua were observed by the expedition in traveling from Cape Farewell to waters north of Angmagsalik. Others were seen on the Liverpool coast at Rathbone Island, August 6, and in the ice pack out of Davy Sound, 72° N. Lat. They appeared to be very sedentary in habits and seldom evidenced any interest in the ship. These records add materially to the status of this bird in eastern Greenland inasmuch as the only previous known record is from Scoresby Sound—that of two females collected by Pedersen in May and June, 1928. The summer of 1936 was very unusual, being marked by ice-free conditions of the east Greenland coast. This may explain the numerous records of the Northern Skua and the total absence of such birds of the pack-ice as the Ivory Gull and Sabine's Gull.

#### **Larus hyperboreus** Gunnerus. GLAUCOUS GULL.

Four stomachs of the Glaucous Gull collected during the 1936 expedition confirm earlier findings (Cottam, 1936, p. 172), and show that fish is its most common fare. Each of the four birds had fed on the pollack (*Pollachius virens*), and three of them had done so exclusively. One bird, however, had made 98 per cent of its meal on the sea urchin (*Strongylocentrotus*) and the remainder on the pollack. This majestic bird was a common breeder on Andree Land, the Liverpool coast, and Ymer Island. On August 3, the young were about half grown. In two instances, the nesting sites were the ragged and steep promontories of low plateaus, while at Andree Land they nested against the nearly vertical sides of the mountains bordering the fjords.

#### **Larus marinus** Linnaeus. BLACK-BACKED GULL.

The Black-backed was found to be the most common gull in Conception Bay, Newfoundland, and at Indian Harbor, Labrador. A pair was also noted at Angmagsalik, Greenland. Near Newfoundland and Labrador, a great part of the food of this gull appeared to be bits of fish thrown overboard by fishermen. It was a characteristic feeding method of these birds to beat slowly over the shallow water between two narrow points of land, greedily seizing every morsel washed in by the waves.

**Rissa tridactyla tridactyla** (Linnaeus). ATLANTIC KITTIWAKE.

Along the Greenland coast the Kittiwake is the most abundant offshore gull. Only immatures were observed at sea during the summer as the adults remain about the breeding rocks. A few were found nesting on Rathbone Island, Liverpool coast.

Bernard Hantzsch (1928, p. 123) found that the food of Atlantic Kittiwakes is extremely variable. "At times," he writes, "they follow the immeasurable shoals of capelin (*Mallotus villosus*); at other times, they are content with crustaceans and all other little creatures of the sea." Two stomachs, examined and reported by Hantzsch, contained crabs.

Forbush (1925, p. 64) found that the bird feeds largely on "smaller fishes of the sea, on crustaceans, mollusks, and other marine animals, and like other gulls, it is more or less of a scavenger." Six stomachs taken on the 1936 Bartlett Expedition confirmed the reports that it feeds on a wide variety of pelagic forms. Fish represented the dominant item of food, occurring in all stomachs collected, and constituting the entire content of three of them. Of the stomach contents of the six birds, pollacks (*Pollachius virens*) amounted to 37.83 per cent, ling (*Urophycis* sp.) formed 15 per cent, and undetermined fish made up an additional 17.67 per cent. Squid was drawn upon to the extent of 16.83 per cent, and in two of the meals represented the dominant items. Beaks of 25 individuals were found in a single stomach. Soft-bodied crustacea, mostly amphipods (including *Gammaracanthus loricatus*) and schizopods (*Thysanoessa spinifer*), aggregated 8 per cent of the total, while polychaete worms entered into three of the meals and averaged 4 per cent of the entire consumption. Plant drift, probably taken accidentally, supplied the remaining fraction of a per cent.

