WATERBIRDS ON THE EDGE: IMPACT ASSESSMENT OF CLIMATE CHANGE ON ARCTIC-BREEDING WATER BIRDS

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Executive Summary

The purpose of this study is to investigate the potential impacts of climate change on a number of Arctic breeding of water birds species. The study applies the HadCM2 general circulation model (GCM) of the Hadley Centre to assess the direct impacts of a changing climate on the breeding conditions of five selected Arctic waterbird populations. Additionally, the current distribution of 20 species is being compared with changes in vegetation predicted by two climate scenarios, a moderate one based on rise in temperature of only 1.7^0C (HadCM2SUL) and an extreme scenario with a rise of 5^0C (UKMO) at the time of CO_2 doubling (2070-2099).

Analysis of spring and summerdata of temperature and precipitation of the last 50 years, interpolated over the area of the species' currently known distribution, demonstrate a significant correlation between the mean June temperature and the juvenile percentage as a measure of breeding success in the Arctic inboth tested populations of the Greater White-fronted Goose (*Anser albifrons*) and in the Taimyr population of the Knot (*Calidris c. canutus*). The Nearctic population of the Knot (*C. c. islandica*), as well as the Curlew Sandpiper (Calidris ferruginea) breeding on the Taimyr Peninsula, did not show a correlation with the mean June temperature.

Under the HadCM2 model, an increase of 1% CO_2/yr results in a moderate increase of the mean June temperature in the Arctic breeding area of Taimyr breeding White-fronted Goose. The conditions for the Taimyr population is particular favourable for the period around 2020. In 2050, the temperature, according to the scenario, seems to fall again, but never below the average of the last 30 years. However, a considerable cooling on the breeding grounds of the goose population in West Greenland could lead to a drop in size of the fragile population, which winters only in the western part of the British Isles. According to the climate model, the temparture around 2080 would not be above the mean values of today.

For three tested wader populations, the pattern of response towards certain climate variables is not consistent and for these species we did not project the mean June temperature or other climate variables into a future scenario. More species need to be tested to ensure the inclusion of the right variables into future sceanrios. Despite these uncertainties, the study maintains that all Arctic water bird population breeding in the predicted area of cooler spring and summer temperatures between Northeastern Canada and West Greenland remain of special concern. Most of them, including the Nearctic Knot and the Sanderling (*Calidris alba*) winter regularly in British coastal waters.

The results of the vegetation models show a large variation in the impact of predicted changes in vegetation on the 20 species. According to the moderate HadCM2Sul, 76% of Tundra Bean Geese (*Anser fabalis rossicus/serrirotris*) will be affected by the alteration of tundra habitats, whilst only 5% of the Sanderling will be affected. For two of the three globally threatened water birds occurring in the Arctic, namely the Red-breasted Goose (*Branta ruficollis*) and the Spoon-billed Sandpiper (*Eurynorhynchos pygmeus*), 67% and 56% respectively of their

current breeding range will change from tundra to forest. The values for the extreme UKMO scenario are even higher, reaching 99% for the Red-breasted Goose. This additional loss of habitat will place these two species at a higher risk of extinction. The Emperor Goose (*Anser canagicus*), already in decline and with 55% of its small range affected, is highlighted as needing further conservation attention.

The results from this study require careful interpretation. Although in Alaska there is already evidence of an increase in forest area, and pollen analyses from the Holocene indicate that vast shifts in forest areas occurred duringinterglacial periods, scientists still argue about the likelihood of such scenarios and about the rate, speed and scale of forest growth into the tundra. However, the results of this study reflect an important component in a matrix of factors affecting the continued existence of Arctic-breeding water birds. They have to be interpreted in relation to other factors affecting the populations of these birds, such as natural predation, hunting (mainly outside the Arctic) and effects of climate change (in particular sea-level rise) outside the Arctic. Further research will be carried out to refine the existing results, based on better distribution data and refined GCMs. Other important components such as sea level rise and change in river runoff in the Arctic and on the major staging areas during migration will be taken into account.

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