Waterbirds around the world

A global overview of the conservation, management and research of the world's waterbird flyways

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Cover photography: Whooper Swans *Cygnus cygnus* arriving at Martin Mere, England. Photo: Paul Marshall. (www.paulmarshallphotography.com)

Experimental disturbance of moulting Greenland White-fronted Geese *Anser albifrons flavirostris*

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Undisturbed wetlands are vital to waterfowl during their wing moult. In many Arctic goose populations, immature and non-breeding birds migrate to remote areas that contain both refuge lakes, safe from predators, and adequate food supplies for the moulting period. In West Greenland, even the most remote areas are today affected by many different human activities during summer. Moulting areas can be disturbed by mineral exploration (2.5-14.6% of ice-free land covered by licences in the 1990s), by hunters, their numbers increased 70% from 1994 to 2002, who now have the ability to reach most coastal areas in their motor-boats (20-fold increase since 1939), and by tourists (e.g. cruise liners have doubled over the last decade). In order to advise Greenland authorities, the aim of this study was to assess the behavioural and spatial response of moulting geese flocks to human intrusion.

Human disturbance was deliberately made to Greenland White-fronted Geese *Anser albifrons flavirostris* moulting on the Naternaq plain in central West Greenland. This Ramsar site holds about 10% of the total population of the Greenland White-fronted Goose (25-30 000). The study was carried out in July 1999 and 2000 in a 75 km^2 lowland tundra area dotted with lakes (68°18'N, 55°55'W). The hypothesis was that moulting geese would react to an intruding person in a similar way to their reaction to an attacking Arctic Fox *Alopex lagopus*: the geese would flee to a refuge lake and stay there until the intruder had disappeared, then normal behaviour would be resumed after a relatively short period. Prior to experimental disturbance, behaviour and distribution patterns of goose flocks were observed during one third of the moulting period (total c. 25 days). Goose flocks used lake systems of on average 4.4 lakes (SD=2.3, n=23) where distances between lakes were on average 52.9 m (SD=58.8, n=107). According to goose dropping counts, a strip no more than c. 20 m from lake shores was used for feeding and resting. There was a linear relationship between available feeding habitat and the number of moulting geese present at a lake ($y = 5.96x - 3.56$, df = 147, $R^2 = 0.74$, $P < 0.001$). This suggests that the food resource determines the number of moulting geese. The minimum feeding habitat that held geese was c. 2.3 ha. Furthermore, the distance from the nearest lake affected the presence of goose flocks: the shorter the distance the higher the likelihood of goose presence. A logistic regression model including feeding habitat and distance to nearest lake as variables, gave a highly significant description of the probability of a moulting goose flock to use a lake (Likelihood ratio $G^2 = 37.89$, df = 2, $P<0.0001$). From these analyses, it appears that the study area supports 70-75% of optimal goose numbers, indicating that few potential sites were vacant.

When a person disturbed the geese by walking straight towards a flock, it became alert at an average distance of 653 m (SD=263, n=14) and fled at a significantly shorter distance of 448 m (SD=155, n=14). Fleeing flocks continued running and swimming for on average 26 minutes (SD=15, n=16) and traversed 1.1 km (SD=0.6, n=16). Moulting habitats from where geese were disturbed were either reoccupied (average period without moulting geese 3.2 days (SD=1.0, n=9)) or not reoccupied during the moulting period (average period 6.3 days (SD=3.4, n=7)). On average, the vacant period lasted for 4.6 days (SD=2.7, n=16) or about 20% of the moulting period. The observed disturbance reactions can impact the geese by (i) reducing their feeding ability because undisturbed habitats are likely to be occupied or not suitable, (ii) causing energy loss of a minimum of 5% of daily energy intake (one incident) due to prolonged running and swimming, and (iii) exposing them to Arctic Fox attacks during fleeing, returning and within inadequate habitats.

Simulations of a person traversing 10 randomly chosen transect lines (width 1 km) through the study area were made. On average 10.4% (SD=10) of all lakes in the study area holding geese were disturbed.

The disturbance effect of one intruding person was much more profound than hypothesised, since the period where geese were affected was measured in days and not in minutes or hours. About half of the moulting habitats stayed vacant for 10-15% of the moulting period, while remaining habitats where flocks were disturbed were unoccupied for the rest of the moulting period. Fleeing geese were not likely to find other adequate moulting habitats because a high proportion were already occupied.

The wetlands of Naternaq Ramsar site hold about 10% of the world population of Greenland White-fronted Goose *Anser albifrons flavirostris*. Photo: David Stroud.