**Sterna paradisaea** Brünnich. ARCTIC TERN.

Only three stomachs of the Arctic Tern, one each from Hudson Land, Ymer Island, and the open sea at about 69° N. Lat. near south Greenland coast, were available for study. Unfortunately, each of these was less than half full; consequently, the food items recorded can be considered as only suggestive of normal food tendencies. Fish occurred merely as a trace in one stomach and amounted to but 1 per cent of the food content of another. All the remaining food material consisted of soft-bodied crustacea, largely schizopods (*Thysanoessa* sp.) and undetermined amphipods. One of the birds had fed exclusively on schizopods.

**Uria aalge aalge** (Pontoppidan). ATLANTIC MURRE.

The Atlantic Murre was fairly common about Funk Island, Newfoundland; however, no specimens were collected.

**Uria lomvia lomvia** (Linnaeus). BRÜNNICH'S MURRE.

All the murrens taken on the Greenland coast were Brünnich's. They were first encountered in abundance at about 68° N. Lat. On Rathbone Island, Liverpool coast, they were found nesting by the thousands with a few Dovekies among them. Hanson noted a few young swimming with their parents August 8, on the Blossville coast.

In all, 19 birds were collected (mostly at 68° 20' N. Lat. and 25° W. Long.) and their alimentary tracts were preserved for subsequent laboratory analysis. Unfortunately, however, only nine of these were sufficiently filled to be used in the tabulation of food percentages. With members of this family, digestion is exceedingly rapid, and particularly is this true when the birds feed, as this species does, to such a large extent upon soft-bodied crustacea; consequently, among a series, a fair proportion of empty stomachs may be expected.

From the data obtained through this analysis, it is apparent that the murre subsists on items of but few species. It is obviously content to make its entire meal on a single species of sea life. Most published reports that mention the food of the bird seem to stress its piscivorous tendencies. This is not supported by our data as only one of the nine stomachs here considered contained fish, and, in this case, the stomach was much less than a fourth full. Although only sculpin (Cottidae), fish bones, and otoliths were in evidence in this holdover meal, it is not improbable that soft-bodied crustacea, which quickly digest and become unrecognizable, had formed a generous proportion of the menu. Undoubtedly, the relative degree of availability of the various forms of marine life has much to do with the selection made.

Of the eight remaining birds, four had fed exclusively upon a single species of schizopod (*Thysanoessa spinifer*), while the remaining four had drawn upon this same soft-bodied crustacean to the extent of 96 to 99 per cent of the respective meals. More than 500 of these creatures were ingested at a single meal. A large amphipod (*Themisto* sp.) formed 4 per cent and 1 per cent, respectively, of two stomachs, while *Gammarus* sp. comprised 2 per cent of another. A squid, amounting to 4 per cent of the food of one meal, was the only other item consumed by these birds. One of the stomachs, which was practically empty, contained a leg fragment of a crab.

Expressing the food content in percentages, it is found that fish formed slightly in excess of 11 per cent, while schizopods comprised nearly 88 per cent of the diet, and the two species of amphipods and the squid together represented only a little more than 1 per cent. With the exception of the one partially filled stomach containing fish fragments, these results are very similar to those obtained from previous Bartlett expeditions and reported upon by Cottam (1936, pp. 174-175), when the food was found to consist primarily of soft-bodied crustacea, with fish forming only slightly more than 1 per cent of the content.

Bent (1919, p. 194) writes that the food of Brünnich's Murre consists mainly of small fish, crustacea, and mollusks, which it obtains at sea, both on the surface and by diving.

#### Alle alle (Linnaeus). DOVEKIE.

Dovekies were first noted at 63° 20' N. Lat., but they did not become common until about one hundred miles south of Scoresby Sound. While crossing the sound in the evening, thousands of these "Little Auks" were seen feeding on the water and the air was filled with the constant murmur of their chirpings. The waters here were almost clouded from the abundant crustaceans and droppings from the birds. That these waters were rich with crustaceans was well attested by the presence of three large whales, probably the Greenland Right Whale. Nearly all the birds shot had their mouths and throats crammed with crustaceans to carry to their nests. On the Liverpool coast large flocks of Dovekies continually passed back and forth over the mountains to their nests at such an altitude as to be almost invisible.

