A COMPARATIVE ANALYSIS OF THE BILL MARKINGS OF WHISTLING AND BEWICK'S SWANS AND OUT-OF-RANGE OCCURRENCES OF THE TWO TAXA

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ABSTRACT.—The only reliable field characteristic distinguishing Whistling from Bewick's swans appears to be the proportions of yellow on their bills, although this has never been quantified. Photographs of the right bill profiles of 300 Whistling Swans and 104 Bewick's (of bill pattern type similar to that of Whistling Swans) were compared. The average proportions of yellow were 3.1% for Whistling Swans and 31.5% for Bewick's, with discrete ranges. Such a large separation in amount of yellow lends credence to the growing number of records of Whistling and Bewick's swans outside their normal ranges. These records are reviewed, as well as records of intergrades. In seven cases where suitable photographs existed, the proportions of yellow on the bill were measured. This confirmed two Whistling Swans in Japan, one (or an intergrade) in England, and three Bewick's Swans and an intergrade in North America. *Received 27 November 1979, accepted 1 April 1980.*

YARRELL (1830) named the Bewick's Swan *Cygnus bewickii* in 1830 but 2 yr later questioned whether this Eurasian swan was indeed specificially distinct from the North American Whistling Swan (Johnsgard 1974), named *Anas columbianus* in 1815 (*Cygnus* later replacing *Anas*). The debate has continued: Stejneger (1882), Wetmore (1951), and Vaurie (1965) regarded them as separate species, while Hartert (1920), Delacour and Mayr (1945), Parkes (1958), and Mayr and Short (1970) considered them conspecific. Palmer (1976) subscribed to this view, suggesting the one inclusive name "Tundra Swan." Portenko (1972) and Johnsgard (1974) went furthest in "lumping" by suggesting that the Trumpeter Swan (*Cygnus buccinator* or *Cygnus c. buccinator*) and the Whooper Swan (*Cygnus cygnus* or *Cygnus c. cygnus*) should also be regarded as the same species, all to be called *Cygnus cygnus,* "Northern Swan," with each of the four swans as subspecies.

Those Bewick's Swans that winter in China, Japan, and Korea have been considered by some to be an eastern race *jankowskii,* with an alleged difference from *bewickii* of a longer bill with more yellow on it. Vaurie (1965) considered this distinction invalid, and measurements made by M. E. Evans support this view: the bill lengths of four adults (two ♂♂, two ♀♀) and two cygnets (one ♂, one ♀), received by the Wildfowl Trust, Slimbridge, England from Hong Kong in 1973 as *jankowskii,* fell within the ranges for *bewickii* given by Evans and Kear (1978), and their bill patterns appeared typical for *bewickii. Jankowskii* is thus not considered separately in this paper.

Recently, the case for conspecificity of Bewick's and Whistling swans has been reinforced by the discovery of their interbreeding in the wild (reviewed later). Their breeding and other behaviors are similar (Evans 1975, 1977a, Scott 1977), and they are also alike in most physical characteristics: body weights and measurements (lengths of bill, tarsus, and wing) overlap considerably, although comparison of the means shows the Whistling Swan to be slightly larger (Scott et al. 1972, Evans and Kear 1978). Their voices are the same, as are anatomical features such as the position

