A REVIEW OF BIRD BREEDING CONDITIONS IN THE ARCTIC IN 2010

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A review of bird breeding conditions in the Arctic in summer 2010 is based on 74 contributions which are available at http://www.arcticbirds.net along with links to other supporting data (reports, etc.). This number is very close to 76 reports received in 2009. Similarly to the previous years, a major part of the information came from survey forms filled in by respondents (*n*=45) and free-form text notes (*n*=18). Internet publications (*n*=11) was the only, although the least comprehensive, source of information for some areas. Most of the data were received from Russia (*n*=42) including 16 contributions from Europe, 5 from West Siberia, 7 from Central Siberia, 4 from Yakutia and 10 from Chukotka and Wrangel Island. Other countries were represented by 3 reports from Norway, 14 from Alaska, 13 from Canada and 2 from Greenland. Accordingly, in 2010 we received 45 reports from Eurasia and 29 from the New World Arctic compared with 44 and 32 in 2009. Spatial coverage of the Arctic region remained uneven, as before, due to differences in distribution of study sites and to variations in involvement of researchers in activities of the Arctic Birds Breeding Conditions Survey.

Weather and other abiotic factors

Weather and related parameters and events such as snowmelt and flood timing, flood height, summer snowfalls can have strong impact on breeding success of birds in the Arctic and Subarctic. We use deviations of mean June air temperatures as a convenient approximation of spring and early summer weather conditions across the Arctic. There were several areas in 2010 with temperatures close to the long-term average (Fig. 1). Weather was notably warmer in June in the east of Taimyr, across the major part of northern Yakutia, in central and southern Chukotka, in the north-west of Canada, in the southern part of Greenland and in Iceland. June was cold in Fennoscandia, across the major part of West Siberia, in central and southern parts of Alaska, in the south of Hudson Bay area and in northeastern Greenland.

Assessment of spring phenology by respondents tallied well with local temperature deviations in some cases, but was in conflict with them in the other. Early or average spring timing was reported by most respondents from areas with below average June temperatures in the European portion of the Arctic and West Siberia. This disagreement is apparently explained by an early start of spring, in May, on the Kola Peninsula, White Sea and Lower Ob’ River. Moreover, observers recorded unusually early, in May, warming and thaw in the extreme north-east of Europe and low snow accumulation in West Siberia and Taimyr, leading to an early tundra clearance there. However, almost all respondents reported that early snowmelt was combined in these areas with cold and rainy June which corresponded to mean monthly temperatures. Similar explanation of a disagreement between early spring phenology and low June temperatures applies to the Yukon River and Seward Peninsula areas in Alaska, as well as to southern Hudson Bay and north-eastern Greenland with low snow accumulation during the winter and/or early start of spring development.

In contrast, high snow accumulation during the winter resulted in delayed spring phenology on Wrangel Island and on the Canadian Arctic archipelago, although June temperatures were close to or above the long-term average there.

According to Fig. 2 above average temperatures prevailed in the Arctic in July 2010, which implied favourable breeding conditions for birds. Air temperatures were particularly high in the extreme north-west of Canada and across major part of eastern Eurasia. July was cold in only two regions, West Siberia, including western Taimyr, and a major part of Alaska, in particular the southern part of the peninsula. Evaluations of summer weather by respondents was in better agreement with mid-summer temperatures than respective parameters for the spring. The most consistent disagreement found in the extreme north-east of Europe resulted from contrasting weather in July with the first half of the month cold and rainy and the second half warm.

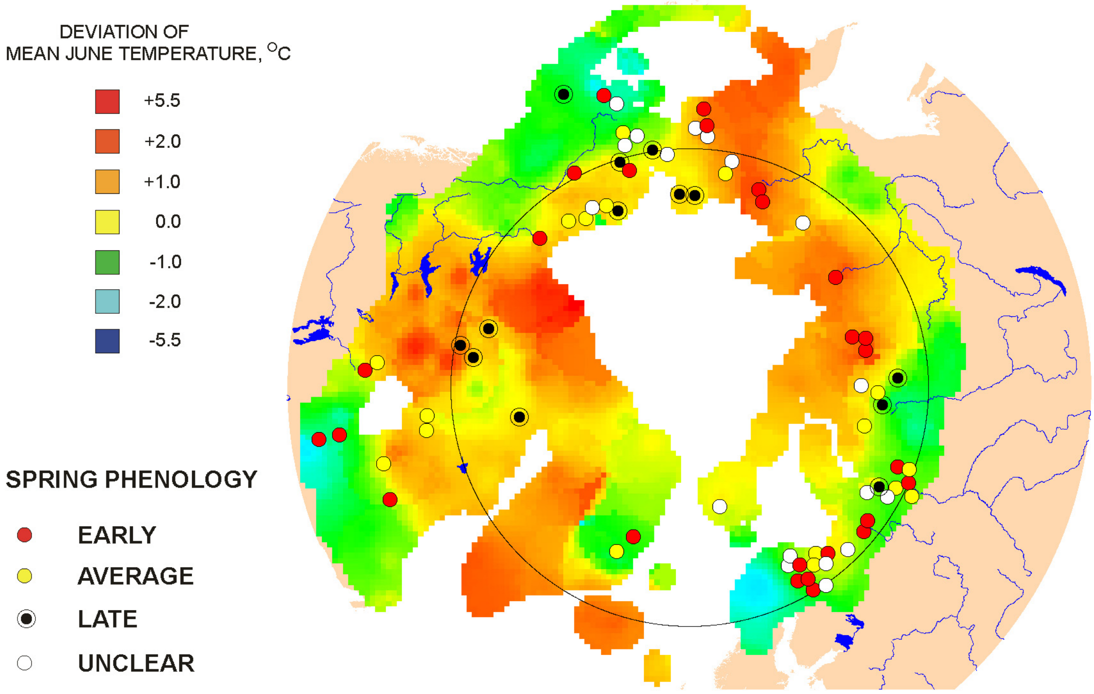


Figure 1. June air temperature and phenological characteristics of spring in the Arctic in 2010. See text in the box below for extended legend.

