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THE DANISH PEARY LAND EXPEDITIONS
LEADER: EIGIL KNUTH

ORNITHOLOGICAL OBSERVATIONS
IN SOUTHERN PEARY LAND,
NORTH GREENLAND, 1973

BY
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WITH 4 FIGURES AND 4 TABLES



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Abstract

The present paper is a report on one summer's work at Jørgen Brønlund Fjord in Southern Peary Land, the Northernmost part of Greenland. The main project was a census of breeding waders and observations of their breeding biology. It was found that some species, e.g. the waders, breed earlier around Jørgen Brønlund Fjord than in most of the Arctic, but in small numbers. This is discussed in relation to the climatic conditions, especially the extremely small amount of snow.

Furthermore an avifaunistic status is given, and discussed in relation to earlier reports. It was found that *Branta bernicla hrota* has disappeared from this part of Greenland since the first part of the century, and that *Calidris canutus* has increased in number.

Methods of wader censuses are discussed.

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INTRODUCTION

In the summer of 1973 the author participated as ornithologist with the 10th Peary Land Expedition under the leadership of EIGIL KNUTH. The expedition was delayed a week by the thaw of the airstrip at Mestersvig and arrived at the airfield at Kap Harald Moltke on 29 May. On the following day I was taken by snowscooter across Jørgen Brønlund Fjord to Brønlundhus (Fig. 1) where, except for a trip by boat and on foot to Nedre Midsommer Sø, Blåsø, and Issø 14–21 July, I stayed alone until 14 August. EIGIL KNUTH and the two other members of the expedition, STEFFEN JØRGENSEN and MORTEN SCHOLER, stayed at the expedition's newly established station at the airfield at Kap Harald Moltke. On 21 August we flew via Mestersvig to Iceland.

Since 1972 when Station Nord closed*, 1600 km of the Greenland coastland has been uninhabited. Danmarkshavn Vejrstation is situated more than 600 km south of Jørgen Brønlund Fjord, and Thule (Qânâq) almost 1000 km southwest. Brønlundhus (82°10'N–30°30'W) was built by the Danish Peary Land Expedition 1947–50, and has since then been the base of the Peary Land expeditions. The station at the airfield at Kap Harald Moltke was built in 1972.

I am grateful to EIGIL KNUTH for his great understanding and for his kindness in giving me the opportunity to carry out ornithological observations in Peary Land. I wish to thank STEFFEN JØRGENSEN for his participation in the trip to Nedre Midsommer Sø, his interest in the work, and his good comradeship. I am indebted to the Meteorological Institute of Copenhagen for data and to the Danish Natural Science Research Council for financial support during the preparation of the material. I am grateful to ELLEN SCHOU, G. H. GREEN, and Dr. phil. FINN SALOMONSEN for criticizing the manuscript.

* Station Nord was reopened in 1975.

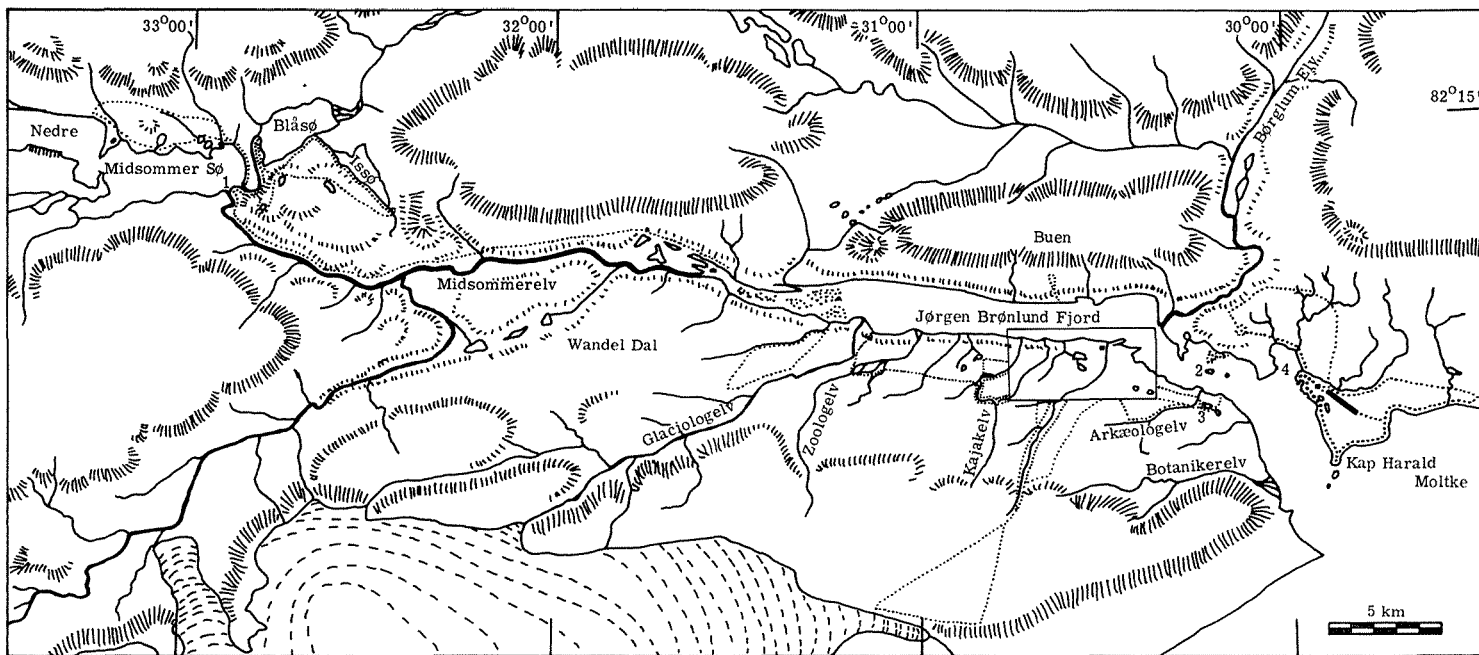


Fig. 1. Map of the area around Jørgen Brønlund Fjord and Nedre Midsommer Sø (lake). The census area (Figs. 2 and 3) is framed, and the journeys on foot beyond this area are indicated by dotted lines. 1: Søleiren, 2: Ederfugleholm, 3: Bagsværd Sø and 4: Slik Bugt.

GENERAL PART

Earlier Investigations

Jørgen Brønlund Fjord is ornithologically one of the best investigated areas in high arctic Greenland. KNUD RASMUSSEN, PETER FREUCHEN, and two Eskimos visited the southern part of Peary Land on the 1st Thule Expedition, June–August, 1912 (FREUCHEN, 1915). LAUGE KOCH (1925) reported some observations made in 1921. On the Danish Peary Land Expedition 1947–50 the area was visited by ULRIK MØHL-HANSEN in the summer of 1947 (MØHL-HANSEN, 1949) and PALLE JOHNSEN, who visited the area in the summer of 1947 and stayed there from August 1948 to August 1949 (JOHNSEN, 1953). Minor ornithological reports from the 3rd, 4th, and 5th Peary Land expeditions in the summers of 1964, 1966 and 1968 have been published by ULRIK RØEN (1965), JEAN JUST (1967), and OLE G. NORDEN ANDERSEN (1970).

Some observations were made by the Joint Services Expedition, which travelled throughout northern Peary Land during the spring and summer of 1969 (GRANT, 1972).

Description of the Area

The topography around Jørgen Brønlund Fjord has already been described in detail several times by, among others JOHNSEN (1953) and HOLMEN (1957). I shall only mention the most characteristic features and refer to photographs which have been published elsewhere.

Jørgen Brønlund Fjord (Fig. 1) is a c. 40 km long and 1–3 km wide tributary of the far bigger Independence Fjord, which lies south of Peary Land. It is situated c. 150 km from the outer coast and forms the easternmost part of Wandel Dal. The latter cuts a large corridor through southern Peary Land and connects Independence Fjord with J. P. Koch Fjord on the northern coast of Greenland. Several rivers flow into the fjord. Børglum Elv drains large parts of central Peary Land, and Midsommerelv, by far the largest river, drains Wandel Dal with the big "Midsommersøer". On the northern side of the fjord the land rises steeply to a plateau c. 700 m high. On the south coast there is a broad lowland, c. 6 km wide, before the land rises to the same height as in the north.

The census area (8.6 km², Fig. 2) was situated around Brønlundhus and bounded to the north by the fjord, to the south by the 100 m contour, and to the west and east by two small rivers debouching 2600 m west and 1500 m east of Brønlundhus. This area consists almost exclusively of sediments (raised seafloor), and bedrock comes to the surface above the 100 m contour. The coast is almost entirely made up of clay

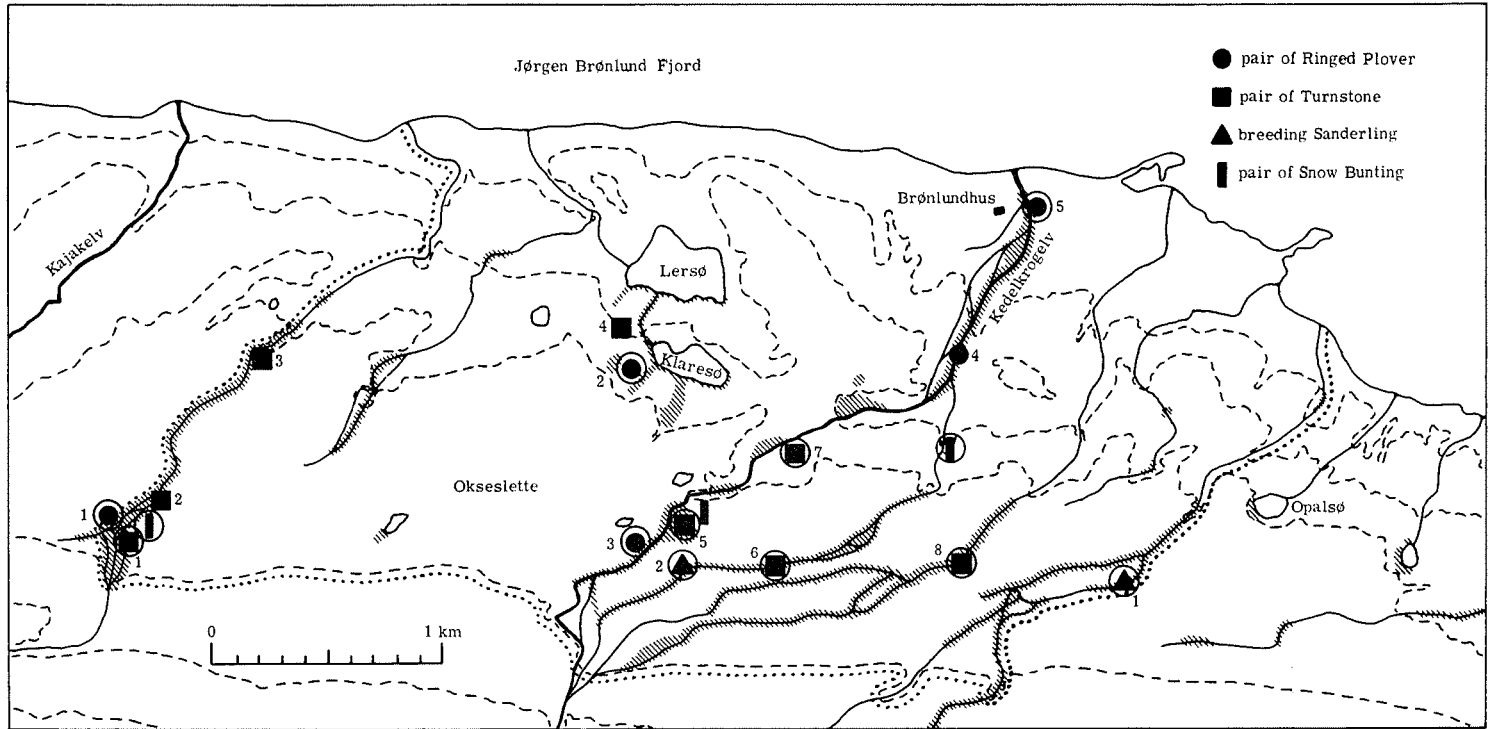


Fig. 2. Map of the census area around Brønlundhus (dotted). The 25 m contours are marked by dashed lines and densely vegetated areas are hatched. Breeding waders and Snow Buntings are plotted, nests or young are circled. The numbers refer to the text dealing with the species concerned.

and gravel slopes. Larger stretches of flat beach only occur at the two splits. The coastal slopes (JOHNSEN, 1953: Fig. 1) are almost barren, but above 60–70 m is the slightly undulating and stony plain, Okselette (JOHNSEN, 1953: Fig. 2). At the southern boundary of the area bedrock replaces the plain and the land rises comparatively steeply to a 700–1000 m high plateau, large parts of it covered by ice.

Some small rivers run through the area, Kedelkrogelv is the largest. Above the study area they mainly run in gorges, but inland deltas occur at several places on the comparatively flat Okselette, and many channels are dispersed across the plain. These numerous small rivers flow slowly over larger areas and are important for their influence on the significant vegetation in the area (HOLMEN, 1957: Figs. 26 and 27). From the 75 m contour the fall increases, and from here the rivers run in deep ravines cut in the clayey slopes which are quite barren. Kedelkrogelv is the only river along which the vegetation is continuous all the way down to the coast, where it forms a large delta at Brønlundhus (RØEN, 1965: Fig. 3).

Apart from the vegetation along the rivers and some snow-patch vegetation, Okselette is completely barren. There are some small ponds and two large lakes in the area. Klaresø (MØHL-HANSEN, 1949: Fig. 3) is up to 3 m deep and has a narrow border of vegetation almost all around the shore, while Lersø less than a metre deep everywhere has an almost barren shore and dries out in some years. RØEN (1965) has described many of the lakes around Jørgen Brønlund Fjord in detail. The two lakes are situated in a large kettlehole which collects large masses of snow, especially on its southwestern side. Thus there are irrigated and vegetated areas here. There are smaller vegetated places elsewhere in the study area, but altogether the vegetation scarcely covers more than one percent of the land. All densely vegetated areas are shown on the map (Fig. 2). In the moister places along the rivers the vegetation consists of *Eriophorum scheuchzeri* meadow, and on somewhat drier areas *Carex aquatilis* meadow grows; both are mixed with grasses, mosses, and lichens. Along the edges of this vegetation and on the areas irrigated by melting snow-patches grow *Dryas*, *Salix arctica*, and *Saxifraga oppositifolia*, as well as grasses, mosses, and lichens. Outside the densely vegetated areas are occasional small patches of *Dryas*, *Salix arctica*, and *Saxifraga*. HOLMEN (1957) has described the vegetation in more detail.

The type of landscape described also covers the rest of the coastland south of the fjord between Botanikerelv and Glaciologelv. More extensive vegetated areas are found at Kajakelv and Zoologelv. Wandel Dal, between the fjord and Nedre Midsommer Sø is more barren, but nearer the lake vegetation increases. At Nedre Midsommer Sø, Blåså, and Issø,

vegetation was only found along small rivers and irrigated areas. The most fertile areas were found immediately east of Solejren and south of Issø.

True bedrock terrain is practically barren. Patches of vegetation are extremely scattered, but at some lower places there are small fertile areas in the river gorges, and these occur for example at some places above the study area between the 100 and 200 m contours.

The entire peninsula around Kap Harald Moltke is definitely a desert, with bare hills of clay and stones stretching for kilometres. There is some snow-patch vegetation along the coast just east of the cape.

Climate

Extreme climatic conditions prevail. The most striking features are the small snow fall (25 mm per annum), the strong winds, the relatively high temperature in summer, and the breaking up of the ice on the fjord each year.

It does not snow much in Peary Land, but in the spring most of the land is snow-covered. However, in the area around Jørgen Brønlund Fjord, the snow most often covers less than one tenth of the land. The strong constant winds and the frequent winter storms blow most of the snow off the area. Deep snow only collects in gorges and behind slopes. The big clay plain of Kap Harald Moltke, which is used as an airfield is free of snow all year round and illustrates these conditions well.

Because of the dry sunny climate and the strong winds most of the snow evaporates before thawing. Fog, which plagues many parts of the arctic, is rare in the fjord. It is often dense above Independence Fjord, but rarely penetrates Jørgen Brønlund Fjord.

The monthly mean temperature for the summer months in the years for which we have records are shown in Table 1. Note that they are relatively high. In 1973 the temperature was above mean in June, but below mean in July.