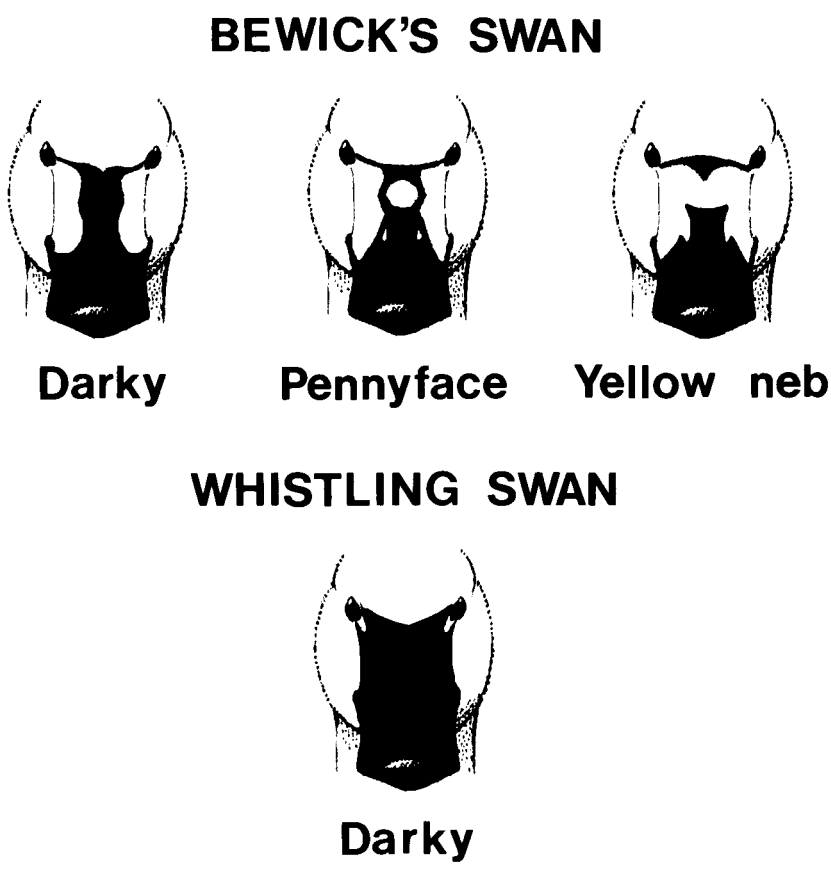

Fig. 1. Types of bill patterns among Bewick's and Whistling swans. (Further variations in the line where the bill and feathering meet and in the sides of the pattern among Bewick's Swans are also shown.)

of the trachea within the sternum. The only reliable field characteristic appears to be the bill. In Whistling Swans this is predominantly black, usually with a small and variable patch of yellow in front of the eye. In Bewick's Swans the proportion of yellow is much larger, although again variable among individuals. The main aims of this paper are to quantify the proportions of yellow on the bills of each of the two subspecies, to determine whether this characteristic is a valid diagnostic feature, and to summarize the occurrences of each subspecies outside its normal range.

METHODS

Whistling Swans.—Over 3,000 Whistling Swans were captured for neck and/or tarsal banding between 1967 and 1976 (Sladen and Kistchinski 1977). Most were captured by cannon-nets or baited wire traps in Maryland or North Carolina on their eastern wintering grounds. The remainder were caught on their breeding grounds on the north slope of Alaska or in western Alaska when molting.

A 35-mm color transparency was taken of the right side of the head of each adult swan, with its identifying neckband. Three hundred of these were selected at random for analysis. They fulfilled the requirements that the bill be at right angles to the camera lens and free from shadows and restrainers, such as fingers. Each transparency was projected onto graph paper, and outlines were made of the complete bill and its yellow patch. From this, the porportion of yellow to the whole bill profile (which included any pink/orange stripe at the gape between the maxilla and mandible) was calculated.

