

Identifying Trumpeter and Tundra Swans



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Figure 1. The wide black facial skin on this adult swan results in the eye not being "isolated," making this a "textbook" Trumpeter. (This fieldmark is discussed in most field guides.) Photographed at Governor Knowles State Forest, Wisconsin, in October 1993. The adult Trumpeter in Figure 2, however, is more typical in that the black does pinch in a little, although not as much as in Tundra Swan.

by Michael A. Patten * and Matthew T. Heindel †

Separation of Trumpeter Swans (*Cygnus buccinator*) from Tundra Swans (*C. columbianus*) of any age is perhaps the most underrated field identification problem in North America. Misconceptions about how diagnostic certain marks are have caused much of the problem, as has a lack of ap-

preciation for just how variable Tundra Swans can be (cover photograph).

This article deals with the identification of all but one of the swans found in the Northern Hemisphere, including Tundra, Trumpeter (Figure 1), and Whooper (*C. cygnus*). Criteria for separating "Whistling" (*C. c. columbianus*) from "Bewick's" (*C. c. bewickii*) are also presented; these subspecies are often referred to

herein by their common names. There is also information on the separation of Bewick's and Whooper swans. Even so, not every problem in swan identification has a solution, and Trumpeter and Tundra swans can look surprisingly similar at any age. (This article does not cover Mute Swan, and observers are cautioned that some immature Mutes have been misidentified as immature Tundras).

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As with many other groups of birds (e.g., shorebirds, gulls), the observer must properly age a swan before attempting to identify it to species; many potentially useful field marks are age related. Look for telltale signs of gray washed into the plumage, especially around the head and neck. Any gray feathering (not the rusty staining shown by many adults) or pink/ivory on the bill indicates that the swan is an immature, and therefore will present a greater challenge.

This paper attempts to unravel the mysteries of swan identification while also trying to dispel many of the misconceptions. Recent papers (e.g., Bailey 1991) have already done so to some extent, but we still have much to learn about the identification of this group of birds.

Taxonomy

Adding to the confusion in identifying Holarctic swans is the close systematic relationship among them. The AOU (1983), following Palmer (1976), recognized Trumpeter and Whooper swans as full species and considered Bewick's and Whistling swans to be subspecies under the collective name Tundra Swan. A few recent authors (e.g., Vaurie 1965) give Whistling and Bewick's full species status. Delacour (1954), Wilmore (1974), and a few others further lumped Whooper and Trumpeter swans into a single species, whereas Portenko (1972) and Johnsgard (1974) considered all of the black-billed northern swans (i.e., Whooper, Trumpeter, and Tundra) to be a single species, which

they call *Cygnus cygnus*, the Northern Swan.

Further confusion has arisen concerning subspecific differences among the currently recognized taxa. A subspecies of Bewick's Swan described from China, Japan, and Korea called *C. c. jankowskii* supposedly differs from nominate Bewick's in having a longer bill that shows more yellow, but these traits are clinal from west to east (Cramp and Simmons 1977). This race is now generally regarded as invalid (Vaurie 1965, Evans and Kear 1978), as is the supposedly smaller *C. c. islandicus* race of Whooper Swan (Cramp and Simmons 1977).

Hansen (1973) suggested that the Alaskan and Red Rock Lakes, Montana, populations of Trumpeter Swans might be subspecifically distinct, with Alaska Trum-

peters being larger, starting from the egg. Barrett and Vyse (1982) performed extensive genetic analysis on various populations of Trumpeter Swans and refuted this hypothesis. There are no currently recognized subspecies for Trumpeter or Whooper swans (Madge and Burn 1988), and the distinctive Bewick's and Whistling swans are the only recognized subspecies of the Tundra Swan.

Distribution

Ranges presented here are adapted from the AOU (1983). Trumpeter Swan is a formerly endangered species confined to western Canada and the western United States. The historic range of this species was much more extensive than at present. The species now breeds locally throughout much of Alaska



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Figure 2. Although some Tundras can show a head profile similar to this bird, this is a typical Trumpeter photographed near Edison, Washington, December 1990. The lack of yellow loreal spot and presence of red tomial stripe are indicative, but not conclusive. The large bill, large head, forehead V, and facial skin offer additional clues.

south to central British Columbia, southern Alberta, and southwestern Saskatchewan south to southeastern Oregon, eastern Idaho, northwestern Wyoming, and southwestern South Dakota. It formerly bred throughout the northern Yukon and Northwest Territories east to northern Manitoba and James Bay and south to Nebraska, Iowa, Missouri, and Indiana.

