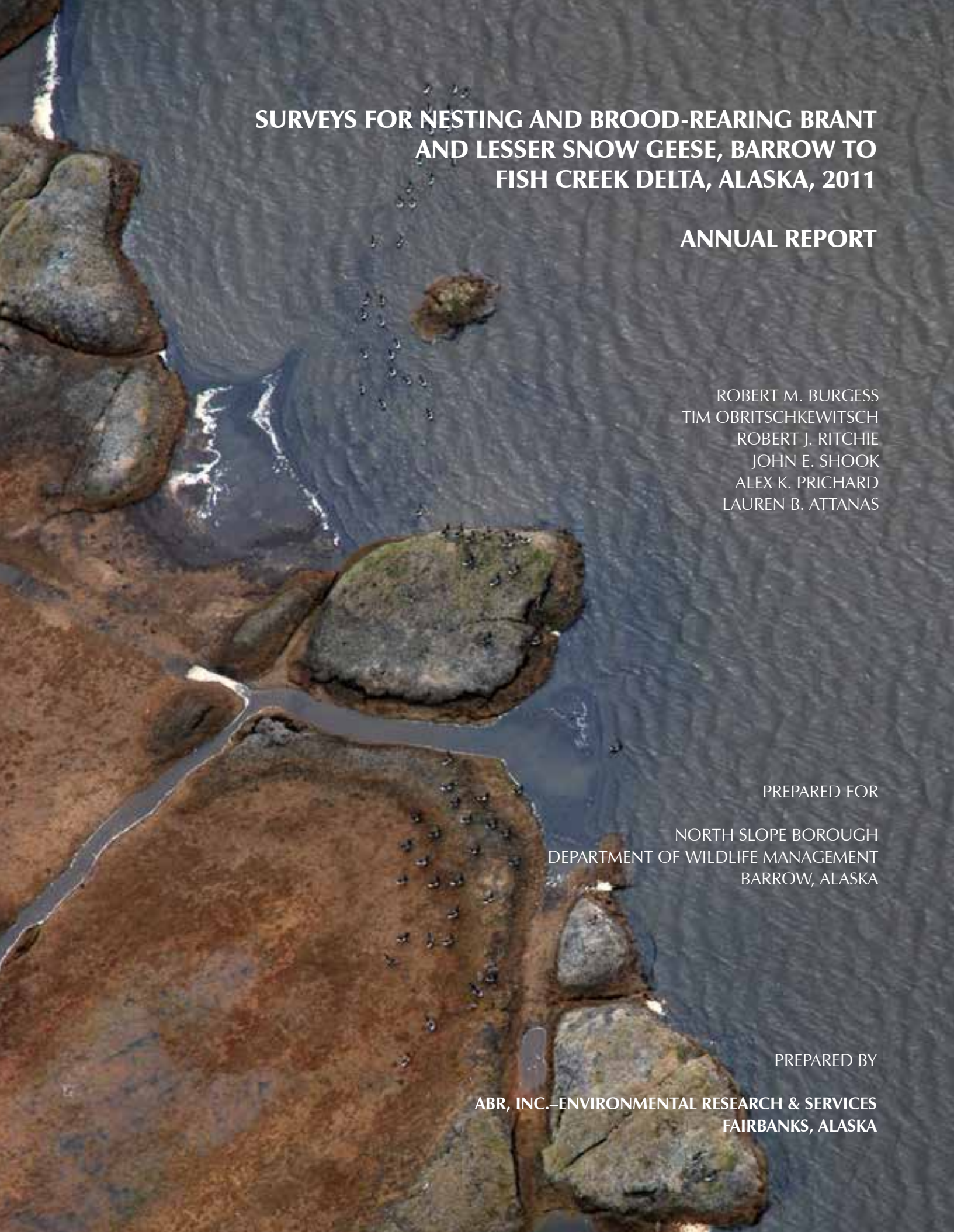

SURVEYS FOR NESTING AND BROOD-REARING BRANT AND LESSER SNOW GEESE, BARROW TO FISH CREEK DELTA, ALASKA, 2011

ANNUAL REPORT

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EXECUTIVE SUMMARY

- In 2011 we continued to monitor Lesser Snow Goose and Brant populations in the region between Barrow and the Fish Creek delta, northern Alaska. As in previous years we visited pre-selected Brant nesting colonies, visited the Snow Goose colony on the Ikpikpuk River delta during incubation (aerial survey and photo census) and after hatch (ground visit for nest-fate searches), conducted brood-rearing surveys for Brant and Snow Geese, and banded Snow Geese.
- Eighteen of the 23 (78%) monitored Brant colonies were occupied in 2011 (356 nests). Nest numbers were 17% lower than in 2010 but were about 15% higher than the 17-year average. Even with a reduced number of monitoring colonies, this program continues to suggest that the small population of Brant is relatively stable in the region, with substantial interannual variation in colony size at individual colonies.
- In July 2011, 17,199 Brant in 168 groups were estimated in the area between Barrow and Fish Creek. This estimate included 11,538 adults in groups without broods, 3,615 adults in groups with broods, and 2,046 goslings. The number of adult birds was the fourth highest recorded since surveys began, while the number of goslings was the second -highest on record. However, the number of brood-rearing/molting adult Brant in our study area appears to have increased from 2,000–5,000 prior to 2001 to 8,000–21,000 after 2001, primarily due to an increase in the number of adults in groups without broods. As in previous years, most Brant broods were recorded in the Harrison Bay section.
- In 2011, nesting Snow Geese again were abundant and widely distributed across the Ikpikpuk River delta, as they have been since 2006. Ice and flooding, however may have displaced some birds from islands in the northern portions of the delta. Visual estimates from an aerial survey on 19 June add up to nearly 10,250 Snow Geese, comprising ~4,500 possible nesting pairs and an additional ~1,250 flying birds on numerous islands on the Ikpikpuk River delta. Numbers from visual aerial estimates in 2011 were higher than those recorded on the Ikpikpuk River delta in 2009.
- In an effort to improve our colony counts, a photo census of the Ikpikpuk Snow Goose colony was undertaken on 19 June 2011. Compared to our visual estimates (4,500 pairs), at least 8,661 Snow Goose nests were identified on aerial photographs. Combined with visual observations of an additional ~1,250 flying birds recorded during our survey flights, 19,022 Snow Geese were recorded on the Ikpikpuk River delta in 2011. Although nests continue to be distributed widely across the entire delta, use of the northwestern delta has decreased in recent years, and in 2011 only 9% of Snow Goose nests were located on the 5 islands with the longest history of use in what is now the western part of the colony. Islands in the central delta comprised the main nesting area of the colony (43% of nests), and increasing numbers of Snow Geese recently have nested farther inland in wet sedge tundra habitats that previously seemed uncharacteristic of Snow Goose nesting habitats in the region.
- After the previous two years of intensive predation by brown bears, nest success and productivity rebounded. Estimated nest survival for the colony in 2011 was 65.3%.
- In July 2011, 26,277 Snow Geese were estimated in our study area, including 5,861 adults in groups without broods. Numbers of adults were the highest recorded since surveys began in 1995. Furthermore, as expected from nest success estimates, broods and total number of young increased markedly from 2010: 10,181 goslings were recorded compared to 194 goslings in 2010. As in previous years, most Snow Geese (83%) were located in the Smith Bay section.
- Banding activities on the Ikpikpuk River delta resumed in 2011 after a 2-year hiatus caused by the near-total destruction of the colony by brown bears. Banding also was conducted on the Sagavanirktok River delta in 2011, but ABR did not band Snow Geese on the Colville River delta. We captured a total of 2,747 Snow

Geese, consisting of 1,394 adults and 1,353 goslings. A total of 313 of trapped geese were recaptures; 309 of these birds were banded by ABR on the Arctic Coastal Plain, and 4 were foreign recaptures, not originally banded by ABR (2 males and 1 female were banded on Banks Island and 1 male was banded on the MacKenzie River delta).

- We also captured 1,915 Snow Geese consisting of 1,035 adults, 880 goslings, and 1 goose of unknown age on the Sagavanirktok River delta. A total of 354 birds were recaptures (18.5%); 346 of these were birds banded by ABR on the Arctic Coastal Plain. Of the recaptured birds banded by ABR, 321 were banded on the Sagavanirktok River delta, 12 on the Colville River delta, and 7 on the Ikpikpuk River delta prior to 2011. Three foreign recaptures were females from Banks Island, Canada, Wrangel Island, Russia, and eastern Nunavut, Canada. The latter bird represents one of the longest east–west movements of any banded Snow Goose on record at the USGS Bird Banding Lab.
- Since banding began in 2000, we have recaptured 1,705 Snow Geese which represents 10.3% of 16,506 Snow Geese processed during our banding operations on the Arctic Coastal Plain. These recaptures included 37 birds originally banded in Northwest Territories, 4 banded in Nunavut, 1 banded in Manitoba, 11 banded on the Colville River delta (prior to 2008), 17 banded near the Sagavanirktok River delta (prior to 2000), 9 banded in Russia, and 1,624 birds banded by ABR and recaptured on the Arctic Coastal Plain (Appendix K).
- As of 31 December 2011, band returns from the Ikpikpuk, Sagavanirktok, and Colville banding sites have been reported by the USGS Bird Banding Laboratory from 24 of the lower 48 states (961), from 5 Canadian provinces (358), from Alaska (42), from 5 states of Mexico (23), and from Russia (2). Fifty-one of the Snow Geese that were recaptured by ABR were previously banded by others outside of Alaska.
- A total of 1,386 of 16,506 (8.4%) Snow Geese originally banded by us on the North Slope have been recovered since 2000. All but 11 returns have been hunter killed or otherwise reported dead. The largest number of band returns were from birds banded in 2008 (277) and the smallest number from 2001 (25). Eighteen-and-a-half percent of bands released in the first year of banding (2000) have been returned, and over 16% have been returned from the first 4 years of banding. The average return rate over all years was 8.4%. The oldest known-age bird (i.e., banded as a gosling) was 11 years old and the oldest unknown age bird was at least 9 years old when the band was returned.
- The distribution of returns and recaptures suggests wide-ranging wintering areas and migratory routes generally similar to those reported for Snow Geese banded 1980–1990 on the Sagavanirktok River delta and Western Arctic Snow Geese in Canada. However, a large number of band returns from Snow Geese banded on the Ikpikpuk River delta were peripheral to or east of the main loci for wintering and spring use areas of the earlier Sagavanirktok River delta birds and the Western Arctic Snow Goose population, including numerous states east of the Mississippi and eastern provinces. Although there is a fair amount of mixing between populations, particularly for male birds, these eastern states and provinces are in the primary migration routes and winter areas of the Central Arctic and Eastern Arctic populations of Lesser Snow Geese, breeding in the eastern Canadian arctic.

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INTRODUCTION

Proposed and potential oil developments in areas west of the Colville River delta, within the National Petroleum Reserve–Alaska, prompted increased inventory and monitoring activities for wildlife resources in the area. Since the mid 1990s, the North Slope Borough (NSB) Department of Wildlife Management has supported a program to monitor the status and productivity of Brant (*Branta bernicla*) and Lesser Snow Geese (*Chen caerulescens caerulescens*) in the area west of the Colville River delta (Ritchie and Burgess 1992, 1993; Ritchie and Flint 1994; Ritchie 1996, 1998a, 1998b, 2001; Ritchie and Rose 1996; Ritchie and Wildman 2000; Ritchie et al. 2002, 2004, 2006, 2007, 2008a, 2009, 2010; Ritchie and Shook 2003, 2005).

The major goal of this program has been to monitor the distribution, abundance, and status of colonial geese in the region. Annual breeding-pair surveys that are conducted by the U.S. Fish and Wildlife Service (USFWS) are inadequate for monitoring colonially nesting species. Similarly, annual molting goose surveys conducted by the USFWS in the Teshekpuk Lake area focus on non-breeding and non-local geese that molt in large lakes between Harrison and Smith bays, but do not include many of the coastal brood-rearing areas used by local breeders. Specific objectives of our surveys were to evaluate the annual abundance of nesting and brood-rearing Brant and Snow Geese, to assess elements of their productivity, including nesting success and gosling production, and to describe their distribution in the region. In addition, we have tried to improve our estimates of productivity for the rapidly growing Snow Goose colony on the Ikpikpuk River delta through annual banding (2000-2003, 2005–2008, 2011) and photo censuses of the colony (2009–2011).

This report presents the results of the twentieth consecutive year of aerial surveys of Brant and Snow Goose nesting colonies in northern Alaska, west of the Colville River delta (1992–2011), and the seventeenth year for brood-rearing surveys (1994–1997 and 1999–2011, augmented by photo census since 2001). Ground-based searches also were conducted for the thirteenth year at the Ikpikpuk Snow Goose colony in 2011 (1992–1993, 2001–2011). Banding of brood-rearing Snow Geese has been accomplished annually in the Ikpikpuk/Piasuk River deltas (hereafter, Ikpikpuk River delta) since 2000, except in 2004 (unfunded), and 2009 and 2010 (due to the near complete failure of the colony, see below). In 2008, 2010, and 2011, we banded Snow Geese on the Sagavanirktok River delta (no banding was conducted in 2009 due to colony failure) and in 2010, after learning of failure at the Ikpikpuk colony, we banded Snow Geese in the Colville River delta. Banding data from all locations are included in this report. A complete summary of the survey types and areas covered by ABR in the course of long-term monitoring of colonial geese for the NSB, 1991–2011, is presented in Appendix A.

STUDY AREA

The study area for monitoring breeding Brant and Snow Geese covers much of coastal Arctic Alaska (Figure 1), although areas of focus have shifted during some periods since monitoring was initiated in 1991. Initial efforts in the 1990s extended from Kasegaluk Lagoon to the Colville River delta. Starting in 1996, nesting and brood-rearing aerial surveys were focused on the Beaufort Sea coast between Point Barrow and Fish Creek, just west of the Colville River delta (Figure 1). While brood-rearing surveys continued to cover all coastal wetlands in this area, the nesting surveys focused on monitoring the status of specific Brant colonies and 1 Snow Goose colony (in the Ikpikpuk River delta) (Figure 1).

The study area comprises coastal tundra with numerous oriented thaw-lakes and is part of the Arctic Coastal Plain Ecoregion, bounded on the north by the Beaufort Sea (Gallant et al. 1995) and whose southern extent is generally within a few kilometers of the coast. Vegetation in the study area is dominated by wet-graminoid/herbaceous plant communities. Along the coast, gravel spits, unvegetated mudflats, and salt marsh are extensive in some areas.

The study area was divided into sections for reporting (Ritchie 1996). Sections 1 and 2 are located west of Barrow and are not included in this report as they have not been surveyed since 1995. The other 3 sections (3–5, Figure 1) have been surveyed annually since 1994, with minor

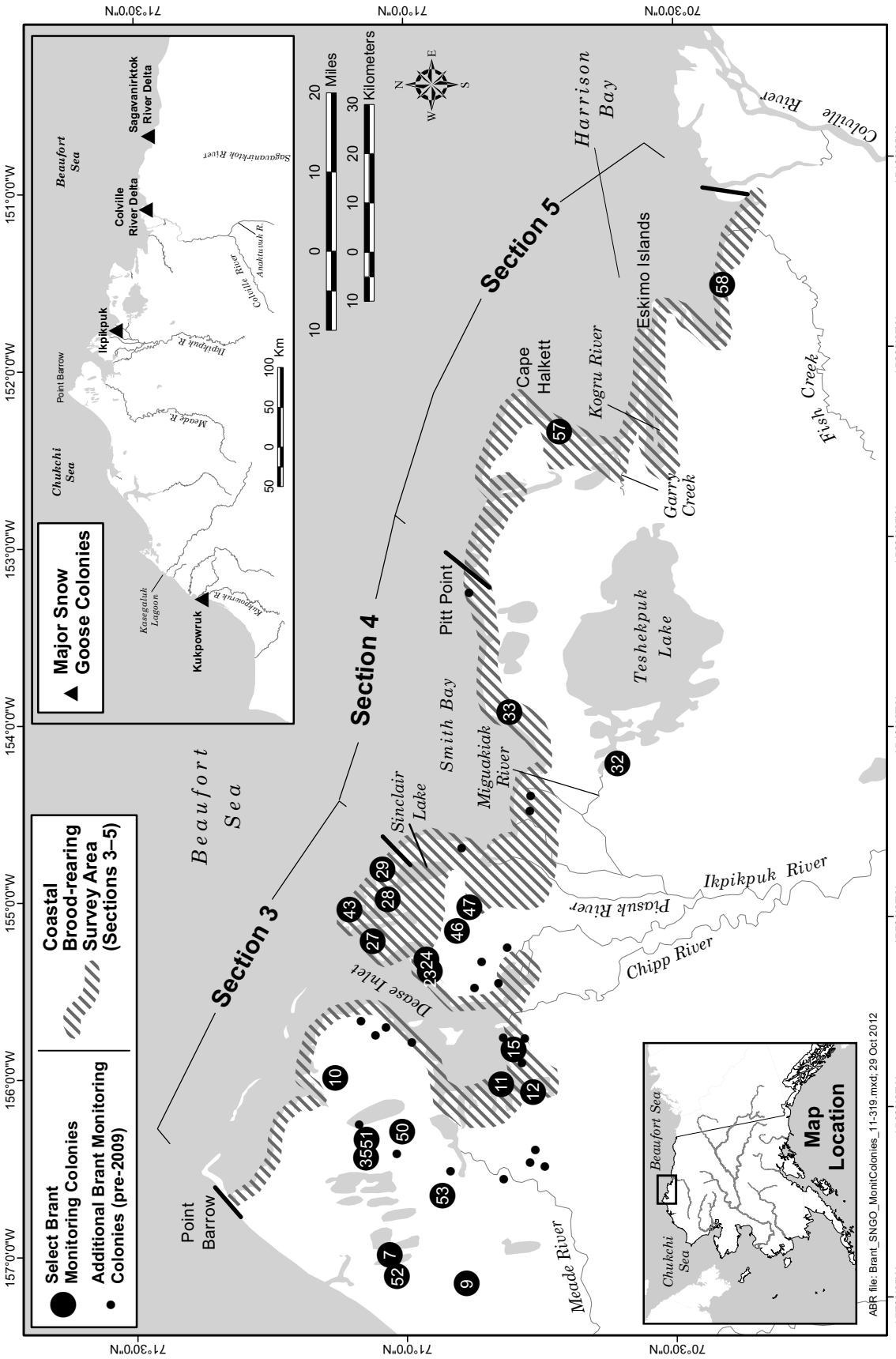

Figure 1. Study area for surveys to monitor breeding Brant and Snow Geese, including locations of 23 specific Brant colonies, 4 major Snow Goose colonies, and brood-rearing survey area along Alaska's northern coastline.

adjustments made to their boundaries in 1997 (Ritchie 1998a). These 3 sections are:

- Dease Inlet (Section 3: Barrow to Sinclair Lake northwest of Smith Bay),
- Smith Bay (Section 4: Smith Bay and inland areas from Sinclair Lake to Pitt Point), and
- Harrison Bay (Section 5: Pitt Point to the western channel of the Colville River).

METHODS

BRANT COLONY MONITORING SURVEYS

Brant colony monitoring focused on 45 known nesting colonies between Barrow and Fish Creek, 1996–2008 (Figure 1). These 45 Brant colonies were thought to be representative of Brant breeding efforts in the region and selected for long-term monitoring from all known colonies found during more wide-ranging surveys in 1994 and 1995 (Ritchie 1996). To further reduce survey costs since 2009, this group of Brant colonies was reduced to 23 of the consistently largest colonies.

A Cessna 185 aircraft with a pilot and 1 observer was used for colony monitoring. The aircraft was flown at 95–140 km/h and 30–100 m above ground level (agl) on 16 June 2011. We used an onboard geographic positioning system (GPS) to locate the 23 known Brant colonies for surveys, aided also by USGS 1:250,000-scale topographic maps. During all surveys, the single observer and the pilot (positioned on opposite sides of the aircraft) recorded numbers of adults and nests for each nesting location. The pilot aligned the plane to make the best pass for counting by the observer and also identified nest sites that might inadvertently be missed by the observer (e.g., in front of the plane). Colonies often were circled to afford better counts. A nest was recorded if either a down-filled bowl or an adult in incubation posture was observed. Male Brant typically flush in response to approaching aircraft and incubating females also occasionally flush, but empty Brant nests can be fairly conspicuous due to copious down.

IKPIKPUK SNOW GOOSE COLONY MONITORING

NESTING PHOTO SURVEY

Since 1996, annual colony monitoring has also included an aerial survey of the Snow Goose colony in the Ikpikpuk River delta (Figure 1). Snow Goose nests in Brant colonies or observed opportunistically during the Brant colony survey are also recorded. With the rapid increase in the size of the Ikpikpuk colony, the aerial survey has become increasingly difficult. So, we augmented our efforts in 2009, 2010, and 2011 with aerial photos in an effort to improve the accuracy of our estimates of nest numbers.

The 2011 aerial photo effort was conducted on 19 June using a Cessna 185 aircraft with a belly mounted camera and aerial photography view port, flown at an air speed of 140–160 km/h (about 120–180 km/h ground speed) and 305 m above ground level (agl). We used an onboard geographic positioning system (GPS) and predetermined flight track lines spaced 200 m apart to cover the known and suspected breeding distribution of Snow Geese in the area. We used a Canon EOS 40D digital SLR camera (10.1 megapixel) controlled by a laptop operated from the front seat. We used a 17–85 mm image-stabilizing camera lens, which was set to a focal length of 26 mm. Photographs were taken at 3-second intervals.

Photographs were projected onto base imagery of the Ikpikpuk River delta in ArcGIS based on the GPS flight log and the exact time that each photograph was taken. Using this method, individual nests, although not perfectly geo-referenced, could be accurately assigned to nesting islands. Comparisons of features identifiable both on aerial photographs and on existing geo-referenced imagery of the Ikpikpuk River delta confirmed that plotted nest locations were accurate within about 30 m. For enumeration in photos, all pairs of Snow Geese on the ground (i.e., not flying) were considered to represent nesting pairs (Kerbes 1982). Birds in flight, small flocks on the ground, and single birds on the ground were not considered to represent nests. Observations confirm that nesting male Snow Geese attend the incubating female, particularly during disturbances, and that aircraft disturbance

rarely causes birds of either sex to flush from nest sites (Kerbes 1982, Burgess and Ritchie 1993).

NEST FATE SURVEY

We conducted a ground search of the Kukpowruk Snow Goose colony in 1992 and 1993 and of the Ikpikpuk Snow Goose colony 1992–1993 and 2001–2011. Similar ground searches of the Kukpowruk colony were conducted by NSB in 1995–2001, 2003, and 2007–2009 (R. Suydam, NSB, pers. comm.) and their data have been reported here. Ground searches were undertaken to enumerate, accurately map, and to assess the fate and productivity of Snow Goose nests. Typically we accessed the western half of the Ikpikpuk colony via fixed-wing aircraft and a ground crew of 3 surveyors supported by packrafts was allowed 5 days to search the major and most readily accessible islands in the western delta where nests typically have been most abundant (Burgess et al. 2011). In some recent years, since the rapid growth of the Ikpikpuk colony, we also conducted a low-altitude (<100 ft) helicopter survey in early August to count nests on islands that were not ground-searched (primarily the eastern half of the delta).

In an attempt to improve estimates of numbers and productivity, we employed a stratified random sampling design in 2010 and 2011. Our goal was to develop a program better suited to monitoring the entire delta population of nesting geese. To select a stratified random sample of nest plots, we first created a systematic grid of points at 100-m intervals across non-mudflat areas of the Ikpikuk River delta (Figure 2). We used aerial photography to differentiate mudflats from vegetated areas. Each point marked the center of a circular plot with a 50-m radius. Plots with >50% coverage of water (e.g., river channel, lakes) were excluded from further selection. The remaining plots were classified within 4 strata: high density, medium density, low density, or zero density of nests. In 2010, the stratification was based on our best information on the distribution of nests in previous years (e.g., Ritchie et al. 2010). In 2011, we used the geolocated aerial photos taken on 19 June to classify each circular plot. The number of nests on each photograph was counted and each photograph (and corresponding location) was assigned to a density stratum. Field plot locations were randomly selected from each stratum. We allocated the field-surveyed plots among strata based on an optimal allocation formula that takes into account the total number of plots in each stratum and the variability of observations within each stratum (estimated from photo counts; Schaeffer et al. 1996).

