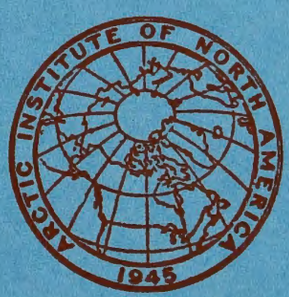
ARCTIC INSTITUTE OF NORTH AMERICA

TECHNICAL PAPER NO. 7

OBSERVATIONS ON CANADIAN ARCTIC *LARUS* GULLS, AND ON THE TAXONOMY OF *L. THAYERI* BROOKS

By

A. H. MACPHERSON



PUBLISHED OCTOBER 1961

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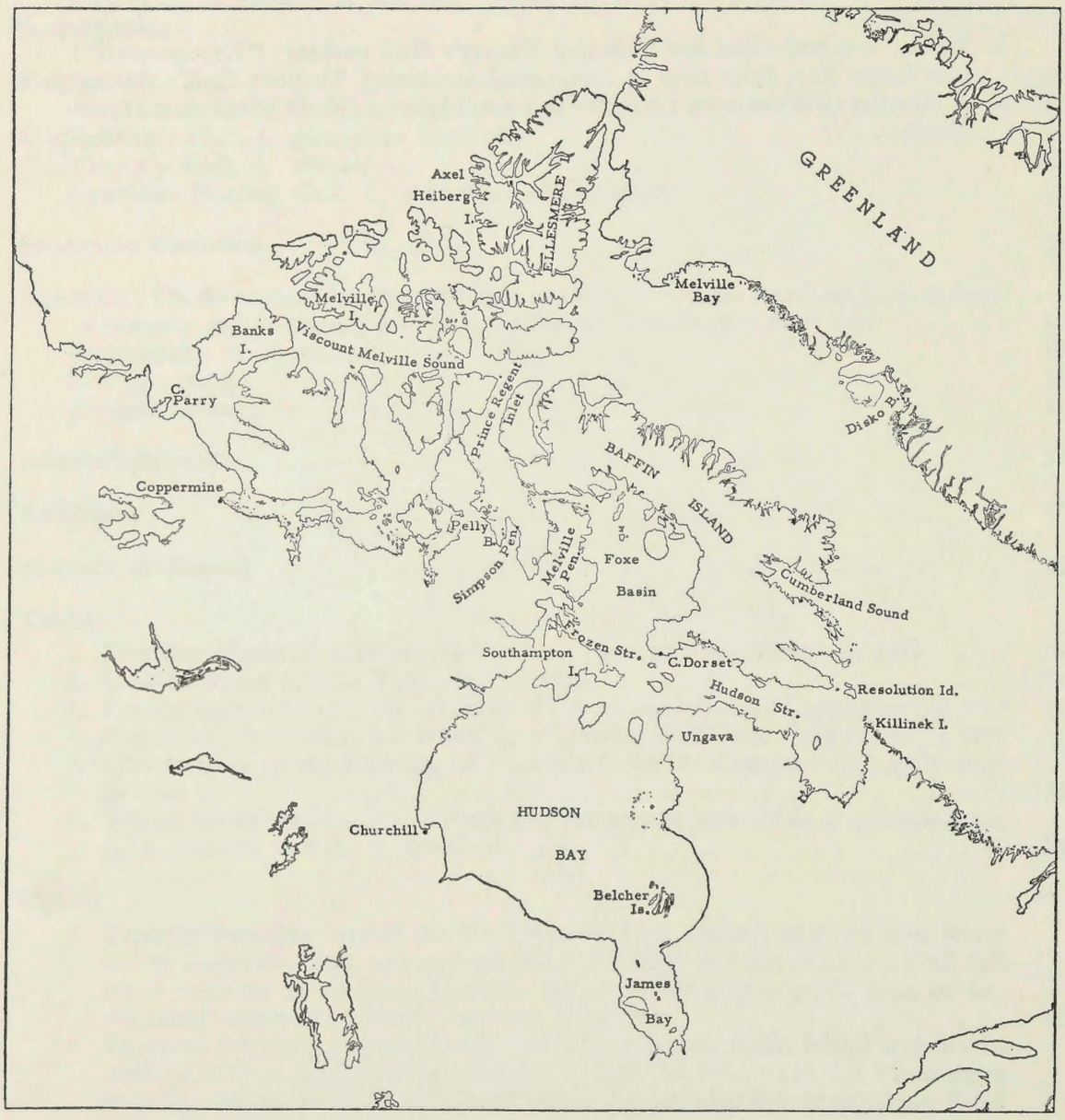

General sketch-map

OBSERVATIONS ON CANADIAN ARCTIC *LARUS* GULLS, AND ON THE TAXONOMY OF *L. THAYERI* BROOKS[1]

A. H. Macpherson[2]

Abstract

Previous work is summarized, and breeding records from northern Canada are plotted on maps. Two seasons were spent in the field. The resulting observations on breeding biology and morphology, and a study of specimens in the National Museum of Canada, indicate that *L. thayeri* is more closely related to *L. glaucoides kumlieni* than to *L. argentatus smithsonianus*. The form is therefore assigned to the species *L. glaucoides*. The characters shared in common by races of the latter species include preference for cliff-nesting, gregarious breeding habits, and possession of a purplish-red orbital ring.

Natal down and juvenal plumage of *hyperboreus*, *kumlieni*, *thayeri*, and *smithsonianus* are compared and contrasted in an appendix.

Introduction

THE large gulls of the Canadian Arctic have been known to most ornithologists chiefly in the form of study skins and at best as winter migrants. Few have seen them on their breeding grounds, and those that have done so have seldom had time to do more than make a collection of specimens for later examination. The present report owes much to Manning's recent study (Manning *et al.*, 1956) in which he described differences in nesting habits between the gulls and compared available information on the colours of their soft parts. The following account describes the taxonomic history of each form, particularly in the years since the publication of Dwight's monumental work (1925). It summarizes our knowledge of breeding ranges and sympatry, describes the observations made in two summers among the gulls, and sets forth conclusions and speculations on the relationships of the forms and their nearctic history.

The following members of the genus *Larus* occur in arctic Canada:

Glaucous Gull, *L. hyperboreus hyperboreus* Gunnerus
Point Barrow Gull, *L. hyperboreus barrovianus* Ridgway
Kumlien's Gull, *L. glaucoides kumlieni* Brewster
American Herring Gull, *L. argentatus smithsonianus* Coues
Thayer's Gull, *L. thayeri* Brooks

Other gulls that will be mentioned are:

Iceland Gull, *L. glaucoides glaucoides* Meyer
Glaucous-winged Gull, *L. glaucescens* Naumann

[1]Based on a thesis submitted to McGill University in 1957 as a requirement for the degree of M.Sc.

[2]Biologist, Canadian Wildlife Service, Ottawa.

Taxonomic history

Glaucous Gull, *L. h. hyperboreus* and Point Barrow Gull, *L. h. barrovianus*

The Glaucous Gull is a large, white-winged gull of almost circumpolar distribution, breeding in the Arctic and Subarctic and wintering on the shores of both the Atlantic and Pacific oceans. The Point Barrow Gull is considered to be a representative of the species, characterized by smaller size and darker mantle, and occupying a small breeding range on the coasts of the Western Canadian Arctic mainland and northern Alaska. The latter form was first described by Ridgway (1886), as a separate species. Dwight (1906), however, considered it inseparable from the Glaucous Gull and the form was omitted from the 1910 edition of the A.O.U. Check-list. After Oberholser (1918) redescribed the form, and presented it as a race of *L. hyperboreus*, Dwight (1919) again found it inseparable from the nominate race. Bishop (1927) later reiterated the distinctness of *barrovianus*, and Rand (1942) agreed. On the basis of Rand's findings, the form was reinstated (A.O.U., 1945, p. 441). Both Bailey (1948, pp. 238–40) and Manning (Manning *et al.*, 1956, p. 94) have since compared the measurements of Glaucous and Point Barrow gulls, and their conclusions support the view that the latter is a distinct form.

Manning (Manning *et al.*, 1956, p. 92) also found the Glaucous Gulls of the Western Canadian Arctic islands to average smaller in wing, bill, and tarsus than those of the Eastern Canadian Arctic, indicating a cline in diminishing size toward the Point Barrow Gull in the west. He believed this fact decreased the likelihood of the direct relationship between the Point Barrow Gull and the Iceland Gull, *L. g. glaucoides*, postulated by Bailey (1948, p. 240). The possibility that the Point Barrow Gull is connected to the Iceland Gull through a palaearctic population is also unlikely, as a large, pale Glaucous Gull, *L. h. pallidissimus*, has been described from eastern Siberia (Portenko, 1939). As Manning points out, this form does not necessarily differ from the Glaucous Gull of the Canadian Arctic, but it is impossible to compare the measurements of the two populations, from the literature, as those given by Portenko for *pallidissimus* were not divided by sex.

Portenko provisionally referred the Canadian Arctic population to *pallidissimus*. His argument against the validity of *barrovianus* is perhaps a consequence of this step, as it would be surprising if identical Siberian and Canadian populations were separated by distinct races in western Eurasia and western North America. Portenko did not, however, discuss the distinctive size characteristics of *barrovianus*, and his argument can therefore not be accepted. Johansen (1958, p. 124) has suggested that *barrovianus*, while properly regarded as a subspecies of *hyperboreus*, shows a probable *L. glaucescens* influence. It is possible that a strong case could be made for the conspecificity of *barrovianus* and *glaucescens*[1], although existing subadult plumage descriptions might be hard to reconcile with this view.

[1]The relationships of *L. glaucescens* are not examined here. I consider it possible that it is closely related to *thayeri*, as according to Brooks (1937) the orbital rings of the two forms are identical in colour. The fact that an occasional specimen of *thayeri* has a wing pattern very similar to that of *glaucescens*, and that it winters in the same region, may also be of significance.

Kumlien's Gull, *L. glaucoides kumlieni*

Kumlien's Gull breeds on the shores of Hudson Strait and on the east coast of Baffin Island; it is a comparatively small gull, with obscure dark markings on the tips of the primaries.

During Kumlien's zoological reconnaissance of Cumberland Sound, eastern Baffin Island, he observed small gulls with restricted grey markings at the tips of their primaries, of which he collected one. These Kumlien (1879, pp. 98–9) believed to be the first Glaucous-winged Gulls recorded from the Atlantic coasts of the continent. However, his specimen and a few winter specimens were shortly thereafter described and assigned to a new species, *L. kumlieni* (Brewster, 1883). Dwight (1906, pp. 36–7), after a study of 22 specimens, accepted the species provisionally, but in a later paper (1925, pp. 195–7), judging from an apparent overlap in wing pattern between Thayer's Gull on the one hand and the Iceland Gull on the other, he concluded that Kumlien's Gull was of hybrid origin. The form was therefore omitted from the fourth edition of the A.O.U. Check-list, published in 1931. With the discovery of the limited breeding range of Kumlien's Gull, removed from the ranges of its supposedly intergrading parents (Soper, 1928, p. 83), and the collection of a new series of breeding adults, Kumlien's Gull was reinstated by Taverner (1933) as a full species. Rand (1942), in a review of northern gulls, suggested that Kumlien's Gull was subspecifically related to the Iceland Gull, and this view has been adopted. Salomonsen (1950–1, p. 320) believes with Rand that Kumlien's Gull is a subspecies of *L. glaucoides*, but apparently rejects Taverner's argument against Dwight's view that it had a hybrid origin. He believes that *kumlieni* is of hybrid *thayeri* x *glaucoides* origin, "which as it inhabits an isolated, restricted area, has become fixed."

American Herring Gull, *L. argentatus smithsonianus*

Races of the Herring Gull, an adaptable and abundant species, are found breeding throughout most of the northern holarctic mainland.

The American race is a fairly large gull with an extensive black pattern at the ends of the primaries. It is somewhat larger than the European nominate race, and usually differs from it in adult wing pattern (Coues, 1863, p. 297). The slightly smaller average size and paler mantle distinguish it from the Siberian race, *L. a. vegæ* (Dwight, 1925, pp. 182, 191, 194).

Thayer's Gull, *L. thayeri*

Thayer's Gull nests only in arctic Canada and in a small area of northwest Greenland. It is intermediate between Kumlien's Gull and the American Herring Gull in size and in the amount and intensity of dark patterning on the primaries.

Thayer's Gull was known to the early explorers of Viscount Melville Sound, Prince Regent Inlet, and Melville Peninsula under various names. By some it was clearly considered a variety of the "Silvery" or Iceland Gull. Temminck held the latter to be a variety of *L. argentatus* whose peculiarity in lacking pigmentation on the primary feathers was "occasioned by climate" (Sabine, 1824, p. cciv). Thayer's Gull was later referred to *L. argentatoides* of Bonaparte (Swainson and Richardson, 1831, pp. 417–8), but the name was believed by Dwight (1925, p. 195) to be of questionable applicability.

The form was described and named by W. S. Brooks (1915, pp. 373–5) from breeding specimens collected on the eastern coast of Ellesmere Island, and additional specimens (migrants) from Alaska. Dwight (1917), believing that his small series exhibited intergradation with the Herring Gull, decided that Thayer's Gull was conspecific with that form, and perhaps more closely related to the European than to the American race (1925, p. 195). This opinion remained unchallenged until Allan Brooks (1937) stated his belief that Thayer's Gull would prove to be specifically distinct from the Herring Gull. He thought it also distinct from Kumlien's Gull, largely because his information indicated a radical difference in the colour of the orbital ring in the two forms.

