Distribution and Identification of Cackling Goose (*Branta hutchinsii*) Subspecies

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Abstract

In this paper, we review what is currently known about the status and distribution of Cackling Goose, *Branta hutchinsii*, and its subspecies: *B. h. hutchinsii*, *taverneri*, *minima*, and *leucopareia*. We also discuss field identification of Cackling Goose subspecies, incorporating information from our own recent field studies, and because Lesser Canada Goose (*B. canadensis parvipes*) closely resembles *B. h. hutchinsii* and *taverneri*, its range and identification are also reviewed.

Taxonomy

The taxonomy of Canada Goose (*Branta canadensis*) and Cackling Goose (*B. hutchinsii*), which are here collectively referred to as "white-cheeked geese," has a long and interesting history. Some authorities have lumped all populations into a single species, Canada Goose (*sensu lato*) (A.O.U. 1910, Swarth 1913, A.O.U. 1931), but most have recognized two to four species (Brooks 1926, Taverner 1931, Sutton 1932, Aldrich 1946, Hellmayr and Conover 1948). Aldrich (1946) asserted that there was near-unanimous agreement among Arctic biologists that "Canada Goose" consisted of two species, whereas Delacour (1951, 1954) recognized only one species with twelve subspecies. Delacour's taxonomy has generally been followed (e.g., Johnsgard 1975, Bellrose 1980, Madge and Burn 1988, del Hoyo 1992, Mowbray et al. 2002), though some authorities recognized fewer subspecies (A.O.U. 1957, Palmer 1976). In 2004, the American Ornithologists' Union split Canada Goose (*B. canadensis*) into two species, Canada Goose (*B. canadensis*) and Cackling Goose (*B. hutchinsii*), based largely on mtDNA evidence (Banks et al. 2004) and essentially along the lines suggested by Aldrich (1946).

Figure 1. The tiny triangular bill and rounded head of this *minima* Cackling Goose (called Ridgway's Goose in this paper) is typical for this subspecies. Individuals of other subspecies would rarely, if ever, show the head and bill shape seen here. Also, the typical adult *minima* wing covert pattern is somewhat visible, with a gray base, dark subterminal band, and white terminal band. Note the prominent neck collar subtended by black, reminiscent of the pattern typical of *leucopareia* Cackling Geese but present in some *minima*. Photographed at Ridgefield National Wildlife Refuge, Washington on 26 November 2005. *Photograph by Steven G. Mlodinow.*

According to current taxonomy, Canada Goose consists mainly of large-bodied populations that breed away from tundra habitats, whereas Cackling Goose consists of smaller-bodied, tundra-breeding populations (cf. Hanson 2006-2007).

Studies of mitochondrial DNA (mtDNA) support the split of Canada Goose (*sensu lato*) into two species (Shields and Wilson 1987a, Van Wagner and Baker 1990, Baker 1998, Scribner et al. 2003). Furthermore, restriction fragment length polymorphism analysis of mtDNA by Shields and Wilson (1987a, 1987b) found a difference of 2% between the two taxonomic groups, placing the divergence of Canada and Cackling Geese at approximately one million years ago. These genetic data also generally support Delacour's (1951)

Figure 2. The purple- to bronzy-glossed breast typical of *minima* Cackling Goose is obvious in this grouping. Note that the immature in the center has wing coverts that lack the bold pattern typical of adults (which is somewhat visible in the birds around it). Also note how the head and apparent bill shape can vary with an individual bird's posture. Photographed at Nisqually National Wildlife Refuge, Washington on 15 January 2006. *Photograph by Steven G. Mlodinow.*

subspecific classifications (Shields and Wilson 1987a, Van Wagner and Baker 1990, Baker 1998, Shields and Cotter 1998), though these distinctions were not detected by Scribner et al. (2003). The combination of geographical remoteness and uncertainties regarding identification led to past assertions that *B. c. parvipes* interbreeds with both *taverneri* and *hutchinsii* (e.g., MacInnes 1962, 1966, Johnsgard 1975, Palmer 1976) and hence the "lumping" of *parvipes* with *taverneri* by some earlier authorities (e.g., A.O.U. 1957, Palmer 1976). However, direct evidence for hybridization between *B. c. parvipes* and any subspecies of Cackling Goose is lacking, and if such hybridization does occur, it is probably rather rare (J. Pearce, J. Leafloor, pers. comm.). This conclusion is supported by the broad array of DNA studies cited above.

The validity of Cackling Goose subspecific designations has sometimes been questioned, as some studies fail to show a mtDNA difference among the currently named subspecies (e.g., Scribner et al. 2003). However, one would expect a more rapid change in genes subject to natural selection than in the neutral mtDNA genes used by most recent studies evaluating taxonomic differentiation (Winker et al. 2007). Consequently, phenotypic differences between populations are likely to appear before such divergence is detectable by research using neutral mtDNA (Winker et al. 2007). Additionally, Baker (2007) argues that multiple markers are sometimes needed to distinguish even between well-differentiated subspecies.

To pose the question as to whether Cackling Goose populations comprise separate subspecies, despite having indistinguishable mtDNA (as currently evaluated), one must ask: "Are, or have, the Cackling Goose populations been subject to different selection pressures?" The answer is, "Almost certainly." The geographical isolation of Cackling Goose populations during the Wisconsin glacial maximum was first suggested by Ploeger (1968) and has been generally accepted (Scribner et al. 2003). During this time of isolation, the populations of Cackling Geese almost by definition occupied different habitats and were subject to different selection pressures (Price 2008). Even now, *leucopareia* and *minima* use distinctly different breeding habitats from *taverneri* and *hutchinsii*, which suggests a difference in natural selection pressures. Since *leucopareia* is allopatric, there is no cline between it and other Cackling Goose taxa. However, no obvious phenotypic cline occurs between the parapatric *minima* and *taverneri* (C. Ely, pers. comm., B. Jarvis, pers. comm.), which would suggest some level of ongoing pre-mating or post-mating isolation (Price 2008). The remaining subspecies, *taverneri* and *hutchinsii*, share similar breeding habitats, and their distribution along the coast of the Beaufort Sea is poorly known; it is not known whether a cline between these two subspecies exists. It has been the authors' experience that Cackling Goose subspecies (as currently defined) tend to flock separately, even when sharing the same wintering grounds with other subspecies of Cackling Geese (and Canada Geese), and are generally recognizable in the field. Furthermore, they have generally discrete breeding ranges, migratory paths, and wintering ranges.

The high level of subspeciation among Cackling (and Canada) Geese may seem suspect when compared with other geese that breed in North America, such as Ross's Goose (no subspecies), Snow Goose (two subspecies), Brant (at least two subspecies breeding in North America), or Greater White-fronted Goose (two or three subspecies). Unlike most other geese, however, Cackling and Canada Geese apparently form pair bonds during spring migration and on the breeding grounds rather than during winter (Owen 1980), a process that would favor greater population structuring and that would cause greater genetic distinctiveness between colonies/populations than in most other geese species (Ely and Scribner 1994), which in turn could potentially lead to greater subspeciation while also confounding our ability to discern the genetic differences among these subspecies.

Distribution

The breeding range of Cackling Goose extends across tundra habitats from Baffin Island and northwestern Québec (and apparently rarely Greenland) west through the northern and western shores of Hudson Bay, across the mainland coastal slope of western Canada and Canadian Arctic islands to Alaska's North Slope, and then southward to Alaska's Yukon–Kuskokwim Delta, and on the Aleutian

Figure 3. This *leucopareia* Cackling Goose (called Aleutian Goose in this paper) shows many of the features typical of its subspecies: a broad white neck collar that is not quite complete and is narrowly subtended by black (though a bit less so than average); medium dark breast with a hint of gloss; dark gular stripe; and a short, steep forehead. This bird's crown is a bit flatter than usual for *leucopareia*. Photographed at Humboldt National Wildlife Refuge, California on 24 January 2006. *Photograph by Ron LeValley.*

Figure 4. The range of breast colors commonly encountered in *leucopareia* Cackling Geese is nicely shown by this threesome. Note that the central bird is a rare *leucopareia* that lacks a gular stripe, but it shows well the very broad anterior white neck collar that is fairly common in *leucopareia* and very rare in other subspecies. Photographed in the Arcata Bottoms, California on 22 February 2005. *Photograph by Ron LeValley.*

Figure 5. A group of *leucopareia* Cackling Geese, illustrating how apparent head and bill shape can vary with posture. The bird in the right rear (with neck extended) probably shows the most "classic" head and neck shape for this subspecies. Also note the prominent gular stripe on these birds and how most have a bold, fairly broad, cream-colored terminal band on the wing coverts (but lacking distinct dark subterminal band typical of *minima*). Photographed in the Arcata Bottoms, California on 22 February 2005. *Photograph by Ron LeValley.*

and Semidi Islands (Map 1; Fox et al. 1996, Gotfredson 2002, Hines et al. 2000, Mowbray et al. 2002, Pearce et al. 2006; J. Leafloor, pers. comm., Jack Hughes, pers. comm.).

For the most part, Cackling Goose subspecies' breeding ranges are well established (see Map 1 and subspecies' accounts, below). The exception occurs along the mainland Arctic tundra from the MacKenzie River Delta west across Alaska's North Slope. In the past, individuals west of the MacKenzie River Delta generally have been labeled *B. h. taverneri* and those breeding on the MacKenzie River Delta and in areas to the east have been called *B. h. hutchinsii* (Delacour 1951, 1954). However, it has been suggested recently that nominate *hutchinsii* may breed west into northeastern Alaska (C. Ely, pers. comm.) and that the subspecies of Cackling Goose breeding on Alaska's North Slope might be *taverneri* (as currently labeled) or might be a different subspecies of Cackling Goose entirely (J. Pearce, pers. comm.).

