BREEDING BIRD CONDITIONS IN THE CIRCUMPOLAR ARCTIC DURING 2015

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A review of breeding conditions for tundra birds in circumpolar Arctic in 2015 was based on data from 53 localities or regions of Arctic and Subarctic (see http://www.arcticbirds.net). The number of sites was higher than in 2014 (*n*=46) which disrupts the decreasing tendency of the recent years for dataflow of the project. As before, most of the data came from questionnaires (*n*=25) or free-form reports (*n*=18), submitted by respondents. Information on several sites (*n*=10), mostly from Nearctic and usually less complete, was found in the Internet. As previously, geographic coverage was heavily biased towards Russia (*n*=36), including 15 reports from the European part of the country, 5 from Western Siberia, 3 from Central Siberia (Taimyr and Severnaya Zemlya Archipelago), 3 from Yakutia and 10 from Chukotka and Wrangel Island. Western part of European Arctic was represented by one report found in the Internet. Information from the New World was based on reports from 5 sites in Alaska, 9 sites in Canada and 2 sites in Greenland. In total, information was available from 37 sites in Eurasia and 16 sites in North America. Apparently, this unevenness of geographic coverage reflects differences in support to the survey by researchers, rather than intensity of field studies in respective regions.

Weather and other abiotic factors

Bird breeding success in the Arctic depends notably on weather and related environmental factors (timing and duration of snowmelt, height and duration of floods, food availability) starting from arrival in spring and until fledging of juveniles. Assessment of these factors is important for evaluation of reproductive success of tundra birds.

Thermal regime in the Arctic and Subarctic in the beginning of breeding season 2015 was characterized by deviations of mean monthly air temperature in June from the long-term average (Fig. 1). Areas with positive anomalies clearly prevailed in June 2015, and negative anomalies were observed in the eastern Canadian Arctic, in the southern and central Greenland, in Iceland, Scandinavia and central Yakutia.

Information from respondents on timing of spring in this year was in general agreement with June temperature anomalies, with few interpretable exceptions. Reports of early spring were made from the Kola Peninsula, although air temperatures in June ranged from average to low there. Apparently, in this subarctic region spring started yet in May, and not in June. Reports of late spring from the Indigirka River area in Yakutia and from the Anadyr Bay area in Chukotka reflected high accumulation of snow during the winter there which resulted in delayed spring phenology in spite of high June temperatures.

Thermal regime changed notably in July 2015 in several Arctic regions which resulted in alternating pattern of positive and negative temperature anomalies (Fig. 2). July was warmer than average in Svalbard, Novaya Zemlya, Gydan Peninsula and western Taimyr Peninsula, in the area from the Kolyma River to north-western Alaska, in the north of Canadian Arctic from the Mackenzie River to Ellesmere Island, in the south of the Hudson Bay and across major part of Greenland. Below average temperatures prevailed in July in Iceland, entire continental European part of the Arctic to lower Ob' River in the east, eastern Taimyr and most of the northern Yakutua, extreme north-east of Alaska, south-east of Canadian Arctic Archipelago and the north of the Labrador Peninsula. Particularly cold conditions were observed in the north of Europe and in the Labrador area.

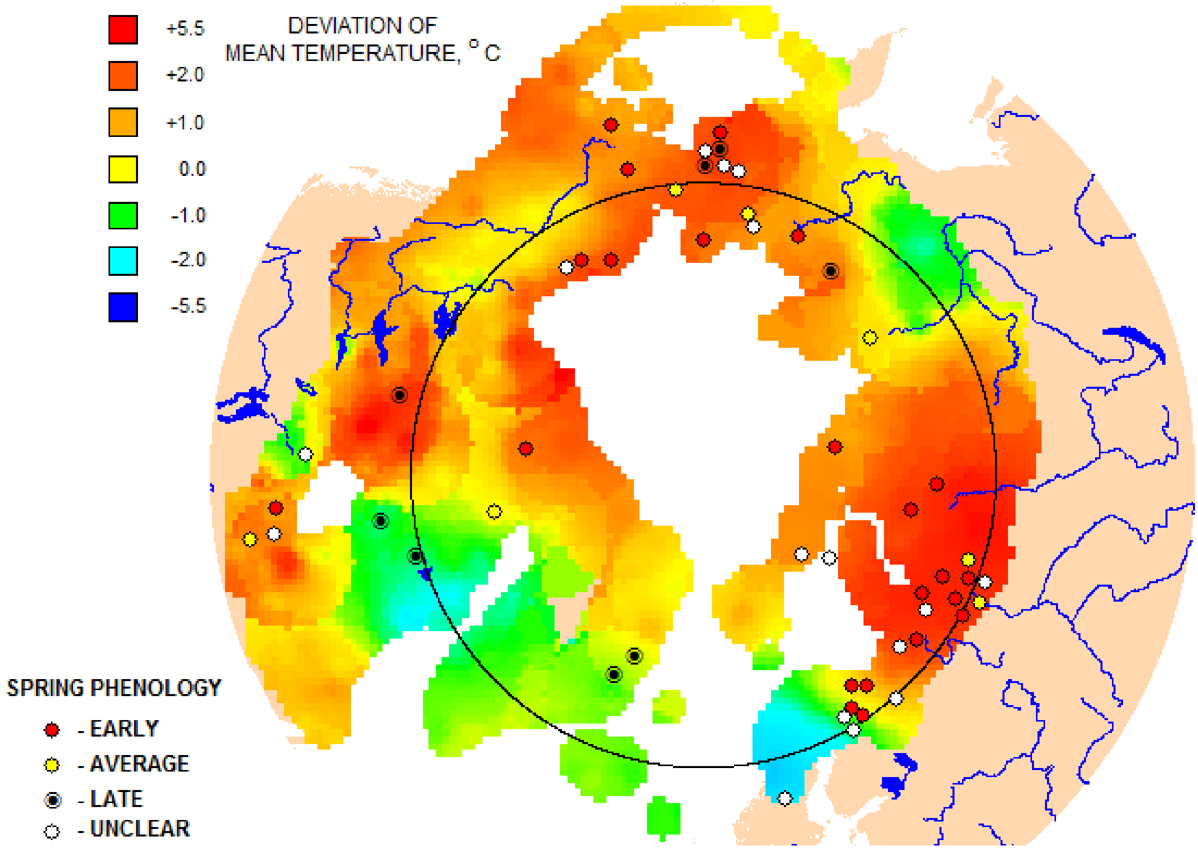

Figure 1. Deviation of June air temperatures and spring phenology in the Arctic in 2015. See text in the box below for extended legend.

