Recent collections in northeastern North America have shown, however, that *P. coerulea* is not a rigid species in that region, for it has been found to be widely distributed throughout an area which was heavily glaciated during the Pleistocene (see fig. 3). It has thus repopulated much of the area which Hultén described as its probable migration path across northern North America.

The known distribution for North America can now be given as follows: western Alaska, eastern Mackenzie District, continental Keewatin District, northern Manitoba (*D. K. Brown 388*, Sept. 15, 1950, decumbent in shade of spruce-larch grove at edge of lake in sandy peaty soil, MacLeod Lake, (approx. 59°10'N 97°30'W) DAO; new to the flora of Manitoba), southern Baffin Island [4], around the coast of Greenland north to at least 74° north latitude in West Greenland [5] and to 72°10' north latitude in East Greenland [6] Northern Peninsula and Long Range Mountains of Newfoundland [7, 8, 9], the mountains of Gaspé, and New England [10].

In a recent letter Dr. Hultén has kindly provided the following interesting information regarding the distribution of this species: "A locality west of Great Slave Lake is very remarkable as also one in Manchuria on the Corean border. The locality in northern Italy is given in old floras and may be doubtful". The author has seen no specimens from these areas.

Rikli [11], has given the following distribution of this species for eastern North America: "In N. Amerika tritt sie in den Gebirgen der atlantischen Staaten der Union, von den White-Mountains New Hampshires durch Maine, Ontario, Quebec bis Labrador, so noch in der Umgebung von Ramah (c. 59° n) auf." The author has seen no specimens from Ontario and has not been able to find any other record of its occurrence in that province. The presence of *P. coerulea,* at least in the southern part of Ontario as indicated by this distribution, is highly doubtful.

Specimens have been examined in the Herbarium of the Division of Botany and Plant Pathology, Science Service, Canada Department of Agriculture, Ottawa (DAO) and the Herbarium of the National Museum of Canada at Ottawa. The author is indebted to Mr. Marcel Raymond, Montreal Botanical Garden, for listing the specimens in the Herbarium of that Institution and the Herbarium of the University of Montreal. He is also indebted to Dr. Bernard Boivin for his advice in the preparation of this manuscript, and to Dr. Eric Hultén for his permission to reproduce the maps from his work.

Conclusion

Phyllodoce coerulea is shown to be an example of what Hultén has described as a rigid species. It is demonstrated here, however, that at least in northeastern North America, it is not a rigid but a plastic species.

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NOTES ON FOOD HABITS OF WATERFOWL IN THE INTERIOR OF UNGAVA PENINSULA [1]

NICHOLAS POLUNIN [2] and CARL R. EKLUND [3]

THE INTERIOR of Ungava Peninsula in northern Quebec was studied in the summer of 1949 for the primary purpose of determining waterfowl species-distribution and productivity. This study was part of the annual survey of the Canadian waterfowl breeding grounds conducted jointly by the Canadian Wildlife Service and the U.S. Fish and Wildlife Service, as reported upon by Crissey, *et al.* (1949). The survey was carried out in cooperation with the Arctic Institute

1 Received for publication October 4, 1952.
2 Harvard University, Cambridge, Mass.
3 Biologist, U.S. Fish and Wildlife Service, Washington, D.C.

of North America and was financed by a grant from the Institute with funds provided by the United States government[4]. The field party consisted of Leon D. Cool, Game Management Agent — Pilot of the Fish and Wildlife Service, and Eklund, with Polunin joining in for a few days toward the end.

Bird skins representing twenty-one species and skins and skulls of three mammal species were collected, together with stomach contents of Canada geese, a Black Duck, and an Old-squaw, and crop contents of Willow Ptarmigan and Rock Ptarmigan. In addition, plants were collected at seven ground stations occupied in the interior. Polunin made the stomach analyses of the geese and identified all plant collections. Contents of the duck stomachs were determined at the U.S. Fish and Wildlife Service Patuxent Research Refuge.

Field work was carried out between June 29 and August 3, 1949. The main bases of operation were the military air base at Fort Chimo on the Koksoak River, and Payne Lake at Latitude 50°19'N., Longitude 73°27' W. The U.S. Air Force parachuted oil and gasoline at the camp on Payne Lake, and from this point it was possible to occupy other ground stations within a 200-mile radius. Operations were carried out with a single-engine Fairchild 24 equipped with pontoons.

Aquatic plants which are of importance for waterfowl food appeared to be almost entirely lacking in the area studied. In any event, the aquatics are relatively unimportant in comparison with the semi-aquatic or terrestrial plants. In an effort to obtain an indication of important food sources, stomach contents of an Ungava Canada Goose (*Branta canadensis interior* Todd), and an Old-squaw (*Clangula hyemalis*) were collected at Payne Lake on July 22. Three other geese of this same subspecies and a Black Duck (*Anas rubripes*) were taken on Gregory (Octopus) Lake at Latitude 58°29' N., Longitude 70°06' W. on July 27. Stomach contents from these specimens are the basis for these notes. While this is an extremely small sample it may be of some interest and value as apparently no waterfowl-stomach collections had previously been made in these areas.

