Observations of Aleutian Cackling Geese *Branta hutchinsii leucopareia* breeding on Buldir Island, Alaska: forty-seven years after discovery of a remnant population

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Abstract

The once endangered Aleutian Cackling Goose *Branta hutchinsii leucopareia* sub-species has recovered to over 100,000 birds. In 2009, we revisited the largest known breeding colony on Buldir Island, Alaska, USA where the birds' breeding biology was first studied during 1974–1977, when the population was only 1,700 individuals. We compared the density and distribution of nests, nesting chronology, clutch size, hatching success, and adult mass and size recorded in 2009 with the earlier data, finding: 1) increased nest densities, 2) expansion of nesting habitat into formerly unoccupied habitat strata, 3) smaller average clutch size, and 4) reduced post-breeding mass of females. Further studies are required to determine inter-annual variation in these variables and how breeding rates on Buldir Island compare with those on recently colonised, neighbouring sites within the Aleutian island chain.

Key words: body mass, body size, breeding biology, clutch size, density-dependence, hatching success.

The once endangered Aleutian Cackling Goose *Branta hutchinsii leucopareia* sub-species (hereafter, Aleutian Goose) has grown from an estimated 1,700 birds in 1977 to over 100,000 individuals (Mini *et al.* 2011; Sanders & Trost 2013). It was thought to have been on the brink of extinction until a remnant breeding colony was discovered on Buldir Island in 1962 (Jones 1963), but subsequent conservation action plans were implemented and the population made a remarkable comeback by the early 21st century (reviewed by Mini *et al.* 2011).

The breeding biology of Aleutian Geese was initially studied on Buldir Island (Fig. 1) from 1974 through to 1977 (Byrd & Woolington 1984), providing information on population structure, habitat characteristics, nesting chronology and breeding success. During subsequent observations made of

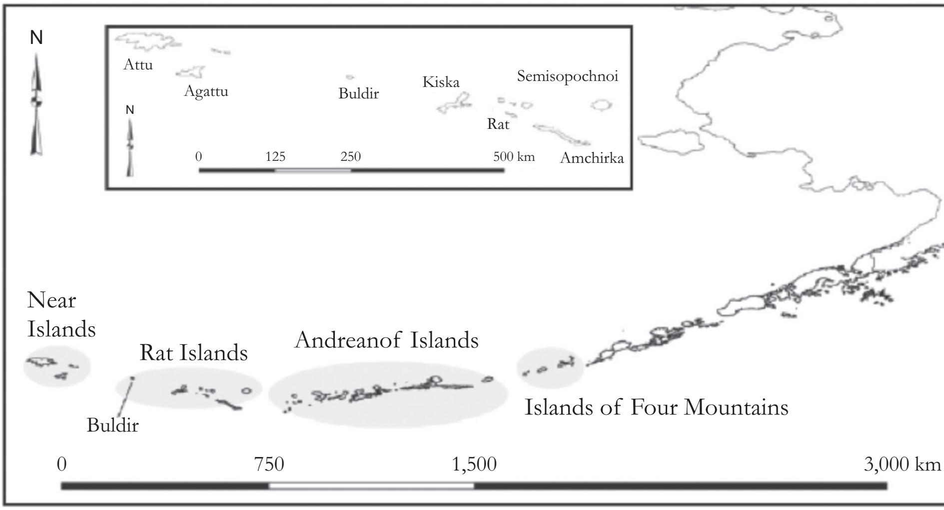

Figure 1. Location of Buldir Island, Alaska, USA within the Rat Islands cluster at the eastern end of the Aleutian Island chain of islands. The remnant population of Aleutian Cackling Geese was discovered on Buldir Island in 1962 by Jones (1963). We returned to assess breeding in summer 2009. Figure derived from Mini *et al.* (2011).

the geese in summer 2009 we attempted to replicate Byrd & Woolington's (1984) methods on revisiting their study plots at the Buldir colony, to permit comparisons between current and previous parameters recorded during the breeding season.

