Population densities of birds in Ørsted Dal, NE Greenland, 2009

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Abstract During June 2009, the bird populations in two study areas in Ørsted Dal, northern Jameson Land in NE Greenland, were censused using the "rapid assessment" method where all "territory holding" pairs and individuals are considered part of the local population. The method provided significantly higher densities of waders (Charadrii) than found in the valley at censuses in July 1974. This is interpreted as a result of all non- and failed breeders having left their territories before the July census. Yet, numbers of Ruddy Turnstones *Arenaria interpres* may have decreased since then, while the nesting population of Pink-footed Geese *Anser brachyrhynchus* has increased quite considerably. Also, arrival and egg-laying in Barnacle *Branta leucopsis* and Pink-footed geese appears to have advanced as compared to previous decades, an advancement interpreted as the result of climate amelioration.

Introduction

In connection with possible molybdenum mining activities in Scoresby Land, the mining company is planning to establish an airfield together with a road, a container port and other facilities for the operations at Gurreholm in the north-western part of the Heden Ramsar Site in western Jameson Land, East Greenland (Cessford 2007, Glahder et al. 2010). To compensate for the loss of breeding and moulting habitat for birds in the Ramsar site, the Greenland authorities are considering the possibility to establish an alternative Ramsar site in the region. The National Environmental Research Institute (NERI), Aarhus University, put forward a preliminary proposal that the large valley of Ørsted Dal in north-eastern Jameson Land could make up such a compensation area (Glahder et al. 2010). To study the extent to which bird populations here match populations in the lost area, NERI conducted studies in the valley in July 2008, focusing on breeding and moulting geese, and in June 2009, focusing on population densities of all bird species. In parallel, similar studies were conduced in the Heden Ramsar Site (C.M. Glahder in litt.).

Prior to these studies, the birds of Ørsted Dal were described in a number of papers and reports following goose and wader studies in the 1960s, 1970s and 1980s (Marris & Ogilvie 1962, Hall & Waddingham 1966, Ferns & Green 1975, Ferns & Mudge 1976, Green & Greenwood 1978, Cabot et al. 1984). In 1974 the breeding waders of a 25 km^2 study area centrally in the valley were censused in connection with an extensive wader study in the Kong Oscar Fjord region (Green & Greenwood op.cit.). This area made up one of our two study areas in the valley in June 2009, although the delineation differed somewhat between the two study years.

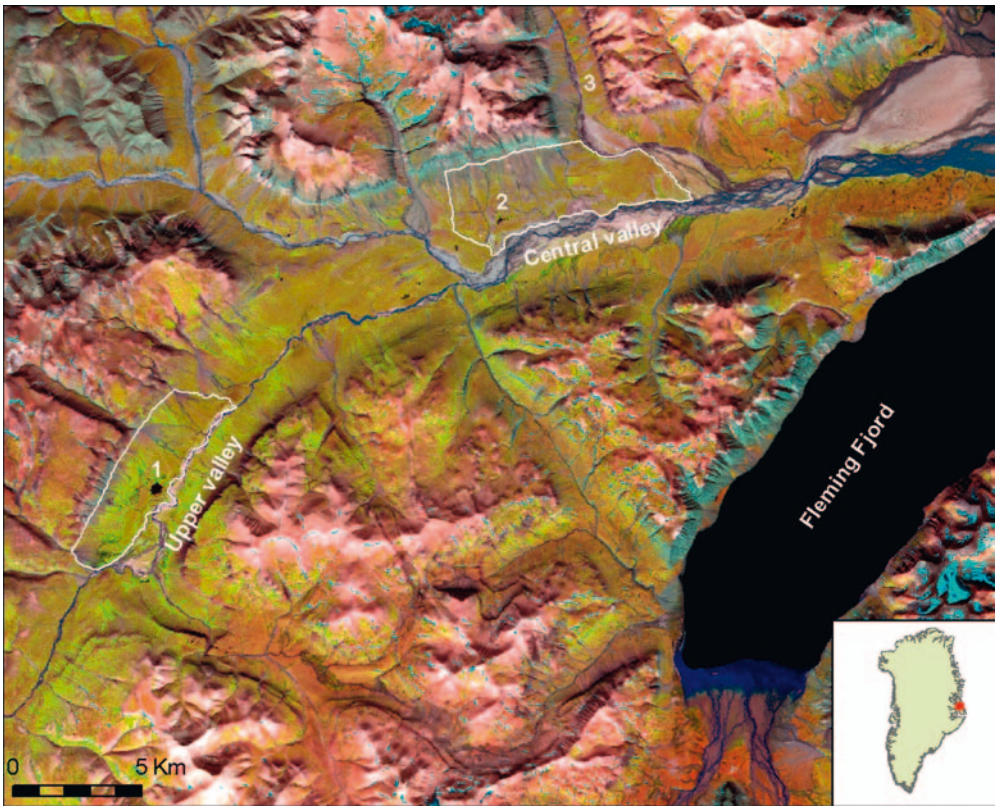


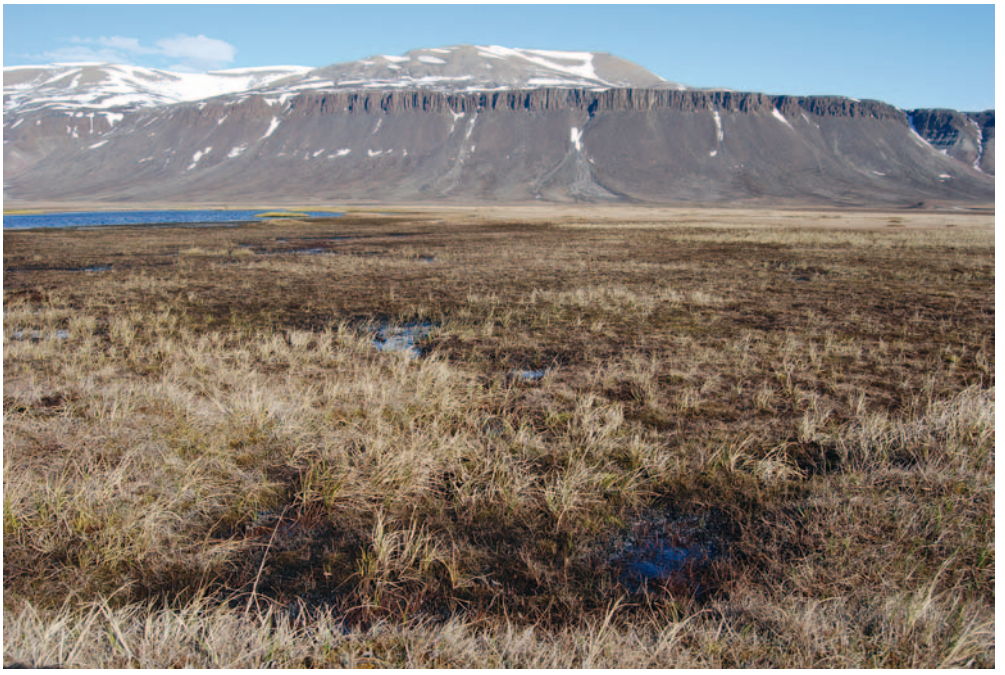
Fig. 1. Satellite image of Ørsted Dal from 16 July 2004 with the position of the two study areas. 1) Primula Pond, 2) Pinkfoot Pond, 3) Horsedal.
Satellitbillede af Ørsted Dal med undersøgelsesområderne vist. 1) Primula Pond, 2) Pinkfoot Pond, 3) Horsedal.