In comparison to Station Nord, which is situated at about the same geographical altitude (81°36'N–16°40'W) but on the outer coast about 200 km east of Jørgen Brønlund Fjord, the mean temperature for June was three degrees higher at Brønlundhus in the four years for which

Table 1. *Monthly mean temperature (C°) for Jørgen Brønlund Fjord.*

	1949	1950	1963	1964	1966	1968	1973
May	÷ 8.6	÷ 6.9					
June	2.5	2.7	1.9	1.1	1.9	2.9	2.7
July	6.0	6.4	5.4	4.2	5.6	6.0	5.1
August	3.7						

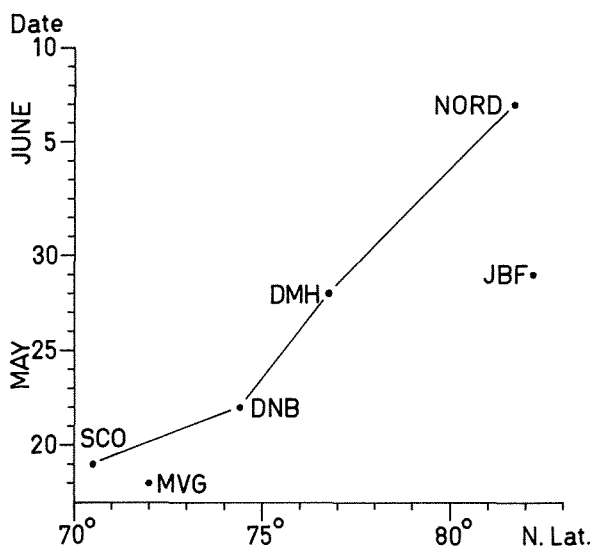


Fig. 3. Mean thawing date for the weather stations in Northeast Greenland 1952-73, as well as for seven years at Jørgen Brønlund Fjord. The stations at the outer coast are connected by straight lines. SCO = Scoresbysund (Kap Tobin) (70.25N/21.58W), MVG = Mestersvig (72.15N/23.54W), DNB = Daneborg (74.18N/20.13W), DMH = Danmarkshavn (76.46N/18.46W), NORD = Station Nord (81.36N/16.40W) and JBF = Jørgen Brønlund Fjord.

there are records from both places (+ 2.0° at Brønlundhus and -1.0° at Station Nord). The temperatures in July were +5.3° at Brønlundhus and +2.5° at Station Nord (KNUTH, 1973).

By comparing the date when the thaw began at Brønlundhus (as defined by MELTOFTE, 1975) to that for the outer coast stations, Kap Tobin, Daneborg, Danmarkshavn and Station Nord, it can be seen (Fig. 3) that the mean date of thawing over a period of 22 years began on 19 May at Kap Tobin, and successively later up the coast to Station Nord, where the mean for the same 22 years was 7 June. However, the mean for seven years at Brønlundhus was 29 May, only one day later than at Danmarkshavn Vejrstation more than 600 km south, and nine days earlier than at Station Nord. Because of our late arrival the date of the start of the thaw in 1973 could not be determined.

Summer frostfree periods at Jørgen Brønlund Fjord vary from 34 to 60 days in the recorded summers (KNUTH, 1973). In 1973 the temperature remained continuously above zero for 41 days.

When I arrived at Brønlundhus it had apparently been thawing for several days. Kedelkrogelv flowed very slightly and there was some meltwater on the fjord ice. Open water was about to appear along the shores of the fjord as well as in Lersø and Klaresø. The snow-cover was limited to large drifts, and covered less than 10 % of the land. However,

cold weather set in from 2 to 4 June, with temperatures constantly below zero, after $+7.9^{\circ}$ had been recorded on 31 May. On 6 June more than one third of the little lake east of Opalsø was ice-free. In Opalsø, Klaresø and Lersø there was a 5–10 m wide stretch of open water along most of the shores. On 7, 8 and 9 June it was cold and windy again, with snow showers. On 10 June thawing was really in progress, and on 11 June there was water in all rivers and more than a third of Lersø was ice-free. On 12 June the little lake east of Opalsø was completely ice-free. On 13 June there was an ice-free strip about 15 m wide in Klaresø, and Kedelkrogelv was running from the 75 m contour. On 15 June Lersø was almost ice-free. On 18 June the entire delta of Midsommerelv was ice-free. Thawing was well under way, and the rivers were running from the 200 m contour. On 21 June Klaresø was half free of ice, and a large opening was forming at the estuary of Børglum Elv. On 2 July the ice in the middle reach had broken up, and Klaresø was nearly ice-free. On 15 July the ice broke up in the entire inner reach.

On the visit at Nedre Midsommer Sø 15–18 July the lake was almost completely frozen. Blåsø was half ice-free, and there was no ice on Issø.

The thaw finished up to an altitude of c. 500 m at the end of June and the small rivers began to dry up in the beginning of July, but in mid-July the thaw culminated on the high plateau, and more water than ever poured into the rivers.

On 6 and 7 August new snow fell on the high mountains, and on 8 and 9 August an especially violent snowstorm raged. Normally such fierce storms do not occur until October. The entire land was covered by snow and the temperature was around zero. On 10 August there was extensive ice slush in the lakes, and the rivers hardly flowed, but much of the new snow melted rapidly around Jørgen Brønlund Fjord. When we flew out through Independence Fjord on 21 August the rest of the land was almost totally snow-covered.

Compared with earlier reports, it can be seen that with the exception of the unusual snowstorm in early August, 1973 was a favourable year. In most years the fjord ice was gone by mid-July, but in 1963, 1964 and 1970 it did not break up until the end of July or later. Conditions in other years for which reports are available were not notably different from 1973 (see also JUST, 1970). Little information exists about the thawing of the lakes in earlier years. In 1964, a cold year (RØEN, 1965), the ice on Klaresø did not really begin to melt until mid-June, and the last ice did not melt until 17 July. On 23 June Lersø was ice-free, and the small, fertile shallow lake east of Opalsø was ice-free on 20 June.

In 1970 and particularly in 1972 it rained heavily during late July and the first half of August (KNUTH, 1973). In 1912 it rained heavily in the beginning of July and in the beginning of August (FREUCHEN, 1915). In 1973 very little rain fell.

Independence Fjord remains ice-covered throughout all summers, whereas the inner part of Danmark Fjord is often ice-free, and when we flew home on 21 August, we saw that most of this fjord was ice-free.

On 2 July copious hatching of mosquitoes commenced around the Brønlundhus area, and after a few days there was a border of empty pupae along the lake shores, in particular the shore of Klaresø.

Activity

The census area around Brønlundhus (Fig. 2) was investigated daily from my arrival on 30 May until I left on 14 August, except 14–20 July. Different parts of the area were examined daily, and the whole area was covered regularly over a few days. Each day all observations were marked on detailed maps of the area with as much information as possible about the birds' sex, age, courtship, song, other behaviour, flocks etc. Most observations were made between 10 a.m. and 8 p.m.

A systematic investigation of the area took place from 13 to 15 June as an introductory survey of breeding birds, and I walked along all the rivers and examined the rest of the area with special attention to vegetated sites and ponds. From 22–29 June the census area was examined especially carefully, most of the rivulets were followed several times and almost every patch of vegetation was scrutinized. I tried to locate all breeding birds and searched for their nests, giving particular attention to the waders. All records of nests and young were filed. Practical experiences with the counts of breeding birds are discussed below (p. 53).

Outside the census area, visits were made in the area between Bagsværd Sø and Arkæologelv to the east, Kajakelv to the west, and up to the 200 m contour. Between 14–21 July we visited Nedre Midsommer Sø, Blåsø, and Issø. We went by boat through the fjord and up the delta of Midsommerelv. From here we hiked through Wandel Dal on the northern side of the river to Søjren and from there we visited the surrounding localities. On our way back we visited the area west of Glaciologelv and the stretch between this river and Brønlundhus. On 23 July we crossed the fjord to the scree under Buen. On 26 July we visited Ederfugleholm and the little islet east of it, and on 27–28 July we climbed the high plateau south of Jørgen Brønlund Fjord to the ice limit and the highest point (c. 950 m) facing Independence Fjord.

During my stay at the Station at Kap Harald Moltke from 14 August until we departed on 21 August I visited the area between Børglum Elv and the coast east of the cape.

Waders were caught for ringing in nets and traps set at foraging places in the delta at Brønlundhus and also on nests. The birds' underparts and wings were dyed yellow, and the birds were ringed with a yellow plastic band besides the numbered ring (see further under ringing p. 38). This study was made in collaboration with the British "Wader Study Group" in order to increase the chance of recoveries in Western Europe. It was also a great help during the census of breeding birds, and gave supplementary information about the birds' movements. All the adult birds captured were weighed, and bills and wings were measured if possible (see p. 38). Sex was determined by plumage characteristics. Nestlings were weighed and their bills measured, mainly in order to determine age and thereby time of hatching.

All times given are local times, that is, two hours later than GMT.

SPECIAL PART

Red-throated Diver (*Gavia s. stellata* (PONTOPPIDAN))

Scattered breeding bird at lakes around Jørgen Brønlund Fjord and Nedre Midsommer Sø. The first Red-throated Diver was heard flying over Jørgen Brønlund Fjord on 9 June, and from 17 June until 3 July up to six were seen either singly or in pairs on the open water in the fjord and Klaresø and Lersø. Thereafter the species was not seen in the area until 22 July, when one flew past. From 4 to 13 August (when I left) 1-3 birds were observed on the fjord and Lersø. The species was not found breeding in the study area in 1973. In 1949 one nest with two eggs was found at Klaresø on 28 June, and as late as 8 August 1950 a nest with two eggs was found at a lake somewhat west of Klaresø (JOHNSEN, 1953).

During my stay at Nedre Midsommer Sø from 15 to 18 July a few birds were observed foraging at Søjren, and up to 15 were seen on Blåsø, some of them paired. Two pairs were seen on small lakes north of Nedre Midsommer Sø. On 17 July one pair was found here with a nest containing two eggs. On 10 July 1966 a nest with two eggs was found at a small lake south of Nedre Midsommer Sø (JUST, 1967).

According to RØEN (1965) and ANDERSEN (1970), 1964 and 1968 were non-breeding years, which must be considered debatable in view of the scattered distribution of the species and the comparatively large number of immature, non-breeding birds which usually stay in the breeding area.

Great Northern Diver (*Gavia immer* (BRÜNNICH))

A Great Northern Diver was seen at Nedre Midsommer Sø on 15 July. The nearest breeding sites are Thule District on the west coast

and Scoresby Sund on the east coast. The species has been observed as a summer visitor as far north as Germania Land on the east coast (MANNICHE, 1910).

Long-tailed Duck (*Clangula hyemalis* (LINNAEUS))

Scattered breeding bird at lakes and on small islands in Jørgen Brønlund Fjord. One pair, the first, was seen on the small lake east of Opalsø 17 June, somewhat later than previous initial observations (Table 3). Subsequently up to two pairs and a single male were seen on Klaresø and Lersø until 26 June. Later 1–2 males, and from 2 July an additional 1–2 females, stayed on these lakes until I left in mid-August.

On 26 July a female with eight newly hatched pull. was seen on the small lake east of Opalsø, and the following day a female, also with eight pull., was seen on Klaresø. On 1 August the brood on the small lake was gone, while the brood on Klaresø was still there when I left in mid-August. From 8 August they began to alternate between Klaresø and Lersø (a distance of about 200 m).

Two males and one female were seen on Issø on 16 July, and in the second half of July up to five males were observed on the fjord. In 1947 and 1948 two pairs of Long-tailed Ducks bred at Klaresø (JOHNSEN, 1953), in 1964 one pair (RØEN, 1965), and on 8 July 1950 a nest with five eggs was found on an islet in the fjord (probably Ederfugleholm) (JOHNSEN, 1953).

King Eider (*Somateria spectabilis* (LINNAEUS))

Common breeding bird around Jørgen Brønlund Fjord and Nedre Midsommer Sø, mainly at small lakes and along the coast, but also in colonies on small islands in the fjord.

One pair, and somewhat later another pair, were the first seen migrating low above the ice along the coast on 6 June. These are the earliest observations of the species in Peary Land to date. On 11 June another pair flew by, on 12 June a flock of 25, and on 13 June a flock of 13 migrated westwards. On 14 June three pairs came from east, one pair left the flock and headed across the land toward Klaresø/Lersø; at this time the birds could not possibly have seen the lakes. Two pairs were observed on the small lake east of Opalsø on 12 June, and five pairs were seen on Klaresø on 15 June, the first ones seen there. Another pair swam in a small pond more than 1½ km away from the coast. Subsequently 1–4 pairs were seen daily on these lakes throughout the month, but from the 20th on the males began to appear alone. The last male was observed on Lersø on 3 July, and after this the males were only seen on the fjord. Thus 32 birds, ¾ of them males, were seen in the shore lead in Independence Fjord 6 km east of Kap Harald Moltke on 2 July, and 30 (al-

most exclusively males) were observed in Slik Bugt on 11 July. The last males are normally seen in mid-July.

A brooding female was found on 7 July in the edge of a vegetated, irrigated slope c. 20 m south of Klaresø, and the following day a brooding female was found in the edge of a *Dryas* tussock c. 20 m from a small pond, c. 100 m west of Kedelkrogelv, and c. 500 m south of Klaresø. On all my following visits the birds were brooding, so the eggs could not be counted as in my experience the birds often leave the nest for good if disturbed. On my return from the visit to Nedre Midsommer Sø on 21 July the nests were empty, and two females swam with five and six pull. on Lersø, and one female with four pull. on Klaresø. On 23 July only the female with six pull. remained on Lersø, while the female with five pull. swam together with the female with four pull. on Klaresø. On the 25th all the broods were gathered on Klaresø, but one young had disappeared from the brood of five. The following 'night' another female with four pull. arrived. On 30 July the brood of six, which was somewhat older than the others, had presumably gone out into the fjord, and only three females with four pull. each remained on Klaresø.

On 1 August only one brood remained on Klaresø, and on the 3rd they were gone too. The young were thus 7–11 days old when they left the lakes. At Danmarks Havn the King Eider broods stayed on the lakes from a few days up to 3–4 weeks (MELTOFTE, 1975). The young could often be seen drying in the sun on the shores of the lakes, and at 'night' the young lay huddled in broods in the grass tussocks on the shores of Klaresø.

On 26 June a nest with one egg was found at a lake c. 6 km east of Kap Harald Moltke. During my visit at Issø on 16 July one female with four newly hatched pull. was seen on the lake. In 1966 King Eiders were frequently observed on Nedre Midsommer Sø (JUST, 1967). Five pull. were hatched in a nest near the coast c. 3 km north of Kap Harald Moltke on 20 July 1973, and on the 26th a female with six pull. was seen on Bagsværd Sø. Ederfugleholm was visited on 26 July, and some old and two down-lined nest bowls were found, but no pull. were seen on the fjord. In 1949 three nests with eggs were found on Ederfugleholm, and in 1950 there were five and one on the little islet east of it (JOHNSON, 1953). In 1968 two nests were found on Ederfugleholm, and two females attempted to breed on the islet east of it (ANDERSEN, 1970). In most years breeding King Eiders have been found at Klaresø/Lersø and the surrounding area.

The earliest record of eggs in Greenland was made on 17 June 1966 when a clutch of four eggs was found at Bagsværd Sø (JUST, 1967).

Small flocks of females were observed on the fjord from mid-July. 5 + 6 females migrated outward through Midsommerelv's delta on 19

July, and on 26 July 40 + 1 + 5 females were seen in the middle reach of the fjord, all of them able to fly. Small flocks were observed off Brønlundhus and Kap Harald Moltke until I left.

The relatively large number of non-breeding females which presumably moult in Jørgen Brønlund Fjord must be birds from a wider area (as the observation of their immigration on 19 July indicates). Thus, they cannot be said to reflect the size of the population of the fjord.

Greenland Rock-ptarmigan (*Lagopus mutus captus* PETERS)

Scattered breeding bird. In 1948–49 the species was very common, but most of the birds were observed during the migration period and outside the nearest surroundings of Jørgen Brønlund Fjord (JOHNSEN, 1953). Concerning the observations from early June to mid-August in the area around Brønlundhus, no more than a few birds have been seen in any year. In 1947 and 1949 respectively two and one brood were seen south of the station. In 1964 a brood was observed on Okseslette (RØEN, 1965), and in 1966 a brood was seen at Botanikerelv (JUST, 1967). In 1968 a total of six individuals was observed at the station in June (ANDERSEN, 1970). The species may be more frequent above 100 m altitude.

None was seen in this area in 1973, but fresh tracks were observed in the snow at the 200 m contour on 5 June, where an old nest was also found. A female with five 'fledged' pull. was seen north of Nedre Midsommer Sø on 18 July, and one male was seen in Wandel Dal on the same day.

