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# Birds, observed and collected by "De Nederlandse Spitsbergen Expeditie" in West and East Spitsbergen, 1967 and 1968-'69; first part

J. DE KORTE

ABSTRACT

The present article mainly concerns the birds of northern Edgeøya, where a Netherlands' expedition had residence for a consecutive period of thirteen months. In addition, information from Hornsund, Kvalpynten and Hopen, also visited by members of the Expedition, is given. Data concerning weight, food, moult, plumage and phenology are presented as well as measurements of the specimens collected.

Special attention has been paid to *Gavia stellata* (taxonomy), *Fulmarus glacialis* (colour phases), *Branta leucopsis* (breeding), *Stercorarius parasiticus* and *Stercorarius pomarinus* (plumages), *Sterna paradisaea* (breeding) *Cepphus grylle* (phenology) and *Plectrophenax nivalis* (taxonomy).

## INTRODUCTION

The main purpose of "De Nederlandse Spitsbergen Expeditie" was the study of the biology of the Polar Bear in the context of the International Polar Bear Census Expedition 1968—'69.

A preliminary expedition was made in 1967; this was merely a reconnaissance summer trip for the main expedition in 1968—'69. The preliminary party consisted of three members: Messrs E. Flipse, R. de Vries and the author.

The main expedition 1968—'69 lasted over a year and had four participants: Messrs E. Flipse, P. de Groot, P. Oosterveld and the author.

All members of both expeditions have contributed materially to the ornithological results reported here. In 1967 the ornithological collection was brought together by the author and the skinning and preparing was done by him in the field with help of Mr de Vries. During 1968—'69 the collection

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was brought together, skinned and prepared by Mr de Groot and the author. This time (not in 1967) the body-weights of the birds were taken and the stomach contents preserved in spirit or formalin for subsequent examination.

Since the main interest of the expedition was the biology of the Polar Bear, the ornithological work was merely supplementary and could not be carried out according to a fixed plan. It can be summarized as follows:

a. Collecting of skins for the "Zoölogisch Museum" of the University of Amsterdam. A total of 234 specimens belonging to 20 species was collected.

b. Field observations. Phenology, census work (large stretches of the coasts of Edgeøya were investigated for breeding places), density and behaviour studies, food and feeding habits and migration.

c. Ringing; with rings from the Stavanger Museum. A total of 78 birds belonging to 5 species was ringed.

d. Bird photography.

At the Zoölogisch Museum in Amsterdam the collected material was examined further.

In this paper the data obtained from skins, the preserved stomach contents and the field records are discussed and, where appropriate, compared with those from other regions, within the geographical distribution of the species in question. The differences and similarities are evaluated from a taxonomic and ecological point of view.

Most of the data were obtained in the Kapp Lee area (fig. 2). In the present report most attention will be given to this area.

## Itinerary (figs. 1 & 2)

"De Nederlandse Spitsbergen Expeditie 1967" left Rotterdam on 27 July with M.S. "Bernes". Sailing north, observations on birds were made daily until, on the last day of July, Spitsbergen was sighted. These observations will be dealt with separately. On 6 August we left Longyearbyen in our boat for Kapp Linné, where we investigated the area. On the 13th we continued our voyage south along the coast, staying two days at Kapp Martin and arriving in Hornsund on the 16th. From here we made trips to Dunøyane and the inner fjord regions, where a year earlier, in 1966 the author had made preliminary observations. On the first of September we sailed back to Longyearbyen and spent the time in Sassenfjorden until our departure on 9 September.

"De Nederlandse Spitsbergen Expeditie 1968—'69" headed north from Bodø on 8 August 1968. We tried to go ashore on Halvmåneøya on the 14th, but heavy pack-ice in combination with strong currents made landing im-

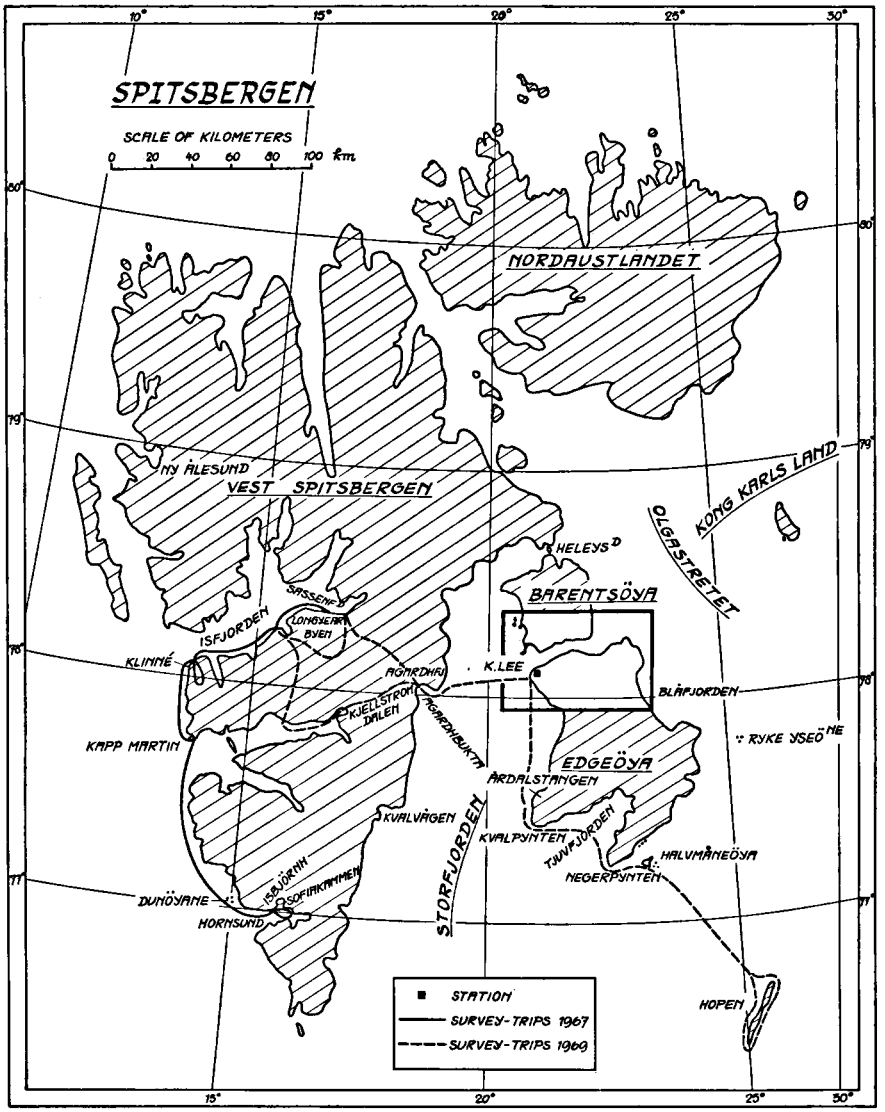



FIG. 1. Map of Spitsbergen with names referred to in this article. The rectangle indicates the Kapp Lee area, which is shown in more detail in fig. 2.

possible that day. For this reason we switched over to Kapp Lee, where we landed with our equipment the next day.

The first months of our stay were devoted to the building of our station, which was placed about 40 m from the shore, with the windows facing N-NW, giving an excellent view over Storfjorden (fig. 3).

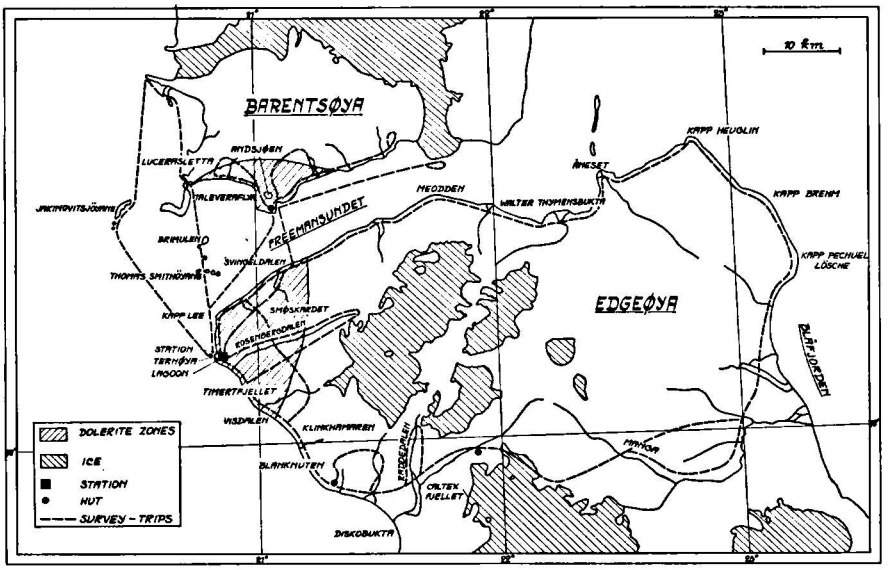



FIG. 2. Map of the Kapp Lee area with names referred to in this article.

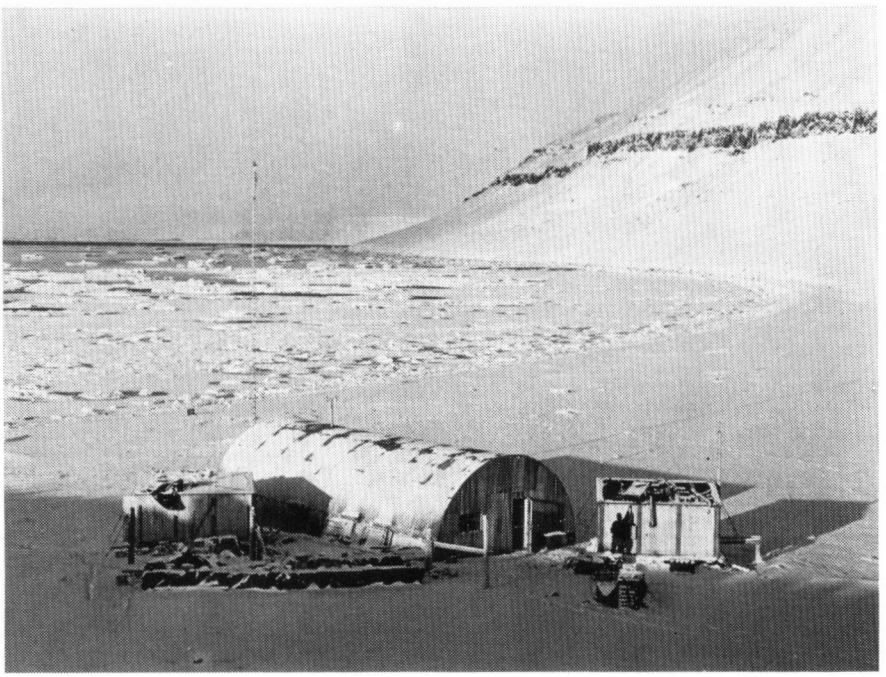


FIG. 3. Station site near Kapp Lee in the second half of September 1968. To the left is Storfjorden, to the right Leefjellet with dolerite sills, in the background the open water of Freemansundet and Barentsøya. Photograph by the author.

During the polar night, lasting from the end of October to the middle of February only short trips on skis were made in the neighbourhood of the station. After the sun had returned, three trips to Longyearbyen were made in March, April and May respectively. From 6 to 26 June the author stayed on Barentsøya and from 12 to 26 July a long trip was made on foot in the northern part of Edgeøya.

Boat trips to Ardalstangen, Hopen and Agardhbukta were made from 20 to 28 August. Finally MS "Nordvarg" collected us on 11 September 1969 for the return voyage to Norway.

*General geographical and climatological description of the Kapp Lee area* (fig. 2).

Kapp Lee is situated at 78°5′ N., 20°55′ E. in the north-western part of the island Edgeøya, which like the island Barentsøya belongs to East Spitsbergen. The two islands consist almost exclusively of horizontally situated Triassic sediments, of which in the Kapp Lee area middle Trias (mainly marine sediments) and upper Trias (mainly terrestrial) are represented. The highest mountains in this region seldom exceed an altitude of 400 m. They have mostly rounded tops and gentle slopes, which in the case of Leefjell and Timertfjell are broken to seaward by dolerite sills, forming cliffs at an altitude of about 115 m (fig. 3). At the Kapp Lee peninsula and Taleveraflya similar dolerite ridges form rocky formations near sea level (fig. 2).

The inland of both Edgeøya and Barentsøya is partly glaciated. Low-lying, fairly extensive plains are found near Diskobukta, Blåfjorden, south of Aneset and at Lucerasletta.