In 2011, we used the same set of circular plots as used in 2010, but in 2011 nesting occurred in areas where nesting had not previously been observed. The 2010 sample of plots was therefore drawn from an area that did not include the entire 2011 nesting extent. To account for this, we stratified the entire 2011 nesting area and applied the results of the nest searches (conducted over the smaller area) to the entire extent. We acknowledge that this could introduce small errors if the new 2011 areas had different nest densities or nest success rates than the corresponding strata in the 2010 area.

A total of 278 circular plots were randomly selected from the area historically used by Snow Geese on the Ikpikpuk River delta as well as adjacent, suitable habitats. The ground crew was instructed to survey as many of these randomly selected plots as possible, but to ensure that surveyed plots were equally distributed across the delta and not lumped in any one area, and to attempt to sample a number of plots from each stratum based on the predetermined optimal allocation. A standard operating procedure describing options for sampling was created and carried in the field by the crew (Appendix B).

A field crew of 2 biologists visited the colony ~2 weeks after hatch and conducted nest-fate searches (11–15 July) at pre-selected plots. In 2010 and 2011, an R-44 helicopter was used to establish a field camp and to move nest searchers between plots. On the ground, the center point of each plot was located using GPS and marked with a piece of survey lath. Using a handheld GPS for navigation, the crew walked the perimeter of each plot and followed a zig-zag search pattern between the outer edges of the plot and the center, ensuring a complete search of the entire plot. Most zero density plots and some low density plots were surveyed from the air to quickly establish whether any nests were present. If a nest was observed, the helicopter landed and a biologist would check the nest.

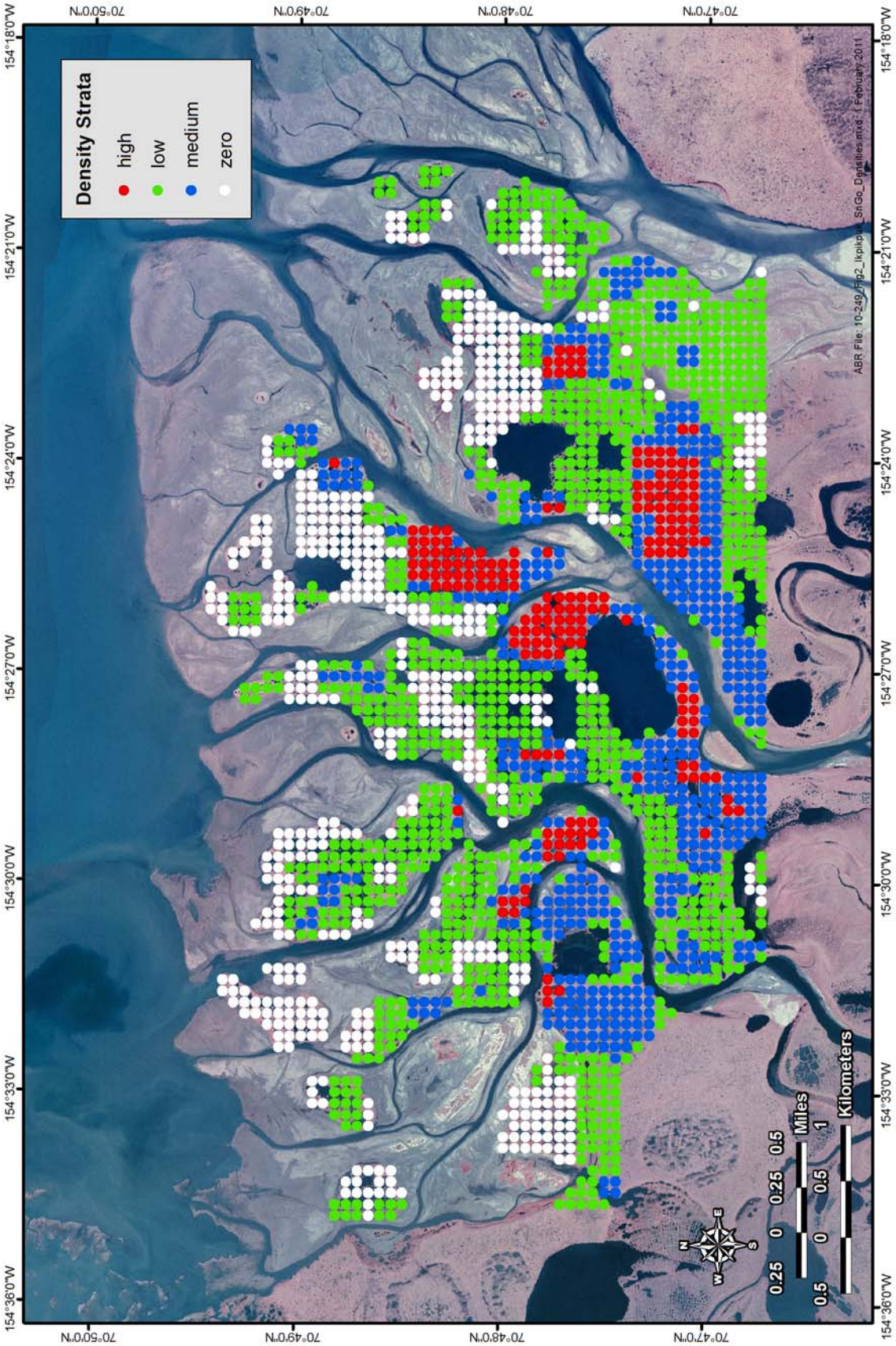

Figure 2. Grid of 50-m radius sample plots and stratification of the Ikpikpuk Snow Goose colony by density, 2011.

Locations of nests in each plot were recorded using a handheld GPS. Nests were classified as *successful* if at least 1 eggshell fragment in the nest bowl was largely separated from a thickened shell membrane (Downing 1980), *unsuccessful* if eggshell fragments were firmly attached to papery shell membrane or if shell fragments were totally missing (Downing 1980). A few nests were classified as *unknown* when physical evidence seemed equivocal. All locations later were entered into a geographic information system (GIS) database (ArcGIS software).

We calculated the total number of nests and nest fate (survival) by strata and then calculated the values for the entire area using the formulas for a stratified random sample (Schaeffer et al. 1996). We calculated confidence intervals for total nests using parametric formulas for a stratified random sample (Schaeffer et al. 1996) and we used bootstrapping to calculate confidence intervals for nest survival based on resampling of the data with replacement. We drew random selections (with replacement) of plots from each stratum that were equal to the total number of plots in that stratum. We then calculated the estimate of the total number of nests and the nest survival for the new data set. We repeated that process 10,000 times and then ranked the results for total nests and nest survival from 1 to 10,000. We calculated 95% confidence intervals by the 2.5% of lowest values and 2.5% of highest values and then determined the range of the remaining values.

BROOD-REARING SURVEYS

The brood-rearing surveys are intended to provide information on the numerical abundance, distribution, and breeding success of Brant and Snow Geese across the study area. Brood-rearing surveys are best conducted several weeks after hatching, when goslings are large, no longer require brooding, and are easily enumerated. In 2011, the brood-rearing survey was conducted 28 July–6 August. The survey was flown by Piper Supercub aircraft at approximately 75–150 m agl and 120 km/h with a pilot and 1 observer. Locations of all Brant and Snow Geese were recorded with an onboard GPS (datum base: WGS 84). Information recorded for each group included species and numbers of adults and young. All locations later were entered into a GIS database (ArcGIS software).

Since 2002, to improve the accuracy of our counts of Snow Geese and Brant, we photographed all large (>50) brood-rearing groups, unless the group was too dispersed to photograph all birds. Many smaller groups also were photographed to test observer proficiency at estimating flocks of various sizes. In 2011, photographs were taken with a Nikon D80 image stabilized digital SLR camera (10.2 megapixel). Photographs were used to count the number of adults and goslings of each species and to identify color phase (white or blue) of Snow Geese. In 2008–2011, we also took digital photographs of some molting groups without broods, when it was possible to do so without making extra passes with the airplane.

SNOW GOOSE BANDING

After a 2-year hiatus due to destruction of nests by brown bears (*Ursus arctos*), banding was again conducted on the Ikpikpuk River 30 July–1 August 2011. Banding also was conducted on the Sagavanirktok River delta 27–29 July 2011. In some prior years (mainly when other large colonies failed), we also banded Snow Geese on the Colville River delta, but we did not band there in 2011. However, a USFWS team did band Snow Geese and Brant on the Colville River delta in 2011 (D. Ward, USFWS, pers. comm.). Capture and banding methods were as described in previous reports (Ritchie et al. 2010).

Band recovery information on geese banded on the Sagavanirktok, Colville, and Ikpikpuk River deltas was extracted from bimonthly reports from the USGS–BRD Bird Banding Lab to update our database. This report includes information on band returns through 31 December 2011 for all 3 locations.

RESULTS AND DISCUSSION

SPRING AND SUMMER CONDITIONS

In Barrow, weather data indicated relatively warm weather during late May 2011 (Figure 3), with more than the average number of thawing degree-days (6.9 TDD in May 2011 compared to a 20-year mean of 3.9 TDD in May). In contrast, June temperatures were somewhat below average

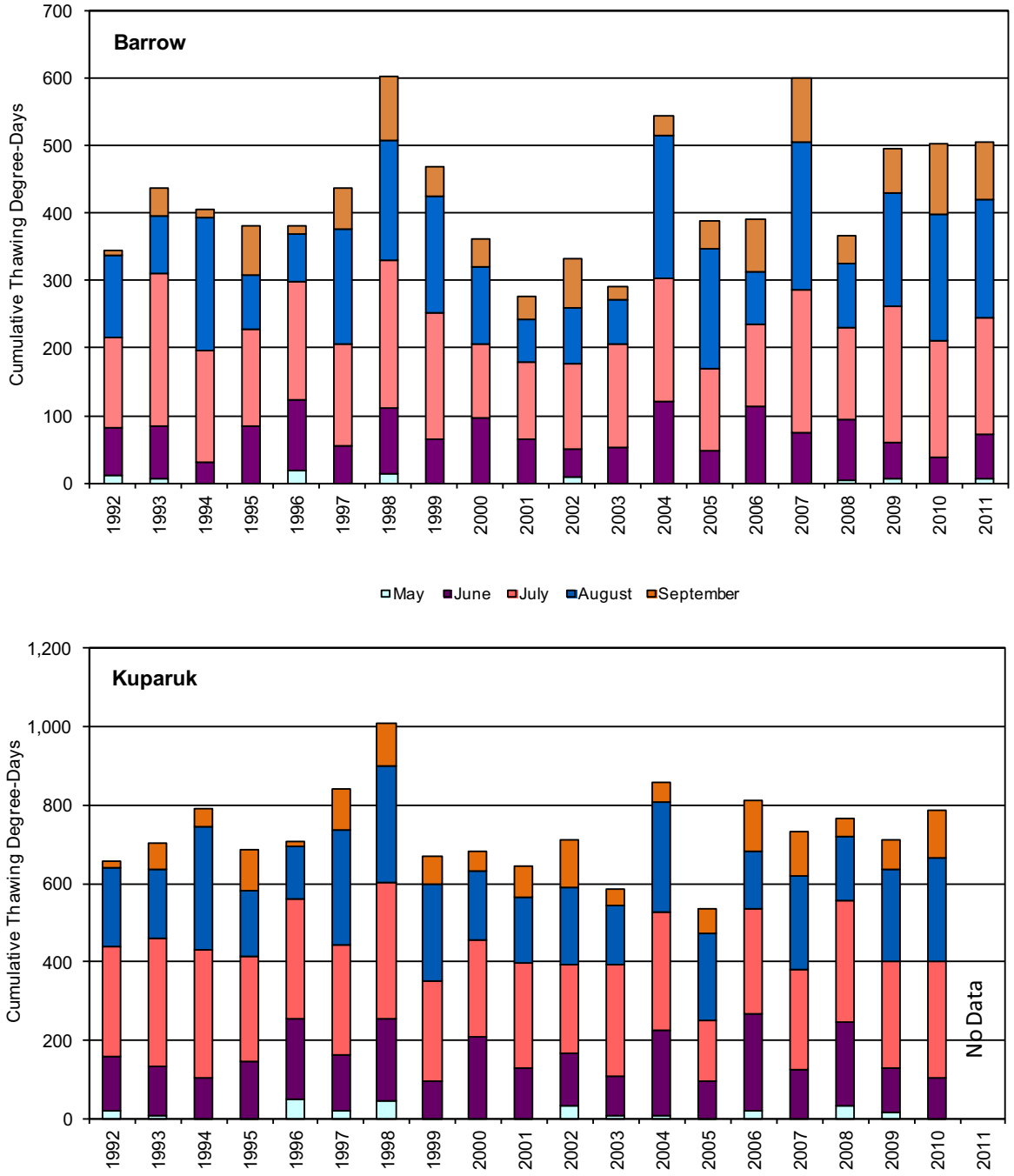

Figure 3. Thawing degree-days by month at the Barrow and Kuparuk airport meteorological stations, Alaska, 1992–2011.

in Barrow (64.6 TDD in June 2011 compared to the 20-year mean of 72.0 TDD in June) and temperatures remained well below the long-term average through July, August, and September. Although temperature data were not available from Kuparuk in 2011, records from Colville Village on the Colville River delta also indicated warmer than average conditions in late May followed by cooler weather in June (Johnson et al. 2011). At Colville Village, the snow-free date was reported as 3 June, 2 days ahead of the long-term mean, and peak discharge of the Colville River occurred on 28 May, 3 days ahead of the long-term mean. During a short period of very warm weather in the Kuparuk oilfield, snow cover decreased from 100% on 22 May to near 0% just 2 days later, although colder temperatures followed and drifts remained under pipelines and around pond margins through mid-June (Stickney et al. 2011). Cool temperatures in June resulted in lake ice persisting through June and larger lakes were not ice-free until early July.

BRANT

COLONY MONITORING SURVEYS

All 23 monitoring colonies in the study area were surveyed 16 June 2011 (Figure 1, Table 1, Appendix A and C). Flight conditions were good (i.e., no restrictive wind or visibility issues) on the survey. No new colonies were identified in 2011.

We recorded a minimum of 356 nests in all of the monitoring colonies (Table 1). Nest numbers were 17% lower than in 2010 but were still about 15% higher than the 17-year average of 310 nests (range 215–427 nests; Table 1, Appendix C; 1994 is excluded from calculations due to incomplete survey in that year). The total number of Brant nests among the 23 monitored colonies appears to be increasing since surveys began in 1995 (Figure 4). Although the number of nests was the highest recorded in the Smith Bay section, most (63%) nests continued to be located in the Dease Inlet section (Table 1).

Eighteen (78%) of the 23 visited colonies were occupied (i.e., at least 1 nest was present) in 2011, lower than the mean occupancy of ~89% at the same sites over the 17 years of complete surveys (Table 1). Nearly all of these monitoring colonies (96%) have been occupied in 12 or more years of surveys (Burgess et al. 2011); 13 (56%) colonies have been occupied in at least 17 years. Occupancy at these 23 colonies has ranged from 65% (1996) to 100% (2008).

BROOD-REARING SURVEYS

We estimated 17,199 Brant in 168 groups in the area between Barrow and Fish Creek in 2011 (Table 2, Figures 5 and 6, Appendices D and E). This estimate included 11,538 adults in groups without broods, 3,615 adults in groups with broods, and 2,046 goslings. The total number of Brant was the fourth-highest recorded, and the number of groups the highest recorded, since surveys began in 1995 (Table 2, Figure 6). The total number of goslings was the second-highest on record, and was nearly twice the 16-year mean (1,061 goslings). The number of brood groups and the number of brood-rearing adults were both the second highest on record. The ratio of goslings to adults within brood-rearing groups was near average, with goslings comprising 36% of the total brood-rearing Brant in 2011, compared to the annual mean of 34% (Appendix F). Just over 35% of all Brant groups were brood-rearing groups (i.e., goslings were present), which was the highest percentage since 2006, but somewhat lower than the annual mean of 39% brood-rearing groups over all 16 years of surveys.

Although we believe that our coastal brood-rearing survey provides good information on the regional abundance of breeding Brant, it must be acknowledged that brood-rearing groups of Brant are also known to use inland habitats on the North Slope (Stickney and Ritchie 1996). In most parts of the North Slope, the number of brood-rearing Brant in inland habitats appears to be relatively small. One exception to this rule, however, may be the extensive area of large lakes north and east of Teshekpuk Lake, where large numbers of Brant occur regularly during July. However, an intensive study of movements in the molting area in 2007 and 2008 indicated that most flightless adult Brant with goslings in the Teshekpuk Lake molting area moved into the outer coastal zone by late July (Lewis et al. 2010a) Our late July coastal surveys therefore should provide fairly good estimates of the locally breeding population of Brant.

The 3 years with the largest numbers of goslings were 2006, 2011, and 2008; and the 3 years with the largest numbers of adults in brood

Table 1. Number of Brant nests by survey section, number of monitoring colonies surveyed, and number and percent of colonies occupied, Barrow to Fish Creek, Alaska, 1994–2011.

	Nests				Colonies		
Year	Dease Inlet	Smith Bay	Harrison Bay	Total	No. Surveyed	No. Occupied	% Occupied
1994	90	44	nd [a]	134	21	13	61.9
1995	149	37	40	226	23	22	95.7
1996	113	38	64	215	23	15	65.2
1997	175	35	73	283	22	20	90.9
1998	147	35	72	254	23	18	78.3
1999	238	18	61	317	23	22	95.7
2000	198	47	77	322	23	22	95.7
2001	237	22	71	330	22	20	90.9
2002	161	23	43	227	23	21	91.3
2003	253	48	21	322	23	19	82.6
2004	197	75	53	325	23	21	91.3
2005	172	88	20	280	23	21	91.3
2006	215	62	41	318	23	22	95.7
2007	175	69	25	269	23	21	91.3
2008	327	49	50	426	23	23	100.0
2009	268	74	31	373	23	20	87.0
2010	262	107	58	427	23	21	91.3
2011	225	114	17	356	23	18	78.3
Mean	200.1	54.7	48.1 [b]	310.0 [b]	-	20.4	89.0
SD	59.3	28.1	20.2	63.1	-	-	

[a] nd = no data
[b] Does not include 1994 data because Harrison Bay was incompletely surveyed in that year

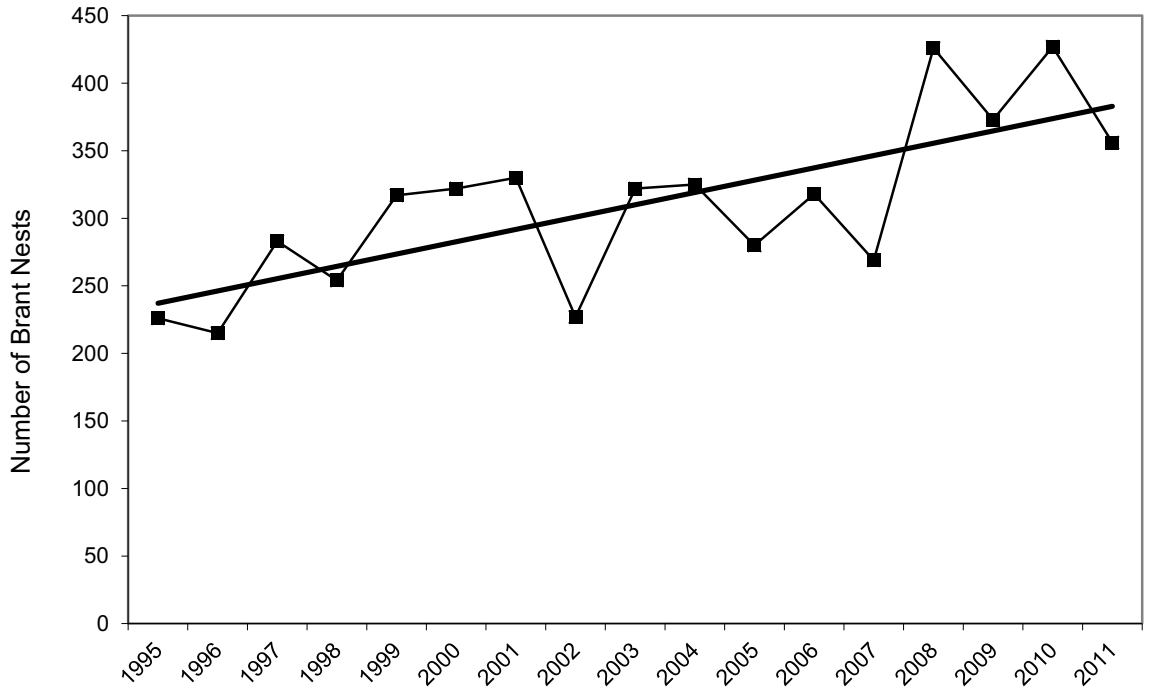

Figure 4. Number of Brant nests in 23 monitoring colonies, 1994–2011, Barrow to Fish Creek, Alaska.

Table 2. Composition of Brant groups during brood-rearing surveys, Barrow to Fish Creek, Alaska, 1995–1997 and 1999–2011.

Year	Total Groups	Brood Groups	Adults Without Broods	Adults With Broods	Total Adults	Goslings	Total Birds in Brood Groups	% Goslings in Brood Groups	Total Birds	% Adults without Broods
1995	39	25	1,180	1,552	2,732	909	2,461	36.9	3,641	32.4
1996	38	26	1,130	828	1,958	633	1,461	43.3	2,591	43.6
1997	72	30	2,866	885	3,751	423	1,308	32.3	4,174	68.7
1999	96	46	3,605	1,378	4,983	1,070	2,448	43.7	6,053	59.6
2000	25	19	790	670	1,460	808	1,478	54.7	2,268	34.8
2001	76	20	10,102	1,308	11,410	435	1,743	25.0	11,845	85.3
2002	84	22	8,002	1,444	9,446	422	1,866	22.6	9,868	81.1
2003	118	29	18,070	1,480	19,550	517	1,997	25.9	20,067	90.0
2004	166	47	12,542	2,840	15,382	1,511	4,351	34.7	16,893	74.2
2005	106	36	5,747	2,448	8,195	1,431	3,879	36.9	9,626	59.7
2006	125	72	6,170	3,923	10,093	2,484	6,407	38.8	12,577	49.1
2007	139	36	8,347	2,265	10,612	882	3,147	28.0	11,494	72.6
2008	147	47	8,989	2,590	11,579	1,814	4,404	41.2	13,393	67.1
2009	161	21	18,404	2,380	20,784	581	2,961	19.6	21,365	86.1
2010	154	33	18,808	2,679	21,487	1,007	3,686	27.3	22,494	83.6
2011	168	59	11,538	3,615	15,153	2,046	5,661	36.1	17,199	67.1
Mean	107	36	8,518	2,018	10,536	1,061	3,079	34.2	11,597	65.9
SD	48	15	6,113	975	6,600	629	1,542	9.2	6,702	18.2

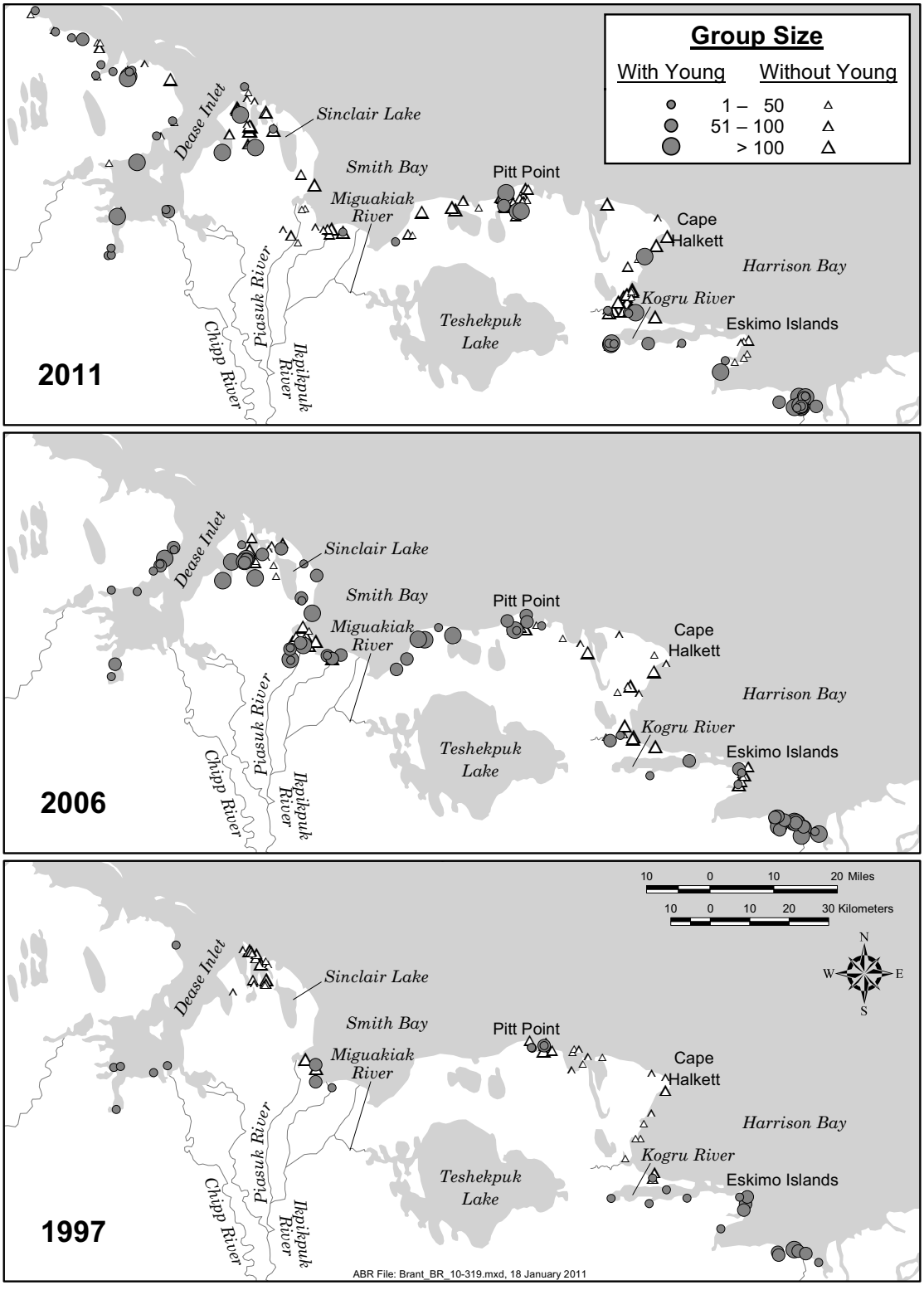

Figure 5. Distribution of Brant brood-rearing groups and groups without young, Barrow to Fish Creek, Alaska, 1997, 2006 and 2011.