Trumpeters winter from southern Alaska, western British Columbia, southern Alberta, and Montana south to Oregon and rarely to California, Utah, New Mexico, and eastern Colorado. They formerly wintered south to North Carolina on the Atlantic Coast, the Gulf Coast states, and the Mexican border. Introduced populations have been established at Turnbull National Wildlife Refuge (NWR) in Washington, Ruby Lakes NWR in Nevada, Malheur NWR in Oregon, Lacreek NWR in South Dakota, and at locations in Minnesota, Wisconsin, and Michigan. Relocation programs are underway at several additional locations. Most of these populations have been established from birds taken from Red Rock Lakes NWR in Montana. During winter, individuals wandering from these introduced populations have been recorded east to Maryland and south to California, Utah, Missouri, and southern Texas.

The two distinct subspecies of Tundra Swan, Bewick's and Whistling, are nearly allopatric; however, they meet occasionally in extreme northeastern Siberia (Portenko 1972). Whistling

Swans breed from northwestern and west-central Alaska east along the Arctic coast of Canada to Baffin Island and south to Hudson Bay. They winter on the Pacific Coast from southern British Columbia southward to California and very rarely to northern Baja California, southern Arizona, and New Mexico. They also occur rarely to the Gulf Coast of Texas and Louisiana and commonly along the Atlantic seaboard from New Jersey (rarely north to Maine) to North Carolina (rarely south to Florida). Numbers also winter in the Great Lakes region (mainly on Lake Erie). A few also migrate through the Mississippi River Valley. Whistling Swans are uncommon on the Great Plains. This subspecies has wandered to Hawaii, northern Mexico, the West Indies, Britain, and Japan.

Bewick's Swans breed from northeastern Europe east along the Arctic Ocean to northern Siberia. They winter in Eurasia south to Britain and northern continental Europe, the Caspian Sea, Japan, Korea, and the China coast. This fairly distinctive subspecies has been reported over twenty times in North America, with reports ranging from Alaska to Oregon and California and east to Maryland. Extralimital records in North America prior to 1980 are discussed by Evans and Sladen (1980). Recently, additional birds have been reported from British Columbia (*American Birds* [AB] 37: 215) and Washington (AB 39: 201) east through Saskatchewan (AB 33: 189 and AB 34: 173) to Pennsylvania (AB 37: 301).

Whooper Swans are found throughout the northern Palearctic, with their breeding range extending from Iceland, Scandinavia, and northern Russia east to Kamchatka and south to Poland and the Caspian Sea. They winter throughout much of their breeding range, and south to central Europe, the eastern Mediterranean, Caspian, and Black seas east to southern China, Korea, and Japan. Small numbers winter somewhat regularly in the central Aleutian Islands. There are a number of extralimital records for Alaska north to Nome (AB 45: 484) and east to Cordova (Roberson 1980). In addition, there is an accepted record from California (along with two others that are pending) and a 1903 Maine specimen, an individual that presumably wandered south from the now extirpated breeding colony in Greenland. Individuals or family groups reported from Minnesota, Massachusetts, New York, Maryland, Ontario, and Illinois are of questionable natural occurrence, a term that could also apply to birds from California, as there is at least one California record (from San Francisco) of an escaped bird.

Habitat

Tundra and Trumpeter swans occupy distinctly different breeding habitats. As their name suggests, Tundra Swans nest on coastal tundra. Trumpeters, however, breed primarily on lakes in the taiga, as do Whoopers in Eurasia.

Habitat differences are less clear in winter. Engler (1990) suggested that Trumpeter Swans prefer smaller bodies of water with

much interspersed land, whereas Tundras favor large open-water impoundments. Cogswell (1977) indicate that (in California) Trumpeters are perhaps more prone to occur coastally in winter than are Tundras, but the basis for this statement is unclear, because the number of coastal-slope winter records for Tundra Swan in California far exceeds the number of Trumpeter Swan records for the entire state. During winter, both of these species occur in wet fields, pastures, protected bays, and large, fresh-water lakes, although Trumpeters are, in general, the far more likely swan on small, wooded lakes in the Pacific Northwest (Bill Tweit, pers. comm.).

Molt

The timing of molt in first-winter Tundra Swans is different from that of first-winter Trumpeter Swans and provides one of the most valuable clues for identifying immatures. Tundra Swans complete their molt by mid-winter, whereas Trumpeters complete their molt by spring (Palmer 1976). By March, most of the gray juvenal plumage on a first-spring Tundra Swan is gone, replaced, faded to whitish, or restricted to the head and neck (and sometimes on the mantle; Bellrose 1976, Palmer 1976). More specifically, Tundra Swans begin their first pre-basic molt in late December, with the dusky immature feathers being gradually replaced by white ones (Jordan 1988). On average, immature Tundras are mostly white by March, with some attaining their first basic plumage as early as late January



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Figure 3. Immature Trumpeter Swan near Edison, Washington, December 1990. The rather large bill proportions, extensively sooty-brown plumage, and angular head are the best clues to this bird's identity.

(Bellrose 1976). They are essentially as white as adults in their first spring, although careful scrutiny should reveal gray plumage, particularly around the head and neck, in all swans less than one-and-a-half years old. Fully adult swans have a completely white head and neck, so even a hint of gray in these areas suggests immaturity, but note that many adult swans have the head and neck stained rusty by oxides in the water in which they forage.