Further complicating matters, some authors have suggested that *B. c. parvipes* breeds in tundra habitats on mainland western Canada and the North Slope of Alaska (e.g., Mowbray et al. 2002). Genetic and morphometric studies of breeding white-cheeked geese in the western Canadian tundra have, so far, detected mostly or entirely Cackling Geese, subspecies undetermined (Hines et al. 2000). In Alaska, limited studies have found mostly Cackling Geese, though two nests of apparent Canada Geese (presumably *B. c. parvipes*) have been found, suggesting that small numbers of Canada Geese may breed in portions of the Alaskan North Slope tundra (Pearce et al. 2006). We have reviewed photographs of breeders from Alaska's Prudhoe Bay area and feel that they are phenotypically *B. h. taverneri*. Examination of photographs taken in areas farther east, from the Yukon coast, has proven inconclusive because of the distance at which the birds were photographed.

During winter, Cackling Geese are widely scattered across the United States and northern Mexico, with concentrations in Washington and Oregon's Lower Columbia River Valley and Columbia Basin, Oregon's Willamette Valley, California's Sacramento and San Joaquin Valleys, in the "Southwest" from northern Jalisco to eastern Colorado, and along the Gulf of Mexico from northern Veracruz to southeastern Louisiana. Wintering populations in colder regions tend to be more mobile, shifting their populations northward or southward, depending on weather conditions.

Ploeger (1968) suggested that the current biogeography of Cackling Goose subspecies might be explained by distributional differences during the Wisconsin glacial maximum, with nominate *hutchinsii* nesting in an ice-free area in the high Canadian Arctic, *minima* breeding on the Bering Shelf, and *leucopareia* using the south coast of the Bering Sea as a refugium. (Ploeger [1968] did not discuss *taverneri*.)

Ridgway's Goose – *Branta hutchinsii minima*

Prior to 2004, Cackling Goose *sensu stricto* was generally referred to as the smallest subspecies of Canada Goose and then bore the scientific name *B. c. minima* (A.O.U. 1957). When split in 2004, Cackling Goose was given the name *Branta hutchinsii*, in accordance with the rules of taxonomic priority (Banks et al. 2004). The subspecies of Cackling Goose that bears the name *minima*—*Branta hutchinsii minima*—lacks an English name that differentiates it from the species as a whole; we use the name Ridgway's Goose for the subspecies here as a matter of convenience, as Robert Ridgway first described this taxon in 1885 (A.O.U. 1957).

Ridgway's Goose breeds on the tidal margins and coastal floodplains of the Yukon–Kuskokwim Delta in western Alaska,

Figure 6. The head shape and cheek patch of this bird are typical of *hutchinsii* Cackling Goose (called Richardson's Goose in this paper). The steep forehead, flat and slightly up-sloping crown, with a peak toward the rear, is a head shape rarely shown by other subspecies. The step-off in the cheek patch behind the eye can be seen in members of any subspecies but was present in the great majority of *hutchinsii* Cackling Geese studied by the authors of this paper. Note that this bird's breast is duskier than the vast majority of *hutchinsii* Cackling Geese and that the bill is a bit shorter than average. The identity of its companion is unknown. Photographed at Lake Loveland, Colorado on 4 March 2006. *Photograph by Larry Semo.*

northwest to Pastol Bay and south to Kuskokwim Bay (Mowbray et al. 2002). More than 90% of the population (between 125,000 and 175,000 individuals) winters in western Oregon's Willamette Valley and along the Lower Columbia River Valley of western Oregon and Washington (Mowbray et al. 2002, U.S. Fish and Wildlife Service 2007). The remainder winters mostly in the Sacramento and San Joaquin Valleys of central California (1000-5000 birds; D. Yparraguirre, D. Kraege, pers. comm.), along the Washington coast north to Grays Harbor, and in Washington's Puget Trough north to King County (approximately 2000 birds; Mlodinow et al. 2006a).

The winter distribution of Ridgway's Goose has shifted in recent times. Prior to 1970, nearly the entire population of 300,000-400,000 birds migrated from Alaska over water to the Washington/Oregon coast, then to the Klamath Basin of southeastern Oregon and northeastern California, and then southward to the main wintering grounds, which were the Sacramento and San Joaquin Valleys (Nelson and Hanson 1959, King and Lensink 1971, Raveling 1984). At that time, very few Ridgway's Geese stopped or wintered in western Oregon or Washington (Gabrielson and Jewett 1940, Kortright 1943). Beginning around 1970, the population of Ridgway's Goose declined precipitously, reaching a nadir of approximately 20,000 in 1984 (Pacific Flyway Council 1999). This decline was likely due to spring subsistence hunting in Alaska and fall harvest, predominantly in California (Pacific Flyway Council 1999). In response, intensive restriction on hunting was instituted, resulting in a rapid rebound, with the population again topping 200,000 in 1997 but subsequently averaging around 150,000 during the ensuing decade (Pacific Flyway Council 1999, U.S. Fish and Wildlife Service 2007). During the recovery period from 1985 to 1993, 15-30% of Ridgway's Geese started migrating through the Willamette Valley instead of the Klamath Basin on their way to California (Pacific Flyway Council 1999). Then in 1994, there was a sudden shift, and only 50% passed through the Klamath Basin; four years later, 95% were migrating to, and wintering in, the Lower Columbia River and Willamette Valleys (Pacific Flyway Council 1999). The reasons for these changes are unclear. However, a shorter migratory route, one not requiring flight over a major mountain range, is clearly advantageous. Furthermore, the habitat in the Willamette and Lower Columbia River Valleys was improving (partly due to management for Dusky Canada Geese, *B. c. occidentalis*) simultaneous with a decline in the habitat of the Sacramento Valley (B. Jarvis, in litt.).

Figure 7. In this picture, two *hutchinsii* Cackling Geese flank a *parvipes* Canada Goose (also called Lesser Canada Goose) The near white breast of these *hutchinsii* is typical for the subspecies, as is the head shape. The long and slender bill, appearing almost drooped, is also commonly seen in this subspecies. Note that the larger *parvipes* behind them has a gular stripe, quite unusual for that taxon. Photographed near Denver, Colorado on 28 January 2007. *Photograph by Steven G. Mlodinow.*

Figure 8. Here, a *hutchinsii* Cackling Goose swims in front of two *parvipes* Canada Geese. The typical head and bill shape of *hutchinsii* Cackling described in Figures 6 and 7, as well as the indented cheek patch, are obvious. The larger *parvipes* Canadas have sleeker heads and longer bills that give the illusion of having a finely pointed bill tip. In combination, this gives a more Canvasback-like profile than is normal for any Cackling Goose subspecies. Photographed at Longmont, Colorado on 26 November 2004. *Photograph by Bill Schmoker.*

Peak arrival on the breeding grounds typically occurs in the second week of May (Raveling 1978, Dau and Mickelson 1979, Ely et al. 1996). The first southbound departures from the breeding grounds are typically in early September. Almost the entire *minima* population stages on the Alaska Peninsula before heading farther south, with numbers peaking there around 10 October (Bollinger and Sedinger 1985, Gill et al. 1996). Most then depart the Alaska Peninsula in mid-October and fly directly to the Lower Columbia and Willamette River Valleys, with a few passing on to the Klamath Basin and then central California (Pacific Flyway Council 1999). Some make the flight from the Alaska Peninsula to Klamath Basin in 48 to 72 hours (Gill et al. 1996).

The first flocks of Ridgway's Geese sometimes appear in southwestern Washington and western Oregon in mid-September, but large numbers typically do not arrive until mid- or late October, with peak numbers present from 25 October to 7 November (Pacific Flyway Council 1999). The first spring migrants leave California in late February, but most depart in early to mid-April (Raveling et al. 1985). Some northward movement in Washington is also apparent as early as mid-February (J. Barry, S. Mlodinow, pers. obs.), but the bulk of Oregon and Washington's Ridgway's Geese leave in late April and appar-

Figure 9. The classic head shape of *taverneri* Cackling Goose (called Taverner's Goose in this paper) is shown by this immature bird, with a rather thick, short bill sloping almost seamlessly into a moderately sloped forehead and a rounded crown. Photographed at Ridgefield National Wildlife Refuge, Washington on 1 December 2006. *Photograph by Steven G. Mlodinow.*

Figure 10. These two *taverneri* Cackling Geese demonstrate the medium gray breast color, darkening slightly on the belly, and the weakly contrasting wing-covert pattern typical of this subspecies. Sometimes, alert *taverneri* will flatten their crowns and present a head shape much like that of *leucopareia* Cacklings, as these birds do. If watched over a long period of time, such birds should assume a more "normal" *taverneri* head shape. These birds can be separated from *leucopareia* because they are adults (no active molt, sharp demarcation between stocking and breast) and lack a neck collar and gular stripe. Their bills are a bit stout for a typical *leucopareia* (but within range of that taxon), and they lack the bright terminal band on the wing coverts that is typical of *taverneri*. Finally, these birds' underparts have a grayish hue, whereas *leucopareia* usually have a more brownish cast beneath. Photographed at Nisqually National Wildlife Refuge, Washington on 5 March 2006. *Photograph by Steven G. Mlodinow.*

ently fly directly to Alaska's Cook Inlet, where they arrive in late April and early May (Pacific Flyway Council 1999), though sizeable flocks (of 100+) are sometimes found in Oregon and Washington into late May (B. Jarvis, in litt.; S. Mlodinow, pers. obs.).