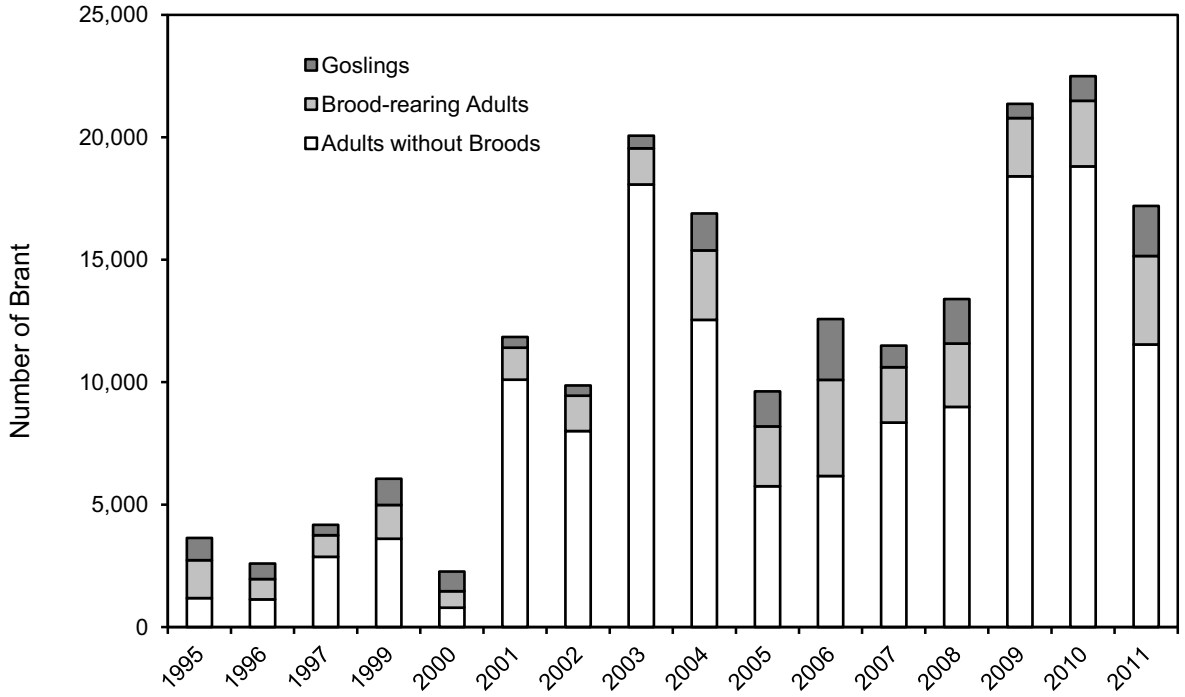

Figure 6. Numbers of adult Brant without broods, brood-rearing adult Brant, and goslings recorded during aerial surveys, Barrow to Fish Creek, Alaska, July 1995–1997 and 1999–2011.

groups were 2006, 2011, and 2004 (Table 2). The brood-rearing data suggest an erratic but generally increasing trend in the breeding population and productivity of Brant in the region since 1995 (Figure 6). However, the number of brood-rearing/molting adult Brant in our coastal study area appears to have increased from 2,000–5,000 prior to 2001 to 8,000–21,000 after 2001 (Table 2), primarily due to an increase in the number of adults in groups without broods (Figure 6).

The distribution of brood-rearing and molting Brant among the 3 sections of the Beaufort Sea coast varies among years. The greatest variation is observed in the Harrison Bay section, and is driven largely by the number of adults without broods (Figure 7). Spikes of Brant groups without broods in the Harrison Bay section probably result from an influx to the Teshekpuk Lake molting area of non-breeding and failed breeding birds from other areas of northern and western Alaska. Although brood-rearing groups are present in the molting area, most of the Brant in the Teshekpuk Lake area are failed- and non-breeding birds that have migrated into the area from distant nesting areas, including other regions of the North Slope (Lewis et al. 2010b) as well as the Yukon–Kuskokwim Delta (hereafter, the Y–K Delta) (Derksen et al. 1979, King and Hodges 1979).

Additional evidence suggests a molt migration to Teshekpuk Lake from the Y–K Delta. In 2003, for example, when productivity of Brant on the Y–K Delta was particularly low due to predation and flooding (C. Nicolai, Univ. of Nevada Reno, pers. comm.), we observed record numbers of Brant in our study area (Figure 6). A further comparison revealed a strong negative correlation between the annual estimate of nests on the Y–K Delta (data from Wilson 2011) and the number of molting adults without young in our survey area (Pearson $r = -0.83$, n = 15, $P < 0.01$; Figure 8). This relationship is somewhat confounded by annual trends within the 2 regions; since 1995, the estimated total number of nests at 5 Y–K Delta colonies has decreased at a rate of about 852 nests/yr ($R^2 = 0.41$, $P = 0.007$; Figure 9), while the number of molting adults in our survey area has increased by about 906 birds/yr ($R^2 = 0.46$, $P = 0.005$; Figure 9). As mentioned earlier, the

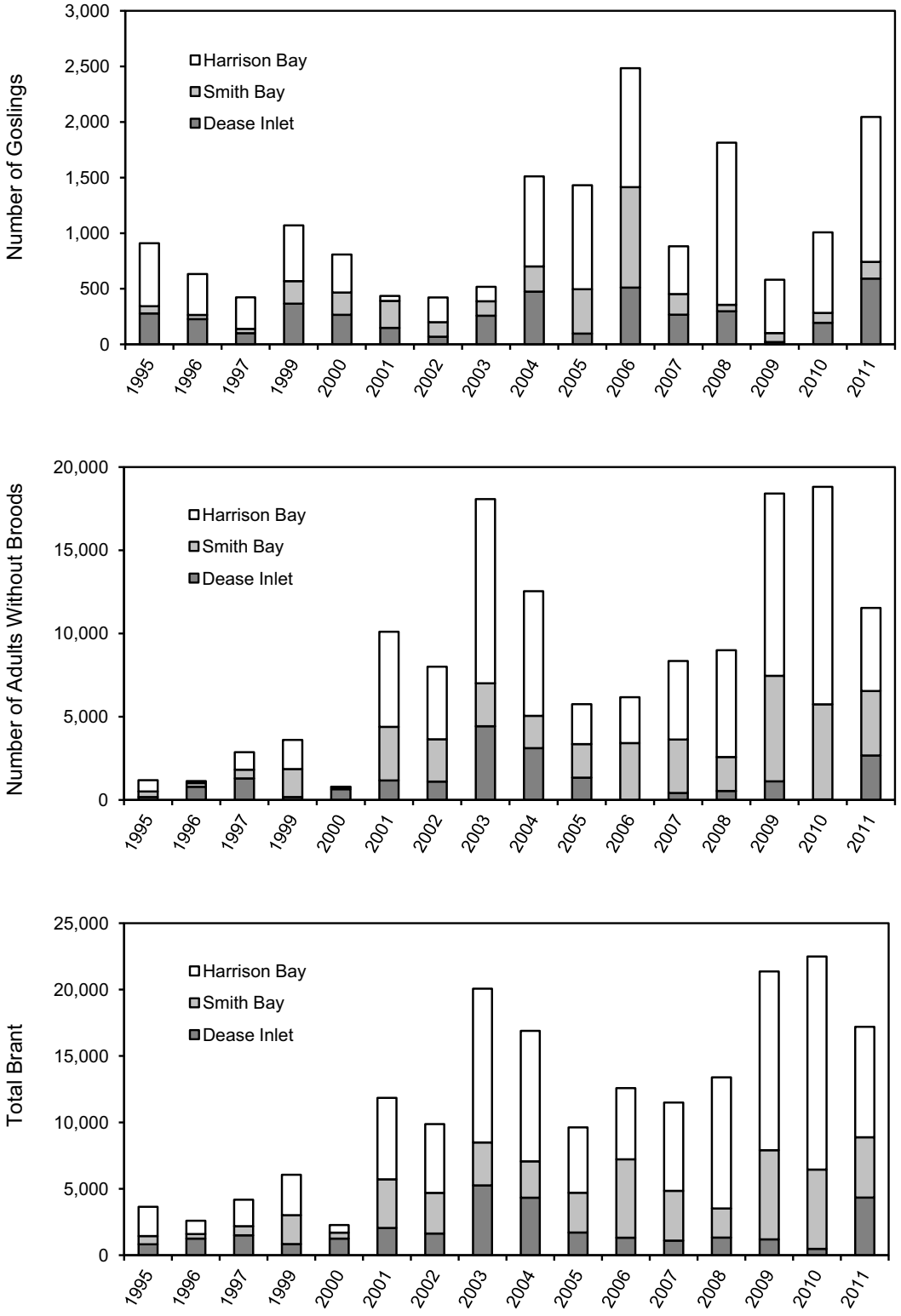

Figure 7. Distribution of Brant goslings, adults without broods, and total birds among 3 sections of the Beaufort Sea coast, Barrow to Fish Creek, Alaska, 1995–1997 and 1999–2011.

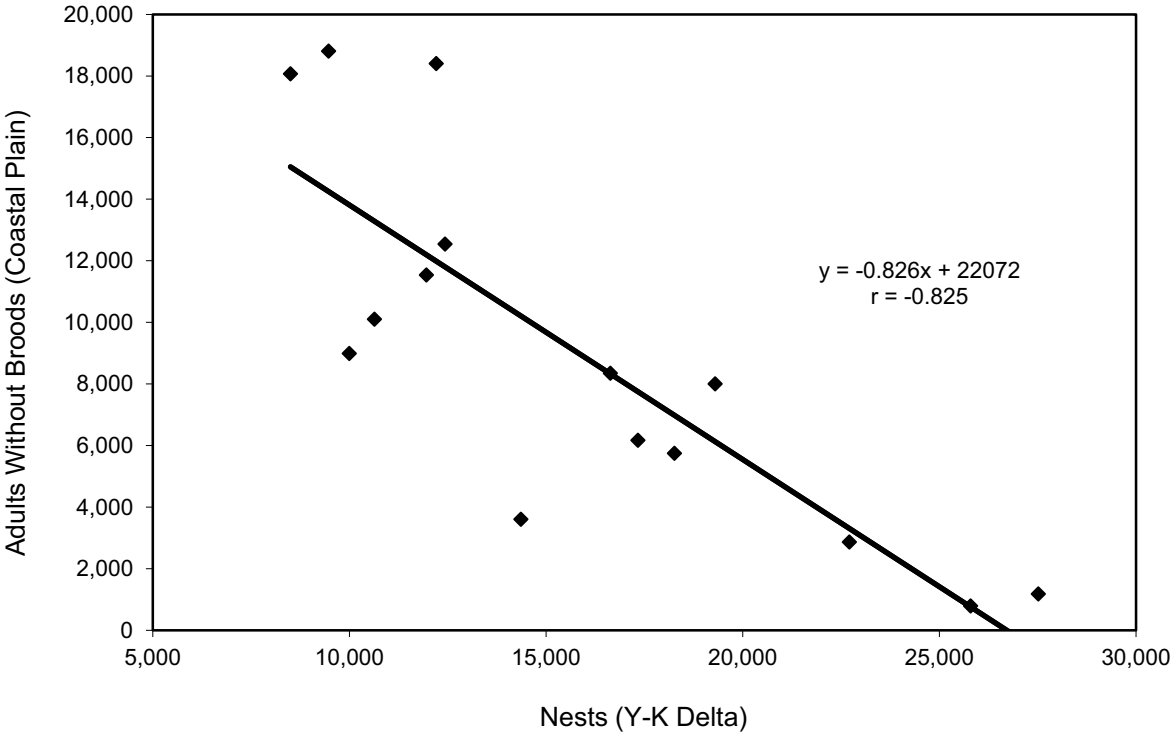

Figure 8. Correlation between the estimated total number of Brant nests in 5 nesting colonies on the Yukon–Kuskokwim Delta (Wilson 2009) and the number of adult Brant in groups without broods between Barrow and Fish Creek, Alaska, 1995, 1997, and 1999–2011 (years in which data were available from both areas).

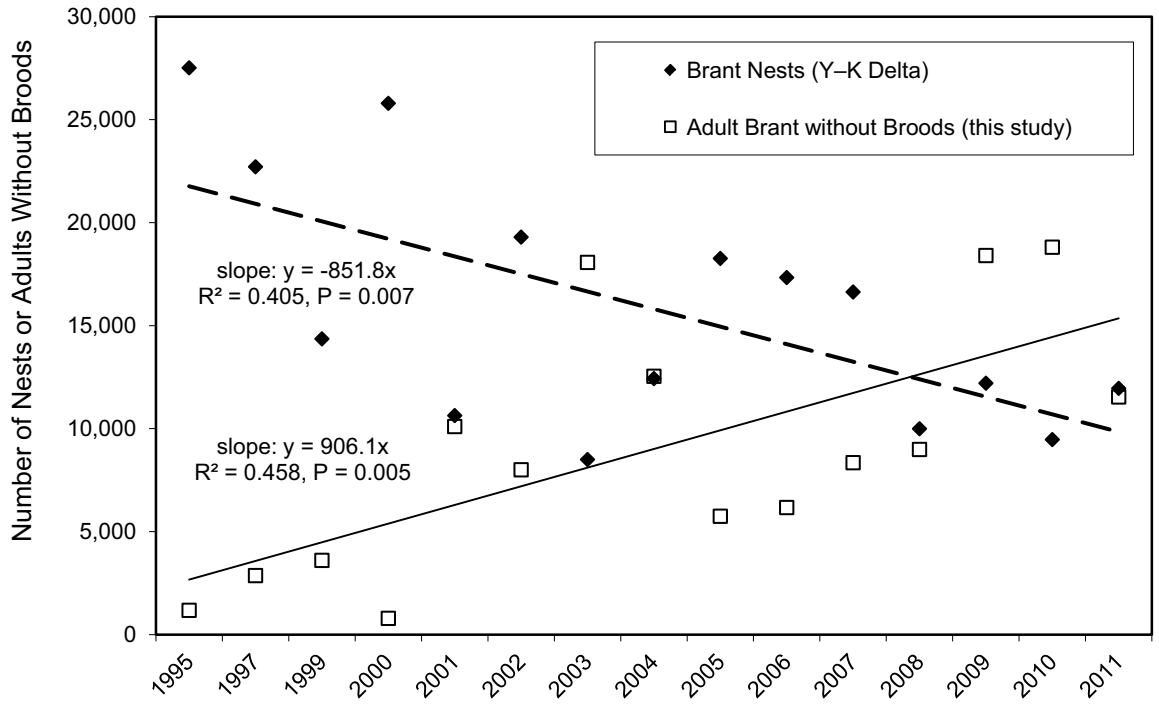

Figure 9. Estimated total number of Brant nests in 5 nesting colonies on the Yukon–Kuskokwim Delta 1995–2011, and number of adult Brant in groups without broods between Barrow and Fish Creek, Alaska, 1995, 1997, and 1999–2011.

breeding population of Brant in our study area has shown a generally increasing trend since 1995. It is unknown whether some Brant emigrated to the North Slope from breeding areas on the Y–K Delta during this period; however, Brant exhibit high fidelity to breeding colonies (Lindberg et al. 1998) and the considerable annual variation in both the numbers of nests on the Y–K Delta (Wilson 2011) and the numbers of molting adults without young in our study area suggests the correlation between the two can likely be attributed to an annual molt migration of failed breeders from the Y–K Delta rather than to large-scale emigration of breeding Brant to the North Slope.

Based on the numbers of goslings, annual productivity for Brant in our study area was highest in 2004, 2006, 2008, and 2011; lowest in 1997, 2001, 2002, and 2003 (Figure 10). Summing thawing degree-days for May through July at Barrow, the coldest years were 2005, 2002, and 2001 and the warmest years were 1998, 2004, and 1996. At Kuparuk, the coldest years were 2005, 1999, and 2007 and the warmest years were 1998, 1996, and 2008 (weather data were not collected at Kuparuk in 2011; Figure 10). Over the 15 years of Brant surveys, thawing degree-days in both Barrow and Kuparuk appear to correlate poorly with overall productivity of Brant in this region, except in 2006 and 2008, when warmer than average Kuparuk temperatures corresponded with high productivity, and in 2007, when colder Kuparuk temperatures corresponded with low productivity.

SNOW GEESE

IKPIKPUK COLONY MONITORING SURVEYS

Visual Aerial Survey Estimate of Nest Numbers

In 2011, Snow Geese were widely distributed across the Ikpikpuk River delta as they have been since 2006. During an over-flight of the delta on 16 June, it was observed that the colony had expanded beyond its former range, onto the mainland to the east, west, and south of the Ikpikpuk River delta. Nest numbers appeared to be lower on the northern portion of the colony compared to previous years. Small islands on the north end of the colony were

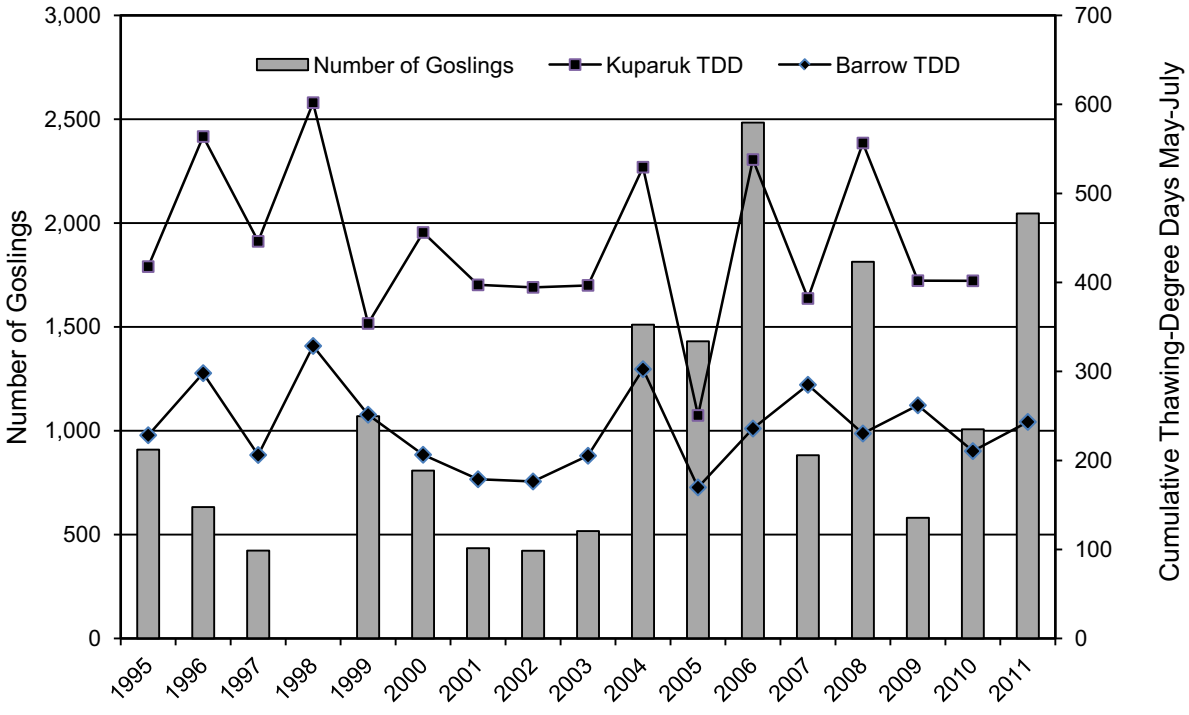

Figure 10. Number of Brant goslings between Barrow and Fish Creek and cumulative thawing-degree days May through July at Barrow and at Kuparuk airport meteorological stations, 1995–2011.

covered with ice, and low areas on some of the larger northern islands were wet, as if they had recently been flooded or covered with ice. In a visual estimate from an aerial survey on 19 June, nearly 10,250 Snow Geese, comprising ~4,500 possible nesting pairs and an additional ~1,250 flying birds, were recorded on numerous islands on the Ikpikpuk River delta and on the mainland immediately adjacent to the delta (ABR, unpubl. data).

Aerial Photographic Nest Census

The 2011 photo survey of the Ikpikpuk Snow Goose colony was also conducted on 19 June in good survey conditions, with clear skies and 10–15 knot winds from the ENE. We flew 30 east–west transects that ranged from 7 to 12 km in length. We started near the south end of the colony and proceeded to the north. Based on our observation of colony expansion to the south during the 16 June over-flight of the colony, we added 3 transects to the southern end of the 2010 survey area for the 2011 photographic survey. The photography session lasted 2 hours 36 minutes, and a total of 2,200 photographs were taken over the delta (including off transect during turns). Nesting pairs of Snow Geese were easily identifiable on the photographs and nests could readily be enumerated. A total of 8,661 Snow Goose nests were identified on aerial photographs, and an additional 225 nests were estimated outside of the area covered by photographs (see below) (Table 3, Figure 11). An additional 1,250 flying birds were estimated during the survey flight, for an estimated total of 19,022 Snow Geese on the Ikpikpuk River delta in mid-June 2011 (Appendix G).