Hørring and Salomonsen (1941, p. 50) expressed the opinion that Thayer's Gull was conspecific not only with the Herring Gull, but also with the Iceland Gull and Kumlien's Gull. Salomonsen later (1950–1, p. 320) omitted the Herring Gull from the proposed polytypic species on the evidence of a range overlap between it and Thayer's Gull in the Frozen Strait region of northwest Hudson Bay. Manning (Manning *et al.*, 1956, p. 98) saw no reason to believe Thayer's Gull more closely related to Kumlien's Gull than to the Herring Gull, as its mantle is darker than that of either, and descriptions of the iris on the labels of four wintering Kumlien's Gulls in the National Museum of Canada indicated no great similarity to the iris of Thayer's Gull as described by Brooks (1937). He was therefore inclined to the belief that Thayer's Gull was specifically distinct from the other gulls of the Canadian Arctic.

The A.O.U. Check-list has followed the opinion of Dwight on the relationships of Thayer's Gull since its edition of 1931.

Investigations

The larger gulls of northern Canada, whose taxonomic fortunes have been followed in the preceding paragraphs, are similar in general appearance and habits, and differ from each other principally in size, and in the absence or degree of black patterning near the tips of the primary flight feathers. These characters are useful in the assignment of specimens to their particular form, but cannot indicate the degree of relationship obtaining between forms, for all may be placed in a series exhibiting overlap or only minor discontinuities in size and wing pattern. If characters other than these are ignored, and the forms considered links of a chain with a comparable degree of relationship between adjacent links (as in Rand, 1942), it is implied that differentiation has occurred in sequence, starting from one of the links and preceding toward the end or ends of the series.

This view seems difficult to reconcile with the known distribution of the gulls, and it appeared to me to create more problems than it solved. The view of Salomonsen (1950–1, p. 320), that the Iceland Gull, Kumlien's Gull, and Thayer's Gull formed a polytypic species appeared to accord better with the facts, and the present investigation was therefore designed to uncover evidence for or against Salomonsen's hypothesis.

Field work during two seasons was directed toward finding out whether or not interbreeding occurred in regions of overlap between breeding ranges, and, if not, toward identification of the factors responsible for reproductive

isolation. As the locations of mixed rookeries suitable for direct observation of pair formation were unknown to me, it was necessary to compare observations made independently on each form, and to assess the relative importance of the differences thus discovered in ensuring reproductive isolation.

Data were secured on the breeding of the gulls, and on the location and characteristics of their breeding sites. Specimens of adults, subadults, juveniles, and downy young were made for comparative studies. Most adult specimens were shot while flying about their nests. Downy young were collected from nests; some juveniles were taken at the breeding sites and some after they had abandoned the rookeries in the fall.

The specimens were examined, weighed, and prepared as soon as possible after death. Whenever practicable the colours of the soft parts were compared with the named colour plates of a copy of Ridgway (1912), lent to me by the National Museum of Canada. Because of the value of this borrowed book, I was loath to expose it to the hazards of canoe or sledge travel, and the colours of many specimens therefore could not be given Ridgway's names. It is believed from the descriptions made in the field that none of those specimens not compared with Ridgway's plates differed much from those properly recorded, nor, it is believed, appreciably narrowed the gaps (where such exist) between the forms. Colour names which refer to Ridgway's plates are capitalized.

The colours described for each form in the following pages were, unless otherwise stated, obtained from fresh specimens that were judged completely adult from an examination of plumage and bill. It is not feasible to collect particular birds from rookeries of Kumlien's or Thayer's gulls; one has to shoot the few that come within range. The birds that were collected were believed by their behaviour to be breeding, but there is no guarantee in some cases that they actually were. Breeding birds that nevertheless retained some evidence of immaturity are not included in the samples without comment.

Collecting schedules were unfortunately not designed to test the possibility that soft-part colouration varies through the year, or even through the breeding season. Unless otherwise mentioned, there was no evidence in any of the series to suggest that the colours did so vary. I believe that further study on seasonal, sexual, and geographical variation of soft-part colouration in the gulls would be well worth while.

Breeding records have been compiled and are shown in the range maps, Figs. 1 to 3. The number beside each marked breeding site refers to a publication or an unpublished observation in the numbered list of references (pp. 37–9). The literature references given are not necessarily those of the original observation, for papers listing several records have been used whenever possible. Only definite statements of breeding at identifiable places, or statements that eggs, nestlings, or very weakly flying young were taken or observed, have been used in compiling the maps. The only places where the breeding form is questionable are those taken from Bray (1943), and identified by the number 10. Bray did not distinguish between nesting sites of Herring Gulls and Thayer's Gulls. I have taken his "Herring Gulls" breeding on cliffs to be Thayer's Gulls, and those breeding on boulders or on the ground to be Herring Gulls. Manning has informed me (orally) that the colonies on the east side

of Foxe Basin mentioned in Bray's paper were on flat ground, and Dr. L. L. Snyder has kindly advised me that 18 of the 19 specimens (including 3 downy young) taken by Manning at breeding colonies in this area were Herring Gulls. The single exception, an adult Thayer's Gull, may be presumed a wanderer.

It was decided to limit field work to two seasons, to be spent working on Kumlien's Gull and Thayer's Gull, and on sympatric Glaucous Gulls and Herring Gulls if possible. The Iceland Gull and the Point Barrow Gull were not studied in the field.

Cape Dorset, southwest Baffin Island, the most accessible settlement near known breeding colonies of Kumlien's Gull, was selected as a base for the summer work of 1955. Glaucous Gulls and Herring Gulls also nested in the Cape Dorset region.

Through the courtesy of the Foundation Company of Canada, I flew to Coral Harbour, Southampton Island, and thence by chartered Arctic Wings Norseman aircraft to Cape Dorset, Baffin Island, arriving on May 7. The first month was spent learning of rookeries in the region, and doing general ornithological collecting, particularly in the vicinity of the edge of the land-fast ice[1]. From June 11 to July 22 the progress of laying, incubation, and hatching was followed at a Kumlien's Gull colony about five miles southwest of the settlement, and at scattered nests of Herring and Glaucous gulls in the vicinity. The coast was then examined by whaleboat to the east and west, from north of the limit of the range of Kumlien's Gull in western Foxe Peninsula to near the abandoned trading post of Amadjuak, a distance of about 225 miles. The main objects of these journeys were the banding of chicks and the making of a gull census. In mid-September I travelled to Churchill by the Hudson's Bay Company vessel *Rupertsland*. A brief account of the work done has been published (Macpherson, 1955).

For the second summer's field work, I would like to have visited the north shore of Frozen Strait, northwest Hudson Bay, which lies within the reported ranges of Thayer's Gull, the Glaucous Gull, and the Herring Gull, but the cost of transport was prohibitive. Instead, I chose the Pelly Bay region of the Central Arctic, newly accessible owing to the Distant Early Warning Line, in the hope that a similar overlap occurred there. A faunal survey was needed of this general area, and costs would be reduced as another biologist, Dr. W. F. Black, was anxious to investigate the marine fauna.

Owing to unavoidable delays, we did not reach Pelly Bay until 8 June 1956, and could do very little work until the arrival of our supplies and equipment ten days later. A young Eskimo, Alexis, joined us on June 20, and remained with us for the rest of the field season. We first examined gull rookeries on the mainland and on islands in the frozen bay, to select the most suitable colony for study. The only gulls breeding in the region were Glaucous and Thayer's gulls. The colony chosen was visited periodically during July, specimens were collected from other colonies, and general ornithological work was also carried out in this period. In early August, the bay was sufficiently ice-free to allow us to travel by canoe, and parts of the eastern, southern, and western shores of the bay were visited between then and early September. We left the region on September 24. A brief account of our work has been published (Macpherson, 1958).

[1]Hereafter referred to as the "floe-edge", a term in general use in northern Canada.

Plate 1. A mixed Glaucous Gull and Kumlien's Gull rookery ("Malitjuak") on Mallik Island near Dorset Island.

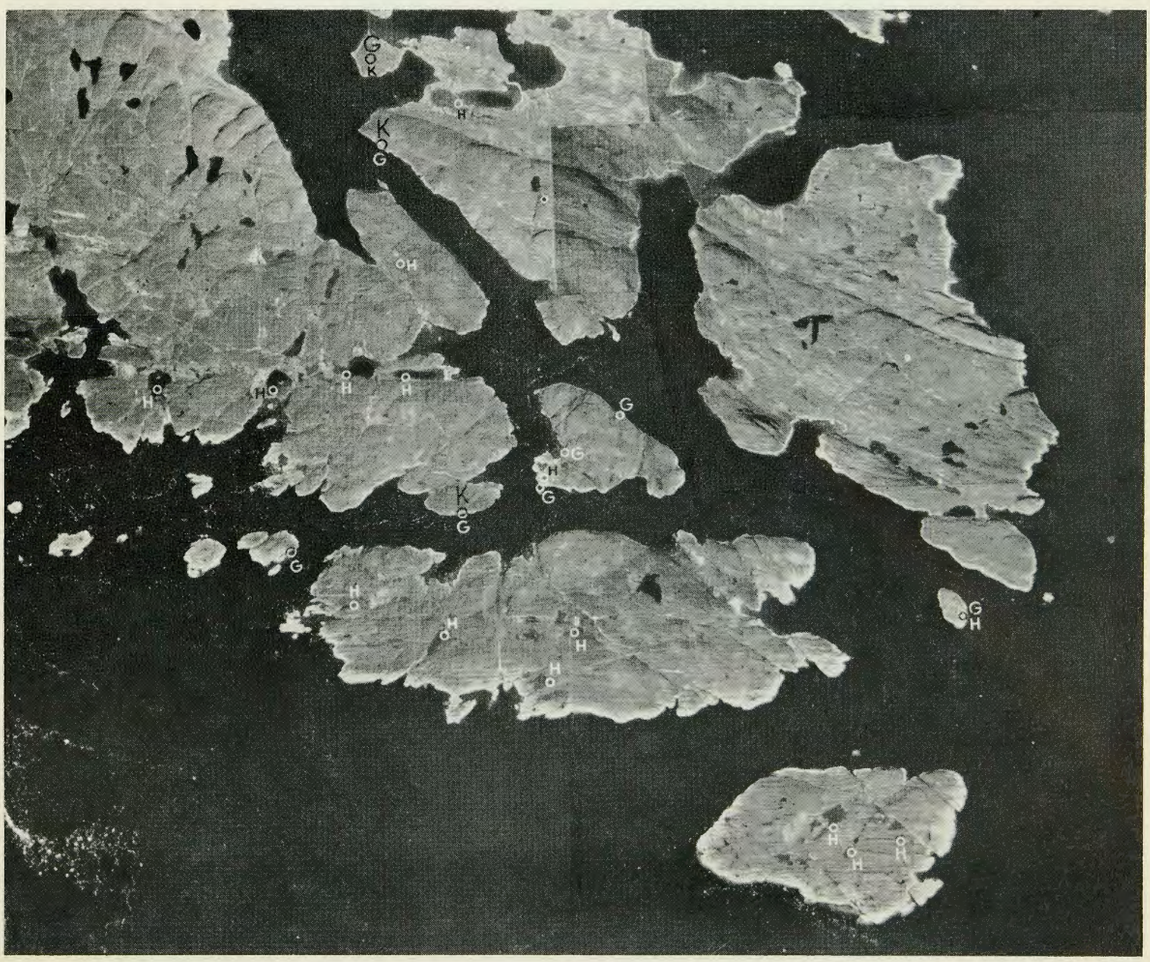

Plate 2. The vicinity of Cape Dorset, southwest Baffin Island, showing the breeding places of gulls. The letters "G", "K", and "H" stand respectively for "Glaucous Gull", "Kumlien's Gull", and "Herring Gull". For the larger mixed rookeries the comparative size of the letters shows which species was the more abundant.

Photo: R.C.A.F.

Plate 3. The vicinity of Login Bay, Pelly Bay, showing the breeding places of gulls. The letters stand for "Glaucous Gull" and "Thayer's Gull"; at the mixed colony ("Krangerarvik") the larger letter shows which species was the more abundant.

Photo: R.C.A.F.

Field observations

Glaucous Gull, *L. h. hyperboreus*

Glaucous Gulls, some apparently paired, were present at the floe-edge near Cape Dorset on 10 May 1955, when it was first visited. They were feeding in open water among the floes, probably on plankton and small fish. Several appeared to be hunting, perhaps for carrion or for disabled birds.

Between 9 and 20 June 1956, a maximum of 8 Glaucous Gulls was seen feeding with up to 75 Thayer's Gulls at the garbage dump of a radar site on Simpson Peninsula. As no Glaucous Gulls were seen on June 10 at a rookery of about 100 pairs of Thayer's Gulls some four miles from the dump, and several were seen about frozen lakes inland, the birds were probably attached to nesting sites on the lakes and rivers, which were not yet sufficiently thawed for nesting to begin.