METHODS OF MAKING MAPS

Maps on Fig. 1–9 are provided to illustrate various aspects of bird breeding conditions in the Arctic in 2010.

Figures 1 and 2 represent an overlay of the map layers reflecting two different types of information. The first one is the deviation of the mean June/July temperature in 2010 from the mean June/July air temperature averaged for the period 1994-2003. This deviation indicates whether the respective month in 2010 was warmer (positive value) or colder (negative value) than average. The colour of the points at different study sites reflects a subjective evaluation by respondents of the spring as being early, average/moderate, or late (Fig. 1), and the summer as warm, average/moderate or cold (Fig. 2). Please note that, although referring to roughly the same period during the summer, the two types of information reflect essentially different phenomena that should not necessarily agree – for example spring could be early and cold. Temperature data were obtained from the National Climatic Data Center (USA, http://www.ncdc.noaa.gov/ol/climate/climateresources.html). Only stations with 26 or more daily records for a month were used for interpolation. The grid map was constructed using inverse distance interpolation, with the following settings: cell size 50 km, search radius 500 km, exponent 1. The area covered by the grid includes the territory obtained from an overlay of Arctic boundaries, as defined by CAFF and AMAP, plus an additional 100-km buffer.

Figures 3–9 illustrate abundance and breeding status of rodents and predators and bird breeding success, basically as these were reported by respondents. In some cases when respondents did not explicitly qualify breeding success, rodent abundance or another parameter, but these were fairly obvious from other information supplied, the site was assigned to a respective category based on the judgement of the compilers.

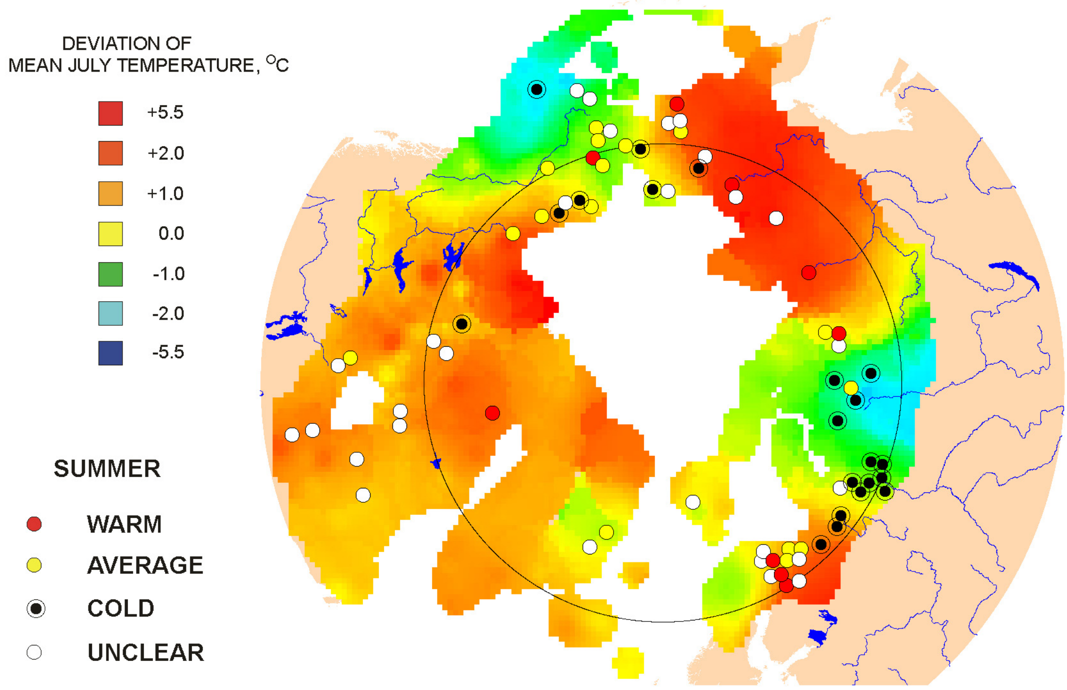


Figure 2. July air temperature and summer conditions in the Arctic in 2010

Unfavourable abiotic factors, other than above-mentioned temperature anomalies, were not widespread in 2010 and rarely had pronounced adverse impact on birds. Torrential rains were reported in the European north to the east of the White Sea (Kanin Peninsula) and in West Siberia. Storms occurred at several sites in July and resulted in death of broods and adults in coastal areas of the south-eastern Barents Sea region. Low survival of chicks of Rough-legged Buzzards *Buteo lagopus* on the Yamal Peninsula was presumably caused by prolonged periods of cold and windy weather. Cold weather and snowstorm in early June resulted in the loss of several nests of Snowy Owls *Nyctea scandiaca* on Wrangel Island. Low accumulation of snow during the winter led to low water levels in the Ob' and Yukon rivers, which had adverse impact on reproduction of waterfowl and some other waterbirds.

Rodent abundance

Abundance of microtine rodents is an important parameter for assessment of breeding conditions of tundra birds due to key role of rodents in tundra food webs. Abundance and breeding status of avian and mammalian predators depend heavily on the abundance of rodents, which results in pronounced fluctuations of predation pressure on tundra birds, their clutches and chicks.