The study areas

Jameson Land is situated in the southernmost part of high-arctic NE Greenland. From relatively low-lying, undulating tundra in the south and west, Jameson Land rises to mountains reaching 800-1300 m a.s.l. in the north. Here, Ørsted Dal is the largest valley, extending about 45 km to the WSW from Fleming Fjord, a tributary of Kong Oscar Fjord (Fig. 1). The valley floor and lower slopes are 4-7 km wide and below 200 m a.s.l.

Most of the valley floor is relatively level or undulating terrain with more landscape profile (up to c. 20 m) at moraines, raised delta terraces and river ravines. At the foot of the steep mountain bluffs surrounding most of the valley, scree slopes together with extensive gravely and stony outwash fans from the many tributary rivers and rivulets dominate.

Two study areas in the valley were selected from satellite images to represent different patterns of wet and dry tundra, one of 17.0 km^2 in the upper valley and one of 23.0 km^2 in the central part of the valley, the latter largely being identical to the study area from 1974 (Fig. 1). Both were demarcated by the main river to the south, by tributary rivulets to the east and west, and by the 200 m contour to the north. The upper area had much wet fen vegetation and a large pond, Primula Pond, with adjacent smaller ponds to the east. The central area had more mesic tundra and dry, almost barren lands. Yet, wet fens with ponds were found also here, particularly in areas irrigated well into the summer season by runoff from large snow-beds and ice-fields. Besides the ankle-high vegetation typical of the high Arctic, knee-high *Salix* bushes typical of the low Arctic were found in a few places in the upper valley. The general habitat patterns of the valley were mapped by Ferns & Mudge (1976) and given in more detail for the central study area by Green & Greenwood (1978).



View over the upper Ørsted Dal study area seen from NW in mid June 2009. A part of Primula Pond is seen in the foreground, and breeding cliffs of Barnacle Geese on the southeast side of the valley are seen in the background. Photo: Lars Dinesen.
Udsigt over undersøgelsesområdet i øvre Ørsted Dal set fra nordvest. En del af Primula Pond ses i forgrunden, og klipperne med ynglende Bramgæs ses i baggrunden.

Snow melts earlier in Ørsted Dal than in adjacent parts of the Jameson Land, and snowmelt was particularly early in 2009. On a satellite image from 3 June the main part of the valley floor appeared largely snow free. The spring melt had apparently taken place already in the second half of May, and upon our arrival in the upper study area on 11 June, we estimated the snow cover to only 1% on the valley floor. Snowmelt in the central area was a little later – probably due to deeper snow – and snow cover was estimated at 5% upon our arrival on 19 June. No ice remained on the ponds except for the large and deep Primula Pond, which on 11 June only had open water along the shores, decreasing to about 70% ice cover when we left on 19 June. The snow cover on the mountain slopes above the study areas was 10% in the upper valley and 20% in the central valley, but with considerably more snow on some of the north facing mountain slopes on the south side of the valley.

For comparison, the snow cover was less than 5% in the central valley on 6 July 1974 (or about the same as we found 17 days earlier in 2009), and Meltofte (1985) estimated it to have been about 40% on 10 June when most birds in NE Greenland initiate egg-laying. 1974 was a particularly late year (Green et al. 1977, de Korte et al. 1981), but records from eight flights passing Ørsted Dal around 1 June in 1996-2005 indicate that snow cover in early June is quite extensive in most years (Table 1). Only the years 2000 and 2005 stand out as having been very early, as they were also at Zackenberg Research Station 300 km further north in NE Greenland (Hansen et al. 2009). Even the very early snowmelt in 2009 is in accordance with conditions at Zackenberg, where the river started to run on 22 May, eight days earlier than in any other year since 1996 and 29 days earlier than in the latest year (Sigsgaard et al. 2009, J. Hansen in litt.).

The south-western flat part of the upper valley study area had been flooded during the spring melt and held no breeding birds. The same was the case for the easternmost flat part of the central study area. The ecosystem phenology of the valley (plant growth and invertebrate emergence) appeared not to be particularly early, in spite of the early snow-

Table 1. Snow cover in central Ørsted Dal estimated from aircraft passing the valley each year around 1 June (H. Meltofte pers. obs.).
Snedækket i den centrale del af Ørsted Dal vurderet fra helikopter og fly under passage af dalen hvert år omkring 1. juni.

Year	Date	Central valley
1996	3 June	Predominantly snow covered
1997	27 May	Much snow
1998	26 May	Extensive snow cover
1999	1 June	80-90% snow cover
2000	3 June	Much snow-free ground
2003	2 June	More than 90% snow cover
2004	1 June	80-90% snow cover
2005	31 May	Very little snow left

melt. Purple saxifrage *Saxifraga oppositifolia* and snow whitlow-grass *Draba nivalis* were blooming extensively at our arrival in both areas, but very few other plants were flowering until some days into our stay. The upper valley, which we covered first, also had the earliest phenology – flowering of 11 common plants and emergence of two insects were 1-9 days later than at Zackenberg in the upper valley, and 3-15 days later in the central valley. Compared with Zackenberg in 1996-2009 (H. Meltofte pers.obs., J. Hansen in litt.), most dates of flowering and insect emergence in Ørsted Dal in 2009 were in the late end of the range.