In addition to the distributional patterns noted above, Ridgway's Goose is also uncommon during migration and winter among the goose flocks of southeastern Washington's Columbia Basin (D. Schonewald, S. Mlodinow, pers obs.), and a few are regularly found in interior British Columbia, with dates ranging from 2 April through 5 June and 8 August through 12 November (Campbell et al. 1990). Furthermore, some are detected during migration along British Columbia's coast (peak: mid-April/early May and October), with an occasional individual wintering (Campbell et al. 1990). Other "fringe" areas of occurrence include Nevada, where the species may be annual (Alcorn 1988) and the Pacific Coast of Oregon south to northern California (Harris 2005). Numbers on the northern California coast may be increasing, with more than 200 in Humboldt County alone during the winter of 2005-2006 (Cole et al. 2006). Also, Ridgway's Geese have recently been found among the flocks of Aleutian Geese (*B. h. leucopareia*) staging during spring in northwestern California, with up to 2000 present in Humboldt County between late February and late March 2007 (D. Bachman, in litt.).

Ridgway's Geese have appeared from Siberia to Hawaii to Europe, but as a vagrant, it is the Cackling Goose subspecies that is most plagued by questions of provenance, as it is by far the most popular among North American aviculturalists (F. Todd, S. Langer, pers. comm.). Examination of birds of known provenance and identity, however, has shown that Ridgway's Goose does disperse far and wide. Approximately 5800 were banded at California's Tule Lake National Wildlife Refuge (which is within the Klamath Basin) and Alaska's Yukon–Kuskokwim Delta between 1937 and 2004 (BBL Game Bird CD 2005). Aside from a few entries that seem erroneous, the 13 band recoveries away from Alaska, British Columbia, Washington, Oregon, and California include five from Nevada, three from Idaho, and one each from North Dakota, Minnesota, Arizona, and easternmost Siberia (BBL Game Bird CD 2005). Furthermore, at least 30 individual Ridgway's Geese have been identified in Hawaii (R. L. Pyle and P. Pyle, unpubl. data), further demonstrating this species' ability to wander great distances. Additional extralimital reports that we have been able to review and endorse include: records of two individuals photographed in Idaho (see <www.idahobirds.net>); three to four records in Colorado (Righter and Semo 2006); two records in Japan (Brazil 1991); five records from the Yukon (Sinclair et al. 2003); two records from North Carolina (including a record involving eight birds; Davis 2005, R. Davis, in litt.); and single records from Baja California Sur (Erickson et al. 2006), Illinois (photograph by B. Hughes), Connecticut (M. Szantyr, in litt.), and Alabama (Summerour 1988). Cackling Geese that were likely *minima* have also been reported from Virginia (E. S. Brinkley, in litt.) and Tennessee (J. Wilson, in litt.), but photographs of these individuals were not obtained and thus we have been unable to review these reports.

In Europe, the provenance of reported Ridgway's Geese may be more questionable. This subspecies has been well documented in England, Ireland, Belgium, the Netherlands, and elsewhere (Batty and Lowe 2001, Batty et al. 2002, Berlijn and CDNA 2002, P. Adriaens, in litt.), but the ratio of *minima* to *hutchinsii* is suspiciously high (e.g., at least 5:2 in the Netherlands as of 2002; Berlijn and CDNA 2002). Even though only about 200 are kept in captivity in Great Britain (M. Ogilvie, unpubl. data), the above ratio and great distance between Europe and western North America have rightfully cast suspicion on the provenance of all European records of *minima* (Berlijn and CDNA 2002; K. Mullarney, L. Evans, H. Lehto, P. Adriaens, in litt.).

Aleutian Goose –
Branta hutchinsii leucopareia

B. h. leucopareia is better known by its common name, Aleutian Goose or Aleutian Cackling Goose. This subspecies currently breeds on Buldir, Attu, Agattu, and Alaid–Nizki Islands in the western Aleutians, Chagulak Island in the central Aleutians, and Kiliktagik and Anowik Islands in the Semidi Islands (Byrd 1998, Kraege 2005; V. Byrd, in litt.). The small Semidi Island population winters on the Oregon coast near Pacific City (Springer and Lowe 1998, Kraege 2005). The Aleutian Island breeding population winters predominantly in California's San Joaquin Valley near Modesto and in the Sacra-

mento/San Joaquin Delta, though small numbers sometimes winter along the California coast in Humboldt and Del Norte Counties (Springer and Lowe 1998, Kraege 2005; P. Springer, unpubl. data), and approximately 350 Aleutian Island breeders winter with the Semidi Island breeders near Pacific City, Oregon (D. Pitkin, in litt.).

In the past, Aleutian Goose had a much larger breeding range, likely nesting on islands near Kodiak Island, west through the Aleutian Islands (*leucopareia sensu stricto*), to the Commander and northern Kuril Islands of Russia (Mowbray et al. 2002), though there is some debate as to whether the now-extirpated (or extinct) Russian birds once constituted a separate subspecies, *B. h. asiatica* (Delacour 1951, Mowbray et al. 2002). The near-extinction of Aleutian Cackling Geese was caused by the introduction of Arctic Fox (*Alopex lagopus*) and Red Fox (*Vulpes vulpes/fulva*) onto their breeding islands; between the years 1750 and 1936, foxes were introduced onto 190 islands within the breeding range of *leucopareia* (Bailey and Kaiser 1993). In 1967, *leucopariea* (then called Aleutian Canada Goose) was listed as "Endangered" by the U.S. Department of the Interior. At that time, only the western Aleutian Buldir Island population was known, and it was estimated at 200-300 birds in 1963 (Kraege 2005). In 1979, another small breeding population was found in the Semidi Islands, just south of the Alaska Peninsula (Hatch and Hatch 1983), and in 1982 a third small breeding population was detected on Chagulak Island in the central Aleutians (Bailey and Trapp 1984). Subsequent genetic studies support placing these three populations within the same subspecies (Shields and Wilson 1987a, Pierson et al. 2000).

Placement on the Endangered Species list led to decreased hunting pressure and some rebound in numbers. It was, however, the elimination of foxes from 41 Aleutian Islands (over one million acres) and translocation of geese from Buldir that led to the dramatic population increase that ensued (Kraege 2005, V. Byrd, in litt.). The Aleutian Island population of *leucopareia* was estimated at 37,000 during the winter of 1999-2000, most of which were from Buldir Island (Kraege 2005). By the winter of 2006-2007, the population was estimated at nearly 119,000 (U.S. Fish and Wildlife Service 2007). The Semidi Island population remains tiny, however, with an aerial survey during May 2005 detecting only 140-150 birds (D. Pitkin, in litt.). Because of the dramatic increase in numbers as a whole, Aleutian Goose was downgraded by the U. S. Fish and Wildlife Service to "Threatened" in 1991 and de-listed entirely in 2001 (Kraege 2005).

Figure 11. Perhaps the most important feature for separating *parvipes* Canada Goose from all Cackling Goose subspecies is the long, narrow bill, as shown in this picture (as well as Figure 8). This head shape is shown by other Canada Goose subspecies as well. Photographed at Wheatridge, Colorado on 13 February 2006. *Photograph by Larry Semo.*

The migratory and winter movements of Aleutian Geese are complex. Most depart Alaska between late September and mid-October, with few seen as far east as Adak Island (V. Byrd, in litt.). Most Aleutian breeders fly non-stop to areas around the Sacramento and San Joaquin River National Wildlife Refuges in California's Central Valley (Springer and Lowe 1998, Griggs 2006). Several thousand, however, also make a brief stop in the New River bottoms on southern Oregon's coast (largely from late September into early November) or along the northern California coast in Humboldt and Del Norte Counties (mostly mid-October to mid-November); individual birds rarely remain more than a week or two (D. Pitkin, in litt.; Harris 2005). Smaller numbers, perhaps a few hundred, pause on the southwestern coast of Washington and in Oregon's Willamette Valley, predominantly in October and November (Hays 1997, Springer and Lowe 1998, Marshall et al. 2003). By mid-November, nearly all Aleutian Geese are at the San Joaquin River National Wildlife Refuge near Modesto or in the Sacramento/San Joaquin Delta (Kraege 2005, Griggs 2006), though a few hundred now winter in Humboldt and Del Norte Counties (Harris 2005). The Semidi Island breeders depart their breeding grounds in late September but do not arrive on the Oregon wintering grounds until mid-October and thus clearly pause somewhere en route (Marshall et al. 2003). By late January and early February, Aleutian Geese are already departing the San Joaquin Valley to stage in Humboldt and Del Norte Counties, where large numbers are present into mid-April (Black et al. 2004, Griggs 2006). They depart quickly, and virtually all are gone by early May (Harris 2005). Increasingly, the central California wintering population is also using the New River bottoms as a spring staging ground, ei-

Figure 12. These two dark *parvipes* Canada Geese may have originated from the Anchorage area. Their breast color is as dark as that of any *taverneri* Cackling Goose, but the long, slender bills mark them as Canada Geese. Birds from the darker, south-coastal Alaska population winter mostly in Oregon's Willamette Valley. Photographed at Ridgefield National Wildlife Refuge, Washington on 16 February 2007. *Photograph by Steven G. Mlodinow.*