Ringed Plover (*Charadrius h. hiaticula* LINNAEUS)

Common breeding bird around Jørgen Brønlund Fjord and Nedre Midsommer Sø. Because of our late arrival, the arrival date of the species in 1973 could not be determined. On 31 May two or three males were observed in song flight at Kedelkrogelv's delta and at Lersø. From 3 June one pair stayed in Kedelkrogelv's delta, one pair at Klarsø/Lersø, and one or two pairs farther up Kedelkrogelv. No song flight was heard during the cold period until 9 June. From 12 June more birds were observed inland, and song flights were regular from the 10th. On 7 June two males were ringed and dyed in Kedelkrogelv's delta. One later bred at the site, while the other was seen for the last time on the 14th c. 1500 m south of the delta after having participated in the song flight in the delta the day before.

There were no larger flocks of Ringed Plovers in Kedelkrogelv's delta in the pre-breeding period of 1973. RØEN (1965) states that 'a large flock' stayed here during the first half of June 1964, perhaps attracted by a large amount of crushed dried fish. JUST (1967) reports

several flocks of 3–6 in 1966 in the delta, and ANDERSEN (1970) reports similar flocks during this period in 1968.

Five pairs were found in the 8.6 km² census area around Brønlundhus (Fig. 2), which gives 0.6 pairs per km². One of the pairs may not have been breeding (Pair 4, see below), but eggs or young were found for the others. About five additional birds, three of them males in song flight, were observed in the area in mid-June. Some of these birds presumably bred south of the area. Lively song flight activity was observed until 23 June, thereafter more rarely.

Pair 1 (Fig. 2). On my first visit to the site on 15 June one pair was seen. The male was observed in song flight on 27 June, and on 1 July the nest with four eggs was found on a stony gravel slope with a scattered growth of *Dryas* c. 50 m west of the fertile marsh vegetation in the river bed. On 3 July I tried in vain to catch the birds on the nest. Perhaps this was the reason why the female was gone on the following day, and was not seen again. On 10 July the male still brooded alone on the four eggs. On the 21st the nest was empty, and the male was seen performing distraction display 1–200 m southwards.

Pair 2. On 31 May a male in song flight was observed south of Lersø, and from 3 June one pair was regularly seen around the lakes. On 12 June two males and one female were observed at Klaresø. The males flew after one another singing, and on the ground the three birds were seen performing threatening and courtship displays. After this the pair were observed irregularly around the lakes, and no nests were found. A c. 14 day old pull. was found and ringed on 30 July c. 100 m southwest of Lersø (ring no. 8151433).

Pair 3. One pair was observed at this site from mid-June, and the male was seen in song flight from 12–23 June. On the 26th the nest was found with four eggs on a barren and stony pile of gravel 2–3 m away from dense vegetation and 15 m from the river. It was noted that the male already carried a ring. On 30 June the female was caught on the nest, and was ringed and dyed yellow (8151406). Immediately after she was released the male attacked her violently and chased her away. Next day she was observed wandering around 2.5 km from the nest. The eggs were cold, and to my great regret the male had gone. On 2 July he was observed flying and singing about 1000 m away from the nest site, and he was shot (ring no. London BB 72603). Three of the eggs contained embryos at least ten days old (21 mm long), the fourth egg was rotten.

Pair 4. One pair was seen here from 7 June. The male sang until the 21st, but despite several hours of observation there was no signs of a brood. The female was seen for the last time on 29 June, the male on 2 July.

Pair 5. As mentioned above, a male was seen here in song flight from 31 May. On 3 June a female had arrived, and courtship display was observed. On 7 June the male was ringed and dyed. At 11 p.m. on 11 June, nest scraping behaviour as described by LAVEN (1940 pp. 244–245) was observed. In addition, two nest scrapes were found within 50 m of the site on the low, barren gravel slopes 10–40 m east of the vegetated delta. The female disappeared, but the male stayed alone in the delta throughout the month. He was observed daily in song flight until 24 June. On 3 July a female was again seen at the site, and three eggs were found in one of the three scrapes c. 40 m away from the river. The following day there were four eggs in the nest. On 27 July there was one pipped egg, two dry and one damp pull. in the nest. Next day the nest was empty. Three pull. (8151430–31–32) were ringed on the

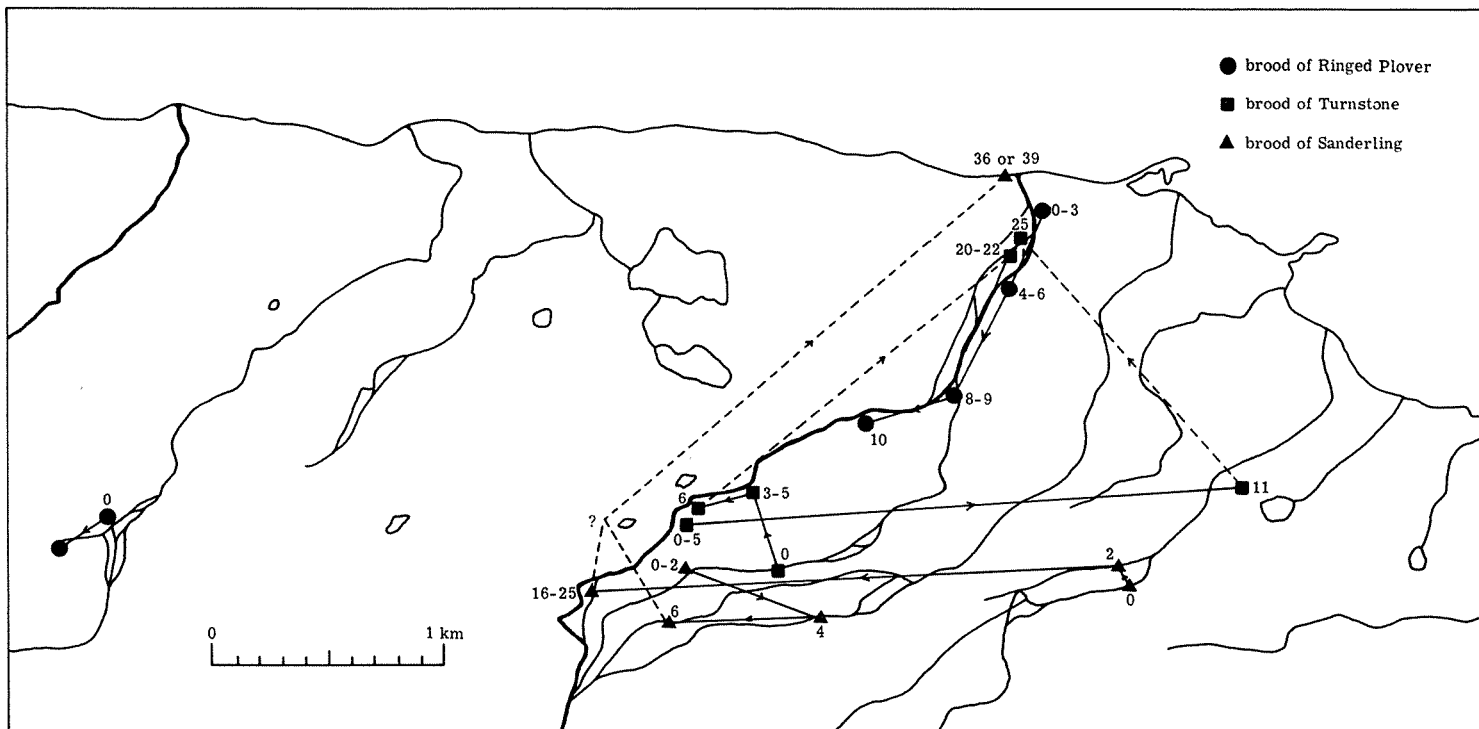


Fig. 4. Observed movements of wader broods. Full-drawn lines connect the positions of pull., dashed lines fledged young (direction of movements indicated by arrows). The age of the young in days is given at the positions in question. Note how the broods wander about near the rivulets on Okselette and go to the coast and Kedelkrogelv's delta when they are fledged. Compare with the map, Fig. 2.

27th, the last one (8151434) on the 30th. The increase in their weight was slight in the first days. The brood remained in the breeding territory during the first three days, and then slowly moved along Kedelkrogelv until on 6 August they were c. 1200 m away (Fig. 4). After the snowstorm on 8 August they could not be found and can scarcely have survived.

Above the census area c. four pairs of Ringed Plovers bred below the 200 m contour. The breeding sites were in the bottom of comparatively fertile river gorges which became snow free relatively late. The birds were frequently seen in song flight, foraging, or attracted by warning pairs in the southern part of the census area. In early August a pair stayed at Kedelkrogelv at the southern border of the census area, and on the 5th the pair was seen with a newly fledged juvenile. On the journey along Kedelkrogelv to the high plateau 27–28 July one or two Ringed Plovers were seen at an altitude of 450 m, and one at an altitude of 600 m.

One pair was probably breeding at Arkæologelv, and at the inland delta of Kajakelv two pairs were breeding at an altitude of 200 m. On 21 June a nest with three eggs was found in the middle of the very stony delta. The nest lay in gravel among stones and *Saxifraga* tussocks only two metres from running water. On 1 July there were still only three eggs in the nest, and both birds were captured for measuring and ringing, but because of the experience with pair 3, only the male was dyed. On 21 July both pairs were still at the site, including the marked ones which performed distraction behaviour. The nest was empty.

At the end of July c. four pairs were observed at Zoologelv. One pair was seen between this river and Kajakelv, and at least five pairs were observed in the area west of Glaciologelv (Fig. 1). In Wandel Dal north of Midsommerelv c. five pairs were seen on a c. 25 km stretch. Two pairs were breeding immediately east of Søjren. A nest with four eggs was found here on a gravel slope 70 m from *Dryas* heath and 120 m away from marsh vegetation and ponds. Two pairs were breeding at the estuary of the river running from Issø to Blåsø. A day old pull. was found and ringed on the 16th (8151418). One pair bred at a small lake at an altitude of c. 200 m on the mountain east of Søjren, and many Ringed Plovers were observed north of Nedre Midsommer Sø, several of them performing distraction behaviour.

By means of extrapolation it can be calculated that six of the eight broods mentioned completed egg-laying c. 19–23 June (incubation period c. 23 days and fledging period 21–24 days). The delayed pair 5 had completed egg-laying on 4 July, and one of the pairs at Søjren had non-starred eggs on 17 July. Three eggs were hatched in Glaciologelv's delta on 16 July 1963 (KNUTH, pers. comm.).

Only a few exact reports of time of breeding in earlier years are

available from Peary Land. FREUCHEN (1915) saw fledged young in Vildtland on 24 July, which fixes the date when incubation began at 10 June, at the latest. JOHNSEN (1953) mentions nearly fledged pull on 24–25 July 1949 in a valley adjacent to Wandel Dal, and RØEN (1965) observed pull at Brønlundhus on 2 July 1964, which means that egg-laying was finished before 10 June.

All earlier writers state Ringed Plovers as very common breeding birds around Jørgen Brønlund Fjord. MØHL-HANSEN (1949) says "hundreds of pairs were breeding". JOHNSEN (1953) states that it was one of the most common birds. RØEN (1965) mentions it as the most common wader, and JUST (1967) and ANDERSEN (1970) state that it is the most common small wader after the Sanderling (*Calidris alba*). (See discussion, p. 41–42).

During the incubation period the males were the most active in giving display, alarm, and distraction behaviour toward enemies near the nest. If one stayed in the territory, the male most often gave alarm calls and low intensity distraction display (DRURY, 1961) directed away from the nest in relation to the observer (disturber). The females usually continued incubating, but when danger increased they took part in alarm calling and display for brief periods, and then flew low to and from the nest in large arcs around the disturber. When the observer was in the immediate vicinity of the nest, the birds gave high intensity distraction – injury feigning – (DRURY, 1961). (After the male of Pair 1 was alone, he remained relatively inactive when I was close to the nest, but repeatedly performed injury feigning in front of me when I retreated to a distance of 75–125 m).

The Ringed Plovers were not always demonstrative. Sometimes when I approached the territory or the nest, the brooding bird quietly left the nest, and on several occasions I could visit the nest without hearing a sound from the birds. Apparently individual birds varied in this respect, and individual birds' reactions could vary from one day to another.

The distance from the nest when alarmist behaviour began differed to some extent. When I approached a territory one of the birds sometimes came to meet me 2–300 m from the nest, and when I retreated sometimes joined me (particularly the males) flying and running in front of me for up to 500 m from the nest. On one occasion a male followed me, alarm calling, 1200 m from the nest site. When they had young, the birds always made themselves known when I approached the brood. Low intensity distraction behaviour was observed at a distance of up to 600 m from the pull. There were no notable differences between the behaviour of the sexes during this period. In some pairs the male apparently gave alarm more actively, in others the female. On three occa-

Measurements.

Ring number	Dyed*	Date	Sex	Age**	Wing mm	Culmen mm	Weight g	Not.
8151401	×	7.6	m.	ad.	130	13	55	
8151402	×	7.6	m.	ad.	131	13	51	
8151406	×	30.6	f.	ad.	132	15	66	breeder
8151407	×	1.7	m.	ad.	129	14	60	} { breeding pair
8151408		1.7	f.	ad.	135	15	64	
London BB 72603		2.7	m.	ad.	132	14	61	breeder/ shot***
8151418		16.7		(1 day)		8.0	8.5	
8151430	} brood	27.7		few hours		7.5	7.4	11 a.m.
control		28.7		1 day			7.3	3 p.m.
control		30.7		3 days		8.1	9.0	7 p.m.
8151431		27.7		few hours		7.8	7.8	
8151432		27.7		few hours		7.1	6.9	11 a.m.
control		28.7		1 day			7.9	3 p.m.
control		30.7		3 days		8.4	8.1	7 p.m.
8151434		30.7		3 days		8.1	8.5	
8151433		30.7		(14 days)		12.6	38.5	
found dead		9.8	m.	juv.		115	13.0	35

* and colour ringed.

** estimated age in parenthesis.

*** skin in the Zoological Museum of Copenhagen.

sions I observed aggressive behaviour towards Sanderlings, once towards a Dunlin (*Calidris alpina*) and a juvenile Knot (*Calidris canutus*). This occurred during the incubation period or during the first days after the young had hatched. When the young were a few days old, the birds left the territory, and aggressive behaviour stopped as described by MASON (1947). Song flight was observed a few times during the summer (the last time on 3 August), probably as a reaction to threats or to alien birds visiting the territory. Outsiders (birds of the same or of other species) were often attracted by pairs giving alarm, and were tolerated in the territory to a certain extent as MASON (1947) describes.

During the census some non-territorial birds were observed foraging in the census area, these were probably birds on foraging expeditions outside their own territories. The yellow male from Kedelkrogelv's delta was observed flying on a foraging expedition to Opalsø on 22 June (distance 1.6 km). These birds alarm called at my presence, but did not perform distraction display.

From 4-10 July some non-territorial Ringed Plovers (failed and/or non-breeders) were observed around Klaresø, where enormous quantities of mosquitoes hatched at this time (see p. 13). The birds foraged partly along the shores of the lake, partly on its surrounding slopes. On 5 and 6 July there were 5-6 birds, on the 7th 8-10, and on the 8th only 2-3.

The breeding birds left the land before 10 August, according to LAVEN (1940) the females first. Subsequently only a few juveniles were seen inland and in Kedelkrogelv's delta (max. 2). The first unattended juvenile was observed at Brønlundhus during the snowstorm on 8 August. It was fairly exhausted, and three hours later it was found dead (weight 35 g). A few were seen around Kap Harald Moltke in mid-August. Small flocks of young birds are normally seen in the deltas along the coast from the middle to the end of August (JOHNSEN, 1953 and RØEN, 1965). Adult birds have been observed until 19 August (JOHNSEN, 1953).

Turnstone (*Arenaria i. interpres* (LINNAEUS))

Very common breeding bird around Jørgen Brønlund Fjord and probably also around Nedre Midsommer Sø. Because of our late arrival, the date of the species' arrival was not determined. In early June some birds were observed singly or in pairs in Kedelkrogelv's delta, at Klaresø, and at the rivers in the area. The largest number seen in the delta was 4–5 on 8 June, but on the 10th all resting waders had left the delta. One Turnstone was ringed and dyed in the delta on 7 June, and another on 8 June when the bird dyed the day before was seen too. One of them was observed at Klaresø on the 9th and thereafter they were gone. Thus, there was a very limited number of resting birds in Kedelkrogelv's delta this year. Larger flocks were observed in earlier years at the end of May and in the first half of June (RØEN, 1965, JUST, 1967 and ANDERSEN, 1970).

Eight pairs, or one pair per km² (Fig. 2) were found in the census area. Nest or young were found of five of these, and apparently one (pair 4) of the remaining three pairs succeeded in breeding. It was very difficult to keep track of the Turnstones during the preliminary count in mid-June as particularly the males were very aggressive and moved about. At this time, however, there were apparently some pairs in the area which did not breed there later.

Pair 1 (Fig. 2). The pair, or only the male, was registered here several times from mid-June. On 3 July the pair was observed with 3–4 day-old pull., and two were found and ringed (753792–93). The female carried a ring, and was shot on 4 July (London CK 58009).