Of six stomachs collected in July and August off the south and east Greenland coast, only four contained food. The results here obtained confirm the belief that this species shares the well-known propensity of many northern pelagic birds of feeding extensively on soft-bodied crustaceans. All but one bird had fed exclusively on amphipods, schizopods, shrimp, and other soft-bodied crustaceans, and it had drawn 93 per cent of its meal from this source. The remaining 7 per cent included a sculpin (Cottidae). The type of soft-bodied crustacean ingested is undoubtedly determined by the degree of availability of the various species.

Bernhard Hantzsch (1928, p. 92) found that of six birds taken off the coast of northern Labrador, "one contained a little gray

stone, one, fine fishbones, and the others contained little marine crustaceans, especially crabs and Gammaridae.”

**Cephus grylle arcticus**<sup>1</sup> (Brehm). NORTHERN BLACK GUILLEMOT.

If the four well-filled stomachs of the black guillemot available for the present study are indicative of food tendencies, we may conclude that crustacea, hard-shelled mollusks, squid, fish, and even the lower invertebrates are equally acceptable and all relished. Austin (1932, p. 139) states that the guillemot feeds entirely on fish, mostly capelin and lance. Hantzsch (1928, pp. 89-90) examined stomachs and found fish in four. One contained crustacean remains of which prawn were unmistakable. The other contained *Gammarus* sp. and *Atylus carinatus* and a small snail.

Of the four stomachs obtained near the Liverpool coast of east Greenland, one contained 18 whole or nearly whole *Margarites groenlandicus* and opercular fragments and shell remains of perhaps 125 additional ones, aggregating 81 per cent of the meal. Gastro-pods of two other species were also noted, but formed only 1 per cent of the content. Remains of seven squid (*Loligo* sp.) comprised the remaining 18 per cent of the meal, although remains of an undetermined fish added a trace to the volume. A second stomach was 94 per cent filled with amphipods, while the remainder consisted of 4 per cent *Margarites groenlandicus*, 1 per cent of what appeared to be ctenophore and 1 per cent brown algae. The third stomach contained only soft-bodied crustacea, including more than 225 schizopods (*Thysanoessa spinifer*), which amounted to 99 per cent of the total. The remaining meal consisted largely of amphipods, although squid had been drawn upon to the extent of 5 per cent of the content.

**Fratercula arctica naumanni** Norton. LARGE-BILLED PUFFIN.

Because the Biological Survey has no other record of a stomach examination of the Large-billed Puffin, it is to be regretted that only one half-filled stomach of this bird was submitted for examination. It was collected at Rathbone Island on the Liverpool coast of east Greenland, on August 6. The food consisted of fragments of one polychaete worm, probably a nereid, and six small pollack fish (*Pollachius virens*). In volume the former comprised 1 per cent and the fish 99 per cent of the stomach content. Another bird was taken on the Greenland coast at 68° N. Lat. but its stomach was empty.

<sup>1</sup> See Peters, 1934, p. 354.

Austin (1932, p. 143) writes that on the Labrador coast the closely related Atlantic Puffin "feeds entirely on fish, which it pursues 'flying' under water with its wings." He describes the puffin as being one of the cleverest fishermen among the alcids and maintains that it is able to catch and hold three fish at once in its bill. Six stomachs of this species (*Fratercula arctica arctica*) examined in the laboratory of the Biological Survey indicate that soft-bodied crustacea enter commonly into the bill of fare. Without doubt, the food of these two races is similar.