Photographic coverage of the Ikpikpuk nesting colony was nearly 100%. The entire area known to contain nests in previous years was surveyed in 2011 without gaps in photographic coverage. Transect lines originally were designed to extend well past the east and west extent of nests; however, it was noted during the survey that some nests were located past the ends of the transect lines, both to the east and west. In an attempt to capture as many of the outlying nests as possible, photographs were taken beyond the original transect endpoints until the pilot initiated a turn to the next transect. Nevertheless, during turns the observer sometimes noted the presence of additional nests beyond the transect end and missed by photographs. Similarly, although we originally intended the survey to start south of the southernmost extent of nests, it became apparent during the flight that some nests were located even farther south than our starting transect. The numbers of non-photographed nests were estimated and recorded on a USGS 1:63,360-scale topographic map. The estimates were included in the totals for the individual nesting areas and the overall colony; and the nesting area maps were extended to include the approximate range of the non-photographed nests. Estimated nests account for 2.5% of the total estimate for 2011 (225 out of 8,886 nests).

Nests were distributed widely across the entire delta in 2011 (Figure 11). Use of the northwestern delta has decreased in recent years, and in 2011 only 9% of Snow Goose nests were located on the 5 islands with the longest history of use (i.e., Islands A–E) in the northwestern part of the colony (Table 3, Figure 12).

To better illustrate the expansion and shifting density of the Ikpikpuk Snow Goose colony, we changed the way we named and displayed nesting areas in 2011. In early years of this study, all known nests in the Ikpikpuk River delta were located on discrete, relatively small islands. It made sense to treat each island as a unit and to monitor changes in distribution by tracking the number of nests on each island. In subsequent years, the colony spread onto much larger islands which were, in some places, separated from one another or from the mainland by narrow or discontinuous channels. In 2011, a substantial number of nests were found on the mainland. Straightforward island designations have become less useful, and in some cases, no longer possible. For example, the northern part of Island F in the central part of the delta was first used in 2001 (Figure 12). In 2006, nests were discovered south of the former range on island F. Instead of treating the new nesting area as an expansion of island F (as done in the past), in 2011 we assigned the area a unique label (nesting area S) even though it is adjacent to and located on the same island as nesting area F. This allows us to more precisely describe changes in distribution of the Ikpikpuk

Table 3. Number of Snow Goose nests by nesting areas in 2011 and historical use of nesting areas in the Ikpikpuk River delta colony, 1992–2011.

Nesting Area[a]	2011 Nests[b]	Years Used	Number of Years Used
A	1	1999–2004, 2006–2011	12
B	3	1993–2011	19
C	0	1993–2010	18
D	584	1999–2011	13
E	178	1992–2011	20
F[c]	192	2001, 2004–2011	9
G	0	2001, 2009–2010	3
H	0	2001, 2004, 2006, 2008–2010	6
I	44	2001, 2004, 2006, 2008–2011	7
J	1,199	2001, 2005–2011	8
K	150	2006, 2009–2011	4
L[d]	628	2006–2011	6
M	3	2001, 2005–2011	8
N	46	2001, 2005–2011	8
O	262	2005–2008, 2011	6
P	15	2008, 2011	2
Q	496	2008–2009, 2011	3
R	3	2010–2011	2
S[e]	1,625	2006–2011	6
T	72	2010–2011	2
U[f]	264	2010–2011	2
V[g]	259	2010–2011	2
W[h]	566	2010–2011	2
X[i]	6	2010–2011	2
Y	18	2011	1
Z	7	2011	1
AA	648	2011	1
BB	389	2011	1
CC	989	2011	1
DD	70	2011	1
EE	169	2011	1
Total	8,886		

[a] See Figure 12
[b] Totals include estimated numbers of nests not covered by photographic survey (see Figure 11)
[c] Does not include nesting areas S or W, which were considered part of "Island F" prior to 2011
[d] Does not include nesting area U, which was considered part of "Island L" in 2010
[e] Was considered part of "Island F" prior to 2011
[f] Was considered part of "Island L" in 2010
[g] Was considered part of "Island O" in 2010
[h] Was considered part of "island F" in 2010
[i] Had 7 nests in 2010, but was considered a peripheral area and was not given a letter designation in the 2010 report

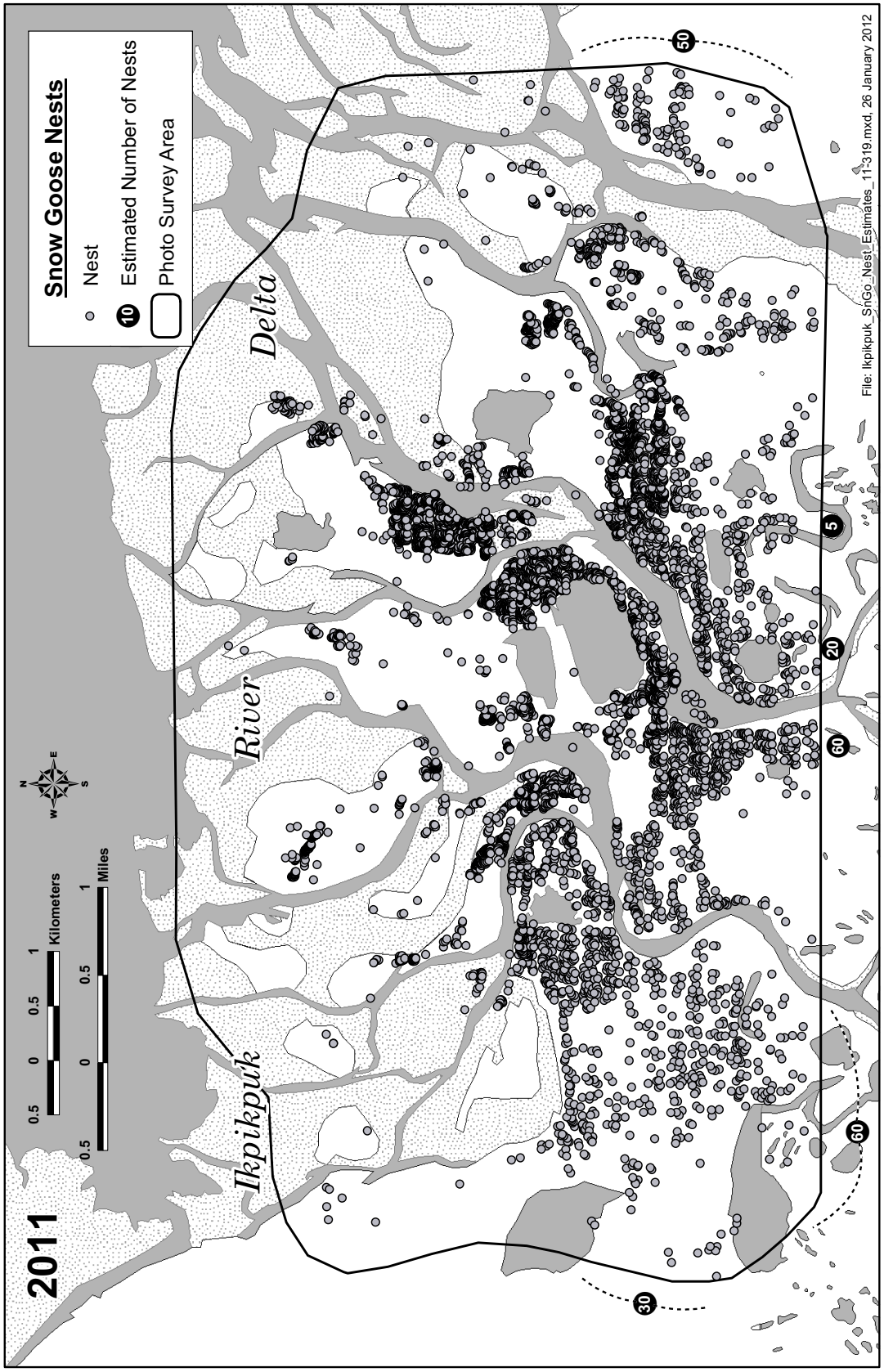

Figure 11. Distribution of Snow Goose nests from aerial photo census of the Ikpikpuk River delta, 2011.

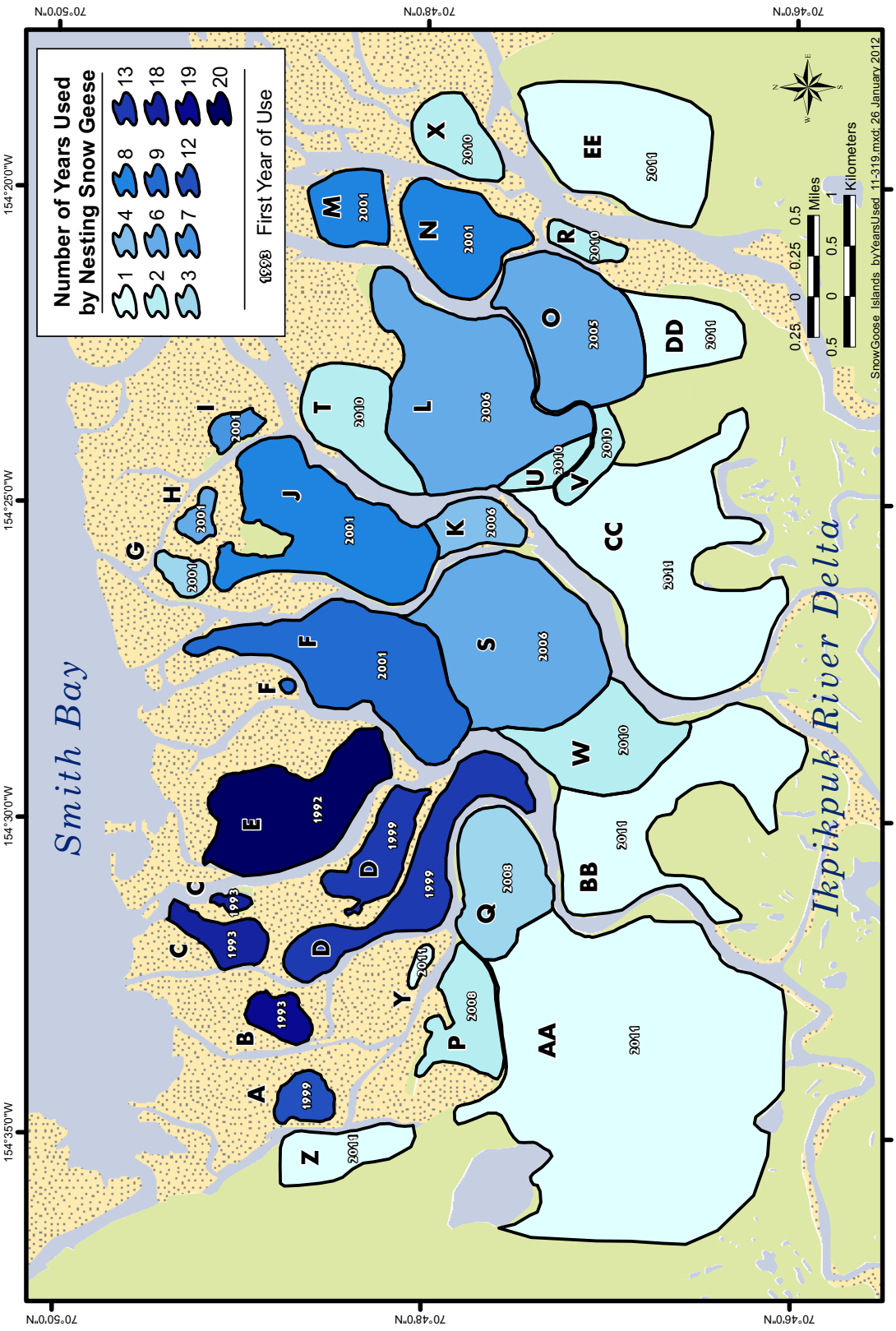

Figure 12. Number of years that each island on the Ikpikpuk River delta has been used by nesting Snow Geese and first year of use of each island, 1992–2011.

Snow Goose colony through time. To further illustrate the southward expansion of the colony in recent years, nesting area W (south of S) was first used in 2010, and nesting area BB (south of W) was first used in 2011 (Figure 12). In 2011 only 192 nests were located in nesting area F, compared to 1,625 in nesting area S, 566 in nesting area W, and 389 in the new nesting area BB.

The 3 nesting areas with the highest numbers of nests in 2011 were J, S, and CC, in the central part of the colony (Table 3, Figure 12). Together, these 3 areas accounted for 43% (3,791) of all nests in the Ikpikpuk River delta colony. Areas J and S have been in use since 2001 and 2006, respectively, and have contained high densities of nest for several years. Nesting area CC was new in 2011 and, with 989 nests, provides a dramatic example of rapid expansion of the colony. In all, 2,290 nests (26%) were found in newly occupied areas in 2011 (Table 3, Figure 12), many of which apparently occupied wet sedge tundra habitats that previously seemed uncharacteristic of Snow Goose nesting habitats in the region.

Estimated Number of Nests from Stratified Random Sampling

A total of 147 plots were surveyed 11–15 July 2011: 44 plots in the high density stratum, 38 in the medium density stratum, 40 in the low density stratum, and 25 in the zero density stratum (Table 4; Figure 13). The stratification worked very well. There were no nests found in 25 plots in the zero density stratum, an average of 0.225 nests/plot in the low density stratum (SD = 0.620; range = 0–3), an average of 3.605 nests/plot in the medium density stratum (SD = 4.233; range = 0–25), and an average of 13.068 nests/plot in the high density stratum (SD = 6.695; range = 2–27). A total of 721 nests were located within sampled plots.

Based on the stratified sample, we estimated that there were zero nests in the zero density stratum, 549 nests in the low density stratum (95% C.I. = 69–1,029), 2,649 nest in the medium density stratum (95% C.I. = 1,653–3,644), and 3,295 nests in the high density stratum (95% C.I. = 2,830–3,759), for an estimated total of 6,493 nests (95% C.I. = 5,320–7,665; Table 5).

Nest Fate and Colony Success

In the 147 plots surveyed, 469 nests (65.9%) were determined to have been successful, 243 were determined to have failed, and the fate of 9 nests was recorded as unknown. In high density plots, 371 of 566 nests with known fates were successful (65.5%). In the medium density plots, 95 of 137 nests with known fates were successful (69.3%), and in the low density plots, 3 out of 9 nests were successful (33.3%) (Table 4). Based on the stratified sample, the estimated nest survival for the colony in 2011 was 65.5% (95% C.I. = 58.3–70.6%). Using 8,886 total nests from the 2011 photo census, we were able to assess the fate of 712 (approximately 8.0%) of nests. Nest success was lower at Snow Goose colony on the Kukpowruk River delta. Fewer than half of the 336 nests located (40.2%) were successful in 2011 (R. Suydam, NSB, pers. comm.).

Evidence at nests in 2011 did not identify any particular causes of nest failures. In 2009 and 2010, evidence at nest sites indicated that brown bears

Table 4. Number of plots, search areas, number of nests, and nest fate of Snow Geese in each density stratum on the Ikpikpuk River delta, 2011.

Density Strata	Colony Area (km²)	Area Searched (km²)	Number of Plots Searched	Nest Fate		
				Successful	Unsuccessful	Unknown
Zero	9.56	0.196	25	0	0	0
Low	24.42	0.314	40	3	6	0
Medium	7.35	0.298	38	95	42	0
High	2.52	0.346	44	371	195	9
TOTAL	43.85	1.155	147	469	243	9

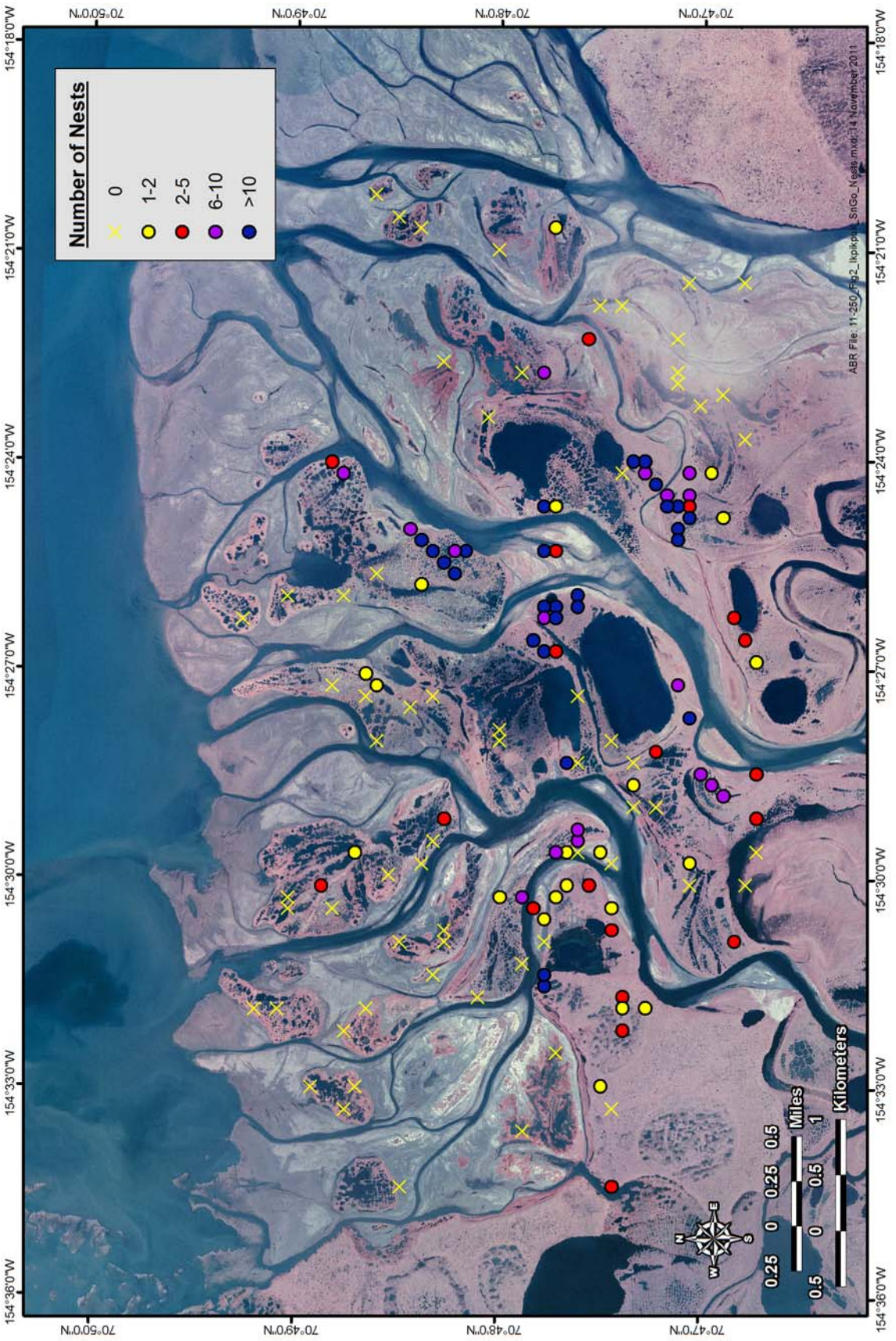

Figure 13. Randomly selected plots searched for Snow Goose nests in the Ikpikpuk Snow Goose colony, 2011.

Table 5. Mean and 95% confidence intervals of estimated number of Snow Goose nests and nesting success, Ikpikpuk River delta, 2011.

Strata	Mean	95% C.I.
ESTIMATED NUMBER OF NESTS		
Zero	0	0–0
Low	549	69–1029
Medium	2,649	1,653–3,644
High	3,295	2,830–3,759
TOTAL	6,493	5,320–7,665
ESTIMATED NESTING SUCCESS (%)		
Zero	—	—
Low	33.3	0–60.0
Medium	69.3	58.0–79.3
High	65.5	59.6–71.6
TOTAL	65.5	58.3–70.6

caused the majority of nest failures and productivity was near zero. Bear predation has frequently affected nesting Snow Geese in northern Alaska. In 2009, the Ikpikpuk and Kukpowruk colonies both were severely affected by brown bears (W. Larned, USFWS, pers. comm.; Ritchie et al. 2010). Brown bears have also eaten eggs and killed some adult Snow Geese at a colony on the outer Colville River delta (J. Helmericks, Golden Plover Air, pers. comm.). In the 1990s, the Howe Island Snow Goose colony was severely affected by brown bears and for several years Snow Geese nested in very low numbers on the Sagavanirktok River delta. Substantial brown and polar bear nest predation has been reported at Snow Goose colonies in eastern and central Arctic Canada (e.g., Rockwell and Gormezano 2009).

BROOD-REARING SURVEYS

Brood-rearing surveys enumerated 62 (21%) molting groups and 239 (79%) brood-rearing groups of Snow Geese between Barrow and Fish Creek in 2011 (Appendix H). The 26,277 total Snow Geese in the region during brood-rearing surveys in 2011 was the highest recorded since surveys began in 1995 (Table 6, Figure 14, Appendix I). This estimate included 5,861 adults in groups without broods, 10,235 adults in groups with broods, and 10,181 goslings. The number of both adult birds and young were the highest recorded since surveys began in 1995 (Figure 14). The ratio of goslings to adults in brood rearing groups was 49.9% in 2011, near the 16-year mean, but higher than any year since 2006 (Table 6, Figure 15).

As in previous years, most Snow Geese (83%) were located in the Smith Bay section (Figure 16, Appendix I). Most of the remaining Snow Geese (15%) were found in the Harrison Bay section, with approximately 1.6% in the Dease Inlet section. Record numbers of both adults and goslings were counted in all 3 sections in 2011. Observations during June surveys and records of nesting in the past (Ritchie et al. 2000) suggest that although birds in all 3 sections could have originated from the nesting colony on the Ikpikpuk River delta (in the Smith Bay section), it is likely that some of the broods recorded in the Harrison Bay section originated from small colonies between Cape Halkett and Fish Creek, including those documented in recent years near the Kogru River mouth and Garry Creek (Figure 16). In 2009 and 2010, when nearly all nests in the Ikpikpuk colony were destroyed by brown bears, gosling numbers were well below average in the Harrison Bay section as well (30% and 24% of the 16-year mean, respectively); however, the decrease was modest compared to the near-total loss of the Ikpikpuk colony in those years, further suggesting that some broods in the Harrison Bay section

Table 6. Composition of Snow Goose groups during brood-rearing surveys, Barrow to Fish Creek, Alaska, 1995–1997 and 1999–2011.