Pair 2. One pair was registered here from mid-June to 3 July, but neither nest nor young were found.

Pair 3. A pair was registered here from mid-June to 3 July, when only an aggressive female was observed. On 27 June she was seen vigorously chasing two Long-tailed Skuas (*Stercorarius longicaudus*).

Pair 4. One pair was regularly registered here from 1 June. The pair was not registered during the 13–15 June census, and only irregularly at the end of June. In early July the birds were more aggressive, and on 23 July the pair was still on

the site and very aggressive. On the 25th the male was seen for the last time, alone and very aggressive.

Pair 5. Some registrations were made here beginning in early June, but during the count in mid-June the pair was not noted. At the end of June the pair was registered regularly, and at 12 a.m. on 29 June the nest was found with four eggs, one of them starred and one pipped. At 4.30 p.m. another egg was starred, and at 11 a.m. on 30 June there were three dry pull. and one rotten egg in the nest (753786-87-88). The nest was situated on gravel surrounded by large stones and some *Salix* and *Saxifraga* and was 5 m from dense vegetation, 20 m from stagnant water, and 50 m from running water. The male was captured, ringed and dyed on 29 June (753783), the female on the 30th (753784). On 5 July the family was less than 200 m away from the nest, but on the 11th the birds were seen near Opalsø (c. 2.5 km in 6 days). On 25 July the male alone with the fledged young were observed in Kedelkrogelv's delta (Fig. 4).

Pair 6. Several pairs were registered in this area in mid-June, and one pair was registered regularly until 23 June. After this date I could not find them and assumed that they had gone. On 2 July they were seen again, and three pull. were found 0.5-10 m from the nest (753789-90-91). The nest lay on clay, which was partly covered with lichen, among stones, *Salix* and *Saxifraga*, about 5 m from dense vegetation and 10 m from slowly flowing water. On 5, 7 and 8 July the family was observed at Kedelkrogelv (Fig. 4), and on the latter date one of the young was found near Pair 5's nesting site. On 22-24 July two fledged, but still downy young were seen with the male in Kedelkrogelv's delta.

Pair 7. This pair may have been among the pairs registered in mid-June which were not found later. On 6 July a very aggressive pair was observed at the site, and on the 8th they were seen with at least one pull. about one week old. Nesting site unknown.

Pair 8. Several pairs were registered in this area during the census in mid-June, but only a single pair was observed after this. On 23 June the nest with four eggs was found situated on gravel with scattered grass, some *Salix* and stones, 10 m from running water. The nest was visited regularly, but usually no birds were seen. On 30 June the female was captured, ringed and dyed (753785), whereupon she apparently left the site. The male remained alone at the nest, and on 8 July there were a wet pull. and three pipped eggs in the nest. On the following day four dead pull. lay in the immediate vicinity of the nest, and the male gave alarm nearby. On the 11th he still gave alarm around the nest. PARMELEE & MACDONALD (1960) also mention that four pull., which a female had to brood by herself, died shortly after being hatched.

One pair may have bred above the census area. None was seen to the east towards Arkæologelv, but 1-2 pairs were breeding at Kajakelv. On 21 July a male with a pull. (753794) about four days old was found at Zoologelv. On 20 July 3-4 breeding birds were observed west of Glaciologelv. None was seen in Wandel Dal. A female giving alarm calls was observed at Blåsø, and 1-2 pairs and a flock of eight were seen north of Nedre Midsommer Sø.

Four of the six observed broods hatched between 30 June and 3 July. One brood hatched on 9 July, and one on c. the 17th, thus egg-laying must have commenced c. 4 June (egg-laying five days, incubation period 22 days). Hatching around the end of June or in early July in

Peary Land was noted by JOHNSEN (1953), who saw a pull. about eight days old on 8 July 1949.

There are some contradictory reports on the frequency of the species around Jørgen Brønlund Fjord. JOHNSEN (1953) says 'not very frequent' and 'much rarer than Sanderling and Ringed Plover'. RØEN (1965) seldom saw the species in the summer, but states that at least five pairs were breeding around Lersø and Klaresø, a statement I consider debatable (see discussion, p. 41). JUST (1967) also observed the species infrequently during the summer and reported that one pair presumably bred at the upper part of Kedelkrogelv. ANDERSEN (1970) stated that the species was very common, almost as common as the Sanderling and the Ringed Plover (see discussion, p. 42).

When I was close to the nest, Turnstones tended to be much more silent than Ringed Plovers. I either visited a nest day after day without hearing or seeing the birds, or I saw one of them calmly foraging a few hundred metres from the nest. But the bird must have just left the nest because the eggs were always warm. ANDERSEN (1970) tells of a female calmly leaving a nest, running, her wings drooping. On other occasions the behaviour of the birds was extraordinarily aggressive. At the start of incubation the males were the more active, but later on there was no apparent difference between the sexes in their aggressiveness towards intruders. It was my impression that males and females brooded at different times of the day and night. BERGMANN (1946) stated that the males brood at night and the females in the daytime.

Although the birds could be completely silent when disturbed during incubation, they made their presence clearly known during hatching and when they had young. As soon as the pair began to move around with their young, the females were the more aggressive, while the males mainly stayed close to the young. This agrees with BERGMANN's observations (1946). When the young were about one week old, they were less inclined to crouch, but tried instead to escape by running away. However, they only ran when the enemy ran, and stood still when the enemy stood still, a tactic which, as I came to realize, was highly effective. As long as the young were small, their behaviour was like that of other young waders, i.e. they did not crouch immediately in response to their parents' alarm calls, but dispersed 10–20 m in all directions before crouching. LAVEN (1940) stated that Ringed Plover young run instead of crouching when they are more than two weeks old.

The distance from the nest when the birds gave alarm was 400 m, while energetic alarm calling was observed up to 600 m away from the young. In dangerous situations strangers or neighbouring birds were tolerated within the territory. The females left in mid-July when the young were two weeks old or more. The last female was observed on

Measurements

Ring number	Dyed*	Date	Sex	Age**	Wing mm	Culmen mm	Weight g	Not.
753781	×	7.6		ad.	151	21	103	
753782	×	8.6	m.	ad.	154	22	89	
753783	×	29.6	m.	ad.	154	21	}	{ breeding pair
753784	×	30.6	f.	ad.	157	21.5		
753785	×	30.6	f.	ad.	152	21		breeder
753786	}	brood		few hours		12	12	
753787				few hours		12	12	
753788				few hours		12	11	
753789	}	siblings		few hours			12	
753790				few hours			11.5	
753791				few hours			12	
control				6-7 days		16		
753792	}	siblings		(1 day)		11	11	
753793				(1 day)		11	11.5	
London CK 58009		4.7	f.	ad.	156	21	101	breeder/ shot***
753794		21.7		(4 days)		14.2	21.0	
753797	×	8.8		juv.	145		77	

* and colour ringed.

** estimated age in parenthesis.

*** skin in the Zoological Museum of Copenhagen.

23 July (Pair 4). On 21 July one pull, about four days old was attended only by a male. The males leave the young when these are about four weeks old and fully fledged. The last male attending young was observed on 31 July. These observations of the role of the sexes when attending young agree with BERGMANN's (1946) observations in Finland. The young mainly stayed together in broods for a while after the males had left them.

Flocks of failed and/or non-breeders were observed from 30 June when two Turnstones were seen together with a Sanderling (*Calidris alba*). From 4 July to the middle of the month flocks of 4-10 Turnstones occurred together with Sanderlings and Knots (*Calidris canutus*) at Klaresø where they foraged along the shores. The flocks mainly stayed at Klaresø, but roved widely, and birds of the same category were seen singly or in small groups at several places. The sexes were about equally represented. A male with a foreign ring was observed on 5 July and was seen at Klaresø until the 11th. On 13 July a yellow-dyed female (either marked in Kedelkrogelv's delta in early June, or the female of pair 5 or 8) was seen among the others at Klaresø. On 17 July a flock of Turnstones and Sanderlings was heard migrating east above Søjren, and on 19 July four flew over Midsommerelv's delta.

The first brood of unattended juveniles was observed on 29 July in Kedelkrogelv's delta, and 1–3 juveniles were seen there most days until I left in mid-August. One was ringed and dyed on 8 August (753797). On 14 August an adult male was seen in the delta. Five adults and four juveniles were observed at Kap Harald Moltke on 18 August. On 13 August 1948 a flock of 15–16 migrated east at considerable height over Brønlundhus (JOHNSEN, 1953), and in most years small flocks of juveniles have been observed in the deltas and along the coast in August.

Knot (*Calidris c. canutus* (LINNAEUS))

Undoubtedly a common breeding bird in Peary Land, but apparently not around Jørgen Brønlund Fjord. No records of young are available from Peary Land, but many juveniles were observed in late July and in August 1973, including a brood still attended by an adult. The Knot was the next most common species (after the Sanderling) observed in northern Peary Land in 1969 (GRANT, 1972).

A total of seven observations of up to five birds (several paired) were made in the study area between 1 and 15 June. Then none were observed until 4–13 July when 1–3 were seen with flocks of Turnstones (*Arenaria interpres*) and Sanderlings (*Calidris alba*) at or near Klaresø. On 4 July the first bird flew calling at considerable height from the direction of Børglum Elv to Klaresø. A flock of 14 adults migrated east through Midsommerelv's delta on 19 July, but apart from these none were seen in Wandel Dal or around Nedre Midsommer Sø during mid-July.

From 29 July and until my departure from Brønlundhus on 14 August, 1–6 juveniles were seen almost daily in Kedelkrogelv's delta, at Lersø and along the coast. Some of the birds appeared to be in broods. On 31 July three juveniles accompanied by an adult were observed at one of the rivulets on Okseslette. The adult gave alarm, and the calls of the juveniles were similar to the ones used by other juvenile waders when still attended by adults. During the snowstorm 8–9 August, up to nine juveniles were observed in Kedelkrogelv's delta. One was so exhausted that it could hardly stand up, but it could fly. The birds probed for grass seeds in the snow, or ate the seeds from grass stems sticking through the snow. One juvenile captured, ringed and dyed on 5 August was seen again in the delta on the 8th.

At Kap Harald Moltke 20–25 were seen in flock on 7 August, and during my stay there from 14–21 August, up to 38 juveniles and three adults in flocks of up to 18 individuals were observed. Some were seen eating grass seeds around the station.

On the first Peary Land Expedition in 1947–50 only one Knot was observed, a juvenile female in Kedelkrogelv's delta on 28 July 1949

(JOHNSEN, 1953). In 1964 and 1966 a few were seen around Brønlundhus from 28 May to c. 12 June (RØEN, 1965 and JUST, 1967). In 1968 4–6 were observed here until 14 June, while 30 were seen at Bagsværd Sø on 31 May. Five adults were observed in Kedelkrogelv's delta on 15–16 July (ANDERSEN, 1970).

Measurements

Ring No.	Dyed*	Date	Sex	Age	Wing mm	Culmen mm	Weight g
753796	×	5.8	m.	juv.	151	24.3	93

* and colour ringed.

Baird's Sandpiper (*Calidris bairdii* (COUES))

On 27 June a Baird's Sandpiper was observed in the southwestern corner of the census area. The bird came from the west, foraged awhile in the fertile river bed, but when chased by a Ringed Plover it flew west again at great height. On 16 July a Baird's Sandpiper was heard and seen flying a little west of Blåsø. The species has not been observed previously in Peary Land. In Greenland it breeds in Thule District and probably in Washington Land (SALOMONSEN, 1950). Practically nothing is known about the birds between this area and Peary Land.

Schiøler's Dunlin (*Calidris alpina arctica* (SCHIØLER))

Regular visitor to Jørgen Brønlund Fjord. An adult foraged in Kedelkrogelv's delta on 29 July.

In mid-June 1949 several were seen (JOHNSEN, 1953). Two were observed on 29 June and one on 31 July 1964, (RØEN, 1965), and in 1968 one was seen on 20 June (ANDERSEN, 1970). The species was not seen in 1966 (JUST, 1967). Six were observed in northern Peary Land in June 1969 (GRANT, 1972). The species has been found breeding northwards to Germania Land, but since little is known about ornithological conditions between there and Peary Land, the northern limit of the species' distribution in Northeast Greenland is unknown (MELTOFTE, 1975).

Sanderling (*Calidris alba* (PALLAS))

Very common breeding bird around Jørgen Brønlund Fjord and Nedre Midsommer Sø. The first pair was observed at Lersø on 31 May, but because of my late arrival, the date when the birds arrived could not be determined. A pair, probably the same birds, was seen at Klaresø on the next day, and from 3–6 June up to seven birds were seen daily in Kedelkrogelv's delta and at the lakes. The birds mainly appeared in pairs, but several groups of two males and one female were observed,

and the males were seen chasing the female in flight (sex determination according to PARMELEE, 1970). The male of one pair seen in the delta on 4 June wore a foreign ring, and on the 6th the birds were seen again at the small lake east of Opalsø. On 7 June there were 17 Sanderlings in Kedelkrogelv's delta, but numbers decreased in the next few days, and on the 10th all had gone. On the 8th two were ringed and dyed in the delta, and the next day one of them was seen with its mate in the same place. None of them were observed later.

On 10 June 2 km up Kedelkrogelv, two birds were observed chasing one another and song fragments were heard and courtship behaviour observed.

During the census 12–15 June c. seven pairs were observed foraging in the census area. Furthermore there were two males in song flight, and one male and one female foraging singly. The last pair was seen on 18 June, and thereafter only 4–6 single females and one male were observed until the end of the month.

PARMELEE (1970) working on Bathurst Island, Canada, showed that mates separate when incubation begins, and that only one of the birds (male or female) completes incubation and attends the young. PARMELEE & PAYNE (1973) showed that the female can lay two clutches, one immediately after the other, and assumed that the male brooded one clutch and the female the other.

Brood 1. A female was observed here on 22 June settling on a nest with four eggs (Fig. 2). The nest lay on a small, lichen-covered hillock between scattered grass and some *Salix* only a few metres from running water. Only the female was seen on this occasion. On five later visits during the incubation period, the female was not at the nest, but was twice seen quietly foraging c. 200 m from it. The eggs were always warm, and no other Sanderlings were seen at the nest. On 30 June the female was caught on the nest and ringed and dyed (8151405). At 2 p.m. on 8 July all four eggs were starred, and on the following day four dry pull. were ringed in the nest at 11 a.m. (8151413–14–15–16), and, besides the female, another bird was heard alarm calling nearby. On 11 July the female gave alarm 1–200 m from the nest, and a male gave distraction display around the same place. I presumed that the male had a brood nearby and watched him, but to my great surprise he was brooding the brood of ringed young. The female constantly alarm called around me, while the male flew warningly back and forth between me and the young, and both birds gave distraction display. On 25 and 27 July the female was observed with the young at Kedelkrogelv c. 2300 m west of the nest (Fig. 4), no other adults were seen. There were up to six juveniles at the site on 3–5 August, at least one of them ringed, but no adults were observed.

Brood 2. Between 13 June and 2 July a solitary male was observed foraging on five occasions at Kedelkrogelv 150 m from this site (Fig. 2). On 26 June he was seen vigorously chasing a Ringed Plover (*Charadrius hiaticula*) at the site, and on 7 July he was observed with four pull. 1–2 days old (pull. 8151409–10–11–12). A female also gave alarm on this occasion. The male was still on the site the next day, but on the 9th he was found with all four pull. at a small river c. 600 m to the east. On the 11th a male, presumably the same, was observed nearby giving energetic alarm calls (Fig. 4).

It was not easy to determine how many other Sanderlings bred in the census area, but according to PARMELEE (1970) a brooding Sanderling leaves the nest for c. 30 % of each day (06–18), mainly to forage within a few hundred metres of the nest. Thus, the chances of locating the birds by visiting the area regularly should be good. In addition to some stragglers in mid-June, foraging females were observed at 3–5 places in the second half of June. A female was twice seen in the southwestern corner of the area. Another female was twice seen where the male from Brood 2 had been seen, and females were observed three times in the southeastern corner of the area. A chirping female left a site 1500 m up Kedelkrogelv on 29 June, and females were once observed foraging in Kedelkrogelv's delta and once at Klaresø. Apart from Brood 2, no males were seen in the census area. On 30 July a female with four fully fledged, but still downy, young was observed at Kedelkrogelv's delta, but on the following day there was only one juvenile in the delta.

The seven pairs observed in the area from 12 to 15 June had left by the 16th and 17th, and I do not think they bred in the area.

I reckon that between 5–7 birds bred in the census area, but it is difficult to explain why there was only one male (the sexes were otherwise equally represented among birds attending young—see below). It is difficult to explain what happened to the seven pairs counted 12–15 June. They left or broke up within the following three days, but the local breeding birds (and most of the other birds found—see below) were incubating at this time, and two breeding birds (the male of Brood 2 and the female in the southwestern corner) were seen foraging by themselves in the same period.