Trumpeter Swans have a protracted first pre-basic molt beginning in January and continuing well into their first spring. Thus, any swan that is obviously dusky in late spring (April and later) is a first-spring Trumpeter (Tobish 1991). The duskiest is typically most evident on the head, neck, and wing coverts, but is also present on some birds on the undertail coverts and along the flanks (Figure 3). Hatching dates of Trumpeter Swans vary up to six weeks (Engler 1990), so there may



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Figure 4. The rather rounded head and small bill proportions suggest immature Whistling Swan. Also note that extensive black at the base of the bill eliminates immature Bewick's Swan. Photographed at Tule Lake, California, in February 1987.



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be considerable variation in the extent of white coloration on first-spring birds.

Size

Overall size. Overall size, both in mass and length, can be helpful in separating Tundra and Trumpeter swans, provided that the birds are associating with one another and that the observer is careful when analyzing apparent size differences. All swans are sexually dimorphic in size, with adult males averaging substantially larger than adult females; the difference is not as pronounced in immatures (Miller et al. 1988). According to Scott et al. (1972), male Trumpeter Swans average 12 kg (26 lb), whereas females average a mere 9 kg (20 lb). Tundra Swans average much smaller, with 7 kg (16 lb) being the mean for males and 6 kg (14 lb) for females. Tundra Swans can be much larger than previously believed (Lowe 1988), however, with a male recently tipping the scales at 10 kg (22 lb). Clearly there is size overlap between male Tundra and female Trumpeter swans, but the frequency of

this overlap is not fully known.

Similarly, the overall body length and wingspan of Trumpeters average larger than those of Tundras. An identification pamphlet available through the Trumpeter Swan Society gives wingspan data for Tundra Swan of 183–203 cm (72–80 in), compared to 213–243 cm (84–96 in) for Trumpeter Swan; furthermore, the average body length is listed as 132 cm (52 in) versus 152 cm (60 in), respectively. Given the extreme size of the male Whistling noted by Lowe (1988), there is certainly overlap with the small extreme of female Trumpeter. Immatures are slightly smaller than adults and do not achieve full adult size until their second spring (Evans and Kear 1978, Miller et al. 1988).

Head and Neck. The heads of Trumpeter Swans look proportionately larger than those of Tun-

Figures 5 and 6. The straight bill of the swan at left looks rather large, a mark typically attributed to Trumpeter, but the mostly pink coloration on the bill is diagnostic of Tundra. Also, the gray of the body is paler than that of Trumpeter this early in the season, and the head is rather round. This bird, photographed at Deep Springs, California, in late October, 1981, was incorrectly published as a Whooper Swan in The Audubon Society Master Guide to Birding. The lower bird, photographed November 1993, is an immature Tundra at Lake Mattamuskeet, North Carolina.



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dra Swans. Trumpeters also have a proportionately longer neck than do Tundras; but there is no standard ratio, and this feature can be exceedingly difficult to judge. Harris et al. (1989) and Hume (1990) went so far as to call Bewick's Swan goose-like compared to Whooper Swan (which is similar in size and proportions to Trumpeter), primarily because Bewick's has a proportionately shorter neck. Clearly the reliability of this feature requires a fair amount of field experience with both species, and even then it would be a subjective determination.

Back Contour. Another potentially useful feature regards the high point of the back on swimming birds. The apex of the back tends to be toward the center on a Tundra Swan, whereas the apex on a Trumpeter Swan tends to be more toward the rear

of the bird, making the body look more elongated. This subtle feature requires a fair amount of field experience with each species before the difference becomes apparent, and it may not be useable on every swan.

Feet. The feet of a Trumpeter Swan are larger than those of a Tundra. In fact, there is no overlap in their respective measurements (Banko 1960). Although this feature will probably not be useful for field identification, it is possible that tracks of a mystery swan could be measured to determine the specific identification of the bird.

Bill Structure

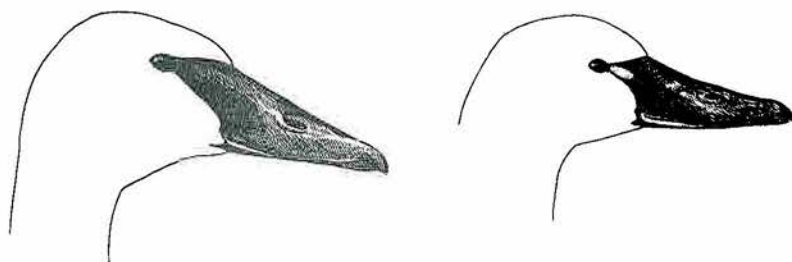
Profile. A long-touted field mark for separating Tundra Swans from Trumpeter Swans is the flat culmen of Trumpeter Swan, contrasted with the concave or dish-shaped culmen of Tundra Swan (Figures 1 to 7). The shape of the culmen, at least in part, is age-related, with young swans of both species showing a flatter, or even convex, culmen (Bailey 1991). Many first-winter