Thirty percent of the area in the vicinity of Kapp Lee is less than 100 m above sea level. The vegetation cover at this level is about 25 %, increasing to 100 % on coastal plateaus and in inland valleys. At elevations above 100 m the mountains are generally bare, but there are local exceptions (Oosterveld, 1971).

Unlike the north-west and north coast of West-Spitsbergen, the eastern part of the archipelago is not influenced directly by the offshoot of the warm North Atlantic Drift. The main features of the climate are dependent on cold polar currents from the N.E. The difference in climate between East- and West-Spitsbergen is reflected throughout in the plant and animal communities in these regions (Summerhayes & Elton, 1928).

At Kapp Lee the winter lasted nine months from the middle of September to the middle of June, during which the average temperature was below zero, although in May and June the maximum temperatures temporarily rose to 5° C. During summer temperatures generally varied between 0° C and 5° C. Maxima up to 8° C were sometimes measured in July (fig. 4). Maximum and minimum temperatures showed a considerable variation during the winter and early spring. Within a few days the temperature level could rise or fall a full 25 degrees Centigrade as a result of changing direction and force of the wind. The lowest temperatures were measured in the middle of December and towards the end of February, — 36° C.

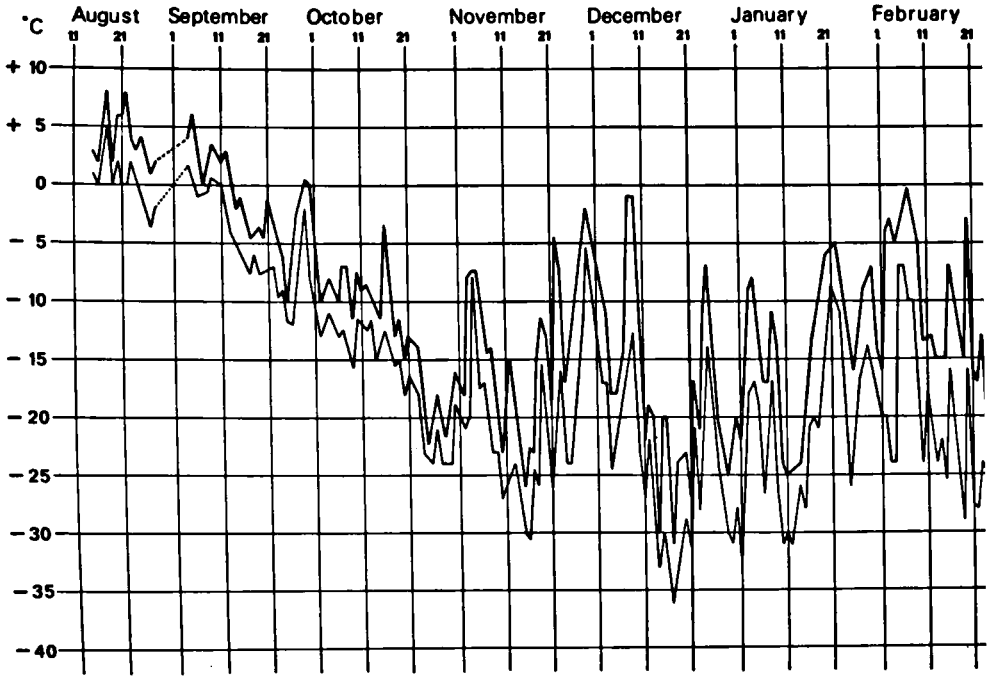



FIG. 4. Daily variation of maximum and minimum temperatures in degrees Centigrade

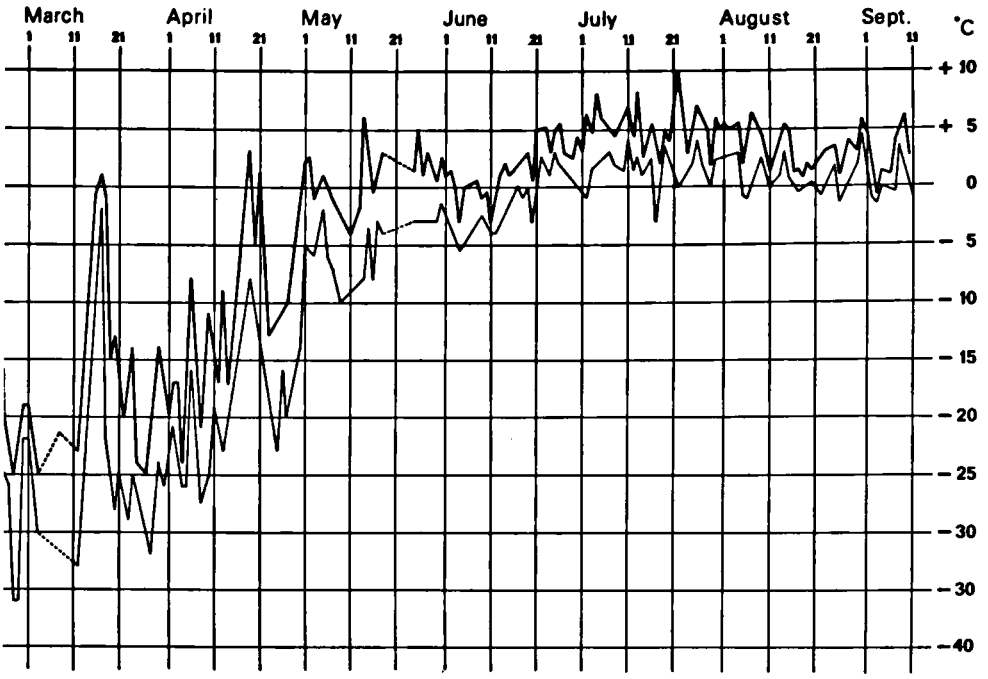
The highest winter temperatures, around zero, were recorded several times throughout the winter. The mean winter temperature (October-April) was — 20° C. This comparatively high temperature is the result of the levelling effect of the storms, blowing for three quarters of the time. During calm weather, temperatures of — 40° C are no exception in the western part of the archipelago, but a similar type of weather is rare in eastern Spitsbergen. Storms blowing from N.E. to S.E. with forces up to, and including the maximum strength 12 of the Beaufort scale were not infrequent.

The precipitation was low (100 to 200 mm annually) and fell mainly in the form of snow, also during the summer months.

As a result of low snow-fall and frequent storms the area is only partly snow-covered throughout the year and in most places the snow-layer is thin. According to Oosterveld (1971) the mean snow-cover percentage for the western part of Rosenbergdalen up to 200 m above sea level in 1969 was: from January to May 55 %, June 45 %, July 20 %, August 5 %, beginning of September 5 % (fig. 5).

Fresh water ponds froze over in the middle of September and started to thaw in the first week of June, being ice-free at the beginning of July.

The first new ice appeared along the coasts in the middle of September and the sea started to freeze over definitely towards the end of this month (fig. 3).




at Kapp Lee, 1968—1969.

In October the ice cover on Storfjorden rapidly increased, while in November only areas with strong currents remained free of ice. By January the whole of Storfjorden and Freemansundet was covered with ice, which remained solid up to the end of May (fig. 5, 6). The ice started to break up in the middle of June, channels of open water appearing only at the end of this month (fig. 7). In the course of July the winter ice gradually drifted away, but depending on wind directions, Storfjorden and Freemansundet were more or less covered with drift ice even during August and September.

## Account of the species

1. **Gavia** spec.

One observation: 12 July 1969 in the lagoon near Kapp Lee. A bird in immature plumage of unknown specific identity, but either *G. immer* (Brünnich, 1762) or *G. adamsii* (Gray, 1859) stayed in the lagoon for several hours, but was not seen again. Both of these species have been recorded in Spitsbergen on rare occasions (Burton, Blurton-Jones & Pennycuick, 1960; Løvenskiold, 1964).

2. **Gavia stellata** (Pontoppidan, 1763). Red-throated Diver.
Material collected: 5 specimens; data in Table I.

FIG. 5. Western part of Rosenbergdalen at the end of May 1969. To the left is frozen Storfjorden, in the background West Spitsbergen. Photograph by the author.

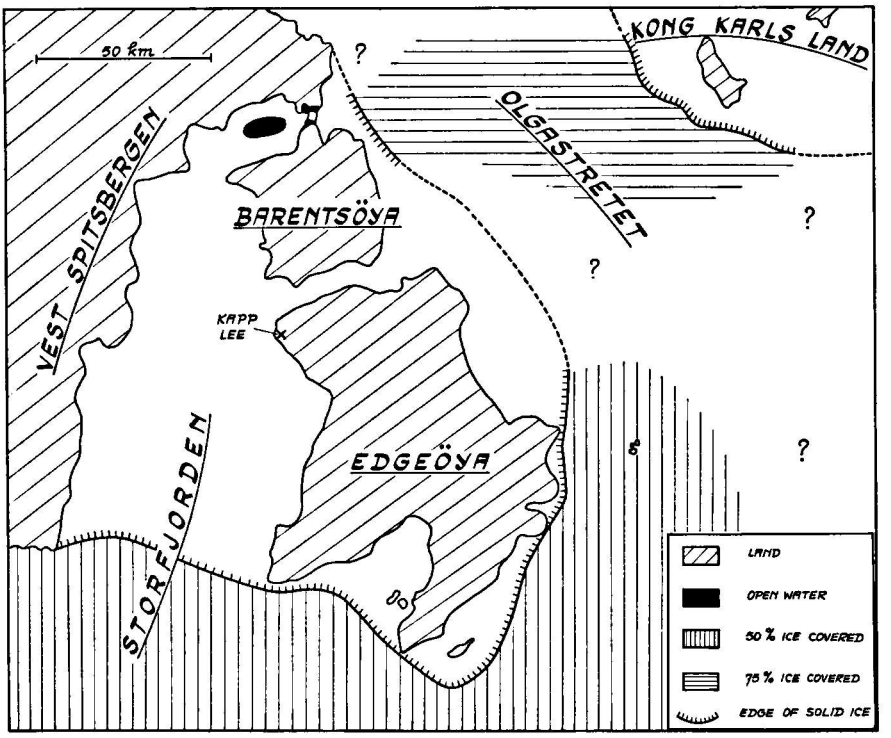



FIG. 6. Ice cover of the sea around Edgeøya in the middle of May 1969, derived from aerial observations (pers. comm. B. Johansen).

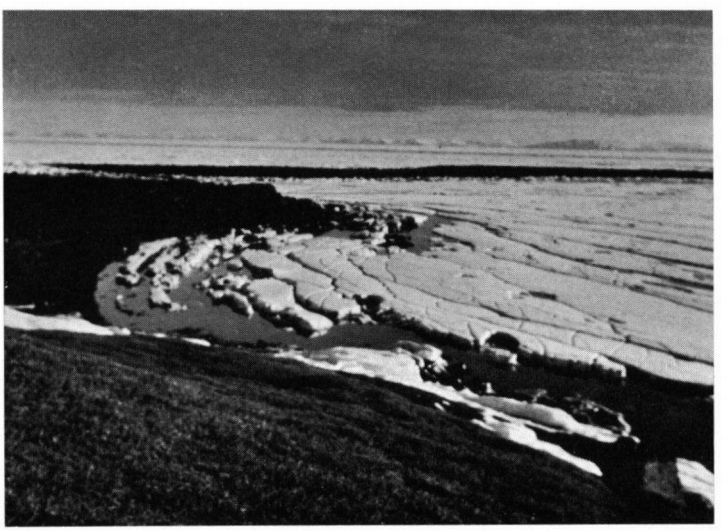


FIG. 7. Channels of open water in the sea ice near the station at the end of June 1969. Photograph by P. Oosterveld.

ZMA No. 22751, ♀ ad., 28.VIII.1967, Dunøyane.
ZMA No. 19780, 19859, ♂ and ♀ (pair), 23.VII.1969, Blåfjordflya.
ZMA No. 19857, 19858, ♀ and ♂ (pair), 24.VIII.1969, Årdalstangen.