Nesting habitat

On the southwest coast of Baffin Island, Glaucous Gulls nested mainly on the steep cliffs fringing the shore. They frequently shared cliff rookeries with Kumlien's Gulls, where they made up on the average about 15 per cent of the breeding gulls (Table 1). One cliff rookery occupied by four pairs of Glaucous and two pairs of Herring gulls was also found (Plate 2, small island at lower right). Glaucous Gulls sometimes formed small homogeneous colonies of five or six pairs, and occasionally nested singly on shoals or cliffs. They rarely nested on solitary lake boulders (two nests found), the preferred situations of the Herring Gulls of the region.

At Pelly Bay, Glaucous Gulls were rather uncommon at the Thayer's Gull cliff rookeries (see Table 2), but nested sparsely on islets in lakes and between the channels of rivers. About five pairs nested on the bank of an island in the flood-plain of the "Kugajuk River"[1] which enters Pelly Bay near the mission. A sandy islet at the mouth of the Kellett River held 14 Glaucous Gull nests, and about the same number was found on the grassy southern slopes of a small rocky islet off the southeast coast of a large island, called locally "Krikriktajuakajuk", at the head of Pelly Bay.

Similar regional differences in nesting habits have previously been mentioned by Manning *et al.* (1956, p. 92), between the Glaucous Gulls of northwestern Ungava and the Hudson Bay islands on the one hand, and those of Banks Island on the other. The differences are probably due to the fact that the Herring Gull nests in the Eastern Arctic, but not at Pelly Bay nor on Banks Island, and that it competes successfully with the Glaucous Gull for nesting sites on islets in lakes. The Glaucous Gull thus nests in Arctic Canada in rookeries of gulls of other species, or singly and in small groups of cliffs, rocky shores, and skerries, or solitarily on lake boulders and islets. It does not appear to form large pure colonies as it does in Disko Bay (Salomonsen, 1950–1, p. 304).

Egg-laying, incubation, and hatching

In the Cape Dorset region, the first indication of attachment to nesting sites was observed on May 27, when a stretch of cliff three and one-half miles

[1]Place names given in quotation marks have not been adopted by the Board on Geographical Names.

long was defended by a pair of Glaucous Gulls. The following day, 6 Glaucous Gulls were seen at a prospective rookery, and were easily provoked into a display of alarm-calling. On June 15, 5 gulls were apparently incubating on inaccessible nests at the "Sungasuk" rookery, and on June 16 an egg from a clutch of three found on a nearby islet contained a large embryo with feather rudiments. The results of observations made on 9 nests during the summer are shown in Table 3.

Little information was secured on the breeding of Pelly Bay Glaucous Gulls. One was seen defending a nest site on an islet on a frozen lake on June 22, and 6 were seen on June 26 around an island in the flood plain of the "Kugajuk River". On July 1 two empty nests were found on islets in a frozen lake on the Precambrian upland west of Login Bay. On July 3 a male with a well-developed brood patch was collected. Glaucous Gulls were seen defending apparent nesting sites on lakes on July 11, 14, and 21, and on August 8 and 20. Two pairs were believed nesting on inaccessible islets at the head of Login Bay on July 10. Of 14 nests found on an islet on August 10, only two contained chicks, and a colony of similar size near the head of Pelly Bay was practically abandoned when first seen on September 4. On September 6, however, several Glaucous Gulls were acting as if they still had unfledged young on islets off the northeast point of "Krikriktajuakajuk".

Population

One hundred and six breeding pairs of Glaucous Gulls were seen on or near the southwest Baffin Island coast between Amadjuak and the island of "Pikiolialuk" (between Lloyd Point and the Trinity Islands). The number of pairs that escaped notice owing to the complexity of the coast, the scattered nature of the nesting sites, and the rather perfunctory examination made, is thought to be in the proportion of one missed to four seen. The total breeding population of the region examined is therefore estimated at about 130 breeding pairs, or approximately one pair on each two-mile stretch of seaward coast. A comparable estimate cannot be made for the Pelly Bay region because Glaucous Gulls there were not confined to the coast, as they were on southwest Baffin Island, but nested on lakes an indeterminate distance inland. However, I attempted a complete count of the number of pairs nesting in the vicinity of our summer camp. In a rectangle twelve miles by eight miles, including Login Bay and the peninsula west of it (see Plate 3), and the south bank of the "Kugajuk", 17 pairs of Glaucous Gulls were apparently nesting. The density of Glaucous Gulls was therefore about 0.2 pairs per square mile. The total includes 5 pairs at a Thayer's Gull rookery, 7 on islets in rivers, 3 on islets in lakes, and 2 on islets in Login Bay.

The Glaucous Gulls of Pelly Bay apparently had little breeding success in the 1956 season. There were said to be fewer gulls than usual at three of the six rookeries seen, and very few young were seen foraging in the fall. Toward the end of August, the Eskimos reported an unusual scarcity of gulls at the fish weirs. A possible explanation of poor breeding success was the lateness of the spring thaw, owing perhaps to heavy snowfalls in the early spring. A consequence of this was the delayed opening of the lakes. On June 22 two nests were found on islets in a frozen lake; no eggs had yet been laid, though the male of a pair, which was collected while defending one of the nests, had enlarged testes.

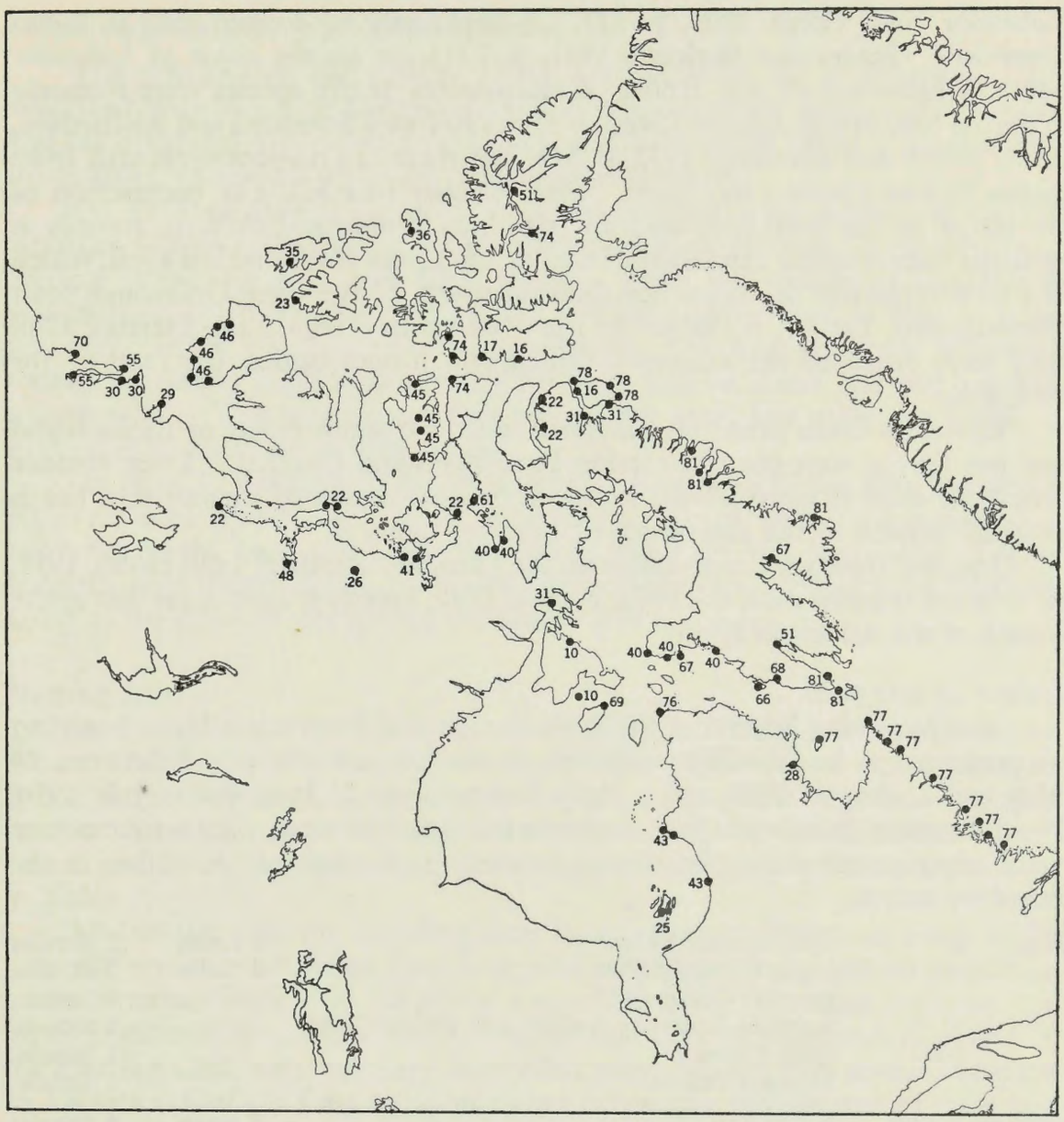

Fig. 1. Reported breeding sites of the Point Barrow Gull (mouth of Mackenzie River east to Harrowby Bay, and perhaps to Cape Parry) and the Glaucous Gull (all other records) in northern Canada. Numbers refer to a publication or unpublished observation listed with the references.

Distribution

The breeding range of the Glaucous Gull (Fig. 1) extends south from the limit of open water to the mainland coast in the west, and to southern Hudson Bay and northeast Labrador in the east. Where its breeding range overlaps that of the Herring Gull it nests on or near the coast leaving inland situations to the latter species. However, north of the range of the Herring Gull, Glaucous Gulls are found nesting some distance inland as well as on the coast, a fact which suggests that Herring Gulls are able to compete successfully with Glaucous Gulls for nest sites distant from the sea.

The Glaucous Gull was formerly reported breeding on cliffs on the west coast of Newfoundland and in nearby lakes and also on the southern

Labrador coast (Bent, 1921, p. 53). It apparently no longer nests in Newfoundland (Peters and Burleigh, 1951, p. 221), or on the coast of Labrador south of Hopedale (Tuck, 1960). Gulls possibly of this species were formerly reported breeding at Albany River on James Bay (see Swainson and Richardson, 1831, p. 419 and Manning, 1952, p. 57), but there are no recent records from James Bay or Hudson Bay south of the Belcher Islands. The contraction of its range in the east suggested by the Newfoundland-Labrador records is perhaps related to the expansion of that of the Great Black-backed Gull, which is found replacing the Glaucous Gull on much of the west Greenland coast (Salomonsen, 1950–1, p. 302). In the Hudson Bay region the Herring Gull may have displaced the Glaucous Gull through competition for food or for nest sites.

Glaucous Gulls breed on the north, east, and south coasts of Baffin Island but not on the west coast bordering Foxe Basin and Channel. Their absence from this coast is unexplained; it cannot be due to lack of nesting sites but is possibly related to the abundance of Herring Gulls.

Judging from specimens taken on the Canadian mainland (and Höhn, 1959, p. 110) the western race, the Point Barrow Gull, breeds at least as far east as the mouth of the Anderson River.

Colour of soft parts

The following list shows the colours recorded from adult birds, breeding or presumed to be breeding, collected on southwest Baffin Island between 30 May and 21 August 1955, and at Pelly Bay between 22 June and 15 July 1956. No differences in soft-part colouration were noted between the two series, nor were any constant differences found between birds taken early and late in the breeding season.

Bill:	light Apricot Yellow	6 males	2 females
	Light Orange-Yellow	2 males	2 females
	greenish Orange-Buff		1 female
	between Antimony Yellow and Yellow Ocher		1 female
	Deep Chrome		1 female
	Mustard Yellow		1 female
Spot on gonys:	Nopal Red	8 males	4 females
	Carmine		3 females
	between Peach Red and Scarlet-Red		1 female
Orbital ring:	Deep Chrome	8 males	6 females
	Light Cadmium		1 female
	Cadmium Yellow		1 female
Iris:	Baryta Yellow	5 males	2 females
	Buff-Yellow	1 male	5 females
	Maize Yellow		1 female
	Pale Orange-Yellow	2 males	

It will be noted that the females tend to be less regular in soft-part colouration than the males, and that perhaps the males tend to be a little brighter or more deeply tinted than the females.

Salomonsen (1950–1, p. 310) described the colours of the soft parts of adult Glaucous Gulls collected in Greenland as follows: "Orbital ring lemon-yellow, iris light golden-yellow, bill pale yellowish, feet light grey or pale flesh-coloured". Kumlien's description (1879, p. 98) of the orbital ring of the Glaucous Gull as "reddish purple" indicates confusion with Kumlien's Gull.

Kumlien's Gull, *L. glaucoides kumlieni*

The distribution and habits of the Iceland Gull, *L. g. glaucoides*, are described with those of Kumlien's Gull in the following paragraphs. I have had no first-hand experience of the race, and have relied entirely on the very informative discussion given by Salomonsen (1950–1).

On 14 May 1955, four days after observations were begun, about 140 Kumlien's Gulls accompanied by a lesser number of Herring Gulls were seen feeding at the floe-edge near Cape Dorset. From the reports of residents it was suspected that Kumlien's Gulls had not been in the area, at least in large numbers, before the date of this observation. On May 15 some 400 were swimming among loose moving pack ice in an area of about one and one-half square miles. The next day a few pairs were seen, but most were still in groups of 15 to 30 or feeding singly.