The abundance of microtine rodents in the Arctic in 2010 is shown on Fig. 3. There was one vast area between the Lena and Kolyma rivers in Yakutia, where high abundance of lemmings coincided with average to high numbers of voles. Lemmings had high numbers also at one site on the Taimyr Peninsula, on Wrangel Island, where the abundance further increased after 2009 high value, and on Bylot Island. Lemmings occurred in average numbers at two sites in West Siberia (central Yamal and Oleny Island), one site on Taimyr and on Victoria Island in Canada. Thus, sites with average to high abundance of lemmings apparently became more numerous in the Arctic in 2010 compared with 2009. Apart from Yakutia voles were abundant in three widely distributed sites, namely, coastal area in the north of Norway, on central Yamal and in south-eastern Taimyr, and occurred in average numbers in 9 more sites across the Arctic.

The abundance of rodents remained generally low in the European portion of the Arctic (13 of 17 sites with available rodent data), although in 2010 compared with 2009 numbers of voles apparently increased in Fennoscandia and decreased in the Urals region. Scarce observations in the north of West Siberia do not allow to judge about prevailing pattern of rodent abundance there, but if it was high in the north of the Yamal Peninsula similarly to its central part then an almost continuous belt of average to high rodent numbers spread across a major part of northern Siberia, from the Urals to the Kolyma River. Sites with low abundance of rodents prevailed in continental Chukotka (5 of 7), in Alaska (10 of 12) and in north-eastern Greenland (2 of 2). Thus, the situation in 2010 remained similar to 2009 on Chukotka and in Greenland, while in Alaska the abundance of voles decreased at least in the Yukon-Kuskokwim Delta. Rodent abundance increased in 2010 in the Canadian Arctic.

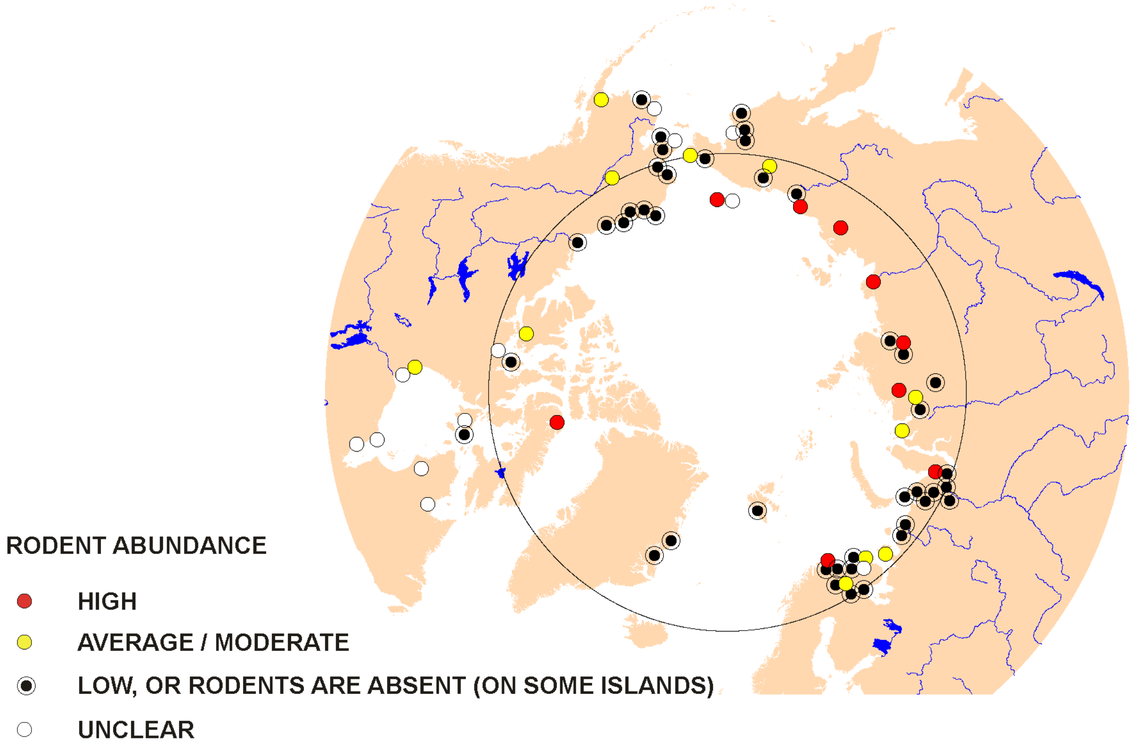
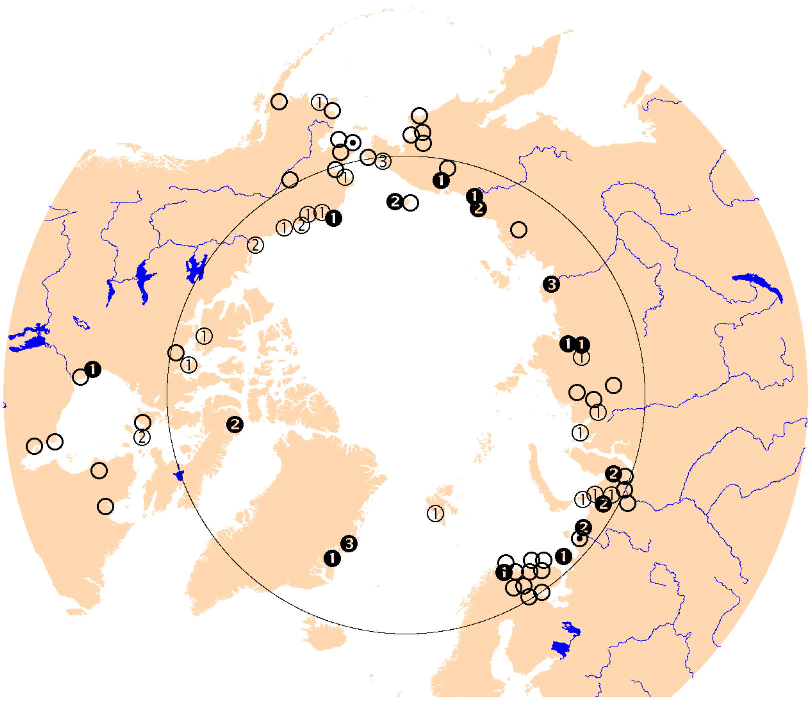