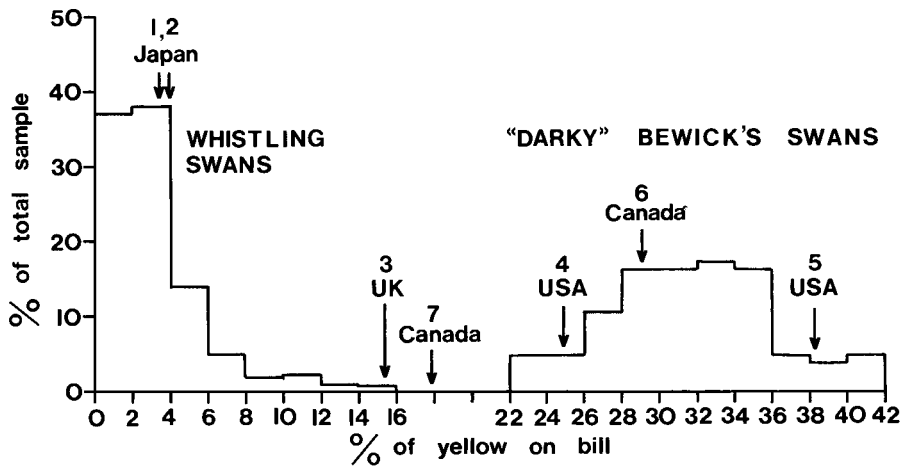

Fig. 2. Proportions (%) of yellow on bills of Whistling Swans and "darky" Bewick's Swans. Numbered sightings of probable Whistling or Bewick's swans outside their normal ranges (ref. Table 1) are also shown.

Bewick's Swans.—Bewick's Swans from their Soviet breeding grounds have been attracted in winter to a lake at the Wildfowl Trust, Slimbridge, England since 1964 by protection from disturbance and a daily food supplement (Evans 1979). By March 1978, 2,400 had been identified individually by their unique black and yellow bill patterns, observed from a few meters distance (Scott 1966, Evans 1977b). These patterns were drawn onto proforma outlines of the left and right profiles and a front view of the head. Many were additionally photographed on the lake through a 600-mm lens or when captured for tarsal banding in a channel off the lake (Evans and Rees 1978). The two profiles and front view of the head of each swan were recorded on black and white prints, together with the code of its tarsal band.

Following Scott (1966), bill patterns of Bewick's Swans are described as being of three different types (Fig. 1): (1) *Darky*—the black extending up the center of the culmen from the tip to the brow; (2) *Pennyface*—the black extending from the tip to the brow but with a varying patch of yellow in the center; and (3) *Yellow neb*—no continuous black from the tip to the brow, i.e. yellow from side to side of the culmen.

The bill patterns of this sample of 2,400 were divided into these three types. Because the Whistling Swan bills were, by definition, all "darky" (Fig. 1), the analysis of the Bewick's Swans' bills was confined to this type for this paper. The same criteria as those applied to the Whistling Swan transparencies were used, leaving 104 right-sided profiles of Bewick's Swans for analysis. The outlines of the bill profile and yellow patch were traced onto graph paper.

Results

The mean proportion of yellow on the bill profiles of Whistling Swans was 3.1%, with a range of 0–16%. Figure 2 shows the frequency distribution of the proportions of yellow. Only 9 birds (3% of sample) had no yellow patch at all, and only 13 (4.3%) had yellow patches representing 10% or more of the total profile. The largest proportion of yellow was 15.8% (Fig. 3).

Among Bewick's Swans, the proportions of "darky," "pennyface," and "yellow neb" types from our sample of 2,400 were 17.9%, 19.1%, and 63.0%, respectively. The mean proportion of yellow on our sample of 104 "darky" types was 31.5%, with a range of 23–42% (Fig. 2), the bill "closest" to that of a Whistling Swan (22.9%) being shown in Fig. 3. The difference between the mean proportion of yellow on the bills of Whistling Swans and "darky" Bewick's Swans was highly significant ($P < 0.001$, t-test).

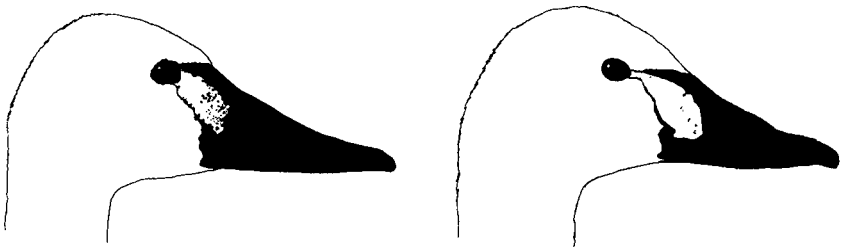

Fig. 3. Whistling Swan with most yellow (15.8%) on its bill (left) and Bewick's Swan with least yellow (22.9%). (Traced from photographs.)