METHODS OF MAKING MAPS

Maps on Figures 1–9 are provided to illustrate various aspects of bird breeding conditions in the Arctic in 2015.

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 2015 from the mean June/July air temperature averaged for the period 1994-2003. This deviation indicates whether the respective month in 2015 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 (Global Summary of the Day (GSOD) dataset, ftp://ftp.ncdc.noaa.gov/pub/data/gsod). 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, predators, and bird breeding success as 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.

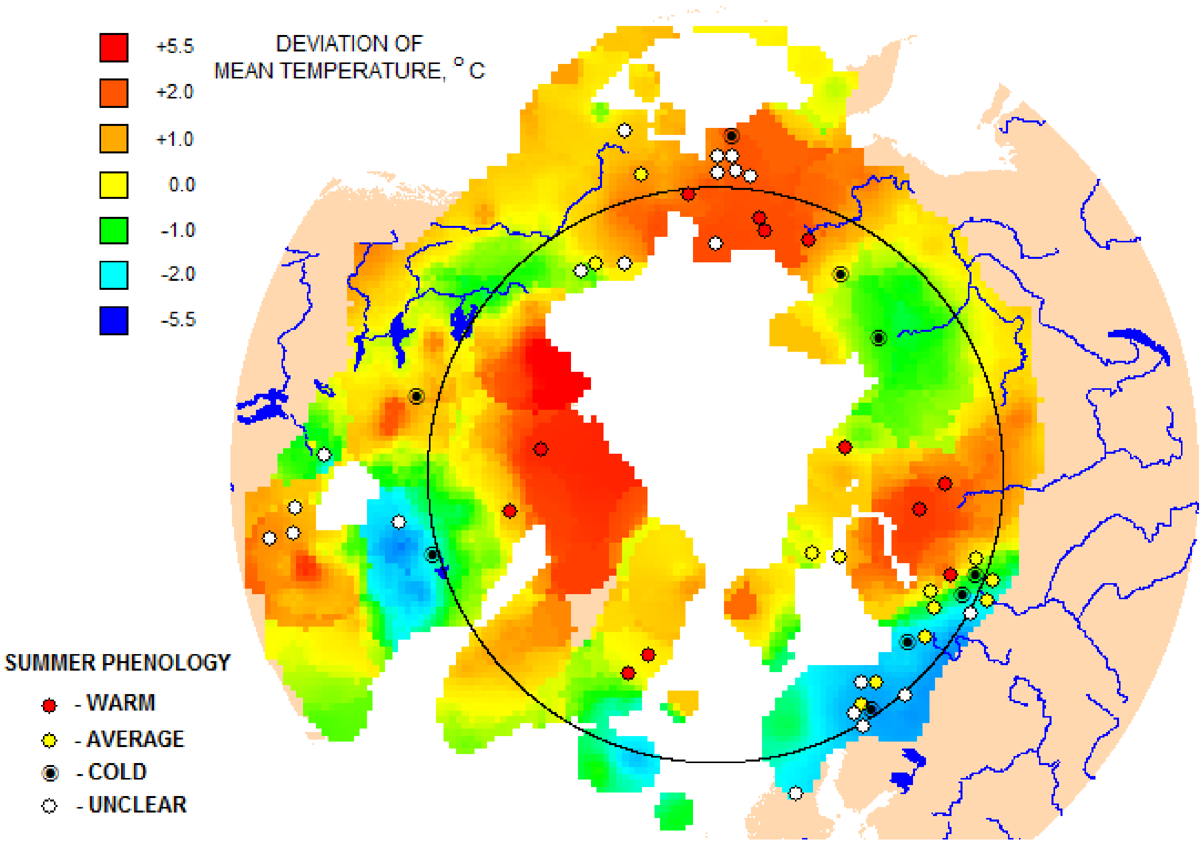

Figure 2. Deviation of July air temperature and summer conditions in the Arctic in 2015.

Evaluation of temperature conditions in summer by respondents mostly agreed with temperature anomalies in July, with some exceptions. Conditions in the north of Europe, apparently, colder than average in July, were in several reports characterized as average. In spite of warm July across entire Chukotka a report of cold weather was made from one site on the sea coast in the south of the area due to prevailing foggy and rainy weather there. Mortality of chicks of Rough-legged Buzzards and Peregrines was caused by cold and rainy weather in summer on Kolguev Island. Low reproductive performance by Rough-legged Buzzards on the Yamal Peninsula was, probably, also attributed to adverse weather. Low growth rate and increased mortality of wader chicks were observed from the second week of July in the Colville River area in the north-eastern Alaska due to cold weather and low food availability.

Extreme events, other than temperature anomalies, were not reported to have widespread adverse impact on breeding success of tundra birds in 2015. However, at a local or regional scales several such events were recorded. Specifically, a storm caused flooding of colonies of Barnacle Geese and gulls on coastal marshes on 10 June in the area of the Tobseda settlement in the European north of Russia. High and long-lasting flood prevented bird reproduction in river floodplains in the lower Ob’ River area and on the Yamal Peninsula, Western Siberia, and in the Colville River area, Alaska. Conversely, dry conditions in the Chaun Bay area in Chukotka and on Bylot Island in Canada, caused by high summer temperatures, could impair feeding conditions of waterbirds and survival of their broods. Catastrophic returns of cold weather were not reported in this year, although a hail was observed in the end of June on Sem' Ostrovov Archipelago, the Barents Sea and snowfalls occurred at nights in early July in Bolshezemelskaya Tundra, north-eastern Europe.