TABLE I. *Gavia stellata*. Weights and measurements.

| Coll. nr. ZMA | Weight g | Wing mm | Tarsus mm | Culmen mm | Condition | Sexual cycle |
|---|---|---|---|---|---|---|
| | | | MALES | | | |
| 19780 | 1690 | 279 | 68.5 | 53.0 | fat | brood patch |
| 19858 | 1755 | 279 | 65.6 | 55.6 | fat | brood patch |
| | | | FEMALES | | | |
| 22751 | | 276 | 66.9 | 50.8 | fat | Oviduct swollen |
| 19859 | 1420 | 271 | 68.2 | 48.8 | fat | swollen, brood patch |
| 19857 | 1420 | 275 | 68.9 | 49.3 | fat | swollen, brood patch |

Vaurie (1965) considers *Gavia stellata* from Spitsbergen and Franz Josephland sufficiently differentiated from other populations of the species to warrant nomenclatural recognition as a separate subspecies: *Gavia stellata squamata* (Portenko, 1939). This is said to be paler on the back of the neck and on the mantle than the nominate form. The ground colour on the back of the neck should be a lighter gray than the nominate form. A total of 8 Spitsbergen Red-throated Divers[1]) (summer birds) was compared with 10 specimens from Greenland, Iceland and northern Sweden (summer birds). Although the Spitsbergen birds may be slightly greyer on the average, the difference is by no means constant. From Table II it can be seen that there is no clear size difference either and no significant differences were found after treating the data statistically with the Student T. test ($P > 0.01$). We conclude therefore, that the Spitsbergen population is hardly different from other populations. Nomenclatorially *Gavia stellata* is best treated as monotypic.

Stomach-contents; 5 examined.

Fish (5 ×) included mainly Gadidae, among which were *Boreogadus* spec. Crustacea (2 ×) included *Thysanoessa inermis, Gammaracanthus loricatus.* Plant remains, very few (1 ×) included *Stellaria humifusa, Salix polaris, Tomenthypnum nitens* and *Drepanocladus uncinatus.*

Field observations (fig. 8).

In 1968 a single bird was seen on 30 August at Rosenbergdalen. In 1969 the Red-throated Diver arrived in the Kapp Lee area about the middle of June (first observed 17 June at Taleveraflya). At that time the fresh water lakes had started to thaw. From 27 June to 2 July a pair came each night for some hours to a narrow strip of open sea behind Ternøya, where they were

[1]) Included additional skins in the museums of Amsterdam and Leiden.

TABLE II. Geographical variation in *Gavia stellata*, (1) is measurements after Schaanning (1933) and Bauer & Glutz von Blotzheim (1966), (2) is measurements after Dementiev (1951).

| Locality | Number | Wing in mm | Culmen in mm | Tarsus in mm | Number | Weight in g |
|---|---|---|---|---|---|---|
| | | | MALES | | | |
| Spitsbergen | 3 | 279; 279; 283 | 52.7; 43.0; 55.6 | 65.6; 67.6; 68.5 | 2 | 1690; 1755 |
| Greenland | 5 | 271—305 (M 289) | 49.6—57.8 (M 52.6) | 66.0—74.3 (M 70.0) | 6(1) | 1370—1900 (M 1740) |
| Russia(2) | 42 | 265—308 (M 283) | | | 4 | 1400—2460 (M 1888) |
| | | | FEMALES | | | |
| Spitsbergen | 5 | 271—284 (M 277) | 48.1—50.8 (M 49.3) | 65.7—70.1 (M 68.0) | 2 | 1420; 1420 |
| Greenland | 4 | 269—286 (M 276) | 47.0—51.5 (M 49.5) | 65.5—75.3 (M 70.5) | 4(1) | 1410—1613 (M 1524) |
| Russia(2) | 40 | 260—298 (M 275) | | | 11 | 1250—2255 (M 1652) |

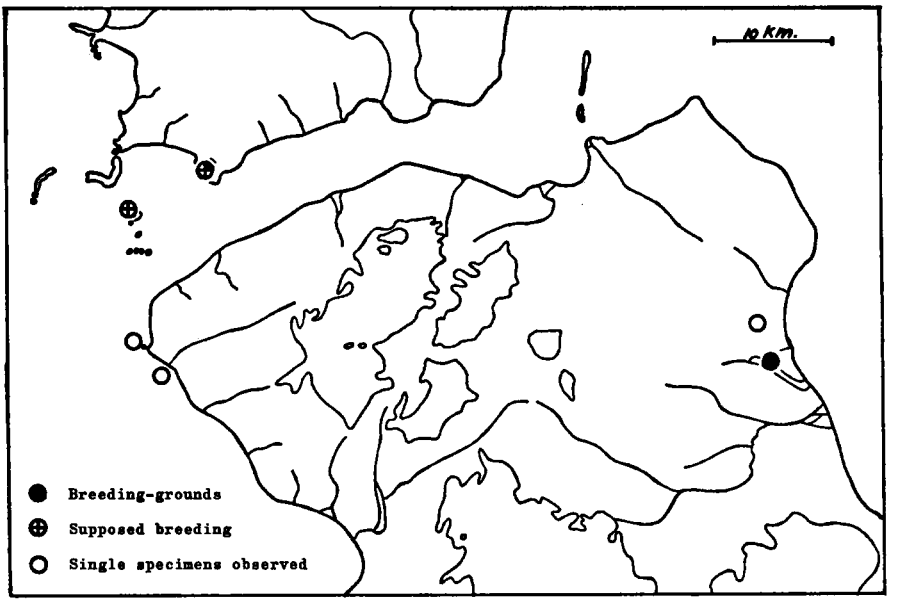



FIG. 8. *Gavia stellata*. The same symbols are used also in the other maps concerning the occurrence of the species.

actively diving. After 2 July the sea-ice had disappeared over a considerable area and the birds were seen flying but no longer foraging near the station. On 27 July four pairs were observed on Blåfjordflya and one nest was located which contained two fresh eggs. The distance from the open sea was about 10 km. On 23 August four pairs were seen on the little lakes of Årdalstangen near Kvalpynten. Latest date of observation: 2 September, 2 birds on the tarns on Brimulen, where the birds had previously been seen that year with young. At this place again 2 adult birds of this species were observed on 27 August 1971 (pers. comm. E. Flipse).

In 1967 I observed pairs with half-grown young on 27 August at Dunøyane. All these data agree with those given by Løvenskiold (1964) for West Spitsbergen.

In conclusion it can be said that the species does not arrive at the nesting sites in the fresh water lakes before these are partly thawed, and leaves when the lakes start to freeze over again. In the breeding time birds are able to cover large distances to reach open sea for foraging.

### 3. **Fulmaris glacialis glacialis** (Linnaeus, 1761). Fulmar.

Material collected: 22 specimens; data in table III.
ZMA No. 22682-22683: 2 ♀ ♀ ad., 9.VIII.1967, Kapp Linné.
ZMA No. 19894, ♀, 14.V.1969, Kapp Lee.
ZMA No. 19888, ♀ ad., 18.V.1969, Kapp Lee.
ZMA No. 19893-19891: ♀ ad., ♂, 20.V.1969, Kapp Lee.
ZMA No. 19881, ♂, 1.VI.1969, Kapp Lee.

TABLE III. *Fulmarus glacialis*. Weights and measurements.

| Coll. nr. ZMA | Weight g | Wing mm | Tarsus mm | Culmen mm | Condition | Sexual cycle | Moult of primaries |
|---|---|---|---|---|---|---|---|
| | | | | | MALES | | |
| 19891 | 785 | 320 | 52.4 | 39.2 | fat | — | 1—2 absent, 3—10 old |
| 19881 | 757 | 310 | 50.5 | 36.3 | fat | — | 1—10 old |
| 19820 | 730 | 319 | 53.1 | 38.6 | fat | — | 1—8 new, 9—10 half grown |
| 19873 | 815 | 332 | 50.6 | 37.8 | fat | brood patch | 1—10 old |
| 19877 | 895 | 338 | 50.2 | 37.0 | fat | brood patch | 1—10 old |
| 19878 | 847 | 299 | 53.5 | 38.8 | fat | — | 1—9 new, 10 half grown |
| 19889 | 800 | 337 | 53.7 | 38.4 | very fat | — | 1—10 new |
| 19879 | 760 | 326 | 46.4 | 36.9 | moderate | brood patch | 1—8 new, 9—10 old |
| 19874 | 730 | 309 | 52.8 | 36.1 | moderate | — | 1—9 new, 10 half grown |
| | | | | | FEMALES | | |
| | | | | | | Oviduct | |
| 22682 | — | 319 | 47.4 | — | fat | swollen | 1 new, 2 absent, 3—10 old |
| 22683 | — | 315 | 47.7 | 32.4 | fat | narrow | 1—10 new |
| 19894 | 631 | 309 | 49.2 | 35.5 | fat | narrow | 1 absent, 2—10 old |
| 19888 | 611 | 318 | 45.8 | 33.1 | fat | narrow | 1—10 old |
| 19893 | 695 | 321 | 47.4 | 35.1 | fat | ? | 1—10 old |
| 19876 | 535 | 321 | 48.8 | 35.8 | fat | swollen | 1—10 old |
| 19871 | 661 | 324 | 49.8 | 36.0 | fat | swollen, brood patch | 1—10 old |
| 19872 | 596 | 325 | 49.2 | 36.1 | fat | swollen, brood patch | 1—2 absent, 3—10 old |
| 19895 | 665 | 324 | 47.0 | 35.9 | fat | swollen, brood patch | 1—10 old |
| 19875 | 560 | 317 | 50.8 | 33.3 | fat | swollen | 1—2 absent, 3—10 old |
| 19890 | 625 | 317 | 48.2 | 34.1 | very fat | swollen | 1 new, 2—4 absent, 5—10 old |
| 19880 | 610 | 319 | 49.0 | 35.5 | very fat | swollen | 1 new, 2—3 absent, 4—10 old |
| 19892 | 590 | 294 | 47.5 | 34.3 | moderate | narrow | 1—9 new, 10 half grown |

ZMA No. 19820-19876: ♂ ♀ ad., 10.VII.1969, Kapp Lee.
ZMA No. 19873-19877-19871-19872-19895: 2 ♂♂, 3 ♀♀ ad., 17.VII.1969, Diskobukta.
ZMA No. 19878-19875-19890-19889-19880: 2 ♂♂, 3 ♀♀ ad., 1.VIII.1969, Kapp Lee.
ZMA No. 19879-19892: ♂ ♀, 8.VIII.1969, Kapp Lee.
ZMA No. 19874, ♂, 9.VIII.1969, Kapp Lee.

The measurements agree with records from Wynne Edwards (1952), Mathiasson (1963), Salomonsen (1965), and Vaurie (1965). The sexual variation in these data is shown in table IV.

TABLE IV. Sexual variation in *Fulmarus glacialis*. Two specimens from Spitsbergen in the collections of the Zoölogisch Museum Amsterdam are also included (1).

| | Sex | Number | Range | S.d. | Mean ± s.d.m. | t |
|---|---|---|---|---|---|---|
| Weight g | ♂ | 9 | 730—895 | 55.00 | 791.0 ± 18.3 | 7.56 |
| | ♀ | 11 | 535—695 | 46.70 | 616.3 ± 14.1 | |
| Wing mm | ♂ | 8[1] | 310—338 | 9.81 | 328.3 ± 3.5 | 2.48 |
| | ♀ | 12 | 309—325 | 4.46 | 319.1 ± 1.3 | |
| Culmen mm | ♂ | 11[1] | 36.1—40.6 | 1.42 | 37.8 ± 0.4 | 5.41 |
| | ♀ | 12 | 32.4—36.1 | 1.28 | 34.8 ± 0.4 | |
| Tarsus mm | ♂ | 11[1] | 46.4—53.7 | 2.24 | 51.5 ± 0.7 | 3.52 |
| | ♀ | 13 | 45.8—50.8 | 1.37 | 48.4 ± 0.4 | |

The difference in body weight between males and females is significant ($P < 0.01$), the males on the average being 175 gr. (28 %) heavier than the females (fig. 9). The differences in culmen (fig. 12) and tarsus lengths are also significant, males exceeding females by 9 % and 6 % respectively. The difference in wing-length is not significant and this makes the difference in weight still more striking. In Baffin Island males are also considerably heavier than females (see data given by Wynne-Edwards, 1952; Watson, 1957). The question arises whether this difference reflects a difference in feeding ecology of the sexes. The difference in culmen length may point in this direction.

No significant seasonal differences in body weight were found, though the females show a slight tendency to loose weight from May to August (fig. 9).

Moult.

Moult of primaries was found from May to August in 12 of our 22 specimens. At first sight the sequence of primary moult did not appear to be correlated with the collecting dates of the specimens. Some specimens from May had started to lose their innermost primaries, while some July birds still had all of their old primaries retained (table III).