OCCURRENCES OF THE TAXA OUTSIDE THEIR NORMAL RANGES

The proportion of yellow on the bills of Whistling and Bewick's swans is thus a reliable diagnostic feature. These results are of more than theoretical interest, for such a distinct field characteristic is invaluable for monitoring occurrences of these subspecies outside their normal ranges.

The Whistling Swan breeds on the tundra of North America and winters in the west (southern Alaska to California) and the east (New Jersey to South Carolina) of the continent. This subspecies was reported as a straggler in northeast Siberia: in November 1882 on Bering Island, in June 1897 and May 1907 at Novomarinsk (present name—Anadyr), and on an unrecorded date on the Anadyr River (Dementiev and Gladkov 1952). In July 1974 a pair with three young and five other Whistling Swans were discovered on the Chukotski Peninsula, around Kolyuchinskaya Bay, in northeast Siberia (Kistchinski et al. 1975). Another pair was found with four young, one parent being a Whistling Swan, the other a Bewick's Swan. Whistling Swans have also been reported wintering in Japan in 6 of the 12 winters since 1968 (T. Ohmori pers. comm.) At least one was apparently paired to a Bewick's Swan. A swan with patches of yellow on its bill small enough to be a Whistling Swan was recorded by M. E. Evans among flocks of Bewick's Swans at Slimbridge in 1968–69 and 1969–70 (the same swan), and a second individual with small patches in 1975–76. One possible Whistling Swan was reported by W. J. L. Sladen (unpublished) among hundreds of Bewick's Swans at Welney, on the Ouse Washes, Cambridge/Norfolk, England in 1971–72, and another was reported in Ireland from December 1978 to February 1979 (F. King pers. comm.).

Bewick's Swans breed in tundra habitat similar to that of the Whistling Swan, mostly within the Arctic Circle from the Kanin Peninsula (45°E) (A. Kistchinski pers. comm.) to Chaunskaya Bay (ca. 170°E) (Dementiev and Gladkov 1952). It is supposed that the swans west of the River Lena migrate southwest to winter in Germany, Denmark, The Netherlands, England, and Ireland and that those to the east of the river migrate to China, Japan, and Korea. In March 1971 a possible Bewick's Swan (an injured bird subsequently held in captivity) was photographed by W. J. L. Sladen (unpublished) at Claiborne, Talbot County, Maryland. In February 1974 W. J. L. Sladen and E. O'Neill (unpublished) saw a Bewick's Swan in a flock of about 4,000 Whistling Swans in the Lower Klamath National Wildlife Refuge, Worden, Oregon. Its mate was a Whistling Swan, and they had a family of two cygnets. In January 1975 a Bewick's Swan and three immature swans, either

TABLE 1. Proportion of yellow on the bills of probable Whistling or Bewick's swans outside their normal ranges.

Ref. no. in Fig. 2	Place and date of sighting	Proportion of yellow on bill	Probable identity
	In normal range of Bewick's Swan		
1	Lake Izu, Japan, 1972–73	3.3%	Whistling Swan
2	Lake Inawashiro, Japan, ?	3.9%	Whistling Swan
3	Slimbridge, England, 1975–76	15.3%	Whistling Swan or Whistling × Bewick's intergrade
	In normal range of Whistling Swan		
4	Claiborne, Maryland, USA, March 1971	24.8%	Bewick's Swan
5	Tule Lake, Oregon, USA, Feb. 1974	38.2%	Bewick's Swan
6	Regina, Alberta, Canada, Oct./Nov. 1978	29.0%	Bewick's Swan
7	Regina, Alberta, Canada, Oct./Nov. 1978	17.8%	Whistling × Bewick's intergrade