Rodent abundance

Abundance of lemmings and voles, a primary food resource, directly determines breeding success of most avian rodent-specialists. And abundance of microtine rodents also has strong impact on breeding success of other tundra birds, because their eggs and chicks represent an alternative food for predators in years of low rodent abundance.

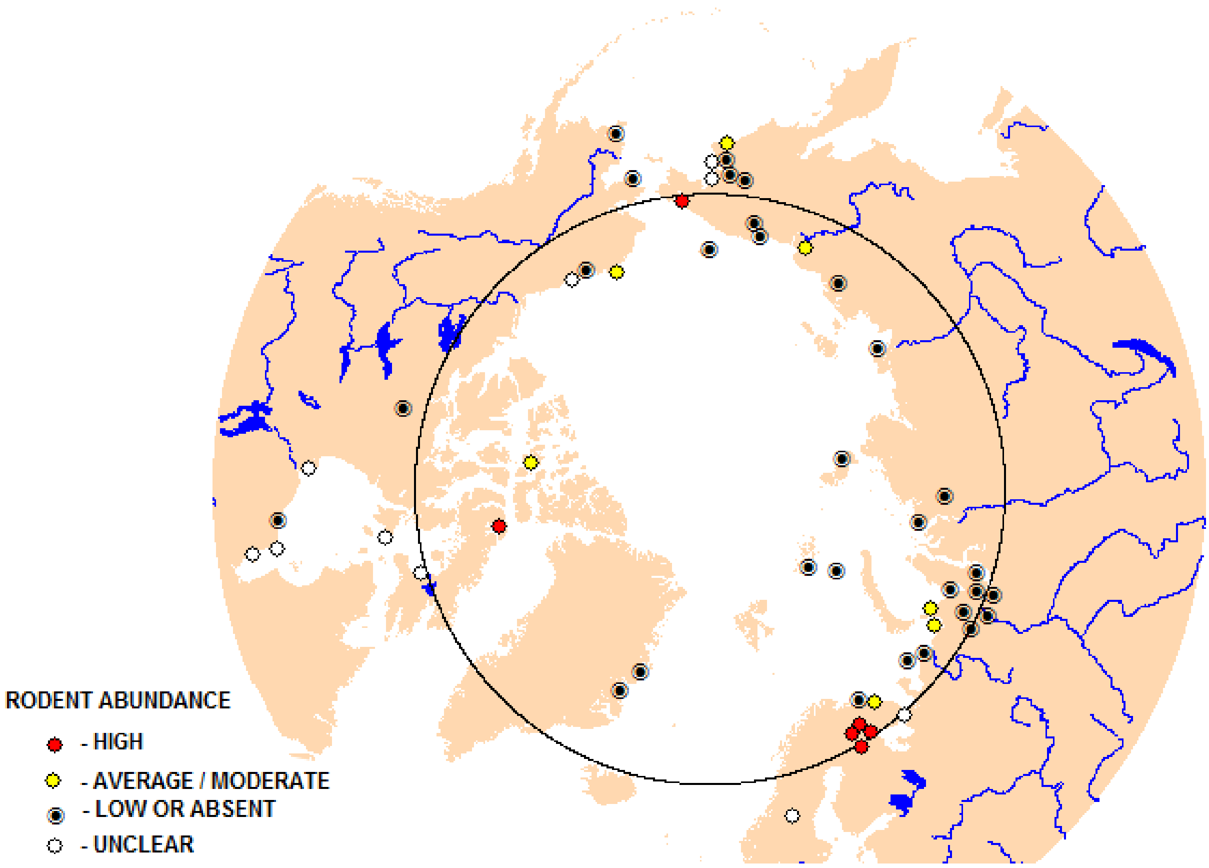

Figure 3. Rodent abundance in the Arctic in 2015

Rodents are absent on Franz Josef Land and Kolguev Island. Apart from these sites assessment of microtine rodent abundance in 2015 was made in 41 sites of the circumpolar Arctic. As in the previous years, low abundance ranks prevailed (Fig. 3), and their fraction in the total number of sites with available information increased from 55% in 2014 to 68% in 2015, approaching high level of 2013 (71%). Vast region with low abundance of rodents spread in 2015 across continental tundra of north-eastern Europe and entire Siberia, including Bolshevik and Wrangel islands in the Arctic Ocean. Localities with average or high abundance of voles in Siberia included one site in the north-east of Yakutia and two sites in the east of Chukotka. Low abundance of rodents was observed in Alaska, with an exception of Barrow area where populations of Arctic Foxes have been controlled, in the south of the Canadian Arctic and in the east of Greenland. Average to high abundance of rodents was recorded in Fennoscandia, Vaigach and surrounding islands, several sites in eastern Chukotka, Barrow area and Canadian Arctic Archipelago. Scarcity of data does not allow to evaluate size of the area with increased lemming abundance in Canada. However, observations on the Kola Peninsula and mass breeding of Snowy Owls *Nyctea scandiaca* in Sweden indicate that an area of high lemming and vole abundance was spread across the entire northern Fennoscandia.