and adult Tundra Swans show a culmen as straight or straighter than what is thought of as typical of Trumpeter (Figure 5). Thus, the usefulness of this mark is limited, even for adult swans. Adult Tundras tend to have a more concave culmen, which is accentuated by the rounded crown (the high point of which is in mid-crown). Adult Trumpeter Swans tend to have a straight culmen, accentuated by the angular head, which peaks toward the nape rather than mid-crown. The peak toward the hindcrown, together with the more massive and straighter bill of Trumpeter, gives it a somewhat Canvasback-like profile. The bottom line is that if an adult swan shows a distinctively concave culmen, then it is a Tundra Swan, but if the culmen is straight, giving a flat profile, then it may be either species.

Nostril Placement. The bill of Trumpeter Swan is proportionately larger and longer than that of Tundra Swan. Particularly important is the placement of the nostrils with regard to bill length and bill tip (Stejneger 1882, Banko

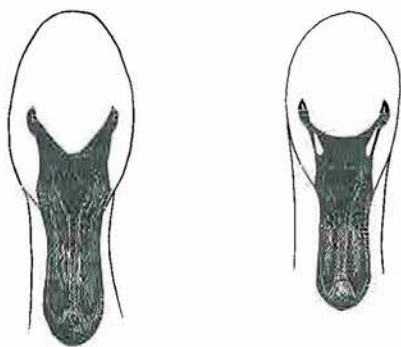
1960). Banko (1960) indicated that the distance from the nail to the nostrils is always 50 mm (2 in) or more for Trumpeter Swan and 50 mm or less for Whistling Swan. Thus, on Trumpeter Swan the distance from the nostril to the eye is about equal to the distance from the nostril to the bill tip. For Tundra Swan, the distance from the eye to the nostril is longer than the distance from the nostril to the bill tip (Scott et al. 1972). Bill size does not correspond to overall body size, because the bill reaches adult size by a swan's first fall (Miller et al. 1988), whereas the body does not attain adult bulk until its second fall or later. As a result, immatures appear to have proportionately larger bills than do adults. Females often appear to have proportionately larger bills than males (Hansen et al. 1971).

Proportions. The larger head and bill of Trumpeter Swan often creates different proportions that may be of use in the field. The best way to estimate relative bill size is to compare the distance from the nape to the eye to the length of the bill, from the tip to the gape. On Tundra Swan, the ratio can be as small as one-to-one, but it is more often the case where the bill length is one-and-a-half times the distance from the nape to the eye. On Trumpeter Swan, the ratio is rarely that small, and the bill length is usually two times the distance from the nape to the eye, with some even greater (Figure 7). Caution is warranted, however, as a true profile is needed to assess this feature, because any fore-



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Figure 7. Compare the length of the bill, from the tip to the gape, with the distance from the eye to the nape. The larger bill of the Trumpeter (left) often yields a ratio of 2:1, whereas some Tundras (right) have a ratio of 1:1. There is substantial overlap, so caution must be used. At the extremes, however, the above ratios may be of value.



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Figure 8. One of the most helpful clues is the shape of forehead feathering on adults. The shallow U, cutting straight across the forehead is diagnostic for Tundra (right). The sharp V on the Trumpeter (left) can be approached by extreme examples of Tundra. Note that immatures of both species can show extensive Vs and are thus not identifiable using this mark.

shortening will alter the perceived ratio. Also, this feature is helpful, not diagnostic, and should only be used in conjunction with other marks.

Feathering at Base. Perhaps the most reliable feature for separating adult Trumpeter from Tundra swans is the shape of the feathering at the base of the culmen between the eyes (the forehead; Figure 8). On adult Trumpeters the feathering typically forms a deep V on the forehead, with white extending well into the center of the base of the culmen. On Tundras of both races the base of the culmen generally cuts across the forehead, forming a shallow curve (a half-moon) or U where it meets the forehead feathering (National Geographic Society 1987). Dunn (1988) considered this mark the best feature for separating these species in the field, although Engler (1990) did not consider this feature diagnostic, and Martha Jordan (pers. comm.) stated that it could be used in adults as a determining characteristic only in combination with others. Nevertheless, an examination of specimens at the United States National Museum (Smithsonian Institution) in

Washington, D.C., showed that 81 percent of Trumpeters ($n = 21$) showed a deep V, whereas 93 percent of Tundras ($n = 27$) showed a shallow V or U or a half-moon, with nearly 60 percent of Tundras showing a U or half-moon (Claudia Wilds, pers. comm.).