Figure 13. The three *taverneri* (the larger birds) and two *minima* Cackling Geese shown here demonstrate average differences between these two subspecies as well as some of the variation within each. Note the rather long-necked appearance of these alarmed *taverneri*. The forward (and left) *minima* shows an unusually dull wing covert pattern for a *minima*, but the bird behind it shows the classic *minima* wing covert pattern that is very rarely, if ever, shown in other subspecies The rear left *taverneri* is near that taxon's extreme of breast darkness and appears to have a rather small bill. This bird, on its own, would be difficult to separate from *minima*. One would have to rely on impressions of overall size and neck length, lacking accompanying birds to use as points of reference. Photographed at Nisqually National Wildlife Refuge, Washington on 5 March 2006. *Photograph by Steven G. Mlodinow.*

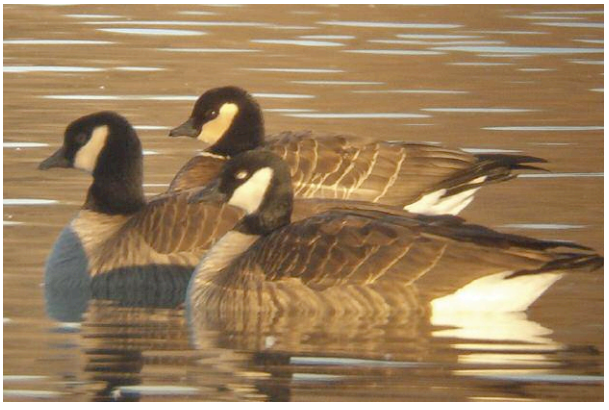


Figure 14. This threesome of Cackling Geese was photographed in eastern Washington at Moses Lake on 27 December 2004. The bird on the left displays head and bill shape typical for a *hutchinsii* Cackling Goose, as well as the whitish breast and indented cheek patch expected in that subspecies. The bird in the rear has the dark breast, tiny bill, and rounded head typical of a *minima* Cackling Goose. The bird on the right is probably not identifiable from this photograph. Its thicker bill and less steep forehead would suggest *taverneri*, but the whitish breast would be unusual for that taxon. *Photograph by Doug Schonewald.*

ther flying directly there from the San Joaquin Valley or pausing first in Humboldt and Del Norte Counties; a few thousand birds arrive along the New River in February, and numbers build until they reach 40,000 or more by early April, with peak arrival occurring during late March and early April (D. Pitkin, in litt.). Very few are found elsewhere during spring migration, with very small numbers found in southwestern Washington, mostly during February and March (Kraege 2005). This taxon is also a very rare spring and fall migrant in Washington's Puget Trough. Currently, there appear to be no valid records for British Columbia (P. Springer, pers. comm.).

Aleutian Geese—if one includes *asiatica* as part of *leucopariea*—were once a regular part of the Japanese avifauna, formerly fairly common between Hokkaido and Tokyo from October to March. Their numbers in Japan declined dramatically after 1900; flocks over 100 did persist into the 1920s, but after then, Aleutian Goose was rare in Japan, and by the late 1980s, one to three per winter had become the norm (Brazil 1991). Since 1995, Aleutian Geese have been reared in captivity and translocated to fox-free Ekarma Island in the Kuril Islands, with a total of 426 having been released as of 2006 (Masayuki Kurechi, Japanese Association for Wild Geese Protection, unpubl. data). Subsequently, small numbers of marked birds from this population have also been found wintering in Japan, with a maximum of 11 detected in 2006; concurrently, there has been an increase in unbanded Aleutian Geese (presumably of wild provenance) found in Japan, averaging about 18 annually since the winter of 1999-2000 (Masayuki Kurechi, Japanese Association for Wild Geese Protection, unpubl. data).

Between 1974 and 2001, approximately 550 Aleutian Geese were banded, mostly on the Aleutians, but also at wintering and staging sites in California (BBL Game Bird CD, 2005). Among the birds banded in California, one was recovered in eastern Washington and another at Cape Navarin, Siberia; among the birds banded in the Aleutians, recoveries include single birds from Hawaii at Midway Island and Johnston Atoll, two in the Marshall Islands, three together in Sonora's Rio Colorado Delta, and one each in northern Baja California, western Arizona, eastern Washington, and Russia's Bering Island (BBL Game Bird CD 2005; Schipper 1985, Russell and Monson 1998).

Other records of vagrant Aleutian Geese that we have been able to examine have come from: Hawaii (at least five individuals; R. L. Pyle and P. Pyle, unpubl. data); Mexico as far south as La Paz, Baja California Sur, from 29 October 2001 to 1 February 2003 (Erickson et al. 2003), and San Jose del Cabo, Baja California Sur, 23 January 2005 (S. Mlodinow, pers obs.); and Kansas (specimen record; M. Thompson, in litt.). Accepted records of Aleutian Geese in California away from typical locations include five records from the Salton Sea (12 November to 18 March; Patten et al. 2004) and at least five records on the southern California coast from November through January (Lehman 1994, Hamilton and Willick 1996, Unitt 2004).

As of 2001, approximately 15 Aleutian Geese were in captivity in Great Britain (Ogilvie unpubl. data). The numbers in captivity on mainland Europe are unknown. In North America, Aleutian Cackling Geese are somewhat uncommon in captivity, partly due to its recent status as an Endangered or Threatened bird, formerly making ownership difficult (F. Todd, S. Langer, pers. comm.).

Taverner's Goose –
Branta hutchinsii taverneri

The existence of this taxon was first suggested by P. A. Taverner in 1931, when he observed a population of small dark white-cheeked geese in northwestern Alaska (Taverner 1931). Since then, the existence of *taverneri*, particularly as distinct from *B. c. parvipes*, has been the matter of debate, until the examination of mtDNA placed these two taxa into different species. As with other Cackling Geese, Taverner's Goose is a tundra breeder. The full extent of its current breeding range is not precisely known. Taverner's does nest in the Yukon–Kuskokwim Delta, on the Seward Peninsula, and along the northeastern Kotzebue Sound (Mowbray et al. 2002). Beyond that, matters are more complicated. Both *parvipes* and *taverneri* have been listed as breeding on Alaska's North Slope (Mowbray et al. 2002), and genetic analysis of feathers from a small number of nests do seem to show both Cackling and Canada Geese on the North Slope, though the former in larger numbers (Pearce et al. 2006). The subspecific identity of the breeding Cackling Geese here, however,

is not certain (J. Pearce, C. Ely, pers. comm.). Review of a limited number of photographs from near Prudhoe Bay indicates that birds there appear to be, phenotypically, *taverneri*.

The eastern limits of the breeding range of Taverner's Goose is uncertain. Delacour (1951, 1954) stated that *taverneri* bred east along the Alaskan North Slope past the Canadian border to the Mackenzie River Delta, an assertion later supported by Sinclair et al. (2003), who considered the Yukon's tundra breeders to be *taverneri*. However, birds in the easternmost portion of this range have, at times, been considered *B. c. parvipes* (e.g., Mowbray et al. 2002). Our review of a limited number of photographs of breeding birds from this area indicates that they do appear to be Cackling Geese, but their subspecies could not be determined. It seems that most (or perhaps all) of the white-cheeked geese breeding on the northwestern Canadian mainland and in northeastern Alaska are Cackling Geese, but their subspecific identification (i.e., *taverneri* vs. *hutchinsii*) remains uncertain.

Due to identification challenges and prior taxonomic uncertainty, the wintering range of *B. h. taverneri* is also poorly understood. It appears that most *taverneri* winter in the Willamette Valley, Lower Columbia River Valley, and Columbia Basin, with smaller numbers along the Washington coast north through Grays Harbor, in the Puget Trough north to Seattle, and in California's Central Valley (D. Kraege, pers. comm.). The estimated number of *taverneri* wintering in the Willamette and Lower Columbia River Valleys is 40,000-50,000 (Marshall et al. 2003, D. Kraege, pers. comm.). The number wintering in the Columbia Basin is unknown; the total of *parvipes/taverneri* there is approximately 100,000 (D. Kraege, pers. comm.), of which we estimate 5-15% are *taverneri*. Similarly, there are about 10,000 *B. h. taverneri/B. c. parvipes* wintering in central California, but the ratio of these taxa there is currently uncertain (D. Yparraguirre, pers. comm.).

Taverner's Geese breeding on the Seward Peninsula/Kotzebue Sound appear to winter in eastern Washington and Oregon, while those breeding in the Yukon–Kuskokwim Delta appear to winter in western Washington and Oregon (M. Eichholz, unpubl. data). The wintering destination of Alaska's North Slope birds is currently uncertain but has been suggested to be eastern Washington and Oregon by Mowbray et al. (2002). However, all recoveries of white-cheeked geese banded during molt (all adults) near Prudhoe Bay on Alaska's North Slope have come from east of the Rockies (M. Eichholz, unpubl. data). Similarly, all recoveries of molting white-cheeked geese banded on eastern Alaska's Arctic tundra have come from east of the Rockies (C. Ely, in litt.). It is entirely possible that some, perhaps most, of these birds were molt-migrant *B. c. parvipes* or even *B. h. hutchinsii*, but it seems unlikely that none were the local breeders, which are likely mostly *B. h. taverneri*. Thus, an unknown number of *taverneri* may winter in the central United States or even into northern Mexico.