In bird populations, negative feedback on demographic rates can occur through a combination of multiple density-dependent (*e.g.* crowding, despotic interactions) and density-independent factors (*e.g.* climate) (Newton 1998). In goose populations regulated by density-dependence, the incidence of successful breeding, clutch size, gosling growth, final body size and survival may be negatively correlated with population size (Cooke *et al.* 1995; Sedinger *et al.* 1998; Lake *et al.* 2008; Black *et al.* 2014). Where data are available on current and previous parameters, a comparison of these measures may contribute to revealing the extent to which different regulatory mechanisms are influencing a population (*sensu* Newton 1998).

In 2009, on Buldir Island, we therefore quantified Aleutian Goose distribution of nests, nesting chronology, clutch size, hatching success, adult body mass and size, and estimated total abundance to compare with the initial, 1970s studies (Woolington & Early 1977; Byrd & Woolington 1984). In particular, we aimed to understand how features of Aleutian Goose breeding biology and the birds' use of resources on a specific nesting island have changed following the dramatic increase in overall abundance over the past three decades.

Study species and location

The Aleutian Goose is most easily identified by its conspicuous white neck-ring separating the black neck plumage from the "ochraceous" under-parts (Delacour 1954). The goose was first described by Brandt in 1836, given race distinction as the Aleutian Canada Goose *Branta canadensis leucopareia* by Delacour (1954), and on the basis of mitochondrial DNA evidence, was reclassified as one of four sub-species of the Cackling Goose – Aleutian Cackling Goose *Branta hutchinsii leucopareia* (American Ornithologists' Union 2004). Aleutian Geese are island nesters with a historic breeding range that encompassed most of the Aleutian Islands, Kuril Islands, Commander Islands (Byrd & Woolington 1984), Chagulak Islands (Bailey & Trapp 1984) and the Semidi Islands (Hatch & Hatch 1983). Observations conducted over fourteen years led Jones (1963) to report "little likelihood of finding a breeding population on any of the Aleutian Islands where Blue Foxes [had] been released and still persist." The Blue Fox, a dark phase of Arctic Fox *Vulpes lagopus*, and Red Foxes *Vulpes vulpes* have been introduced throughout most of the archipelago by fur trappers as early as the 1750s. In 1962, Jones (1963) and his assistant reached Buldir Island, one of the few islands on which foxes had not introduced, where they recorded 60 adults and at least seven goslings. Two other remnant flocks were subsequently described on Chagulak Island (Bailey & Trapp 1984) and in the Semidi Islands (Hatch & Hatch 1983).

Mini *et al.* (2011) reviewed the events that led to the recovery of the sub-species. In 1967 the U.S. Fish & Wildlife Service (USFWS) began protection of the Aleutian Goose when it was officially declared endangered by the Endangered Species Protection Act of 1966 (32 FR 4001) when their population was down to 800 birds. By 1990, the population had rebounded to over 6,000 through lethal removal of foxes, hunting closures and captive rearing programmes (Byrd & Springer 1976). In March 2001, the USFWS removed the Aleutian Goose from the endangered and threatened species list (U.S. Fish & Wildlife Service 2001). Based on mark-recapture methods, the preliminary estimate for the 2015 population was of 189,100 individuals (95% CI = 154,000–224,200; Olson 2015). Current breeding distributions and densities on Aleutian Islands beyond the three islands with remnant breeding populations remain uncertain.

The study of Aleutian Goose breeding biology was conducted on Buldir Island, Alaska, USA (52°21'N, 175°56'E). Formed in the late quaternary period, and consisting of two volcanic peaks and an alluvial valley, Buldir Island is the most western of the Rat Islands group of the Aleutian Island Archipelago, and the most isolated (Coats 1953) (Fig. 1). Shemya Island is 125 km to the west, and 109 km to the east is Kiska, making Buldir Island the only landfall in a 220 km-wide stretch separating the Pacific Ocean from the Bering Sea. Buldir Island's 2,000 ha landscape is dominated by two vegetation complexes: a lowland tall-plant complex and an upland short-plant complex (Byrd 1984). With the exception of a small beach near the northwest point, steep talus slopes surround the island and are prone to frequent rockslides (Coats 1953). Buldir Eccentric, the highest point on the island, rises to 655 m. Unlike other Aleutian Islands, Buldir is generally unaltered by anthropogenic influences (Byrd 1984), and the native flora and fauna have not been altered by the introduction of predators (*e.g.* foxes), which commonly occurred on other islands in the Aleutian island chain (Bailey 1993; Williams *et al.* 2003; Croll *et al.* 2005).