On May 30 flocks of 20 to 30 screaming Kumlien's Gulls, totalling about 80, were seen flying high above West Inlet. There were two prospective rookeries in the area, and the behaviour of the gulls was suggestive of Tinbergen's description (1953, p. 44) of the performance of European Herring Gulls at the point of occupying the Dutch gull colonies.

Nesting habitat

Seventeen breeding sites of Kumlien's Gull, including two mentioned by Soper (1928), were found on the southwest Baffin Island coast between Amadjuak and "Pikiolialuk", a distance of about 200 miles. Eskimos reported another three sites, including one inland. At all of the sites Kumlien's Gulls nested gregariously. Estimates of the numbers of pairs at each are shown in Table 1.

All but three of the breeding sites found were rookeries on steep cliffs. The cliff rookeries all faced the sea or tidal inlets, except for one on an islet in a lake communicating with the sea by a reversing fall. The three rookeries not on cliffs differed markedly from typical nesting sites of Kumlien's Gull and of the Herring Gull, although they resembled many nesting sites found occupied by Glaucous Gulls. Two were on rather flat, rocky islands; one of these had a broken ridge of rock on it, and the other was low and wave-smoothed. The third was on a rocky, crannied part of a larger, higher island. These three atypical Kumlien's Gull rookeries were also peculiar in that they were shared with Herring Gulls; the Glaucous Gull, a more common associate of Kumlien's Gull, bred at two of them. At the two rookeries containing all three species, Kumlien's Gull made up about 10 per cent and about 30 per cent of the breeding birds, and about 12 per cent at the one shared with Herring Gulls only. Where Kumlien's Gull and the Glaucous Gull nested together, the former made up on the average about 85 per cent of the population.

The nesting habitat of the Iceland Gull in Greenland is similar to that of Kumlien's Gull on the southwest Baffin Island coast. According to Salomonsen (1950–1, pp. 313–4), their rookeries normally range in size from half a dozen to some one hundred pairs, and are situated on steep cliffs facing fiords or sounds. Iceland Gull rookeries are rare on the outer coasts and islands, and are never found on freshwater lakes. Although it is true that such situations are rarely chosen by Kumlien's Gull, none the less it seems likely that the Iceland Gull is more specialized in nesting habitat than is the western race.

The other exceptional nesting sites of Kumlien's Gull (small, comparatively level islands), are paralleled in the Iceland Gull by ". . . colonies on low isolated skerries off the coast . . .".

Egg-laying, incubation, and hatching

Eighty pairs of Kumlien's Gulls occupied a rookery found on May 31 (Plate 2, on tip of peninsula at lower centre). The nests were small, low, untidy structures of coarse vegetation, and were placed on ledges on the shattered face of a cliff above a channel with swift tidal currents, at that date choked with pack ice in rapid motion. The gulls had repaired old nests, and had made several new ones, including one on the land-fast ice which formed a narrow shelf below the cliff. They called frantically during the examination of their nests, of which the 20 seen were empty, but, unlike Glaucous Gulls at the same rookery they were careful to avoid coming within shot-gun range. The rookery was again visited on June 7, when a few eggs had been laid, and the nests were numbered with paper tags[1]. Another visit was made on June 11, and others at approximately two-day intervals until July 22.

The first series of nests under observation became inaccessible on June 21, through the destruction of the ice-shelf at the base of the cliff by a spring tide. As this had been predicted, another series, until then difficult of access owing to an overhanging snow cornice, had been approached from the top on June 16, but the break in observations complicates the interpretation of the data, which are summarized below.

The first egg seen in the colony was probably laid on June 5, and the last about the 20th. Clutch-size varied between one and three eggs per nest; however, a nest seen at the West Foxe Islands contained four chicks of varying size, and perhaps four-egg clutches are occasionally laid by Kumlien's Gulls. The mean size of 35 clutches was 2.11 eggs.

The minimum egg loss (not allowing for eggs which may have been laid and lost between observations) was 15 out of 74, or 20.3 per cent. The first chick was seen on July 5, and had probably hatched the same day. The comparative numbers of chicks and pipped eggs to whole eggs were 6 to 21 on July 9, and 9 to 10 on July 11.

Population and distribution

Kumlien's Gull occupies a more or less unbroken breeding range (Fig. 2) on the coast of Baffin Island from Cumberland Sound to Foxe Peninsula. There is some evidence for the belief that it also breeds in the vicinity of Digges Sound, northwest Ungava Peninsula (see Manning, 1949, pp. 194–5, for a discussion of the records; Tuck, 1955, like Manning, did not record it).

The most westerly rookery of Kumlien's Gull seen in 1955 was one of three found during the summer that were not on cliffs. It was on a rocky island, and was shared by the three large gulls indigenous to the region. To the west and north there are few cliffs large enough for Kumlien's Gull to colonize, but the presence of the atypical colony at the western limit of the range of the species suggests that factors other than the lack of cliffs prevent

[1]The tags were made from biscuit cartons, and were bright red on the reverse. Although carefully hidden under the nest material, most were quickly discovered and removed by the gulls. Unfortunately, I was not then aware that Tinbergen (1953, p. 153) had mentioned the tendency of *L. argentatus* to remove red objects from the nest.

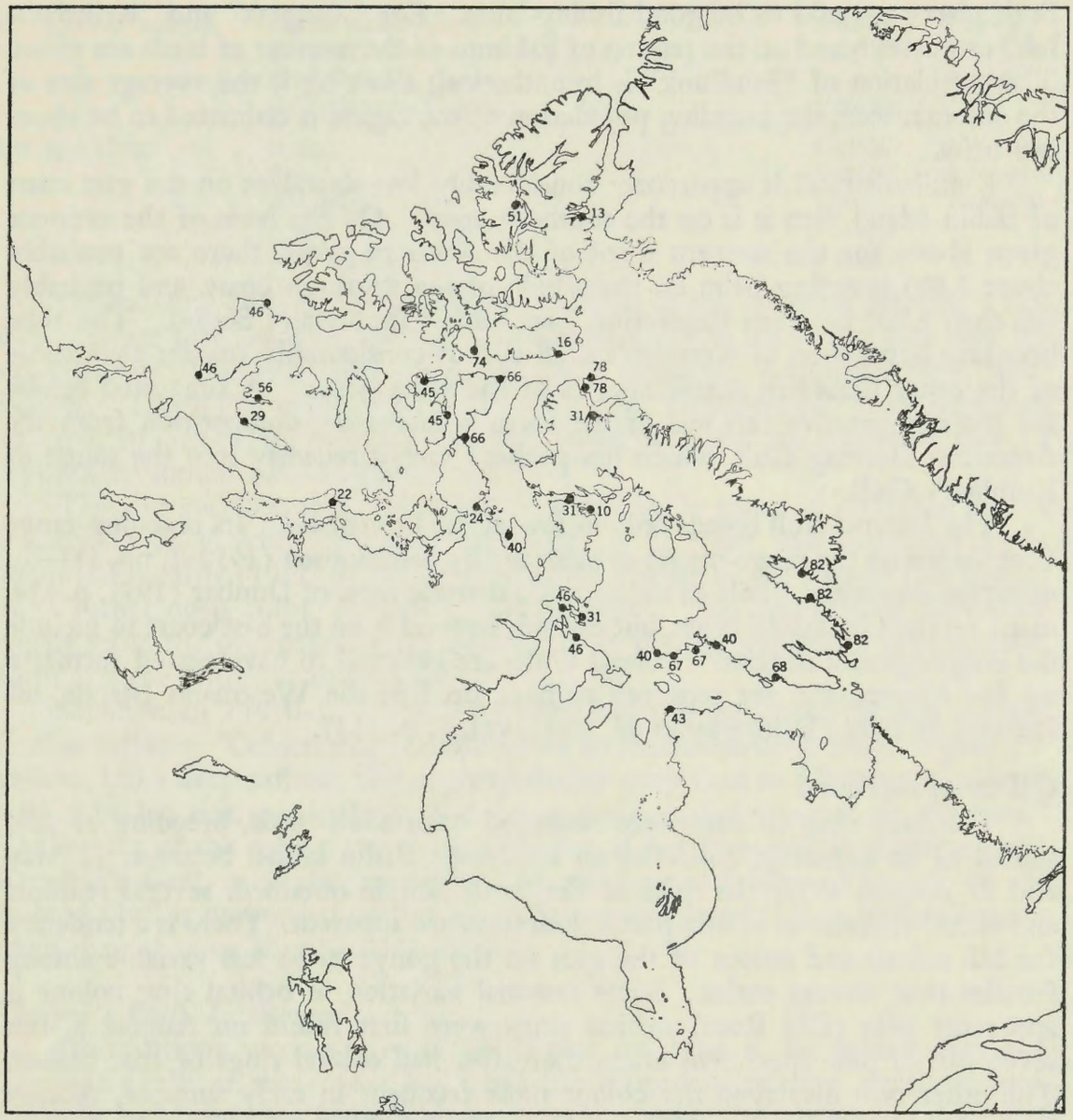

Fig. 2. Reported breeding sites of Kumlien's Gull (southern Baffin Island and northwestern Ungava Peninsula) and Thayer's Gull (all other records) in northern Canada. Numbers refer to a publication or unpublished observation listed with the references.

its further expansion. Possibly subarctic water (Dunbar, 1951, p. 114, map), the limits of which closely approximate the limits of the breeding range of Kumlien's Gull on Baffin Island, is a necessary part of its environment.

The number of Kumlien's Gulls occupying the 17 rookeries (see Table 1) visited between "Pikiolialuk" and Amadjuak was estimated to be 515 pairs. Three other colonies, which were not visited, were reported by Eskimos. Two, "Kangiak" and "Krikriktaluk", were on coastal islands, and one, "Saudluok", was inland, southeast by south of Mingo Lake at 64°23N., 72°01W. The latter colony has been seen in winter only when it is unoccupied. It is one of two lake-colonies in the region, the other being in "Negus Lake", mentioned previously as communicating with the sea through a reversing fall.

Both places are said to be good fishing-lakes. For "Kangiak" and "Krikriktaluk" estimates based on the reports of Eskimos of the number of birds are given. The population of "Saudluok" is hypothetical; allowing it the average size of the colonies seen, the breeding population of the region is estimated to be about 689 pairs.

Kumlien's Gull is apparently considerably less abundant on the east coast of Baffin Island than it is on the southern coast. On the basis of the estimate given above for the western third of the southern coast, there are probably about 2,100 breeding pairs on the whole of the southern coast, and probably less than 1,000 between Resolution Island and Cumberland Sound. The total breeding population of Kumlien's Gull is thus considerably smaller than those of the other Canadian Arctic species of the same genus. A suggested reason for the comparative rareness of the form is increasing competition from the American Herring Gull, which has perhaps spread recently into the range of Kumlien's Gull.

The Iceland Gull breeds only in low-arctic Greenland. Its breeding-range (not shown on the range-maps) as recorded by Salomonsen (1950–1, pp. 311–2), occupies almost the whole of the marine subarctic zone of Dunbar (1951, p. 114, map) on the Greenland coast, but extends beyond it on the east coast to include the Angmagssalik district. Iceland Gulls are believed to have nested formerly on Jan Mayen, and are reported to have bred in the Westmann Islands, off Iceland, in 1939 (Witherby *et al.*, 1944, vol. 5, p. 113).

Colour of soft parts

The following colours were recorded from adult birds, breeding or presumed to be breeding, collected on southwest Baffin Island between 31 May and 25 August 1955. In spite of the small sample obtained, several seasonal and sexual differences in soft-part colouration are apparent. There is a tendency for bill colour and colour of the spot on the gonys to be less variable among females than among males. Some seasonal variation in orbital ring colour is apparent: pale (Old Rose) orbital rings were first found on August 8, but seven out of nine specimens taken thereafter had orbital rings of that colour. The other two displayed the colour most frequent in early summer, Acajou Red. Finally, there is a possible tendency for male birds to have a more heavily speckled iris than females.

Bill:	near Aniline Yellow	2 males	4 females
	between Cadmium Yellow and Aniline Yellow		1 female
	between Deep Chrome and Yellow Ochre	1 male	
	pale Honey Yellow	1 male	
	between Mustard Yellow and Primuline Yellow	1 male	
	Pale Green-Yellow	1 male	
	Martius Yellow	1 male	
Spot on gonys:	Carmine	3 males	5 females
	Nopal Red	1 male	
	Scarlet-Red	1 male	
	Mikado Orange	1 male	
	Salmon-Orange	1 male	
Orbital ring:	Acajou Red	6 males	2 females
	Pompeian Red	1 male	2 females
	near Old Rose	5 males	2 females
	Orange-Buff	1 male	

Iris ground colour:	Maize Yellow	3 males	2 females
	Baryta Yellow	2 males	1 female
	Buff Yellow		2 females
	Pale Orange-Yellow	2 males	
Iris speckling:	none	1 male	2 females
	light	3 males	3 females
	moderate	3 males	1 female
	heavy	5 males	
	very heavy	1 male	

Orbital-ring colour appears the least variable of the soft-part colours. The data indicate that Dwight (1906, p. 29) was mistaken in his assumption that the orbital rings of all the "white-winged" gulls, including Kumlien's Gull, were yellow. The single orbital ring noted above as "Orange-Buff" may represent an error in recording, as it was written down without the comment that its atypicality should have elicited.