Figure 3. Rodent abundance in the Arctic in 2010

Predators

The Arctic Fox *Alopex lagopus* is an arctic predator having the strongest impact on breeding success of ground-nesting birds. In 2010 Arctic Foxes remained numerous breeders in the same regions as in 2009, Yakutia and north-eastern Greenland (Fig. 4). Foxes were abundant on the northern coast of Chukotka, but breeding was not confirmed for this area. Breeding Arctic Foxes were observed in 2010 in 47% of sites where these animals were present (17 of 38), which was slightly higher than in 2009 and tallied with an increase in rodent abundance. Arctic Foxes were common breeders in areas with high rodent abundance, central Yamal, Yakutia, Wrangel Island and Bylot Island. In spite of high numbers in north-eastern Greenland breeding success of foxes was low there due to low lemming numbers. Breeding of Arctic Foxes was recorded at one site in Fennoscandia.



	Present	Rare	Common	Abundant
Breeding	●	❶	❷	❸
Non-breeding	⊙	①	②	③
Absent, or not reported			○	

Figure 4. Abundance of Arctic Foxes in the Arctic in 2010

The Red Fox *Vulpes vulpes* has more southerly distribution than the Arctic Fox, and was recorded at 20 sites in 2010 (18 in 2009 and 24 in 2008). Most of observations in 2010 were made in Alaska, and, as previously, Red Foxes were not recorded on Taimyr and in Greenland.

Ermines *Mustela erminea* were recorded at 7 sites (8 in 2009), but only in Russia, from the Kola Peninsula to Chukotka. Observations of Least Weasels *Mustela nivalis* were made at 4 sites (6 in 2009), on the Kola Peninsula, in Yakutia and in Alaska; of Minks *Mustela vison* at 4 sites (in Europe, West Siberia and Alaska); of Wolverines *Gulo gulo* at 5 sites (in Europe and Chukotka); of Wolves *Canis lupus* at 8 sites, with a half of records made on Chukotka; of Brown Bears *Ursus arctos* and Black Bears *U. americanus* at 14 sites across entire Eurasia and Alaska, but most often on Chukotka. As previously, bears destroyed nests on Golden Eagles *Aquila chrysaetos* and White-tailed Sea Eagles *Haliaeetus albicilla* on Yamal. Hunting for moulting and juvenile geese by Wolverine was recorded in Bolshezemelskaya Tundra.

Among avian rodent specialists owls are heavily dependent on abundance of rodents for breeding (Fig. 5). Snowy Owls were recorded at 15 sites in 2010 (compared with 14 sites in 2009) and nested at 5 sites with high lemming abundance (there was a single site with breeding Snowy Owls in 2009), however, they were numerous breeders only on Bylot Island. Breeding Snowy Owls were common on Wrangel Island and in the Lena River Delta and rare in the west of Taimyr and on plains to the west of the Kolyma River delta. Short-eared Owls *Asio flammeus* have more southerly distribution compared with Snowy Owls and benefit there from high abundance of voles. In 2010 Short-eared Owls were recorded at 22 sites (24 in 2009) of which they bred at 3 sites (4 in 2009), namely, south-eastern Taimyr, Lena Delta and Barrow in Alaska. Boreal owls were recorded at two northern taiga sites.