Beware of young birds: immature swans of either species show a distinct deep V on the forehead (Madge and Burn 1988) that actually extends farther out on the culmen than it does on adult Trumpeters (Bailey 1991); thus, some immature Tundra Swans can match the adult Trumpeter pattern almost exactly. The shape of the feathering is formed during the bird's first winter, at which time immature Tundra Swans are still developing bare-part shape and coloration. First-year birds can acquire their adult face pattern as early as January or as late as June. Thus, even during their first spring, some Tundra Swans can still show a V on the forehead, while at the same time the plumage appears (essentially) all white.

Loral Skin. The shape of the bare skin at the base of the bill is an important field mark, but again it must be assessed prop-

erly. Much has been written about how the black pinches in as it approaches the eye on a Tundra Swan, making the eye appear isolated (cover photograph). The black is wider on a Trumpeter Swan, such that the eye does not appear to be as isolated from the facial skin (Figure 1). Stallcup (1985) exaggerated the differences between the two species; the distinction is really quite subtle. Several other sources (e.g., Roberson 1980, National Geographic Society 1987, Madge and Burn 1988) illustrate the feature more correctly. As with many of the field marks relating to swans, the apparent eye isolation is a subjective criterion. As stated by Engler (1990), "an open-minded superficial view" works better than attempting to make a firm distinction between the eye and the face. Despite the subjective nature of this feature, it is a reliable mark; but beware of Whistling Swans lacking the yellow loreal spot, as they appear to have larger, fuller bills. Thus, apparent eye isolation is more easily determined on birds with a yellow loreal spot, in which case the determination is not necessary!

Cheek Contour. Another useful feature is the shape of the white feathering on the cheek where it approaches and meets the gape. On Tundra Swan, the black facial skin curves more abruptly as it approaches and meets the gape and angles nearly straight down, forming a squared base. On Trumpeter, the black extends farther out onto the cheek, so that there is a slightly rounded or nearly straight line from the

gape to the lower edge of the eye. Thus, the white cheek forms a sideways V as it meets the gape on Trumpeter, rather than having a squared-off end (Figure 1).

Bill Coloration

Adults. Bill coloration is useful in one regard: if the swan in question has a bright yellow or an orange-yellow loreal spot, then Trumpeter can be eliminated as a possibility. But beware of Trumpeter Swans showing a pale area in the lores. Banko (1960) noted an anomalous olive-yellow loreal spot on one Trumpeter. Furthermore, an "occasional adult male" Trumpeter Swan shows a "wear patch" above the nostril. This patch is usually pale straw (Fix and Jordan 1988) or gray (Banko 1960), but not bright yellow. It is also typically round in shape. The statement by Palmer (1976) that some Trumpeters have an "orange-yellow" loreal spot is almost certainly an error.

Although a bright yellow loreal spot will eliminate Trumpeter Swan, the lack of this spot does not eliminate Whistling (although it does eliminate Bewick's and Whooper swans). With a fairly small sample size ($n = 55$ adults), Tate (1966) showed that as many as 30 percent of adult Whistling Swans lacked yellow on the bill and that birds lacking this spot are frequently misidentified. Using a similar sample size ($n = 50$ adults), Miller et al. (1988) found only 10 percent in which yellow was "completely absent" from the lores; interestingly, an additional four adults from their sample lacked yellow on only one side of the bill!

Tobish (1991) corrected one such misidentification, as he noted that the adult Trumpeter Swan pictured in *The Audubon Society Master Guide to Birding* was in fact an adult Whistling Swan with an all-black bill (and bright red tomial stripes).

Tomial Stripe. Some authors (Kortright 1942) have indicated that a red or salmon stripe on the tomium ("lips") is found only on Trumpeter. This character is in fact of little or no value, although it averages brighter and thicker on Trumpeter (Banko 1960). Adult Tundra Swans regularly show a combination of a red tomial stripe and no yellow loreal spot. First-spring Trumpeters often lack the salmon tomial stripe, just as first-spring Whistlings often lack a loreal spot, and immature swans often do not at-

tain their fully adult bill coloration until their second fall (Tobish 1991).

Immatures. Madge and Burn (1988) indicate that immature Trumpeter Swans show extensive black at the base of the bill, whereas immature Tundra Swans have a pink base to the bill. Both their text and illustration are misleading, because they imply that an immature swan with a black base to the bill is a Trumpeter. A juvenile Tundra Swan gradually acquires a black bill during its first winter; by spring, its bill has become mostly black. Thus, an immature swan showing extensive black at the base of the bill could be either species, especially after November. Juvenile swans in early fall may be separated on the basis of this character with some confidence, however, be-



DOMINIC SHERONY

Figure 9. Probable immature Trumpeter Swan near Rochester, New York, in late February 1994. Note the dusky plumage throughout the head, neck, and upperparts. At this season, a Tundra would likely be white on the upperparts and flanks, and the head, if gray, would not be as dark as it is on this individual. Also, subjective characters (for example bill size, proportions, and the angular head) are consistent with Trumpeter.