Year	Total Groups	Brood Groups	Adults Without Broods	Adults With Broods	Total Adults	Goslings	Total Birds in Brood Groups	% Goslings in Brood Groups	Total Birds
1995	13	13	0	198	198	232	430	54.0	430
1996	7	4	107	63	170	85	148	57.4	255
1997	22	10	384	98	482	138	236	58.5	620
1999	31	23	278	515	793	624	1,139	54.8	1,417
2000	42	29	485	623	1,108	910	1,533	59.4	2,018
2001	31	19	422	352	774	241	593	40.6	1,015
2002	37	27	115	1,591	1,706	1,150	2,741	42.0	2,856
2003	48	44	38	1,952	1,990	2,210	4,162	53.1	4,200
2004	69	50	1,062	2,644	3,706	3,456	6,100	56.7	7,162
2005	74	43	2,995	1,513	4,508	1,331	2,844	46.8	5,839
2006	152	143	211	7,590	7,801	8,744	16,334	53.5	16,545
2007	119	83	2,095	4,089	6,184	3,454	7,543	45.8	9,638
2008	279	206	3,591	9,355	12,946	8,306	17,661	47.0	21,252
2009	162	20	14,509	607	15,116	155	762	20.3	15,271
2010	123	14	10,614	573	11,187	194	767	25.3	11,381
2011	301	239	5,861	10,235	16,096	10,181	20,416	49.9	26,277
Mean	94	60	2,673	2,625	5,298	2,588	5,213	47.8	7,886
SD	91	72	4,253	3,401	5,622	3,418	6,798	11.3	8,146

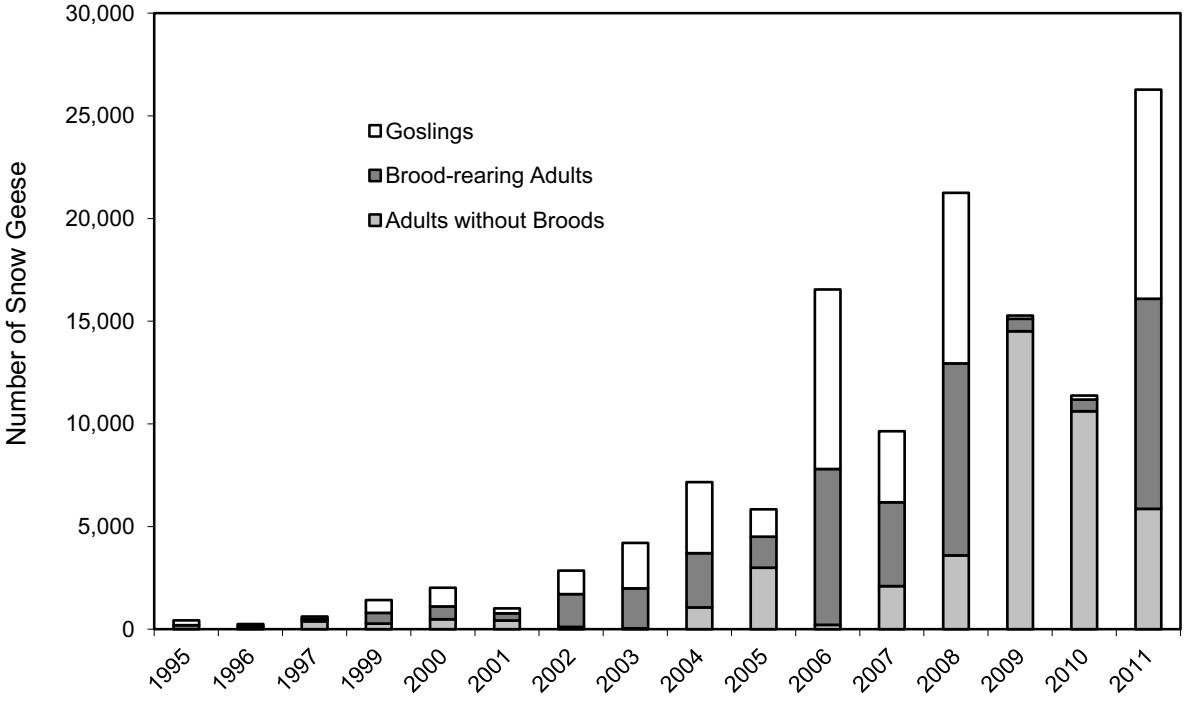

Figure 14. Numbers of adult Snow Geese without broods, brood-rearing adult Snow Geese, and goslings recorded during aerial surveys, Barrow to Fish Creek, Alaska, July 1995–1997 and 1999–2011.

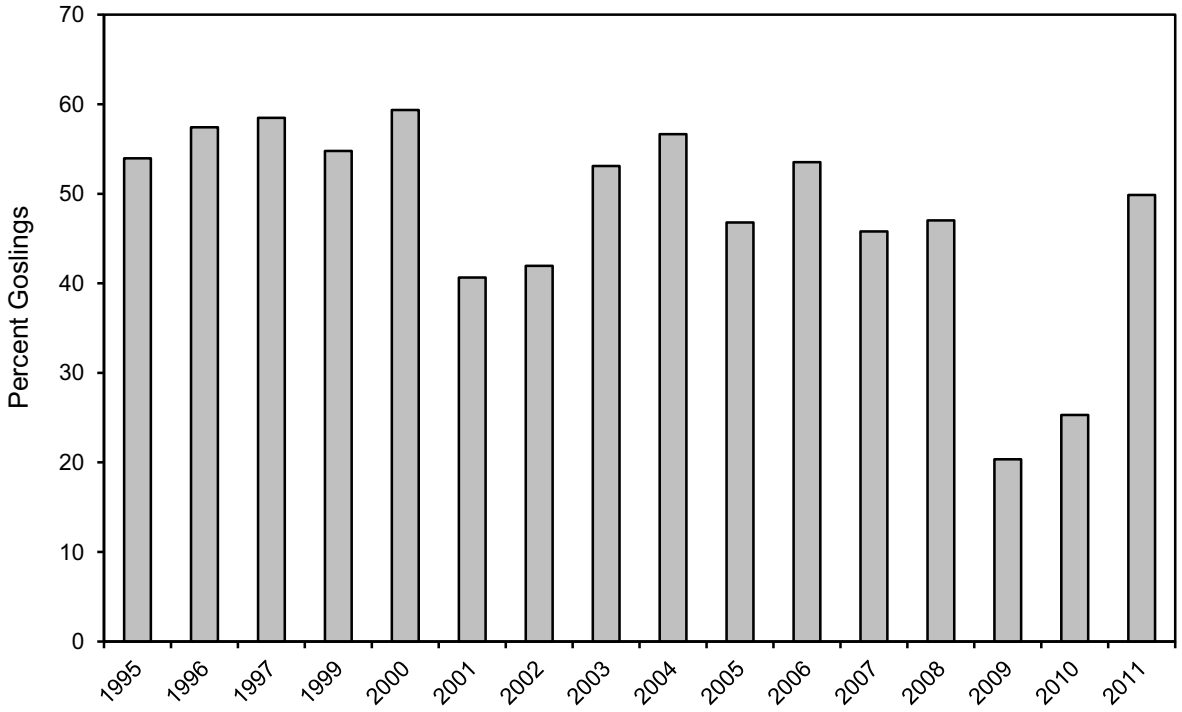

Figure 15. Percent goslings in Snow Goose brood-rearing groups, Barrow to Fish Creek, Alaska, 1995–1997 and 1999–2011.

originated outside of the Ikpikpuk River delta colony. Overall, however, gosling numbers in the Harrison Bay section have tracked numbers in the Smith Bay section fairly closely, including spikes in 2006, 2008, and 2011, and dips in 2009 and 2010, suggesting that some brood rearing Snow Geese in the Harrison Bay section did originate in the Ikpikpuk River delta colony.

The rapidly increasing population of Snow Geese in the region also has been documented by the Teshekpuk Lake molting goose surveys, which have been conducted annually since 1982 (Mallek 2011). Numbers of molting Snow Geese in the Teshekpuk Lake surveys first exceeded 500 geese in 1997, with 1,000 in 1999, and 2,000 in 2001 (goslings not included). Numbers continued to increase from 2003–2009, breaking 4,000 in 2006, and exceeding 6,000 in 2007 and 2009. Numbers were the fourth highest on record (4,427) in 2011 (E. Mallek, USFWS, pers. comm). While these numbers parallel increases in the number of breeding Snow Geese in local colonies, it is unknown whether these large numbers of molting Snow Geese are associated with the local breeding colonies, and unknown numbers of failed breeders or non-breeding Snow Geese may migrate into the Teshekpuk area from colonies farther afield, as has been demonstrated for Brant and other geese in the region, perhaps including birds associated with Canadian or Russian nesting areas. However, fewer molting Snow Geese were seen in the Teshekpuk area in 2011 than in either 2009 or 2010 (years in which the Ikpikpuk delta nesting colony suffered substantial nest losses), suggesting that the near record counts of molting Snow Geese in those years included failed breeders from the Ikpukpuk delta.

We identified 221 adult blue-phase geese on photos of brood-rearing Snow Geese in 2011, representing 2.4% of all adult Snow Geese in these photos. Blue-phase Snow Geese in the groups we have captured for banding have ranged from 1–5% of total birds since 2000 (Burgess et al. 2011; Ritchie 2001; Ritchie et al. 2002, 2004, 2006, 2007, 2008a, 2011; Ritchie and Shook 2003, 2005). Prior to rapid growth of the Ikpikpuk colony, blue-phase Snow Geese rarely were observed in northern Alaska (<1% on Howe Island,

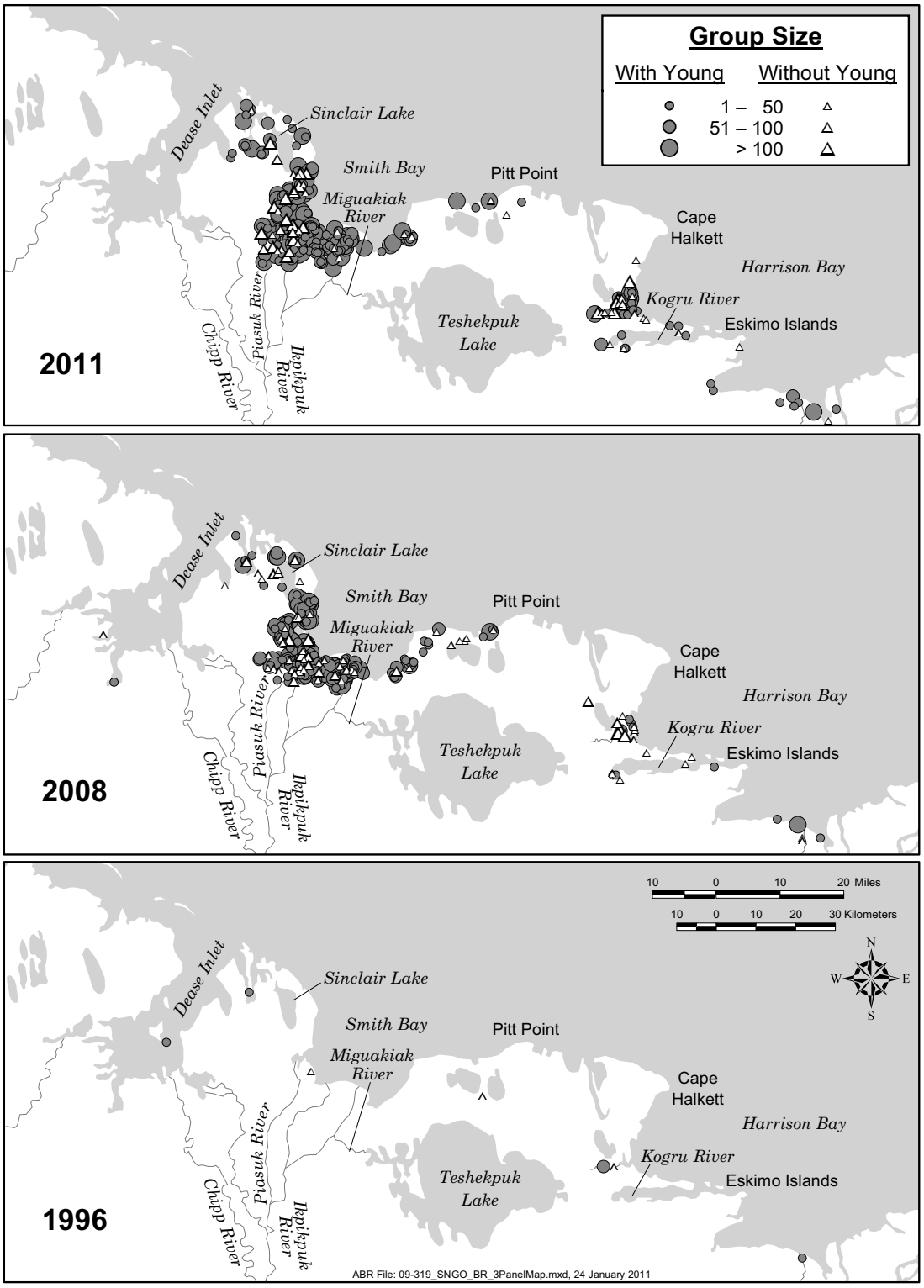

Figure 16. Distribution of Snow Goose brood-rearing groups and groups without young, Barrow to Fish Creek, Alaska, 1996 (when no nests were located at the Ikpikpuk colony), 2008 (when record numbers of nests were recorded at the Ikpikpuk colony), and 2011.

Johnson and Troy 1987; also Ritchie et al. 2000) and blue-phase geese represent only a small percentage (<0.5%) of the nearest mainland Snow Goose colonies in western Canada (J. Hines, CWS, pers. comm.). In contrast, blue-phase Snow Geese are much more common in nesting colonies in the eastern Canadian arctic (Dzubin 1979). The higher percentage of blue-phase geese in our study area suggests the possibility of immigration from such colonies in eastern Canada or a "founder effect" (e.g., resulting from a handful of blue-phase individuals being present during the founding of the Ikpikpuk colony). A blue-phase goose was recorded in Smith Bay as early as 1981 when the Ikpikpuk colony probably comprised fewer than 50 pairs (Johnson and Troy 1987).

SNOW GOOSE BANDING AND BAND RETURNS

Banding activities on the Ikpikpuk River delta resumed in 2011 after a 2-year hiatus caused by the near-total destruction of the colony by brown bears and consequent low number of goslings there in 2009 and 2010. Banding was again conducted on the Sagavanirktok River delta in 2011, but ABR did not band Snow Geese on the Colville River delta.

We banded Snow Geese at 2 sites on the Ikpikpuk River delta between 30 July and 1 August (Appendix J). We captured a total of 2,747 Snow Geese, consisting of 1,394 adults and 1,353 goslings. In addition, we banded 2 Greater White-fronted Geese that were captured accidentally with the Snow Geese. Slightly more males than females were banded in 2011, and 28 adults and 45 goslings were blue-phase birds (Table 7). An additional 4 blue-phase birds were recaptured. Excluding 7 geese that were handled multiple times in 2011 (because they mixed with larger unbanded groups after release), a total of 313 geese were recaptures; 309 of these birds were banded by ABR on the Arctic Coastal Plain, and 4 were foreign recaptures, not originally banded by ABR. All recaptured geese banded by ABR were originally banded on the Ikpikpuk or Piasuk deltas prior to 2011. All 4 foreign recaptures were banded in the Northwest Territories: 2 males and 1 female were banded on Banks Island and 1 male was banded on the MacKenzie River delta (Appendix K).

We also banded Snow Geese at 5 sites on the Sagavanirktok River delta between 27 and 29 July 2011 (Appendix J). We captured 1,915 Snow Geese consisting of 1,035 adults, 880 goslings, and 1 goose of unknown age (i.e., data not recorded). In addition, we banded 1 Greater White-fronted Goose that was captured accidentally with the Snow Geese. Approximately 53% of Snow Geese we banded were females, and 12 adults and 15 goslings were blue-phase birds (Table 8). An additional 4 blue-phase birds were recaptured. A total of 354 birds were recaptures (18.5%); 346 of these were birds banded by ABR on the Arctic Coastal Plain; 5 (4 females, 1 male) were banded by LGL Alaska Research Associates, Inc., on the Kadleroshilik or Sagavanirktok River deltas; and 3 were banded outside of Alaska. Of the recaptured birds banded by ABR, 321 were banded on the Sagavanirktok River delta, 12 on the Colville River delta and 7 on the Ikpikpuk River delta prior to 2011. All 3 foreign recaptures were females: Banks Island, Canada (1); Wrangel Island, Russia (1); and Dewey Soper Bird Sanctuary in eastern Nunavut, Canada (1) (Appendix K). The latter bird represents one of the longest east–west movements of any banded Snow Goose on record at the USGS Bird Banding Lab (J. Lutmerding, pers. comm.).

Since banding began in 2000, we have recaptured 1,705 Snow Geese which represents 10.3% of 16,506 Snow Geese processed during banding operations by ABR on the Arctic Coastal Plain. These recaptures included 37 birds originally banded in Northwest Territories, 4 banded in Nunavut, 1 banded in Manitoba, 11 banded on the Colville River delta (prior to 2008), 17 banded near the Sagavanirktok River delta (prior to 2000), 9 banded in Russia, and 1,624 birds banded by ABR and recaptured on the Arctic Coastal Plain (Appendix K). Two more recaptures were banded in Alaska by someone other than ABR. At the time of this report, complete information on banding locations for these 2 birds was not available from the Bird Banding Lab.

After 10 years of banding, some evidence is emerging of the level of exchange among regional breeding populations of Snow Geese on the Arctic Coastal Plain (Table 9). Fifteen birds originally banded on the Ikpikpuk/Piasuk River deltas were recaptured on the Sagavanirktok/Kadleroshilik deltas and 1 was recaptured on the Colville River

Table 7. Summary of age, sex, and color phase of Snow Geese banded or recaptured at 2 sites on the Ikpikpuk River delta, Alaska, 30 July–1 August 2011.

		New bands						Recaptures [a]			Foreign recaptures [b]		
		Adults			Goslings			Adults			Adults		
Location	Color Phase	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total
Eastern Ikpikpuk Delta	White	275	368	643	348	352	700	117	26	143	1	1	2
	Blue	8	8	16	7	17	24	3	1	4	–	–	–
	Intermediate	1	2	3	–	–	–	1	–	1	–	–	–
	Subtotal	284	378	662	355	369	724	121	27	148	1	1	2
Western Ikpikpuk Delta	White	166	238	404	350	257	607	115	41	156	–	2	2
	Blue	2	10	12	10	11	21	5	–	5	–	–	–
	Intermediate	–	1	1	–	–	–	–	–	–	–	–	–
	Subtotal	168	249	417	360	268	628	120	41	161	–	2	2
Total		452	627	1,079 [c]	715	637	1,352 [d]	241	68	309	1	3	4

[a] Recaptures are birds banded and recaptured by ABR and exclude 5 geese that were banded and recaptured and 2 geese that were recaptured twice during 2011 banding operations.
[b] Foreign recaptures are birds banded by someone other than ABR but recaptured during ABR banding operations.
[c] Excludes 2 birds of unknown sex
[d] Excludes 1 bird of unknown sex

Table 8. Summary of age, sex, and color phase of Snow Geese banded or recaptured at 5 sites on the Sagavanirktok River delta, Alaska, 27–29 July 2011.

		New bands						Recaptures [a]			Foreign recaptures [b]		
		Adults			Goslings			Adults			Adults		
Location	Color Phase	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total
Eastern Ikpikpuk Delta	White	275	368	643	348	352	700	117	26	143	1	1	2
	Blue	8	8	16	7	17	24	3	1	4	–	–	–
	Intermediate	1	2	3	–	–	–	1	–	1	–	–	–
	Subtotal	284	378	662	355	369	724	121	27	148	1	1	2
Western Ikpikpuk Delta	White	166	238	404	350	257	607	115	41	156	–	2	2
	Blue	2	10	12	10	11	21	5	–	5	–	–	–
	Intermediate	–	1	1	–	–	–	–	–	–	–	–	–
	Subtotal	168	249	417	360	268	628	120	41	161	–	2	2
Total		452	627	1,079 [c]	715	637	1,352 [d]	241	68	309	1	3	4

[a] Recaptures are birds banded and recaptured by ABR and exclude 5 geese that were banded and recaptured and 2 geese that were recaptured twice during 2011 banding operations.

[b] Foreign recaptures are birds banded by someone other than ABR but recaptured during ABR banding operations.

[c] Excludes 2 birds of unknown sex

[d] Excludes 1 bird of unknown sex

Table 9. North Slope recaptures of Snow Geese originally banded by ABR at the Ikpikpuk/Piasuk River delta (2000–2003, 2005–2008 and 2011), the Colville River delta (2008 and 2010), and the Sagavanirktok/Kadleroshilik River deltas (2008 and 2010–2011) and of Snow Geese originally banded by LGL at the Colville River delta (2001) and the Sagavanirktok/Kadleroshilik River deltas (1980–1993).

			Recapture Location					
	Total Banded[a]		Ikpikpuk/Piasuk deltas		Colville delta		Sagavanirktok/ Kadleroshilik deltas	
Banding Location	Female	Male	Female	Male	Female	Male	Female	Male
Banded by ABR (2000–2011)								
Ikpikpuk/Piasuk deltas	5,364	5,252	757	315	0	1	9	6
Colville delta	886	895	0	0	39	23	8	5
Sagavanirktok/Kadleroshilik deltas	2,011	2,070	0	0	2	2	284	168
Banded by LGL (includes birds banded 1989–2001)								
Colville delta	36	34	0	0	0	11	1	0
Sagavanirktok/Kadleroshilik deltas	4,072	3,982	0	2	2	2	11	4

[a] Excludes 31 birds of unknown sex (19 banded on the Ikpikpuk/Piasuk deltas, 6 on the Colville delta, and 6 on the Sagavanirktok/Kadleroshilik deltas)

delta. To date, none of the birds banded by ABR on the Colville or Sagavanirktok River deltas have been recaptured on the Ikpikpuk delta, but 4 birds banded on the Sagavanirktok were recaptured on the Colville, and 13 birds banded on the Colville were recaptured on the Sagavanirktok. Additional evidence of mixing among all 3 regional populations is provided by recaptures of birds banded by LGL: 2 birds originally banded on the Sagavanirktok/Kadleroshilik deltas were recaptured on the Ikpikpuk and 4 were recaptured on the Colville delta; and 1 bird banded on the Colville was recaptured in the Sagavanirktok/ Kadleroshilik deltas.

Snow Geese are known to have strong natal philopatry (Cooke et al. 1975) in which females are more likely to return to the region where they were born whereas males are likely to follow their mates. Among the 24,602 Snow Geese of known sex that were banded on the Arctic Coastal Plain between 1980 and 2011 (including this study, Johnson 2000, and Noel et al. 2002), 50.3% were female. Among Snow Geese banded and then recaptured by ABR on the Arctic Coastal Plain, 67.9% were female (1,099 females and 520 were males; Table 9) We used a chi-square test of independence and Fisher's exact significance test to determine if the sex ratio of recaptured birds differed from the sex ratio of birds banded for each colony. We limited our analysis to birds that were recaptured in the same colony where they were initially banded and to birds banded by ABR. For each colony, we calculated the total number of birds of each sex that were banded in all years except the most recent year of banding. We excluded the most recent year because birds banded in the most recent year could not be recaptured. We compared these totals to the numbers of birds of each sex that were recaptured in each colony in subsequent years (Appendix L). In each of the 3 colonies, the sex ratio of banded birds was close to 50:50 but with slightly more females than males (Appendix L). The sex ratio changed significantly between banding and recapture on the Ikpikpuk River delta ($P < 0.001$) and the Sagavanirktok River delta ($P < 0.001$), but the difference was not significantly different from zero in the Colville River delta ($P = 0.115$).

No banding has been conducted in the Kukpowruk River delta, the westernmost breeding population on the Arctic Coastal Plain and it remains unclear whether Snow Geese nesting on the Arctic Coastal Plain of Alaska are part of one regional breeding population or several separate ones.

We also continue to acquire and summarize data on band returns from banding activities during 2000–2008 and 2010–2011. As of 31 December 2011, band returns from all 3 banding locations (Ikpikpuk, Sagavanirktok, and Colville) have been reported by the USGS Bird Banding Laboratory from 24 of the lower 48 states (961), from 5 Canadian provinces (358), from Alaska (42), from 5 states of Mexico (23), and from Russia (2) (Table 10, Figure 17). Fifty-one of the Snow Geese that were recaptured by ABR were previously banded by others outside of Alaska (Appendix K). The distribution of returns and recaptures suggests wide-ranging wintering areas and migratory routes generally similar to those reported for Snow Geese banded 1980–1990 on the Sagavanirktok River delta (Johnson 1996) and Western Arctic Snow Geese in Canada (Kerbes et al. 1999). However, a fairly large number of band returns from Snow Geese banded since 2000 on the Ikpikpuk River delta were peripheral to or east of the main loci for wintering and spring use areas of the earlier Sagavanirktok River delta birds and the Western Arctic Snow Goose population (Appendix M). Some of these locations include Arkansas (32 geese), Illinois (2), Kansas (22), Kentucky (2), Louisiana (8), Mississippi (3), Manitoba (3), and Nunavut (1; Appendix M). Although there is a fair amount of mixing between populations, particularly for male birds, these eastern states and provinces are in the primary migration routes and winter areas of the Central Arctic and Eastern Arctic populations of Lesser Snow Geese, breeding in the eastern Canadian arctic (Bellrose 1976, Francis and Cooke 1992).

A total of 1,386 of 16,506 (8.4%) Snow Geese originally banded by us on the North Slope have been recovered since 2000 (through 31 December 2011) (Table 11). All but 11 returns have been hunter killed or otherwise reported dead, and an additional 2 birds had no encounter information but the band number. Seven returns were of birds banded by us that were recaptured and released alive during banding operations at other colonies (see below). One was an injured bird caught in

Table 10. Band returns (through 31 December 2011) by season, region, and year, from Snow Geese banded in the Ikpikpuk River delta region, Alaska, 2000–2008 and 2011[a]; at the Colville River delta, 2008 and 2010; and Sagavanirktok River delta/Foggy Island Bay areas, 2008 and 2010–2011.