Figure 15. This Cackling Goose combines the bulk, head, and bill shape of *taverneri* Cackling Goose with the dark breast and strikingly marked wing coverts of *minima*. Apparent intermediate types occur and should be considered unidentifiable to the level of subspecies. Photographed at Nisqually National Wildlife Refuge, Washington on 15 January 2006. *Photograph by Steven G. Mlodinow.*

Figure 16. The white breast, relatively slender bill, and indented cheek patch of this bird are all suggestive of *hutchinsii* Cackling Goose. However, the head shape is far more rounded than is normal for that subspecies; also, the bill has a swelling at the base of the mandible, atypical for nominate birds and more typical of *taverneri*. Within the range of *hutchinsii* Cackling Goose, such a bird might easily be labeled as one, but atypical birds (particularly in apparently extralimital contexts) such as this are best left unidentified to subspecies. Photographed at Shillapoo Bottoms, Washington on 13 January 2006. *Photograph by Steven G. Mlodinow.*

In western Washington and Oregon, arrival and departure dates for Taverner's Geese seem similar to those for Ridgway's Geese. In the Columbia Basin, movement is more complex. Southbound Taverner's first arrive between late October and mid-November, with peak arrival during the first two weeks of November (D. Schonewald, pers. obs.). Taverner's Geese are widespread in the Columbia Basin as long as water is open and agricultural fields are not covered by snow. (Harsh weather sufficient to cause lakes and reservoirs to freeze or depositing a few inches of snow on fields typically causes Taverner's Geese to disappear from much of the Columbia Basin [D. Schonewald, pers. obs.].). It appears that birds either retreat to areas adjacent to the Columbia River itself (which remains unfrozen) or, at times, move as far south as Summer Lake, Goose Lake, the Klamath Basin, and the

Figure 17. This is another example of a bird best left simply as "Cackling Goose." Its bright white breast and dull wing coverts seem outside the range of an adult *minima*, yet the head and bill shape are somewhat intermediate between *hutchinsii* and *minima* Cackling Goose. Given that this bird is in western Washington with *minima* and *taverneri* Cackling Geese, it seems most likely that it is an aberrant *minima* or an intergrade, rather than an atypical *hutchinsii* Cackling Goose. Photographed at Nisqually National Wildlife Refuge, Washington on 5 March 2007. *Photograph by Steven G. Mlodinow.*

Warner Valley of southern Oregon and California (B. Jarvis, in litt.). Northbound movement into the Columbia Basin and western Washington is often detected as early as mid-February, and departure for the breeding grounds begins in early to mid-March, with the last birds typically departing by mid-April (D. Schonewald, S. Mlodinow, J. Barry, pers. obs.).

Much like that of Ridgway's Goose, the current wintering distribution of Taverner's Goose has changed notably in recent times. Prior to the 1970s, wintering numbers in western Oregon and Washington were likely quite small. Then, in the 1970s, this number increased quickly and by decade's end had stabilized at about 50,000 birds (Simpson and Jarvis 1979). Whether these birds appeared secondary to a population increase, or perhaps more likely, a shift from wintering grounds in California (or elsewhere) is unknown. Subsequently, there has been a slow spread northward, with over 1000 using the Puget Trough in Thurston and King Counties as of the winter of 2005-2006 (Mlodinow et al. 2006a).

The question of the status of Taverner's Goose in the continent's center has yet to be answered, but the Eichholz data cited above suggest that some *taverneri* do occur regularly east of the Rockies. There are single specimens from Irion County and Waller County, Texas (T.O.S. 1995, M. Lockwood, in litt.) and six specimens collected between November and January in Colorado, identified as *taverneri* by A. Phillips, in the Denver Museum of Nature and Science (Bailey and Niedrach 1965; L. Semo, pers. obs.). A photograph from Polson, Montana during November 2004 depicts one of four *taverneri* that were present (*fide* Dan Casey, Wayne Tree). Furthermore, ten apparent *taverneri* were among approximately 9000 *parvipes* and nominate *hutchinsii* in Weld County, Colorado on 27 January 2007 (Leukering et al. 2007), and five were among *parvipes* and nominate *hutchinsii* at Fort Collins, Colorado 5 January 2008, with another near Denver on 11 January 2008 (C. Cox, in litt.). Given the previous taxonomic and identification uncertainties of Taverner's Goose, and the huge numbers of other Cackling and Canada Geese present, small numbers of *taverneri* could easily pass through the mid-continent largely undetected.

Records from areas farther out of typical range include at least one well-documented bird in the British Isles, with several sightings from Ireland (January 2000, February 2001) and Scotland (November/December 2001, October 2002) thought to pertain to the same individual (C. Batty, in litt.; Batty and Lowe 2001, Batty et al. 2001). In eastern North America, well-documented vagrants include a bird photographed in Onondaga County, New York by Jay McGowan and Kevin McGowan (in litt.), 23-26 September 2004; another photographed at Janesville, Wisconsin during October 2004 by Tim Avery (in litt.); one photographed near Amherst, Hampshire County, Massachusetts 13-22 October 2007 by J. P. Smith (Ellison and Martin 2008); and one, possibly the same individual, photographed by Mark Szantyr and others and seen by many observers in Middlefield, Connecticut 30 November through early December 2007 (Hunt 2008). In Hawaii, six Taverner's Geese have been identified through winter 2007-2008 (R. L. Pyle and P. Pyle, unpubl. data). In Mexico, one Taverner's was photographed with six *minima* at Lagunita el Cipres, Baja California on 8 December 2004 (Erickson et al. 2005). Taverner's Goose is extremely rare in captivity in North America (F. Todd, S. Langer, pers. comm.) and essentially undocumented in captivity in Great Britain (M. Ogilvie, unpubl. data). Although we have not been able to review and vouch for all recent reports of extralimital Taverner's Geese, those we have reviewed suggest that this subspecies does occur as a vagrant in Hawaii and east of the Rockies and should be looked for and carefully documented.

Richardson's Goose –
Branta hutchinsii hutchinsii

The nominate subspecies of Cackling Goose, most commonly known as Richardson's Goose or Richardson's Cackling Goose (and also as Hutchins's Goose), breeds on the Canadian Arctic tundra from southern Baffin Island and northwestern Québec, west through the northern and western shores of Hudson Bay, to southern Banks Island and the Mackenzie River delta (Delacour 1951, 1954, Hines et al. 2000, Mowbray et al. 2002; J. Leafloor, Jack Hughes, pers. comm.). Richardson's Geese have apparently bred, at least on rare occasion, in western Greenland as well (Fox et al. 1996, Gotfredson 2002). Though birds breeding on the continental Arctic slope from the Mackenzie River west are thought to be *taverneri*, the precise border between *taverneri* and nominate *hutchinsii* has not been defined, nor has the degree of potential or actual intergradation between the two (J. Leafloor, J. Pearce, D. Derksen, pers. comm.).

The main wintering range of Richardson's Goose is split in two, with an eastern population wintering along the coastal plain of the Gulf of Mexico from northern Veracruz to southeastern Louisiana and a western population wintering from northern Jalisco through western Texas and eastern New Mexico to eastern Colorado. Smaller numbers of birds winter between these two main groups. The northern boundary of the wintering range depends somewhat on snow cover and open water, particularly in the West, where birds might be common as far north as northern Colorado or may retreat well into Texas. Furthermore, depending on weather conditions, individuals and small flocks sometimes linger into winter, or even overwinter, as far north as the Canadian border. The eastern wintering population comes mostly from the "Tallgrass Prairie" breeding population of white-cheeked geese (Dickson 2000). The Tallgrass Prairie population is named for its original (precolonial) wintering habitat and breeds in the Canadian Arctic from Baffin Island west to Prince of Wales Island. It consists mostly of nominate *hutchinsii* but probably contains some *parvipes* as well; the mid-winter population totaled around 300,000 through most of the 1990s (Dickson 2000). The western wintering population is mostly derived from the "Short-

Figure 18. Name that goose! These three shots show how much the head and bill shape of a single bird can vary from moment to moment. In Figure 18a (left), the bird has the head and bill shape of a *leucopareia* Cackling Goose, but in Figure 18b, the bill suddenly appears tiny and the head rounded much like a *minima*. But in Figure 18c, the bill seems a tad thicker and more smoothly fits the contour of the head, more like a *taverneri*. In real life, the head and bill most often appeared like that of *leucopareia* (as in Figure 18a), but its call resembled that of *taverneri*, and its tattered plumage yields no helpful clues. Photographed at Chametla, Baja California Sur on 3 March 2007. *Photographs by Marshall J. Iliff.*