WHOOPER SWAN

T. J. ULRICH / VIREO



BEWICK'S SWAN

B. GADSBY / VIREO

Figures 10 and 11. The extensive yellow base to the bill, extending past the nostril, is diagnostic of Whooper (top photo). Also, note that bill proportions and the shape of the loreal skin where it meets the gape are like those of Trumpeter. On Bewick's Swan (lower photo) the yellow extends forward in a more rounded manner and does not reach the nostril.

cause most immature Tundra Swans have pink meeting the face. Furthermore, Martha Jordan (pers. comm.) indicates that there is a qualitative difference in the distribution of black on the bill, with a Trumpeter Swan appearing to have a bill that is "black with a pink area in the middle," (Figure 3) whereas a Tundra has a

"pink bill with black at the ends" (Figures 5 and 6). Clearly the most fail-safe use of this mark is if an immature swan shows pink meeting or nearly touching the facial feathering, then it is a Tundra Swan.

Even though the species are similar in size and structure, separating Whooper Swan from Trumpeter Swan on the basis of bill color is straightforward at all ages. When adult, Whooper Swan has bright yellow on the basal half of the bill; the Trumpeter's bill is all black (or has a small area of pale gray or dull olive-yellow, as mentioned earlier). Even the identification of immatures is fairly simple because Trumpeters always show extensive black at the base of the bill, whereas Whooper has an ivory, pale silver-gray, or pale pink color here that gradually becomes yellow by the first spring.

Coloration of Legs and Feet

All of the northern swans have black legs and feet as adults, although Palmer (1976) indicates that, "at least in Bewick's, variants include (rarely) individuals with yellow legs." Coloration of the legs and feet of immatures is more variable. Godfrey (1986) states that immature Trumpeter Swans have olive-buff legs and feet with webs that are "yellowish to grayish, becoming dusky with age." He further states that immature Tundra Swan lacks yellow in the feet. Palmer (1976) provides a similar description for immature Trumpeter Swans, stating that, even in their second or third winter, the legs and feet are "commonly" a

"more or less muted orange-yellow," becoming blacker with age, but often gray and sometimes "olive-yellow to varying extent." The legs and feet of immature and adult Tundra Swans are said to be simply "black," although they are "grayed to vivid flesh color" on juveniles (Palmer 1976); Bellrose (1976) called immature Tundra's feet "flesh-colored."

The strongest wording has been provided by Kortright (1942), who states that "young Trumpeters have much yellow on [their] feet which young Whistlers never have." Because no other modern references mention these differences in foot color, their usefulness is uncertain.

Vocalizations

The voices of Tundra, Trumpeter, and Whooper swans are qualitatively similar (Johnsgard 1972). Even so, once learned, they are the most useful and diagnostic feature for identifying swans in the field. The "once learned" caveat cannot be stressed enough and observers would do well to listen to tapes *before* attempting to identify calling swans in the field. Keep in mind that a jumble of calls emanating from a flock of birds may combine in such a way that you will hear calls quite different from the call of a single bird.

The common call of Tundra Swan has a bugling quality that would cause most observers to logically assume that it was "trumpeting." The call is most often described as a high-pitched, yodeling series, usually three, of *whoorp* or *whoo* notes. This call has been likened to that of a Snow

Goose (*Chen caerulescens*) (Roberson 1980, Tobish 1983a) or a Sandhill Crane (*Grus canadensis*). It is, in general, higher-pitched and more quavering than the common call of Trumpeter Swan. Use caution when assessing calls, because Tundras frequently produce lower-pitched *yow* calls just before takeoff or when alarmed and can give other calls that are lower-pitched than those of a Trumpeter (Bill Tweit, pers. comm.; Patten, pers. obs.).

The notes of the Trumpeter Swan are louder, more resonant trumpetings, sometimes given singly, but usually doubled, that differ in tone and volume from those of Tundra Swan. Tobish (1983c) indicated that each note of the call, if doubled, is at the same pitch. There is a subtle difference between these notes, however, with the first note being slightly lower and softer, whereas the second is higher and more forceful. The deeper call of Trumpeter Swan has been attributed to its different windpipe, which has an extra convolution, enabling it "to produce a louder and more far-reaching note on a lower key, with the musical resonance of a French Horn" (Bent 1925). Its call has also been likened to the honk of a French taxi cab (Terres 1980; Jon Dunn, pers. comm.). The call has been compared to that of a Sandhill Crane (Palmer 1976, Roberson 1980), although it is the call of Tundra Swan that more readily evokes this species to the authors. Beware of the calls of immature Trumpeters, which are higher-pitched than those of adults and are more easily mistaken for those of Tundra Swan.

Whooper Swans utter a low-pitched, bugled *whoop-whoop* (Tobish 1983b), which is "deeper and stronger" than a Bewick's Swan's call (Cramp and Simmons 1977). They will give a single bugled note when alarmed. This call is quite similar to that of a Trumpeter, but slightly higher-pitched and less sonorous.