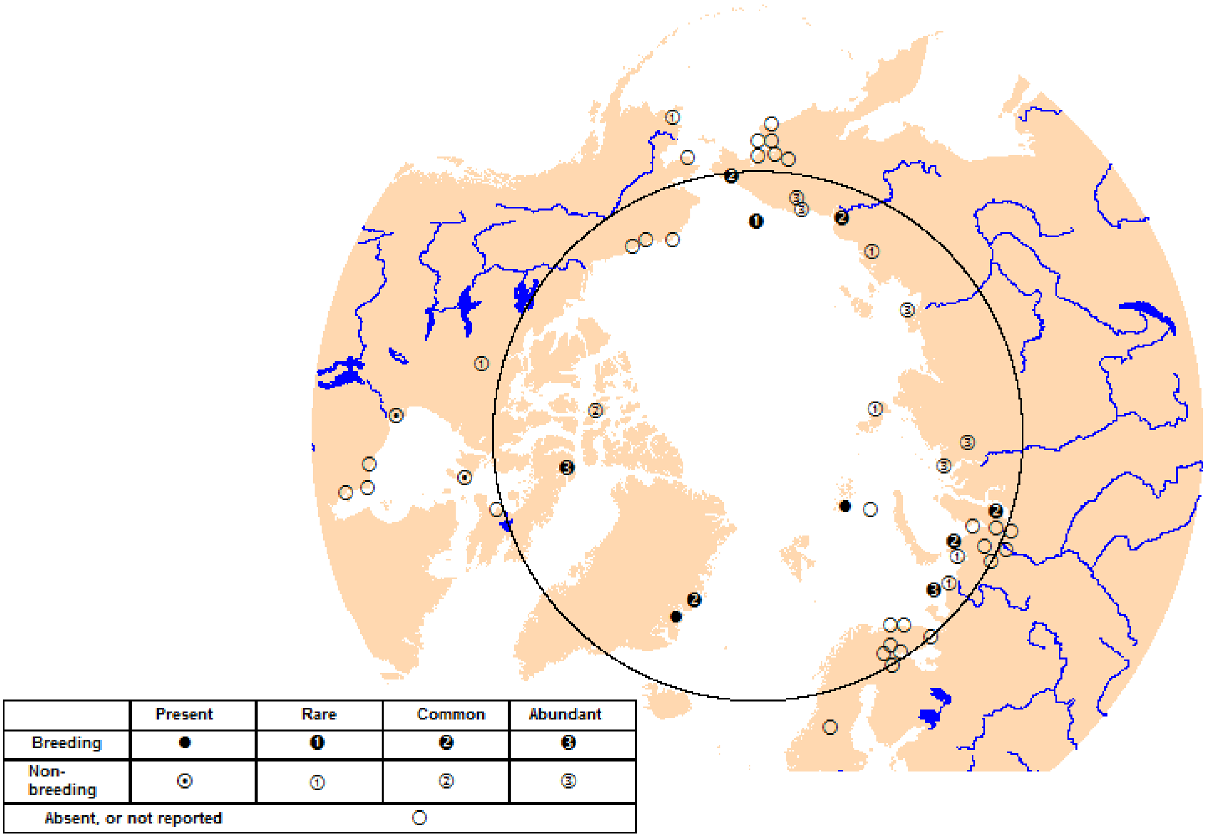

Figure 4. Abundance of Arctic Foxes in the Arctic in 2015

Predators

Arctic Fox *Alopex lagopus* has the strongest impact on breeding success of tundra birds among mammalian predators. This impact depends on the abundance and activity of foxes, which in their turn depend on dynamics of the abundance of microtine rodents. Arctic Foxes were observed in 2015 in 24 sites of the Arctic (Fig. 4), and their reproduction was reported in 42% of the sites, which is below respective parameter of the reproductive effort in the previous two years (54%). This tallies well with increased fraction of sites with low rodent abundance (see above). Arctic Foxes bred intensively mostly in areas of high rodent abundance, but also on Kolguev Island and in the south-east of the Yamal Peninsula where mass mortality of domestic reindeers had occurred in 2014 and predators had got additional food resources. A brood of Arctic Foxes was found near a seabird colony on Franz Josef Land, while on Wrangel Island Arctic Foxes bred only in the vicinity of main colony of Snow Geese, feeding on geese eggs. Breeding Arctic Foxes found food near human settlements in the south-east of the Yamal Peninsula. Lemming abundance was low in the north-eastern Greenland, and few breeding attempts of Arctic Foxes were mostly unsuccessful there. Non-breeding Arctic Foxes were numerous at several sites in Central and Eastern Siberia which had adverse impact on breeding success of tundra birds. Arctic Foxes were not recorded on the Kola Peninsula, in the south of Chukotka and in the north of Alaska.

Red Fox *Vulpes vulpes* is also an efficient predator on eggs and chicks of tundra birds, but it has more southerly distribution than Arctic Fox. Red Foxes were observed at 12 sites in Europe, Western Siberia, Chukotka, Alaska and Canada in 2015, which indicated lower occurrence than in 2014 (18 of 46 sites) and similar occurrence to 2013 (11 of 56 sites).

Ermine *Mustela erminea* was reported in total from 8 sites on the Kola Peninsula, Taimyr, Lena Delta and Chukotka, which is similar to reporting rate in 2014 (n=6) and 2010 (n=7), higher than in 2011 (n=4), and lower than in 2013 (n=11) and 2012 (n=14). Least Weasel *M. nivalis* was recorded at a single site on the Kola Peninsula which is similar to 2014, but below the reporting rate in the previous years (2-6 sites in 2009-2013). American Mink *M. vison* was observed at 3 sites on the Kola Peninsula; a reporting rate similar to the previous years (3 sites in Europe and Alaska in 2014, 2 sites in Europe in 2013 and 4 sites in 2012). Wolverine *Gulo gulo* was reported from 6 sites (compared with 1–5 sites in 2010-2014), Wolf *Canis lupus* – from 7 sites, an increase compared with 3 and 2 sites in 2013 and 2014, respectively, but similar to 5-8 sites in 2010-2012. Brown Bear *Ursus arctos* was observed at 13 sites, similarly to reporting rate in 2010-2013 (8-14 sites), and Polar Bear *Ursus maritimus* was recorded at 6 sites. As previously, single records were made of Marten *M. martes* and Eurasian Otter *Lutra lutra*. Independent hunting of dogs in tundra was observed at two sites in Chukotka. A nest of Gyrfalcons *Falco rusticolus* was destroyed by a Brown Bear on the Yamal Peninsula.