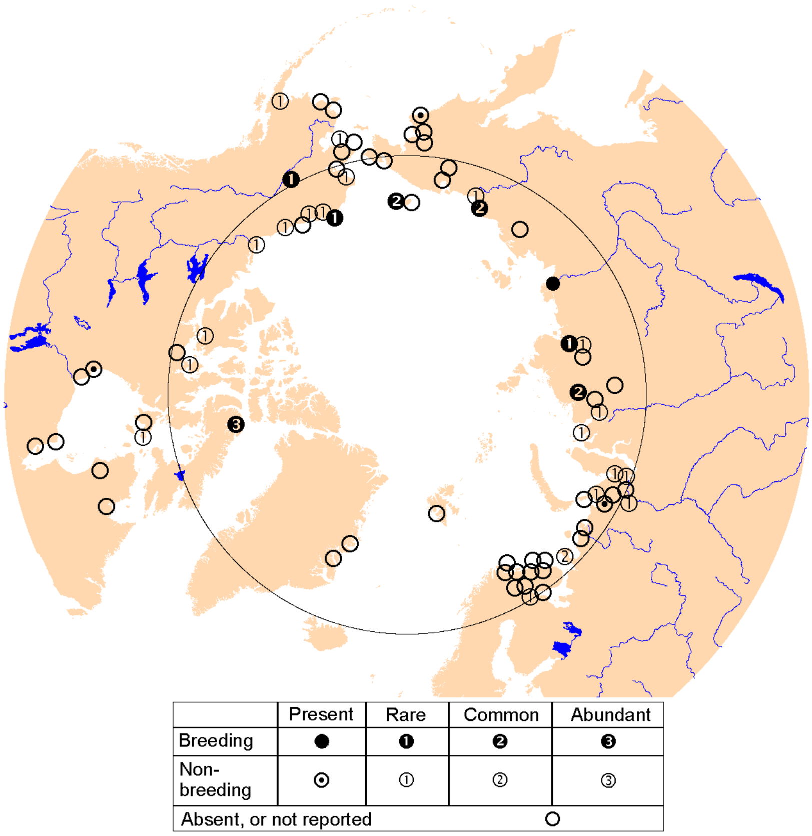
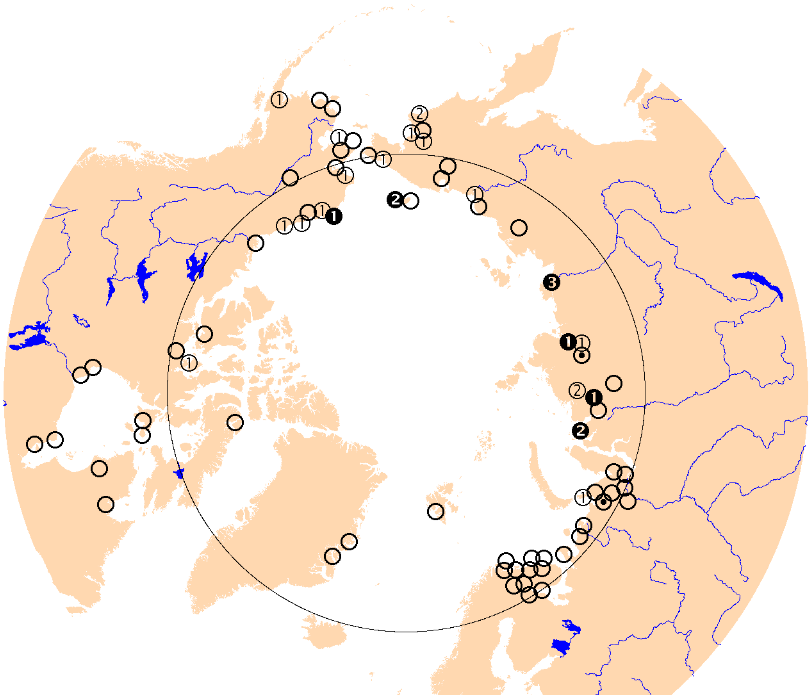


Figure 5. Abundance of owls in the Arctic in 2010

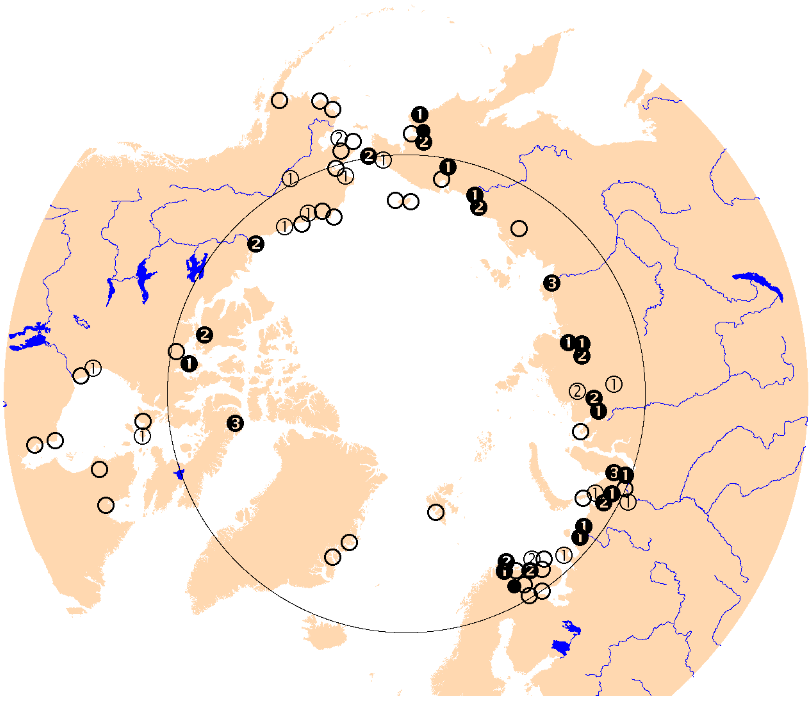
The Pomarine Skua *Stercorarius pomarinus* is a rodent specialist heavily dependent on lemmings. In 2010 these skuas were observed at many sites on migration and early summer movements and bred at 6 of them (Fig. 6), while in 2009 breeding had been recorded at 2 sites. Pomarine Skuas were abundant breeders in the Lena River delta and common breeders on Oleny and Wrangel islands; single breeding pairs were recorded on the western Taimyr, eastern Taimyr and in the Barrow area in Alaska. It is not clear why Pomarine Skuas did not breed on Bylot Island where lemmings occurred in high numbers in 2010.