Season / Region	Year of Band Return[b]												
	2000	2001	2002	2003	2004[c]	2005	2006	2007	2008	2009[c]	2010[c]	2011	Total
Fall													
Canada	6	2	7	23	4	14	25	21	78	10	54	48	292
Lower 48				1	1				2	5	2	1	12
Subtotal	6	2	7	24	5	14	25	21	80	15	56	49	304
Winter													
Canada	1					3		6	5	2	1	2	20
Lower 48	9	4	24	45	29	59	99	105	149	75	154	53	805
Mexico		2		3		1	2	4	1	4	4	1	22
Subtotal	10	6	24	48	29	63	101	115	155	81	159	56	847
Spring													
Alaska				2	1	6		4	3	3	9	5	33
Canada				1	2	1	3	3	1	14	4	6	35
Lower 48		3	3	6	4	2	13	18	24	21	17	28	139
Mexico						1							1
Subtotal		3	3	9	7	10	16	25	28	38	30	39	208
Summer													
Alaska		1			1			1	1	2	1	2	9
Canada					1	1		6	1			1	10
Russia					1	1							2
Subtotal		1			3	2		7	2	2	1	3	21
Season unknown													
Canada										1			1
Lower 48							1			1	3		5
Subtotal							1			2	3		6
Total	16	12	34	81	44	89	143	168	265	138	249	147	1,386

[a] Numbers may differ from previous annual reports (e.g., Ritchie et al. 2011) due to more accurate date allocation.
[b] Year of band return is defined as March–February and records may have a different calendar year than the year listed in this table.
[c] No banding occurred on the Ikpikpuk River delta in 2004, 2009, or 2010.
[d] Fall = September and October; winter = November through February; spring = March through May; and summer = June through August. Returns with dates reported as "hunting season" by the Bird Banding Laboratory were assigned approximate dates based on hunting season dates in the reported state; those with postmarked or unknown dates were listed as "Season unknown" and listed under the postmark year.

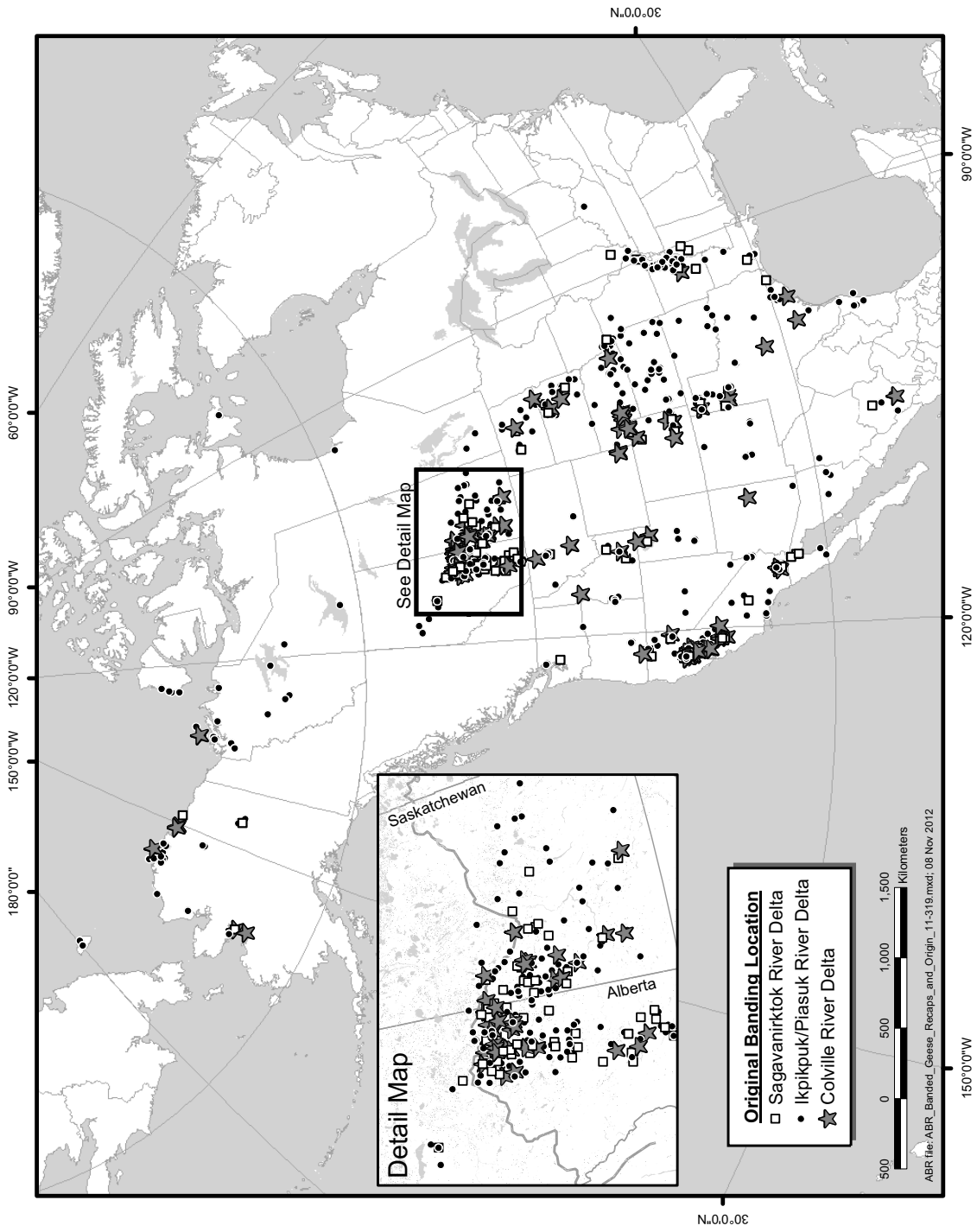

Figure 17. Locations of band recoveries from Snow Geese banded on the Colville River delta and the Sagavanirktok River delta in 2008, and the Ikpikpuk River delta, 2000–2011.

Table 11. Summary of band returns, 2000–2011 (through 31 December 2011) by year class (years from banding date) for Snow Geese banded by ABR on the North Slope, Alaska. Snow Geese were banded at the Ikpikpuk River delta, 2000–2003, 2005–2008 and 2011; at the Colville River delta, 2008 and 2010; and Sagavanirktok River delta/Foggy Island Bay areas, 2008 and 2010–2011.

	Year of Banding										
	2000	2001	2002	2003	2005	2006	2007	2008	2010	2011	Total
Total birds banded	227	160	822[d]	1,074[d,e]	1,253[a,d]	1,755[f]	1,693[g]	2,772	2,750	4,000	16,506
Goslings banded	142	69	414	681	700	1,135	1,036	1,629	1,307	2,233	9,346
% Goslings	62.6	43.1	50.4	63.4	55.9	64.7	61.2	58.8	47.5	55.8	56.6
Year class of goslings at return											
0	13	6	22	43	47	81	61	117	97	59	546
1	3	4	7	22	23	23	26	40	8	–	156
2	2	2	7	13	13	25	11	31	–	–	104
3	1	1	3	9	6	10	8	5	–	–	43
4	1	–	4	8	3	9	–	–	–	–	25
5	1	–	9	12	5	3	–	–	–	–	30
6	–	–	5	6	2	–	–	–	–	–	13
7	2	–	2	10	–	–	–	–	–	–	14
8	–	–	4	–	–	–	–	–	–	–	4
9	–	1	1	–	–	–	–	–	–	–	2
11	1	–	–	–	–	–	–	–	–	–	1
Total returns for birds banded as goslings	24	14	64	123	99	151	106	193	105	59	938
% of goslings returned at age zero	9.2	8.7	5.3	6.3	6.7	7.1	5.9	7.2	7.4	2.6	5.8
% of total returns at age zero	5.7	3.8	2.7	4.0	3.8	4.6	3.6	4.2	3.5	1.5	3.3
Adults banded	85	91	408	393	551	619	657	1,140	1,437	1,765	7,146
% Adults	37.4	56.9	49.6	36.6	44.0	35.3	38.8	41.1	52.3	44.1	43.3
Year classc of adults at return											
0	7	1	8	18	13	19	22	38	30	9	165
1	1	1	8	7	15	4	13	21	8	–	78
2	3	1	7	9	8	13	12	19	–	–	72
3	1	1	5	1	8	4	10	6	–	–	36
4	1	2	6	3	9	10	1	–	–	–	32
5	1	–	8	8	5	2	–	–	–	–	24
6	–	2	4	4	2	–	–	–	–	–	12
7	2	–	6	8	–	–	–	–	–	–	16
8	1	1	7	1	–	–	–	–	–	–	10
9	1	2	–	–	–	–	–	–	–	–	3
Total returns for birds banded as adults	18	11	59	59	60	52	58	84	38	9	448
Total returns (all ages)	42	25[h]	123	182	159	203	164	277	143	68	1,386
% of bands returned to date	18.5	15.6	15.0	16.9	12.7	11.6	9.7	10.0	5.2	1.7	8.4

[a] Includes 2 birds of unknown age at time of banding
[b] Includes 1 bird of unknown age at time of banding
[c] Equals 1 less than minimum age for birds banded as adults
[d] Includes 1 bird captured and released alive at Banks Island, NWT, Canada
[e] Includes 2 birds captured and released alive at Wrangel Island, Russia
[f] Includes 2 birds captured and released alive at Banks Island, NWT, Canada
[g] Includes 1 bird captured and released alive at Lavoy, Alberta, Canada
[h] Includes 1 bird with unknown encounter dates; age could not be calculated

2008 that was later released alive. Two birds encountered in 2011 were listed as "caught by hand" and were later released alive. The largest number of band returns were from birds banded in 2008 (277) and the smallest number from 2001 (25). Over all years, 56.6% of banded birds were captured as goslings or known-age birds; 67.7% of returns were banded as goslings; and 5.8% of birds banded as goslings were reported dead within 1 year of banding (Table 11). Eighteen and a half percent of bands released in the first year of banding (2000) have been returned, and over 16% have been returned from the first 4 years of banding. The average return rate over all years was 8.4%. The oldest known-age bird (i.e., banded as a gosling) was 11 years old and the oldest unknown age bird was at least 9 years old when the band was returned.

Most band returns are from fall migration (defined by the banding lab as September and October) and wintering (November through February) areas (Table 12). Of 1,386 total band returns from the 3 banding locations (through 31 December 2011), 61.1% were in winter (847) and 21.9% were in fall (304). All but 40 of these fall and winter recoveries were hunter returns; 15 of the remaining recoveries were described as "found dead," "caught by dog," "caught due to disease," "caught due to striking wires or towers," "collected," or "struck by motor vehicle." Just one winter recovery, an injured bird found in Texas, was reported alive. Half of all fall and winter recoveries have come from California (584 fall/winter returns). The remaining fall and winter recoveries were distributed across Canada (312; Alberta, Saskatchewan, Manitoba, and Northwest Territories), Mexico (22 fall/winter returns; Baja California, Chihuahua, Durango, Sonora, and Tamaulipas), and 23 of the other lower 48 states (excluding California, 233 fall/winter returns; Table 12; Figure 17).

There also have been 229 spring (March through May) and summer (June through August) recoveries of Snow Geese from Snow Geese banded at our 3 banding locations on the Arctic Coastal Plain (Table 12); most of these were also hunter kills, and all but 10 were reported as dead. Thirty-seven of 42 spring and summer records from Alaska were hunter kills (17 from Barrow, 1 from Ikpikpuk River delta, and the rest from 10 other locations in northern Alaska). Thirty-eight of the 45 spring and summer records from Canada were hunter kills (17 from Northwest Territories, 1 from Nunavut, 15 from Saskatchewan, 2 from Manitoba, and 4 from Alberta). One hundred thirty-three of 139 spring and summer recoveries from the lower 48 states were hunter kills; the 1 spring/summer record from Mexico was a bird that was found dead. A total of 7 Snow Geese banded on the Ikpikpuk River delta in 2003 were recaptured, processed, and released during banding activities at other Snow Geese colonies: 5 on Banks Island (3 females and 2 males, all banded as goslings) and 2 on Wrangel Island, Russia (a female banded as a gosling and a male banded as an adult). An additional 2 birds were listed as having been captured with larger groups of molting geese near Prudhoe Bay in 2011. The distribution of recoveries appears to be similar among the 3 banding/breeding locations (Figure 17).

SUMMARY AND CONCLUSIONS

In 2011, we continued our annual surveys and monitoring of Brant colonies and Snow Geese nesting on the Ikpikpuk River delta. For Brant, we estimated numbers of nesting Brant at a sample of 23 of the largest of the 45 Brant colonies that were monitored annually between 1995 and 2008. Brant occupied 78% of the 23 monitored colonies in 2011, with an estimated 356 nests at these colonies. Nest numbers decreased 17% from 2010, but were about 13% higher than the 18-year average. Estimates of Brant numbers during brood-rearing surveys in 2011 indicated 17,199 Brant in 168 groups (15,153 adults and 2,046 goslings). The total number of Brant was down from 2010, which was the highest ever recorded, although 2011 ranked fourth among all years in the total number of Brant observed. The number of goslings in 2011 (2,046) was about double the 18-year mean (1,061 goslings). The number of adult Brant without broods (11,538) was down from 2010 (18,808) but higher than the long-term average (8,518). About half (48%) of the Brant observed were located in the Harrison Bay section of the western Beaufort coast, 26% were in the Smith Bay section, and 25% were in the Dease Inlet section. Peak numbers of Brant in western Beaufort coastal areas occur when large numbers of non-breeding Brant occur in the Harrison Bay section near Teshekpuk Lake.

Table 12. Band returns of Snow Geese (through 31 December 2011) by season, region, and state. Snow Geese were banded at the Ikpikpuk River delta, 2000–2003, 2005–2008 and 2011; at the Colville River delta, 2008 and 2010; and Sagavanirktok River delta/Foggy Island Bay areas, 2008 and 2010–2011.

Region	Season[a]					
State/Province/District	Fall	Winter	Spring	Summer	Unknown[b]	Total
Alaska			33	9		42
Canada						
Alberta	195	16	2	2	1	216
Manitoba	1		2			3
Northwest Territories	1		16	7		24
Nunavut				1		1
Saskatchewan	95	4	15			114
Lower 48						
Arizona		5				5
Arkansas		29	3			32
California	5	579	5		3	592
Colorado		22	38			60
Idaho		11	6			17
Illinois		2				2
Iowa		1	2			3
Kansas		21	1			22
Kentucky		2				2
Louisiana		8				8
Mississippi		3				3
Missouri		10	5			15
Montana	1	20	1			22
Nebraska	1	5	28		1	35
Nevada		3				3
New Mexico		8				8
North Dakota	1	3	9			13
Oklahoma		4	1			5
Oregon	2	3	4			9
South Dakota		2	22		1	25
Texas		56	5			61
Utah		3	5			8
Washington	2	3				5
Wyoming		2	4			6
Mexico						
Baja California		1	1			2
Chihuahua		1				1
Durango		6				6
Sonora		9				9
Tamaulipas		5				5
Russia						
Chukotka				2		2
Total	304	847	208	21	6	1,386

[a] Seasons defined by the banding lab as: fall = September and October; winter = November through February; spring = March through May; summer = June through August.

[b] Date reported as a postmark date by Bird Banding Lab. No approximate date could be assigned.

We also visited the Snow Goose colony on the Ikpikpuk River delta, as we have for the previous 20 years. More than 19,000 Snow Geese were estimated at the colony in late June and 8,886 nests were enumerated from aerial photos. The previous high number of nests, from aerial photos in 2010, was 4,769 nests. The large increase in 2011 followed 2 years of near zero productivity in the colony that resulted when at least 4 brown bears caused near total failure of nests throughout the entire colony. Prior to 2008, the Ikpikpuk colony was growing at a remarkable rate and nesting success ranged from 48–97%. In 2011, nesting success was estimated at 66%. During brood-rearing surveys in 2011, 26,277 Snow Geese were recorded, including 16,096 adults and 10,181 goslings. The total number of Snow Geese, including both adults and goslings were the highest in the 16-year record. As in most previous years, most Snow Geese were located in the Smith Bay section (83%). Most of the remaining Snow Geese (15%) were located in the Harrison Bay section and only 2% were located in the Dease Inlet section. It is likely that many of the broods recorded in the Harrison Bay section originated from small colonies between Cape Halkett and Fish Creek.

In 2011, 2.4% of adult Snow Geese in aerial survey photographs during brood-rearing were blue phase birds. Among birds handled during banding since 2000, approximately 1–5% annually were blue phase. Prior to the rapid expansion of the Ikpikpuk colony in 1999, blue phase Snow Geese were rarely observed in northern Alaska. Fewer than 1% of birds handled during banding 1980–1993 in the Sagavanirktok River delta (Johnson and Troy 1987) were blue phase.

Snow Geese were banded at 2 sites on the Ikpikpuk River delta (2,747 geese) and 5 sites in the Sagavanirktok/Kadleroshilik River deltas (1,915 geese). Since banding began in 2000, we have recaptured 1,705 Snow Geese which represents 10.3% of 16,506 Snow Geese processed during banding operations by ABR on the Arctic Coastal Plain. Recaptures include 37 birds originally banded in Northwest Territories, 4 in Nunavut, 1 in Manitoba, 11 on the Colville River delta (prior to 2008), 17 on the Sagavanirktok River delta (and environs, prior to 2000), 9 banded in Russia, and 1,624 banded by ABR and recaptured on the Arctic Coastal Plain. Small numbers of recaptures provide evidence of exchange among regional breeding populations on the Arctic Coastal Plain and similar numbers of male and female Snow Geese appear to have changed breeding locations. The distribution of band recoveries appears to be similar among the 3 banding/breeding locations at which ABR has banded. In general, the distribution of band returns from migration and wintering areas is similar to Western Arctic Snow Geese from western Canada and the Sagavanirktok River delta. However, a growing number of band returns suggest some level of mixing with the larger populations of Snow Geese that nest in central and eastern arctic Canada, winter in the Gulf states, and migrate in the central and eastern flyways.

Snow Goose breeding populations have been expanding in North America since at least the 1960s (Kerbes 1983, Kerbes et al. 1983, McCormick and Poston 1988, Alisauskas and Boyd 1994), perhaps due to increased availability of agricultural resources in wintering areas (Davis et al. 1989). Over-population of breeding colonies has led to long-term degradation of some nesting areas and arctic coastal salt marshes used for brood-rearing (Kerbes et al. 1990, Ganter et al. 1995, Srivastava and Jefferies 1996), decreased growth and survival of goslings (Cooch et al. 1991, Williams et al. 1993, Gadallah and Jefferies 1995), and dispersal of young breeders to higher quality breeding areas (Ganter and Cooke 1998).

In our study area on the North Slope of Alaska, the fairly large increases in the number of molting Brant are correlated with concurrent larger increases in Snow Goose numbers, especially in the Smith Bay region. A local increase in productivity of Brant could suggest a benefit to Brant from “predator swamping” in nesting and brood rearing areas (i.e., more geese reduces the overall proportion of the goose population susceptible to predators). Prior studies have demonstrated higher nest success in larger Brant colonies compared to smaller colonies (Raveling 1989) and have linked increased predation rates on Brant nests to reduced populations of alternative prey species (Anthony et al. 1991), generally supporting the theory that Brant may benefit from greater numbers of Snow Geese. Increases in numbers of Brant in the region appear, however, to

result largely from increases in numbers of molt migrants in the Teshekpuk Lake molting area and, although the number of Brant nests among the monitored colonies has increased since 1995, the number of goslings counted in the study area during brood-rearing surveys has fluctuated widely and shows no strong trend.

In the long term, one might predict a negative impact on Brant from a substantial increase in Snow Goose numbers due to competition for, or degradation of salt marsh habitats used by both species during brood rearing. Intense grazing by Brant, focused exclusively on above-ground biomass, appears to have no lasting deleterious effects on salt marsh grazing lawns (Person et al. 1998). In contrast, Snow Geese remove rhizomes and meristematic tissue by grubbing in the spring, which can result in long-term degradation of these plant communities in the vicinity of nesting colonies (e.g., Kerbes et al. 1990, Abraham and Jefferies 1997), potentially reducing available brood-rearing habitat for both species.

We recommend continued monitoring of Brant and Snow Geese in the study area. Nesting and brood-rearing surveys should continue to be used to monitor numbers and productivity of both species. Efforts to photo-census the Ikpikpuk Snow Goose colony should continue and, if the colony is successful, ground-search efforts at the colony should be adjusted to ensure representative sampling of nests for evaluation of nest fate. Banding efforts should continue at the Ikpikpuk Snow Goose colony and at other large colonies, as possible, in years of reasonably good productivity, to better understand the relationships between colonies and populations. Continued monitoring of Brant and Snow Goose numbers and distribution in the region will provide managers valuable and timely information on the status of these species and the potential for negative competitive interactions of Brant with the rapidly increasing population of Snow Geese.

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Appendix A. Summary of survey areas and types of surveys conducted for long-term monitoring of Snow Geese and Brant in northern Alaska, 1991–2011.

	Ikpikpuk River Delta Snow Goose Colony			Kukpowruk River Delta Snow Goose Colony			Regional Aerial Surveys[a]	
Year	Aerial Nesting Survey	Ground-based Nest Search	Banding	Aerial Nest Survey	Ground-based Nest Search	NSB Ground Search[b]	Nesting	Brood-rearing
1991	no	no	no	yes	no	no	none	none
1992	yes	yes	no	yes	yes	no	Area A[a, c]	none
1993	yes	yes	no	yes	yes	no	Area A[c]	none
1994	yes	no	no	yes	no	no	Area A	Area A[d]
1995	yes	no	no	yes	no	yes	Area A	Area A
1996	yes	no	no	no	no	yes	45 colonies[e, f]	Area B[a]
1997	yes	no	no	no	no	yes	45 colonies[f]	Area B
1998	yes	no	no	no	no	yes	45 colonies[f]	none
1999	yes	no	no	yes[g]	no	yes	45 colonies	Area A
2000	yes	no	yes	no	no	yes	45 colonies	Area B
2001	yes	yes	yes	no	no	yes	45 colonies	Area B
2002	yes	yes	yes	yes[h]	no	no	45 colonies	Area B
2003	yes	yes	yes	no	no	yes	45 colonies	Area B
2004	yes	yes	no	no	no	no	45 colonies	Area B
2005	yes	yes	yes	no	no	no	45 colonies	Area B
2006	yes	yes	yes	no	no	no	45 colonies	Area B
2007	yes	yes	yes	no	no	yes	45 colonies	Area B
2008	yes	yes	yes	no	no	yes	45 colonies	Area B
2009	yes	yes	no	no	no	yes	23 colonies	Area B
2010[i]	yes[i]	yes[i]	no	no	no	no	23 colonies	Area B
2011[i]	yes[i]	yes[i]	yes				23 colonies	Area B

[a] Area A comprised parts of both the Chukchi and Beaufort Sea coasts between the southern end of Kasegaluk Lagoon in the west and the western edge of the Colville River delta; Area B comprised the western Beaufort Sea coast between Barrow in the west and the western edge of the Colville River delta.

[b] North Slope Borough (NSB) survey data provided by R. Suydam, NSB Dept. of Wildlife Management. Surveys were conducted only on the Kukpowruk River delta and did not include searches of the Epizetka River delta, where Snow Geese have been recorded nesting in some years.

[c] In 1992 and 1993, regional aerial surveys did not record Brant, only Snow Geese.

[d] In 1994, weather conditions prevented a complete brood-rearing survey and excluded that part of the Chukchi Sea coast between Franklin and Barrow.

[e] In 1996–2008, the nesting surveys focused on 45 known Brant colonies between Barrow and the western edge of the Colville River delta. Snow Goose nests/colonies observed in transit between Brant colonies also were recorded.

[f] In 1996–1998, in addition to the 45 known Brant colonies, additional inland areas were surveyed intensively for Brant and Snow Goose nests. In 1996, 3 inland areas were surveyed: an area south of Dease Inlet and west of the Chipp River, the area between the Ikpikpuk River and east to Teshekpuk Lake, and the Fish Creek delta (see Ritchie and Rose 1996). In 1997, the area east of Teshekpuk Lake and to Harrison Bay and south to Fish Creek was surveyed (see Ritchie 1998a). In 1998, the area north of Teshekpuk Lake (to the Beaufort Sea coast) and tundra immediately south of Teshekpuk Lake was surveyed (see Ritchie 1998b).