The legs and feet of Kumlien's Gull, particularly those of juveniles, have a slightly more greyish cast than do those of Herring and Glaucous gulls. Wynne-Edwards (1952, p. 371) describes the colour of the legs of this species as "a rather deep color, perhaps brownish pink". No appreciable difference (apart from the greyness) in the flesh tones of the leg was noted between this form and the others of the region.

Salomonsen (1950–1, pp. 310–1) describes the soft parts of the Iceland Gull as follows: "Orbital ring reddish-violet or reddish-brown, iris pale greyish-yellow, bill a deep saffron, feet slightly darker grey than in Glaucous Gull and with a leaden tint, particularly distinct on the toes, less distinct on the tarsi." The colour of the orbital ring is thus similar, if not identical, in this form and Kumlien's Gull, as is the appearance of the legs and feet. The iris of the Iceland Gull is unmottled according to Salomonsen, and differs in this respect from that of most Kumlien's Gulls.

Thayer's Gull, *L. thayeri*

Observations were begun at Pelly Bay on June 8, by which date the Thayer's Gulls of the region had probably started to occupy their colonies, for gulls had been seen feeding on garbage at a radar site for several days and an occupied rookery was examined on June 10. Between June 10 and 14, a maximum of 75 Thayer's Gulls was seen feeding on refuse, or standing with bulging gullets on the ice of a nearby lake. On the lake numerous tracks showed the gulls were attracted to places where only a thin powdering of snow covered the blue ice. Close to shore meltwater had begun to flood the ice, and most of them roosted, apparently by preference, in the wet snow.

Nesting habitat and breeding

All breeding Thayer's Gulls seen in 1956 occupied rookeries on precipitous cliffs. Some of the cliffs (see Table 2) were up to three miles inland, but most were on islands, and facing straits.

A rookery discovered on June 10, 300 to 400 feet in height, was occupied by about 100 pairs of Thayer's Gulls, but an attempt to examine the nests failed owing to the difficulty of climbing the cliff. The rookery called "Krangerarvik" (Plate 5) was chosen for study, but owing to the difficulty of working on the cliff, egg-laying and incubation could not be followed in detail. The records

taken are shown in Table 5. No eggs were found at the last visit, and many nests appeared to have been abandoned during the incubation period.

On August 24 a rookery of some 200 pairs of Thayer's Gulls, one of the largest of the region, was visited. The cliff, on Korvigdjuak Island, was estimated to be about 1,000 feet high, but no gulls were breeding above about 300 feet. Well-fledged young were standing on the ledges, but none was seen in flight. The first flying young were seen on August 31 and September 1 at the Mission, and on September 10 about 100 were seen coasting southward near the Arrowsmith River. Young Thayer's Gulls were still common at the mouth of the "Kugajuk" River and at the garbage dump of the radar site up to the time of our departure from the region in the last week of September, but adults had decreased greatly in numbers in the week following September 10.

Distribution

Thayer's Gull breeds in the central and western parts of arctic Canada (Fig. 2), and in a small area in northwest Greenland (Salomonsen, 1950–1, p. 319). The southern limit of its breeding range lies farther north than that of any of the other large gulls. Its habit of breeding gregariously in cliff rookeries is perhaps responsible for the fact that it does not appear to breed as far north as the less gregarious and less specialized Glaucous Gull. In the High Arctic Thayer's Gull is rare in the west; there is one probable breeding record from Melville Island (Sabine, 1824, p. cciv), doubtless from the southern coast. In the eastern High Arctic Thayer's Gulls are more common, and the presence of a breeding site on Mökka Fiord, east-central Axel Heiberg Island (Parmalee, 1959), suggests that others remain to be discovered in Eureka Sound and Norwegian Bay. "Herring Gulls" reported to nest on cliffs on southern Ellesmere Island (Pilot, 1959) are very probably Thayer's Gulls[1].

Breeding specimens, now in the National Museum of Canada, were taken by R. M. Anderson at Dolphin and Union Strait. Thayer's Gull appears to be absent from the predominately low mainland coast west of this area, perhaps owing to the scarcity of suitable cliffs. A record of the Ivory Gull breeding on the cliffs of Cape Parry (Swainson and Richardson, 1831, p. 419) is perhaps referable to Thayer's Gull or to the Glaucous Gull, as it was almost certainly not an Ivory Gull.

The breeding range of Thayer's Gull extends eastwards to include the northwest shore of Southampton Island, where breeding specimens have been collected at a cliff colony (Manning *et al.*, 1956, p. 97). Between this most southerly known breeding site of Thayer's Gull, and the most northerly known Herring Gull breeding site on roughly the same latitude, at Crozier River, Melville Peninsula (Bray, 1943, p. 528), lies over 300 miles of coastline on which both species probably occur; certainly both species are recorded as breeding on the north side of Frozen Strait (Manning *et al.*, 1956, p. 97). Thayer's Gull appears to be geographically isolated from Kumlien's Gull on Baffin Island and from the Iceland Gull in Greenland. The lowlands bordering Foxe Basin may constitute an effective barrier on the west coast of Baffin Island, but there appears to be no comparable barrier on the east coast, and it is

[1]Dr. R. L. Christie, Geological Survey of Canada, very kindly confirmed this supposition for me in the summer of 1960. He also found Glaucous Gulls breeding at cliff rookeries in the region.

possible that Kumlien's Gull and Thayer's Gull will some day meet there, if they have not done so already (the coast is ornithologically imperfectly known). At present there is no meeting on the southwest coast of Baffin Island, but one might occur in the future. The heavily glaciated coast of Melville Bay is doubtless an effective barrier between Thayer's Gull and the Iceland Gull on the west Greenland coast.

Thayer's Gull winters on the Pacific coast from British Columbia to southern California. According to Brooks (1937) the winter distribution of the American Herring Gull on the west coast lies south of that of Thayer's Gull.

Colour of soft parts

Adult specimens, breeding or presumed breeding, collected between 15 June and 22 August 1956, showed soft-part colouration as listed below. As in Kumlien's Gull, a tendency for females to be less variable in bill and "spot on gonys" colouration than males was apparent. Also, as in Kumlien's Gull, the orbital rings seen in August were paler on the average than those seen in June: the first Old Rose orbital ring was noted on June 21, and four birds taken in August all had orbital rings of that colour (that they were all males is probably merely a sampling accident). The orbital ring described as "slightly orange" in my notes was slightly orange in comparison with that of more typical birds, or a deep red with a slight orange tint. All adult Thayer's Gulls collected had irides more or less speckled with brown or dark grey, obscuring the ground colour and rendering satisfactory comparisons with colour standards impossible. Nevertheless, the ground colour appeared to be fairly constant in colour, and may be described as a dull, pale yellow similar to that of Kumlien's Gull. Four birds with traces of immaturity had very light (1), light (2), and moderate iris speckling, suggesting a possible average increase in speckling with age. It is well known that immature American Herring Gulls have dark irides, but, as they become clear before the bird attains complete adult plumage (Poor, 1946, pp. 147–8), the darkness of the iris in Thayer's Gull can hardly be considered homologous.

Bill:	pale Sulphine Yellow	2 males	2 females
	Empire Yellow	1 male	1 female
	between Baryta Yellow and Pinard Yellow		1 female
	Primrose Yellow	1 male	
	between Deep Colonial Buff and Olive-Ocher	1 male	
	Primuline Yellow	1 male	
	Mustard Yellow	1 male	
Spot on gonys:	Brazil Red and pale Brazil Red	3 males	2 females
	Strawberry Pink	1 male	1 female
	Nopal Red	2 males	
	Grenadine	1 male	
Orbital ring:	Acajou Red	5 males	3 females
	Pompeian Red		1 female
	Old Rose and pale Old Rose	5 males	
	"slightly orange"		1 female
Iris speckling:	very light	1 male	
	light	4 males	
	moderate	1 male	5 females
	heavy	1 male	2 females
	very heavy	7 males	2 females

Brooks (1937, p. 20) describes the colours of the soft parts in this species as follows: iris, "varies from straw-color, thickly powdered with brown or grayish specks, to pale brown, freckled with darker"; eyelid, always purplish-pink; bill in winter paler yellow or more greenish than that of the American Herring Gull.

American Herring Gull, *L. argentatus smithsonianus*

Herring Gulls were present at the floe-edge near Cape Dorset on May 10, when observations were begun. On May 14, 60 were seen, all apparently unpaired, dabbling amongst the flocks of eiders, murres, and guillemots. On May 21, about 100 were feeding in loose pack ice with some 400 Kumlien's Gulls. On that day 3 pairs, and on the next day 2 pairs, were seen among the many unattached birds.

Nesting habitat

Most of the Herring Gull nests in the Dorset region were perched on boulders in lakes (see Plates 2 and 6). Lakes with more than two such nests were rare, and usually they held only one, except perhaps on the northwest part of the Foxe Peninsula coast; here, a lake just north of Cape Queen, similar in size to several seen in the Dorset region supporting one or two nests, was occupied by 6 nesting pairs. Nesting boulders were also found in rivers; three were noted close together at a good fishing spot on a river near Enukso Point. One nest, on a lake on an island west of Dorset, could be reached dry-shod on June 28, probably owing to a fall in the lake level after the early summer thaw. It had recently been ravaged, probably by a fox.

Three colonies were found on small islands in lakes (see Table 1), with 12 to 30 pairs inhabiting each (average 18). These nesting islands were all low, with a predominance of soil and sphagnum over rock, and comparatively profuse vegetation. One of them could be reached by wading. Two were on small lakes reputed to contain many fish, and the other a short distance from a fishing river near Enukso Point.

Two marine colonies in which all three species nested together contained 60 and 70 per cent Herring Gulls respectively. The one composed of Herring and Kumlien's gulls contained 30 pairs of the former and 4 of the latter. Two pairs of Herring Gulls were found nesting on the wide ledges of a cliff on a small island, west of Cape Dorset, with 4 pairs of Glaucous Gulls, and a pair with one largely down-covered chick was found on a little shoal near the mouth of Chorkbak Inlet. Nesting sites on cliffs or shoals are, however, rarely occupied by Herring Gulls on southwest Baffin Island.

Egg-laying, incubation, and hatching

The first sign of attachment to nesting site was noted on May 28, when 4 pairs of Herring Gulls were seen defending nests at the "Aitken Lakes" (one female collected; largest ovum, 6 mm.). A nest found on June 3 on a lake-boulder contained no eggs, but a pair of Herring Gulls nearby showed alarm at my approach. Several other pairs were seen around ice-covered lakes on the mainland. On the same evening 6 pairs were seen sitting on the sea ice about one mile from shore, perhaps for protection during the night. On June 5, 2 pairs were seen at another frozen lake, and a lake still one-third frozen was occupied by 3 pairs; only one pair was nesting on this lake later in the season, but pairs occupied each of the two adjacent lakes. On June 12, 5

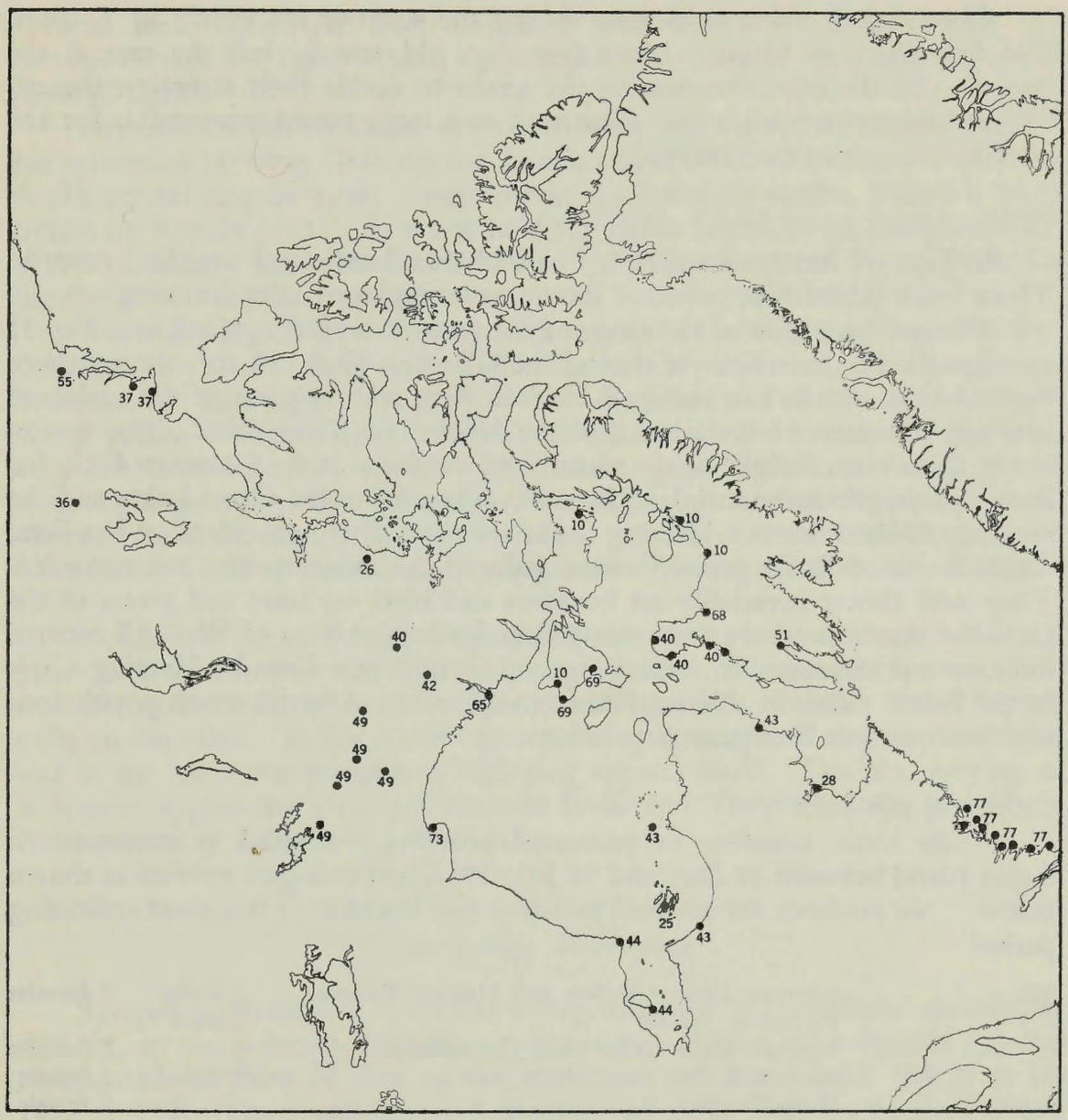

Fig. 3. Reported breeding sites of the Herring Gull in northern Canada. Only a few of the many inland and subarctic sites are shown. Numbers refer to a publication or unpublished observation listed with the references.