The abundance of Rough-legged Buzzards is also dependent to a considerable extent on rodent abundance. This species was observed in 2010 at 40 sites and nested at 27 of them (68%) (Fig. 7), which indicated an increase in breeding effort compared with the previous year when buzzards nested at 52% of sites. In the Palearctic the number of sites with observed (30) and breeding (23) Rough-legged Buzzards was much higher compared with the Nearctic (10 and 4, respectively) which reflected differences in the abundance of rodents between these regions. The abundance of Rough-legged Buzzards was high in 2010 in several regions of high rodent abundance, including central Yamal, Lena Delta and Bylot Island, while in 2009 such sites were not recorded. The abundance was average at several sites in the north of Fennoscandia, at one site in the extreme north-east of Europe, on Taimyr, in the Kolyma River delta, on Chukotka, in the Mackenzie River Delta and on Victoria Island. Breeding effort was low in the north-east of Europe due to low abundance of rodents across the entire region, and very low production was reported from two sites.



	Present	Rare	Common	Abundant
Breeding	●	❶	❷	❸
Non-breeding	⊙	①	②	③
Absent, or not reported			○	

Figure 6. Abundance of Pomarine Skuas in the Arctic in 2010



	Present	Rare	Common	Abundant
Breeding	●	❶	❷	❸
Non-breeding	⊙	①	②	③
Absent, or not reported			○	

Figure 7. Abundance of Rough-legged Buzzards in the Arctic in 2010

Several other species of avian predators have wide distribution in the Arctic, however, we had no information about relation of their abundance with rodent numbers in 2010 or impact of these predators on breeding success of tundra birds. A notable exception was high predation pressure of White-tailed Sea Eagles on incubating Common Eiders *Somateria mollissima* in colonies on the White Sea resulting from increased abundance of eagles from mid 1980s.

Distribution and numbers of tundra birds

Generally, Arctic Birds Breeding Conditions Survey does not have a major focus on accumulation of information allowing to reveal long-term trends in distribution or numbers of tundra birds. However, reports of observers having good knowledge of regional fauna can provide useful insights into occurring changes. Thus, nesting Barnacle Geese *Branta leucopsis* were first reported on Kharlov Island near the Kola Peninsula coast in 2005, since when their numbers have increased and in 2010 breeding was recorded on Ainovy Islands. We have mentioned above an increase in the abundance of White-tailed Sea Eagles in the European north, while population of Peregrine Falcons *Falco peregrinus* increased on western Taimyr. A long-term decline in Lapland Bunting *Calcarius lapponicus* population was recorded on the Yamal Peninsula, while populations of the Raven *Corvus corax* and Magpie *Pica pica* increased in this region. Breeding of Raven was recorded for the first time in 2010 in the Ary-Mas sparse larch forest island in the south-eastern Taimyr. Since 2003 breeding Ross's Gulls *Rhodostethia rosea* were not observed in the north-western Chukotka. A decrease in the abundance of Sabine's Gulls *Xema sabini* was reported from the latter region during several years and a similar trend was discovered in 2010 in the south-east of Chukotka, on the Russkaya Koshka Spit. A long-term positive trend was observed in the population of the Emperor Goose *Anser canagicus* in the Yukon-Kuskokwim Delta.

Specific to 2010 geographical patterns in variations in abundance of tundra birds were rarely evident in the available information. However, several observers reported a notable decrease in the abundance of ducks, primarily diving ducks, in regions to the west and east of the Polar Urals. The abundance of Pectoral Sandpipers *Calidris melanotos* decreased in 2010 on Belyaka Spit, Chukotka, and in the Mackenzie River Delta, Canada, but increased in the Barrow area, Alaska. American Golden Plovers *Pluvialis dominica* were absent on Southampton Island, where previously they had bred in low numbers.

There are more chances to reveal trends in the abundance of Willow Grouse *Lagopus lagopus* and Rock Ptarmigans *L. mutus*, because these birds have wide distribution and are enough conspicuous to be noted even by general public. The number of reports about these birds increased in 2010 compared with 2009 both for Rock Ptarmigan (20 vs 15 sites) and for Willow Grouse (36 vs 27 sites). According to available data the abundance of Rock Ptarmigans did not change in 2010 compared with 2009, while changes in the abundance of Willow Grouse were reported from different regions of the Arctic. The comparison of Fig. 8 in the current issue and Fig. 5 on page 50 in «Arctic Birds» No. 12 indicates that the abundance of grouse (both species?) dropped to low level during 2009-2010 on the Kola Peninsula. Numbers of Willow Grouse apparently increased in Europe to the east of the White Sea, in West Siberia and at southern Taimyr, and there were almost no sites where this species was reported as rare. In contrast, populations of Rock Ptarmigans on Taimyr and in the adjacent regions were, probably, at a low (in agreement with an earlier proposed trend), as these birds were recorded at three sites only and were rare everywhere. Grouse remained common at most sites in the Kolyma River delta and on Chukotka.

Grouse were common or abundant in Alaska for several years. Rock Ptarmigans were recorded there on the Seward Peninsula and farther north, while Willow Grouse occurred almost everywhere. These two species were reported in the north and south of the Canadian

Arctic, respectively, but sparse information did not allow to judge about changes in their abundance.