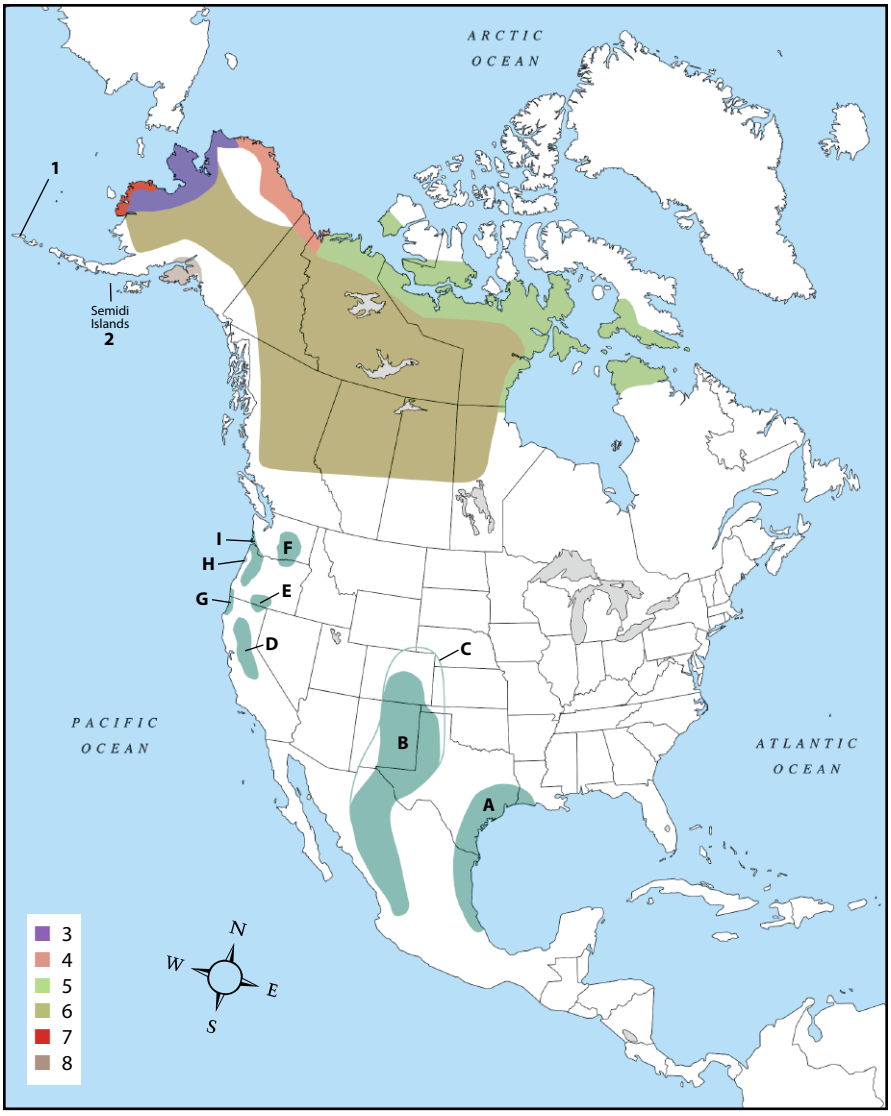
grass Prairie" breeding population (also named for original wintering habitat), which breeds in the Canadian Arctic from Victoria Island to the Alaskan border (Dickson 2000, Hines et al. 2000). This population is said to consist of nominate *hutchinsii* and *parvipes*, in unknown proportions, with *hutchinsii* occupying tundra habitats and *parvipes* taiga and forested habitats (Dickson 2000, Hines et al. 2000), but given the "accepted" range of *taverneri*, this taxon might be part of the Shortgrass Prairie population as well; midwinter surveys during the 1990s averaged around 400,000 birds total (Dickson 2000). Notably, a study of neck-banded birds in Lubbock, Texas revealed that birds wintering there originated from Baffin Island to the western Arctic, though most did come from the Shortgrass Prairie population, as expected (Ray and Miller 1997).

Migration occurs predominantly between the east slope of the Rocky Mountains and 95° W longitude. Southbound migration occurs rather rapidly, with initial or peak arrival usually occurring during the first half of October all the way from southern Manitoba to northern Mexico, though a few southbound migrants are found throughout this range as early as September (Howell and Webb 1995, Sharpe et al. 2001, M.A.R.C. 2003, Lockwood and Freeman 2004). Fall arrival can be somewhat later, however, depending on the timing of freeze-up at breeding and staging grounds. Departure from southern wintering grounds occurs mostly during February, with a few birds remaining into March (Howell and Webb 1995, Lockwood and Freeman 2004, Rottenborn and Brinkley 2007) and rarely into early April (T. Leukering, pers. obs.). In Nebraska, numbers of Richardson's Geese begin to accrue in late February and peak in early to mid-March, with few remaining into April (Sharpe et al. 2001). In southern Manitoba, peak spring arrival is somewhat later, occurring during the first half of May (M.A.R.C. 2003).

Richardson's Geese stray east of their main flight path with some regularity. For example, they are fairly common in northern Indiana during November and otherwise rare to uncommon in Indiana from October into April, with counts of 100+ coming from February, April, and November (Brock 2006). They are also considered uncommon fall and rare spring transients at Point Pelee, Ontario (A. Wormington, unpubl. data), and they occur regularly in small flocks in western New York (A. Wilson, R. Veit, in litt., Veit et al. 2008).

Farther east, the status of Richardson's Geese is imperfectly known. A.O.U. (1957) simply states that they winter on the Atlantic Coast south to South Carolina but makes no reference to abundance. Most of this region's recent literature on avian status and distribution (e.g., Bull 1974, Veit and Petersen 1993, Walsh et al. 1999, Zeranski and Baptist 1990) has not been revised since the split of Cackling and Canada Geese, though more recent texts (e.g., Rottenborn and Brinkley 2007) contain specific data on status and distribution of Cackling Goose. In the past four years, at least, birder interest in identifying Cackling Geese *sensu lato* on the Atlantic coast and east of the Mississippi River generally has increased substantially, as one notes in reading the regional reports in *North American Birds*. Currently, Richardson's Goose is identified regularly in small numbers from southern Québec and Massachusetts south to Virginia (P. Bannon, D. Veit, M. Szantyr, A. Wilson, L. Larsen, P. E. Lehman, P. Davis, E. S. Brinkley, R. Davis, in litt.). North of Massachusetts, Richardson's seems somewhat less regular, or at least less numerous, north to Nova Scotia (L. Bevier, I. McLaren, J. Wilson, in litt.), and it has yet to be found in Newfoundland (B. Mactavish, in litt.). In recent regional reports in *North American Birds* from August 2006 through February 2008, only two were reported from Atlantic Canada (Mactavish 2007, Dalzell 2007, Mactavish 2008, Dalzell 2008), whereas 72 were reported from New England (Ellison and Martin 2007, Hunt 2007, Ellison and Martin 2008, Hunt 2008), more than 61 (not fully enumerated) from New York, New Jersey, and Delaware (Veit and Paxton 2007, Rohrbacher et al. 2007, Veit et al. 2008, Rohrbacher et al 2008), 100+ from Maryland and Virginia (Day 2007, Day and Brinkley 2007), and seven in North Carolina (Davis 2007a, Davis 2007b, Davis 2008a, Davis 200b). Richardson's Geese are much rarer along the Atlantic Coast south of North Carolina. There are currently at least five records from South Carolina (Post 2004, Davis 2006), three from Georgia (Davis 2006, Davis 2007b, Davis 2008b), and three records from Florida (Stevenson 1977, Pranty 2006, Simpson et al. 2007).

Richardson's Geese occur regularly in Europe. They are annual in Great Britain and Ireland (Batty and Lowe 2001, K. Mullarney, L. Evans, in litt.) and Cackling Geese (likely mostly Richardson's) have been recorded ten or more times in Belgium (P. Adriaens, in litt.), about four times in Finland (H. Lehto, in litt.), with other records extant from elsewhere in Europe. In Great Britain and Ireland, these birds have been generally considered wild (K. Mullarney, L. Evans, C. Batty, in litt.), but in mainland Europe, most countries' authorities have considered them probable escapees (H. Lehto, P. Adriaens, in litt.), probably because they are waterfowl. Al-



though there are only about 60 in captivity in Great Britain compared with approximately 200 Ridgway's Geese (M. Ogilvie, unpubl. data), British records of Richardson's Geese greatly outnumber those of Ridgway's Geese (Batty and Lowe 2001, Batty et al. 2002, L. Evans, in litt.), which would appear to suggest wild provenance for many of the Richardson's found in Europe.

West of the Rockies, Richardson's Goose has been noted far less often, perhaps due to the montane barrier or perhaps due to the presence of numerous other Cackling Geese. There are three records from Washington's Columbia Basin (Mlodinow et al. 2006b, Mlodinow et al. 2007), which is perhaps not surprising, as many of that area's wintering *moffitti* Canada Geese and Mallards (*Anas platyrhynchos*) originate in Alberta and thus cross the Rocky Mountains (D. Kraege, pers. comm.). Elsewhere, there are two specimens from the Lower Colorado River Valley (California/Arizona; Rosenberg et al. 1991), a likely correct report from Oregon's Klamath Basin (Aldrich 1946), a group of eight photographed during 23 November 2007 in Oregon along the Columbia River Gorge (Mlodinow et al. 2008), and two photographed at Scottsdale, Arizona (Deviche and Moore 2007). Finally, a bird photographed in the Colorado plains had been banded as a molting adult in central Alaska, establishing that Richardson's has occurred in that state, at least as a molt-migrant (B. Schmoker).

Lesser Canada Goose – *Branta canadensis parvipes*

We include Lesser Canada Goose (*Branta canadensis parvipes*) in this article because of

MAP 1. LEGEND.

1: Breeding range of Aleutian Goose, *B. h. leucopareia*, Aleutian Islands population. Includes Buldir, Attu, Agattu, and Alaid–Nizki Islands in the western Aleutians and Chagulak Island in the central Aleutians.
2: Breeding range of Aleutian Goose, Semidi Islands population.
3: Unequivocal breeding range of Taverner's Goose, *B. h. taverneri*.
4: Historically, the white-cheeked geese breeding in this region have been considered *B. h. taverneri* and/or *B. c. parvipes*. Currently most of the breeding birds appear to be Cackling Geese, though which subspecies is unclear. Most are likely *taverneri*, but nominate *hutchinsii* may well be present, and the boundary between the breeding ranges of these two taxa is unknown. A small number of Canada Geese, likely *parvipes*, also appear to nest in this region.
5: Breeding range of Richardson's Goose, *B. h. hutchinsii*.
6: Main breeding range of Lesser Canada Goose, *B. c. parvipes*.
7: Breeding range of Ridgway's Goose, *B. h. minima*.
8: Isolated population of Canada Geese near Anchorage currently considered *parvipes* but with some phenotypic differences.