We did not see a single collared lemming *Dicrostonyx torquatus;* neither did we see any active summer burrows, although there were several holes, particularly in the upper valley. Similarly, the number of winter nests was very limited, and only few were clearly from the previous winter. At Karup Elv, only 80 km from Ørsted Dal, the lowest number of winter nests were recorded in 2009 since monitoring began here in 1988, whereas lemmings had occurred in some numbers in 2008 (B. Sittler in litt.). Accordingly, arctic foxes *Alopex lagopus* bred in 2008, but although they were commonly seen in Ørsted Dal in 2009, there was no indication of breeding. We saw one or a few almost every day and estimated that about four different individuals occurred in each of the two study areas. Two fox dens, each with 12-33 entrances, were found in both of the study areas, but with no sign of occupation.

Methods

The field method of our censuses was the "rapid assessment" used by Boertmann et al. (1991) which follows the same procedure as used in the initial, all-covering census carried out at Zackenberg during several years (see Meltofte et al. 2009 for a manual). The method strives to cover all "territory holding" pairs and individuals during the period of territory establishment, pair formation and egg-laying – the period in which the birds most actively display territorial behaviour. Ideally, the census should be performed after dispersal of pre-breeding flocks and before initiation of incubation, when many birds become secretive and hard to record (Meltofte 2001). In NE Greenland, however, this period usually lasts for a few days only (between 10 and 20 June), so in practice a census will often have to be extended beyond this ideal period.

We covered the upper study area during 11-16 June and the central area during 19-25 June. Apart from Pink-footed Geese *Anser brachyrhynchus,* we found few nests, so we do not know the egg-laying phenology. But judged from a few incomplete as well as complete wader clutches (see the species accounts) and the relatively late flowering and invertebrate emergence – the latter of decisive importance for initiation of egg-laying in waders (Meltofte et al. 2007a) – we estimate that our timing approximated the ideal timing fairly closely. A census timed this early will produce much higher figures than censuses performed in July, when the failed breeders have left their territories (Meltofte 2001) – as were all previous studies in the area. This is further dealt with in the discussion. It should be noted that several rivulets within the study areas may have been hard to pass during peak spring snowmelt, and hence it would have been difficult to work in the area in mid June in a year where snowmelt was late.

Each study area was covered by transects walked in parallel by the two of us. According to the method, no part of the study area must be observed from a greater distance than 100 m, so we aimed to walk transects 200 m apart; in practice, however, the distance varied between 150 m and 225 m. The upper scree slopes towards the 200 m contour, and especially the extensive outwash fans, were observed from greater distances, while fens and other well vegetated areas were observed from shorter distances.

We used small radios to coordinate our coverage and to make sure that we did not record any birds twice. Furthermore, one of us used a GPS to track our positions, while the other carried a satellite image in order to make recognition of topographic features easier. Yet, due to lack of previous experience with the study areas, our coverage

Table 2. Census results ("territories"/nests) from the two study sites in Ørsted Dal, 2009, together with the results from the central area in 1974 (moderated from Green & Greenwood 1978 to better fit our delimitation of the central area). *Optællingsresultaterne ("territorier"/reder) fra de to undersøgelsesområder i Ørsted Dal, 2009, sammen med resultaterne fra det centrale område i 1974.*

Site *Område*	Upper valley		Central valley		Central valley	
Census period *Optællingsperiode*	11-16 June 2009		19-25 June 2009		8-24 July 1974	
Area *Areal* (km²)	17.0		23.0		21.2	
	n	Density	n	Density	n	Density
Red-throated Diver *Gavia stellata*			1	+		
Pink-footed Goose *Anser brachyrhynchus*	27	1.6	84	3.7		
Barnacle Goose *Branta leucopsis*	8	0.5	7	0.3	+	+
Northern Pintail *Anas acuta*	1	0.1				
King Eider *Somateria spectabilis*			1	+		
Long-tailed Duck *Clangula hyemalis*	17-23	1.0-1.4	2	0.1	1	+
Rock Ptarmigan *Lagopus mutus*	1	0.1				
Common Ringed Plover *Charadrius hiaticula*	22-29	1.3-1.7	28-30	1.2-1.3	6	0.3
Red Knot *Calidris canutus*	6	0.4	6-7	0.3	5	0.2
Sanderling *Calidris alba*	14-16	0.8-0.9	35-40	1.5-1.7	11	0.5
Dunlin *Calidris alpina*	88-94	5.2-5.5	39-44	1.7-1.9	11	0.5
Ruddy Turnstone *Arenaria interpres*	13-15	0.8-0.9	12-13	0.5-0.6	26	1.2
Red-necked Phalarope *Phalaropus lobatus*	2	0.1			2-3	0.1
Long-tailed Skua *Stercorarius longicaudus*	17-25	1.0-1.5	9-18	0.4-0.8	+	+
Snow Bunting *Plectophenax nivalis*	20-29	1.2-1.7	7-9	0.3-0.4	+	+
Waders total *Vadefugle totalt*	145-162	8.5-9.2	120-134	5.2-5.8	61-62	2.9

was hardly as accurate as at Zackenberg, but more in accordance with the study of Boertmann et al. (1991), in which HM participated.

All birds and other relevant observations were recorded on field maps and on tape, and later each day the observations were copied to census maps. According to the method, all pairs as well as single individuals uttering song, alarm calls or other indicative behaviour are considered as belonging to the local population, i.e. representing a pair/territory (Meltofte et al. 2009). Silent individuals are considered as uncertain pairs/territories, while overflying individuals are neglected.

We used approximately 52 man-hours to cover the upper area and 47 man-hours to cover the central area. In addition to this census time, we collected observations during many hours of hiking and at the camp, but these random observations were not used in the census.

The weather was rarely optimal for bird census work. Most of the time it was windy with "a strong and persistent easterly valley breeze" (Ferns & Mudge 1976) that sometimes blew dust from the flood plain high into the air. When this cold and humid wind was not blowing from the ice-covered Greenland Sea, a slightly milder, dry wind was blowing from inland. The easterly wind often brought fog and sometimes light precipitation, but this rarely hampered our work. Conditions on our arrival with helicopter on 11 June were windy and snowy, and on 22-23 June it was raining and blowing persistently for 24 hours during which the mountains above c. 400 m were covered with new snow. Otherwise, we could work on the tundra every day.