The treeless landscapes of the Aleutian Islands are characterised by their maritime tundra-plant communities and maritime climate (Maron *et al.* 2006). Most days during the study period were foggy with high winds and light precipitation.

Methods

Habitat strata were identified as south-facing slope (S) plots, inland tall-plant slope (I) plots, north-facing slope (N) plots, and upland mossy-willow (U) plots (Woolington & Early 1977). A stratified random sampling technique was employed in the 1977 study when 30 plots were distributed among the four strata based on prior knowledge that geese were selecting nest sites differentially among the four strata (Fig. 2; Woolington &

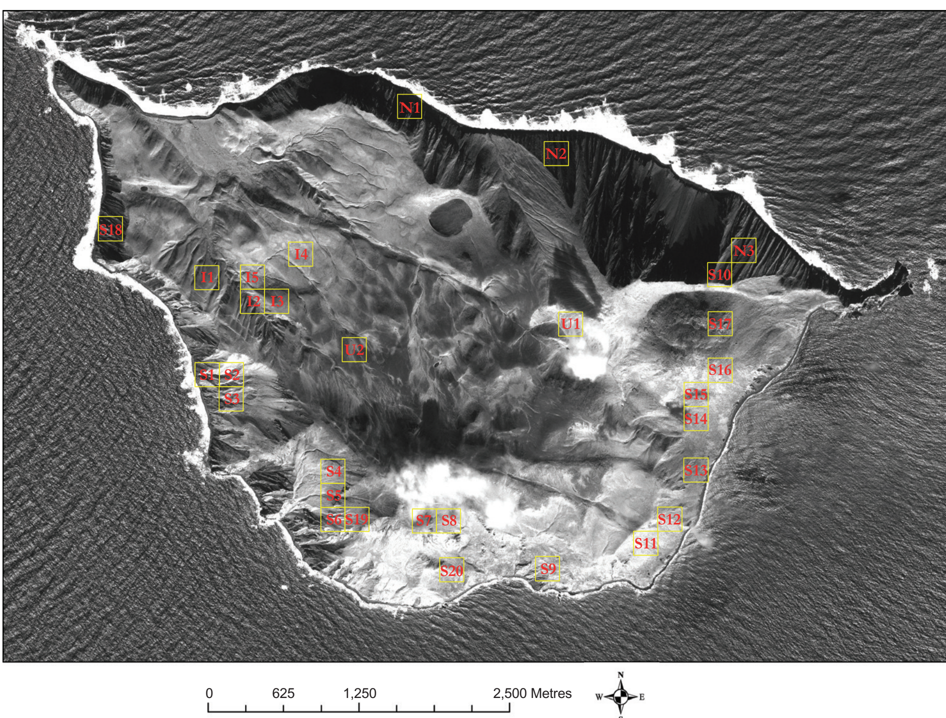

Figure 2. Satellite image of Buldir Island, Alaska, USA showing the location of the 30 randomly-stratified 200 × 200m plots studied in 1977. In 2009, we searched for nests in randomly-selected 100 × 100m sub-plots (total = 31 sub-plots) within each of the original upland (U), inland (I), south-facing (S) and north-facing (N) strata.

Early 1977). Nesting data in 2009 were obtained from 27 of these 30 plot locations. We replaced three of the plots that had washed away on steep slopes, choosing new plot locations randomly within strata. We added one additional plot in the inland tall-plant (I) strata, making a total of 31 plots in 2009.