Herring Gull nests were found on Okolli Island on four separate lakes. All were perched on boulders at least 20 yards from the early summer shoreline, and most of them were buttressed with fairly large rocks (see Plate 6).

Herring Gulls reacted differently from the other gulls to a threat to their nests, disappearing quietly as soon as the danger was recognized. This method of defence, the removal of the most conspicuous factor, is probably more efficient against casual human predation than are the fierce though uncompleted attacks of Glaucous Gulls and the frantic alarm-calls of Kumlien's and Thayer's gulls. There is, of course, biologically no middle ground between concealment and defence. When the nest had obviously been discovered, the parent Herring Gull usually returned to swoop at the observer, particularly after the chicks had hatched.

Observations made on 6 nests during the summer are shown in Table 4. The first chick to hatch, when a few days old, usually left the nest at the approach of the observer, causing the adults to divide their attention thenceforward between two places. This was, to a large extent, responsible for the poor breeding success observed.

Distribution

In Fig. 3 I have not attempted to include all mainland breeding records. Those from inland Keewatin are shown as examples of inland nesting.

The northern limit of the range of the American Herring Gull (see Fig. 3) overlaps the southern limit of that of the Glaucous Gull in Labrador, southern Baffin Island, on the east shore of Hudson Bay, and on parts of the mainland between the coast of Keewatin and the Mackenzie River delta. The species is not, however, confined to the vicinity of the sea as is the Glaucous Gull, for it nests throughout the mainland barrens, and south to the Great Lakes and the northern United States. Herring Gulls are particularly abundant on the Foxe Basin coasts of Baffin Island, where gulls of no other species are recorded. They nest almost invariably on boulders and islets on lakes and rivers in the Canadian Arctic, and are very rarely found nesting on sea cliffs[1]. All records indicate a preference for solitary nesting in northern Canada; Herring Gulls in the north differ in this respect from Canadian Atlantic coast populations and from certain European populations.

Colour of soft parts

Adult birds, breeding or presumed breeding, collected in southwestern Baffin Island between 28 May and 15 July 1955, had soft-part colours as shown below. No evidence for seasonal variation was found over this short collecting period.

Bill:	between Apricot Yellow and Mustard Yellow	2 males	2 females
	Primuline Yellow	1 male	
	between Maize Yellow and Cadmium Yellow		2 females
	Apricot Yellow	1 male	1 female
	Deep Chrome		1 female
Spot on gonys:	Nopal Red and pale Nopal Red	2 males	5 females
	Scarlet	1 male	1 female
	Scarlet-Red	1 male	
Orbital ring:	Cadmium Yellow	4 males	3 females
	Cadmium Orange		2 females
	Deep Chrome		1 female
Iris:	Straw Yellow	2 males	3 females
	Baryta Yellow		1 female
	Pale Orange-Yellow	2 males	
	Buff-Yellow		2 females

Five specimens that showed traces of immaturity in bill or plumage differed from the adults in averaging somewhat duller bill colour and spots on the gonys

[1]According to Soper (1946, p. 236) Herring Gulls frequently nest on cliffs in the Lake Harbour region. He described a rookery containing Herring Gulls on the West Foxe Islands, near Dorset (1928, p. 83), but I saw only Kumlien's Gulls and Glaucous Gulls there in 1955. As the gulls in a molested colony quickly attract neighbouring gulls to the scene, including those of other species, it seems possible that Soper was mistaken.

(Nopal Red, Spectrum Red, Capucine Yellow, Ochraceous-Salmon, and Salmon-Orange). Their orbital rings and irides differed only slightly from those of adults.

The colours shown above agree well with those given by Brooks (1937) for wintering Herring Gulls on the Pacific coast. The view that the Herring Gull's orbital ring becomes orange-red in the breeding season, which is mentioned by Brooks (1937), does not hold for Baffin Island birds; Dwight (1925, p. 192) similarly has said that the Herring Gulls of eastern North America usually have vermilion orbital rings in the breeding season.

The irides of 8 Herring Gulls from a series of 11 adults (6 males, 5 females) collected by T. W. Barry and J. Eisenstadt at the delta of the Boas River, Southampton Island, in 1956, are variously described as "clear", "yellow", and "clear yellow". Those of the other three (all males) are described as "yellow, very few brown flecks", "yellow, pale brown spots, slight", and "dark brown with slight gold flecking" (Barry, 1956). Although one of the birds is small (Barry No. 6, exposed culmen, 49.8 mm.), the others are normal in size, and none shows in other characters any evidence of intergradation with Thayer's Gull.

Incidentally, it will have been noted that the colour of the orbital ring provides a useful means for distinguishing in the field between Herring Gulls and Glaucous Gulls on the one hand, and Kumlien's, Iceland, and Thayer's gulls on the other. In the former group, the yellow orbital ring appears light, and in the latter the purplish orbital ring appears dark. The iris, varying as it does in appearance among Kumlien's Gulls and Thayer's Gulls, provides a less satisfactory field mark.

Systematic discussion

Sympatric forms which do not intergrade may be considered specifically distinct, on the principle that the evolution of intrinsic reproductive barriers corresponds in point of time to the attainment of species rank (Mayr *et al.*, 1953, p. 79). There can be no doubt that effective intrinsic barriers obtain between the following pairs:

L. h. hyperboreus – *L. a. smithsonianus*
L. h. hyperboreus – *L. g. glaucoides*
L. h. hyperboreus – *L. g. kumlieni*
L. h. hyperboreus – *L. thayeri*
L. g. kumlieni – *L. a. smithsonianus*

An occasional hybrid is known. Bertram and Lack (1933, p. 297) observed a pair of gulls on Bear Island, of which one was *argentatus* and the other *hyperboreus*, and also saw the apparent offspring of a similar mixed mating. Manning (Manning *et al.*, 1956, p. 95) believed a specimen from Killinek Island to be possibly a hybrid *hyperboreus* x *glaucoides*. Such occasional hybridization, which is known to occur among several pairs of sympatric gull species, cannot be considered evidence of conspecificity, but indicates breaches of a barrier which must be assumed to have evolved through the agency of selection.

Several unusual gulls in the National Museum of Canada collection have been identified as intergrades between *thayeri* and *smithsonianus*, and this has

to a great extent been responsible for the view that the two forms are conspecific. Leaving for the moment the question of their correct identification, the circumstances of their collection have, it is believed, enhanced their taxonomic importance. These are, first, that none forms part of a large series of breeding birds, and second, that four of the seven specimens in the group were taken in or near a range overlap between *thayeri* and *smithsonianus*. Dwight (1917) clearly had in mind two of these specimens, from Fullerton Harbour, when he relegated *thayeri* to the species *L. argentatus*. Manning (Manning *et al.*, 1956, pp. 97–8), although noting that *thayeri* and *smithsonianus* behave as distinct species in the Southampton Island–Frozen Strait region, found two of the unusual birds, from Piling Bay and Pond Inlet, "suggestive of possible intergradation" in the region of northern Foxe Basin and northern Baffin Island.

The unusual specimens agree in having a wing pattern tending toward that of *thayeri*, and measurements comparable to those of male *thayeri* or female *smithsonianus*. The subterminal mirror on the second primary joins, or nearly joins, the white area on the inner vane, and there is a general reduction of the area of black on the other primaries. In some of the specimens the comparable white areas on the first primary also join. All those whose sexes were recorded by the collector are said to be females. The group includes one (sex "female?") from Pond Inlet, taken on the same day as a typical male (sex "male?") *thayeri*, a female from Piling Bay in northern Foxe Basin, two females from southern Quebec (from Moisie Bay, and near Bonne Esperance), a female from Youghall, New Brunswick, and two (unsexed) specimens taken by a member of the *Neptune* expedition at Fullerton Harbour, on about the same date as a typical male *smithsonianus* (also unsexed).

A comparison was made between the seven unusual specimens and a series of breeding *smithsonianus* taken in 1955 on southern Baffin Island. It was found that their primary patterns were included in the range of variations shown by those of the latter group, being more extensive than, or nearly identical to, those of two females (N.M.C. 44066, skin and skeleton; N.M.C. 44084, wing and skeleton) collected between Amadjuak and Cape King Charles. There is no reason to believe that the two latter specimens are hybrids or intergrades, as the colours of their soft parts and their measurements were normal for *smithsonianus*. That the unusual specimens are within the range of variation of a series of breeding *smithsonianus*, and taken from well outside the breeding range of *thayeri*, is considered adequate evidence against the view that they are intergrades between these forms. The evidence suggests that they represent a variant in the *smithsonianus* populations which is expressed only in a few females.

Manning (Manning *et al.*, 1956, p. 97) notes that a series of *smithsonianus* from Southampton Island averaged less white on the wings than a small series from the Gulf of St. Lawrence. Dwight (1917) referred a mid-summer specimen from Tadoussac to *thayeri*. The possibility that *smithsonianus* populations of the Atlantic coast have a comparatively reduced primary pattern was suggested by the regions of collection of some of the unusual specimens, by the remarks of Manning and of Dwight, and by the number of records of *thayeri* on the Atlantic coast. In order to test this possibility, the proportions of the total number of specimens in each of three large geographical groupings bearing a subterminal mirror on the second primary (a

discontinuous character inversely related to the extent of the dark pattern) were compared. The results obtained were: western interior, from the Great Lakes to the Yukon, 9 out of 23; Hudson Bay, James Bay, and southern Baffin Island, 42 out of 74; Labrador, Quebec, and the maritime provinces, 12 out of 18. These results suggest that the extent of the dark pattern declines from west to east.

It seems clear from the foregoing that intergradation between *thayeri* and *smithsonianus* has not been substantiated; there is therefore no direct evidence for the view that the two forms are conspecific. The following examination of the nature of the reproductive barrier between *kumlieni* and *thayeri* on the one hand, and *smithsonianus* (and, by inference, *hyperboreus*) on the other, was undertaken with a view to clarifying the systematic position of *thayeri.*

It is apparent from an inspection of the evidence regarding nesting site preference and gregariousness that differences in habitat form an important reproductive barrier between *smithsonianus* on the one hand, and *kumlieni* and *thayeri* on the other. That this barrier is not insuperable, however, is shown by the presence of colonies on the southwest Baffin Island coast in which *kumlieni* and *smithsonianus* nest in close proximity to one another, and obviously an intrinsic reproductive barrier is also present. An inquiry into the possible nature of the barrier has been made on the basis of my observations. A study of breeding behaviour at one of the mixed colonies found in 1955 ("Iripaiyuk") has been undertaken recently by Mr. N. G. Smith, a graduate student at Cornell University, and it is expected that his observations will throw further light on this interesting problem.

There can be no doubt that, at least in the mixed colonies, interbreeding among the forms is prevented by species recognition. Mantle colour perhaps functions as a recognition mark between *L. fuscus* and *L. argentatus* in northern Europe, and perhaps also between *L. hyperboreus* and *L. marinus* in Greenland and elsewhere. The differences between the colours of their mantles, however, are far greater than those between the mantle colours of Canadian arctic gulls, and in the latter forms mantle colour probably is not used as a recognition mark.