Maps with exact delineations of the study areas and the positions of nests and territories will be presented in a project report. When comparing with previous studies the different timing should be kept in mind (see the discussion), as should the different delimitation of the central study area in 1974 and 2009. Our area in the central valley included more land to the east and less to the west and north-east than the area used in 1974; the latter covered a total of 25 km^2, but only 21.2 km^2 was within the borders of our area. Finally, most population figures from 1963 are not comparable with either ours or those from 1974, since Hall & Waddingham (1966) only included actual finds of nests or young.

Species accounts

Red-throated Diver *Gavia stellata*
One pair nested on Pinkfoot Pond in the central study area, where one bird was seen on the nest on both 22 and 24 June. In 1963, two pairs and a single individual were recorded in the valley, including birds on both Pinkfoot Pond and Primula Pond (Hall & Waddingham 1966). Two pairs with chicks were seen in 1974 in lower Ørsted Dal and two pairs in tributary valleys (Ferns & Mudge 1976). In 1984, up to three birds were seen in the lower valley (Cabot et al. 1984).

Pink-footed Goose *Anser brachyrhynchus*
A total of 107 nests of Pink-footed Geese were encountered in the two study areas (Table 2), which is much more than anticipated. In 1961, no breeding records were made in the valley, but in 1963 a total of 25 goslings were seen in the entire valley (Hall & Waddingham 1966). In 1974, the number of goslings was three times higher, and 30 pairs were estimated to have nested successfully in the entire valley (Ferns & Green 1975, Ferns & Mudge 1976). In 1984, the entire valley was censused in June, resulting in 53 breeding pairs (Cabot et al. 1984). Of these, none were found in our upper study area, and only two in the central area. Since our study areas only covered a fraction of the valley (40 km^2 out of c. 260 km^2 lowland), the total today can be many hundreds. This considerable increase has happened in parallel with a tenfold increase in the entire Icelandic-Greenlandic population during the second half of the 20th century (Madsen et al. 1999, Mitchell 2008).

Nests were most often situated on small mounds in fens or on dry tundra, but avoiding the driest parts of the study areas. Several nests were predated by foxes during our stay, and we observed both robbing of single eggs and killing of incubating geese (followed by total depredation of the nest) – all unrelated to our presence (Dinesen 2010). We found 14 predated nests and seven killed adults.

The first goslings were observed on 24 June, when three pairs were encountered with 3, 4 and 4 young, respectively. This is among the earliest known in high-arctic Greenland, where hatching around this date has been recorded only once before (Ferns & Green 1975, Cabot et al. 1984, Madsen et al. 1984a). Allowing 1-2 days from hatching of the first egg until the goslings depart the nest, 26-27 days for incubation and one egg laid per day (typically 4-5 eggs) (Cramp & Simmons 1977), egg-laying must have been initiated shortly after 20 May.

Nowadays, the breeding birds in NE Greenland arrive in mid May (Meltofte 2006a). A mass immigration of more than 2000 Barnacle Geese *Branta leucopsis* and Pink-footed Geese passed the outer Scoresby Sund fjord on 13 May 2009 (C. Egevang in litt.); the proportion of Pink-footed Geese were estimated at c. 20%.

In addition to the breeding birds, 50-100 immature geese occurred in the upper study area and 50-80 in the central study area. The northward moult migration of immature Icelandic Pink-footed Geese, which nowadays mainly takes place during the second half of June (Meltofte 2006a), did not result in many birds passing over our study areas – we counted 283 between 14 June and our departure on 25 June, with a peak on 20 June. In 1983 and 1984, the moult migration did not commence until 24-25 June (Cabot et al. 1984). During the aerial surveys on 18 July 2008, 1310 Pink-footed Geese, including goslings, were counted in the entire valley (Glahder et al. 2010, D. Boertmann in litt.). This is 5.8 times as many as counted in 1963, when a total of 225 moulting birds were recorded in the valley (Hall & Waddingham 1966). Totals of 477 (including 83 young), 970, 456, 368, 912 and 699 were recorded in 1974, 1982, 1983, 1987 and 1989, respectively (Ferns & Green 1975, Madsen & Boertmann 1982, Mosbech & Glahder 1990). In 1984 numbers were low in July due to human disturbance, so totals of 520 were found in June and only 299 in July (Cabot et al. 1984).

In all of Jameson Land, 19 100 Pink-footed Geese were counted from the air in 2008, a threefold increase from 6640 in 1983 (Mosbech & Glahder 1990, Glahder et al. 2010) and a further manifestation of the outstanding increase of this population.

Canada Goose *Branta canadensis*
One individual, apparently of the subspecies *B. c. hutschinsii*, was encountered at Primula Pond in the upper study area on 14 June. There are only a few previous records of this species in NE Greenland (Boertmann 1994, Hansen et al. 2009).

Barnacle Goose *Branta leucopsis*
Ørsted Dal is well known for its large colonies of Barnacle Geese nesting at a height of up to 400 m on the mountain bluffs surrounding the valley. In both 1963 and 1974, in the order of 60-70 broods were recorded in the valley (Hall & Waddingham 1966, Ferns & Green 1975, Ferns & Mudge 1976), and in 1984 the population was censused to 201 pairs distributed on nine cliff colonies all around the valley (Cabot et al. 1984).

The Pink-footed Geese had a hard time defending themselves against the many arctic foxes in 2009. Photo: Lars Dinesen.
De Kortnæbbede Gæs blev konstant angrebet af de mange polarræve i Ørsted Dal i 2009.

We counted a minimum of eight pairs on the mountain bluff above our upper valley study area (colony no. 8 with 16 nests in Cabot et al. 1984) together with 106 individuals on the bluffs on the south side of the valley (nos 6 and 7 with 77 nests in Cabot et al. op.cit.). Both figures may include prospectors, but particularly on the south side, many individuals sitting on eggs may have been missed due to the large distance to the cliffs. Also on the eastern corner of Horsedal, near the central study area, where about 30 nest sites were counted in 1974 (Ferns & Green 1975, Ferns & Mudge 1976) and 50 nests in 1984 (no. 4 in Cabot et al. op.cit.), we saw birds on the mountain bluffs.