According to Stresemann (1966), immature Fulmars start the primary moult some months earlier than adults. Four of our specimens were certainly immature birds (oviduct narrow, table III), showing primaries ($P_1$ is innermost primary) as follows: 14 May, $P_1$ not present $P_{2-10}$ old; 18 May $P_{1-10}$

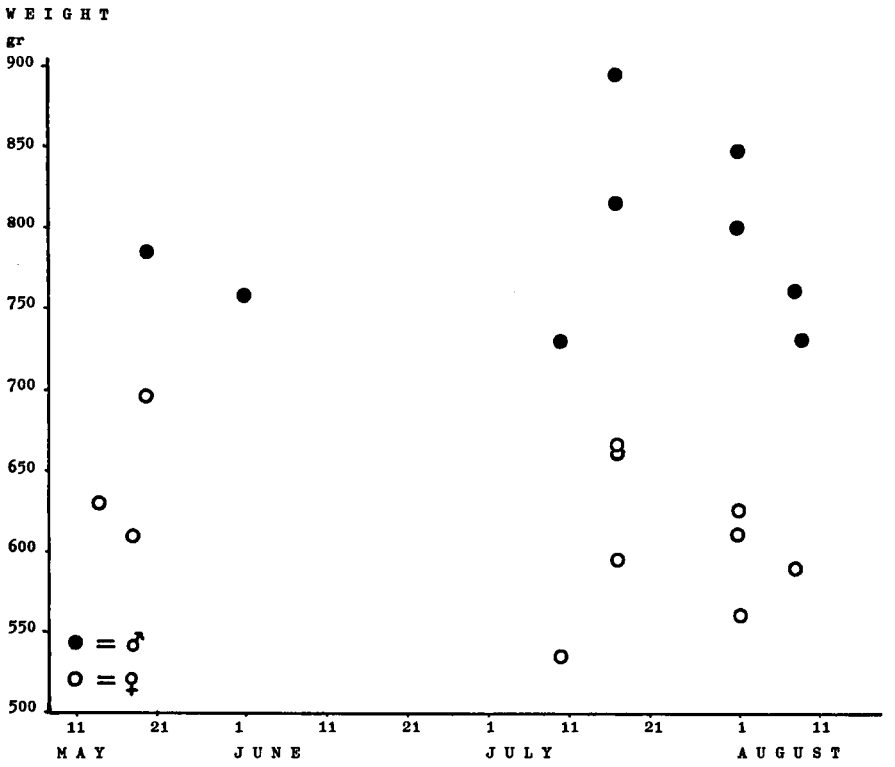



FIG. 9. *Fulmarus glacialis*. Weights of males and females, collected near Kapp Lee in spring and summer 1969.

old; 9 August (2) $P_{1-9}$ new $P_{10}$ half grown and $P_{1-10}$ new.

Eleven of our specimens were certainly adults (brood patch and swollen oviduct), showing primaries as follows: 10 July, $P_{1-10}$ old; 17 July (5), $P_{1-10}$ old (4) and $P_{1-2}$ not present $P_{3-10}$ old; 1 August (3), $P_{1-2}$ not present $P_{3-10}$ old, $P_1$ new $P_{2-3}$ not present $P_{4-10}$ old, $P_1$ new $P_{2-4}$ not present $P_{5-10}$ old; 8 August, $P_{1-8}$ new $P_{9-10}$ old; 9 August, $P_1$ new $P_2$ not present $P_{3-10}$ old.

From these data it is obvious that in Spitsbergen the immature Fulmars start the primary moult in May and complete this moult in August, while the adult birds begin to lose their primaries about two months later.

Given this difference in timing, the stage of primary moult can help us in some cases to determine whether a Fulmar is immature or adult. Six males from table III did not show brood patches. Judging from their primary moult five of them were immatures, while the sixth (1 June, $P_{1-10}$ old) could be an immature as well as an adult bird.

From all 22 Fulmars, only 7, collected in July and August, showed some degree of moult of small feathers, mostly over the whole body.

Colour-phases.

It is a well-known phenomenon, that the Fulmar shows different colour-phases (Fisher, 1952; Salomonsen, 1965). The percentages of these phases differ in different localities within the Fulmar's range. Fisher (1952) proposed four colour categories for the Fulmar "LL" double light, "L" light, "D" dark and "DD" double dark. I have tried to use these categories. In the field it is rather difficult to allocate the observed individuals with certainty to one of these categories. As a result the percentages I have given have some inherent uncertainty.

Middle August 1967, I made a count of the colour phases during a boattrip along the west coast of Spitsbergen from Kapp Linné to Hornsund. Late August 1967, I counted in Hornsund near Sofiakammen and Luciakammen. During our stay on Edgeøya in 1968 and 1969 I regularly counted the birds seen on and around the island. The results of these counts are shown in table V.

TABLE V. *Fulmarus glacialis*. Percentages of colour phases in Spitsbergen. A = Field observations, Kapp Linné to Hornsund, middle of August 1967. B = Field observations, Hornsund, late August 1967. C = Field observations, Edgeøya, middle of August to middle of September 1968 and 1969. D = Field observations, Edgeøya, May to middle of August 1969. E = Skins (24) from Edgeøya and Isfjord, May to middle of August, a = total, b = males, c = females.

| Colour category | A | B | C | D | E | | |
|---|---|---|---|---|---|---|---|
| | | | | | a | b | c |
| "LL" | 5 % | 1 % | 1 % | 0 | 0 | 0 | 0 |
| "L" | 10 % | 4 % | 9 % | 5 % | 4 % | 9 % | 0 |
| "D" | 75 % | 75 % | 70 % | 70 % | 71 % | 82 % | 62 % |
| "DD" | 10 % | 20 % | 20 % | 25 % | 25 % | 9 % | 38 % |

As a check on field observations I ascertained the percentages of the colour categories in the material collected on Spitsbergen. Comparison with truly "LL" forms from the North Sea in the museums of Amsterdam and Leiden, made the division in categories more reliable than that of the field observations. The percentages of males and females in different categories were also calculated (table V). The observations on skins agree fairly well with those obtained in the field. It must be stressed, however, that the borderlines between the categories remain arbitrary to some extent (see also fig. 11).

Discussion of table V: the difference in percentages between the counts from middle August '67 and late August '67 may be due to a larger number of light stragglers from the south along the West-Spitsbergen coast than in the inner fjord regions of Hornsund, where the Fulmars have breeding places (personal observations).

The differences in percentages between Edgeøya, May to middle August and middle August to middle September may be due to light stragglers, coming north after the breeding season in more southern regions.

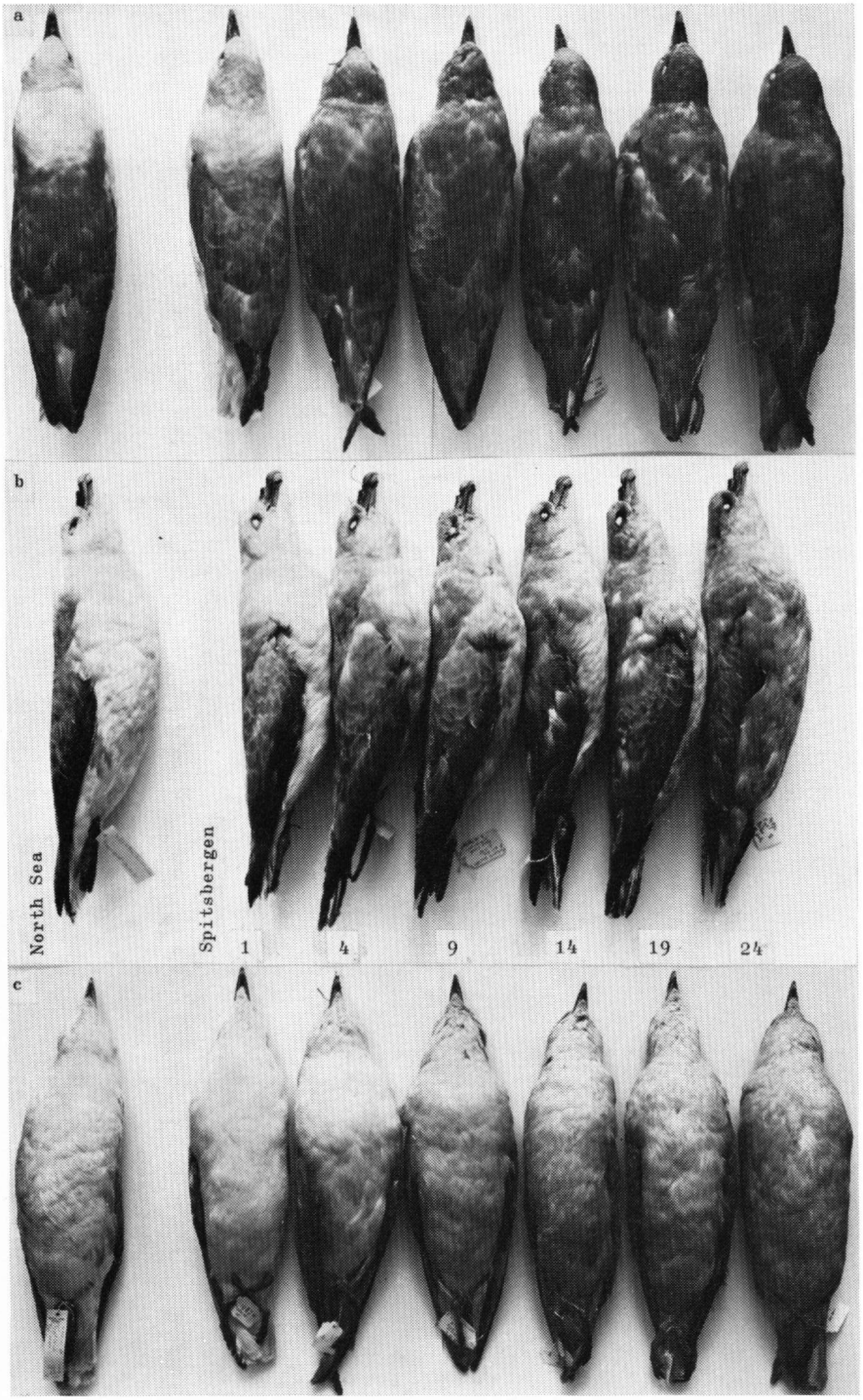



FIG. 11. *Fulmarus glacialis*. Dorsal (a), lateral (b) and ventral (c) view of colour phases. A light North Sea specimen and 6 Spitsbergen specimens arranged according to increasing pigmentation. Explanation of numbers in fig. 10.

The difference between West Spitsbergen and Edgeøya may be due to the more pronounced high-arctic regime in the east, with which the dark form is associated, according to Salomonsen (1965).

It is interesting to note that the females tend to be darker than the males. In order to see more exactly how the males and females differ, all the specimens (24) were arranged according to increasing pigmentation. In fig. 10 is shown how the sexes are distributed over the colour categories. The three lightest specimens of this range are males, the five darkest are females. From this figure the tendency of the males to be lighter than the females is quite clear. Fig. 11 shows a North Sea specimen of colour category "LL" and the numbers 1, 4, 9, 14, 19 and 24 of the series of fig. 10.

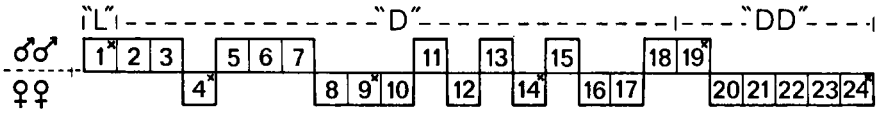



FIG. 10. *Fulmarus glacialis*. Distribution of sexes in a serie of 24 specimens, arranged according to increasing pigmentation. The specimen numbers marked with × are shown in fig. 11. "L", "D", and "DD" indicate colour categories (see text).

If there is a correlation between sexes and pigmentation of the Spitsbergen Fulmars, then the question arises if this is so in other Fulmar populations. Thirty-one specimens from the North Sea were arranged in the same way as the Spitsbergen birds and the same trend was obvious.

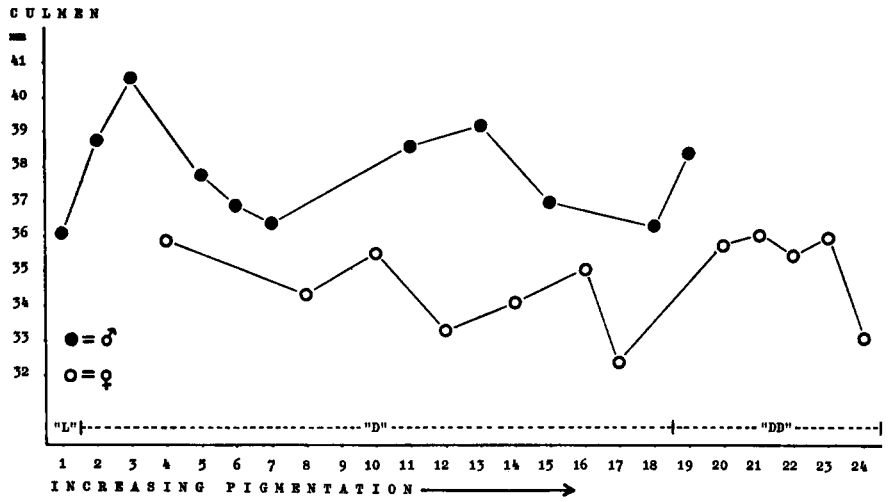



FIG. 12. *Fulmarus glacialis*. Culmen length in relation to increasing pigmentation. Numbers 1—24 indicate relative measure of pigmentation.