Owls belong to avian rodent-specialists and they were recorded in 2015 at 21 site. Snowy Owls *Nyctea scandiaca* were observed at 16 sites (compared with 10 sites in 2014, 11 sites in 2013, 19 sites in 2012, 14 sites in 2011 and 15 sites in 2010). Short-eared Owls *Asio flammea* were observed at 8 sites (compared with 12 sites in 2014, 18 sites in 2013, 21 sites in 2012, 16 sites in 2011 and 22 sites in 2010), while several species of boreal owls were reported from 2 taiga sites on the Kola Peninsula (Fig. 5). Breeding of Snowy Owls was reported from 2 sites (compared with 6 sites in 2014 and one site in 2013), and of Short-eared Owls at one site (compared with one site in 2014 and 3 sites in 2013). There were no sites where breeding owls were abundant in 2015, while two such sites existed in 2014. Snowy Owls were common breeders at a single site, in Sweden, which happened for the first time in a period of 30 years. Breeding areas of owls included also Lower Ob' River, where Short-eared Owls bred in this year, and the north of Alaska, where Snowy Owls bred in low numbers. Accordingly, a frequency of Snowy Owl reporting increased in 2015, but the number of breeding sites notably decreased, and frequency of Short-eared Owl reporting dropped to the lowest level after 2010.

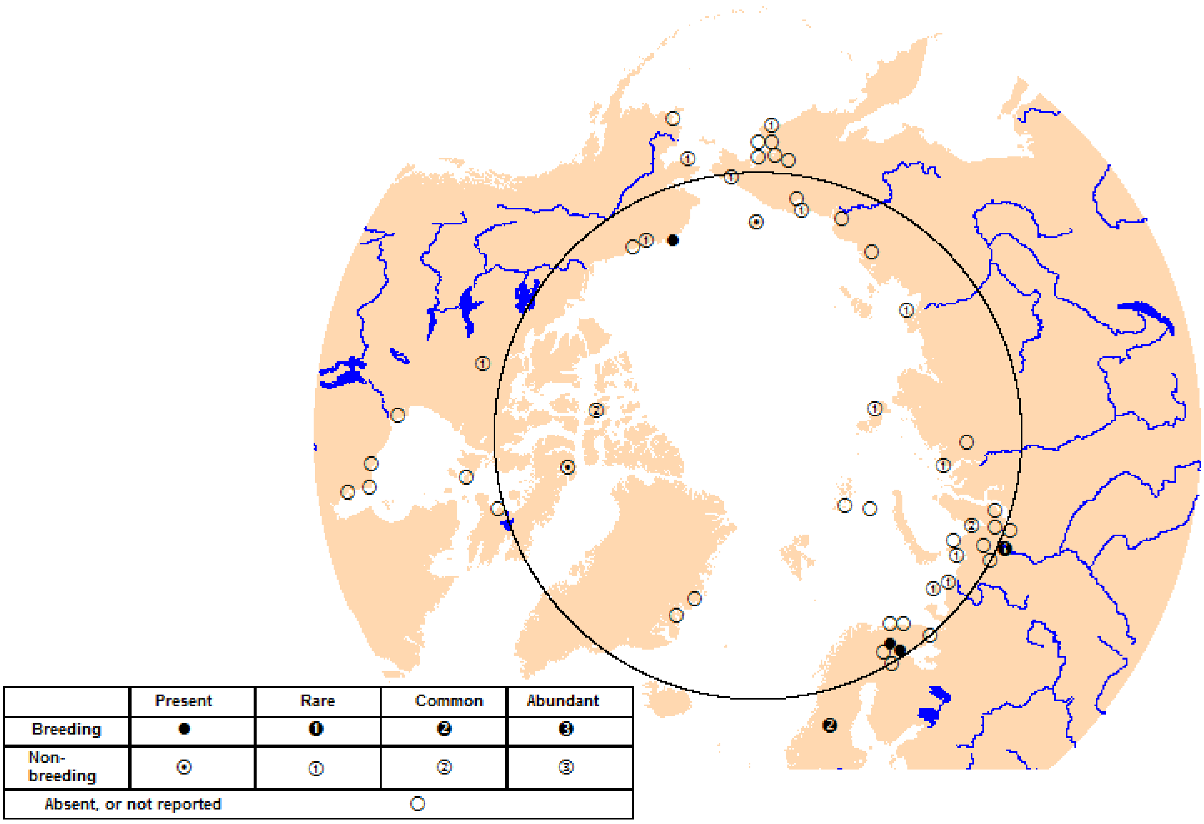

Figure 5. Abundance of owls in the Arctic in 2015

Pomarine Skua *Stercorarius pomarinus*, another conspicuous rodent-specialist, was recorded in 2015 at 15 site (Fig. 6) which is lower number than in 2014, when the species was observed at 19 sites, but similar to the observation rate in 2013 (16 sites). Breeding of Pomarine Skuas was reported from only two sites, and these birds were not abundant anywhere, with an exception of annual mass occurrence on spring migration in the south-eastern Chukotka. Skuas were common on Golets Island in the extreme north-east of Europe, but breeding was confirmed only for a single pair there. It is obvious that reproductive effort by Pomarine Skuas decreased in 2015 compared with 2014, when they bred at 6 sites. Pomarine Skuas did not breed on Bylot Island in Canadian Arctic Archipelago, although the abundance of lemmings there was high for a second year in a row.

Distribution of Rough-legged Buzzards *Buteo lagopus* did not change notably in 2015 (Fig. 7) compared with the previous year. However, while the total number of sites where the species was recorded changed little, from 27 sites in 2014 to 26 sites in 2015, the number of breeding sites increased from 14 to 19, e.g., from 52% to 73% of the total number of sites with records. As previously, the number of observations from Eurasia (22) massively prevailed over observations from the Nearctic (4), as well as the number of breeding sites (16 versus 3). Reproductive effort of Rough-legged Buzzards was low at most sites, as they were rare breeders at 12 sites, common at 4 sites, and abundant at a single site, on Vaigach Island. Buzzards are specialized on rodents to a lesser extent compared with Snowy Owls and Pomarine Skuas which allows them to breed at a low abundance of rodents. High availability of alternative avian prey allows Rough-legged Buzzards to breed in relatively high numbers at uninhabited by rodents sites, such as Kolguev Island (Pokrovsky *et al.* 2015).