Payne Lake is the largest of the Ungava lakes within the tundra region, and vegetation on the surrounding terrain is characterized by a vast array of mosses and lichens, sedges (*Carex* spp.), grasses, willows, dwarf birch (*Betaula glandulosa*), baked-apple or cloudberry (*Rubus chamaemorus*), narrow-leaved Labrador tea (*Ledum palustre* var. *decumbens*), and arctic blueberry (*Vaccinimum uliginosum* var. *alpinum*). The plant communities are in general comparable with those described for nearby coastal localities by Polunin (1948). Gregory Lake is located not far south of the tree line in what is commonly termed forest tundra, and the terrain and vegetation of the area have been described in outline by Polunin (1949).

STOMACH ANALYSES

The gizzard contents of the goose specimen collected at Payne Lake looked like gritty grey mud with some intermixed organic shreds. It gave the impression that the bird had been feeding on algal-invested mudflats or lake-bottoms, but microscopic examination immediately showed the organic material to be of vascular plant origin, most of it evidently resulting from the breakdown of leaves of sedges and/or grasses. Organic material composed about half of the bulk, and about half of this was of narrow shreds of leaf, up to nearly 1 cm. long, containing usually a single vascular bundle; the other half consisted of still further broken down, more or less colloidal, particles. The remainder was of mineral origin and consisted of coarse sand or grits up to 3 mm. in diameter, and finer material including a considerable proportion of whitish sand. The total contents of the gizzard measured about 20 cc. The oesophagus was empty.

In goose specimen 1 from Gregory Lake the oesophagus and gizzard contents totaled about 18 cc., of which approximately one-quarter by bulk was mineral material of fine whitish sand, with some coarse sand or grits from 1 to 3 or occasionally 4 mm. in diameter. The remaining three-quarters by bulk was of organic material, much the greater part being of portions of leaves of *Carex* spp. (mostly of *C. aquatilis*) up to 10 cm. in length. Also determined were the tip of a branch of *Vaccinium uliginosum* var. *alpinum* bearing three small leaves; four small leaves of *Polygonum viviparum;* a scrap of coniferous "touch-wood" (such as is often found floating on lakes and pools in forested areas, and which is apt to be left on herbage or shores when the water recedes); the shoot of a dicotyledonous plant locking leaves; five leaves of *Pedicularis flammea;* and a few small leaves apparently of a grass. This last could have been the almost ubiquitous *Poa arctica*. Most of the leaves of

4 Data obtained will be used by Eklund in a doctorate thesis at the University of Maryland.

the *Polygonum* and the *Pedicularis* were complete with petioles, and almost all of the material appeared to have been browsed when fresh. These are typically marsh plants, though not exclusively so. No algal or other cryptogamic material was found.

The contents in the gizzard and the oesophagus of the second goose specimen from Gregory Lake totaled about 27cc. About one-quarter of the bulk was of mineral material, largely coarse sand and grits up to 4 mm. in diameter. The remainder consisted of plant material, of which about two-thirds was too disintegrated to identify although clearly it was for the most part of monocotyledonous origin — chiefly shreds of leaf material of sedges and/or grasses. Identifiable among the larger pieces were fairly numerous scraps of leaves of *Carex* spp.; about ten stems of *Juncus* spp.; fifteen pieces of leaves of, apparently, *Luzula parviflora* (several were clearly of this species, being characteristic and nearly 1 cm. wide); several scraps of *Stellaria longipes* s. l. stems with attached leaves; and four scraps of *Polytrichum* cf. *alpinum.* Other, smaller scraps of mosses (2 of *Hypnum* sp. and 3 of *Bryum* sp. or spp.) were included, perhaps by chance; pieces of leaf of *Polygonum viviparum;* scraps of two different, black and withered leaves of *Salix* sp.; the top of an inflorescence of *Calamagrostis neglecta;* three short pieces of slender grass stem which could have been from the *Calamagrostis;* and two fresh-looking leaves of *Cochlearia officinalis* s. l. which suggested seashore feeding although this plant in some forms is apt to occur in marshy and some other habitats inland. Although there was little flowering or fruiting material on the whole, there was found one characteristic part of an inflorescence of *Carex vaginata* and another of *Poa arctica,* and what might have been young fruits of *Luzula parviflora.* Far more important in contributing such bulk as to suggest some degree of selective feeding were (1) stems of *Equisetum arvense* which comprised perhaps one-seventh of the total bulk, and (2) a lesser but still considerable amount of leaf material of *Achillea millefolium* s. l., which suggested a drier habitat than most of the other determinable material. *Equisetum arvense,* while often plentifully scattered in marshes, grows gregariously in drier, especially sandy situations which it may colonize vigorously, and its bulk in this material suggested that the bird might have been feeding in such an area, where it would be more likely to find the *Achillea* than in moist habitats. This is supported by the dense branching of the *Equisetum* material, which in this form is more typical of dry than of moist habitats. Some very narrow, indeterminable grass leaves up to 8 cm. in length were also found in this sample.