On a breeding place on Edgeøya of ca. 340 pairs (see field observations) I observed both light and dark birds mixed at random on the ledges. The dark birds were in the majority (table V). Mostly both members of a pair belonged to "D", often they belonged to "D" and "DD" and several times I saw "D" and "L" together.

Judging from my material, pigmentation and bill-size show independent variation (fig. 12). This supports the statement of Salomonsen (1965) that the geographical variation in dimorphism and that in bill length do not coincide in the Fulmar.

Stomach contents; 20 examined (table VI).

TABLE VI. *Fulmarus glacialis*. Food in totals and percentages of stomachs examined.

| Food | Males (9) | Females (11) | Total (20) |
|---|---|---|---|
| Cephalopods (beaks) | 6 (67 %) | 10 (91 %) | 16 (80 %) |
| Total number of beaks | 18 | 57 | 75 |
| Beaks per stomach examined | 2.0 | 5.2 | 3.8 |
| Crustacea | 4 (44 %) | 2 (18 %) | 6 (30 %) |
| Gammaridae | 1 (11 %) | — | 1 (5 %) |
| *Thysanoessa inermis* | 3 (33 %) | 2 (18 %) | 5 (25 %) |
| Polychaeta (jaws) | — | 4 (36 %) | 4 (20 %) |
| Total number of jaws | — | 49 | 49 |
| Jaws per stomach examined | — | 4.5 | 2.5 |
| Fish | 2 (22 %) | 2 (18 %) | 4 (20 %) |
| Offal | 2 (22 %) | — | 2 (10 %) |
| Empty | — | — | none |

In the stomach contents we frequently found the beaks of small cephalopods, but only in one instance did we identify another portion of the animal, viz. eyelenses. Gammaridae included *Gammarus locusta*. Only the jaws of Polychaeta were found in the stomach contents. All fish remains (bones and otoliths) were too far digested to be identifiable. Offal included in one case blubber (whale or seal) and in one case hair. It seems that males eat more Crustacea than females and females eat more Cephalopoda and Polychaeta. A difference in diet between the sexes has been recorded in other arctic sea birds by Belopolskii (1957).

For both males and females Cephalopoda are a conspicuous item of diet, but it is possible that *Thysanoessa* (see table VI) is more important than appears from these data; cephalopod beaks are digested more slowly than *Thysanoessa* (Hartley & Fisher, 1933). It is possible that the cephalopods had been eaten elsewhere than at the site of collection of the birds, as these were all collected when they came flying along the coast and never while they were feeding.

TABLE VII. *Fulmarus glacialis*. Food in percentages of stomachs in different periods.

| | MAY | | | JULY | | | AUGUST | | |
|---|---|---|---|---|---|---|---|---|---|
| Food | Total (5) | ♂♂ (2) | ♀♀ (3) | Total (7) | ♂♂ (3) | ♀♀ (4) | Total (8) | ♂♂ (4) | ♀♀ (4) |
| Cephalopods | 60 % | 50 % | 67 % | 100 % | 100 % | 100 % | 75 % | 50 % | 100 % |
| Beaks per stomach | 0.8 | 0.5 | 1.0 | 4.9 | 4.0 | 5.5 | 4.6 | 1.3 | 8.0 |
| Crustacea | 40 % | 50 % | 33 % | 29 % | 33 % | 25 % | 25 % | 50 % | — |
| Polychaeta | — | — | — | 29 % | — | 50 % | 25 % | — | 50 % |
| Jaws per stomach | — | — | — | 2.6 | — | 4.5 | 3.9 | — | 7.8 |
| Fish | — | — | — | 43 % | 67 % | 25 % | 13 % | — | 25 % |
| Offal | 20 % | 50 % | — | 14 % | 33 % | — | — | — | — |

In Bjørnøya (Duffy & Sergeant, 1950) and Greenland (Hagerup, 1926) cephalopods were also found in nearly all the specimens examined.

The stomach contents of birds, collected in spring and in summer showed some differences (table VII).

It seems, that the Fulmars eat more cephalopods, polychaets and fish in the summer than in the spring, when they seem to eat more Crustacea and offal. The earliest stomach collected on 14 May (♀) and the latest one collected on 9 August (♂) both contained only one cephalopod beak.

Two stomachs (♀, 17 July; ♂, 11 August) contained nematodes.

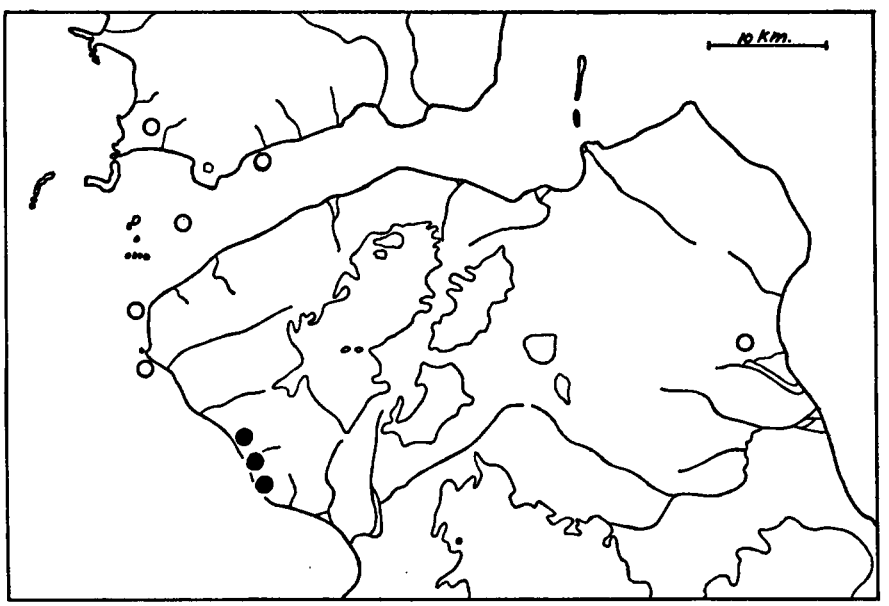



FIG. 13. *Fulmarus glacialis.* (Legend in fig. 8).

Field observations (fig. 13).

In 1968 we saw Fulmars from the time we arrived, middle August, until 3 October. On that date we saw some birds several km from the coast, flying over the freezing sea.

By that time minimum and maximum temperatures had fallen to —18° and —10° C respectively (fig. 4).

The first observation in 1969 was on 23 Feb., when five birds flew north along Kapp Lee. Min. and max. temperatures were —24° and —13° C respectively that day. We saw no Fulmars until 11 April; from that date onwards we saw some every day. They came as well from the North as from the South, indicating that they crossed frozen Storfjorden (fig. 6) from both directions.

On 4 May there were circa 40 birds flying around a polar bear carcass on

Storfjorden. In May, when Storfjorden was still frozen, it was obvious that more Fulmars flew northward than southward. In the first half of June Fulmars flew regularly eastwards over the still frozen Freemansundet; in the second half of this month they came also from the East. On 14 June a colony of about 20 pairs was discovered on the mountain Klinkhamaren. On 13 July we counted 23 pairs there. On the mountains north of Diskobukta along the coast we found another 340 pairs. They sat on ledges at about 150 m above sea level in a slate formation. They were difficult to reach and I could not manage to look in the supposed nests. On 17 July I could not see nestlings or eggs, but from the behaviour of the birds on the ledges I concluded that they were incubating. All birds (5) collected in the immediate vicinity of the colony showed brood patches. A lot of the birds from this colony were feeding around the mouths of the little streams, that ran into the sea, in the neighbourhood of the colony.

On 22 July we saw two Fulmars above Blåfjordflya, coming from the North-West at 10 km distance from the sea. One of them was chased by two Arctic Skuas so that it was forced to alight on a pond.

Fulmars were seen every day flying in all directions, in Freemansundet and near Kapp Lee until the day of our departure on 11 September.

4. **Clangula hyemalis** (Linnaeus, 1758). Long-tailed Duck.

Material collected: 1 specimen.
ZMA No. 19861, ♀ ad., 23.VIII.1969, Årdalstangen.
Oviduct swollen, brood patch present. Condition fat.
Weight 662 gr. Wing 208 mm. Culmen 23.8 mm. Tarsus 32.7 mm.
Was in summer plumage and showed some degree of moult of small feathers all over the body.

Stomach: Full of Gammaridae, including *Gammarus locusta* (sea water species), and much grit. This specimen was collected on a fresh water tarn (see field observations).

Field observations.

In 1969 the Long-tailed Duck arrived in the Freemansundet area about the middle of June (first observed 17 June in the thawing fresh water ponds on Taleveraflya). By that time three pairs had arrived, of which the males were in dark summer plumage. The birds were courting intensely, the males carrying their elongated tail feathers vertically and uttering their metallic call. When pairs approached each other too closely, one drake chased the other and the fugitive bird often escaped by diving.

On 25 July we saw a moulting male in Thymensbukta, as it tried to escape by swimming; it probably was flightless. On 2 August there was a male in the lagoon behind our station in rest plumage. We did not observe it flying. On 23 August a female in summer plumage was observed at Årdalstangen in one of the fresh water tarns (see Material collected).

5. **Somateria mollissima borealis** Brehm, 1824. Common Eider.

Material collected: 2 specimens.
ZMA No. 19854, ♂ 20.VI.1969, Barentsøya.
ZMA No. 19853, ♀ 30.VI.1969, Kapp Lee.
Weights and Measurements:

| | Weight | Condition | Wing | Culmen | Tarsus |
|---|---|---|---|---|---|
| ♀ | 2165 g | very fat | 275 mm | 48.7 mm | 47.5 mm |
| ♂ | 2285 g | very fat | 285 mm | 50.0 mm | 51.0 mm |

The male was in nuptial plumage and did not show moult. It had large testis (21 mm) indicating a breeding condition. The female showed a beginning of post-nuptial moult of small feathers and had a narrow oviduct.
Stomach-contents; 2 examined.

Male: large quantities of Gammaridae, mostly *Gammarus locusta*. Female: large quantities of both *Gammarus locusta* and *Gammaracanthus loricatus*. The male was collected on a fresh water lake, the female while foraging in the sea, along the coast.
Field observations (fig. 14).

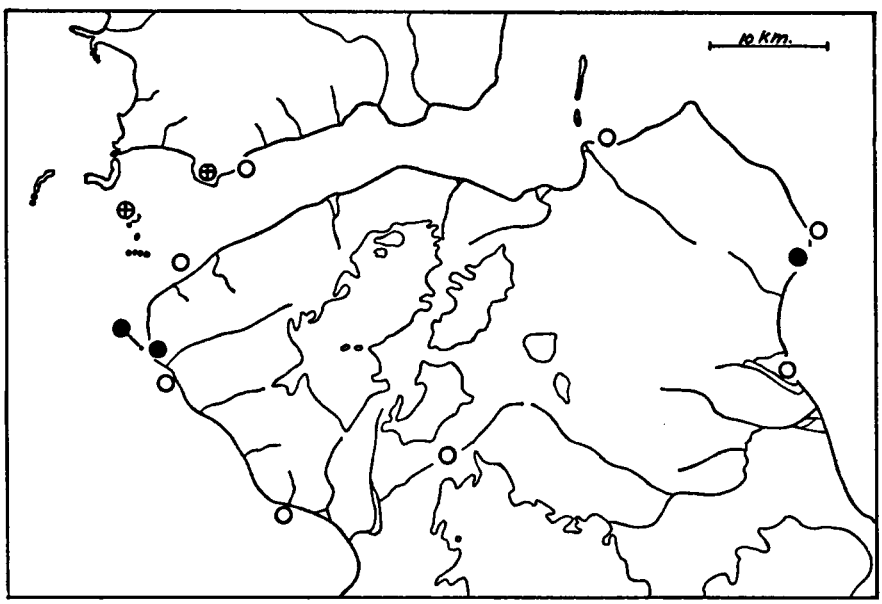



FIG. 14. *Somateria mollissima*. (Legend in fig. 8).

In 1968 on 22 August there were 51 moulting males in the lagoon behind the station. On 31 August 2 females with 6 half-grown young were seen. On 11 September there were 108 males in moult on the sea near Rosenbergdalen. On 17 September 26 males in post-nuptial plumage were seen on the sea.