Due to an anticipated increase in time needed to quantify a potentially larger number of nests, sampling effort was prioritised by searching a randomly allocated 100 × 100 m sub-plot within each of the original 200 × 200 m plots. This alteration allowed for surveying within each of the 31 plots by two observers (JC & SKA) during the short nesting period. The location of each nest was recorded with GPS, and a 2 m stake with reflective flagging was erected nearby to aid in nest relocation. All other survey techniques were consistent with Byrd & Woolington (1984).

Based on nesting chronology from previous years on Buldir Island (Byrd & Woolington 1984), nest checks began on 31 May 2009, when the majority of geese should have finished laying a clutch. Nest searching ceased on 11 June to reduce disturbance and potential predation to young broods (*sensu* MacInnes 1962; Byrd & Woolington 1984). It was discovered that on days with reduced fog, Glaucous-winged Gulls *Larus glaucescens* would follow researchers during nest searches. Sometimes, gulls would quickly remove an egg from a nest when the goose flushed. By conducting surveys during days with thick fog, wind and precipitation, researchers were able to avoid Glaucous-winged Gull depredation of goose nests.

In nests that had two or more eggs, two were floated (see Westerkov 1950) to determine the stage of incubation, following the methods and flotation angles used by Byrd & Woolington (1984). The angle of the oldest egg on the date of discovery was used to estimate the duration of incubation. Onset of laying date was then calculated by subtracting the estimated length of incubation, one day for each egg in the clutch, plus one additional day, from the date on which the clutch was inspected. This laying rate was used in other studies of other small geese at similar latitudes, which lay one egg each day, but usually skip one day before the fourth or fifth egg is laid (MacInnes 1962; Mickelson 1975; Byrd & Woolington 1984).

At a minimum of 3 days following projected hatching dates, nests were revisited to determine the fate of the clutch (successful, failure, or abandoned). A pair was considered to have bred successfully if at least one egg hatched, with evidence of shells broken and detached from intact membranes (Mickelson 1975; Byrd & Woolington 1984). A clutch was classified as having failed if there was evidence of destroyed eggs. Nests with full clutches of cold eggs remaining, and no female attending, were considered abandoned (Klett *et al.* 1986).

Conventional banding drives (*sensu* Cooch 1955) were not possible on Buldir Island because the geese rarely formed large flocks. Consequently, geese were captured in tall vegetation by hand or with the aid of nets attached to long handles (Byrd & Woolington 1984). A sample of 100 adult geese was captured (21–30 July 2009), weighed and measured, with measurements including: 1) 'culmen 1' – measured from the bottom of the V-point where the integument meets the hard portion of the upper mandible to the distal tip of the bill nail; 2) skull; 3) total tarsus; 4) tarsus bone; and 5) mid toe (Dzubin & Cooch 1992). Adult body mass and skeletal size measurements recorded in this study were compared with measurements taken in the 1970s (V. Byrd, unpubl. data). Sex was determined by cloacal examination (Owen 1980).

Each bird was marked with a U.S. Fish & Wildlife Service steel leg ring, and also with a blue 44.5 m high neck collar engraved with a unique white alpha-numeric code (series J00–J99) to permit identification of individual birds in the field.

The total number of breeding pairs on the whole of Buldir Island was estimated following methods used by Byrd & Woolington (1983) and Woolington & Early (1977), by multiplying the mean number of nests per plot with the number of plots available within a given stratum.

Wilcoxon rank sum tests were used to test for differences in the distribution of nests between sample plots surveyed in the 1977 and 2009 breeding seasons. A Student's *t*-test was used to compare mean clutch sizes from samples collected in 2009 with those from 1977, and also among habitat strata in 2009. Chi-square tests were used to compare hatching success among habitats. Additionally, *t*-tests were used to compare adult body size measurements between the 1970s and 2009.