Outside the census area a male with 3–4 downy juveniles was observed at Arkæologelv on 26 July, and 'rodent-running' males were seen at Zoologelv on 21 July and between Zoologelv and Kajakelv. None were seen in Wandel Dal in mid-July. Three (1 + 1 + 1) were seen north of Nedre Midsommer Sø, and on 17 July a 'rodent-running' female was observed at a small lake c. 200 m up the mountain east of Søjren. On 16 July a total of 13 young Sanderlings in six broods (two of the young, however, varied so much in size that they might have belonged to different broods) were found on a c. five kilometre stretch along the rivulet between Issø and Blåsø and along the western shore and south of Issø. Twelve were measured and ringed (8151417 and -19 to -29). Three broods were attended by females, one by a male, and one apparently both by male and female. One brood was attended by an unsexed adult. The age of the young was determined by means of PARMELEE's (1970) culmen length measurements. Two broods were 2–3 days old, three broods 6–8 days old and one brood 9–12 days old. The

two very young broods were separated by no more than c. 100 m. One was attended by a female, the other by a male.

Altogether, eight broods were hatched 5–9 July and two 13–14 July, which with an incubation period of 24–32 days and five days of egg-laying (PARMELEE, 1970) means that the latest date on which egg-laying could have commenced was 7 June (i.a., Brood 2), but laying may have begun at the end of May or in the first days of June if the mates have participated in laying of double-clutches.

FREUCHEN (1915) saw four pull. in Valmuedal on 6 July 1912, and another five to six broods on the 9th. MØHL-HANSEN (1949) saw three day-old pull. at Kedelkrogelv as late as on 3 August 1947. JOHNSEN (1953) observed courtship behaviour on 2 June 1949 at Klaresø.

A total of 11 single birds attending young were sexed, and five were males and six females (including Brood 1). In addition one brood was apparently attended by both a male and a female, but there were so many birds on this site (between Blåsø and Issø) that each could very well have had its own brood.

PARMELEE (1970) only once saw two adults attending one brood, but later only the male attended, and the female was not observed brooding the young. PEDERSEN (1934 and 1942) shot eight brooding birds in Northeast Greenland – all females – and a bird giving alarm near a brooding female was a male. Frequently, he saw two alarmed birds with young, but one more actively so than the other. ROSENBERG *et al.* (1970) kept a nest under constant observation for three hours at the beginning of the incubation period on Wollaston Forland. Two birds were at the nest, but only one of them brooded. “A constant vocal communication between the two mates was noted.” The mate chased the brooding bird off the nest several times, and the mates foraged together for brief periods. Most often two birds were observed together at broods, and one mate always gave alarm more actively than the other, but many broods were also attended by only one adult. MANNICHE (1910) notes that only the females incubate and attend the young, and that the males gather in flocks when incubation begins. Thus, statements about the frequency with which broods are attended by one or two adults diverge considerably. In general, however, most of my observations in Peary Land is in accordance with PARMELEE’s results, but further detailed investigations of the whole subject is needed.

My observations of the birds’ behaviour at Nest 1 during the incubation period agree with other reports. Most often the bird left the nest long before I approached it, and usually remained silent nearby. Alternatively, a brooding bird would flatten itself on the nest, and only fly off when one was a few metres from it, and then give injury feigning or ‘rodent-run’ display. Alarm was usually given when I was less than

Measurements

Ring number	Dyed*	Date	Sex	Age**	Wing mm	Culmen mm	Weight g	Not.
8151403	×	8.6		ad.	119	22	44	
8151404	×	8.6	m.	ad.	122	24	47	
8151405	×	30.6	f.	ad.	123	25.5		breeder
8151409		7.7		(1-2 days)			9.3	attended by m.
8151413		9.7		few hours		9.5	7.9	} attended by f.
8151414	} brood	9.7		few hours			7.7	
8151415		9.7		few hours			7.9	
control		11.7		2 days		12	11.5	
8151416		9.7		few hours			7.8	
8151417			16.7		(8 days)		15.1	
8151419	} siblings(?)	16.7		(9-10 days)		16.0	31.8	} attended by f.
8151420		16.7		(11-12 days)		17.2	35.5	
8151421	} siblings	16.7		(7-8 days)		15.0	23.6	
8151422		16.7		(7 days)		14.8	23.3	
8151423	} siblings	16.7		(6 days)		14.1	21.6	
8151424		16.7		(2-3 days)		12.0	13.8	
8151425	} siblings	16.7		(2 days)		11.2	11.8	
8151426		16.7		(2-3 days)		12.0	12.0	
8151427	} siblings	16.7		(2 days)		11.2	9.5	
8151428		16.7		(2-3 days)		12	11.0	
8151429		16.7		(8 days)		15.1	31.1	attended by f.

* and colour ringed.

** estimated (calculated) age in parenthesis.

200 m from the pull. but occasionally at 400 m. When I was close to the young, the bird displayed by feigning injury, or most often by a 'rodent-run'. As soon as the young were fledged, the adults usually gave alarm only when I was less than 50 m from the young.

The first failed and/or non-breeders were observed on 30 June, when a pair foraged at the rivulets on Okseslette, and a male was seen together with two Turnstones (*Arenaria interpres*). Subsequently females and males were observed singly, in pairs, or in small flocks. At Klaresø flocks of 6-16 birds were seen from 3 to 9 July; fewer later on. The sexes were equally represented in the flocks, and most often the birds were paired, at least in the beginning of the period. Between 6-9 July song fragments were heard from males pursuing females. The birds mainly foraged along the shores of Klaresø, but they also roved together with Turnstones and Knots (*Calidris canutus*). Four were observed at Blåsø on 16 July, and on the 17th some were heard migrating east together with Turnstones above Søjren. On 3 July a male carrying a foreign ring (the male from 4th and 6th June?) was observed at Klaresø, and on 8 July a female also carrying a foreign ring was seen there.

The last adult attending young was seen on 30 July; thereafter

only one moulting adult male was observed in Kedelkrogelv's delta on 13 August. The first unattended juvenile was seen on 31 July. Subsequently up to 11 were observed until mid-August, most of them in the delta. They often appeared in broods. Three ringed juveniles were seen on the beach at Brønlundhus on 13 August (Fig. 4). Up to 5-6 juveniles were observed at Kap Harald Moltke 15-18 August.

American Long-tailed Skua (*Stercorarius longicaudus pallescens*

LØPPENTHIN)

Presumably a scattered and irregularly breeding bird in southern Peary Land. The species has never been found breeding around Jørgen Brønlund Fjord. In 1912 FREUCHEN (1915) reported breeding in southern Peary Land, but neither eggs nor young were found. The question is whether, in view of the minimal vegetation, there are in any year enough Lemmings (*Dicrostonyx groenlandicus*) in the immediate vicinity of Jørgen Brønlund Fjord for the Skuas to breed there.

In 1973 the first observed were a flock of six which migrated west over Okseslette on 5 June. Subsequently up to three individuals were observed nine times on the ice and on the land around the fjord and Nedre Midsommer Sø until 26 July, when two flew east through the fjord. On 27 June two flew west at great height above Okseslette.

In most years none, or few Lemmings have been reported at Jørgen Brønlund Fjord, but few are seen unless there are very great numbers present. In 1970 when many Skuas bred in Germania Land, only a few Lemmings were seen during the summer (MELTOFFE, 1975). No doubt it is easier to estimate the number of Lemmings on the basis of the Skuas' breeding activity than vice versa. In 1973 I saw two Lemmings, and some holes and winter nests were found. In 1947, 1948 and 1950 no Skuas were observed although in 1948 there were some Lemmings. In 1949 there were many Lemmings around Jørgen Brønlund Fjord, but only five Skuas were seen throughout the summer (JOHNSEN, 1953). 1964, 1966 and 1968 have been called poor Lemming years, but some Skuas were seen in all these summers, fewest, however, in 1964 (RØEN, 1965; JUST, 1967; ANDERSEN, 1970).

Northward migrating birds were observed over Independence Fjord in early June 1912 (FREUCHEN, 1915), and in early June 1968 some migrated west through Jørgen Brønlund Fjord (ANDERSEN, 1970), just as in 1973.

Ivory Gull (*Pagophila eburnea* (PHIPPS))

Irregular and scarce visitor at Jørgen Brønlund Fjord. In 1973 the species was observed between 15 June and 13 August, a total of

seven observations of 1–2 individuals flying along the coast or over the fjord, all adults.

The species was not observed in 1947–50. A few birds were seen in 1963 (KNUTH), 1964 (RØEN, 1965) and 1968 (ANDERSEN, 1970), but none in 1966 (JUST, 1967).

Glaucous Gull (*Larus h. hyperboreus* GUNNERUS)

Scarce breeding bird in Jørgen Brønlund Fjord and at a small colony at Nedre Midsommer Sø. When I arrived at Kap Harald Moltke on 29 May, the Glaucous Gulls were already present. Up to six were observed daily during June at the islands in the middle reach of the fjord, over the fjord and at Brønlundhus. Until 20 June they often visited rubbish at Brønlundhus, but otherwise they were seen searching for food in the shore leads and eating seals' excreta. Glaucous Gulls were only rarely observed over the land.

In July and August 1–2 Glaucous Gulls were regularly seen over the fjord, and on 26 July two pull. and one pipped egg were found in a nest on the little island east of Ederfugleholm where there were also 3–4 old nests. In addition to the breeding pair there were 1–2 adults nearby. In 1968 three pull. were found on this island on 20 July (ANDERSEN, 1970).

During my visit to Nedre Midsommer Sø in mid-July, 4–5 were seen besides four in the little colony mentioned by JOHNSEN (1953) on a mountain bluff in the middle of the south coast of Nedre Midsommer Sø (observed from the north coast).

Arctic Tern (*Sterna paradisaea* (PONTOPPIDAN))

Scarce breeding bird at Jørgen Brønlund Fjord and Nedre Midsommer Sø. The first Arctic Terns observed in 1973 were three birds migrating west along the coast at Brønlundhus on 10 June. After this the species was only seen a few times in the fjord in June and in early July. A pair was found breeding on Ederfugleholm on 26 July and two pull. weighing 14.2 and 9.2 g were found near the nest. An additional 7–10 adults were observed around the islands where, however, they did not breed. In 1949 a nest with one egg was found on the island on 24 July (JOHNSEN, 1953), and in 1968 three nests with 2, 2 and 1 egg were found on 5 July. On the 20th the nests were empty, and only two newly-hatched pull. were found. On 2 August all the terns were gone (ANDERSEN, 1970).

When I stayed at Nedre Midsommer Sø in mid-July 3–4 birds were observed daily at Søjren, and a nest with two eggs, one of them starved, was found on 16 July in comparatively level, barren mountain terrain

2–300 m west of Blåsø. On the following day still only one of the eggs was starred. Another nest was found on 16 July on a gravel hill at the outflow of the river from Issø to Blåsø. It contained two starred eggs. Some Terns were also seen at the easternmost part of Midsommerelv and in its delta in mid-July.

Snow Bunting (*Plectrophenax n. nivalis* (LINNAEUS))

Common breeding bird. On my arrival in Peary Land on 29 May the spring flocks had broken up, and the pairs were distributed in the land. Yet some still moved around and some males sang, and pairs were seen in early June at sites where none bred later on. The species was not numerous in the census area. Only 1–10 were observed daily during early June, and fewer later on. Song was heard until the first days of July. A total of seven males was heard singing at various sites in the census area during counts 13–29 June, but only three of them were heard regularly at the same site (Fig. 2). Observations of feeding and young indicated that at least two of these three pairs bred.

Regarding the area around Brønlundhus in 1964 it was stated that “every single river ravine housed at least one pair, and on Okseslette south of the station there were about 300 m between the pairs” (RØEN, 1965 – translated from Danish).

The species bred more abundantly on the mountain slopes above the census area. Unquestionably, this is due to the differences between the biotopes mentioned in the introductory remarks (p. 8–9). The census area mainly consisted of clay and gravel plains and slopes while the bedrock dominated above, with many clefts and piles of rock. Breeding birds were found at a height of c. 600 m along Kedelkrogelv. On the 25 km hike north of Midsommerelv in mid-July only 5–7 Snow Buntings were seen, but around Nedre Midsommer Sø the species bred more abundantly. A total of 7–10 pairs was found.

Adults were feeding young in the nest from 27 June. Fully fledged young were seen from 15 July. In 1964 a newly fledged juvenile was seen on 1 July, and a week later many were fledged (RØEN, 1965). From the early morning of 8 August (i.e. just before the snowstorm) and until I left, 20–40 young Snow Buntings stayed around Brønlundhus and in Kedelkrogelv's delta. Some small flocks were also observed in the surrounding area, but most often there were only a few individuals farther away from the station. The Snow Buntings pulled through the 8–9 August snowstorm very well; no exhausted birds were found.

COMPLETIVE BIRD LIST FOR THE REGION

The list comprises species previously observed in the southern part of Peary Land, but not seen in 1973.

Snow Goose (*Anser caerulescens* (LINNAEUS))

Occasional visitor. On 8 July 1949 two Snow Geese were observed near Brønlundhus, and on 2 and 8 August of the same year two were seen at a lake near the estuary of Børglum Elv where they had apparently stayed while moulting (JOHNSEN, 1953). On 14 July 1968 a Snow Goose passed Brønlundhus heading west (ANDERSEN, 1970). One was seen in northern Peary Land in July 1969 (GRANT, 1972). The race Greater Snow Goose (*Anser caerulescens atlanticus* KENNARD) breeds in Thule District, and the birds observed in 1949 surely belonged to this race (SALOMONSEN, 1950).

Pale-breasted Brent Goose (*Branta bernicla hrota* MÜLLER)

Regular migrant in the beginning of this century, and presumably breeding in the area, but has now disappeared from this corner of Greenland (MELTOFTE, 1975). In 1912 several flocks of up to nine birds were observed migrating west along the south coast of Peary Land on 8 and 9 June (FREUCHEN, 1915). In 1921 northward migrating Brent Geese were observed in the outer part of the south coast of Peary Land (KOCH, 1925). On all the Peary Land expeditions from 1947 to 1973 Brent Geese were only seen once. On 7 July 1968 a single Brent Goose passed Brønlundhus heading west (ANDERSEN, 1970). Only one was seen in northern Peary Land in June 1969 (GRANT, 1972).

Brent Goose bones have been found at almost all the Independence-I culture settlements (c. 2100–1800 B.C.) around Jørgen Brønlund Fjord and at one Independence-II settlement (c. 635 B.C.) (KNUTH, 1967).

Greenland Falcon (*Falco rusticolus candicans* GMELIN)

Scarce and scattered breeding bird. The species was found breeding on the south coast of Peary Land in 1921 (KOCH, 1925). One nesting site was found on the eastern corner of Buen mountain at Børglum Elv in 1947 (MØHL-HANSEN, 1949), and a pair was observed several times at a nesting site in the small colony of Glaucous Gulls (*Larus hyperboreus*) on the south coast of Nedre Midsommer Sø in 1949 (JOHNSEN, 1953). From 24 August to 4 September 1948 1–2 falcons were seen almost daily at Jørgen Brønlund Fjord (JOHNSEN, 1953). In 1964 one was seen on 17 August over Klaresø (RØEN, 1965). The species was not

seen in 1966 (JUST, 1967). In 1968 one was observed at Brønlundhus on 2 June (ANDERSEN, 1970). The nesting site on the eastern corner of Buen can hardly have been occupied for many years; I could find no traces of it when I visited the site on 17 August.

Curlew Sandpiper (*Calidris ferrugenea* (PONTOPPIDAN))

One was shot on 12 June 1966 at a little lake near Brønlundhus. The species had not been found in Greenland previously (JUST, 1967).

Grey Phalarope (*Phalaropus fulicarius* (LINNAEUS))

Scarce, but regular visitor. On both 25 June 1949 and 24 June 1950 one was observed near Jørgen Brønlund Fjord (JOHNSEN, 1953). In 1964 up to five were seen at the little lake east of Opalsø from 12 June and throughout the summer (RØEN, 1965), and in 1968 two females and one male were seen at a little lake on 19 June (ANDERSEN, 1970). 13 were observed in northern Peary Land in June and July 1969 (GRANT, 1972).

Red-necked Phalarope (*Phalaropus lobatus* (LINNAEUS))

Occasional visitor. In 1963 one was observed at Klaresø (KNUTH), and in 1964 one was seen on 15 July in the little lake east of Opalsø (RØEN, 1965). The species has been found breeding as far north as Hold with Hope (74°N) in Northeast Greenland (SALOMONSEN, 1950).

Sabine's Gull (*Xema sabini* (SABINE))

A Sabine's Gull was shot at Brønlundhus on 18 June 1966 (JUST, 1967). This is the only record from Peary Land.