A: Main eastern wintering ground of *hutchinsii*.
B: Main western wintering ground of *hutchinsii*. It is possible that some *taverneri* winter here as well.
C: A major wintering area for *parvipes*.
D: California's Central Valley. Wintering ground of almost all *leucopareia* but also small numbers of *minima*, *taverneri*, and *parvipes*.
E: Klamath Basin and nearby wetlands in southeastern Oregon/northeastern California. Minor wintering ground for *parvipes* and *taverneri*. Formerly, major stopover point for *minima* en route to California's Central Valley.
F: Columbia Basin. Major wintering ground for *parvipes* and *taverneri*.
G: Humboldt and Del Norte Counties, California and Curry County, Oregon. Major spring and minor fall stopover point for *leucopareia*, usually accompanied by small numbers of *minima*.
H: Pacific City, Oregon. Wintering grounds of entire, or nearly entire, Semidi Islands population of *leucopareia*, along with small numbers of *minima*.
I: Willamette Valley/Lower Columbia River Valley/southern Washington coast. Main wintering ground for *minima* and Anchorage population of *parvipes*. Also, major wintering ground of *taverneri*.

its similarity to Richardson's and Taverner's Geese. (The discussion of its status and distribution will be abbreviated.) It should be noted that identifying vagrant Lesser Canada Geese is made difficult not only by its similarity to Richardson's and Taverner's Geese but also because it may resemble other subspecies of Canada Goose and intergrades within the Canada Goose complex.

Lesser Canada Geese breed in boreal and subarctic taiga habitats from central interior Alaska east through the northern Yukon and Northwest Territories to eastern Nunavut and south to northern Manitoba, Saskatchewan, Alberta, and British Columbia (Hines et al. 2000, Mowbray et al. 2002). Lesser Canadas winter predominantly in the Continent's interior from northwestern Mexico through eastern New Mexico, western Texas, and western Oklahoma to eastern Colorado and Nebraska (Hines et al. 2000, Mowbray et al. 2002, Silcock 2007). Large numbers also winter in the Columbia Basin of eastern Washington and Oregon, with smaller numbers in southeastern Oregon, western Oregon's Willamette Valley, the Lower Columbia River Valley of western Oregon and Washington, and California's Central Valley (Hines et al. 2000, Mowbray et al. 2002, Marshall et al. 2003, Wahl et al. 2005, Deuel 2005). The population in south-central Alaska (around Anchorage), which averages darker-breasted than other *parvipes*, winters mostly in western Oregon (Mowbray et al. 2002, Marshall et al. 2003). Potential vagrant Lesser Canada Geese have been reported from Hawaii to Europe (R. L. Pyle and P. Pyle, unpubl. Data; Batty and Lowe 2001, Batty et al. 2002). Given its large numbers, northerly and broad distribution, and lengthy migration route, a wide pattern of vagrancy would be expected in this subspecies.

Identification

It is somewhat unusual to start an identification discussion with a volley of caveats. However, in the case of subspecies, which compel us to consider a great deal of technical literature (some of it not useful or reliable), extreme caution is in order. A quick review of the subject in Johnsgard (1975), Bellrose (1980), Madge and Burn (1988), Ogilvie and Young (1998), Sibley (2000), and Dunn and Alderfer (2006) may plunge a potential goose-watcher into dismay. The array of websites on the subject often do not agree on criteria for identifying subspecies of Cackling Geese.

To counter this confusion, the authors of the present paper were chosen to research and write this paper because of their varied backgrounds and expertise with at least two of the taxa discussed. Our level of experience was broadened by sharing a large numbers of photographs and visiting each other's "homelands" to study geese in the field. Most importantly, we studied the birds within their normal ranges, where they can often be found in flocks numbering in the thousands—and typically, where only no more than two taxa are numerous. Between 2003 and 2007, we repeatedly visited the core wintering ranges of each subspecies: *B. h. hutchinsii* in Colorado, *B. h. minima* in the Willamette Valley and Puget Trough of Oregon and Washington, *B. h. leucopareia* in California, and *B. c. parvipes* in the Willamette Valley, Washington's Columbia Basin, and Colorado. Given the number of birds counted and identified in the flocks studied, we conservatively estimate that minimally 100,000 of each taxon except *taverneri* were observed; the estimated minimum for *taverneri* is 50,000. All of our work was done between October and April. Consequently, the marks we discuss are most applicable to that time frame.

The most important caveat for field observers to keep in mind is that not all Cackling Geese can be identified to subspecies. Even under ideal circumstances, with highly experienced observers studying geese in typical wintering range, we estimate that only 90-95% of birds viewed closely well can be identified with a high degree of confidence. The presence of multiple geese for comparison is extremely helpful, as they provide bases for comparisons of color, size, and shape. Therefore, a lone bird is far less likely to be identified with confidence, and identifications from photographs can be even more difficult, as snapshots often capture structure poorly (cf. Figure 18). By our estimate (based on current knowledge), the chances for a solid identification of a lone photographed bird may be as low as 10-20%.

Accurate identification of Cackling Geese subspecies in the field must rely heavily on size and structure, as plumage features overlap broadly among taxa; the presence of birds of known subspecific identity thus greatly improves the chances of identifying flockmates of other taxa, whether of Cackling Goose or Canada Goose. Apparent size and structure can vary dramatically with changing posture, activity, and even distance. Also, apparent size of a bird in the field may not be as concrete as one might think: all taxa show some degree of sexual dimorphism, and goslings' diets significantly influence their adult size (Leafloor et al. 1998; see also Aubin et al. 1993, Lindholm et al. 1994, Larsson and Forslund 1991, Sedinger and Flint 1991).

Underpart coloration is commonly used in subspecific identification of Cackling and Canada Geese. However, we find this character to be highly variable within each taxon, perhaps due to genetic variability, or perhaps also partly because of diet (Leafloor, unpubl. data, S. Langer, pers. comm.). Additionally, immatures of all subspecies average paler than adults, an important factor to bear in mind. However, and likely of greater importance, perceived coloration is highly subjective, even under the best circumstances, and even with birds of known subspecies for comparison. In an unpublished study, Pearce asked experienced goose biologists to rate a series of geese using the Munsell scale. These biologists then rated the same birds (in a different order of appearance) under the same conditions. The variation in the scoring of these geese in these experiments was striking, both between observers *and for the same observer*. What this means for us in the field is that our perceptions under far less ideal circumstances will be even less reliable.

In our discussion of cheek patches below, we mention the "gular stripe." This is a dark line down the middle of the throat present on some birds. This line can be quite thin and is best seen on feeding birds facing away as they reach down to graze.

During our field studies, we looked at large numbers of birds, typically in several different locations. However, some of our conclusions may be skewed by the populations we encountered, as there may well be some interpopulation variation, especially in *parvipes*. Also, many of our estimates in frequency of neck collars and gular stripes were done without first distinguishing adults from immatures, which may also skew our data. Estimates regarding the frequency of field characteristics were made by counting the percentage of birds bearing or lacking the given feature in several portions (100 birds minimum) in the flocks examined.

With these caveats in mind, we are of the opinion that it is nonetheless possible to identify accurately most Cackling Geese found in flocks and a fair number of strays found singularly or in small groups. The reader should refer to the photographs (Figures 1-18) for more extensive consideration of subspecific identification features.

Head shape

minima: Typically moderately sloped forehead with rounded crown giving "cute" appearance. Angle of forehead slightly steeper than that of bill as it meets forehead. When alert, often shows "boxier" shape.

hutchinsii: Typically short steep forehead ris-

ing almost straight up from bill, with somewhat flat crown, peaking slightly toward rear.
leucopareia: Forehead often steep, but usually not as much so as *hutchinsii*, and somewhat longer (distance between base of bill and top of crown greater). Crown relatively flat and rounded to rear as it curves into nape.
taverneri: Somewhat similar to *minima*, but generally gives a more massive feeling. Tends to flatten crown when alert.
parvipes: Highly variable, with many birds having a head shape similar to a more delicate version of *B. c. moffitti* and other large taxa of Canada Goose. Some have a short steep forehead, much like *hutchinsii*, followed by a sloping crown with rounded rear-crown. Birds east of Rocky Mountains seem more likely to show initial steep forehead.

Bill shape
minima: Typically small and triangular, but somewhat variable. Rarely slender and long and rarely showing bulge near base of mandible.
hutchinsii: Typically long and narrow in profile, though shorter than *parvipes*. Often shows a bit of droop towards tip. Occasionally, shorter and more triangular like *minima*. Culmen never convex.
leucopareia: Not as thick and triangular as *taverneri* but deeper in profile than *hutchinsii*. Longer and larger than *minima*. Almost an "average" of the other subspecies.
taverneri: Usually rather stout and somewhat triangular, often with a bulge near base of lower mandible, almost imparting a Snow-Goose-like appearance.
parvipes: Long and slender, sometimes with convex culmen. Often showing a rather pointed tip to bill, particularly in populations east of Rocky Mountains.