Results

Whereas Woolington & Early (1977) recorded 21 nests in the 30 original (200 × 200 m) plots in 1977, we found 61 nests in the 100 × 100 m sub-plots in 2009. In 2009, nests were observed in plots located in three of the four habitats: 39 nests were found among 21 south-facing (S) plots, 21 in six inland tall-plant (I) plots, one in two north facing (N) plots, and no nests in two mossy-willow (U) plots. Nest densities in 2009 were significantly higher in (S) plots ($W = 30$, $P = 0.005$) and (I) plots ($W = 124.5$, $P = 0.02$) compared with 1977 (Table 1). Nests were found in eight of the 19 plots where previously no nests were recorded by Woolington & Early (1977). Woolington & Early (1977) reported encountering seven nests outside of the survey and census areas; in contrast, we found 125 nests that were not within the survey plots.

In 2009, average clutch size was 3.4 eggs (s.d. = 1.3, n = 61 nests), which was significantly smaller than in 1977 (mean ± s.d. = 5.5 ± 1.0, n = 36; t = 8.67, d.f. = 83, $P \leq 0.001$). Clutch size did not vary between the two main habitat types where nests were found in 2009 (south-facing (S) plots, mean ± s.d. = 3.4 ± 1.1, n = 39; inland tall-plant (I) plots, mean ± s.d. = 3.8 ± 1.3, n = 21; t = 2.03, d.f. = 35, P = 0.18, n.s.; Table 2).

Mean estimated date of nest initiation in 2009 was 17 May (range: 4–29 May, n = 61 nests), which was 8 and 13 days earlier than the recorded mean initiation in 1974 and 1975, respectively (Byrd & Woolington 1984). Mean date of nest initiation on both the south-facing slopes (range: 5–30 May 2009, n = 39) and inland tall-plant slopes (range: 7–27 May 2009, n = 21) was 18 May. The mean estimated hatch date was 21 June (range: 9–30 June, n = 61 nests), which was six days earlier than the average hatch date in

Table 1. Estimated nesting densities for Aleutian Geese on Buldir Island, Alaska in 1977 and 2009.

	South-facing slopes		North-facing slopes		Inland tall-plant slopes		Upland mossy-willow	
	1977	2009	1977	2009	1977	2009	1977	2009
Number of plots sampled	20	21	3	2	5	6	2	2
Total nests in sample plots[a]	20	156	0	4	1	84	0	0
Mean number of nests per plot 200 × 200m (4 ha)	1	7.24	0	2	0.2	14	0	0
Mean number nests per 100 ha	25	181	0	50	5	350	0	0
Total number nests in stratum	140	1,014	0	80	19	1,302	0	0[b]

[a] Number of nests found in 2009, multiplied by 4 to represent the number of nests in a full plot.
[b] No nests were found within sampled plots, but nests were discovered in this habitat.

1974, and 12 days earlier than the average of 3 July in 1975 (Byrd & Woolington 1984).

All habitat types with nests within sample plots had evidence of successful hatching, including a single nest discovered in the north-facing habitat. Hatching success was significantly higher in the south facing (S) plots (79.4% of 39 nests) compared to inland tall-plant (I) plots (38.1% of 21 nests) (χ^2_1 = 10.28, P = 0.013; Table 2).

Mean body mass for adult geese was significantly lower in 2009 than in 1977 (males: t = 2.54, d.f. = 67, P = 0.01; females: t = 2.33, d.f. = 96, P = 0.02; Table 3). Culmen 1 (males: t = –0.97, d.f. = 67, P = 0.33; females: t = –1.02, d.f. = 96, P = 0.38) and tarsus (males: t = 1.49, d.f. = 67, P = 0.14; females: t = 0.72, d.f. = 96, P = 0.47) measurements did not differ.

Extrapolating from the mean number of nests per plot in 2009 resulted in a breeding population estimate of 4,791 individuals, which is almost three times larger than the estimated total population size of 1,700 individuals (including 334 breeding birds) in the 1977 breeding season.

Discussion

In the 1970s Aleutian Geese showed preferences in nest site suitability, which appeared to be influenced by slope aspect, elevation and vegetative complex on Buldir Island (Woolington & Early 1977; Byrd &

Table 2. Summary of Aleutian Goose nest distribution, density, clutch size and population estimates for Buldir Island, Alaska in 2009, compared with 1977 values.