Snowy Owl (*Nyctea scandiaca* (LINNAEUS))

Scarce breeding bird in Peary Land. A total of eight was observed on expeditions up to and including 1950, three on the first Peary Land Expedition 1947–50, but only one was seen at Jørgen Brønlund Fjord (JOHNSEN, 1953). KNUD RASMUSSEN found the species breeding in northwestern Peary Land in 1917, but there are no records of breeding in southern Peary Land. The only Snowy Owl found here after 1950 was a dead specimen on the ice on Øvre Midsommer Sø in 1966 (JUST, 1967). Only one was seen in all of northern Peary Land in 1969 (GRANT, 1972).

Hornemann's Redpoll (*Carduelis flammea hornemanni* (HOLBØLL))

Scarce visitor, primarily in the migration period, or scarce breeding bird. The sole observations from Peary Land are 3–4 flocks of up to 6–8 individuals around Jørgen Brønlund Fjord in September 1948, and

two on 25 July 1949 in a valley tributary to Wandel Dal (JOHNSEN, 1953). There are two observations from the land between Danmark Fjord and Independence Fjord; one bird was seen on 18 May 1912 (FREUCHEN, 1915), and one was seen and heard singing on the south coast of Independence Fjord in 1921 (KOCH, 1925).

The race breeds in Thule District (SALOMONSEN, 1950), and has been found in Northeast Greenland, breeding northwards up to Danmarks Havn (77°N), but our knowledge of its distribution is poor (MELTOFTE, 1975).

Lapland Bunting (*Calcarius l. lapponicus* (LINNAEUS))

Several observations from the area around Independence Fjord in 1912 (RASMUSSEN and FREUCHEN, 1915) were rejected by SALOMONSEN (1950) as erroneous determinations.

Two **Pink-footed Geese** (*Anser fabalis branchyrhynchus*), one **Pomarine Skua** (*Stercorarius pomarinus*), three **Arctic Skuas** (*Stercorarius parasiticus*), and one **Greenland Wheatear** (*Oenanthe o. leucorrhoa*) were observed in northern Peary Land in 1969 (GRANT, 1972).

RINGING AND MEASURING

In the first half of June two walk-in cage traps and four mist nets were placed in Kedelkrogelv's delta at Brønlundhus. The traps were 100×60×30 cm, made of wire mesh, and had two funnel entrances and five metre long guide walls leading to each entrance. Oatmeal, fat and pieces of dried fish were used as bait. The mist nets were 10 m long, two-shelf lightbrown Japanese nets.

Four waders were caught in the traps and two in the mist nets in early June. The birds were dyed yellow on the underpart of the body and wings with picric acid dissolved in 50 % isopropanol. A ring from the Zoological Museum in Copenhagen was placed on the left leg and a yellow plastic ring on the right leg.

Foxes, attracted by the bait, entered the traps several times, and

Table 2. *Number of ringed, dyed and measured birds, 1973.*

	Ad.	Pull.	Juv.	Dyed*	Total ringed	Dead	Total full grown's measured
<i>Charadrius hiaticula</i> ..	5	6		4	11	2	7
<i>Arenaria interpres</i>	5	9	1	6	15	1	7
<i>Calidris canutus</i>			1	1	1		1
<i>Calidris alba</i>	3	20		3	23		3

* and colour ringed.

destroyed them, and a Muskox also stepped on one of them! Two foxes were shot in order to protect trapped birds, and warning shots were used to keep the Glaucous Gulls away.

Brooding waders were caught on eggs and newly hatched young with 40 cm wide and 30 cm high heartshaped wire mesh cage traps secured by a couple of pegs over the nest. Seven birds were caught in this way, and six of them were dyed and marked with colour rings. A Ringed Plover (*Charadrius hiaticula*) female was chased away by the male immediately after being dyed, and a Turnstone (*Arenaria interpres*) female also disappeared. Two dyed Ringed Plover males, a pair of Turnstones and a Sanderling (*Calidris alba*) female completed breeding. The birds' reaction to the nest cages differed considerably. Some Ringed Plovers did not come closer than a few metres to the trap, even when it was placed a short distance from the nests. Others pushed their heads against the wire netting until they found the entrance, or until I turned the trap. Turnstones behaved similarly, often lying down and brooding on the ground beside the trap before they found the entrance.

Ringling and measuring of the nestlings was carried out as rapidly as possible, since in cold weather they may die in less than fifteen minutes if not brooded by the parents. When I found young by watching the parents approach them, I usually let the parents brood them for awhile before attempting to catch them.

Two walk-in cage traps were again placed in the delta at Brønlundhus in early August, and two juvenile waders were caught.

When possible, all captured birds were weighed and the bill and right wing measured. The wing was flattened and the primaries straightened on the ruler before the measurement was taken so giving the maximum length. The bill was measured along the culmen from the tip to the feathering. The birds were weighed with 30 and 100 gramme "Pesola" spring balances.

Some earlier measurements from Peary Land are available (MØHL-HANSEN, 1949 and JOHNSEN, 1953). MØHL-HANSEN's measurements are given for both fresh and dried skins, while JOHNSEN's are mainly from dried skins. MØHL-HANSEN's material showed that wing measurement of six adult Ringed Plovers had shrunk 2–5 mm, or an average of 4.3 mm (3.2 %). Four juvenile Turnstones had shrunk 2–6 mm, average 4.3 mm (2.8 %). An adult Sanderling had shrunk 3 mm (2.4 %).

List of Recoveries to Date

Ringed Plover (*Charadrius hiaticula*)

On 2 July 1973 I shot a ringed breeding male (London BB 72603) (p. 18). It had been ringed as an adult on 21 August 1971 in West Kirby (53.23N/03.12W), Wirral, Cheshire, England, and recaptured on 23

August 1972 in Bardsea (54.09N/03.05W), Ulverston, Lancashire, England.

A Ringed Plover "dyed completely yellow" was seen on 3 September 1973 at Cley in Norfolk, England (A. J. PRATER, in litt.), and on 18 August 1974 an adult Ringed Plover was seen "carrying a large yellow colour ring" on the right leg (and not dyed) in the river Dee estuary in North Wales, Britain (G. H. GREEN, in litt.). These were certainly two of my birds.

Turnstone (*Arenaria interpres*)

On 4 July 1973 I shot a breeding female (London CK 58009) (p. 23). It had been ringed as an adult on 5 August 1967 in Holbeach Marsh (52.53N/00.09E), Lincolnshire, England. A bird I ringed as a pull. (Copenhagen 753787) on 30 June 1973 was caught by a cat on 15 December 1973 on Sula Island (63.51N/08.27E), Fosna, Sør Trøndelag, West Norway.

The recapture of a Greenland Turnstone in West Norway supplements our knowledge of Greenland waders passing West Norway, the western coast of Jutland and the Waddensea on their autumn migration.

DISCUSSION

The areas around Jørgen Brønlund Fjord are desert-like as vegetation only covers a small percentage of the land. Because of the constant strong wind most of the snow is blown off, and the land becomes extremely dry in summer. Meltwater from the mountain regions and a few large snowdrifts irrigates a small portion of the land allowing plants to grow and making bird life possible. The strong and frequently warm wind causes the lakes and fjords to thaw early, and since fog is relatively rare in the fjord, the number of sunlit hours is high. Similarly favourable conditions are found in northern Peary Land in the eastern end of Nordpasset, in Drivhuset in the northern end of Frigg Fjord and at Kap James Hill on the north coast (GRANT, 1972).

Nowhere could the bird life be called rich. I could walk for hours without seeing a single bird. Only 14–15 species have been found breeding in Peary Land, several of them extremely sparsely. An additional 14 species have been observed, three may be breeding birds, (i.a. Grey Phalarope (*Phalaropus fulicarius*), Ivory Gull (*Pagophila eburnea*) and Hornemann's Redpoll (*Carduelis flammea hornemanni*).

The ornithological observations from the beginning of the century were collected intermittently during exploratory travels. Some biologists worked in the land for a longer period during the Peary Land expeditions. On the first Peary Land Expedition 1947–50 emphasis was

laid on collecting skins and investigating stomach contents, while on the later Peary Land expeditions ornithological observations were subordinate to other biological investigations.

Faunistic

The following birds bred in the census area around Brønlundhus (Fig. 2): at least one pair of Long-tailed Ducks (*Clangula hyemalis*), at least four pairs of King Eiders (*Somateria spectabilis*), five pairs of Ringed Plovers (*Charadrius hiaticula*), eight pairs of Turnstones (*Arenaria interpres*), 5–7 Sanderlings (*Calidris alba*) (not pairs) and 2–3 pairs of Snow Buntings (*Plectrophenax nivalis*). Red-throated Diver (*Gavia stellata*), Rock-ptarmigan (*Lagopus mutus*), Glaucous Gull (*Larus hyperboreus*) and Arctic Tern (*Sterna paradisaea*) were found breeding sparsely around Jørgen Brønlund Fjord and Nedre Midsommer Sø.

It is difficult to determine the relative frequency of the species in the land as a whole, in particular the frequency of Snow Buntings in comparison to the wader species is hard to define, as their biotopes are completely different. The census area is hardly representative; especially the number of waterfowl was excessive. The abundance of Turnstones in the census area was likewise scarcely representative of the rest of the land where both Ringed Plovers and Sanderlings were apparently more numerous.

Earlier reports on the relative frequency of the species are difficult to evaluate as they are undoubtedly based to a large extent on the number of birds in the pre-breeding as well as the post-breeding period (adults and juveniles). MØHL-HANSEN (1949) and JOHNSEN (1953) noted that the Ringed Plover was the most common wader in 1947–50 followed by the Sanderling. The Turnstone was described as “not very common” and “much rarer than Ringed Plover and Sanderling”. RØEN (1965) stated that the Ringed Plover was “extraordinarily common” in 1964, and the Turnstone and Sanderling common. Five pairs of Turnstones were noted breeding around Klaresø and Lersø, a number which I find doubtfully high, however, considering the comparatively large number of post-breeders which stay in this area in July and the Turnstones’ large alarm distance from the young. Two broods were observed on the site in 1964. JUST (1967) and ANDERSEN (1970) mention the Sanderling as the most common wader in 1966 and 1968 followed by the Ringed Plover and the Turnstone. By far the largest number of birds observed in northern Peary Land in 1969 were Sanderlings (505 individuals out of a total of 1057 observed birds) (GRANT, 1972). Thus, it appears that over the years the number of Ringed Plovers has declined in relation to the Sanderling, but the situation is complicated because Sanderlings gather

far more into flocks, and accordingly they are always most frequent in pre- and post-breeding flocks. Furthermore, the Sanderling is the far more difficult of the two species to find during the incubation period. The last few years' heavy and constant rainfall in late July and the first half of August may have reduced the Ringed Plovers' breeding success to a greater extent than Sanderling as the former generally breed later than the other waders. The snowstorm in the beginning of August 1973 undoubtedly affected Ringed Plover young most severely.

As far as the Turnstone is concerned, there is a marked contrast between its relative scarcity in 1947-50, 1964 and 1966 compared with 1968 when it was reported to be almost as common as the Ringed Plover and the Sanderling. In 1973 it was the most common breeder near Brønlundhus.

The Knot (*Calidris canutus*) has undergone a more readily observed change of status. During the four summers 1947-50 only one individual was observed (JOHNSEN, 1953), the first record from Peary Land. In 1964 and 1966 a few birds were seen at the end of May and in the beginning of June (RØEN, 1965 and JUST, 1967). In 1968 up to 30 were seen in the same period, and some were also observed in mid-July (ANDERSEN, 1970). In 1969 the Knot was the second most common bird in northern Peary Land (150 individuals) (GRANT, 1972). In 1973 pre-breeding and post-breeding adults, adults with juveniles, and juveniles in flocks were seen, but there were no direct observations of breeding. Up to 41 were observed daily in August. I am unable to give any explanation of these changes among the waders (see also MELTOFTE, 1975).

Snow Buntings were reported to breed in every single ravine in 1964, and there were only 300 m between the pairs on Okseslette (RØEN, 1965).

The Brent Goose (*Branta bernicla hrota*) apparently no longer breeds in Peary Land or further south in East Greenland, and its migration along Northeast Greenland has ceased (MELTOFTE, 1975). During early June 1912 and 1921 several flocks of Brent Geese were observed migrating north and west in Independence Fjord (FREUCHEN, 1915 and KOCH, 1925), and at the beginning of the century the species was described as one of the most common birds on the northwestern coast of Peary Land (SALOMONSEN, 1950). During ten Peary Land expeditions to the area around Jørgen Brønlund Fjord, which must be an important 'pathway' during migration, only one was observed, and during the traverse of northern Peary Land in 1969 only one was seen (GRANT, 1972). The marked decrease may possibly be due to the reduction in vegetation, which has presumably taken place because of the decrease in precipitation in Northeast Greenland since the turn of the century (VIBE, 1967 and MELTOFTE, 1975). During the Independence-I Culture

(c. 2100–1800 B.C.) when, according to bone finds, the Brent Goose was one of the most important game birds, the climate in Peary Land was relatively warm with abundant precipitation, the fjords were ice-free during the summers, and vegetation was more abundant (FREDSKILD, 1973). Hence, Muskoxen must have been numerous as they were basic to the Palaeo-Eskimo Culture of the time (KNUTH, 1967).

The northern limit of the breeding of Eider (*Somateria mollissima*), Barnacle Goose (*Branta leucopsis*), Schiøler's Dunlin (*Calidris alpina arctica*) and Grey Phalarope in Northeast Greenland is not accurately known (MELTOFTE, 1975). On the basis of regular observations of Schiøler's Dunlin and, especially, of Grey Phalarope in Peary Land, it seems likely that these two species breed farther north than the northernmost records to date in Germania Land (77°N) indicate. Practically nothing is known about the ornithology of the land between these areas.

Fig. 2 shows that birds bred on or close to vegetated areas, and all the nests found were either in or very close to dense vegetation. A few old Sanderling nests were found in isolated patches of vegetation up to a few hundred metres from irrigated dense vegetation, and ANDERSEN (1970) found a Turnstone nest several hundred metres from water. NETTLESHIP (1973) found Turnstone nests at Lake Hazen on Ellesmere Island at a maximum of 230 m from wet areas. The Snow Buntings were more numerous on the mountain slopes up to an altitude of 600 m, and the Ringed Plovers commonly bred in the comparatively fertile river gorges up to an altitude of 2–300 m.

When hiking through Wandel Dal and around Nedre Midsommer Sø in mid-July I found the distribution of the wader species to be very uneven. At slightly vegetated irrigations in Wandel Dal the only wader found was Ringed Plover, and the species was the most common by far around Nedre Midsommer Sø. Yet, six broods of Sanderlings were found on a c. 5 km long well vegetated stretch at Blåsø and Issø. Only a few Turnstones were observed around Nedre Midsommer Sø. King Eiders, Arctic Terns and Glaucous Gulls were breeding here, and Long-tailed Ducks were seen faraway from salt water.

Because of the food situation (see HOLMES, 1970), the population density in the census area was obviously smaller than recorded elsewhere. Turnstone breeding density was 0.9 pairs per km². NETTLESHIP (1973) found 3 pairs per km² in a 23 km² census area at Lake Hazen on Ellesmere Island, and on single counts in 1969 I found c. 2 pairs per km² at Danmarks Havn (MELTOFTE, 1975). The five pairs of Ringed Plovers give a density of 0.6 pairs per km² in the census area in 1973. At Danmarks Havn I found eight pairs per km² in an area of the same size (MELTOFTE, 1975), and six pairs per km² were found at Daneborg in 1964 (ROSENBERG *et al.*, 1970). Sanderling density was far less than

one pair per km² at Jørgen Brønlund Fjord in 1973, but on Bathurst Island, Canada, 2–3 pairs were estimated breeding per km² in 1968 (PARMELEE, 1970). Altogether, slightly more than two pairs of waders per km² (three species) bred in the census area around Brønlundhus in 1973. 9.3 pairs of waders per km² (three species) bred at Daneborg in 1964 (ROSENBERG *et al.*, 1970), and at Danmarks Havn I found 15 pairs of waders (four species) per km² on single counts in 1969 (MELTOFTE, 1975) (see footnote p. 54).