Overall size and shape
minima: Smallest. Sometimes does appear almost Mallard-like in size. Proportionately short-necked, thick-necked, small-chested, long- and slender-winged. Neck usually held down at angle when feeding, with little or no loop.
hutchinsii: Apparently quite variable, with western populations being smaller than those from east (J. Leafloor, pers. comm.). Often appears quite small, almost as petite as *minima*. Full extent of size variation not well established. Neck usually held down at angle when feeding, with little or no loop.
leucopareia: Mid-sized. Most birds clearly larger than most *minima* and clearly smaller than most *taverneri*, but size differences do not usually "jump out" at observer. Somewhat longer-necked than *minima*, but still fairly thick-necked. Somewhat big-chested in appearance. Neck sometimes bent or looped when feeding, but to a lesser degree and frequency than *taverneri*.
taverneri: Largest Cackling Goose, with some birds approaching size of Lesser Snow Goose (*Chen caerulescens caerulescens*). Large-chested in appearance. Size difference with *minima* usually quite apparent in mixed flocks. There is enough overlap with *leucopareia* that size is not valuable in separating these subspecies. Additionally, though larger on average than *hutchinsii*, there is probably enough overlap in size that body size may not be useful in separating these. Smaller than *parvipes*, a difference typically apparent in field. Longer-necked than other Cackling Geese, which is especially obvious when in alert posture. Neck often somewhat bent or looped when feeding. Wings appear broader than those of *minima* in flight, and tail may be longer than that of other Cackling Geese and *parvipes* Canada Goose.
parvipes: Size similar to Pacific Greater White-fronted Goose (*Anser albifrons frontalis*). Longer more slender neck than any of the Cackling subspecies, showing a distinct loop in neck as feeds.

Underpart coloration
minima: Averages darkest of Cackling Geese. Adults typically dark and glossy-breasted, with a purple to bronze sheen. Immatures are sometimes rather pale and are less often glossy-breasted, particularly when molting. There is near complete overlap in breast color (but not gloss) with *taverneri*, but *minima* are probably never as white-breasted as "typical" *hutchinsii*. Virtually all adults and most immatures are darkest on breast and paler on flanks/belly, the reverse pattern of *taverneri* and *hutchinsii*. Occasionally, *minima* are uniformly colored beneath, but rarely, if ever, palest on breast.
hutchinsii: Variable, but never appear as dark as "typical" *minima*. Almost complete overlap with other taxa. Rarely, if ever, glossy-breasted. Great majority are white- or whitish-breasted, averaging distinctly paler than *leucopareia* and paler than *taverneri*. Darkness of underparts typically uniform.
leucopareia: Gray- to bronzy-brown-chested, with medium darkness between "typical" *taverneri* and *minima*. Less glossy than *minima*. Darkest and most bronzy birds often monochromatic below, whereas paler birds often shade from a paler breast to darker belly/flanks (as in *taverneri*). Of 10,000 studied in Humboldt County, California during late February 2007, only 10 indviduals showed a *minima*-like pattern in underparts. Semidi Island birds average darker than Aleutian breeders (D. Pitkin, in litt.).
taverneri: Typically medium-gray-breasted, becoming darker on belly/flanks. Some can be quite brown and dark-breasted, but even the darkest birds do not show usual *minima* pattern of being darkest on breast and are very rarely glossy-breasted. Occasional birds are very white-breasted, like "classic" *hutchinsii*, but these pale *taverneri* are still darker on flanks/belly.
parvipes: Through almost entire range, majority of birds are quite white-breasted, with darker belly/flanks. However, a fair percentage shows medium-gray breasts (substantially overlapping with *taverneri*, though the difference in chest color is usually evident when comparing flocks of *parvipes* and *taverneri*). Birds breeding in south-coastal Alaska and wintering predominantly in Oregon's Willamette Valley can be quite dark gray, with some individuals approaching Dusky Canada Goose (*B. c. occidentalis*) in darkness.

Cheek patch and gular stripe
minima: Gular stripe common, but exact frequency hard to assess; several flocks of 1000+ birds evaluated during winter of 2006-2007 in Washington showed surprising variability, ranging from an estimated 40% to 95% of birds in any given flock. Appearance of a gular stripe seems not to be dependent on age (in *minima* and other taxa).
hutchinsii: We estimate that up to, but not exceeding, 25% of this subspecies have a compete gular stripe. Many, perhaps most, show a *step-off narrowing of cheek patch* at level of eye, a feature that is uncommon in other taxa, excepting *parvipes*.
leucopareia: Gular stripe nearly always present. Fewer than 10 individuals of 5000+ studied in late February 2007 in Humboldt County, California lacked a complete gular stripe. Most of these exceptions still had a partial gular stripe. Also, we estimated that in 20% of *leucopareia*, the gular stripe was broad enough as to be visible from a strictly lateral view, a character that is rare (we estimate below 5% of individuals) in other taxa.
taverneri: Similar to *minima* in shape of cheek patch and frequency of gular stripe. Frequency of gular stripe varied from 40-75% in flocks evaluated during winter of 2006-2007 in Washington and Oregon (flocks ranging from 100-600, percentages based on actual counts).
parvipes: Of 10,000+ birds evaluated in Colorado and eastern Washington during winter of 2006-2007, we estimated that fewer than 1% showed a gular stripe in both populations. In western Washington and Oregon, several

small flocks (<50 birds) of darker *parvipes* (presumably from south-coastal Alaska) were observed. Frequency of gular stripe not tabulated but within 25%-50% range. Cheek shape of Colorado birds often resembled that of *hutchinsii*, whereas eastern and western Washington birds showed this pattern infrequently.

Note that there may be subtle average differences in cheek patch shape that we did not detect; the only useful variation we found is discussed under *hutchinsii*. Additionally, when gular stripes are present, they can range from very thin to very wide; the subspecies that show more frequent gular stripes, on average, also seem to show wider gular stripes, but this was not closely studied and seems a valuable character only in *leucopareia*.

Neck collars

The neck collar, if present, is a white line separating the black neck from the body. It is highly variable in thickness, but it is virtually always thickest anteriorly and typically (except in *leucopareia*) absent on the hind neck, thus forming an anterior crescent, not a complete ring. Readers should also note that neck collars, even when present, are most easily seen on birds with dark chests and can virtually disappear in conjunction with the very pale breast of many *hutchinsii* and *parvipes*.

minima: Of 10,000+ studied in Washington from November 2006 into February 2007, we estimated that 10-20% had at least partial neck collars. Unfortunately, we did not assess this mark by age class initially and thus do not have data for adults versus immatures. However, it was noted that immature *minima* were much less likely than adults to have neck collars from October into late February, when some molting immatures acquire this character. Only about 1% of *minima*, all adults, have a neck collar as broad as a typical *leucopareia*, and less than half of these had that neck collar subtended by a dark band, as in most *leucopareia*. Notably, minima with thick white neck collars tend to be among the darkest-breasted individuals. Very few (estimated at fewer than 1 in 1000) had white extending far (25% or more) up the anterior neck.

hutchinsii: Frequency of neck collars similar to that of *minima*, but collar never subtended by dark. White wedge extending up anterior neck is rare enough that we know of no instances.

leucopareia: A broad white neck collar is a hallmark of *leucopareia* and present on all adults. We estimated that in greater than 99% of adults examined in Humboldt County, California, during February 2007, there was a dark ring subtending the white neck collar. On an estimated 90% or more of adults, the neck collar was quite wide anteriorly, but even on those birds, most showed at least a small gap posteriorly. A wedge of white extending far up anterior neck was present on approximately 1% of adults. Findings were similar among immatures at that time, excepting that an estimated 5-10% had a very thin partial neck collar, about 5% lacked the dark collar subtending the white one, and none had a white wedge extending up anterior neck. Notably, most hatch-year birds are without any white at base of neck from October through December, and it is not clear when the collar molts in (D. Pitkin, R. LeValley, pers. comm.; *contra* Johnson et al. 1979).

taverneri: Perhaps the least likely to have a white neck collar. We estimated that more than 99% of immatures lacked a neck collar, at least into mid-February, and a neck collar was present on only approximately 2-5% of adults. We know of none with white extending far up anterior neck. During our four years of study, we found two or three individuals that may have been *taverneri* with a *leucopareia*-like neck pattern, including the dark ring beneath the white collar.

parvipes: Frequency of neck collars similar to that of *minima* and *hutchinsii*, but collar never subtended by dark. We found no birds with white extending far up anterior neck.

Wing covert pattern

minima: Approximately 75% of adults show a blue-gray base to each feather with a dark brown subterminal band and strongly contrasting white or whitish terminal band. Few if any immatures show this pattern, and in all subspecies, immatures have a less contrasting wing covert pattern than adults.

hutchinsii: Typically, brown or gray-brown base to each wing covert, darkening distally and forming a somewhat diffuse medium-brown subterminal band followed by a pale brownish terminal band. Occasionally terminal band broad and nearly white. Some with duller wing pattern. Rarely, if ever, shows "classic" adult *minima* wing covert pattern.

leucopareia: More *minima*-like than *hutchinsii*, but base to wing coverts still typically brownish rather than gray, and subterminal band tends to be more diffuse than that of *minima* but better defined than in *hutchinsii*. Terminal band often quite broad and well delineated but usually cream colored; only occasionally white or nearly white. Rarely (estimated below 1%) shows pattern of "classic" adult *minima*.

taverneri: Similar to *hutchinsii*, but more likely to show some features of *minima*, including grayish hues on bases of wing coverts and more likely to have a well-formed subterminal band and/or bright whitish terminal band. We estimated that fewer than 5% show a "classic" adult *minima* wing covert pattern.

parvipes: Similar to *hutchinsii*.

Voice

minima: A high yip or yelp. Little variation.

hutchinsii: Similar to *minima*.

leucopareia: Deeper than *minima* and often double-noted.

taverneri: Most commonly, a yip or yelp similar to *minima*, but deeper in pitch. Also a distinctive deep "whoop," reminiscent of some Canada Goose calls, most often given upon take-off or landing.

parvipes: Similar to a high-pitched Great Basin Canada Goose (*B. c. moffitti*).

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