		1977 values[a]	2009 values[b]
Total nests found		36[c]	61[d]
Total nests within plots		21	61 (244)[e]
Estimated nests on island		167	2,396[f]
Distribution of nests among strata	South-facing slopes	20	39 (156)[e]
	Inland tall-plant slopes	1	21 (84)[e]
	North-facing slopes	0	1 (4)[e]
	Upland mossy-willow slopes	0	0
		80.7[g]	65.5%
Hatching success	South-facing slopes	–	79.4% (39 nests)
	Inland tall-plant slopes	–	38.1% (21 nests)
	North-facing slopes	–	100% (1 nest)
	Upland mossy-willow slopes	–	–
Mean clutch size (*n*, s.d.)		5.5 (n = 36)	3.4 (61, 1.275)
Estimated number of breeding geese		334	4,792[h]

[a] Woolington & Early 1977, unpublished report of 30 sample plots.
[b] 31 plots were sampled in 2009.
[c] Includes nests found outside of sample plots.
[d] Only nests within plots were recorded.
[e] A 100 × 100m sub-sample of 200 × 200m plots (multiplied by 4 to represent full plot numbers).
[f] Total number of nests estimated on the island using methods of Woolington & Early 1977.
[g] Hatching success data were not available for 1977. Byrd & Woolington (1983) reported 80.7% for 1975–1976.
[h] Estimate of breeding geese on Buldir Island in 2009 (*i.e.* twice the estimated number of nesting pairs on the island).

Table 3. Summary of Aleutian Goose body size measurements taken in 2009 and compared to measurements taken from 1974–1976 on Buldir Island, Alaska.

	1974–1976[b]		2009	
Body size measurements	Male (*n* = 36)	Female (*n* = 46)	Male (*n* = 33)	Female (*n* = 52)
Body mass (g)	1,945.6 (136.6)[a]	1,704.0 (156.6)	1,842.7 (196.8)	1,612.7 (221.8)
Culmen 1(mm)	36.6 (2.1)	35.1 (1.4)	37.1 (2.17)	35.5 (2.32)
Total tarsus (mm)	92.4 (3.4)	86.7 (3.7)	91.3 (2.62)	86.18 (3.42)

[a] Mean (s.d.)
[b] 1974–1976 values provided by USFWS, Alaska Maritime National Wildlife Refuge.

Woolington 1984), but it was not known whether availability of nesting habitat was limiting the number and productivity of breeding pairs. Aleutian Geese nested on the island at far greater densities in 2009 than in the 1970s, suggesting that density-dependence was not evident in the 1970s, but a combination of factors such as crowding, territoriality and environmental heterogeneity (*sensu* Newton 1998; Rodenhouse *et al.* 2003) may now be influencing the birds' breeding success. Some evidence for density effects comes from the finding that the geese nested within inland tall-plant slopes (I) plots in 2009 – which were not used in the 1970s – and had lower hatching success than geese nesting on south-facing slopes, although clutch sizes in 2009 were similar among habitat strata. Moreover, average clutch size was significantly smaller in 2009 (3.4 eggs) and hatching success was lower (65.5%) than in 1975–1976 (5.5 eggs and 80.7%) when the estimated population size was 1,700 individuals (172 breeding pairs). Cooke *et al.* (1995) likewise documented a reduced clutch size and lower hatching success in an increasing colony of Lesser Snow Geese *Chen c. caerulescens* in Canada, with Sedinger *et al.* (1998) also finding a reduction in clutch size at an increasing Black Brant *Branta bernicla nigricans* colony in Alaska. One possible explanation for the smaller clutch sizes and lower hatching success on Buldir Island in 2009 could be the foraging performance of females on arrival and during incubations breaks (*sensu* Prop *et al.* 1984), especially with increased competition due to higher bird densities (*sensu* Black *et al.* 2014), but further behavioural studies are required to determine whether this is affecting the Aleutian Geese. Alternatively, there may be a higher proportion of younger females in the breeding population. It is well-established that younger geese lay fewer eggs and achieve lower hatching success (Kear & Berger 1980; Rockwell *et al.* 1983; Forslund

& Larsson 1992). Reduced ability to acquire body stores at spring staging areas with higher goose densities may also be a relevant factor (see Mini & Black 2009; Spragens *et al.* 2015). Further study is required to test among these alternative hypotheses.

