

Geographical variation in the bill patterns of Whooper Swans

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Introduction

Recent studies on swans in Britain have revealed that while the bill patterns of Bewick's Swans *Cygnus columbianus bewickii* show great individual variation (P. Scott 1966; Evans 1977; D. K. Scott 1978, 1981) the bills of Whooper Swans *Cygnus c. cygnus* are much less variable despite their larger size. Although extensive records exist of the bill patterns of the Bewick's Swan, there are very few for the Whooper Swan.

Sightings of intergrades between Bewick's and Whistling Swans *Cygnus c. columbianus* and out-of-range occurrences of both races (Evans & Sladen 1980) suggest some interchange between them. D. K. Scott (1981) suggests a cline in the extent of yellow on the bills of Bewick's Swans across the Soviet arctic, those in the east showing significantly less yellow than those in the west; this is possibly continuous with a similar variation across the Canadian arctic in the Whistling Swan. By contrast photographs of flocks of Whooper Swans in Japan (Anon 1978) gave the striking impression that the eastern Whooper Swan shows more yellow on its bill than its western counterpart.

Quantitative data on the frequency of Whooper Swan bill patterns were collected during field-work in Iceland, Scotland and Japan, and from photographs and notes.

Study areas

Flocks of Whooper Swans were observed in Scotland in the winters of 1979/80 and 1980/81, at Manor Farm near Stirling and the Wildfowl Trust refuge at Eastpark Farm, Caerlaverock, Dumfries. Supplementary data from the Wildfowl Trust refuge at Welney, Norfolk, were made available by D. K. Scott. Similar observations were made at four localities in Iceland during the summers of 1978, 1979 and 1980. Ellithavatn near Reykjavik, Arnarvatn near Myvatn, and marshes to the north-west of Myvatn were breeding sites; a bay called Neslandavik, on the west side

of Myvatn was a moulting ground.

In Japan, flocks were observed in February and March 1980 at Odaito, on the northern island of Hokkaido and on the main island of Honshu, at Kominato and Ominato (Aomori prefecture), Izunuma (Miyagi prefecture) and Hyoko (Niigata prefecture). Odaito, Kominato and Ominato were marine; Izunuma was a natural freshwater lake and Hyoko a man-made lake. At all five localities the swans were fed either by a resident swan-keeper and/or by the general public. Large numbers could therefore be observed at close quarters.

Methods

Each flock was scanned when birds were close enough to be classified. Where little or no movement of the flock was occurring, each individual was watched until its bill could be seen adequately (i.e. the culmen was fully visible) before moving on to the next individual. Where movement was occurring a continuous scanning method was used, recording only those birds where the bill was already visible. Inevitably, since swans spend much time feeding and sleeping there was always a proportion of the flock which could not be classified. When more than one scan was made at a single locality, that recording the highest total number of individuals was used in the analysis. During the study, 898 bill patterns were recorded, 264 from Europe and 634 from Japan.

Results

The bill patterns of Whooper Swans are not as variable as those of the Bewick's Swan, making individual recognition more difficult. Moreover the patterns do not fit usefully into the classification 'darky', 'pennyface' and 'yellowneb' used for Bewick's Swans (P. Scott 1966). In the Whooper Swan, darkies (where the culmen is black from the tip of the bill up the centre-line to the feathering: Fig 1a) are

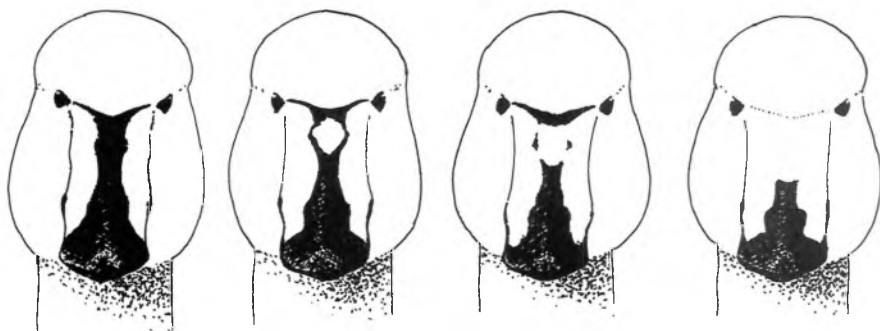


Figure 1. Bill patterns of the Whooper Swan (D. K. Scott).

extremely uncommon and pennyfaces (Fig 1b) are also uncommon; yellownebs constitute the bulk but can be divided into two types, black-base (where there is a continuous black line along the feather line from eye to eye and sometimes extending down the culmen: Fig 1c) and yellow-base (where the base of the bill is yellow or where there are only a few spots of black along the feather line: Fig 1d).

Using these four categories, birds could be classified easily at fairly close range (<200 m). Of the 264 individuals categorized in Europe, only 2 (<1%) were darkies, 8 (3%) were pennyfaces, 196 (74%) were black-based yellownebs and 58 (22%) were yellow-based yellownebs. On the other hand, of the 634 individuals categorized in Japan there were no darkies, 3 (<1%) pennyfaces, 23 (4%) black-base yellownebs and 608 (96%) yellow-base yellownebs.

Pennyfaces and darkies were lumped with black-based yellownebs for further analysis. The difference in proportions of yellow and black-based yellownebs between Japan and Europe was highly significant, there being more yellow-based and fewer black-based birds in Japan than in Europe ($\chi^2 = 531.84$, $df = 1$, $p < 0.001$).

Much of the data from Iceland were collected from photographs viewed under a hand lens. This is likely to produce a bias towards yellow-bases since small amounts of black along the feather line can be missed. There were apparently more yellow-bases in Iceland than in Scotland ($\chi^2 = 5.0$, $df = 1$, $p < 0.05$). However, the overall difference between Europe and Japan is upheld if Iceland is compared

separately with Japan ($\chi^2 = 524$, $df = 1$, $p < 0.001$). The proportions of the different bill patterns from Welney (85 birds) were found to be almost identical with those from Scotland.

Discussion

For the Bewick's Swan the higher proportion of darkies in the east compared with the west 'is consistent with the likelihood of significant gene flow across the Bering Straits between Bewick's and Whistling Swans' (D. K. Scott 1981). The cline in the Whooper Swan however, is in the opposite direction and, as a consequence, the bill patterns of Whoopers are maximally different from those of the Trumpeter Swan *cygnus c. buccinator* where their present ranges are closest, indicating perhaps a much earlier divergence of these two species, or a more consistent isolation.

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Summary

Field observations in Britain, Iceland and Japan showed that Whooper Swans *Cygnus c. cygnus* at the eastern end of their range have more yellow on their bills than do those at the western extreme. While the bill patterns of Bewick's *C.*

columbianus bewickii and Whistling Swans *C. columbianus columbianus* are most similar where their ranges are closest, those of the Whooper and Trumpeter Swans *C. c. buccinator* are then most different. The latter pair may have diverged earlier or have remained more consistently isolated.

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A 'yellowneb' Whooper Swan *Cygnus cygnus* showing a black brow. (Dr L. W. S. Eyears)