At the other end of the central study area, three pairs with 2, 2 and 3 goslings, respectively, were encountered at Pinkfoot Pond on 21 June. On 25 June, seven pairs were present here with four broods of one gosling, two of two, and one of four. At both occasions, the families abandoned the ponds at our appearance. Allowing 2-3 days from hatching until appearance in the lowland (Cabot et al. 1984), 24-25 days for incubation, and one egg laid per day (typically 4-5 eggs) (Cramp & Simmons 1977), these clutches must have been initiated around 20 May. This is the earliest ever recorded in Greenland (cf. Cabot et al. 1984, Madsen et al. 1984a, Meltofte 2006a), fitting well with the notion that the arrival of these birds to NE Greenland now takes place already in mid May, with massive immigration recorded over outer Scoresby Sund fjord during 13-16 May 2009 (C. Egevang in litt.; see above).

In addition to the formerly mentioned, flocks totalling 50-100 immatures were found daily in the upper study area and 15-30 in the central area. On 18 July 2008, 2275 Barnacle Geese (including young) were recorded in the entire valley (Glahder et al. 2010, D. Boertmann in litt.). This is a considerably increase from 1961, 1963, 1974, 1982, 1983, 1984, 1987, 1988 and 1989, when totals of 473, 736, 1231, 1688, 1402, 1238, 1480, 1753 and 1299 (some figures including goslings) were recorded, respectively (Ferns & Green 1975, Madsen & Boertmann 1982, Mosbech & Glahder 1990). In all of Jameson Land, a total of 16600 Barnacle Geese was counted from the air in 2008, which is

2.4 times as many as the 6820 recorded in 1983 (Mosbech & Glahder op.cit., Glahder et al. op.cit.). These increases parallel the 6-7-fold increase that occurred of the total NE Greenland population during the second half of the 20th century, so that the population now numbers about 70000 individuals (cf. Madsen et al. 1999, Mitchell & Walsh 2008).

Northern Pintail *Anas acuta*
A pair was seen on Primula Pond on the upper study area between 14 and 18 June. The species is probably an annual summer vagrant to NE Greenland (Boertmann 1994), and occasional breeding cannot be excluded.

King Eider *Somateria spectabilis*
A pair was seen on the ponds east of Pinkfoot Pond in the central study area on 21 June, and a male was sitting on a pond west of the study area the following day. In 1961, three females were seen in the valley (Marris & Ogilvie 1962), and in 1963, a female with a brood was encountered off the delta of Ørsted Dal in addition to adult birds at Primula Pond and in the lower valley (Hall & Waddingham 1966). None were found in 1974 (Ferns & Mudge 1976), whereas in 1984 up to nine males and six females (including one with two ducklings) were seen in the lower valley and seven males and one female in Primula Pond (Cabot et al. 1984).

Long-tailed Duck *Clangula hyemalis*
In the upper valley study area, 17-23 pairs of Long-tailed Ducks were recorded, mainly on and around Primula Pond, but also at other ponds and water bodies in the study area (Table 2). This figure consists of 17 pairs actually seen and 6-8 males, which may have been unpaired or – less likely – already have had incubating mates. In the central study area, only two pairs were found in the eastern part of the area.

In July 1961, a female with a brood was seen in the valley together with a flock of 16 females (Marris & Ogilvie 1962). In July 1963, two nests/broods were encountered in the entire valley, as were groups of 10 and 12 (Hall & Waddingham 1966). In July-August 1974, 44 adult Long-tailed Ducks together with seven small ducklings were counted in Primula Pond, 1-2 females were found in the central study area and two broods on ponds in the lower valley (Ferns & Mudge 1976). In June 1984, 32 Long-tailed Ducks were counted in the entire valley, of which five pairs occurred in Primula Pond (Cabot et al. 1984).

Gyrfalcon *Falco rusticolus*
An adult Gyrfalcon was seen during the snowfall at our arrival in the upper study area on 11 June, where it was chased by a dozen Long-tailed Skuas *Stercorarius longicaudus.* In 1974, an adult was recorded near the mouth of the valley (Ferns & Mudge 1976), and in 1982, 1983 and 1984 a pair was occupying a nest site on the cliffs of the south side of the upper valley (Madsen & Boertmann 1982, Cabot et al. 1984).

Rock Ptarmigan *Lagopus mutus*
A territorial male was recorded in the upper study area on 15 June. Otherwise, the remains of a total of eight Rock Ptarmigans were found in the upper study area and seven in the central study area. All of them consisted of winter plumage feathers, and most likely the birds had been predated by foxes or Gyrfalcons during the previous winter or spring. No records of live birds were made in 1961, 1963 or 1974, whereas varying numbers were seen in 1982 and 1984 (Marris & Ogilvie 1962, Hall & Waddingham 1966, Ferns & Mudge 1976, Madsen & Boertmann 1982, Cabot et al. 1984).

Common Ringed Plover *Charadrius hiaticula*
Ringed Plovers were common in both study areas, with 22-29 territories in the upper area and 28-30 in the central area (Table 2). In the latter area, P.N. Ferns and G.P. Mudge only found seven pairs in 1974 (Green & Greenwood 1978), while in the entire valley they found 252 pairs (Ferns & Mudge 1976). [Note that figures on wader pairs for 1974 given in the text refer to the original census area of 25 km^2, while figures given in Table 2 refer to the reduced area of 21.2 km^2.]

On 15 June, we found a nest with one egg, and on 17 June one with four eggs, both in the upper study area. Except for one Ringed Plover flying high together with two Ruddy Turnstones *Arenaria interpres* on 15 June, we saw no flocks.

Eurasian Golden Plover *Pluvialis apricaria*
A Golden Plover stayed for a short while in the central study area on 20 June, whereupon it left, flying high towards west along the valley. A single bird also stayed briefly in the central valley in 1974 (Ferns & Mudge 1976). The species has been known to breed in southern Jameson Land, southern Liverpool Land and SW Scoresby Land for several decades (Boertmann 1994, Bennike 2007), and two pairs were found in western Jameson Land in 2009 (C. M. Glahder in litt.).