The mean clutch initiation and hatch dates recorded in 2009 were more than one week earlier than those reported during the 1970s (Byrd & Woolington 1984). An earlier arrival and nesting chronology for other northern waterfowl has been described in recent years by Dickey *et al.* (2008), with higher mean temperatures and lower snow cover in spring being associated with earlier egg-laying and hatching dates. The average temperature between 3 June and 17 June in 2009 was 6.8°C, which is slightly higher than the average temperature in 1977 which was 5.6°C from 29 May–20 June.

Aleutian Geese on Buldir Island generally nested between 10–320 m in elevation, which is consistent with the distribution of cover and food plants, which do not occur above 320 m where upland mossy dwarf-willow (U) plot habitats dominate (Byrd 1984; Byrd & Woolington 1984). In 1975, 100% of nests were found among the beach rye-umbel and beach rye-umbel fern plant communities of the south facing slope stratum, despite making up only 68% of the available habitat (Byrd & Woolington 1984). The distribution of goose nests in 2009 differed significantly from distributions from 1970s breeding seasons on Buldir Island. For example, only one of 26 nests in 1977 compared to 22 of 61 nests in 2009 were discovered in survey plots outside of the south-facing slope (S) plots (Woolington & Early 1977). No nests were found during the 1970s or 2009 surveys in the upland mossy-willow habitat (U) plots, although in 2009, we encountered four nests in this habitat while hiking between plots.

Hatching success in 2009 observed on south-facing (S) plots, was higher (79.4%; Fig. 3) than in other habitat strata, perhaps due to enhanced growth and abundance of food plants. It has been argued for Barnacle Geese *Branta leucopsis* that food acquired by females prior to nesting and during incubation breaks may influence incubation constancy, thereby reducing the period that eggs are vulnerable to predators (Prop *et al.* 1984; Black *et al.* 2014). The primary predators of goose eggs and goslings on Buldir Island were Glaucous-winged Gulls and Arctic Skuas *Stercorarius parasiticus* (Byrd & Woolington 1984).

Body mass of female and male Aleutian Geese, but not their body size, was significantly lower in 2009 than in the 1970s. A more detailed examination is required to provide necessary insight, but the difference in mass may be due to increased competition for food at higher bird densities during the breeding season and/or during spring staging, as argued above. Since final body size in other goose populations has been linked to foraging conditions experienced in summer in the goslings' natal areas (Cooch *et al.* 1991a,b; Loonen *et al.* 1997; Black *et al.* 1998; Larsson *et al.* 1998), the lack of a change in body size between the 1970s and 2009 may indicate a consistent food supply where broods are reared in upland habitats where short, palatable vegetation occurs on Buldir Island (see Byrd & Woolington 1984).