[g] In 1999, aerial surveys included nests located near the mouth of the Epizetka River in an area not included in previous surveys.

[h] In 2002, all nests were located near the mouth of the Epizetka River, none were found at the Kukpowruk River delta.

[i] In 2010 and 2011, the aerial nest survey also included aerial photo-survey and the ground-based nest search was modified to improve colony-wide estimates of numbers.

Appendix B. Standard operating procedures for surveys of nesting success for Lesser Snow Geese, Ikpikpuk River delta, Alaska, 2011.

STRATIFIED RANDOM NESTING PLOTS

- Ground searches are best conducted within a week or 2 of hatching in the colony. Access the Ikpikpuk River delta via a helicopter and establish a camp along the western side of the delta.
- Plots are circular with a 50 meter radius. Mark the center of the plot with a piece of survey lath and use a handheld GPS to determine the distance from the centerpoint. Walk the plot using a zigzag pattern with 1 or 2 people. Search the entirety of the plot on dry land and use the GPS track to make sure the entire plot was searched and no nests were recorded twice.
- During ground surveys, precise locations of nests should be recorded using a handheld GPS. Nests are classified as *successful* if at least 1 eggshell fragment in the nest bowl was largely separated from a thickened shell membrane (Downing 1980), *unsuccessful* if eggshell fragments were firmly attached to papery shell membrane or if shell fragments were totally missing (Downing 1980). Nests are classified as *unknown* when physical evidence seemed equivocal (and all unexamined nests also were classified as unknown fate). Do not count membranes for productivity nor habitat. When nests are densely packed, leave a marker in each nest bowl (a small piece of cut-up tongue depressor) to prevent double-counting of nests.
- We have randomly selected 75 High density plots, 75 medium density, 75 low density plots and 50 Zero density plots. This is more plots than can be done during the survey period. Choose your sample using the following criteria: use an optimal allocation of plots from from the 4 different strata; make sure plots from each strata are distributed across the study area in approximate proportion to their abundance; when choosing among potential plots in the same stratum, search plots with lower random numbers first; and when possible, search plots in clusters in order to minimizes helicopter use and transit time. The optimal allocation among stratum for 2011 is 26% low density, 38% medium density, and 37% high density plots. As you mark-off clusters of plots, mark them on your maps so that you have a visual of where you've been and what you have left to do.
- Try to survey at least 15 zero density plots. These can be done quickly, scan from the helicopter before landing (sit on opposite sides). These probably could be done without having to shut down the helicopter – use your judgment based on habitat (if you think you could see nests well).

Appendix C. Brant colony locations and total numbers of nests recorded on aerial surveys, Barrow to Fish Creek, Alaska, 1994–2011.

Colony No.	Survey Section[a]	Latitude	Longitude	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
9	3	70.8951667	-157.0330000	10	15	24	34	15	24	16	19	13	25	10	27	8	13	25	19	24	15
52	3	71.0243333	-157.0098333	0	6	4	13	3	11	13	12	21	23	23	12	6	25	40	8	11	13
7	3	71.0401667	-156.8920000	6	10	7	13	12	8	16	22	13	30	10	8	14	4	23	7	17	1
53	3	70.9465000	-156.5598333	0	12	5	6	0	6	3	nd	0	4	4	6	3	0	3	12	4	1
19	3	70.8340000	-156.4595000	3	1	0	3	0	5	0	0	0	0	0	0	1	2	2	nd	nd	nd
18	3	70.9331667	-156.4236667	1	5	4	0	6	5	6	0	4	8	3	4	0	4	13	nd	nd	nd
20	3	70.7590000	-156.3801667	2	0	0	1	1	0	1	4	2	1	2	0	2	3	2	nd	nd	nd
35	3	71.0910000	-156.3690000	0	7	0	4	0	4	5	8	10	0	11	6	8	8	12	7	95	11
60	3	70.7865000	-156.3615000	0	5	2	1	0	1	1	0	1	1	2	3	0	1	0	nd	nd	nd
36	3	71.0341667	-156.3418333	0	8	0	0	3	0	0	3	2	5	5	5	7	3	4	nd	nd	nd
54	3	70.7776667	-156.2921667	0	1	5	2	0	1	4	0	2	2	6	0	2	3	4	nd	nd	nd
51	3	71.0910000	-156.2663333	0	6	0	5	3	7	2	1	3	6	2	4	2	0	10	2	3	2
50	3	71.0255000	-156.2205000	0	2	3	3	6	8	8	8	5	8	10	1	7	4	13	21	6	9
49	3	71.1006667	-156.2141667	0	5	8	4	6	7	4	5	7	2	5	6	5	3	8	nd	nd	nd
12	3	70.7851667	-155.9788333	10	6	0	3	2	3	2	4	2	0	2	0	2	3	3	0	4	0
11	3	70.8448333	-155.9426667	25	20	20	10	30	29	35	25	30	45	40	0	52	40	98	96	58	86
10	3	71.1525000	-155.9331667	6	10	4	11	7	13	4	15	9	15	0	4	10	6	4	1	9	14
14	3	70.8073333	-155.8265000	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	nd	nd	nd
15	3	70.8233333	-155.7531667	5	1	0	0	0	13	0	0	2	0	0	2	0	1	2	0	3	0
64	3	71.0126670	-155.7270000	0	5	0	0	0	0	3	nd	1	nd	0	1	4	1	0	nd	nd	nd
48	3	70.8121667	-155.7145000	0	4	9	0	7	2	4	0	8	4	6	3	2	3	3	nd	nd	nd
25	3	71.0801667	-155.6948333	4	2	0	2	1	0	2	2	0	0	1	1	0	0	0	nd	nd	nd
65	3	70.8433330	-155.6895000	0	3	0	0	0	3	0	6	0	2	0	0	0	0	0	nd	nd	nd
44	3	71.0613333	-155.6521667	0	1	2	3	6	2	2	4	8	5	3	2	1	3	1	nd	nd	nd
26	3	71.1083333	-155.6186667	5	3	0	6	2	3	5	6	1	3	1	3	0	0	0	nd	nd	nd
17	3	70.8991667	-155.4236667	3	3	6	7	3	2	7	5	1	3	3	0	0	3	4	nd	nd	nd
16	3	70.8546667	-155.3955000	5	0	1	3	0	3	1	2	0	2	1	0	0	0	4	nd	nd	nd
23	3	70.9818333	-155.3365000	6	5	10	17	20	27	21	28	8	22	3	19	19	22	19	14	13	19
45	3	70.8866667	-155.2783333	0	4	0	0	3	2	4	5	1	5	5	1	0	3	3	nd	nd	nd
24	3	70.9888333	-155.2753333	10	10	12	25	28	30	23	32	10	25	40	34	51	20	13	34	35	28
22	3	70.8396667	-155.2008333	3	5	0	1	4	1	5	6	2	3	6	4	0	0	3	nd	nd	nd

Appendix C. Continued.

Colony No.	Survey Section[a]	Latitude	Longitude	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
27	3	71.0893333	-155.1798333	3	8	0	7	2	9	15	16	5	0	6	8	2	4	3	9	19	0
46	3	70.9333333	-155.1166667	0	0	0	0	0	3	8	3	0	2	2	12	3	7	10	1	13	3
43	3	71.1335000	-155.0073333	0	2	0	nd	0	0	2	0	10	20	12	7	4	2	12	28	12	7
47	3	70.9111667	-154.9843333	0	15	14	16	11	17	16	33	15	15	12	14	17	7	18	3	6	16
28	3	71.0626667	-154.9468333	4	8	10	2	1	15	2	5	2	10	8	5	4	7	10	6	0	0
29	3	71.0736667	-154.7853333	5	6	0	6	7	11	7	6	3	3	2	3	3	2	9	0	0	0
30	4	70.9270000	-154.6625000	3	0	0	0	0	0	0	0	0	0	nd	0	2	0	3	nd	nd	nd
31	4	70.8006667	-154.4586667	5	5	5	8	4	15	6	2	6	0	nd	4	0	nd	0	nd	nd	nd
34	4	70.7998333	-154.3751667	0	2	0	0	0	1	0	0	0	0	0	0	0	nd	0	nd	nd	nd
32	4	70.6395000	-154.2016667	40	35	35	30	30	15	40	10	20	30	63	85	50	60	40	70	34	105
33	4	70.8393333	-153.9236667	4	2	3	5	5	3	7	12	3	18	12	3	12	9	9	4	3	9
56	4	70.9133333	-153.2755000	0	6	2	0	3	1	1	6	1	0	nd	0	2	2	2	nd	nd	nd
57	5	70.7408333	-152.4080000	nd	15	35	28	25	6	27	26	9	11	23	3	6	13	17	9	39	4
58	5	70.4308333	-151.6450000	nd	25	29	45	47	55	50	45	34	10	30	17	35	12	33	22	19	13

[a] 3 = Dease Inlet, 4 = Smith Bay, 5 = Harrison Bay

Appendix D. Location and numbers of Brant during brood-rearing surveys, Barrow to Fish Creek, Alaska, 2011.

				Visual Estimate			Photo Count		
Section	Location	Latitude	Longitude	No. Adults	No. Young	Total	No. Adults	No. Young	Total
3	Chipp River Mouth	70.85665	-155.61704	40	8	48			
3	Chipp River Mouth	70.85227	-155.60022	60	10	70	54	14	68
3	South Admiralty Bay	70.74819	-155.97574	15	6	21			
3	South Admiralty Bay	70.74710	-155.99808	30	18	48			
3	South Admiralty Bay	70.76464	-155.97899	6	9	15			
3	Inaru River Mouth	70.83746	-155.94487	70	70	140	70	73	143
3	Inaru River Mouth	70.85458	-155.92224	7	0	7			
3	Brant Point South	71.30111	-156.58339	17	0	17			
3	Brant Point South	71.30815	-156.55059	14	10	24	14	20	34
3	S Tekegakrok Point	71.26045	-156.40696	20	10	30	13	26	39
3	S Tekegakrok Point	71.26544	-156.41953	40	0	40			
3	Scott Point West	71.24780	-156.29489	6	13	19			
3	Scott Point West	71.24560	-156.21792	20	30	50	40	36	76
3	Scott Point	71.24095	-156.11699	20	0	20			
3	Scott Point	71.24055	-156.09892	20	0	20			
3	Avak Bay	71.22773	-156.10267	70	0	70			
3	Iko Bay	71.18823	-156.08701	4	6	10			
3	Iko Bay	71.16333	-156.12017	12	10	22	14	24	38
3	Iko Bay	71.16173	-156.10924	25	0	25			
3	Iko Bay	71.17302	-156.00255	14	19	33			
3	Ross Bay	71.18085	-155.90475	16	0	16			
3	Ross Bay	71.17346	-155.91587	65	0	65			
3	Ross Bay	71.17394	-155.89092	40	3	43			
3	Ross Bay	71.16904	-155.89590	35	0	35			
3	Ross Bay	71.16359	-155.89421	50	20	70	109	71	180
3	Ross Bay	71.15783	-155.90084	40	20	60	59	52	111
3	Ross Bay	71.17716	-155.87435	36	10	46			
3	Tulageak Point	71.19425	-155.78869	45	0	45			
3	Christie Point	71.16032	-155.60724	350	0	350			
3	NW Admiralty Bay	71.06062	-155.57388	35	0	35			
3	NW Admiralty Bay	71.06280	-155.58524	40	8	48			
3	NW Admiralty Bay	71.02749	-155.66336	5	0	5			
3	NW Admiralty Bay	71.02695	-155.69284	22	23	45			
3	McTavish Point	70.96457	-155.82128	70	30	100	80	50	130
3	West Admiralty Bay	70.96283	-156.01153	8	0	8			
3	Kurgorak Bay	70.99153	-155.24314	75	75	150	255	64	319
3	Kurgorak Bay	71.03595	-155.19634	65	0	65			
3	Tangent Point South	71.09653	-155.14651	250	0	250			
3	Tangent Point South	71.09233	-155.14136	150	0	150			
3	Tangent Point South	71.08690	-155.13711	35	0	35			
3	Tangent Point South	71.07992	-155.12461	120	20	140	90	37	127
3	Tangent Point South	71.05926	-155.08004	50	0	50			

Appendix D. Continued.

				Visual Estimate			Photo Count		
Section	Location	Latitude	Longitude	No. Adults	No. Young	Total	No. Adults	No. Young	Total
3	Tangent Point South	71.04296	-155.06280	300	0	300			
3	Tangent Point South	71.04437	-155.05501	425	0	425			
3	Tangent Point South	71.05296	-155.05063	250	0	250			
3	Tangent Point South	71.05617	-155.06052	230	0	230			
3	Tangent Point	71.11860	-155.08098	12	0	12			
3	Tangent Point	71.13273	-155.07183	45	0	45			
3	Tangent Point	71.14555	-155.09871	32	2	34			
3	Mckay Inlet	71.01338	-155.06959	75	0	75			
3	Mckay Inlet	71.01089	-155.06708	23	0	23			
4	Piasuk River Delta	70.82378	-154.60412	50	0	50			
4	Piasuk River Delta	70.78689	-154.72176	50	0	50			
4	Piasuk River Delta	70.80412	-154.76824	55	0	55			
4	Piasuk River Delta	70.81613	-154.82274	25	0	25			
4	Smith River	70.84863	-153.25135	55	0	55			
4	Smith River	70.85781	-153.23637	70	15	85	118	13	131
4	Smith River	70.85819	-153.21376	70	20	90	96	20	116
4	Smith River	70.86043	-153.20153	30	0	30			
4	Smith River	70.88931	-153.22237	65	0	65			
4	Smith River	70.88640	-153.19984	50	0	50			
4	Smith River	70.88394	-153.20572	16	0	16			
4	Smith River	70.89257	-153.19898	300	0	300			
4	Smith River	70.91253	-153.18394	70	0	70			
4	Smith River	70.90973	-153.16472	65	0	65			
4	Smith River	70.88453	-153.17242	22	0	22			
4	Smith River	70.88397	-153.19365	40	0	40			
4	Smith River	70.88231	-153.27024	36	0	36			
4	Smith River	70.88402	-153.28428	100	0	100			
4	Smith River	70.86874	-153.32511	75	0	75			
4	Smith River	70.87155	-153.33089	50	20	70	51	26	77
4	Smith River	70.86958	-153.33276	60	0	60			
4	Smith River	70.89414	-153.34875	150	0	150			
4	Smith River	70.88925	-153.34256	85	0	85			
4	Smith River	70.88538	-153.32697	40	0	40			
4	Smith River	70.89843	-153.30241	120	0	120			
4	Smith River	70.90117	-153.31407	60	30	90	74	28	102
4	Smith River	70.90279	-153.30869	120	0	120			
4	Smith River	70.89544	-153.29032	50	0	50			
4	McLeod Point East	70.86827	-153.50011	50	0	50			
4	McLeod Point East	70.88517	-153.60651	100	0	100			
4	McLeod Point East	70.86400	-153.65953	175	0	175			
4	McLeod Point East	70.87030	-153.68370	165	0	165			
4	Boat Creek	70.85962	-153.88662	125	0	125			
4	Ikpikpuk River East	70.80830	-153.97944	65	0	65			

Appendix D. Continued.

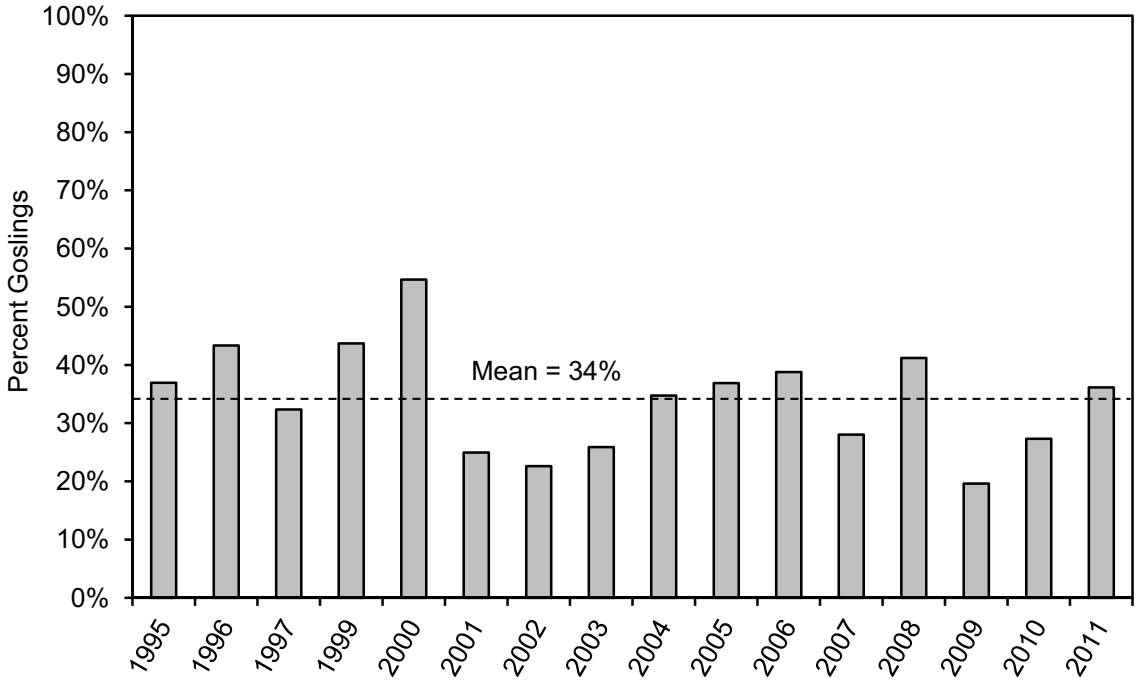
				Visual Estimate			Photo Count		
Section	Location	Latitude	Longitude	No. Adults	No. Young	Total	No. Adults	No. Young	Total
4	Ikpikpuk River East	70.80594	-153.94875	23	0	23			
4	Ikpikpuk River East	70.78920	-154.06351	40	0	40	21	15	36
4	Ikpikpuk River Delta	70.81962	-154.49685	250	0	250			
4	Ikpikpuk River Delta	70.81868	-154.52327	60	0	60			
4	Ikpikpuk River Delta	70.81770	-154.55110	23	0	23			
4	Mckay Inlet	71.11292	-155.02742	24	0	24			
4	Mckay Inlet	71.00475	-155.01873	100	8	108			
4	Mckay Inlet	71.08908	-154.95130	255	0	255			
4	Mckay Inlet	71.08608	-154.94819	100	0	100			
4	Sinclair Lake	71.04815	-154.89912	30	20	50			
4	Sinclair Lake	71.04633	-154.89708	175	0	175			
4	SE Sinclair Lake	70.94522	-154.70573	70	0	70			
4	SE Sinclair Lake	70.92159	-154.61340	180	0	180			
4	Piasuk River Delta	70.86605	-154.67673	45	0	45			
4	Piasuk River Delta	70.86386	-154.69788	40	0	40			
4	Ikpikpuk River Delta	70.80745	-154.50864	70	0	70			
4	Ikpikpuk River Delta	70.81246	-154.41930	150	0	150			
4	Ikpikpuk River Delta	70.81058	-154.41887	20	20	40			
5	Fish Creek Delta	70.38901	-151.27439	20	30	50	26	29	55
5	Fish Creek Delta	70.41009	-151.34962	30	30	60	38	29	67
5	Fish Creek Delta	70.41338	-151.34320	20	30	50	30	5	35
5	Fish Creek Delta	70.41188	-151.34212	50	20	70	74	32	106
5	Fish Creek Delta	70.41365	-151.38641	175	175	350	147	156	303
5	Fish Creek Delta	70.39294	-151.38034	80	80	160	58	46	104
5	Fish Creek Delta	70.39359	-151.36945	80	80	160	58	53	111
5	Fish Creek Delta	70.39054	-151.37197	50	50	100	44	18	62
5	Fish Creek Delta	70.39009	-151.37306	100	70	170	128	139	267
5	Fish Creek Delta	70.39124	-151.37203	25	20	45			
5	Fish Creek Delta	70.38834	-151.37776	100	100	200	160	174	334
5	Fish Creek Delta	70.38715	-151.40240	20	20	40			
5	Fish Creek Delta	70.38884	-151.41832	70	50	120	64	92	156
5	Fish Creek Delta	70.40191	-151.51807	25	25	50	34	37	71
5	Kolikpik River Mouth	70.47626	-151.90035	150	5	155	192	15	207
5	Atigaru Point	70.51809	-151.71970	35	0	35			
5	Atigaru Point	70.50846	-151.74288	17	0	17			
5	Atigaru Point	70.50244	-151.86570	30	11	41			
5	Atigaru Point	70.50065	-151.80469	14	0	14			
5	Atigaru Point	70.54898	-151.70740	55	0	55			
5	Atigaru Point	70.54715	-151.73949	36	0	36			
5	Atigaru Point	70.54466	-151.76034	35	0	35			
5	Kogru River	70.54538	-152.16289	20	0	20			
5	Kogru River	70.54515	-152.15321	14	20	34			
5	Kogru River	70.54678	-152.37740	30	30	60	46	44	90

Appendix D. Continued.

				Visual Estimate			Photo Count		
Section	Location	Latitude	Longitude	No. Adults	No. Young	Total	No. Adults	No. Young	Total
5	Kogru River	70.54966	-152.63826	30	30	60	4	35	39
5	Kogru River	70.54620	-152.63458	90	0	90			
5	Kogru River	70.54702	-152.62635	120	100	220	169	86	255
5	Kogru River	70.55006	-152.62038	25	0	25	25	0	25
5	Kogru River	70.55006	-152.62038	125	100	225	73	51	124
5	Kogru River	70.54809	-152.60441	10	11	21			
5	Garry Creek South	70.60939	-152.32758	160	0	160			
5	Garry Creek	70.62659	-152.47953	400	0	400			
5	Garry Creek	70.62062	-152.51127	30	10	40	30	18	48
5	Garry Creek	70.61754	-152.50175	12	20	32			
5	Garry Creek	70.62366	-152.53486	175	0	175			
5	Garry Creek	70.62584	-152.49633	125	0	125			
5	Garry Creek	70.62128	-152.45128	4	0	4			
5	Garry Creek	70.61908	-152.45541	150	75	225	256	88	344
5	Garry Creek	70.62550	-152.64336	12	10	22			
5	Garry Creek	70.62271	-152.63553	30	15	45			
5	Garry Creek	70.61882	-152.64123	100	0	100			
5	Garry Creek	70.62503	-152.65157	10	0	10			
5	Garry Creek	70.62103	-152.63442	120	0	120			
5	Garry Creek	70.62548	-152.60494	200	0	200			
5	Garry Creek	70.63221	-152.49436	200	0	200			
5	Garry Creek	70.67379	-152.47704	300	0	300			
5	Garry Creek	70.66949	-152.47719	150	0	150			
5	Garry Creek	70.66967	-152.48325	15	0	15			
5	Garry Creek	70.66562	-152.48259	45	0	45			
5	Garry Creek	70.65636	-152.48289	25	0	25			
5	Garry Creek	70.66255	-152.51257	150	0	150			
5	Garry Creek	70.65907	-152.52125	475	0	475			
5	Garry Creek	70.65142	-152.51772	400	0	400			
5	Garry Creek	70.64466	-152.51371	200	0	200			
5	Garry Creek	70.64219	-152.51207	200	0	200			
5	Garry Creek	70.65650	-152.53524	400	0	400			
5	Garry Creek	70.64617	-152.57235	175	0	175			
5	Abraham BM	70.72721	-152.50194	65	0	65			
5	Abraham BM	70.74344	-152.43210	10	0	10			
5	Abraham BM	70.74828	-152.38602	175	40	215	238	30	268
5	Cape Halkett	70.77375	-152.30820	200	0	200			
5	Cape Halkett	70.79455	-152.23315	175	0	175			
5	Cape Halkett	70.83754	-152.29317	30	0	30			
5	Cameron Point	70.87231	-152.63217	160	0	160			

Appendix E. Distribution and composition of Brant groups during brood-rearing surveys, Barrow to Fish Creek, Alaska, 1995–1997 and 1999–2011.