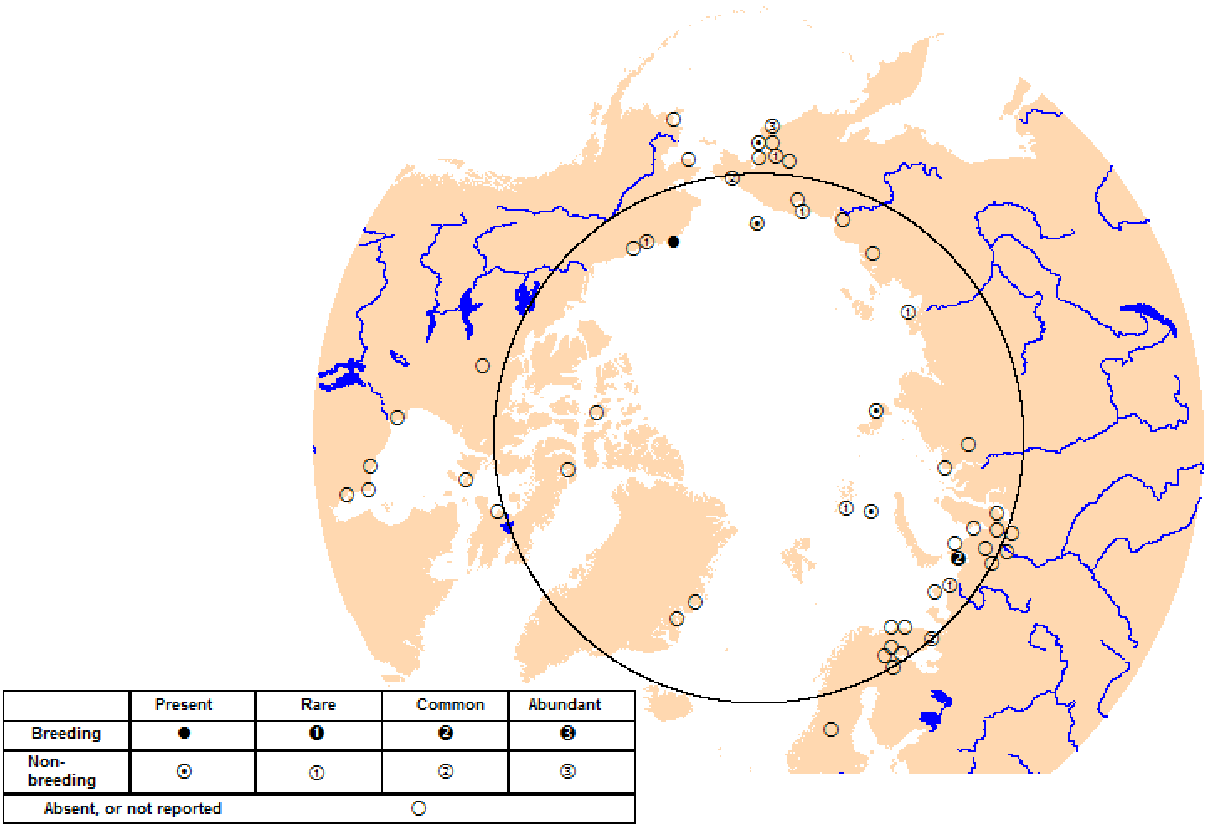

Figure 6. Abundance of Pomarine Skuas in the Arctic in 2015

Information about other avian predators was generally not sufficient for the assessment of their impact on breeding success of tundra birds. A notable exception is represented by the White-tailed Sea Eagle *Haliaeetus albicilla*, which numbers and predation pressure on other large birds in the European part of the Arctic has continued to grow. Increasing number of reports of predation by eagles on incubating birds was registered in 2015. Eagles continued to capture incubating Common Eiders *Somateria mollissima* and gulls on islands of the Kandalaksha Bay in the White Sea, and incubating Barnacle Geese *Branta leucopsis* in the Pechora Delta area. This activity was also discovered in 2015 on islands of south-east of the Barents Sea. Strong adverse impact of White-tailed Sea Eagles on reproductive success of seabirds was observed in colonies of Kittiwakes *Rissa tridactila* and guillemots *Uria spp.* on islands near the northern coast of the Kola Peninsula.