**Otocoris alpestris alpestris** (Linnaeus). NORTHERN HORNED LARK.

The three horned larks taken July 8 at Indian Harbor, Labrador, where the bird was a common nesting species, are of interest in that they show an unusually large proportion of animal matter in their food. One bird had consumed no fewer than 22 species of animal and plant life, while the others had each taken 12 kinds. Adult and larval Lepidoptera were consumed in numbers by each bird and averaged more than a fourth (27.33 per cent) of the entire amount consumed. These included the genus *Agrotis* sp. and undetermined Geometridae and Noctuidae. Large ants (*Camponotus* sp.) were next in the order of importance of the animal foods, averaging 7 per cent of the total. Other hymenopterous material, including ichneumon wasps, added another 5.67 per cent. A number of dipterous forms were next in order with 4.33 per cent, followed by spiders with 3.33 per cent. Leaf-hoppers, aphids, and other true bugs supplied 2.67 per cent, while mollusks, mostly a small *Mytilus edulis*, made up the remaining 1.67 per cent animal food, making an aggregate of 52 per cent.

Of the 48 per cent vegetable material, 31.67 per cent consisted of fruits and seeds of the bog bilberry (*Vaccinium uliginosum*), while the remaining consisted of cyperaceous seeds and undetermined vegetable debris.

**Corvus corax principalis** Ridgway. NORTHERN RAVEN.

A Northern Raven was reported at Cape Tattershall, Liverpool coast, by the photographer of the expedition. At Angmagsalik, Hanson collected a specimen without making food habit studies. Stomach examinations of birds taken on previous Bartlett expeditions (Cottam, 1936, p. 176) show that, like many other Corvidae, the raven is both predacious and omnivorous in its feeding habits.



**Oenanthe oenanthe leucorhoa** (Gmelin). GREENLAND  
WHEATEAR.

The Greenland Wheatear was particularly abundant about ponds in the valleys back of Angmagsalik, but no stomach collections were made.

**Anthus spinoletta rubescens** (Tunstall). AMERICAN PIPIT.

The American Pipit is an abundant species at Indian Harbor, Labrador; however, no stomach specimens were collected.

**Anthus pratensis** (Linnaeus). EUROPEAN MEADOW PIPIT.

A specimen of the meadow pipit, rare in Greenland, was taken at Angmagsalik, but unfortunately its stomach was not saved for laboratory analysis.

**Calcarius lapponicus lapponicus** (Linnaeus). LAPLAND  
LONGSPUR.

Three longspurs were collected at Angmagsalik, and, like the other passerine birds of this region, they were molting heavily. Food habit studies of the species were not made.

**Plectrophenax nivalis nivalis** (Linnaeus). EASTERN SNOW  
BUNTING.

Some half dozen snow buntings were observed about a rock slide at Hudson Land. They are also fairly common at Angmagsalik. Two stomachs were available for laboratory analysis. Both birds were taken at Hudson Land, Musk-ox Fjord, Greenland, on July 31, 1936, and both had gorged themselves on the seeds of *Carex* sp. One bird had also the fragmentary remains of an undetermined bug, a beetle, and a bee.

### MAMMALS

**Ovibos moschatus wardi** Lydekker. GREENLAND MUSK-OX.

Because of the comparative rarity of the musk-ox, it is unfortunate that the stomach of the sole specimen obtained, a calf taken at Musk-ox Fjord, northeast Greenland, was nearly empty, and the small amount of food present was so finely comminuted as to make satisfactory determination impossible. It appeared that *Salix glauca* represented the principal food item. MacFarlane (1905, p. 689) confirms the observations of Greely (1886, pp. 104-105) on the feeding habits of the Musk-ox. Greely examined a number of stomachs of these animals and made careful observation in the field

concluding that they fed almost entirely on dwarf willow, saxifrages, and grasses. In the winter, he writes that they use their hoofs in digging for their food. Manniche (1910, pp. 88-89) writes that four musk-oxen, killed on October 31, 1906, had their stomachs filled with fine grass, and that an old bull shot August 26, 1907, "contained hardly anything but grass." Others killed later contained mostly grass and a little *Salix* sp. Preble (1908, p. 154) reports that the stomach of a large bull killed at the head of Dease River on August 7 was filled with willow twigs and leaves.