Bewick's or Bewick's × Whistling intergrades, were seen on Hog Lake, near Red Bluff, California, with about 200 Whistling Swans (Stallcup and Winter 1975). This Bewick's Swan appeared to have a Whistling Swan mate (S. Laymon pers. comm.), and two other adults, possible intergrades, were reported with them (J. V. Remsen pers. comm). The possibility is that the same breeding pair was at Worden and at Hog Lake. In each case the Bewick's Swan was large, but, unfortunately, photographic details of each sighting were insufficient to determine conclusively whether the birds were the same or different. If, however, the same pair were involved in both years, the two possible intergrade adults in 1975 may have been their cygnets from the previous year. Association of former offspring with their parents during the winter has been observed frequently in Bewick's Swans (Evans 1979). An adult Bewick's Swan and an immature, thought to be different from those on Hog Lake, were seen west of Oroville, California in February 1975 (Stallcup and Winter 1975). Stallcup and Winter (1976) reported 2 swans with bills matching the pattern of Bewick's Swans and 10 others with more yellow than on normal Whistling Swans among 3,000 swans at Victoria Island, California in 1975–76. They further reported a Bewick's Swan with 1,000 Whistling Swans at Chico Sewage Ponds, California. In 1977–78 Winter and Manolis (1978) reported a Bewick's Swan, as well as three possible Bewick's × Whistling Swan intergrades, on Victoria Island, California. Another possible intergrade was near Benton, California. In October and November 1978 a Bewick's Swan, paired to a Whistling Swan, was present among Whistling Swans 16 km north-northwest of Regina, Saskatchewan, Canada (R. Kreba pers. comm.). Also present was a possible intergrade, although it was not noticeably accompanying the Bewick's Swan. All were extensively photographed, and from the bill pattern it was unlikely that the Bewick's Swan was the same bird as at Worden and Hog Lake.

Finally, in December 1977 a coded orange neck band was found on a dead swan washed up on a lagoon beach on Adak Island, Aleutian Islands National Wildlife Refuge, Alaska (J. Martin pers. comm.). This neck band had been placed on a Bewick's Swan cygnet in Chaunskaya Bay in northeast Siberia by A. Y. Kondratiev and other Soviet scientists in August 1977 as a part of the U.S.-USSR Environmental Protection Agreement. This is the first record of a banded Bewick's Swan in North America.

In seven cases, where suitable photographs existed of the sightings summarized above, we analysed the bill patterns by the same methods as described earlier. The results (Table 1) confirmed two Whistling Swans in Japan and one Whistling Swan (or possibly an intergrade) in England, and three Bewick's Swans in North America. A further intergrade in North America was suggested.

Interest in looking closely at swans has grown from two programs. One, organized through the Wildfowl Trust in England since 1964, has used bill patterns of Bewick's Swans (some with coded color tarsal bands) to identify individuals (Evans 1977b). Elsewhere, in Eurasia and in North America, the Swan Research Group of the International Waterfowl Research Bureau has, since 1970, been marking individuals in a circumpolar program using coded color neck and/or tarsal bands (Sladen and Kistchinski 1977). Looking for characteristic bill patterns or neckbands necessitates the careful and painstaking examination of every individual in the flocks. Thus, we anticipate more photographic data for measurements similar to those used here.

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A.O.U. Announcements

Fellows and Elective Members are reminded that nominations for Elective Member may be submitted to the Secretary on the prescribed form up until five months prior to the opening of the next Stated Meeting. The deadline for 1981 is **24 March.** Nominations for Fellow of the A.O.U. also must be received by that date. Nominations for Vice-President and Elective Councilors (3) may be made in writing to the Secretary at any time prior to the Annual Meeting.

The 99th Stated Meeting of the A.O.U. will be held at the **University of Alberta, Edmonton, Alberta, Canada** during the week of **August 24–27, 1981.**

The American Ornithologists' Union solicits applications for research grants from its **Josselyn Van Tyne** and **Alexander Wetmore Memorial Funds.** The Van Tyne awards will consider any aspect of avian biology; the Wetmore awards are limited to taxonomy/systematics. Grants are usually in amounts of a few hundred dollars. Preference is given to students and other persons without other sources of funds. Application forms may be obtained from **Dr. A. S. Gaunt, A.O.U. Committee on Research Awards, Department of Zoology, The Ohio State University, 1735 Neil Avenue, Columbus, Ohio 43210.** Applications must be completed before **18 March 1981.**