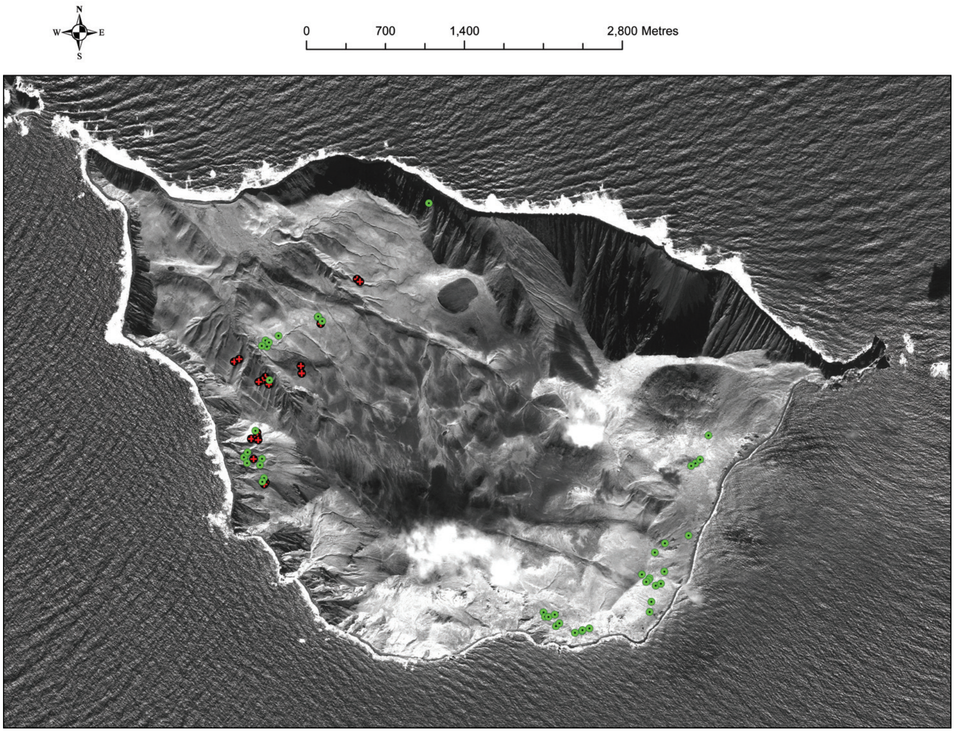

Figure 3. Satellite image of Buldir Island, Alaska, USA with 2009 breeding season failed (red cross) and successful (green circle) nest locations.

During breeding seasons in the 1970s, population estimates were made based on how goose nests were distributed across the Buldir landscape, and sample plots were stratified to reflect that distribution. Based on a subset of the sample plots and strata assessed in 2009, we estimated 4,791 breeding geese on the island, which is 2.8 times larger than the 1977 estimate of 1,700 birds. The 2009 value is likely to have been under-estimated because the stratification of plots no longer reflects the current distribution. To assess more accurately the Buldir Island breeding population, we would suggest a re-stratification of sample plots so that they are proportionate to the total amount of suitable habitat they represent when compared to the whole island. For example, the number of sample plots per stratum should be proportionate to the total area of the island that stratum covers. The 2009 sampling effort used a sampling design based on historical distributions. Now that geese are nesting in all stratum, an increased sampling effort (more plots) on inland tall-plant (I) and north-facing (N) slopes would have yielded more nests per hectare and increased the population estimate.

Habitat improvement through fox removal continues to be a high priority conservation effort on the Aleutian Islands. Since the late 1940s, USFWS has restored 33 islands, totalling more than 241,393 ha, through the removal of foxes. Aleutian Geese have readily colonized islands near reintroduced populations once free of foxes (J. Williams, USFWS, pers. comm.). In the central Aleutians, the USFWS had removed foxes from several islands by 2000, including Carlisle, Herbert, Kagamil, Uliaga and Seguam, and these islands now have potential for colonization by the geese (U.S. Fish & Wildlife Service 2001). Habitat improvement on Attu Island (90,320 ha) also now provides a substantial amount of available nesting habitat (U.S. Fish & Wildlife Service 2001). In 2009, researchers identified successful Aleutian Goose nests while visiting Rat Island, which was recently colonized by Aleutian Geese (J. Williams, USFWS, pers. comm.). Despite the availability of suitable nesting habitat, natural expansion to unoccupied islands east of Buldir Island may be limited due to an abundant population of Bald Eagles *Haliaeetus leucocephalus*. Further research is needed to quantify Aleutian Goose colonization rates as it relates to fox removal (*sensu* Petersen *et al*. 2015 for Common Eiders *Somateria mollissima*).

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Photograph: Josh Cocke on an inland tall-plant slope on Buldir Island, while catching Aleutian Cackling Geese during their annual moult, by Steven Alton.