The high Arctic subspecies of Dunlin *Calidris alpina arctica* was a numerous wader breeding in Ørsted Dal. Photo: Lars Dinesen.
Den højarktiske race af Almindelig Ryle Calidris alpina arctica*, som er en talrigt ynglende vadefugl i Ørsted Dal.*

Red Knot *Calidris canutus*
Knots were not particularly numerous in the two study areas, since we only found six and 6-7 territories in the upper and the central study area, respectively (Table 2). Similarly, P.N. Ferns and G.B. Mudge found five "territories" in the latter area in 1974 (Green & Greenwood 1978), while they found 16 "territories" in the entire valley (Ferns & Mudge 1976).

On 14 June, we found a nest with one egg in the upper study area. In this area, up to three birds were feeding communally at Primula Pond, and two plus two were flying high together with Ruddy Turnstones. Also in the central study area, up to four knots were feeding communally at ponds and on the tundra, and up to two were seen in flocks with Turnstones.

Sanderling *Calidris alba*
Sanderlings were common in both study areas and particularly so in the central area, with 35-40 territories against 14-16 in the upper area (Table 2). P.N. Ferns and G.B. Mudge only found 11 "territories" in the central area in 1974 (Green & Greenwood 1978) and 37 in the entire valley (Ferns & Mudge 1976).

A nest found on 22 June in the central study area only held two eggs. Two Sanderlings were seen feeding together in the upper study area, while in the central study area up to four were feeding communally at ponds, in fens and on arctic heath, mainly together with Dunlins *Calidris alpina*.

At two occasions, Sanderlings with colour bands and flags were recorded in the central study area. Both had been marked in Ghana within the last two years (J. Reneerkens in litt.). Another Sanderling banded in Ghana was seen at Zackenberg in 2009, supporting the presumption that a significant proportion of the Greenland Sanderlings winters in West Africa (Meltofte 1985, Lyngs 2003).

Dunlin *Calidris alpina*
Dunlin was the most numerous wader in both study areas with 88-94 territories in the upper study area and 39-44 in the central (Table 2). P.N. Ferns and G.B. Mudge only found 13 "territories" in the latter area in 1974 (Green & Greenwood

1978) and 87 in the entire valley (Ferns & Mudge 1976), i.e. about the same as we found in the upper study area alone.

We found three nests each with four eggs in the upper study area on 17 June. Communally feeding flocks of Dunlin were found almost daily at Primula Pond, with 24 as the maximum and in addition a flock of 15 passing by on the same day (18 June). In the central study area up to 20 were feeding together at ponds and in fens, with up to seven passing by in flocks.

Ruddy Turnstone *Arenaria interpres*
13-15 Turnstone territories were recorded in the upper study area and 12-13 in the central study area (Table 2). In the latter, P.N. Ferns and G.B. Mudge found as many as 26 "territories" in 1974 (Green & Greenwood 1978), with 71 in the entire valley (Ferns & Mudge 1976).

No nests or eggs were found by us in the upper area (except for a predated egg 15 June). In both study areas up to four birds were seen feeding communally or passing over in flocks with Red Knots and Ringed Plovers.

Red-necked Phalarope *Phalaropus lobatus*
Up to two males and two females were present simultaneously on and around Primula Pond in the upper study area during our entire stay there. None were seen in the central area. In 1963, five adult Red-necked Phalaropes were seen at Primula Pond, and in the central study area one at Pinkfoot Pond, with an additional one in the lower valley (Hall & Waddingham 1966). In 1974, five adults were present at Primula Pond in July, including a pair with two almost fully grown chicks (Ferns & Mudge 1976). In 1982, 13 were seen at Primula Pond (Madsen & Boertmann 1982), while in 1984 up to six were seen here besides two in the lower valley (Cabot et al. 1984). The species is a scarce but regular breeder in southern NE Greenland north to Zackenberg (Meltofte 2006b).

Arctic Skua *Stercorarius parasiticus*
A single light-phase Arctic Skua was seen in the upper study area on 16 and 17 June, and one in the central valley on 24 June. In 1963, the species was found breeding in the central valley (Hall & Waddingham 1966), while none were recorded in 1974 (Ferns & Mudge 1976). In 1984, two birds were seen (Cabot et al. 1984). The species is a scarce breeder in southern NE Greenland, where it primarily breeds near seabird colonies.

Long-tailed Skua *Stercorarius longicaudus*
Long-tailed Skuas were common in both study areas in 2009, but no proof of breeding was obtained. We recorded 17-25 territories in the upper study area and 9-18 in the central study area (Table 2). The birds were often mobbing arctic foxes and Glaucous Gulls (and on 11 June a Gyrfalcon), and it cannot be excluded that a few pairs attempted to breed in spite of the very low lemming density (cf. Meltofte & Høye 2007).

The species was also common in 1961 and 1974, but no breeding was confirmed in these years either (Marris & Ogilvie 1962, Ferns & Mudge 1976). In 1963 and 1984 extensive breeding took place (Hall & Waddingham 1966, Cabot et al. 1984).

Glaucous Gull *Larus hyperboreus*
One or two Glaucous Gulls were seen almost daily in both study areas. Breeding colonies exist at the mouth of Ørsted Dal (Hall & Waddingham 1966, Cabot et al. 1984).

Snowy Owl *Nyctea scandiaca*
A few old pellets from this species were found, but no birds were seen. In 1963 a pair nested in the valley and another in a tributary valley, whereas single individuals were seen in 1961, 1974, 1982 and 1984 (Marris & Ogilvie 1962, Hall & Waddingham 1966, Ferns & Mudge 1976, Madsen & Boertmann 1982, Cabot et al. 1984). However, a pair nested unsuccessfully in the main valley in 1983, and a pair was seen in a tributary valley in 1984 during an aerial survey (Cabot et al. op.cit.; see also Madsen et al. 1984b).

Common Raven *Corvus corax*
Single Ravens were seen almost daily in both study areas. At a few occasions, Ravens were seen flying along the rock faces, where the Barnacle Geese nested. The species is a regular, but sparse breeder in NE Greenland (Boertmann 1994), and it was also recorded in Ørsted Dal at the earlier surveys (Marris & Ogilvie 1962, Hall & Waddingham 1966, Ferns & Mudge 1976, Madsen & Boertmann 1982, Cabot et al. 1984).