Table 3. *Initial dates of observation in all years of investigation in southern Peary Land.*

	1912 ¹	1921 ²	1949 ³	1950 ³	1964 ⁴	1966 ⁵	1968 ⁶	1973
<i>Gavia stellata</i>		9.6	11.6		19.6	17.6	21.6	9.6
<i>Branta bernicla</i>	8.6	3.6						
<i>Clangula hyemalis</i>			5.6		3.6	12.6		17.6
<i>Somateria spectabilis</i>	12.6		8.6		8.6	10.6		6.6
<i>Lagopus mutus</i>			22.2	11.3				
<i>Charadrius hiaticula</i>	5.6	3.6	2.6		28.5	30.5	22.5	—
<i>Arenaria interpres</i>	1.6	4.6	3.6		25.5	26.5	28.5	—
<i>Calidris canutus</i>					28.5		30.5	—
<i>Calidris alba</i>		3.6	2.6		4.6	30.5	28.5	—
<i>Stercorarius longicaudus</i>	2.6	3.6	4.6	1.6	8.6	4.6	2.6	5.6
<i>Larus hyperboreus</i>	8.6	4.6	27.5	5.6	27.5	21.5	(24.5)	—
<i>Sterna paradiseae</i>	12.6		13.6	6.6	14.6	28.6	30.6	10.6
<i>Plectophenax nivalis</i>			26.4	15.4				—

1: FREUCHEN (1915), 2: KOCH (1925), 3: JOHNSEN (1953), 4: RØEN (1965), 5: JUST (1967) and 6: ANDERSEN (1970). "—" means that the species had possibly arrived before I arrived on 30 May.

Arrival and Pre-breeding Period

All the dates of initial observations made in southern Peary Land are shown on Table 3. Unfortunately, our delayed arrival prevented determination of arrival dates of many species in 1973. Red-throated Diver, King Eider and Arctic Tern were recorded first in 1973, but first dates for scarcer species fluctuate because some time may elapse between their actual arrival and first observations. The Arctic Tern is one example of this; after seeing the first birds migrating into the fjord on 10 June, I saw none until 5 July. Yet terns were seen several times around Kap Harald Moltke during this period. Thus, no great significance can be attached to the dates reported for 1966 and 1968.

As mentioned earlier (MELTOFTE, 1975) Long-tailed Duck and King Eider arrive somewhat earlier in Peary Land than in Germania Land, 600 km to the south. These species arrive at open water along the outer coast long before they arrive at inland lake breeding sites. Their

earlier arrival at the small lakes at Jørgen Brønlund Fjord reflects the early thawing of these lakes. The nearest open-water areas at the outer coast are probably those around Mallemukfjeld more than 300 km from Jørgen Brønlund Fjord, and presumably they come directly from there. It is unlikely that there is any open water on their way at this time of the year. Large numbers of King Eiders and some Long-tailed Ducks were observed at Mallemukfjeld on 8, 9 and 10 June 1907 (MANNICHE, 1910).

In early June 1973 the waders were mainly observed in Kedelkrogelv's delta and at Klaresø and Lersø. They did not leave the delta until about 10 June, whereupon many could be seen along the rivulets on Okseslette. Their number in the delta culminated in the cold period around 7–8 June, and only during this period were incompletely moulted Sanderlings seen. Even though I saw surprisingly few waders inland in early June, some of the local breeding birds had already begun egg-laying and brooding at this time, and many of the birds present in the area in the middle of the month did not remain to breed and left shortly afterwards.

Similarly ROSENBERG *et al.* (1970) observed highest numbers at Daneborg in early June 1964 and thought them to be more northerly breeding birds resting during the spring migration. In 1969, when the amount of snow in Germania Land was unusually small, no large concentrations of birds were observed in the particularly favourable area around Danmarks Havn, while in the spring of 1970, which was late and rich in snow, many waders and other species stayed in this area until mid-June. Among the latest were several incompletely moulted birds (MELTOFTE, 1975). It is noteworthy that local breeding birds at Danmarks Havn as well as at Jørgen Brønlund Fjord had commenced egg-laying and incubation while these flocks were in the area. In my opinion, the High Arctic Greenland waders arrive directly in the breeding areas from Iceland, and these accumulations in the first half of June consist mainly of individuals that, in favourable places (especially in unfavourable years), wait for their breeding sites to become accessible. These flocks may include young non-breeding and/or later breeding individuals. The presence of moulting birds in the flocks supports this possibility.

ROSENBERG *et al.* (1970) discuss the biological significance of the often long interval between the arrival and the beginning of egg-laying, the so called 'pre-breeding period', and find it obscure. It is variable, lasting from only a few days in the Barnacle Goose, up to several weeks in waders and waterfowl, and more than a month in the Snow Bunting males. SALOMONSEN (1972 p. 59–61) is of the opinion that, while the geese arrive paired and copulation has taken place during migration, most other arctic species need some time at the breeding sites for mating,

development of gonads and copulation. My observations of very early breeding waders and ducks in both Germania Land and Peary Land indicate that these species can also begin egg-laying shortly after arrival. It is known that waterfowl arrive at the breeding sites in pairs. A number of reports state that depending on the weather most arctic waders can arrive at the breeding sites in pairs too, or pair on arrival as they are usually faithful to their mates and territories (i.a., BERGMANN, 1946, HOLMES, 1966, LAVEN, 1940, MANNICHE, 1910, NETTLESHIP, 1973, PALMER, 1967, and PARMELEE, 1970, and my own observations). It is striking that the Barnacle Goose, which has the briefest pre-breeding period in Northeast Greenland, is also the species which breeds at the most fixed time. The waders and, in particular, ducks and gulls breed at times varying from year to year and from place to place. Ducks and gulls may not breed at all.

It seems obvious to conclude that the pre-breeding period is a time of adjustment to the great variation in local climate in the Arctic, so giving the birds an opportunity to adjust time and extent of breeding to the conditions of the year concerned (see also HÖGSTEDT, 1974 and PERRINS, 1970). The Barnacle Geese accordingly "take a chance" each year (which their long breeding and moulting periods necessitate), while waders and especially waterfowl and gulls can postpone egg-laying or omit breeding completely in unfavourable years.

Time of Breeding and Non-breeding Years

The literature gives surprisingly little exact information of time of start of breeding in Northeast Greenland. Few searches have been made for nests; eggs found were usually collected and hatching dates were not determined. The following papers, which contain observations made during the breeding period, have been perused for information on the time of breeding: ANDERSEN (1970), BAY (1894), BIRD & BIRD (1941), DEICHMANN (1909), FREUCHEN (1915), GREEN & WILLIAMS (1973), JOHNSEN (1953), JUST (1967), MANNICHE (1910), MELTOFTE (1975), MÖHL-HANSEN (1949), PEDERSEN (1926, 1930, 1934, 1942), ROSENBERG *et al.* (1970), RØEN (1965), and SCHAANNING (1933).

Several species have been found breeding relatively early in Peary Land: Red-throated Diver and Long-tailed Duck lay eggs in late June, King Eider in mid-June, Rock-ptarmigan in early June, Ringed Plover in mid-June (also found in early June), Turnstone and Sanderling in early June, Glaucous Gull and Arctic Tern in late June, and Snow Bunting in early June. The information from Peary Land does not indicate much fluctuation in the time of egg-laying from year to year. 1964 was the only year with reports of a somewhat late and cold spring,

but some of the earliest records of Ringed Plover and Snow Bunting young were made in that year, and no other species were delayed (RØEN, 1965). It may be that this extremely northerly area is subject to smaller annual climatic variation than more southerly arctic areas; in particular, the amount of snow is hardly ever so extensive as to postpone the start of breeding. In 1973 several species laid eggs during brief cold periods in early June.

Comparison of the time of breeding in Peary Land with the rest of High Arctic Greenland shows that King Eider, Ringed Plover and Sanderling are the earliest recorded, and Red-throated Diver, Long-tailed Duck, Rock-ptarmigan, Turnstone and Snow Bunting are among the earliest.

The time and extent of breeding of the Arctic Terns and the waterfowl vary considerably from year to year depending on the thawing of the fjords and lakes (MELTOFTE, 1975). Accordingly, the situation around Jørgen Brønlund Fjord reflects the favourable and comparatively stable climate. However, it should be emphasized that conditions at the outer coast are undoubtedly much less favourable and less stable.

Very little information is available concerning waders, but most of the reports of breeding from southern Northeast Greenland are later than those from Peary Land. Yet I saw fully fledged Turnstone young at Danmarks Havn on 17 July 1969 and 1970 and Dunlins on 16 July 1969. An unattended fully fledged juvenile Knot was seen on 24 July 1969 (MELTOFTE, 1975). SCHAANING (1933) reported records (by trappers) of eggs of Turnstone and Knot in Hold with Hope on 1 June 1931. However, I doubt the reliability of these statements as in my opinion they are probably due to misprints.

Published records do not provide much information about the annual variation. MANNICHE (1910) does not mention any variations with respect to the waders between the favourable year 1907 and the unfavourable year 1908, and I found no variation between the two very different years 1969 and 1970 at Danmarks Havn; This area is, however, exceptionally favourable, (MELTOFTE, 1975). Records from Daneborg 1964 (ROSENBERG *et al.*, 1970), a late year, show no significant delays. In 1972 when spring began early, but June was unusually cold with snow, several broods of Ringed Plovers hatched normally at Meistersvig (GREEN & WILLIAMS, 1973). In 1939, the poorest year reported until now from Northeast Greenland (PEDERSEN, 1942), the waders apparently bred to a normal extent, but late. It is difficult on the basis of the material to determine how late, but pull. were first observed in the beginning of August (see also BERTRAM *et al.*, 1934).

Thus, it can be summarized that the waders breed relatively early around Jørgen Brønlund Fjord, but there are some reports of equally

early breeding of some species in the southern part of Northeast Greenland. Little is known about regional differences between favourable and less favourable areas, for example those near the coast against more continental, and consequently earlier thawing areas. Most of the reports dating from the first half of the century indicate that the waders bred later then than now, but the very early records of young of some waders in early July 1912 in Peary Land (FREUCHEN, 1915) contradict this, at least concerning Peary Land.

NETTLESHIP (1973) and HOLMES (1966) have demonstrated that the hatching of Turnstones and Dunlins is correlated with the hatching of *Diptera*. As far as I can determine on the basis of my own observations of the hatching of these insects in Northeast and North Greenland, this is in agreement with conditions there. In general the same wader species breed somewhat later in low and high arctic North America (HOLMES, 1966; NETTLESHIP, 1973; PALMER, 1967; PARMELEE, 1970; PARMELEE *et al.*, 1967, and PARMELEE & MACDONALD, 1960). Even though there is a correlation between the hatching of wader young and the hatching of *Diptera* in the breeding area, and even though the commencement of breeding is doubtless generally determined by hours of daylight, light intensity or the like, weather conditions, the snow cover (thawing) and accordingly feeding conditions must, however, be the factors that determine the annual beginning of breeding (see HÖGSTEDT, 1974, LACK, 1933, PERRINS, 1970 and SOIKKELI, 1967).

The literature gives little information about the extent to which the arctic waders lay a second clutch if the first is lost. In general, however, this only occurs occasionally (HOLMES, 1966). LAVEN (1940) noted that Ringed Plovers at a breeding site at the Baltic Sea laid new eggs 5–6 days after the first ones were lost if the latter had only been brooded for 6–12 days. If the first clutch was 14–21 days old, new eggs were laid 11–20 days later. BERGMANN (1946) reported from the Bay of Finland that the Turnstones rarely laid a second clutch of eggs, but if no more than 1–2 eggs had been laid when the clutch was lost, at least eight days went by before a new clutch was laid. In Finland VOULANTO (1968) noted that Turnstone laid a second clutch three weeks after normal egg-laying. HOLMES (1966) stated that in the arctic regions Dunlin can lay a second clutch if the first one is lost early. In Finland replacement clutches were common for this species (SOIKKELI, 1967).

Second replacement clutches have never been recorded (or looked for) in high arctic Greenland, but there are numerous very late reports of breeding from years in which several normal broods were found. Newly hatched pull. of Ringed Plover, Turnstone, Dunlin and Sanderling have been found in Northeast Greenland and Peary Land in late July and early August (GREEN & WILLIAMS, 1973; JOHNSEN, 1953;

MANNICHE, 1910; MØHL-HANSEN, 1949; PEDERSEN, 1930 and my own observations). These clutches were laid in early July and could be either delayed or second attempts. The late brood of Ringed Plovers at Brønlundhus in 1973 (Pair 5) can be attributed to the disappearance of the first female and the subsequent arrival of a new female. The sad fate which befell the young from this brood during the snowstorm in early August doubtlessly indicates the poor chance of replacement broods surviving.

On the basis of their records of newly hatched young in early August along with the observations of flocks of juveniles along the coasts, MØHL-HANSEN (1949) and JOHNSEN (1953) advance the theory that the juveniles were birds from the southern part of Northeast Greenland. ROSENBERG *et al.* (1970) quote these observations and interpret them as an example of 'Zwischenzug'. But as early as in 1912 FREUCHEN (1915) had found Ringed Plover and Sanderling young in Peary Land which hatched during the first days of July, and JOHNSEN himself (1953) also reported young of these species hatched around 1 July in 1949. The few late broods they found must have been from delayed or replacement clutches.

There are no reliable records of non-breeding years for waders in high arctic Greenland. The sole report is that by BIRD & BIRD (1940), which states that in 1938 the waders did not breed on Hochstetter Forland. In their faunistical report from the same visit (BIRD & BIRD, 1941) they noted records of Turnstone, Knot and Sanderling breeding on Hochstetter Forland in 1938. Ringed Plover, Dunlin, and Grey Phalarope are also mentioned as breeding in the area. PEDERSEN (1942) stated that the same year (1938) was a fine breeding year for the waders in the Dove Bugt area, and as mentioned above the waders bred to a full extent in the extremely unfavourable year 1939, but some weeks late (see also BERTRAM *et al.*, 1934).

There are many reports of non-breeding years among waterfowl, Skuas and Terns in the arctic regions, but none from Peary Land (see, however, p. 14). However, the Long-tailed Skua has never been observed breeding in Jørgen Brønlund Fjord (see p. 33).

Post-breeding Flocks and Departure of the Waders

PALMER (1967) stated that most one-year-old arctic waders do not return to the breeding sites, but summer in tropical and temperate regions. But a small number of these birds do travel to reach the breeding sites and remain there in flocks with other non-breeders during breeding time. Flocks of this kind have never been observed in Greenland; post-breeding flocks are first seen in the breeding areas in the beginning of

July. By far the majority of the one-year-old Turnstones and Knots do not attain full nuptial plumage (at least those summering in Britain) (MINTON), and should consequently be easily recognized. Birds of this kind have not, however, been reported from high arctic Greenland. Incompletely moulted birds have been observed in pre-breeding flocks in early June (MELTOFTE, 1975). It is possible that these late-developed birds do not breed, but they undoubtedly mate and/or maintain territories as no flocks are seen after the pre-breeding flocks break up until the first post-breeding flocks appear. It is also possible that these birds are first-time breeders as, according to SOIKKELI (1967), first-time breeding Dunlins in Finland arrive later and breed later than older birds. He also noted that one third of the one-year-old Dunlins in Finland breed, and that some others maintain territories without breeding, but the majority summer farther south.

BERGMANN (1946) states that in Finland non-breeding and failed breeding Turnstones stay on the territories approximately until the young of other pairs hatch. The many replacement and/or delayed clutches in high arctic Greenland were laid at the latest in early July, and considering the time that passes before a new clutch can be laid after the first is lost (p. 48), it appears that no further attempt to breed is made if the brood is lost after the turn of the months of June-July, and that non-breeding birds as well as birds which have lost the brood earlier without relaying leave the territories about this time. A pair of Ringed Plover (pair 4), which did not breed or lost the brood early, left the territory at this time. The occurrence of post-breeding flocks in high arctic Greenland fits in closely with this as the first birds are seen during the last days of June, and their numbers increase in the beginning of July.

Therefore flocks in the first half of July presumably consist of birds having been mated, and/or birds which have maintained territories without breeding and apparently of failed breeders. The sole investigation of birds from these flocks in Greenland was by MANNICHE (1910). Most of the Sanderlings were males without brood patches, the rest females with brood patches; the majority of the birds of other species had brood patches. HOLMES (1966) stated that in early July all Dunlins in flocks in arctic Alaska had brood patches and were failed breeders. The number of birds in these flocks varies from year to year, and HOLMES (1966) assumes that this reflects the breeding success.

In both Germania Land (MELTOFTE, 1975) and at Jørgen Brønlund Fjord Sanderlings predominated in these flocks in the first half of July. Up to eight Ringed Plovers, ten Turnstones, three Knots and 16 Sanderlings stayed at Klareso; the sexes were almost equally represented in all species.

The flocks begin to leave the land in mid-July; they stay as long as the supply of food is high (primarily adult *Diptera*) and leave when it declines (NETTLESHIP, 1973).

The females of most of the arctic wader species leave the care of the unfledged young to the males (BERGMANN, 1946; HOLMES, 1966; LAVEN, 1940; NETTLESHIP, 1973; PALMER, 1967; PARMELEE, 1960; and SOIKKELI, 1967 and my own observations). Most female Turnstones left Peary Land in mid-July 1973. The majority of the other adult waders had gone by the end of July or early August, shortly after the young had fledged; the Ringed Plovers were the last to leave. Only a few adult Turnstones, Knots and a single Sanderling were seen later.