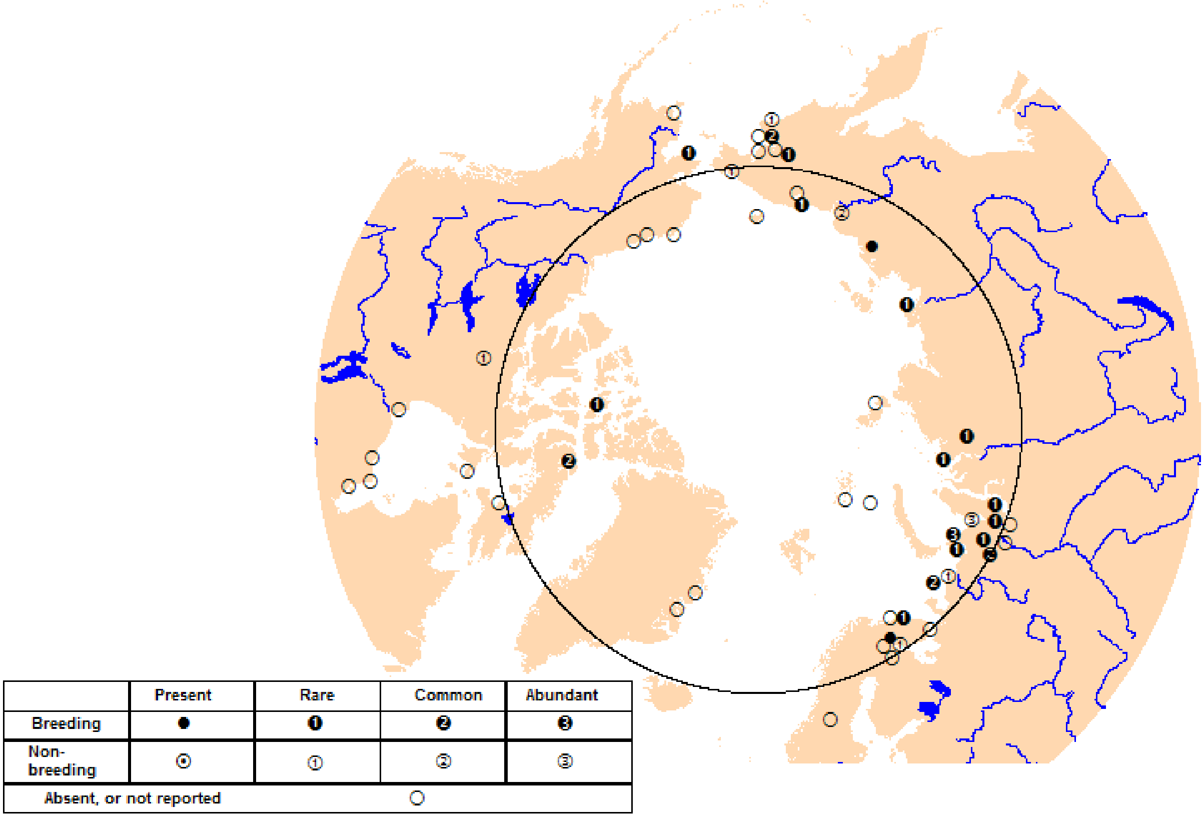

Figure 7. Abundance of Rough-legged Buzzards in the Arctic in 2015

Distribution and numbers of tundra birds

Information from respondents sometimes contains unusual observations of birds including records outside of their distribution range. A few such observations in 2015 included one nesting pair of Barnacle Geese in the north-west of Taimyr which was the first breeding record of the species on Taimyr, in Siberia and in Asia. Vagrant Common Goldeneye *Bucephala clangula*, two Golden Eagles *Aquila chrisaetos* and Blyth's Reed Warbler *Acrocephalus dumetorum* were observed in the same area on Taimyr. Breeding of Steller's Eider *Polysticta stelleri* was confirmed for the first time on Severnaya Zemlya archipelago, while Redwings *Turdus iliacus* expanded north along the lower Kolyma River valley following shrub expansion in the area. Four species of North-American passerines recorded as vagrants in the north of the Chukotka included Fox Sparrow *Passerella iliaca*, Golden-crowned Sparrow *Zonotrichia atricapilla*, White-crowned Sparrow *Z. leucophrys* and Dark-eyed Junco *Junco hyemalis*. A couple of adverse tendencies in species distribution was reported. Turnstones *Arenaria interpres* and Arctic Terns *Sterna paradisaea* stopped nesting on the Belyaka Spit in the north of Chukotka, where previously these species were common breeders.

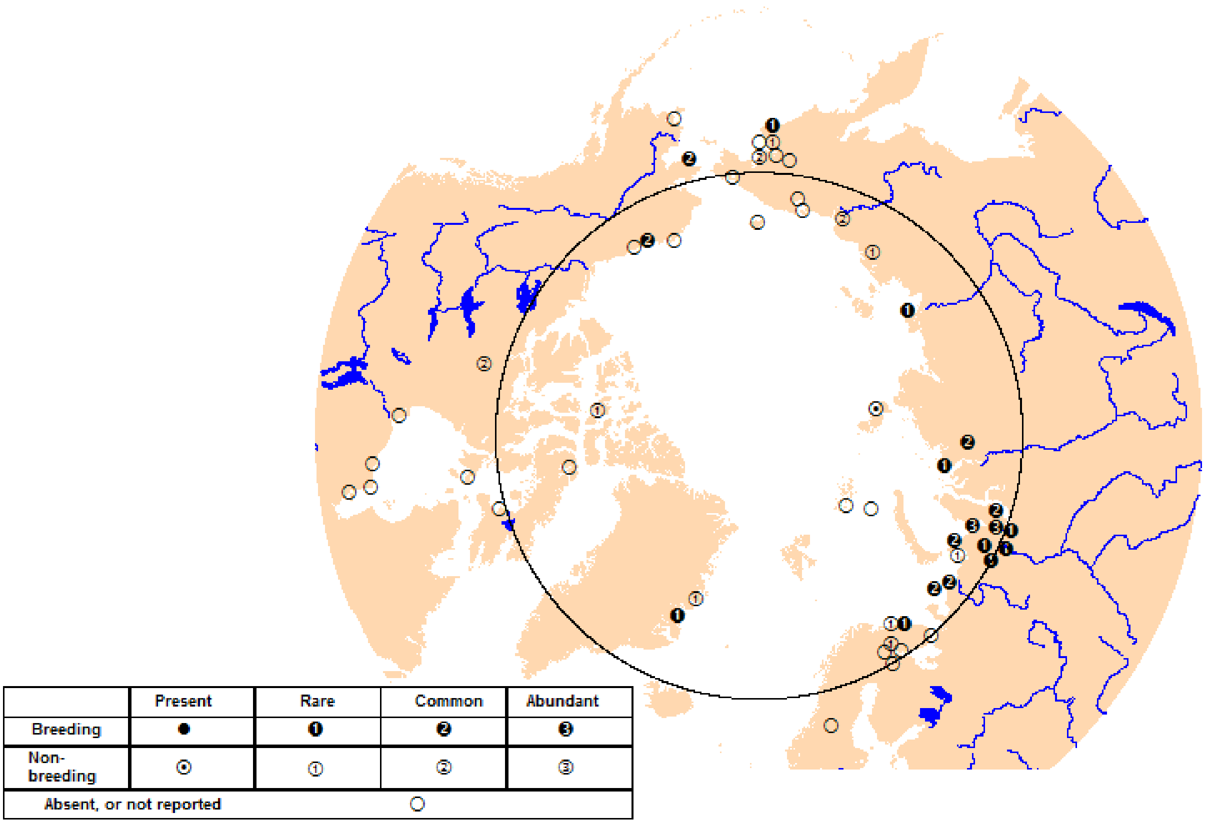

Figure 8. Abundance of grouse and ptarmigan in the Arctic in 2015

Information about emerging trends in the abundance of Willow Grouse *Lagopus lagopus* and Rock Ptarmigan *L. mutus* are of particular interest, because these species show pronounced dynamics in numbers which is relatively easy to assess due to conspicuousness of these birds. Figure 8 shows abundance and breeding status of grouse and ptarmigan in the Arctic in 2015. The number of sites where each of the two species was observed in 2015 decreased compared with the previous years. Willow Grouse were recorded at 19 sites (compared with 36, 31, 30, 27, 23 sites in 2010-2014, respectively), and Rock Ptarmigans were recorded at 11 sites (compared with 20, 17, 11, 11, 16 sites in 2010-2014, respectively). This dynamics tallies with a general tendency of decreasing abundance in most regions. Willow Grouse were reported abundant in 2015 at two sites, both on the Yamal Peninsula, while there were 4 of 23 sites with high numbers across the Arctic in 2014 and 6 of 25 in 2013. Elsewhere this species was mostly common (10 of 19 sites), but rare on the Kola Peninsula, in Yakutia and Chukotka. The abundance of Rock Ptarmigans did not change notably in 2015 compared with 2014 and they remained common in Alaska and rare almost everywhere in Eurasia and Greenland.