Redpoll/Arctic Redpoll
Carduelis flammea/hornemanni
Redpolls were seen on the ground or flying over the study areas at two occasions. A male on 14 June was identified as *flammea*. Both species are scarce breeders in the region, with *hornemanni* being common locally (Boertmann 1994). No records were made in 1974, whereas varying

numbers were seen in 1961, 1963, 1982, 1983 and 1984 (Marris & Ogilvie 1962, Hall & Waddingham 1966, Ferns & Mudge 1976, Madsen & Boertmann 1982, Cabot et al. 1984).

Lapland Bunting *Calcarius lapponicus*
Male Lapland Buntings were seen flying over our study areas at two occasions. The species is a scarce breeder in the southern part of the region (Boertmann 1994). There are no previous records from Ørsted Dal.

Snow Bunting *Plectrophenax nivalis*
Totals of 20-29 Snow Bunting territories were recorded in the upper study area and 7-9 in the central area (Table2). Most were found on the scree slopes towards the upper limit of the study areas.

Discussion

The species composition and relative abundance found in our study resemble what was known from the valley and for southern high-arctic Greenland in general, but there are some notable exceptions. First of all, the numbers of Pink-footed and Barnacle geese have increased considerably. For the Pink-footed Goose this increase was especially pronounced in the case of the numbers of breeding pairs found in the study areas. These increases reflect the growth in the populations of both species during the second half of the 20th century, after improved protection from shooting combined with better feeding conditions on the wintering grounds (Madsen et al. 1999).

Secondly, our figures for some of the breeding waders were much higher than recorded in 1974, in case of the Dunlin even surpassing what was then estimated for the whole valley with tributaries. No doubt, this is due to the better timing of our censuses compared with those in 1974, when the census in the central valley took place in mid July and the remaining parts of the valley were surveyed in late July and early August. After early July, only successful breeders remain, whereas unsuccessful breeders leave their territories around 1 July to form post-breeding flocks, and they initiate their southbound migration early (Meltofte 1985). On top of this comes that the coverage of the valley outside the central census area must have been rather cursory, as most of the valley was surveyed by only two persons in a little more than two weeks.

On the other hand, numbers of Common Ringed Plovers and Ruddy Turnstones found in 1974 were surprisingly high, both in the central study area (Ruddy Turnstone) and in the entire valley (both species). It is possible that chick-tending adults giving alarm-calls far from their offspring may have inflated the estimate, a possibility also discussed by P.N. Ferns and G.B. Mudge (Green & Greenwood 1978). This might possibly explain the high figures for Ringed Plover in the general valley, but hardly all of the discrepancy between 1974 and 2009 for Turnstone in the central valley study area, where Ferns and Mudge found almost twice as many pairs as we did, so it would seem that Turnstone numbers have decreased. Interestingly, a similar decrease took place between the 1970s and the late 1980s at Danmarks Havn, 600 km further north (Boertmann et al. 1991), and the mid-winter counts of this population in NW Europe show decreasing numbers during the 1990s followed by an increase in recent years (Wetlands International 2008).

It should be stressed, that our methods are intended to cover all "territory-holding" pairs and individuals regardless of whether they actually breed or not (Meltofte 2001). In this connection, the many communally feeding waders (mainly Dunlins) seen by us are of interest, because all breeders as well as non-breeders ought to be dispersed on territories from mid June until around 1 July (Meltofte 1985). The question is then whether these birds were on feeding excursions away from their territories – a habit previously recorded by de Korte et al. (1981) in southern Jameson Land – or they were genuine non-breeders. Their highly fluctuating numbers might support the first possibility.

The only species missed among those we expected to see was the Wheatear *Oenanthe oenanthe,* but it is known to be scarce in NE Greenland, and only single pairs were found nesting in the valley in 1974 and 1983, although four pairs were recorded in the upper valley in 1982 (Ferns & Mudge 1976, Madsen & Boertmann 1982, Cabot et al. 1984).

Another change compared with pre-1980 visits is the earlier arrival of breeding and moulting Pink-footed and Barnacle geese today, and the correspondingly earlier egg-laying (Meltofte 2006a, this study). Most likely, this can be attributed to the marked climatic amelioration having taken place in NE Greenland during recent decades (cf. Dickey et al. 2008, Hansen et al. 2008), an amelioration resulting in significantly earlier flowering, invertebrate emergence, and egg-laying in waders at Zackenberg (Høye et al. 2007).

Population densities – and egg-laying phenology – of arctic-breeding waders appear to be gov-

erned by access to food resources early in the season (Meltofte 1985, Meltofte et al. 2007b). Hence, population densities in high-arctic Greenland are correlated with the ratio of snow-free vegetated ground in early June (Meltofte op.cit., Mortensen 2000). Total densities of waders in Ørsted Dal – 5-9 pairs per km^2 (Table 2) – were similar to other fairly good areas in Jameson Land (Mortensen 2000) and central NE Greenland (Meltofte op.cit., Boertmann et al. 1991), while optimal areas may support up to 14-18 pairs per km^2 (Boertmann op.cit., Meltofte 2006b). That Ørsted Dal does not reach such densities may at least in part be a result of a relatively late appearance of invertebrates in spring – in spite of the much earlier snowmelt compared with the surrounding valleys. Similarly, Long-tailed Skuas were found in densities typical for arctic tundra, but not as high as at Zackenberg (cf. Meltofte & Høye 2007).

For waders, the densities in Ørsted Dal were similar to densities found in the Heden Ramsar Site, where the mining infrastructure is planned to be built (C. M. Glahder in litt.). With the densities found, it is likely that the total wader populations in Ørsted Dal and adjacent valleys – the area proposed by Glahder et al. (2010) as a new Ramsar site instead of the anticipated reduction of the Heden Ramsar Site – number between 1000 and 2000 pairs. This is much more than the numbers supposed to be displaced by the planned infrastructure and associated activities at Gurreholm in the Heden Ramsar Site, provided that no dogs or hunting are allowed in that area.

However, the relative abundance of waders is markedly different between the two sites. Ørsted Dal, with much drier land than Heden, has much higher densities of Common Ringed Plover and Sanderling (the former being almost absent at Heden), whereas densities of Dunlin and Red Knot are several times higher at Heden, where also a few pairs of Golden Plover and Grey Phalarope *Phalaropus fulicarius* are breeding (C. M. Glahder in litt.).