From the middle of September to the first week of October groups (20—50 individuals) of eiders flew southwards daily above Storfjorden. On 26 September we counted ca. 500 birds of this species in open water on the freezing sea. Thereafter we saw eiders every day at this place until 8 October. By that time minimum and maximum temperatures had fallen to —14° C. and —7° C. respectively (fig. 4).

The first time we saw the Common Eider in 1969 was on 14 May, when four males flew North over frozen Storfjorden. By that time temperatures were near freezing point. On 21 May several hundreds of eiders were seen in the open water of Heleysundet (fig. 6) (pers. comm. Bjørn Johansen). From late May onwards every day groups of eiders (30—60 indiv.) flew North. We saw eiders flying around Ternøya every day. Often it seemed, that they intended to alight there, but we never saw them actually do so before the second week of June, when the sea-ice along the coast began to crack. In the middle of June small groups (3—8 indiv.) flew east through Freemansundet. On 13 June for the first time a pair alighted on the thawing fresh water ponds of Taleveraflya. Later on in June there were 4 pairs in these ponds. They were courting intensely and several times I saw them copulate. They were together with some pairs of King Eider (*S. spectabilis*), the males of which often chased away the males of the Common Eider, the Common Eiders always withdrawing. The drakes of the King Eider were also courting the females of the Common Eider, but these females never paid attention to their courtship. Van Oordt (1921) observed in Isfjord a male King Eider paired with a female Common Eider. Dalgety (1932) and Lings (1932) have also recorded mixed pairing. In one instance, after her mate was killed I saw a female Common Eider together with a pair of King Eiders for some days.

In the second half of June there were about 300 eiders in the channels between the breaking sea-ice near the coast of Kapp Lee. They were courting all the time, the calls of the males were heard constantly.

On 30 June we found for the first time a scrape with down, containing one egg on Ternøya. On this island were ca. 100 nest scrapes from years before. Terns are also known to breed here. This phenomenon of a mixed colony is well known in Spitsbergen (Løvenskiold, 1964).

Until the middle of July the Arctic Foxes had access to the island via the sea-ice constituting a connection with the mainland of Edgeøya during low tide. Every day they looked in all the scrapes. They returned to the mainland before high tide. On 10 July there were still no nests containing eggs at this place, though every day some Eiders were seen on the island and we regularly found empty eggshells in the neighbourhood. A nest containing three eggs was found on 9 July on the hill near our station; the next day it was found empty. Near Kapp Pechuel Lösche we found a nest with two fresh eggs on 24 July.

From late July until the middle of August there were about 40 females in the neighbourhood of Ternøya, thereafter they disappeared. During the first week of September every day groups (20—40 individuals) of females were seen, flying south along the coast.

We made the following observations concerning young: 16 August, Ternøya, 1 female with 2 young and 2 females with 5 young; 2 september, Brimulen; 2 females with 5 young; 4 september, Kapp Lee, 3 females with 8 young. Together 8 females with 20 young. These are low numbers, when we take into account that in late June more than 300 eiders had residence in this area. It seems that the season 1969 was a bad one for the Eider production, probably due to ice conditions, giving the foxes access to the breeding places.

It may be that this low production is no exception in this area. On 25 August 1971, E. Flipse (pers. comm.) observed only 2 females with 4 young near Ternøya and on 27 August about 80 adults with only 2 young near Brimulen.

We made the following observations concerning moult in 1969: 17 July, Diskobukta; 41 males, all flightles; 24 July, Kapp Pechuel Lösche; 22 males and females, all in nuptial plumage; 25 July, Å-neset; 1 male, flightless, 14 females, 2 flightless and 12 in nuptial plumage; 6 September, Lagoon; ca. 180 males, all flightless.

On 1 September 1971, 120 to 130 moulting Eiders were seen near the lagoon and Ternøya (pers. comm. E. Flipse). Judging from observations in three different years (1968, 1969, 1971), it seems that this area attracts the moulting Eiders in autumn.

Note on flightspeed.

When flying with a helicopter above a group of Common Eiders an air speed of 50—55 knots was measured (pers. comm. Mr. Solberg).

### 6. **Somateria spectabilis** (Linnaeus, 1758). King Eider.

Field observations.

In 1969 King Eiders arrived in the Kapp Lee area in the first week of June (observed on 7 June), when one pair came to the ponds on Taleveraflya, which had just started to thaw. On 17 June a second pair had arrived; other pairs came on 19, 24 and 25 June respectively. They were often courting during this period (fig. 15) and several times I observed copulations. The drakes chased each other as well as drakes of the Common Eider (*S. mollissima*), present on the same lakes. They also courted Common Eider females, but according to our observations these never payed attention to this courtship (see above).

During the middle of June the birds rested on the water from approximately 11 p.m. to 8 a.m. Thereafter they went ashore, the duck only a few meters, but the drake sometimes as far as about 50 m, walking around inquisitively all the time until noon. From about 1 to 4 p.m. they rested on land on the edge of the water, the head tucked between the feathers. From 4 to 11 p.m. they foraged in the ponds and courted, usually copulating two or three times.

On 2 July a drake in nuptial plumage was seen in the channels of the breaking sea-ice behind Ternøya, swimming among hundreds of Common Eiders (see above).

On 21 August in a pond on Årdalstangen a female was seen with two half-grown young.

FIG. 15. *Somateria spectabilis*. Drake displaying courtship, 21 June, Barentsøya Photograph by E. Flipse.

### 7. **Anser fabalis brachyrhynchus** Baillon, 1833. Pink-footed Goose.

Field observations (fig. 16).

In 1969 the Pink-footed Geese arrived in the Kapp Lee area on 25 May, when 3 birds of this species were seen in Rosenbergdalen, where they grazed together with a group of 14 Barnacle Geese (*Branta leucopsis*). By that time minimum and maximum temperatures were —3° and +1,5° C respectively (fig. 4) and the snow had partly melted away in the valley (fig. 5). They were seen there until 1 June. In the first half of this month, several times some birds of this species were observed, flying north.

On 25 June a nest containing 5 eggs was discovered on the northern side of Rosenbergdalen. On 27 June, when we visited the nest, only the gander flew away, the goose continued incubating although approached to about 10 m, which according to Nyholm (1965), is a very short distance. By 1 July the young of this nest had hatched. Allowing for an incubation period of 26 days (Løvenskiold, 1964) we may assume that the clutch was completed between 1 and 5 June. So after arriving on 25 May it took them probably less than one week to start egg-laying. According to Løvenskiold (1964) hatching in

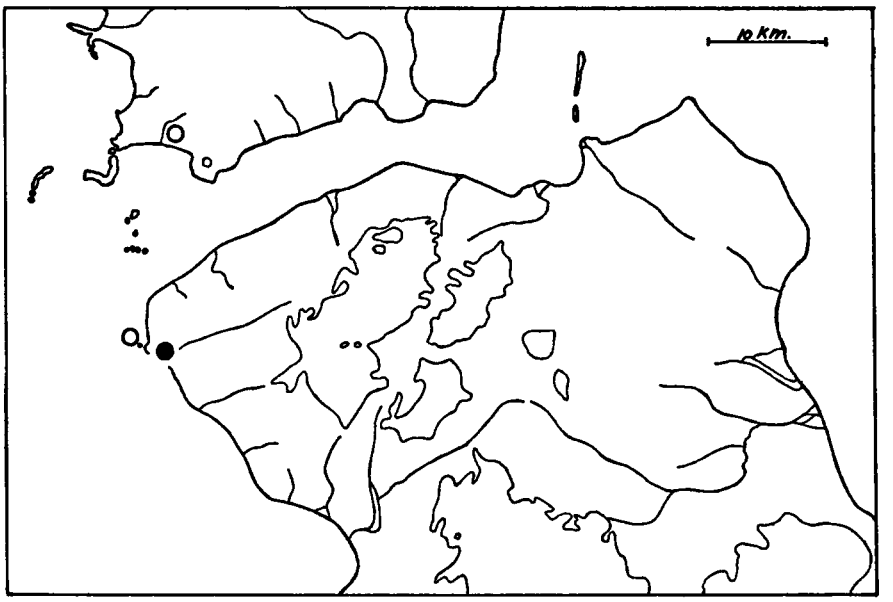



FIG. 16. *Anser fabalis.* (Legend in fig. 8).

West Spitsbergen usually takes place between 4 and 16 July. Therefore our hatching date of 1 July seems a rather early one. Blurton-Jones & Gillmor (1957) observed hatching in 1957 before 1 July and considered this as unusually early and to be the result of the mildness of the preceding winter. This explanation does not hold in our case.

### 8. **Branta bernicla hrota** (Müller, 1776). Brent Goose.

Field observations

In 1969 first observed on 4 June, when 2 birds of this species grazed together with 3 Barnacle Geese in Rosenbergdalen. They were not seen afterwards. From records in literature (Løvenskiold, 1964; Norderhaug, 1969) it appears that Brent Geese arive later in the year than Barnacle Geese and Pink-footed Geese. This was also the case at Kapp Lee where they were seen 16 and 10 days later than Barnacle Geese and Pink-footed Geese, respectively. On 21 August we saw a skein of 18 Brents at Årdalstangen flying north (see also Norderhaug, 1969).

Our observations at Kapp Lee differ markedly from those made by Dalgety (1928), who in August 1927 saw flocks of Brent Geese numbering up to about 400 at this place. The drastic reduction of the Brent Geese population in the first decades of this century (Løvenskiold, 1964; Norderhaug, 1968), may be gives an explanation of this difference in numbers observed.

9. **Branta leucopsis** (Bechstein, 1803). Barnacle Goose.

Material collected: 2 specimens.
ZMA No. 19779, 19833: 2 ♂♂ ad., 29.V.1969, Barentsøya.
Weights and Measurements:

| ZMA No. | Sex | Weight | Condition | Wing | Culmen | Tarsus |
|---|---|---|---|---|---|---|
| 19779 | ♂ | 2160 g | very fat | 412 mm | 28.3 mm | 70.6 mm |
| 19833 | ♂ | 2335 g | very fat | 403 mm | 28.6 mm | 69.3 mm |

Both birds were non-breeders (small testis), but older than one year. Their body weights were indeed high when compared with either winter birds (average 1870 g, Boyd, 1963) or July birds from Spitsbergen (average 1997 g, Nyholm, 1965). This is in accordance with the fact that on the arrival at the breeding places in the second half of May the birds are very fat (Løvenskiold, 1964).
Stomach contents; 2 examined.

Both stomachs contained ca. 80 % grit. In one stomach, 80 % of the plant remains were mosses (*Polytrichum, Bryum, Distichum*); 20 % were grasses. In the other stomach, 80 % of the plant remains were grasses (*Festuca, Luzula, Carex, Poa*). *Equisetum variegatum* and unidentified lichen were of minor importance. There were no fragments of mosses.
Field observations (fig. 17).

From 22 August to 12 September 1968 we regularly saw skeins of Barnacle Geese numbering up to about 50 near our station, flying south. Several large

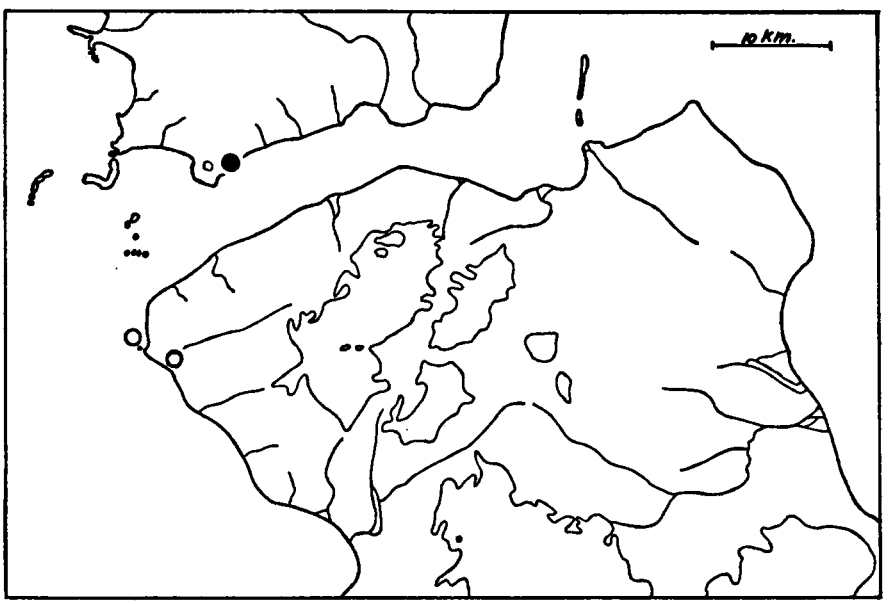



FIG. 17. *Branta leucopsis*. (Legend in fig. 8).

flocks were seen resting on the sea near the coast. It is probable that at least some of these observations relate to the same birds and a simple addition of birds seen (670) probably yields an overestimation of the number of Barnacle Geese migrating along Kapp Lee. The highest numbers seen at one time were 141 on 30 August, 80 on 10 September and 230 on 11 September respectively. Assuming these geese came from the north and taking into account the sparse observations of this species in north-eastern Spitsbergen (Løvenskiold, 1964; Norderhaug, 1968), the numbers are still unexpectedly high. This may indicate that all breeding places in this area have not yet been discovered, as throughout Spitsbergen the Barnacle Goose population is expanding (Norderhaug, 1968). No flightless bird of this species, indicating moult, has been observed.