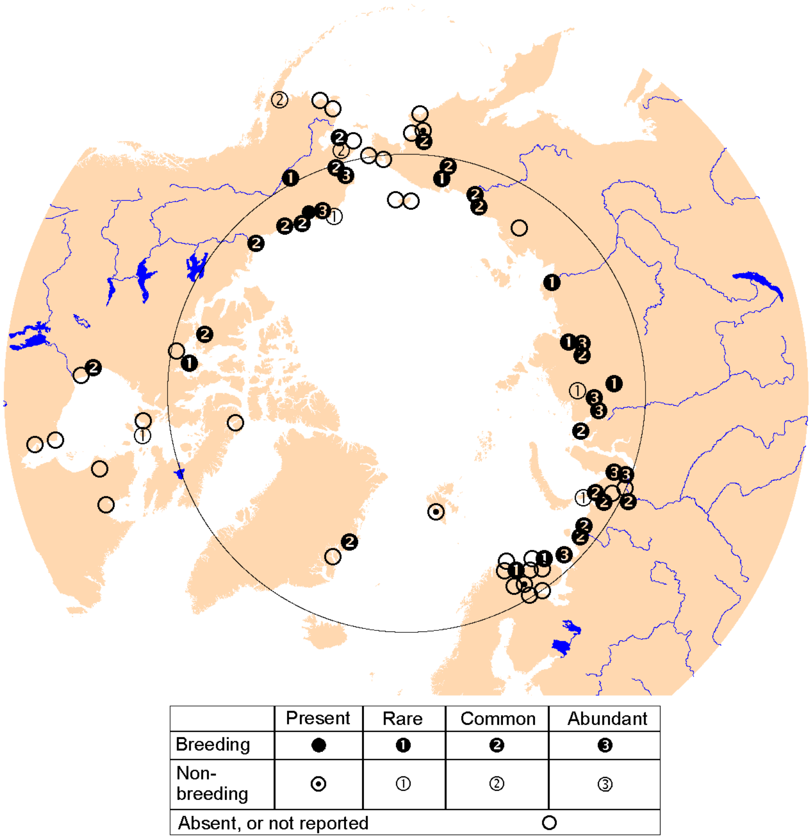


Figure 8. Abundance of grouse in the Arctic in 2010

Breeding success

As previously, breeding success of tundra birds was mostly evaluated by respondents, although in several cases this was done by the survey coordinators when clear evidence was present in the submitted contributions. Circumpolar pattern of the breeding success of tundra birds in 2010 is shown on Figure 9. Reports of average breeding success were the most common in northern Europe, the north of West Siberia and in the west of Taimyr. Breeding success was evaluated at two sites in Yakutia, and both ranks were high. Apparently birds indeed bred successfully in this region of the Arctic, because high proportion of juvenile waders of Siberian origin was recorded on the non-breeding grounds in Australia (Minton *et al*. 2011). Reproduction was probably successful in Chukotka. Breeding success was explicitly evaluated at few sites in this region, however, three observers reported high abundance of broods at the end of the season or indicated that breeding conditions had been favourable. Breeding success was evaluated mostly as average or high in Alaska, however, a small number of juvenile Bar-tailed Godwits *Limosa lapponica* of the Alaskan subspecies arrived in autumn to Australia which indicated low breeding success at least in this species (Minton *et al*. 2011). In spite of the fact that data from the Canadian Arctic were available from a small number of dispersed sites, they still indicated an improvement of breeding conditions compared with extremely unfavourable situation in summer 2009. The season was apparently poor in the north-eastern Greenland.

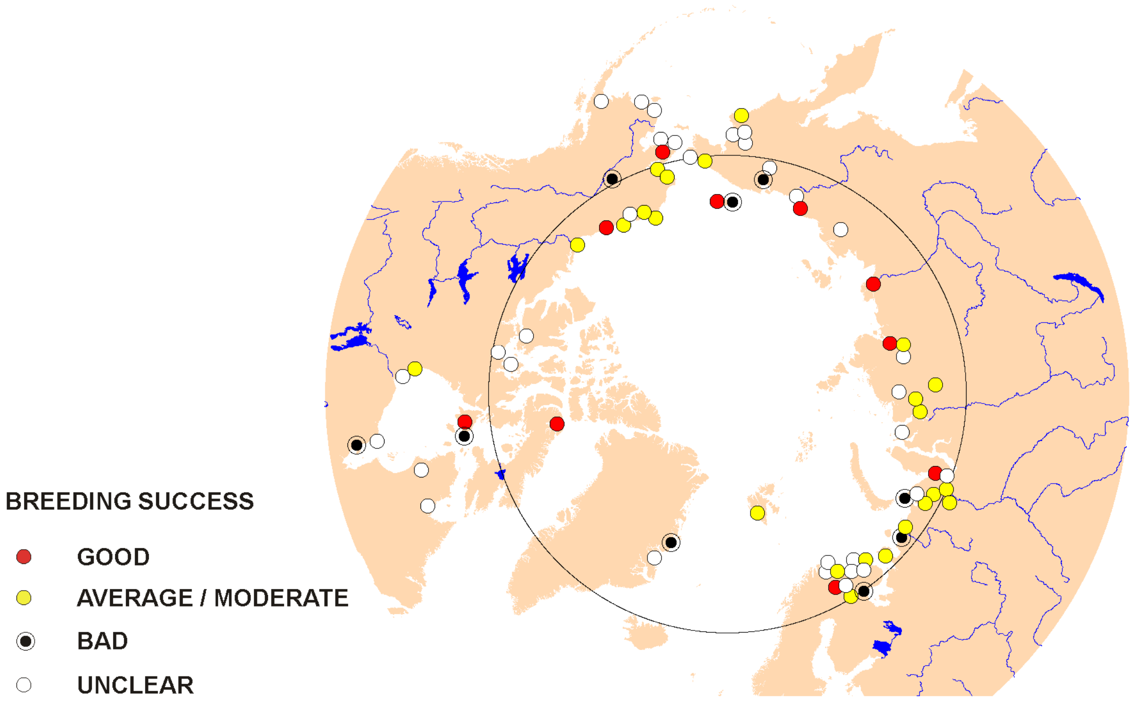


Figure 9. Bird breeding success in the Arctic in 2010

Comparison with predictions for 2010

Predictions of bird breeding performance in several Arctic regions for 2010 were made based on observations in summer 2009, taking into account the implied regularity of variation in rodent populations and a corresponding variation in predation pressure on egg clutches of ground-nesting birds. It is possible now to compare these prediction with actual situation in summer 2010.