The juveniles went to the coast as soon as their parents left them (Fig. 4), but due to lack of food at the coast in Peary Land, they mainly foraged at vegetated slopes and river deltas nearby. JOHNSEN (1953) has demonstrated by examination of stomach contents in August that young waders in Peary Land feed chiefly on vegetable material at that time, mainly grass seeds; this is in agreement with my own observations.

The number of juvenile waders at Jørgen Brønlund Fjord did not coincide with the frequency of the species nearby during the breeding period. Juvenile Knots were by far the most numerous; up to 38 were seen at Kap Harald Moltke, but Ringed Plover juveniles were surprisingly scarce, perhaps because many broods succumbed during the heavy snowstorm in early August. The large number of Knots must originate from other parts of Peary Land, and indicates that the species must be a very common breeding bird. The juvenile waders leave the land in the second half of August; birds migrating east have been seen from the middle of the month, with the last records in early September.

Immatures and Non-breeders of other Species

Some probably non-breeding Red-throated Divers were observed in Blåsø mid-July. A female found dead on the beach in Jørgen Brønlund Fjord on 7 July 1964 had very poorly developed ovaries (RØEN, 1965). One or two Long-tailed Duck females stayed at Klaresø and Lersø in July and August, and in several years, including 1973, up to 40-50 King Eider females were observed in Jørgen Brønlund Fjord from mid-July to late August. On 19 July 1973, 11 migrated out through Midsommerelv's delta. These King Eider females, which come from a larger area to stay in the ice-free Jørgen Brønlund Fjord when moulting, are probably both immatures and failed breeders. The two Long-tailed Duck females could very well have been failed breeders.

All observed King Eider males, Long-tailed Skuas, Glaucous Gulls

and Arctic Terns were adult. Some non-breeding Glaucous Gulls and Arctic Terns were observed in late July.

Migration

Most of the breeding birds in North Greenland have both a western and an eastern population. One part of the population migrates down the west coast of Greenland, and another down the east coast, and thus belongs to the Northeast Greenland population. This means there must be a migratory divide somewhere in North Greenland.

The high arctic waders which winter in the old world show two migratory routes. In spring the Northeast Greenland population migrates north across the British Isles and Iceland straight to their breeding sites. The population which breeds in the western part of North Greenland (i.a., the Thule area) and on the most northeastern Canadian islands migrates over the inland ice from around Angmagssalik to the Disko Bugt area, and across Melville Bugt (SALOMONSEN, 1967).

Direct observations of spring and autumn migration show that most of the species in Peary Land belong to the Northeast Greenland populations. This is true of King Eider, Turnstone, Knot, Sanderling, Long-tailed Skua, and Arctic Tern, and probably Red-throated Diver, Long-tailed Duck, Gyrfalcon, Rock-ptarmigan, Ringed Plover, and in the past also the Brent Goose. Observations of Glaucous Gulls are contradictory. JOHNSEN (1953) saw Glaucous Gulls arriving from the west in Nedre Midsommer Sø and Jørgen Brønlund Fjord, while FREUCHEN (1915) saw Glaucous Gulls arriving from the east in Independence Fjord. It seems reasonable to suggest that the migratory divide for this species occurs in this area. JOHNSEN (1953) thought that the Snow Buntings around Jørgen Brønlund Fjord came from both west and south (east), but most observations of migration indicate they are eastern birds. The Northeast Greenland population winters in Central Russia, while the west coast population winters in the central part of North America (SALOMONSEN, 1967). Measurements and plumage indicate that the birds in Peary Land belong to the Northeast Greenland population (JOHNSEN, 1953).

JOHNSEN (1953) claims that the Long-tailed Skua migrates to and from the breeding sites in North and Northeast Greenland in an east-west or northeast-southwest direction over the inland ice. This statement is based on FREUCHEN's (1915) observation of Long-tailed Skuas migrating west over the inland ice in August, and on the presumption that they would arrive earlier in Germania Land than in Peary Land if they came from the south along the coast, as well as on the fact that the species is rarely seen in Southeast Greenland. Later observations of

migrating birds indicate, however, that the Skuas arrive in Peary Land from the east. They probably do not appear earlier in Germania Land and are rare in Southeast Greenland because they migrate over the sea (the Polar Ice) similar to several other species (i.a., Long-tailed Duck, King Eider and Arctic Tern).

Table 4. *The results of the two counts of breeding birds and the final results of the registrations made throughout the summer in the census area around Brønlundhus.*

	13.-15.6	22.-29.6	Whole summer
<i>Charadrius hiaticula</i> . . .	5-8 pairs	6 pairs	5 pairs
<i>Arenaria interpres</i>	7-11 pairs	7 pairs	8 pairs
<i>Calidris alba</i>	7 pairs + 4 singles	3-4 breeders	5-7 breeders

Census of Breeding Waders

The results of the census are shown on Table 4. The census 13-15 June was a preliminary rapid survey of the whole area, while that of 22-29 June was a thorough examination of the whole area with an intensive search for nests, (see also p. 13). The final result is based on these two counts and later records of nests or young. (The circumstances concerning each pair/breeding bird are further described in the Special Part).

During the 13-15 June count more pairs were found than bred later. These extra registrations may be due in part to birds leaving the area shortly afterwards; also some Turnstones were undoubtedly registered more than once. Yet the figures seem to agree more than they actually do, for example two pairs of Turnstones, which were later found breeding, were not registered during this count. Some pairs of Ringed Plovers and Turnstones probably bred south of the area. In my opinion the seven pairs of Sanderlings found in mid-June were not local breeding birds, but pairs which left a few days after the census. If they bred elsewhere, it was later than the majority of the birds. Two of the four single birds were foraging breeding birds, while two were singing males which were not found later.

The results of the thorough census 22-29 June were much better. The extra pair of Ringed Plovers were probably breeding birds from south of the area, while a pair of Turnstones was not found until later.

The small number of breeding birds in this area, some of them ringed and dyed, enabled me to keep good track of their activity. Most surprising was that the Ringed Plovers, and especially the Turnstones, could remain completely unnoticed when I visited the territories during

the incubation period. I checked the nests I had found repeatedly and found the eggs warm, but neither saw nor heard the birds, or I would merely see a bird calmly foraging nearby. The Sanderlings were scarcely noticed at the nest; most were simply registered as solitary foraging birds.

On the other hand, when the Ringed Plovers and Turnstones made their presence known, the distance from the nest when they gave alarm was often considerable. When I approached a nest, the Ringed Plovers would give alarm 2–300 m from it, and they often ran and flew in front of me to a distance of 500 m from the nest; a male once followed me 1200 m away from the nest. The Turnstones gave alarm up to 400 m from the nest. During hatching and while the broods wandered around, the birds always made their presence known, often at a considerable distance from the young (see under the specific species).

Wader broods begin to move soon after hatching (Fig. 4), and it is only possible to make reliable counts from the time when the last pre-breeders leave the area until the young are hatched. In 1973 this was from about 20 June to about 1 July. Thus failed breeders and territory claiming, but non-breeding pairs are included in the numbers as these do not leave the territories until the time of hatching. Since the waders may often remain completely unnoticed or, on the contrary, give alarm at a considerable distance from the nest, it is necessary to check the area many times during this period to localize every pair and (if possible) the nests. Supplementary counts before and after this period are, as Table 4 indicates, advisable. Sanderlings present special difficulties as pairs cannot be considered local breeding birds, and brooding birds are not easily noticed at the nests. Yet since brooding Sanderlings are off the nest in order to forage c. 30 % of each day (PARMELEE, 1970), these birds are the easiest to find and follow back to the nest.

During many earlier censuses of breeding waders, both in arctic and in temperate regions (e.g. MELTOFTE, 1975), waders have been considered so easy to register that only one or a few counts were thought necessary. On the basis of my results in Peary Land I seriously question this method*. It may be argued that the birds give alarm at longer distances from the nest when the pairs are as scattered as in Peary Land; this is possible, but I think it unlikely. On the other hand, counts in denser populations will be affected far more by the fact that many neighbouring birds are attracted by alarm calling pairs, and thus many alarmed birds constantly surround the census taker. My investigation was considerably facilitated by dye-marking the birds. The frequently silent behaviour of the birds at the nest must also occur elsewhere.

* In the summer of 1975 the census at Danmarks Havn was repeated by the author. The results, which differ considerably, will be published in *Dansk ornithologisk Forenings Tidsskrift* or *Ornis Scandinavica*.

Literature

- ANDERSEN, O. G. N., 1970: Ornithological Observations on the 5th Pearyland Expedition in the summer of 1968. With a Review. (Danish, with English Summary). – *Dansk orn. Foren. tidsskr.* **64**: 104–112.
- BAY, E., 1894: Den østgrønlandske Expedition, udført i Aarene 1891–92 under Ledelse af C. Ryder. Third part. – *Meddr Grønland* **19**, 1.
- BERGMANN, G., 1946: Der Steinwälzer, *Arenaria i. interpres* (L.) in seiner Beziehung zur Umwelt. – *Acta zool. fenn.* **47**: 1–136.
- BERTRAM, G. C. L., D. LACK & B. B. ROBERTS, 1934: Notes on East Greenland Birds with a discussion of the periodic non-breeding among arctic birds. – *Ibis* (**13**) **4**: 816–831.
- BIRD, C. G. & E. G. BIRD, 1940: Some Remarks on Non-breeding in the Arctic, especially in North-east Greenland. – *ibid.* (**14**) **4**: 671–678.
- 1941: The Birds of North-east Greenland. – *ibid.* (**14**) **5**: 118–161.
- DEICHMANN, H., 1909: Birds of East Greenland, in Carlsbergfondets Expedition til Øst-Grønland, udført i Aarene 1898–1900 under Ledelse af G. AMDRUP. Third part. – *Meddr Grønland* **29**, 4.
- DRURY, W. H., 1961: The breeding biology of shorebirds on Bylot Island, North-west Territories, Canada. – *Auk* **78**: 176–219.
- FREDSKILD, B., 1973: Studies in the vegetational history of Greenland. – *Meddr Grønland* **198**, 4.
- FREUCHEN, P., 1915: Report of the 1. Thule Expedition. Scientific Work. Zoology. – *ibid.* **51**, 12.
- 1915 a: Ibid. Meteorological Observations. – *ibid.* **51**, 13.
- GRANT, C. T., 1972: Ornithology Report. in Joint Services Expedition, North Peary Land 1969. – Report.
- GREEN, G. H. & A. E. WILLIAMS, 1973: The University of Dundee NE Greenland Expedition 1972. Wading Birds Study Project. – Report, 22 pp.
- HOLMEN, K., 1957: The vascular plants of Peary Land, North Greenland. – *Meddr Grønland* **124**, 9.
- HOLMES, R. T., 1966: Breeding ecology and annual adaptations of the Red-backed Sandpiper (*Calidris alpina*) in northern Alaska. – *Condor* **68**: 3–46.
- 1970: Differences in population density, territoriality, and food supply of Dunlin on arctic and subarctic tundra. in A. WATSON (Ed.), “Animal populations in relation to their food resources”. – Oxford & Edinburgh.
- HÖGSTEDT, G., 1974: Length of the pre-laying period in the Lapwing *Vanellus vanellus* L. in relation to its food resources. – *Ornis Scand.* **5**: 1–4.
- JOHNSEN, P., 1953: Birds and Mammals of Peary Land in North Greenland. – *Meddr Grønland* **128**, 6.
- JUST, J., 1967: Ornithological Observations on the 4th Peary Land Expedition in the Summer of 1966. (Danish, with English Summary). – *Dansk orn. Foren. Tidsskr.* **61**: 133–137.
- 1970: Marine Biological Investigations of Jørgen Brønlund Fjord, North Greenland. – *Meddr Grønland* **184**, 5.

- KNUTH, E., 1967: Archaeology of the Musk-ox Way. — *Cont. Cent. Etud. arct. finno-scand.* **5**. — Paris.
- 1973: Kap Moltke 1972. — Report, 156 pp.
- KOCH, L., 1925: Nord om Grønland. — Copenhagen.
- LACK, D., 1933: Nesting conditions as a factor controlling breeding time in birds. — *Proc. Zool. Soc. London*: 231–237.
- LAVEN, H., 1940: Beiträge zur Biologie des Sandregenpfeifers (*Charadrius hiaticula* L.). — *Jour. f. Ornith.* **88**: 183–287.
- MANNICHE, A. L. V., 1910: The terrestrial Mammals and Birds of North-East Greenland. Biological Observations. — *Meddr Grønland* **45**, 1.
- MARSHALL, A. J., 1952: Non-breeding among arctic Birds. — *Ibis* **94**: 310–333.
- MASON, A. G., 1947: Territory in the Ringed Plover. — *Brit. Birds* **40**: 66–70.
- MELTOFTE, H., 1972: Ornithological Observations in the Norwegian Sea, the Greenland Sea, and NE Greenland, July–August 1972. — *Dansk orn. Foren. Tidsskr.* **66**: 108–112.
- 1975: Ornithological Observations in Northeast Greenland between 76°00' and 78°00' N. Lat. 1969–71. — *Meddr Grønland* **191**, 9.
- MINTON, C. D. T. (no year): Wader Ageing Guide. — Wader Study Group.
- MÖHL-HANSEN, U., 1949: The Bird-Life in Pearyland, North-Greenland. Observations on "Dansk Pearyland Ekspedition" in the summer 1947. (Danish, with English Summary). — *Dansk orn. Foren. Tidsskr.* **43**: 109–129.
- NETTLESHIP, D. N., 1973: Breeding ecology of Turnstone *Arenaria interpres* at Hazen Camp, Ellesmere Island, N.W.T. — *Ibis* **115**: 202–217.
- PALMER, R. S., 1967: Species accounts. in *The Shorebirds of North America*, G. D. Stout (Ed.). — New York.
- PARMELEE, D. F., 1970: Breeding behavior of the sanderling in the Canadian high arctic. — *Living Bird* **9**: 97–146.
- & S. D. MACDONALD, 1960: The birds of west-central Ellesmere Island and adjacent areas. — *Natl. Mus. Canada Bull.* **169**.
- PARMELEE, D. F. & R. B. PAYNE, 1973: On multiple broods and the breeding strategy of arctic sanderlings. — *Ibis* **115**: 218–226.
- PARMELEE, D. F., H. A. STEPHENS, and R. H. SCHMIDT, 1967: The birds of south-eastern Victoria Island and adjacent small islands. — *Natl. Mus. Canada Bull.* **222**.
- PEDERSEN, A., 1926: Beiträge zur Kenntnis der Säugetier- und Vogelfauna der Ostküste Grönlands. — *Meddr Grønland* **68**, 3.
- 1930: Fortgesetzte Beiträge zur Kenntnis der Säugetier- und Vogelfauna der Ostküste Grönlands. — *ibid.* **77**, 5.
- 1934: Die Ornis des mittleren Teiles der Nordostküste Grönlands. — *ibid.* **100**, 11.
- 1942: Säugetier und Vögel. Dansk Nordøstgrönlands Expedition 1938–39. — *ibid.* **128**, 2.
- PERRINS, C. M., 1970: The timing of birds' breeding seasons. — *Ibis* **112**: 242–255.
- ROSENBERG, N. T., N. H. CHRISTENSEN, & B. GENSBØL, 1970: Bird Observations in Northeast Greenland. — *Meddr Grønland* **191**, 1.
- RØEN, U., 1965: Ornithological Observations on the 3rd Pearyland Expedition in the Summer of 1964. (Danish, with English Summary). — *Dansk orn. Foren. Tidsskr.* **59**: 85–91.
- 1968: Studies on Freshwater Entomostraca in Greenland III. — *Meddr Grønland* **184**, 4.
- SALOMONSEN, F., 1950: The Birds of Greenland. — Copenhagen.
- 1967: Fuglene på Grønland. — Copenhagen.
- 1972: Presidential Address: Zoogeographical and ecological problems in arctic

- birds. in Proceedings of the XVth International Ornithological Congress. – Leiden.
- SCHAANNING, H. T. L., 1933: Zoological Results of the Norwegian Scientific Expeditions to East-Greenland I. 1. A Contribution to the Bird Fauna of East Greenland. – *Skrifter om Svalbard og Ishavet* **49**: 2–24.
- SOIKKELI, M., 1967: Breeding cycle and population dynamics in the dunlin (*Calidris alpina*). – *Ann. Zool. Fenn.* **4**: 158–198.
- VIBE, C., 1967: Arctic animals in relation to climatic fluctuations. – *Meddr Grønland* **170**, 5.
- VUOLANTO, S., 1968: On the breeding biology of the Turnstone (*Arenaria interpres*) at Norrkär, Gulf of Bothnia. – *Orn. fenn.* **45**: 19–24.