When we saw the last of the Barnacle Geese of the season (11 and 13 individuals) on 12 September, the minimum and maximum temperatures had fallen to —1° and +3° C., respectively (fig. 4).

In 1969 the Barnacle Geese arrived on 19 May, when two birds alighted in Rosenbergdalen. By that time minimum and maximum temperatures had risen to —4° and +3° C, respectively. On 20 May there were 6 and on 23 May 26 birds of this species, which were grazing the whole of the day.

FIG. 18. *Branta leucopsis.* Goose incubating on a ledge at about 20 m over the sea, 23 June, Barentsøya. Photograph by E. Flipse.

By the middle of May the snow which had during the winter covered ca. 55 % of the western part of Rosenbergdalen (Oosterveld, 1971), had started to melt (fig. 5). The geese were seen grazing most frequently at the edges of melting snowfields, where new shoots of plants were rapidly developing. From 24 May onwards the Barnacle Geese showed some restlessness and a few were flying north. From 25 May until 4 June at least some birds of this species were seen daily in this place. Thereafter they were occasionally sighted until the 14th.

On 27 May a group of 37 Barnacle Geese was observed, sitting on a dolerite formation at the eastern side of Taleveraflya. This formation forms a steep cliff facing east over Freemansundet, rising from the frozen sea to a height of circa 30 m and ranging from south to north over about 200 m. Later on this place turned out to be a breeding place. Nests (fig. 18) were located on ledges from 5—25 m high within a horizontal range of about 100 m. On 30 May still no eggs were found. On 7 June 21 birds were seen grazing on the tundra of Taleveraflya, within 1 km distance of the cliff; they seemed to prefer moist patches of vegetation (see above). We estimated the number of pairs breeding on the cliff ledges at 7, and actually located 6 nests with eggs, all of which we visited. We did not manage to reach the place where the 7th pair was sitting and therefore could not establish the clutch-size. In table VIII are shown the results of egg counting on different dates in June.

The loss of eggs in nest I was due to predation by Glaucous Gulls (*Larus hyperboreus*), breeding among the Barnacle Geese. Probably they robbed nest II too, this nest was not covered with down, when we found it empty on 23 June. In our opinion it was inaccessible for foxes. Nest III was covered with down, when found empty, it could have been reached by a fox. In this colony we found a dead Glaucous Gull, lying on its nest at a distance of about one meter from a Barnacle Goose nest. Several times we saw Barnacle Geese driving away Glaucous Gulls that came too close, the latter always withdrawing. Clutch-size (table VIII) and time of egg laying do not differ from records from West Spitsbergen given by Løvenskiold (1964).

The total number of Barnacle Geese that had residence on and around the breeding place was 37, 14 of which were breeders, 23 were non-breeders, which is 62 % of the total number.

It is interesting to compare these observations with other observations from Taleveraflya from July 1967 and July 1969 (Norderhaug, 1967 and 1969). 18 July 1967, Andsjøen 24 adults and 6 young; 27 May 1969, East Taleveraflya 37 adults; 23 June 1969, East Taleveraflya 27 adults + 4 pairs with eggs; 28 July 1969, Andsjøen 4 pairs with young.

It is likely that these observations concern the same group of birds. During our stay on Taleveraflya in June 1969 we often saw birds that belonged to the colony population flying to and from Andsjøen. Possibly the 27 adults from 23 June were moulting elsewhere on 28 July, while the 4 pairs of birds with eggs were caring for their young. Birds without family often

TABLE VIII. *Branta leucopsis*. Chronology of numbers of eggs found in 6 nests. Average number of eggs laid per nest was 4.8.

| Nest | 30th May | 7th June | 11th June | 14th June | 15th June | 19th June | 23th June | Largest number | Total number laid |
|---|---|---|---|---|---|---|---|---|---|
| I | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 3 |
| II | 0 | ? | ? | 7 | 1 | 2 | 0 | 7 | 8 |
| III | 0 | ? | ? | 4 | 4 | 0 | 0 | 4 | 4 |
| IV | 0 | ? | ? | 4 | 4 | 4 | 4 | 4 | 4 |
| V | 0 | ? | ? | 4 | 4 | 4 | 5 | 5 | 5 |
| VI | ? | ? | ? | ? | ? | ? | 5 | 5 | 5 |

separate from birds rearing young during the moulting period, which starts in the middle of July, the non-breeders starting about a week earlier (Blurton-Jones & Gillmor, 1960; Hall, 1962; Bauer & Glutz von Blotzheim, 1968). Consequently these complete their flightless period sooner. On 18 July 1967, the flock of 24 adults and 6 young had obviously not separated into birds with and without young. Provided this flock comprised all Barnacle Geese belonging to the nesting locality described above, the population has increased by 13 birds (54 %) in two years, which is in accordance with the general increasing trend found in the number of Barnacle Geese in West Spitsbergen during the sixties (Norderhaug, 1968).

In the contex of the moult it is may be of interest to record the observations, which were made by us in 1967 in the Hornsund area: 19 August, Isbjørnhamna at sea, 22 adults and 21 young, all of them flightless; 20 August, Store Dunøya, 73 adults; 16 flightless; 27 August, Store Dunøya, 111 specimens, all could fly; 27 August, Nordre Dunøya, 216 specimens, all could fly.

In contrast to our observations in 1968 and to those of Dalgety (1928), who saw on 21 August 1927 16 Barnacle Geese at Rosenbergdalen, we did not observe a single goose on migration along Kapp Lee in the autumn of 1969. In the autumn of 1971, Barnacle Geese were seen again near this place from 31 August to 6 September; this time they were in flocks numbering up to 48 individuals (pers. comm. E. Flipse).

Note on the study of Barnacle Geese in the field.

It is of ultimate importance that the geese are not disturbed on the breeding place, when there are Glaucous Gulls in the neighbourhood, which usually is the case. Table VIII may show how the disturbance by man can cause severe predation by these gulls. In the future Barnacle Geese should not be studied in this way.

### 10. **Lagopus mutus hyperboreus** Sundevall, 1845. Ptarmigan.

Field observations.

On 23 October 1968, near the station, we observed our first Ptarmigan, a completely white bird; three days later 3 specimens were seen. During the whole winter they were often seen in the surrounding valleys. In Snøkardet they were present nearly every day from February until May. On 13 April we saw one on a pass from Kjellstrømdalen to Agardhdalen (West Spitsbergen). On 24 May we observed a brown female for the first time that year (fig. 19), together with a white male on Timertfjellet. From the last week of May to the middle of June white males were seen in Rosenbergdalen, on Leefjellet and on the mountains of Barentsøya, along Freemansundet. From the middle of June onwards we did not note them any more in the valleys. These observations tally with Løvenskiold's (1964) experiences with this species. During the summer Ptarmigans are usually not seen in the lowlands.

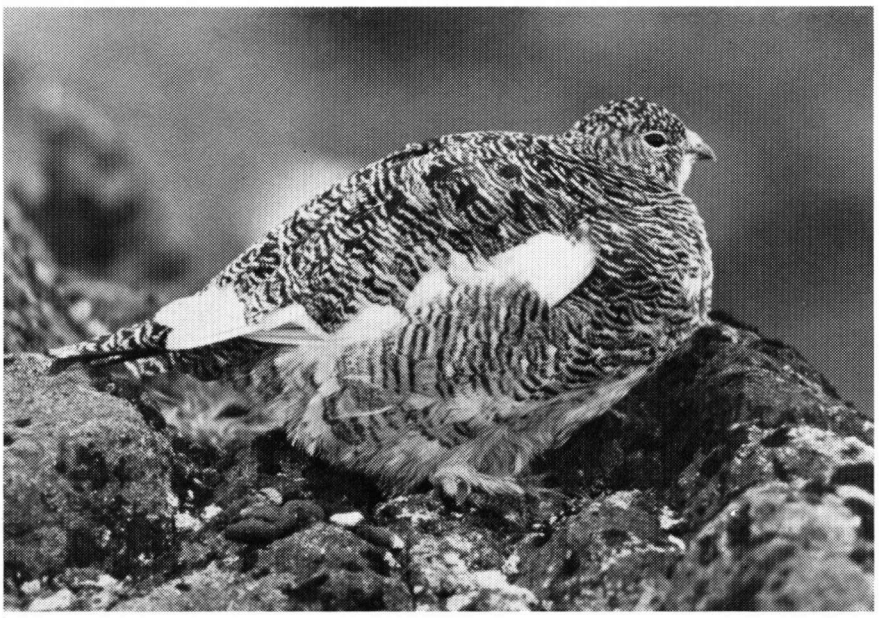


FIG. 19. *Lagopus mutus*. Female in brown summer-plumage, 24 May, Kapp Lee. Photograph by the author.

11. **Charadrius hiaticula hiaticula** Linnaeus, 1758. Ringed Plover.

Field observations.

Twice observed in 1969. On 19 June a bird of this species stayed near the station for some time; it flew north and was not seen again. On 19 July in Diskobukta near the coast, 5 birds were seen flying north.

On West Spitsbergen this species is more common. In 1967 we saw them in Longyearbyen (5 August, one), Kapp Linné (6 August, one, 11 August, one with young) and Nordre Dunøya (27 August, two).

12. **Arenaria interpres interpres** (Linnaeus, 1758). Turnstone.

Field observations.

Twice observed. On 18 May one was seen near Rosenbergdalen and on 12 June two specimens on Taleveraflya. All these birds foraged for some time on the tundra and were not seen again.

This species is more common on West Spitsbergen. In 1967 we saw them on Kapp Linné (6 August, two, 11 August, three) and Nordre Dunøya (27 August, three). All the birds observed were in adult summer plumage.

13. **Calidris maritima maritima** (Brünnich, 1764). Purple Sandpiper.

Material collected: 27 specimens; data in table IX.

ZMA No. 22779 — '82, 3 ♀, 1 ♂, 9.VIII.1967, Kapp Linné.
ZMA No. 22783 — '93, 5 ♀, 6 ♂, 11.VIII.1967, Kapp Linné.
ZMA No. 20031 — '32, 2 ♀, 23.IX.1968, Kapp Lee.
ZMA No. 20027, ♂, 10.VI.1969, Barentsøya.

ZMA No. 20030, 20034 — '38, 2 ♂, 1 ♀, 3 ♂, 6.VII.1969. Kapp Lee.
ZMA No. 20029, ♀, 6.VIII.1969, Kapp Lee.
ZMA No. 20033, ♂, 8.VIII.1969, Kapp Lee.

The sexual variation in the Purple Sandpipers collected is shown in table X.