For breeding and particularly for the moulting geese, much larger numbers of Pink-footed Geese are found in the Heden Ramsar Site than in the proposed Ramsar site of Ørsted Dal, implying that this will not fully make up for the likely reduction at the Heden site as a consequence of the planned mining activities. According to the aerial survey performed in July 2008 (Glahder et al. 2010) the proposed Ramsar site in and around Ørsted Dal held c. 3000 moulting Pink-footed Geese, which is only about 60-80% of the number expected to avoid the Gurreholm area after initiation of the mining activities. In contrast, the Ørsted Dal area has considerably more Barnacle Geese than the Gurreholm area.

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Resumé

Bestandstætheder af fugle i Ørsted Dal, Nordøstgrønland, 2009

I forbindelse med mineaktiviteter i Scoresby Land, Østgrønland, planlægges der en transportvej, en flyveplads, en havnemole og en række andre faciliteter i Ramsarområdet Heden i det vestlige Jameson Land. For at kompensere for de forringelser, som dette i så fald vil medføre for fuglene i Ramsarområdet, overvejes det at udpege et erstatningsområde omkring Ørsted Dal i det nordøstlige Jameson Land. I den forbindelse har Danmarks Miljøundersøgelser ved Aarhus Universitet gennemført undersøgelser af fuglelivet i Ørsted Dal i juli 2008 (Glahder et al. 2010) og juni 2009. Undersøgelserne i 2009 vedrørte primært ynglefuglene i dalen, og det er disse, der afrapporteres her.

To undersøgelsesområder på hhv. 17,0 km^2 i den øvre del af dalen og 23,0 km^2 i den centrale del af dalen blev dækket hhv. 11.-16. juni og 19.-25. juni. Det centrale område var overvejende sammenfaldende med et område, som blev undersøgt i 1974 (Green & Greenwood 1978).

Områderne blev gennemvandret ad transekter med 200 meters afstand, og alle fugleobservationer noteret på feltkort. Par samt enkeltindivider, der sang eller varslede, blev accepteret som repræsenterende et par/territorium, mens tavse enkeltindivider blev betragtet som usikre par/territorier.

Snesmeltningen var stort set overstået, da vi begyndte tællingerne, idet 2009 havde et usædvanlig tidligt forår (jf. Tabel 1). Vejrer var ikke optimalt under tællingerne, idet det ofte blæser i dalen, men egentligt dårligt vejr blev kun oplevet få dage.

Vi så ingen lemminger, og kun enkelte friske vinterreder blev fundet. Polarræve sås næsten dagligt i undersøgelsesområderne, og vi skønner, at der var 3-4 forskellige individer i hvert af områderne.

Som i andre højarktiske områder var fuglefaunaen domineret af vadefuglene – Stor Præstekrave, Islandsk Ryle, Sandløber, Almindelig Ryle og Stenvender – samt af et stort antal ynglende Kortnæbbede Gæs, især i den centrale del af dalen (Tabel 2). Havlit, Lille Kjove og

Snespurv var også talrige, ligesom Bramgæs ynglede på tilstødende fjeldvægge og siden bragte ungerne ned i lavlandet. De øvrige påviste og potentielle ynglefugle i undersøgelsesområderne var Rødstrubet Lom, Spidsand, Kongeederfugl, Fjeldrype og Odinshane, ligesom Jagtfalk, Almindelig Kjove, Gråmåge, Ravn og Grå/Hvidsisken formentlig ynglende i dalen eller dens omgivelser. Tillige sås Canadagås, Hjejle og Laplandsværling.

De fundne tætheder af vadefugle var væsentligt højere end fundet ved de tidligere undersøgelser, hvilket primært skyldes, at vi optalte fuglene på det optimale tidspunkt i juni, mens de tidligere undersøgelser blev foretaget i juli, hvor alle ikke-ynglende og fejlslagne ynglefugle har forladt territorierne. Dog synes bestanden af Stenvender at være reduceret siden tællingen i 1974 i det centrale område. Omvendt er der nu langt flere både ynglende og ikke-ynglende Kortnæbbede Gæs i dalen, end der var dengang, ligesom det samlede antal Bramgæs er steget kraftigt. Begge dele kan tilskrives den mangedobling af de totale bestande, som er sket i løbet af anden halvdel af de 20. århundrede som følge af bedre beskyttelse mod jagt og forbedrede fourageringsmuligheder om vinteren i Nordvesteuropa, hvor disse fugle overvintrer.

Mangelen på lemminger medførte, at vi ikke fandt sikre beviser for ynglen hos Lille Kjove, ligesom vi ingen Sneugler så. Polarrævenes prædation på de rugende gæs og deres æg var betydelig.

De første Bramgæs med gæslinger sås allerede den 21. juni, og de første klækkede Kortnæbbede Gæs den 24., hvilket er hhv. flere dage tidligere end fundet før og en tangering af den tidligere rekord. Disse datoer betyder, at æglægningen begyndte omkring den 20. maj. Også ankomsten af begge arter synes at ske tidligere nu – midt i maj – end den gjorde i 1950erne, 60erne og 70erne, og både dette og den tidligere æglægning kan formentlig tilskrives klimamildningen, som har været særlig følelig i arktiske områder.

De fundne tætheder af ynglende vadefugle – 5-9 par pr km^2 (Tabel 2) – svarer til relativt gode områder i resten af Jameson Land og til en række udvalgte områder længere nordpå i Nordøstgrønland, men større tætheder – op til 14-18 par pr km^2 – findes flere steder i det centrale Nordøstgrønland, hvor snesmeltningen og produktionen af smådyr starter tidligt (Meltofte 1985, 2006b, Boertmann et al. 1991, Mortensen 2000).

To Sandløbere blev set med farveringe fra Ghana, hvilket sammen med en tilsvarende observation fra Zackenberg dette år bekræfter, at en væsentlig del af Nordøstgrønlands Sandløbere overvintrer i Afrika (Meltofte 1985, Lyngs 2003).

Tæthederne af ynglende vadefugle i Ørsted Dal er fuldt på højde med eller overstiger tæthederne i Ramsarområdet Heden, men den relative hyppighed af arterne er meget forskellig i de to områder. Antallet af Bramgæs er langt større i Ørsted Dal end ved Gurreholm i det nordvestlige Ramsarområde på Heden, mens der er væsentligt flere Kortnæbbede Gæs på Heden end i Ørsted Dal (Glahder et al. 2010).

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