
Future flights across the Arctic basin: Will climate change overturn bird migration?

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Abstract

Climate models predict that from 2050, the Arctic Ocean will be sea-ice free each summer. This will modify a wide range of ecological processes, including bird migration. We assessed the potential for new transarctic bird migration (overturning migration from the Atlantic into the Pacific) and/or arctic year-round residency as a result of a disappearing arctic sea-ice cover following global warming.

Among the 449 bird species which breed in the Arctic, we identified 24 which may stop migrating, and 29 which may engage in trans-arctic migration, on the basis of their biological characteristics. Potential future resident species were mainly pelagic seabirds and coastal migrants, whereas only arctic pelagic migratory birds may potentially engage in future transarctic migrations regarding sea-ice melt.

To illustrate the opportunities and constraints acting upon the birds engaged in those strategies, we performed an in-depth modelling study of the biogeography of the Little auk (*Alle alle*), a pelagic, migratory bird endemic to the Arctic, and one of the most numerous seabirds in the area. By coupling species distribution models (SDM) and climatic models, we estimated the range of future wintering and breeding areas, for resident or transarctic migratory individuals. Further, we used a mechanistic bioenergetics model (NicheMapper), to compare the energetic costs of current little auk migration from the high-Arctic into the temperate Atlantic, with potential future strategies of high-Arctic residency or transarctic migration from the North Atlantic into the North Pacific. Overall, we demonstrate that all three migratory strategies may occur in little auks; but that even if bird thermoregulatory costs may be reduced in a warming Arctic, transport costs across the arctic basin will remain substantial.

This study illustrates how global warming may impact the biogeography of migratory species, and how seascape conservation and marine management should integrate these upcoming major changes.

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