It was expected that the low stage of rodents populations on the Kola Peninsula and the White Sea region would continue, causing a decrease in numbers of predators and increase in bird breeding success. Actually rodent populations have started to increase, but consequences of this scenario were similar to predicted due to a decrease in a pressure of predators on bird nests.

The abundance of rodents in the north-east of Europe in 2010 dropped to low values, as predicted, however, predation pressure on tundra birds did not increase. It is possible that survival of mammalian predators was low in winter or that they migrated from the region before summer due to already insufficient food resources at that time.

An increase in the abundance of rodents was expected in 2010 in the north of West Siberia, with associated increase in bird breeding success. This increase indeed occurred on central Yamal and, probably, in the north of the Gydan Peninsula enabling high reproductive performance by birds there in spite of unfavourable weather conditions during summer. Lemming numbers and bird breeding success were predicted to increase on Taimyr, and indeed lemming abundance became average to high at several sites. However, high breeding success of birds was confirmed at a single monitoring site.

In spite of high abundance of lemmings and voles in some regions of Yakutia in 2009, we allowed for a possibility of further increase in the rodent abundance. At the same time, after successful reproduction of rodent-specialists we expected an increase in the pressure of predators on bird nests and decrease in bird breeding success. In reality both rodent abundance and breeding success of birds were high for the second year in a row in this region.

Expectations of an increase in rodent abundance and associated increase in bird breeding success were not fully realised on Chukotka. The abundance of voles in this region reached the average value at two sites and an increasing trend was recorded at one more site, while breeding success of birds increased to average mainly due to improvement of summer weather conditions compared with extremely unfavourable season 2009.

Breeding success of birds was expected to be average at the best in 2010 in the Yukon-Kuskokwim delta in Alaska due to predicted increase in the abundance of predators. The pressure of predators was actually not strong, probably, due to an adverse impact of delta flooding in the course of autumn storms in 2009, but bird breeding success was not high still due to unfavourable weather conditions. Contrary to expectations the abundance of rodents did not start to increase on the Seward Peninsula and in the north of Alaska. However, breeding success of birds was average at most sites, as predicted, which was, probably, due to low abundance of predators and relatively favourable weather.

Available data from a single site in the west of the Canadian Arctic indicated that situation there was similar to northern Alaska, with low abundance of rodents and average breeding success of birds. The abundance of predators was generally low at other sites across vast Canadian north which resulted in a certain increase in bird breeding success and tallied with predictions. In contrast, similar expectations were not realised in the east of Greenland, where Arctic Foxes occurred in high numbers and nest success was low.

In summary, the predictions of mostly favourable conditions and average breeding success across the Arctic were confirmed, although the situation in some regions differed from expectations.

Acknowledgements

This review was made possible due to contribution to the ABBCS in 2010 by the following people: O.Y. Anisimova, A.B. Babenko, V.V. Baranyuk, Y.I. Berezkin, D. Berteaux, J. Bety, A. Black, N.S. Boyko, A. Bruner, P. Bruner, M. Cadieux, S. Conant, C.P. Dau, L. DeCicco, L. Demongin, J. Diray, A. Dixon, A.E. Dmitriev, A.G. Dondua, I.V. Dorogoi, D. Edwards, N.A. Egorova, D. Ehrich, D. Eterius, A.V. Ezhov, R. Gates, G. Gauthier, A.A. Gavrilov, G. Gilchrist, A.S. Gilyazov, M.G. Golovatin, V.V. Golovnyuk, E.V. Golub, J. Gregersen, J. Hansen, W.F. Harvey, C. Harwood, A. Hellquist, R. Ims, N.Y. Ivanenko, J.A. Johnson, O.W. Johnson, L. Jonsson, G.D. Kataev, S. Kendall, S.P. Kharitonov, A.V. Kondratyev, Y.V. Krasnov, V. Kubelka, N.V. Kudryavtsev, O.Y. Kulikova, R.B. Lanctot, N.V. Lebedeva, J. Lefebvre, J.R. Liebezeit, K.E. Litvin, E.Y. Loktionov, O.L. Makarova, H. Matusik, S.A. Mechnikova, M.V. Melnikov, I.E. Menyushina, O.Y. Mineev, Y.N. Mineev, V.V. Morozov, T.E. Noah, A.V. Osadchiy, S.P. Paskhalny, V.V. Pavlinin, L. Pirie, R.V. Plotnikov, I.G. Pokrovsky, A.B. Popovkina, I.N. Pospelov, V.I. Pozdnyakov, J. Rausch, J. Rodrigue, A.A. Romanov, S.B. Rozenfeld, D.R. Ruthrauff, M. Salek, S.E. Savage, N.R. Senner, E.V.Shutova, V.N. Sidorov, B. Sittler, S.M. Sleptsov, P. Smith, A.A. Sokolov, V.A. Sokolov, G.A. Solovyev, D.V. Solovyeva, E.L. Tolmacheva, D. Troy, I.I. Ukolov, N.I. Vartanyan, D.D. Vasyukov, M.V. Vladimirtseva, N.N. Yakushev, E.M. Zainagutdinova, N.V. Zanuzdaeva. J.R. Wilson provided invaluable help by improving the English.

References

Minton, C., R. Jessop, & C. Hassell. 2011. Wader breeding success in the 2010 Arctic summer, based on juvenile ratios of birds which spend the non-breeding season in Australia. *Stilt* **60**: 58-60.