Habits

Certain habits are variously treated as diagnostic, indicative, or useless for identifying swans. The habits of these species do require some attention, but they should only be used as suggestive indicators in connection with more reliable features such as bill structure, bill coloration, and voice. Thede Tobish (pers. comm.) found published information about posture to be inconsistent and felt that it "should probably be down-played." Keep this caveat in mind when attempting to identify a Trumpeter Swan based on how it is acting or how it holds its neck.

Probably the most oft-cited character is the kink that Trumpeter Swans supposedly show at the base of the neck, with the bird's neck angling back sharply at the breast and then rising from some point behind it. Both Trumpeter and Tundra swans, however, can swim or stand with their necks kinked back over their bodies or with the neck held vertically from the breast.

Jordan (1988) indicates that Trumpeter Swan bobs and pumps its head before taking flight and Tundra Swan does not. Tundra Swans do bob their heads frequently (Engler 1990; Patten,

pers. obs.), however, so the usefulness of this character is questionable.

While standing on land, Trumpeter Swans typically hold their body angled upward, with the breast above the horizontal plane (i.e., above the level of the tail). On the other hand, Tundras typically stand more horizontally, with the breast and the tail appearing to be on the same plane (Jordan 1988). Furthermore, Tundras often hold their head horizontally as well, with the "jaw line" near or slightly below a 90° angle with the neck. Trumpeters often hold their head angled downward, closer to a 60° angle with the neck (Engler 1990).

Bewick's Swan

As noted above, any adult swan with a bright yellow or orange-yellow loreal spot is not a Trumpeter. The choices are now narrowed to two species: Whooper Swan and Tundra Swan. Separating adult Bewick's Swan from adult Whooper Swan is a relatively straightforward process. Whooper Swan is a larger species, equally as large in comparison to Bewick's as Trumpeter is to Whistling. Whooper Swans are most easily identified by the shape of the yellow on the bill. On Whooper, the yellow is extensive, extending forward to (or just past) the nostrils (Scott et al. 1972) to form a distinct point (Figure 10). On Bewick's Swan, the yellow does not reach the nostril, but instead curves gently at the anterior edge to form a rounded patch that almost always lies entirely posterior to the nostrils (Figures 11 and 12). Both Whooper and Be-

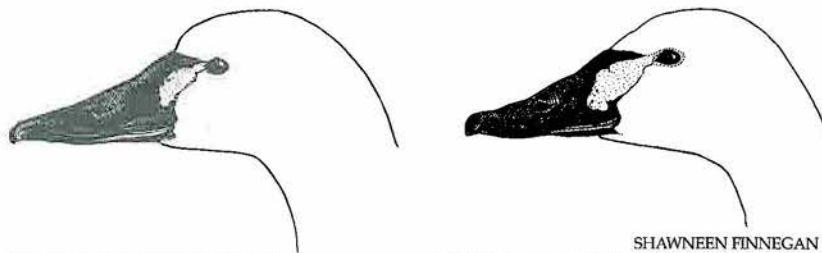


Figure 12. Tundra Swan (left) and Bewick's Swan (right). Although Evans and Sladen (1980) found no overlap in the extent of yellow present on Whistling and Bewick's swans, the maximum amount of yellow shown by a Whistling (see also cover photograph) and the minimum shown by a Bewick's is close indeed, making subspecific field identification of either bird sketched here, for example, tenuous at best.

wick's swans show yellow on the underside of the bill. Whooper shows little variation in this pattern (Madge and Burn 1988). Bewick's is quite variable (Evans and Sladen 1980), with individuals even showing slight year-to-year changes in pattern (Scott 1966). Despite the variability, Bewick's never approaches the pattern shown on Whooper (Madge and Burn 1988, Harris et al. 1989). Beware of hybrids, because a Whooper \times Bewick's swan has been reported at least once from Iceland (*British Birds* 84: 284).

Immatures are less reliably identified, although Ferguson-Lees et al. (1983) indicate that (like Whistling) Bewick's acquires whiter plumage by midwinter, earlier than does Whooper. In a reversal of the trend of larger swan species maturing more slowly, Whooper often attains the adult bill pattern before Bewick's (Madge and Burn 1988, Harris et al. 1989). Both taxa show a pale pinkish and/or ivory patch at the bill's base, similar in shape to the yellow area of adults. Sometimes the bill's pale coloration on a young Bewick's Swan is angled toward the bill tip, approaching a typical Whooper Swan pattern, and thus complicating field identification (Scott Terrill, pers. comm.).

Balch (1980) indicates that Whooper Swan often kinks its

neck back in Trumpeter Swan fashion, but the same caveats that apply to Trumpeter in this regard almost certainly apply to Whooper as well. These caveats also hold true for the head shape, profile, and apparent body proportions (Stephen 1991). The call of Whooper differs in quality from that of Bewick's, much as Trumpeter's differs from Whistling's, although the call of Whooper is not as deep and full as that of Trumpeter.