TABLE IX. *Calidris maritima*. Weights and measurements.

| Coll. nr. ZMA | Weight g | Wing mm | Tarsus mm | Culmen mm | | Condition | Moult of small feathers |
|---|---|---|---|---|---|---|---|
| | | | | MALES | | | |
| 20027 | 64 | 119 | 20.5 | 27.2 | | fat | none |
| 20030 | 66 | 123 | 21.9 | 25.5 | | „ | „ |
| 20034 | 68 | 122 | 22.1 | 27.4 | | „ | „ |
| 20036 | 59 | 120 | 21.3 | 27.4 | | „ | „ |
| 20037 | 74 | 123 | 20.1 | 27.6 | | very fat | „ |
| 20038 | 67 | 126 | 22.4 | 29.0 | | „ „ | „ |
| 20028 | 66 | 121 | 22.5 | 27.6 | | fat | whole body |
| 20033 | 68 | 125 | 22.5 | 28.4 | | very fat | „ „ |
| 22782 | — | 127 | 22.0 | 24.8 | | fat | „ „ |
| 22785 | — | 126 | 22.6 | 31.8 | | „ | „ „ |
| 22787 | — | 121 | 21.5 | 26.5 | | „ | „ „ |
| 22789 | — | 126 | 22.5 | 27.8 | | „ | „ „ |
| 22790 | — | 126 | 22.9 | 29.7 | | „ | „ „ |
| 22791 | — | 125 | 22.1 | 28.3 | | „ | „ „ |
| 22793 | — | 122 | 22.1 | 24.9 | | „ | „ „ |
| | | | | FEMALES | | | |
| | | | | | Oviduct | | |
| 20035 | 69 | 128 | 22.9 | 30.0 | swollen | fat | none |
| 20029 | 72 | 124 | 22.1 | 31.9 | „ | moderate | whole body |
| 22779 | — | 102 | 22.0 | 19.2 | narrow | fat | „ „ |
| 22780 | — | 102 | 22.9 | 20.6 | „ | „ | „ „ |
| 22781 | — | 122 | 22.4 | 26.2 | swollen | „ | none |
| 22783 | — | 121 | 22.4 | 30.5 | „ | „ | whole body |
| 22784 | — | 124 | 22.9 | 32.1 | „ | „ | „ „ |
| 22786 | — | 124 | 22.0 | 30.8 | „ | „ | „ „ |
| 22788 | — | 126 | 22.5 | 30.0 | narrow | „ | „ „ |
| 22792 | — | 131 | 22.0 | 32.2 | swollen | „ | „ „ |
| 20031 | — | 123 | 21.6 | 22.3 | narrow | „ | „ „ |
| 20032 | — | 127 | 23.1 | 27.0 | swollen | „ | „ „ |

TABLE X. Sexual variation in *Calidris maritima*. [1])Included 2 specimens from 30.V.1969 (62 g) and 6.VII.1969 (61 g).

| | | Sex | Number | Range | S.d. | Mean ± s.d.m. | t |
|---|---|---|---|---|---|---|---|
| Weight | g | ♂ | 10[1]) | 59— 74 | 4.3 | 65.5 ± 1.4 | 1.83 |
| | | ♀ | 3 | 69— 87 | 9.6 | 76.0 ± 5.6 | |
| Wing | mm | ♂ | 15 | 119—127 | 2.6 | 123.5 ± 0.7 | 1.43 |
| | | ♀ | 9 | 121—131 | 3.1 | 125.2 ± 1.0 | |
| Culmen | mm | ♂ | 15 | 24.9—31.8 | 1.8 | 27.5 ± 0.5 | 2.90 |
| | | ♀ | 9 | 26.2—32.2 | 2.2 | 30.1 ± 0.7 | |
| Tarsus | mm | ♂ | 15 | 20.1—22.9 | 0.8 | 21.9 ± 0.2 | 2.22 |
| | | ♀ | 9 | 22.0—23.1 | 0.4 | 22.5 ± 0.1 | |

Females exceed males in weight, wing-, culmen-, and tarsus-length, but only the difference in culmen length proved to be significant ($P < 0.01$). The measurements are similar to those given by Løvenskiold (1950) for 19 Spitsbergen birds, except for the tarsus measurements for which we obtained larger values, apparently due to differences in the method of measurement. Weights of Purple Sandpipers wintering in Murmansk, were considerably higher (average males 76.8 g, females 86.2 g; Dementiev, 1951) than those of our summer birds from Spitsbergen (table IX).

Moult.

None of the birds collected in June and July showed moult, while all collected in August and September except one, showed at least some signs of moult of the small body feathers (table IX). The single specimen without moult (ZMA No. 22781) was a breeding female caring for two young (ZMA No. 22779, 22780), while all other birds collected in August occurred in flocks and were obviously not attending young.

Stomach contents; 12 examined.

All stomachs contained both animal and plant remains. Animal remains constituted 10 % to 95 % of the contents; plant remains 5 % to 90 %, with averages of animal and plant remains per stomach of 60 % and 40 %, respectively.

58 % of all stomachs contained Diptera, 42 % Gammaridae (*Gammarus locusta*), 17 % Collembola, 83 % Musci (*Bryum, Dicranum, Distichum, Polytrichum* etc.), 42 % Gramineae (*Festuca rubra*), 25 % *Salix polaris* (leafs), 17 % fresh water green algae, 17 % lichen, 8 % marine diatoms and 17 % feathers.

The birds were mostly collected while foraging among boulders in the intertidal zone, some on the tundra.

From these stomach analyses it appears that the Purple Sandpiper is an omnivorous bird, eating marine as well as terrestrial invertebrates and plants, but terrestrial material predominating. This is in accordance with records from Hartley & Fisher (1936). Possibly invertebrates are more important than it would appear from the above-mentioned figures as animals are more rapidly digested than plants and therefore may remain undetected.

Field observations (fig. 20).

In the autumn of 1968 we saw Purple Sandpipers daily. In the first half of September there were groups of 30 to 50 on Ternøya and in the lagoon. Afterwards their number decreased, the last ones being observed on 28 September, while they were foraging along the coast. By that time minimum and maximum temperatures had fallen to —12° and —7.5° C, respectively (fig. 4).

In 1969 the species was observed for the first time on 23 May (one near the station and four on Timertfjellet). By then temperatures had risen to about 0° C (fig. 4). According to Løvenskiold (1964) this date of arrival is early, for he mentions only one case of an earlier arrival out of a series of

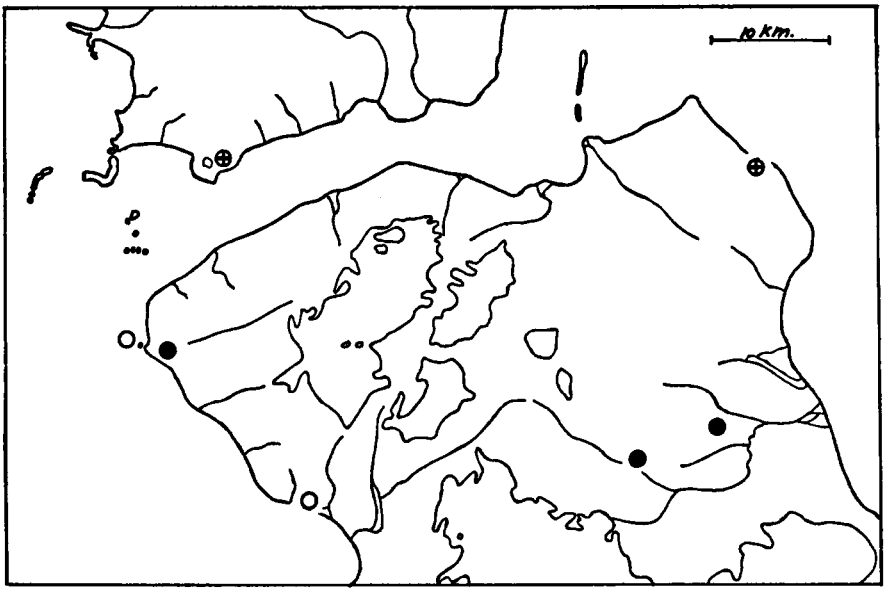



FIG. 20. *Calidris maritima.* (Legend in fig. 8).

34 records from different years. During the last week of May and the first week of June the numbers increased regularly. Within a week after their arrival pairs had been formed. Sexual display was commonly observed until the middle of June, some continuing until the end of that month. In May and June the wing-ceremony, described by Keith (1938) and Bengtson (1970), was often performed by single birds, when approached at close quarters, but they ceased with the performance in the course of July.

On 27 June a nest with 4 eggs was discovered in Rosenbergdalen. On 15 July the birds were still incubating, but on 18 July the young had hatched and had left the nest. If we allow for an incubation period of 21 days (Løvenskiold, 1964), then this clutch must have been completed between 24 and 27 June. We found other nests with 4 eggs on 20 July near Mangaelv, at about 15 km from the coast and on 21 July on Blafjordflya at about 9 km from the coast.

During July groups of Purple Sandpipers were seen foraging in the intertidal zone. Obviously these groups consisted of non-breeders (Løvenskiold, 1964), but they were not necessarily first year birds, as one female (ZMA No. 20035) collected from these groups had a swollen and twisted oviduct, proving that she had bred in previous years (table IX).

A group collected on 6 July 1969 consisted of 6 males and 1 female. A group collected on 11 August 1967 at Kapp Linné consisted of 6 males and 5 females, 4 of which had a swollen, twisted oviduct. As in 1968 concentrations of Purple Sandpipers were noticed in 1969 during the second half of August and the first half of September, in the lagoon and on Ternøya.

It is a well known phenomenon that after middle August these birds assemble for the autumn migration. On 11 September, the day of our depature, Purple Sandpipers were still present at this place.

14. **Crocethia alba** (Pallas, 1764). Sanderling.

Field observations.

This species was observed once in 1969, when on 16 July in Diskobukta one Sanderling was seen foraging in the intertidal zone among a flock of Purple Sandpipers.

15. **Phalaropus fulicarius** (Linnaeus, 1758). Grey Phalarope.

Material collected: 2 specimens.

ZMA No. 20025, 20026, ♂ and ♀ (apparently a pair) 18.VI.1969, Barentsøya.

Weights and measurements:

| | Weight | Condition | Wing | Culmen | Tarsus |
|---|---|---|---|---|---|
| ♂ | 55 g | very fat | 126 mm | 21.9 mm | 22.0 mm |
| ♀ | 68 g | very fat | 134 mm | 22.2 mm | 22.4 mm |

Neither of these birds showed moult.

The male had well-developed testes, the female had a swollen oviduct, which contained an egg with shell. The birds were collected while foraging at the edge of a fresh water pond at Taleveraflya.

Stomach contents; 2 examined.

Both stomachs contained about 95 % animal and 5 % plant remains

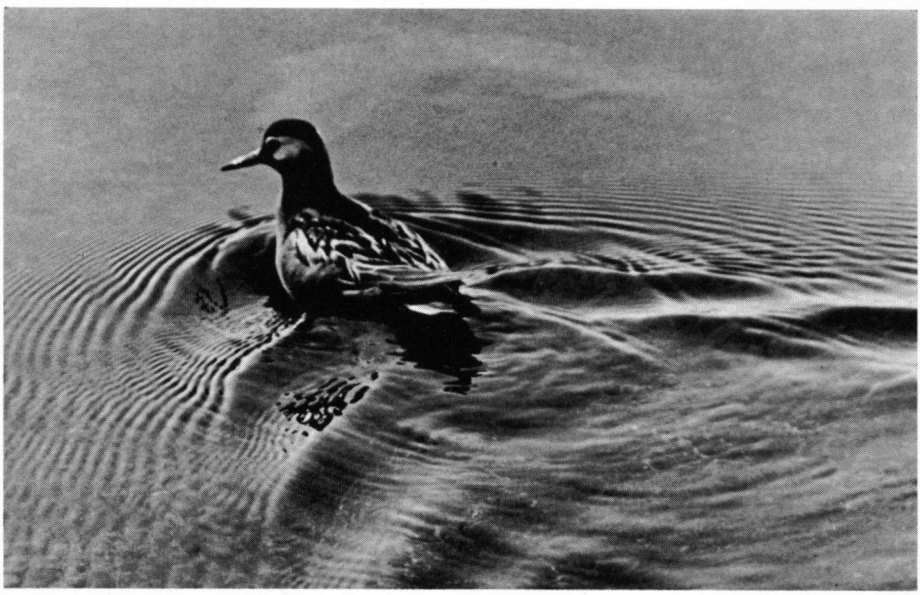


FIG. 21. *Phalaropus fulicarius*. Female, middle of June, Barentsøya. Photograph by E. Flipse.

(volumes). Plants included some fresh water blue algae, mosses (*Bryum*) and leafs and stem fragments of Graminaea (*Bucinellia phruganodes*). Animals included, Chironomid larvae (mass), which are living in reducing mud.
Field observations.

In 1969 the Grey Phalarope (fig. 21) arrived in the Kapp Lee area in the first week of June (first observation on 7 June, when a pair was seen in the ponds on Taleveraflya, which had just started to melt. On 8 June a second pair had arrived, another pair came on 10 June and finally two pairs arrived on 17 June. According to our observations all the Phalaropes arrived in pairs and were displaying from the moment of their arrival. During the middle of June I saw them copulate regularly, while they were standing in shallow water and not on dry ground as described by Løvenskiold (1964). From 17 June onwards I started to see them quite often some meters ashore and for the first time one pair was noted chasing another. On 18 June the female of the collected pair was not far from egg-laying (see above), but on 20 June, when visiting the ponds with Grey Phalaropes for the last time that year, the 4 remaining pairs apparently had not yet started to lay.

In early August 1967, we saw Grey Phalaropes at Kapp Linné until the 12th of that month, when we left this place. They were observed foraging on the sea close inshore and on fresh water ponds. On 6 August we observed at this place a male with an almost fully grown young.

J. DE KORTE
Institute of Taxonomic Zoology (Zoological Museum)
University of Amsterdam,
Plantage Middenlaan 53
Amsterdam 1004 — the Netherlands

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