Another possible recognition mark is the pattern of pigmentation on the primary feathers. The pattern on the primaries of *kumlieni* occasionally approaches that of *smithsonianus* in intensity, but never in extent. It is normally more grey than black, and very restricted, whereas that of *smithsonianus* is black or blackish-brown, and also large and conspicuous. That of *thayeri* is intermediate in colour and extent between those of *kumlieni* and *smithsonianus*, and appears to vary within rather wide limits. A bird taken at Coppermine by D. V. Ellis, and described on its N.M.C. label as a female *hyperboreus*, is referable to *thayeri* on the basis of size and the collector's notation, "eyelid pink". The primaries of this specimen are nearly immaculate, with only the faintest brown wash patterning the tips. Two specimens of *kumlieni* from southwest Baffin Island closely match this bird in primary pattern; it is obviously highly aberrant. There are two other specimens of *thayeri* in the National Museum of Canada, one from near Cornwallis Island (once mistaken for *kumlieni*: see Hennessey, 1909, p. 504) and the other from Eureka, bearing dove-grey rather than black or grey-black wing patterns. The possibility that such birds are fairly common is suggested by a statement of Brooks (1937) showing that he was familiar with this variant in wintering birds. What appears

to have been a similar specimen was taken by Bray (1943, p. 528) in northern Foxe Basin. None was seen at Pelly Bay in 1956. The amount of variation in the colour of the primary patterns of *thayeri* and *kumlieni* is thus considerable. For the present, it may be concluded that the colour and the extent of the wing patterns of the gulls are more variable than might be expected if they were of importance in reproductive isolation.

The case for the colour of the orbital ring as a recognition mark seems convincing. Brooks (1937, p. 20) remarks that the eyelids of gulls thicken and carunculate with the advent of the breeding season, ". . . taking on, as a rule, a more vivid color than in the winter."[1] If this is so, the colour of the orbital ring probably plays an important part in breeding activity, and, as no distinct sexual differences were found, its role must be to ensure species recognition. Not only is it the most constant in colour of all the soft parts examined, but it also provides a forcible contrast, that of *kumlieni* and *thayeri* being a dull reddish-purple, and that of *smithsonianus* and *hyperboreus* a bright yellow. As has been mentioned, the colour of the orbital ring of *glaucoides* apparently matches that of *kumlieni* and *thayeri.*

Thus between *L. hyperboreus* and *L. a. smithsonianus* on the one hand, and *L. g. glaucoides, L. g. kumlieni,* and *L. thayeri* on the other, there exists a morphological difference which may be reasonably supposed to have been developed as a recognition mark, or, in other words, as a defence against attempted interbreeding. The evolution of a recognition mark necessarily implies selection against hybrid matings through infertility or lowered survival of young, and I consider it evidence that *L. a. smithsonianus* and *L. thayeri* are not conspecific.

The form originally described as *Larus thayeri* has been shown to be very similar to *L. g. glaucoides* and *L. g. kumlieni* in several characters (gregariousness, reaction to danger to the nest, preference for cliff-nesting, colour of orbital ring), and to differ from other members of the same genus from arctic Canada, to a considerable extent, in all of them. The three forms are known to be distinctly similar in general appearance and proportions. As is usual in the case of morphologically differing allopatric forms, it is difficult to decide on the degree of relationship obtaining between them. Their morphological differences hardly warrant specific separation, and the erection of an *Artenkreis,* or species group, would seem to lead to unnecessary taxonomic complexity. Although geographical isolation prevents their interbreeding, it ". . . is not an intrinsic isolating mechanism, and there is no guarantee that the morphological hiatus caused by the temporary stop in the gene flow is proof of the evolution of isolating mechanisms." (Mayr *et al.,* 1953, p. 103). Salomonsen's hypothesis, that these forms are conspecific, cannot be altered by the findings of the present study; on the contrary, it is strengthened by additional evidence.

The western form, *thayeri,* winters on the Pacific coast from southern British Columbia to San Diego (A.O.U., 1957, p. 222); there are also a few records from the Atlantic coasts of North America.

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[1]Brooks, after comparing his observations on wintering birds with a single drawing made by Taverner of a breeding specimen, believed that *thayeri* was an exception to the rule. Even if in fact the eyelid of *thayeri* does not change seasonally in colour (but see p. 21, for some evidence that it does), it may on the other grounds mentioned still be considered a recognition mark.

It seems fairly well established that *kumlieni* winters in the area between southern Labrador and the coast of New Jersey, occasionally reaching the Great Lakes (A.O.U., 1957, p. 218), the coast of Maryland (a specimen of *kumlieni* banded as a downy on the southwest Baffin Island coast on 5 August 1955, was shot about the end of November 1957 at Chester River, Chestertown, Maryland), and Newfoundland (Peters and Burleigh, 1951, p. 224). Considering the difficulty, and perhaps the impossibility, of distinguishing between a substantial proportion of *glaucoides* and *kumlieni* specimens, the evidence for *glaucoides* wintering in numbers in the same region (A.O.U., 1957, p. 218; Peters and Burleigh, 1951, p. 223) may be considered less conclusive. Nevertheless, there are a number of records, and the evidence suggests that *glaucoides* and *kumlieni* come into broad and regular contact in winter in the region of the Gulf of St. Lawrence and Newfoundland. They might therefore be expected to differ less between themselves than either does from the virtually completely allohiemal[1] *thayeri*. This expectation may be confirmed by an examination of mantle colour, size, and breeding distribution in respect to origin of water mass. The comparative darkness of the mantle of *thayeri*, and its larger size, perhaps reflect on the one hand its relatively warm winter range, and on the other its relatively high-arctic breeding distribution.

It seems probable that the races of *glaucoides*, *kumlieni*, and *thayeri* differentiated from isolated populations of a nearctic immigrant in glacial time. The fact that none has shown divergence in the colour of the orbital ring with respect to the others, suggests that orbital ring colour was a functional recognition mark maintained to mitigate against attempts at interbreeding with a species possessing a yellow orbital ring and distributed throughout the ranges of the three races If *hyperboreus* was the hypothetical bird invoked above (implied in further speculations below), the question arises as to how it escaped differentiation concurrent with that proceeding in the *glaucoides* stocks. A possible explanation is that the barriers which isolated the *glaucoides* stocks were ice-bound seas, and the aptitude of *hyperboreus* for inland-nesting (overt only in the absence of *smithsonianus*) enabled its populations to maintain contact.

It is an attractive speculation that the sites of the refugia from which the *L. glaucoides* stocks later spread were on parts of the coasts now occupied by them in winter. It seems reasonable to suppose that *L. a. smithsonianus* was originally an inhabitant of inland lakes and rivers, and that its appearance on the Atlantic coast resulted in a movement northward of representatives of *L. glaucoides* into Greenland and Baffin Island. *L. argentatus* has not yet occupied Greenland.

The nearest relations of the polytypic species *L. glaucoides* presumably have reddish orbital rings. Three species from the holarctic region qualify, namely *glaucescens*, *fuscus*, and *marinus*. The former is said by Brooks (1937) to have an orbital ring exactly similar to that of *thayeri*, and the other two have orbital rings described by Witherby *et al.* (1944, vol. 5, pp. 103, 108) as vermilion. *L. glaucescens* is probably the nearest relation of *L. glaucoides*, and may represent a later immigration of the same stock, perhaps from the west rather than from the east.

If *L. hyperboreus* was the first *Larus* gull to invade the Arctic, as seems probable from its apparent adaptation in size and paleness, its habit of being the

[1]For a discussion of this concept see Salomonsen, 1955.

first to arrive in the spring, its circumpolar high-arctic breeding range, and the northward retreat that it appears to be making at this time of climatic amelioration, then the relatively slight degree of geographical variation that is found within the species (particularly if *barrovianus* be excluded: see p. 6) can be attributed to the near-continuity of the breeding ranges of its populations. The same does not apply to *L. argentatus*, whose holarctic breeding range is more interrupted, and the triviality of the differences obtaining between *vegæ*, *smithsonianus*, and *argentatus* can be taken as evidence of its recency of arrival in North America. Apparent competition between *smithsonianus* and *hyperboreus* where their breeding ranges overlap in arctic Canada (pp. 11, 13, and 14) may be considered supporting evidence for this hypothesis.

APPENDIX: THE DOWNY AND JUVENAL PLUMAGES OF *LARUS GLAUCOIDES KUMLIENI*, *L. G. THAYERI*, *L. ARGENTATUS SMITHSONIANUS*, AND *L. HYPERBOREUS HYPERBOREUS* COMPARED

Authenticity of specimens

The specimens on which the following descriptions are based were all collected by me in 1955 and 1956. Downy *kumlieni* and *smithsonianus* were collected from nests that had been under observation for many days. Downy *hyperboreus* came both from known nests and from an islet at which the only adult gulls seen were of that species. Downy *thayeri* were collected from six nests which were impossible to see without alarming the adults in the rookery, and the parents were therefore never actually identified on the nests. However, the locations of the five *hyperboreus* nests at this rookery were known to me, and I have no doubt that the downies are in fact *thayeri*. All are separable from *hyperboreus* of comparable age from southwest Baffin Island.

Six of the ten specimens of *kumlieni* in juvenal plumage were shot from the ledges at "Malitjuak" (see Table 1). One of the other four was collected at "Pikiolialuk" (see Table 1), and the other three were collected in flight near Cape Dorset. One of the birds collected in flight (N.M.C. 44043) is very much darker than the others (see Plate 4); it is very possible that the specimen is actually a wandering juvenile *thayeri*, as it fits into the dark end of a series of that form. A number of specimens of *hyperboreus* and *smithsonianus* were shot some distance from known breeding places, but there can be no doubt as to their identification. The specimens of *thayeri* in juvenal plumage were all shot in flight at Pelly Bay. They are believed to be correctly identified for the following reasons: no adult *smithsonianus* was identified in the area during the summer, most of the skins can be separated easily from those of juvenile *smithsonianus*, and all are obviously unlike *hyperboreus* in colour and size.

Plate 4. Juvenal plumage in Canadian arctic *Larus* gulls. Left to right: *L. a. smithsonianus* from southwest Baffin Island, N.M.C. 44085, 44086, 44088, 44091; *L. g. thayeri* from Pelly Bay (skulls removed for study), N.M.C. 44434, 44437, 44440, 44445, 44449; *L. g. kumlieni* from southwest Baffin Island, N.M.C. 44042 (skull removed for study), 44044, 44045, 44043. The last is possibly *L. g. thayeri* (see text).

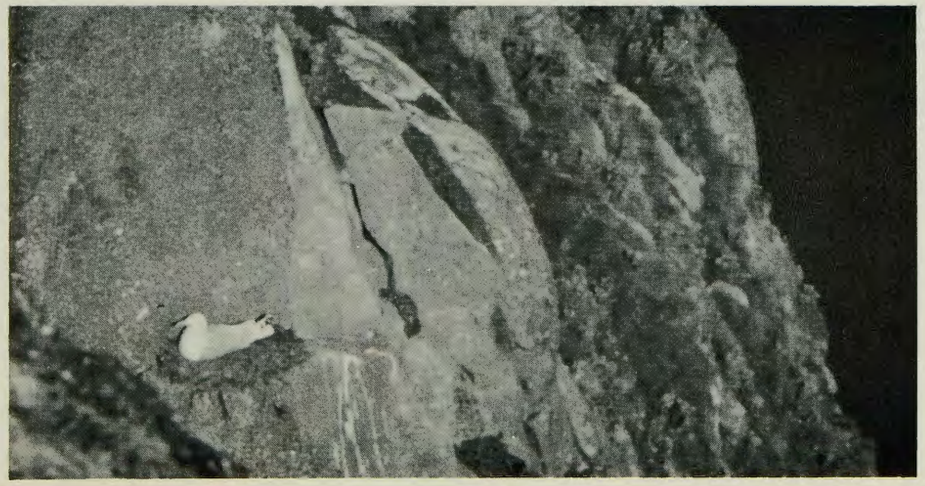

Plate 5. Part of a mixed Glaucous Gull and Thayer's Gull rookery ("Krangerarvik") near Login Bay, Pelly Bay. In the foreground incubating Thayer's Gull.

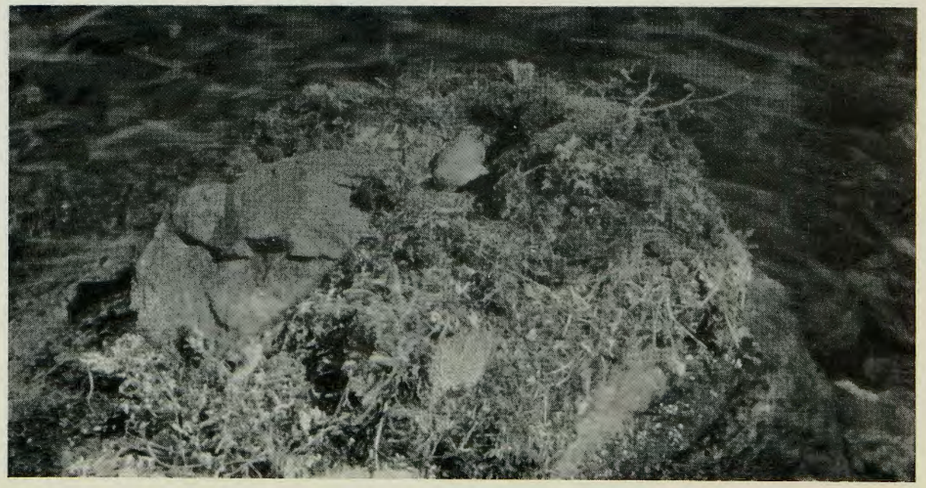

Plate 6. A Herring Gull's nest on a boulder in a small lake on Okolli Island near Dorset Island.