With the increased frequency of reports of Bewick's Swans in North America, careful attention must be paid to Whistling Swans that show more than the "expected" amount of yellow on the bill. The extent and shape of the yellow patch on the bill of both Whistling and Bewick's are variable, but do not overlap (Evans and Sladen 1980). This lack of overlap might indicate that all individuals of each taxon could be readily separated in the field, but such is not the case. A Whistling Swan showing the maximum amount of yellow (cover photograph, Figure 12) would probably be inseparable in the field from a Bewick's showing the minimum (Figure 12). Roberson (1980), however, indicated that Bewick's has a yellow stripe on the underside of the mandible, a feature shared by Whooper Swan, but apparently lacking on

Whistling. This feature needs more study.

Although Bewick's average slightly smaller than Whistling, there is enough overlap in measurements that using size as an indicator is not possible. Separating immature Bewick's from immature Whistling is often not possible. Some young Bewick's, however, show an extensive ivory or dull pinkish patch at the base of the bill that is noticeably paler than the dark pink and black of Whistling (Patten and Heindel, pers. obs.); this patch can be difficult to see on a distant bird. Furthermore, because immature Whistlings gradually acquire black bills during their first winter, any immature Tundra Swan showing extensive black toward the base of the bill is a Whistling.

Summary

Field identification of Tundra and Trumpeter swans can be a challenging task that requires excellent views and a careful use of field marks. Aging is an important first step in swan identification: look for gray coloration on the feathering or pink on the bill, either of which indicates that the bird is not an adult. The identification of immatures is more difficult than that of adults, if not impossible.

Voice and comparative size are the best clues when identifying Whistling and Trumpeter swans, but the use of either requires an appreciation of variation. Vocalizations are diagnostic, but they require experience. Lone, silent swans are often a challenge. Bill proportions, such as nostril placement and relative bulk compared to the head, facial skin features, and feathering on the forehead are the best characters for separating black-billed swans. Bright yellow on the base of the bill eliminates Trumpeter Swan,

but, if the yellow is extensive, then the challenge is to separate Whistling from Bewick's, or Bewick's from Whooper. Assessment of the extent and shape of the yellow patch are critical to proper identification.

The key provided below should be helpful in identifying, or narrowing the possibilities, of any white swan you encounter. The key emphasizes basic identification points. More detail about these features is found in the text.

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KEY TO SWAN IDENTIFICATION		
To use this dichotomous key, choose between a number with and without an accent (for example 1 and 1'). Continue to follow your choices until a species name is written in the adjacent box.		
1	Plumage wholly white (perhaps some rusty staining).	Adult
2	Orange bill with black knob.	Mute Swan
2'	Bill black, with or without a bright yellow patch.	
3	Bright-yellow patch on base of bill.	
4	Yellow patch extensive (covers most of bill base).	
5	Yellow patch covers basal half of bill; extends forward to or past nostrils, forming a point.	Whooper Swan
5'	Yellow patch large, rounded on front edge; extends at most to posterior edge of nostrils.	Bewick's Swan
4'	Yellow patch medium to small in size.	
6	Yellow stripe on underside of mandible.	Bewick's Swan
6'	Underside of mandible wholly black.	Whistling Swan
3'	Bill essentially all black.	
7	Bill proportions determined.	
8	Distance from nostrils to bill tip equals distance from eye to nostrils OR bill length is 2x or more distance from eye to nape.	Trumpeter Swan
8'	Distance from nostrils to bill tip is greater than distance from eye to nostrils OR bill length is roughly equal to or 1.5x distance from eye to nape.	Whistling Swan
7'	Bill proportions not determined.	
9	Culmen obviously concave.	Whistling Swan
9'	Culmen straight or slightly concave.	
10	Feathering cuts straight across forehead or is shallowly rounded.	Whistling Swan
10'	Forehead feathering cuts a V into the culmen	
11	Black extends narrowly to meet eye, creating obvious eye isolation.	Whistling Swan
11'	Black extends wider to eye; eye less isolated.	
12	Black from eye to gape is abruptly angled or squared; V on forehead shallow.	Whistling Swan
12'	Black extending from eye to gape is smoothly angled or gently round, forming a triangular or sideways V-shaped cheek patch; V on forehead deep.	Trumpeter Swan
1'	Plumage white with some gray smudging or extensively sooty, gray, or brown.	Immature
13	Bill pinkish-gray or gray with clean-cut black base.	Mute Swan
13'	Bill lacks gray coloration.	
14	Large ivory or silvery patch at basal portion of pink bill; either Whooper or Bewick's. Try to use size, extent of white coloration, voice, and other clues.	
14'	Bill wholly or mostly pink and black.	
15	Pink of bill meets or nearly meets facial feathers.	Whistling Swan
15'	Base of bill extensively black.	
16	Plumage is obviously sooty, gray, or brown.	
17	After March.	Trumpeter Swan

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