**Thalarctos maritimus eogroenlandicus** (Knottnerus-Meyer).

EAST GREENLAND POLAR BEAR.

Two East Greenland Polar Bears were taken on the 1936 expedition. Their stomachs were nearly empty and contained in each case only a trace of fish and a small amount of fatty material. Fragmentary remains of Gadidae were recognized in one stomach.

From published accounts, it seems that the bulk of the food of the polar bear consists of seals. Soper (1928, p. 31) reports that it also catches young walruses and feeds infrequently on lemmings and vegetable matter. Brown (1868, p. 344) writes that although its principal food consists of seals, "it is somewhat omnivorous in its diet, and will often clear an islet of eider-duck eggs in the course of a few hours." During the sealing season, he reports, the bear is a constant attendant on the sealer for the sake of carcasses. He further writes that he has seen it feeding on different species of dead whales which are found floating.

Manniche (1910, p. 66) likewise points out that in addition to the bear's feeding on seals, its excellent smelling sense leads it to any large carcass upon which it readily feeds. He also states that it feeds on "lower marine animals which it obtains near a crack in the ice and along the seashore." Manniche further reports that he has found the remains of seals and crabs in the bear's stomach. Vegetable foods apparently are of little value to it.

**Alopex lagopus ungava** (Merriam). LABRADOR ARCTIC FOX.

A single specimen of the arctic fox was obtained by Captain Bartlett on August 6, 1935, near Bushnous Island, Melville Bay. Its stomach contents confirm the conclusion that this species is truly a predator in the northland. The animal had recently fed on a Dovekie (*Alle alle*), which comprised the sole stomach item.

From Soper's (1928, p. 35) extended studies on Baffin Island, he concluded that the fox lives largely on lemmings throughout the year. He further concluded that ptarmigan may constitute a part of the diet, and rarely the arctic hare, especially the young. During March and April, he says, the foxes capture many of the helpless young of the ringed seal in their snow dens on the ice. Preble (1902, p. 62), found the bones and feathers of various birds, principally ptarmigan, scattered about the entrance of an inhabited burrow.

#### **Alopex groenlandicus** (Bechstein). GREENLAND ARCTIC FOX.

A den of the Greenland Arctic Fox was visited at Ymer Island, northeast Greenland, on August 3, 1936. Remains of several colored lemmings (*Dicrostonyx*) and an undetermined gull were noted.

#### **Lepus arcticus groenlandicus** Rhoads. GREENLAND HARE.

Two well-filled stomachs of the Greenland Hare, taken the first week of August at North Fjord, northeast Greenland, indicate that even though the same foods were eaten by both rabbits, a fairly wide variety of succulent herbs are acceptable as articles of their diet. *Carex* sp., *Calamagrostis* sp., and *Potentilla* sp. occurred as food for both hares and averaged 47.5 per cent, 25 per cent, and 17.5 per cent respectively of the total. *Pedicularis* sp. and an undetermined grass (Poaceae) each occurred as a part of one meal, and each represented 10 per cent of the total in that particular stomach. Plant fiber of *Draba* sp. formed but a trace of one meal. Rhoads (1897, p. 359) comments that this hare seeks the sides of hills where the wind prevents the snow from lodging deeply, and where, even in winter, it can procure for food the berries of the Alpine arbutus, the bark of some dwarf willows, or evergreen leaves of the Labrador tea (*Ledum*).

Preble (1908, p. 199) found that arctic hares of the Athabaska-Mackenzie region had become so abundant in 1903 that they had eaten even dense thickets of willows and other shrubs almost to the ground. In places, the Banksian pines appeared to furnish their principal food.

#### **Cystophora cristata** (Erxleben). HOODED SEAL.

Only a single stomach was available for study and it was nearly empty. The only food items recognizable were the remains of fragmentary beaks of a few cephalopods.

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