Specimens examined (*N.M.C. catalogue numbers*)

Natal down: *hyperboreus*—43979 to 43983, 43990 to 43995 (southwest Baffin Island); *smithsonianus*—44060, 44064, 44065 (southwest Baffin Island); *kumlieni*—44017, 44019 to 44027 (southwest Baffin Island); *thayeri*—44424 to 44429 (Pelly Bay).
Juvenal plumage: *hyperboreus*—44000, 44001 (southwest Baffin Island), 44390, 44391 (Pelly Bay); *smithsonianus*—44080 to 44082, 44085 to 44091 (southwest Baffin Island); *kumlieni*—44032 to 44037, 44042 to 44045 (southwest Baffin Island); *thayeri*—44431 to 44445, 44447 to 44449, 44451, 44452 (Pelly Bay).

Downy young

Probably none of the specimens used for natal down comparisons was more than five days old when collected, and most were only two or three days old. All except two *smithsonianus* and two *thayeri* still possessed egg teeth. Several larger downies were used in the comparison of the colour of legs and bill.

Underparts: The differences between forms are not well marked. The dark patches on the lower surface of the head are variable in all forms, but they are on the average least pronounced in *hyperboreus*, all specimens of which nevertheless have well-defined lateral marks, although some lack the median ones. One specimen of *kumlieni* has only a single median spot. The buffy streak below the throat and the pale abdomen are similar in all. The *smithsonianus* and *thayeri* downies have darker down on the sides of the legs and the ventral surface of the tail and rump than do those of *hyperboreus* and *kumlieni*.

Upperparts: Two of the forms, *smithsonianus* and *thayeri*, are generally darker than the other two, *hyperboreus* and *kumlieni*. The markings on the head are coarsest and most obvious in the darker forms, and smallest and least conspicuous in *hyperboreus*, the palest. In *smithsonianus* the marks form continuous or nearly continuous lateral lines, and a more diffuse median line. The marks are smaller, more numerous, and more generally spread over the head in the other forms. In the general tone of the back, the two darker forms are practically indistinguishable from each other, as are the two lighter forms. On the average, however, *thayeri* presents a more marbled, less diffusely marked appearance on the back than does *smithsonianus*, and the same may be said of *kumlieni* when compared with *hyperboreus*. The downy *smithsonianus* specimens are slightly more buffy than are the others, including *thayeri* (also noted by Manning *et al.*, 1956, p. 100).

Legs and feet: The pink, fleshy legs and feet of *hyperboreus* contrast in life with the greyer, leaner members of *smithsonianus*, *kumlieni*, and *thayeri*. The colours, however, were difficult to match with those of Ridgway (1912), and did not give the satisfactory separations expected. The webs of three *hyperboreus* downies were Smoke Gray, and those of nine *kumlieni* were Light Grayish Olive (8) and Smoke Gray (1). In the study skins, the legs and feet of *smithsonianus* are the darkest, followed closely by *thayeri*, and then by *kumlieni* and *hyperboreus* in that order. The colour varies widely in each form; the lightest *smithsonianus* matches the darkest *thayeri*, and the darkest *hyperboreus* the lightest *thayeri*. The claws vary in colour with the feet,

ranging from pale horn colour to blackish, being generally darker in *smithsonianus* and *thayeri* than in the others, but showing a pronounced variability, particularly in *thayeri* and *kumlieni*.

Bill: The following descriptions of bill colour were made in the field or written later from drawings of fresh specimens. *L. h. hyperboreus* (southwest Baffin Island): tip of bill anterior to dark pigment, Pinkish Vinaceous (3), Pale Vinaceous-Drab (1), Light Drab to Pale Ecru-Drab (1); base of bill variously Dark Grayish Brown, Dusky Neutral Gray, Dark Neutral Gray, tending to pale at the base in large downies, in one instance to Purplish Gray. *L. g. kumlieni*: tip anterior to dark pigment, Vinaceous-Buff (4), Vinaceous-Buff to Pale Vinaceous-Fawn (3); dark area similar in intensity from before the nostrils to the base, described as Blackish Violet-Gray (4), Dark Grayish Brown (1). *L. a. smithsonianus*: tip anterior to dark area, Drab-Gray (2), "tinged Avellaneous" (1); proximal part of bill fairly evenly coloured except in a large downy whose bill was Heliotrope Gray on the base, otherwise Dusky Purplish Gray (3). In the study skins the dorsal surface of the proximal two-thirds of the bill is generally much paler in *hyperboreus* than it is in the other forms. An examination of the sides of the bill also revealed areas of paleness around the gape and the base. In *hyperboreus*, but not in the other forms, the dark base of the bill in the downy young appears to "grow out", becoming confined to a broad ring with areas of paleness before and behind when the bird is fledged. In the other forms the bill, except for the tip, remains generally dark, that of *kumlieni* being the least heavily pigmented.

Juvenal plumage (see also Plate 4)

Underparts: All forms vary considerably in the darkness of the streaking on breast and abdomen. The underparts of *hyperboreus* are the palest. The darkest specimen of *thayeri* is darker than the darkest *smithsonianus*. N.M.C. 44043, here treated with reservations as *kumlieni*, matches the darkest *smithsonianus*, and fits into the darker end of the *thayeri* series.

Upperparts: The back feathers of all are similar in pattern, with pigmented feather tips edged with pale yellowish-buff and sometimes obscurely barred. The "watered" effect well described by Dwight (1925, p. 184) is common to all the forms. Juvenile *hyperboreus* are generally the palest, followed in order by *kumlieni*, *thayeri*, and *smithsonianus*. Eight out of the ten *kumlieni* are very similar to *hyperboreus*, but their feather tips, although buffy, lack partially or entirely the warm golden tinge of *hyperboreus*. In all *kumlieni* except N.M.C. 44043 there are dusky subapical spots on the primaries exactly as in *hyperboreus*. No such spots are visible on specimens of *thayeri* and *smithsonianus*. Apart from *hyperboreus* the series most uniform in back colour is that of *smithsonianus*. These birds have on the average darker backs than any of the others, and the pale feather edgings show to greater advantage. It was noted that the last characteristic depended on the presence or absence of barring proximal to the edging on the back and scapular feathers. It is difficult to be precise as in some specimens the barring is obscure. My examination gave the following figures on incidence of barring on scapular feathers: *hyperboreus*, 4 out of 4; *kumlieni*, 9 out of 10 (N.M.C. 44043 being the exception); *thayeri*, 13 out of 20; *smithsonianus*, 1 out of 10. The colour of the ends of

the primaries differs fairly constantly between *smithsonianus*, *thayeri*, and *kumlieni*. The area examined was located about one-half inch from the tip of the first primary, on the inner vane. It is difficult to measure consistently the colour of a primary feather, as it is more or less translucent. I held it in all cases about one foot above a dull black surface, and examined the area through the perforated patches of a colour atlas (Villalobos-Dominguez and Villalobos, 1947). The results obtained (Table 6) indicate that most of the specimens could be identified by this method. The belief that young *kumlieni* have darker primaries and tails than young *smithsonianus*, first mentioned by Kumlien (1879, p. 99) and more recently by Wynne-Edwards (1952, p. 371), is contradicted by the results of the present examination. Manning's statement that there seems to be a remarkable individual variation in *thayeri* in first flying plumage (Manning *et al.*, 1956, p. 100) is as true of the new series from Pelly Bay as it is of the six specimens that he examined. Three of the latter match specimens in the Pelly Bay series, and, on the evidence of Manning's colour determinations, the other three probably do also (they were not available for comparison). The two *thayeri* in juvenal plumage from Frozen Strait that Hørring (1937, pp. 70–1) examined also probably match specimens in my series.

Acknowledgments

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Table 1. Breeding places of gulls on the southern coast of Foxe Peninsula, 1955.

	Lat.	Long.	No. of pairs[1] G	K	H	Remarks
Enukso Pt.*	64° 34N.	78° 09W.			12	Grassy islet on lake
Pikiolialuk	64 27	78 06	4	20	40	Rocky island
Krikriktapik	64 22	77 53		4	30	Rocky shoal
Kangetukjuak	64 24	77 41			30	Grassy islet on lake
Epitakudluk	64 15	76 53	1	13		Steep cliff on tidal inlet
Arnanguwatok	64 11	76 44	6			Cliff ledges on island
Sangasuk	64 11	76 39	5	75		Cliff on headland
Malitjuak	64 14	76 40	5	60		Cliff on tidal inlet
Malitjuak N.	64 15	76 41	8	6		Cliff ½ mile from sea
Tenetuke Id.	64 12	76 38	9			Cliffs, one on shoal
Tellik Bay*	64 18	76 36	1		2	Boulders in lakes
Okclli Id.*	64 10	76 36			5	Boulders in lakes
Sakkiak Id.*	64 08	76 32			4	Boulders in lakes
Pitsulak Id.	64 10	76 30	4		2	Cliff ledges on island
Parketuk Bay*	64 17	76 30	2		2	Boulders in lakes
Negus Lake	64 18	76 28	3	14		Cliff on island in lake
Negus Bay*	64 17	76 22	2			Cliff ledges on bay
Kaiyerktualuk	64 17	76 15			12	Island on lake
Pudla Inlet*	64 19	76 18	20	30		Cliff on tidal inlet
Ooglukjuak Id.*	64 16	75 42	4	20		Cliff on island
Kangiak	64 35	75 45		60		Cliff (not seen)
Arnahuaksak	64 28	75 30	1	40		Cliff on island
Angiualukjuak	64 25	75 11	2	75		Cliff on tidal inlet
Naujakudluk	64 22	75 03		40		Cliff on island
Teseyuyekudluk	64 24	74 35		25		Cliff on tidal inlet
No name	64 19	74 08			1	Small shoal
Iripaiyuk	64 16	73 54	20	10	70	Rocky island
Iluperolik	64 04	73 15		38		Cliff on island
Naujalik	64 04	73 11	3	15		Cliff on island
1 mi. west of above			4			Cliff on island
Krikriktaluk	64 14	73 11	5	80		Cliff (not seen)
Kapokaktok	64 02	72 57	2	30		Cliff above tidal rapid
Saudluok	64 23	72 01		34		Cliff on lake (not seen)
			111	689	210	

[1]G—Glaucous Gulls; K—Kumlien's Gulls; H—Herring Gulls.
*Indicates place names which have been adopted by the Board on Geographical Names.

Table 2. Gull rookeries seen at Pelly Bay in 1956.

	Lat.	Long.	No. of pairs Thayer's	Glaucous	Remarks
Naujardjuit	68° 28N.	89° 48W.	100		300- to 400-ft. cliff, 3 mi. from sea
Kiniktok	68 38	88 56	6	3	60-ft. cliff on inlet
Igluligardjuk	68 38	89 59	15	2	80-ft. cliff on sea
Omanark	68 40	89 54	4		120-ft. cliff on sea
Korvigdjuak Id.*	68 55	90 00	200		At 300-ft. level on 1000-ft. cliff on sea
Krangerarvik	68 39	89 47	30	5	170-ft. cliff, about 2 mi. from bay

*Indicates place names which have been adopted by the Board on Geographical Names.

Table 3. Egg-laying, incubation, and hatching of Glaucous Gulls near Cape Dorset in 1955.

Nest	June 16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	July 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	3e (1 egg removed)												2e			1c 1e*																			
2				2e		3e																		3e				1e 2p				3c			
3				3e (2 eggs removed)																								1e				1c			
4				2e																				2e				1c 1e						1e*	
5				2e		3e (1 egg removed)																		2e				1e 1p				1c			
6				2e		3e																		3e				1c 2p				2c			
7										3e																		2e 1p						3c	
8													1e																					1e	
9								3e (2 eggs removed)																						1e						1c

e—egg; p—pipped egg; c—chick; *—cold or abandoned.

Table 4. Egg-laying, incubation, and hatching of Herring Gulls near Cape Dorset in 1955.

Nest	June 12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	July 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1						2e																														
2	1e		2e				3e (1 egg removed)																	2e				1e 1p				1c 1p			1c 1p*
3	1e		2e				3e (1 egg removed)																	2e				2p				2c			
4	3e (1 egg removed)																							2e				2c							
5	1e		2e				3e (1 egg removed)																	2e								1c 1p			1c 1p*
6			3e (1 egg removed)																2e		1c 1e			1e*											

e—egg; p—pipped egg; c—chick; *—cold or abandoned.

Table 5. Observations on the breeding of Thayer's Gulls at "Krangerarvik", Pelly Bay, in 1956.

Date	Number of nests containing					
	1	2	3 eggs	1	2	3 chicks
July 1	7	5				
July 9	5	4	2			
July 13	2	8	7			
July 17	3	10	9			
August 4				1	7	1

Table 6. The colour[1] of the inner vane of the first primary in juvenile *L. a. smithsonianus*, *L. g. thayeri*, and *L. g. kumlieni*.

Form	Colour	Frequency
smithsonianus	OOS 1 4°	2
	2 3°	3
	3 2°	3
	4 2°	1
	6 2°	1
thayeri	OOS 4 2°	1
	6 2°	8
	7 2°	7
	8 2°	4
kumlieni	OOS 9 2°	2
	13 2°	7
	14 2°	1

[1]Symbols for colours from Villalobos-Dominguez and Villalobos (1947).

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