The stomach contents of the third goose specimen from Gregory Lake were very similar to those of specimen 1 from this lake, though the total volume was larger, being about 30 cc. The pieces of *Carex* leaf tended to be larger, some being as much as 15 cm. long. There appeared to be less mineral matter than in the other specimens, the amount being roughly estimated as about one-sixth of the total volume. Leaves or portions of leaves of *Carex* spp. composed most of the bulk. These tended to be softer and narrower than in specimen 1, and they appeared to consist substantially of *C. canescens,* of which there were also about a dozen young flowering axes represented in the material. Some were advanced enough for determination but others may possibly have belonged to *C. brunnescens,* as suggested by some of the narrow leaves. There were also at least four flowering axes of what appeared to be *Carex aquatilis,* although they were too young for certain determination. Also identified were a single flowering axis of *Juncus albescens* and several "budding" ones apparently of *J. filiformis.* The only dicotyledonous material detected consisted of ten more or less whole leaves of *Pedicularis flammea* and two of *Polygonum viviparum,* all of which appeared to have been in a fresh condition when eaten. There were also included a few very narrow and scabrous leaves apparently of some grass. In this sample the material seemed to be less broken down than in the second specimen from Gregory Lake, although practically all probably came from the *Carex* leaves which appeared to form the main article of diet.

Stomach contents of an Old-squaw Duck contained 3.5 cc. by volume, of which 75 percent was composed of grit. The food content was 100 percent animal matter, and this consisted of fragments of several Caddisfly larvae and their cases (Trichoptera).

The contents of the Black Duck stomach contained 3.8 cc. by volume of which 2 cc., or 53 percent, was grit. The food eaten consisted of 97 percent vegetable matter and the remainder was animal matter. The plants consisted of 5 percent crowberry seeds *(Empetrum nigrum);* 3 percent marestail seeds (*Hippuris vulgaris*); 3 percent butter-

cup seeds (*Ranunculus* sp.); 1 percent seeds of cinquefoil (*Potentilla* sp.); 5 percent immature *Carex* sp. seeds; 35 percent finely-ground fibers from a seed plant, possibly *Carex;* and 45 percent finely-ground filamentous algae. The latter may have been taken incidentally to the feeding on more desirable plant foods. The animal matter was composed of fragments of diving beetle (*Colymbetes* sp.), traces of water mites, and fragments of operculi from several snails.

Only the most tentative conclusions can be drawn from these limited samplings. It may be said that the geese in these areas, and at this time, tend to feed predominantly on monocotyledonous plants that grow in damp situations, since in all stomach contents collected the main bulk was of leaves of sedges, grasses, or grass-like plants, though on occasion there was a substantial admixture of stems of *Equisetum* and, in others, what appeared to be more than chance scraps of leaves of *Pedicularis flammea, Polygonum viviparum,* and even in one instance of *Achillea millefolium* s.l. One-sixth to one-half of the total volume of contents consisted of mineral matter. The Black Duck, likewise, fed principally on vegetable matter. Food taken by the Old-squaw Duck consisted of animal matter, as would be expected. In this respect it might be said that lack of insect food in Ungava during the summer, would never be a limiting factor in the distribution of the Old-squaw!

No sign of Algae, Lichenes, Bryophyta, or Fungi was observed in the geese, except for what looked like a smut on one of the sedges, and the few, probably chance, scraps of mosses found in one sample. Apart from the predominant sedges and/or grasses, a considerable range of both monocotyledonous and dicotyledonous material was found, apparently indicating a lack of precise selectivity, though its total bulk seemed usually to be negligible.

In goose specimens 1 and 3 from Gregory Lake the birds appeared to have been feeding largely or entirely in marshy or other wet areas along the lakeshore, for with one exception all of the plants identified in the gizzards and oesophagi were typical marsh plants, and although some are able to grow in other habitats they rarely do so in abundance or together. The exception is *Juncus filiformis,* which in this region is more characteristic of sheltered grassy slopes and late-snow areas, although it also occurs on wet shores and occasionally in marshes. There seems no reason to doubt that the goose taken at Payne Lake had also been feeding in a similar area. Nothing was identified from the contents of its gizzard, but the material appeared to be all of monocotyledonous origin, and other land habitats are not populated predominantly by such plants in this region.

Plants found in the second goose specimen taken at Gregory Lake can occur in marshes, and some are largely restricted thereto (including the frequent hummocks in them), while several are more characteristic of other habitats — *Cochlearia* of seashores, *Stellaria longipes* and *Polytrichum* of drier areas, and *Equisetum arvense* and *Achillea millefolium* of well-drained situations, at least when growing in any abundance in the vicinity. Accordingly, the impression is gained that this bird fed partly in marshes and partly on sandy banks nearby, such as are plentiful around the shores of Gregory Lake. In general, however, the sedgy marshes that develop most luxuriantly around lakes and tarns in the North, with perhaps some of the damper grassy plains of extensive flat areas, appear to constitute the favorite summer browsing grounds of geese, as has frequently been observed in Spitsbergen as well as in various parts of the Canadian Arctic Archipelago (Polunin, 1948).

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