Breeding success

Breeding success of birds in the Arctic in 2015 was assessed at 38 of 53 sites (72%, Fig. 9), which is similar to the value of 2013 (70%) and higher than in other recent years (61% in 2014, 53% in 2012 and 52% in 2011). The assessment was based on nest survival estimates at 38% of sites (54% in 2014), while at other sites it was based on impressions of observers about abundance of broods or juveniles of local origin at the end of the breeding season.

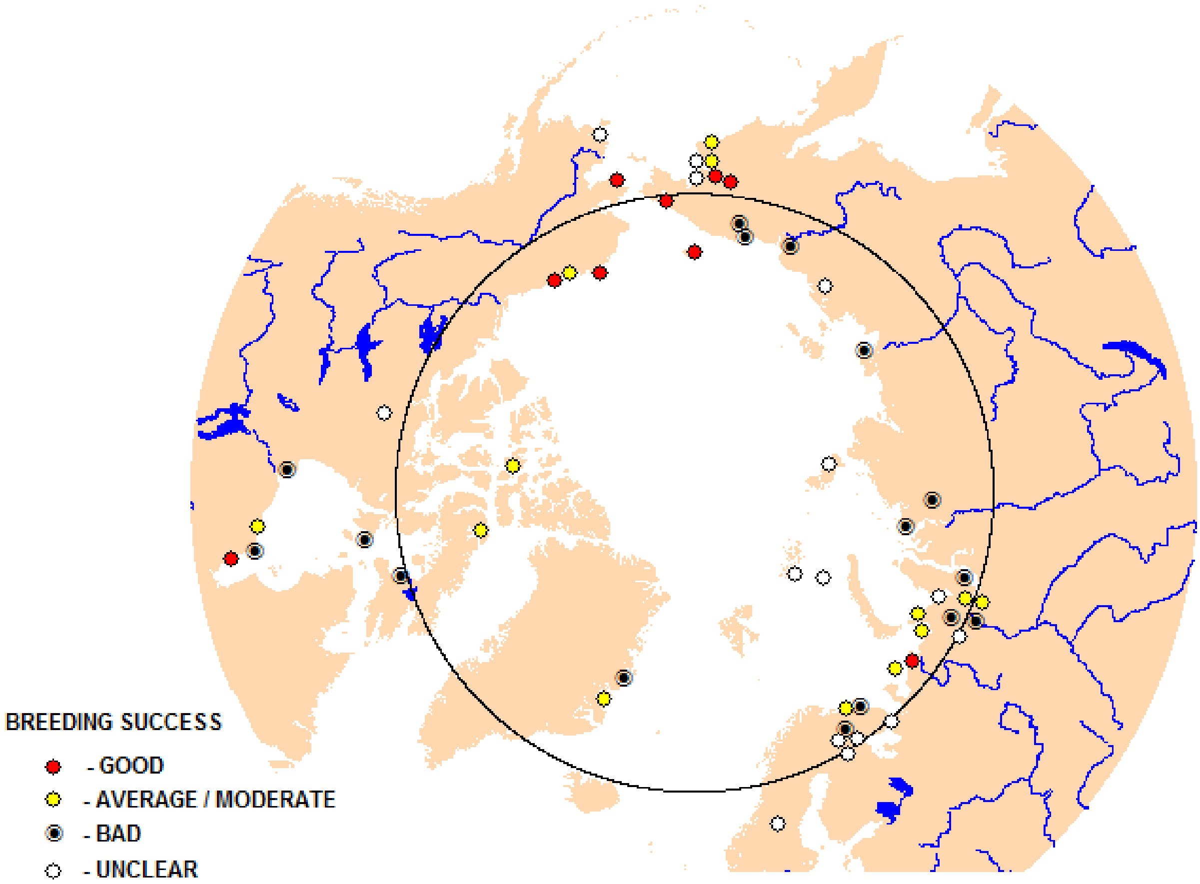

Figure 9. Bird breeding success in the Arctic in 2015.

The number of sites with high and low ranks of bird breeding success increased in 2015 compared with 2014 from 3 to 9 (i.e., from 11% to 24%) and from 8 to 16 (i.e., from 28% to 42%), respectively, on behalf of the number of sites with average success, which decreased from за 61% to 34%. This result did not support a tendency of the previous three years of a nearly constant fraction of sites with low breeding success and redistribution of remaining sites between groups with average and high ranks. In 2015 sites with high breeding success prevailed in the east of Chukotka and in Alaska and sites with average success prevailed in the European Arctic. The number of sites with low success was nearly the same as the number of sites with higher success on the Yamal Peninsula, in the Canadian Arctic and in north-eastern Greenland. A vast region with low breeding success at all sites included Taimyr, Yakutia and north-western Chukotka (Fig. 9). Rodent abundance decreased to low level in this region in 2015 and the abundance of Arctic Foxes was high, which explains the observed situation with bird breeding success. The conclusion about bird breeding failure across major part of the north of Siberia tallies fully with observations on Australian non-breeding grounds where juvenile proportions in waders breeding in Siberian tundra were very low in winter 2015/2016, while juvenile Bar-tailed Godwits *Limosa lapponica baueri* from Alaska occurred in higher than average numbers (Minton et al. 2016).

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