Section Year	Total Groups	Brood Groups	Adults Without Broods	Adults With Broods	Total Adults	Goslings	Total Birds in Brood Groups	Total Birds
Dease Inlet								
1995	15	11	170	373	543	278	651	821
1996	17	12	786	236	1,022	227	463	1,249
1997	24	6	1,288	110	1,398	100	210	1,498
1999	21	14	172	302	474	366	668	840
2000	17	13	646	340	986	266	606	1,252
2001	16	9	1,165	739	1,904	148	887	2,052
2002	24	8	1,098	468	1,566	68	536	1,634
2003	38	13	4,427	567	4,994	258	825	5,252
2004	54	19	3,112	741	3,853	474	1,215	4,327
2005	16	4	1,338	270	1,608	97	367	1,705
2006	18	18	0	806	806	511	1,317	1,317
2007	22	10	414	418	832	267	685	1,099
2008	25	15	536	487	1,023	298	785	1,321
2009	14	2	1,115	57	1,172	21	78	1,193
2010	12	10	23	257	280	194	451	474
2011	51	23	2,668	1,083	3,751	592	1,675	4,343
Mean	24	12	1,185	453	1,638	260	714	1,899
SD	13	5	1,231	275	1,364	163	412	1,423
Smith Bay								
1995	8	5	340	210	550	65	275	615
1996	5	4	225	80	305	38	118	343
1997	5	3	530	120	650	39	159	689
1999	30	13	1,680	286	1,966	203	489	2,169
2000	2	1	130	120	250	200	320	450
2001	22	7	3,219	201	3,420	243	444	3,663
2002	14	6	2,546	382	2,928	131	513	3,059
2003	20	7	2,581	522	3,103	130	652	3,233
2004	21	10	1,940	574	2,514	227	801	2,741
2005	41	12	2,018	581	2,599	399	980	2,998
2006	54	29	3,412	1,585	4,997	903	2,488	5,900
2007	49	11	3,210	346	3,556	186	532	3,742
2008	23	3	2,043	98	2,141	58	156	2,199
2009	52	6	6,342	286	6,628	81	367	6,709
2010	46	4	5,717	170	5,887	89	259	5,976
2011	52	8	3,874	510	4,384	150	660	4,534
Mean	28	8	2,488	379	2,867	196	576	3,064
SD	19	7	1,819	365	1,935	211	564	2,006
Harrison Bay								
1995	16	9	670	969	1,639	566	1,535	2,205
1996	16	10	119	512	631	368	880	999
1997	43	21	1,048	655	1,703	284	939	1,987
1999	45	19	1,753	790	2,543	501	1,291	3,044
2000	6	5	14	210	224	342	552	566
2001	38	4	5,718	368	6,086	44	412	6,130
2002	46	8	4,358	594	4,952	223	817	5,175
2003	60	9	11,062	391	11,453	129	520	11,582
2004	91	18	7,490	1,525	9,015	810	2,335	9,825
2005	49	20	2,391	1,597	3,988	935	2,532	4,923
2006	53	25	2,758	1,532	4,290	1,070	2,602	5,360
2007	68	15	4,723	1,501	6,224	429	1,930	6,653
2008	99	29	6,410	2,005	8,415	1,458	3,463	9,873
2009	95	13	10,947	2,037	12,984	479	2,516	13,463
2010	96	19	13,068	2,252	15,320	724	2,976	16,044
2011	65	28	4,996	2,022	7,018	1,304	3,326	8,322
Mean	55	16	4,845	1,185	6,030	604	1,789	6,634
SD	29	8	4,094	697	4,480	414	1,048	4,567



Appendix F. Percent goslings in Brant brood-rearing groups, Barrow to Fish Creek, Alaska, 1995–1997 and 1999–2011.

Appendix G. Numbers of adults, nests, and estimated nesting success of Snow Geese at the Kukpowruk River delta and Ikpikpuk River delta colonies, 1991–2011.

	Kukpowruk			Ikpikpuk		
Year	Adults[a]	Nests[b]	Nesting Success	Adults[a]	Nests[c]	Nesting Success
1991	185	55	nd	nd	nd	nd
1992	130	26	8%	200	60	7%
1993	135	44	89%	140	42	21%
1994	10	0	nd	20	5	nd
1995	68	36	11%	200	55	nd
1996	nd	57	65%	0	0	nd
1997	nd	35	0%	160	50	nd
1998	nd	46	4%	195	nd	nd
1999	45	5[d]	nd	552	176	nd
2000	nd	13	0%	1,500	250	nd
2001	nd	9[d]	nd	1,230	335	48%
2002	147	41[d]	nd	1,232	918	63%
2003	nd	18	≥44%	1,364	1,149	97%
2004	nd	nd	nd	2,900	1,436	90%
2005	nd	nd	nd	2,390	1,116	70%
2006	nd	nd	nd	4,421	2,386	86%
2007	nd	204	61%	9,300	2,505	85%
2008	nd	320	nd	14,398	4,641	89%
2009	nd	315	<50%	9,374	4,479	1%
2010	nd	nd	nd	11,868	4,769	8.5%
2011	nd	nd	nd	19,022	8,886	65.5%

[a] Total number of adults equals all adults in flight plus those associated with nest sites; all estimates of adults are from aerial visual surveys exclusively, except in 2010 and 2011 when nests were enumerated from aerial photo survey, and flying adults were estimated visually during the photo survey flight

[b] Number of nests at Kukpowruk were determined from aerial surveys, except in 1996–1998, 2000–2001, 2003, and 2007–2009 when nests were enumerated during North Slope Borough ground searches (R. Suydam, NSB, pers. comm.)

[c] Number of nests at Ikpikpuk were determined from aerial surveys in 1992–2000, ground searches in 2001–2003, combined aerial and ground counts in 2004–2009, and an aerial photo survey in 2010 and 2011

[d] Aerial surveys in 1999, 2001, and 2002 included the Epizetka River mouth, 2 miles north of Kukpowruk River—in 1999, all nests were located near the Epizetka River mouth and none were found at the Kukpowruk River

Appendix H. Locations and numbers of Snow Geese (visual estimates and photo counts) during brood-rearing surveys, Barrow to Fish Creek, Alaska, 2011.

				Visual Estimate			Photo Count			
Section	Location	Latitude	Longitude	No. Adults	No. Young	Total	No. Adults[a]		No. Young	Total
3	Kurgorak Bay	70.98173	-155.16312	1	3	4				
3	Kurgorak Bay	70.99238	-155.15354	2	2	4				
3	Tangen Point South	71.06660	-155.08328	60	60	120	94	(6)	97	191
3	Tangen Point South	71.08204	-155.06427	18	27	45				
3	Tangen Point South	71.10289	-155.06318	30	20	50	30		28	58
3	Mckay Inlet	71.01262	-155.06937	30	20	50	50		39	89
3	Mckay Inlet	71.01089	-155.06708	10	10	20				
4	Piasuk River Delta	70.82778	-154.61105	50	50	100	57		68	125
4	Piasuk River Delta	70.82508	-154.60533	8	12	20				
4	Ikpikpuk River Delta	70.77705	-154.58209	12	15	27				
4	Ikpikpuk River Delta	70.77690	-154.59061	50	70	120	71	(2)	82	153
4	Ikpikpuk River Delta	70.77281	-154.59017	40	40	80	52	(3)	34	86
4	Ikpikpuk River Delta	70.77552	-154.60763	40	50	90	42		58	100
4	Ikpikpuk River Delta	70.77894	-154.59711	20	30	50	16		23	39
4	Piasuk River Delta	70.81979	-154.61738	100	100	200	64	(3)	60	124
4	Piasuk River Delta	70.82093	-154.61784	40	40	80	36		17	53
4	Piasuk River Delta	70.82678	-154.61996	16	20	36	13		21	34
4	Piasuk River Delta	70.82685	-154.61213	80	80	160	81	(2)	85	166
4	Piasuk River Delta	70.81909	-154.64142	50	50	100	71	(1)	29	100
4	Piasuk River Delta	70.81313	-154.63675	45	45	90	35	(2)	41	76
4	Piasuk River Delta	70.80089	-154.63152	100	100	200	191	(1)	71	262
4	Piasuk River Delta	70.80084	-154.65474	4	6	10				
4	Piasuk River Delta	70.79757	-154.63929	70	70	140	60		36	96
4	Piasuk River Delta	70.78693	-154.65616	65	65	130	88	(2)	64	152
4	Piasuk River Delta	70.76963	-154.62499	10	11	21				
4	Piasuk River Delta	70.76493	-154.67307	60	60	120	60	(2)	42	102
4	Piasuk River Delta	70.77132	-154.66423	6	8	14				
4	Piasuk River Delta	70.77466	-154.66608	30	30	60	15		12	27
4	Piasuk River Delta	70.77792	-154.66428	30	30	60	26		23	49
4	Piasuk River Delta	70.79257	-154.67118	10	3	13				
4	Piasuk River Delta	70.79695	-154.67240	20	20	40	23		23	46
4	Piasuk River Delta	70.80700	-154.67327	30	30	60	26		41	67
4	Piasuk River Delta	70.82176	-154.66487	100	100	200	111	(4)	113	224
4	Piasuk River Delta	70.82411	-154.66613	100	100	200	108	(3)	108	216
4	Piasuk River Delta	70.82579	-154.66890	300	0	300				
4	Piasuk River Delta	70.83211	-154.69226	70	70	140	81		70	151
4	Piasuk River Delta	70.82647	-154.70079	60	60	120	37	(2)	29	66
4	Piasuk River Delta	70.81792	-154.69686	6	0	6				
4	Piasuk River Delta	70.80726	-154.69400	30	30	60	46	(2)	28	74
4	Piasuk River Delta	70.80096	-154.69357	70	110	180	89	(1)	83	172
4	Piasuk River Delta	70.78908	-154.70358	30	0	30	45		0	45
4	Piasuk River Delta	70.78193	-154.70035	60	15	75	66		7	73

Appendix H. Continued.

Section	Location	Latitude	Longitude	Visual Estimate			Photo Count			
				No. Adults	No. Young	Total	No. Adults[a]		No. Young	Total
4	Piasuk River Delta	70.76034	-154.69412	80	80	160	115	(4)	77	192
4	Piasuk River Delta	70.76449	-154.69193	20	20	40	19		25	44
4	Piasuk River Delta	70.77234	-154.72889	12	5	17				
4	Piasuk River Delta	70.78501	-154.72972	40	40	80	76		30	106
4	Piasuk River Delta	70.78869	-154.72040	40	40	80	46	(3)	40	86
4	Piasuk River Delta	70.79541	-154.73293	150	0	150				
4	Piasuk River Delta	70.80564	-154.73482	25	25	50	34		22	56
4	Piasuk River Delta	70.81141	-154.73719	20	20	40				
4	Piasuk River Delta	70.81210	-154.73763	10	6	16				
4	Piasuk River Delta	70.81326	-154.73859	100	0	100				
4	Piasuk River Delta	70.83067	-154.73844	220	0	220				
4	Piasuk River Delta	70.78187	-154.76008	80	80	160	102	(2)	95	197
4	Piasuk River Delta	70.76844	-154.75735	90	0	90				
4	Piasuk River Delta	70.75211	-154.74478	30	30	60	54		42	96
4	Piasuk River Delta	70.74127	-154.76270	100	100	200	72	(1)	70	142
4	Piasuk River Delta	70.75642	-154.77634	250	0	250				
4	Piasuk River Delta	70.81414	-154.79390	80	80	160	82	(1)	76	158
4	Piasuk River Delta	70.81600	-154.79401	25	25	50	27	(1)	23	50
4	Piasuk River Delta	70.81947	-154.81984	90	0	90				
4	Piasuk River Delta	70.82017	-154.81182	30	30	60	26	(1)	40	66
4	Piasuk River Delta	70.82151	-154.80778	100	100	200	161	(1)	89	250
4	Piasuk River Delta	70.81067	-154.81993	20	20	40	19		21	40
4	Piasuk River Delta	70.77507	-154.81184	15	0	15				
4	Piasuk River Delta	70.75916	-154.80503	20	20	40				
4	Piasuk River Delta	70.74558	-154.82898	12	23	35				
4	Piasuk River Delta	70.77111	-154.83849	14	0	14				
4	Piasuk River Delta	70.78278	-154.84221	10	26	36				
4	Piasuk River Delta	70.79735	-154.84960	20	20	40	20	(1)	17	37
4	Piasuk River Delta	70.80341	-154.85299	7	13	20				
4	Piasuk River Delta	70.80677	-154.85481	50	50	100	58		55	113
4	Piasuk River Delta	70.80641	-154.87415	13	0	13				
4	Piasuk River Delta	70.79453	-154.87643	6	13	19				
4	Piasuk River Delta	70.77796	-154.86951	175	0	175				
4	Piasuk River Delta	70.75431	-154.85314	40	40	80	48		46	94
4	Smith River	70.85434	-153.29855	3	0	3				
4	Smith River	70.88148	-153.19501	2	1	3				
4	Smith River	70.88527	-153.40268	19	0	19				
4	Smith River	70.88802	-153.40315	17	0	17				
4	Smith River	70.88443	-153.41330	50	80	130	86	(1)	84	170
4	McLeod Point East	70.86921	-153.50541	20	30	50				
4	McLeod Point East	70.88538	-153.63229	40	60	100	67	(1)	98	165
4	Ikpikpuk River East	70.81090	-153.98740	20	0	20				
4	Ikpikpuk River East	70.80759	-153.97667	20	25	45				
4	Ikpikpuk River East	70.80619	-153.93715	45	0	45				

Appendix H. Continued.

				Visual Estimate			Photo Count			
Section	Location	Latitude	Longitude	No. Adults	No. Young	Total	No. Adults[a]		No. Young	Total
4	Ikpikpuk River East	70.80387	-153.92653	4	8	12				
4	Ikpikpuk River East	70.79644	-153.94532	30	30	60	40		44	84
4	Ikpikpuk River East	70.79786	-153.94947	8	20	28	16		24	40
4	Ikpikpuk River East	70.80116	-153.95641	70	90	160	129		90	219
4	Ikpikpuk River East	70.80387	-153.98530	80	90	170	188	(5)	136	324
4	Ikpikpuk River East	70.81649	-154.00017	30	35	65	57		45	102
4	Ikpikpuk River East	70.78920	-154.06351	30	30	60	81	(1)	40	121
4	Ikpikpuk River East	70.78321	-154.08130	70	70	140	86	(6)	129	215
4	Ikpikpuk River East	70.76864	-154.13806	8	19	27				
4	Ikpikpuk River Delta	70.77736	-154.25672	80	80	160	98		151	249
4	Ikpikpuk River Delta	70.80995	-154.34026	30	30	60	46	(2)	19	65
4	Ikpikpuk River Delta	70.81575	-154.42884	8	11	19				
4	Ikpikpuk River Delta	70.81577	-154.43412	16	16	32				
4	Ikpikpuk River Delta	70.81617	-154.43772	40	0	40				
4	Ikpikpuk River Delta	70.82045	-154.45567	60	60	120	75	(1)	63	138
4	Ikpikpuk River Delta	70.81730	-154.58837	10	17	27				
4	Mckay Inlet	71.09278	-155.04006	24	24	48	39	(1)	38	77
4	Mckay Inlet	71.09385	-155.02764	10	0	10				
4	Mckay Inlet	71.00369	-155.02138	30	30	60	59	(1)	69	128
4	Sinclair Lake	70.99501	-154.95077	20	20	40	30	(3)	22	52
4	Sinclair Lake	70.99125	-154.95486	10	13	23				
4	Mckay Inlet	71.06308	-154.91514	30	30	60	46		12	58
4	Sinclair Lake	71.02527	-154.90132	45	45	90	48		49	97
4	Sinclair Lake	71.01857	-154.89703	210	0	210				
4	Sinclair Lake	71.01224	-154.88234	16	7	23				
4	Sinclair Lake	70.98205	-154.84805	85	0	85				
4	Sinclair Lake	70.94834	-154.73699	25	0	25				
4	Sinclair Lake	70.96516	-154.70562	70	70	140	89	(1)	100	189
4	Sinclair Lake	71.01175	-154.71835	14	23	37				
4	Sinclair Lake	71.05181	-154.74890	4	7	11				
4	Sinclair Lake	71.07221	-154.78292	14	17	31				
4	Cape Simpson North	71.03474	-154.67996	35	35	70	54	(5)	54	108
4	Cape Simpson North	71.03241	-154.65814	6	7	13				
4	Cape Simpson South	70.95979	-154.61132	40	40	80	54	(1)	46	100
4	SE Sinclair Lake	70.95252	-154.62880	75	80	155	48	(1)	86	134
4	SE Sinclair Lake	70.95088	-154.64956	175	0	175				
4	SE Sinclair Lake	70.94953	-154.69167	150	0	150				
4	SE Sinclair Lake	70.94870	-154.70468	30	30	60	34	(2)	41	75
4	SE Sinclair Lake	70.94522	-154.70573	18	0	18				
4	SE Sinclair Lake	70.94572	-154.64330	90	90	180	177	(6)	204	381
4	SE Sinclair Lake	70.92991	-154.63912	28	30	58				
4	SE Sinclair Lake	70.92467	-154.66924	20	0	20				
4	SE Sinclair Lake	70.92161	-154.68541	40	40	80	26	(2)	26	52
4	SE Sinclair Lake	70.92106	-154.69034	20	20	40	60	(1)	51	111

Appendix H. Continued.

Section	Location	Latitude	Longitude	Visual Estimate			Photo Count			
				No. Adults	No. Young	Total	No. Adults[a]		No. Young	Total
4	SE Sinclair Lake	70.92011	-154.69726	120	0	120				
4	Piasuk River Delta	70.90882	-154.62992	6	10	16				
4	Piasuk River Delta	70.90860	-154.63221	60	60	120	54	(2)	63	117
4	Piasuk River Delta	70.90588	-154.65464	2	0	2				
4	Piasuk River Delta	70.90153	-154.66279	100	100	200	116	(5)	86	202
4	Piasuk River Delta	70.89987	-154.68488	16	25	41				
4	Piasuk River Delta	70.89500	-154.70811	40	40	80	56		55	111
4	Piasuk River Delta	70.90220	-154.71517	30	30	60	48	(2)	50	98
4	Piasuk River Delta	70.90803	-154.73175	120	0	120				
4	Piasuk River Delta	70.90851	-154.73323	30	0	30				
4	Piasuk River Delta	70.90938	-154.75944	50	50	100	109	(3)	87	196
4	Piasuk River Delta	70.90456	-154.76164	50	50	100	62	(4)	88	150
4	Piasuk River Delta	70.89219	-154.75987	18	20	38				
4	Piasuk River Delta	70.89210	-154.78725	200	0	200				
4	Piasuk River Delta	70.89406	-154.80134	30	30	60	32	(2)	41	73
4	Piasuk River Delta	70.89489	-154.81134	100	100	200	150	(5)	168	318
4	Piasuk River Delta	70.89852	-154.80449	2	4	6				
4	Piasuk River Delta	70.89572	-154.80609	90	90	180	129	(4)	134	263
4	Piasuk River Delta	70.89812	-154.84341	40	40	80	49		72	121
4	Piasuk River Delta	70.88765	-154.84151	30	30	60	42	(2)	60	102
4	Piasuk River Delta	70.88704	-154.81732	40	40	80	44	(1)	70	114
4	Piasuk River Delta	70.87570	-154.78816	60	60	120	71	(2)	65	136
4	Piasuk River Delta	70.87559	-154.79360	40	40	80	38		35	73
4	Piasuk River Delta	70.87790	-154.83249	45	20	65	60		30	90
4	Piasuk River Delta	70.87571	-154.83494	18	22	40				
4	Piasuk River Delta	70.87127	-154.86508	230	0	230				
4	Piasuk River Delta	70.86247	-154.81468	40	40	80	62	(1)	55	117
4	Piasuk River Delta	70.86574	-154.82740	20	20	40	34	(1)	24	58
4	Piasuk River Delta	70.86429	-154.83746	30	0	30				
4	Piasuk River Delta	70.87590	-154.76638	35	45	80	56	(2)	72	128
4	Piasuk River Delta	70.86027	-154.67712	70	70	140	84	(3)	85	169
4	Piasuk River Delta	70.85894	-154.74732	60	60	120	68	(1)	77	145
4	Piasuk River Delta	70.85857	-154.78443	34	15	49	35	(3)	20	55
4	Piasuk River Delta	70.85455	-154.81126	100	100	200	127	(8)	120	247
4	Piasuk River Delta	70.85450	-154.81562	50	50	100	82	(1)	78	160
4	Piasuk River Delta	70.85103	-154.83314	50	50	100	62	(2)	67	129
4	Piasuk River Delta	70.84960	-154.83677	30	30	60	22	(1)	35	57
4	Piasuk River Delta	70.84301	-154.78258	180	0	180				
4	Piasuk River Delta	70.85352	-154.66388	40	60	100	69	(2)	67	136
4	Piasuk River Delta	70.85616	-154.63657	18	28	46				
4	Piasuk River Delta	70.83881	-154.66894	80	80	160	106	(2)	59	165
4	Piasuk River Delta	70.83453	-154.75940	24	17	41				
4	Piasuk River Delta	70.82093	-154.90714	10	13	23				
4	Piasuk River Delta	70.82350	-154.91294	60	60	120	82	(1)	73	155

Appendix H. Continued.

Section	Location	Latitude	Longitude	Visual Estimate			Photo Count			
				No. Adults	No. Young	Total	No. Adults[a]		No. Young	Total
4	Piasuk River Delta	70.82510	-154.94257	50	50	100	76	(2)	79	155
4	Piasuk River Delta	70.82417	-154.95255	20	24	44				
4	Piasuk River Delta	70.80994	-154.94841	200	0	200				
4	Piasuk River Delta	70.80285	-154.94544	20	20	40				
4	Piasuk River Delta	70.80197	-154.94517	20	20	40				
4	Piasuk River Delta	70.79036	-154.94085	20	20	40				
4	Piasuk River Delta	70.77363	-154.93080	55	0	55				
4	Piasuk River Delta	70.75941	-154.92375	30	30	60	33	(1)	38	71
4	Piasuk River Delta	70.74250	-154.92858	60	60	120	61	(4)	66	127
4	Piasuk River Delta	70.73971	-154.93809	10	18	28				
4	Ikpikpuk River Delta	70.81067	-154.59029	80	80	160	74		63	137
4	Ikpikpuk River Delta	70.81217	-154.56848	80	80	160	80	(3)	73	153
4	Ikpikpuk River Delta	70.80659	-154.51315	20	10	30	16		11	27
4	Ikpikpuk River Delta	70.80635	-154.43611	10	18	28	10	(1)	21	31
4	Ikpikpuk River Delta	70.80044	-154.37717	50	50	100	76		82	158
4	Ikpikpuk River Delta	70.79994	-154.38588	70	70	140	95	(1)	91	186
4	Ikpikpuk River Delta	70.79997	-154.40292	16	20	36	26		23	49
4	Ikpikpuk River Delta	70.79692	-154.37026	15	15	30	16		30	46
4	Ikpikpuk River Delta	70.80453	-154.37084	60	60	120	62	(1)	64	126
4	Ikpikpuk River Delta	70.80389	-154.37380	40	40	80	40		45	85
4	Ikpikpuk River Delta	70.79814	-154.34724	90	90	180	92	(1)	67	159
4	Ikpikpuk River Delta	70.79309	-154.33998	30	30	60	32	(1)	37	69
4	Ikpikpuk River Delta	70.79011	-154.35743	6	9	15	8	(3)	12	20
4	Ikpikpuk River Delta	70.79009	-154.37130	35	35	70	30		38	68
4	Ikpikpuk River Delta	70.79270	-154.39408	20	20	40	26		21	47
4	Ikpikpuk River Delta	70.79098	-154.39712	50	50	100	49		43	92
4	Ikpikpuk River Delta	70.78954	-154.39673	60	60	120	63	(4)	62	125
4	Ikpikpuk River Delta	70.80339	-154.41594	20	30	50	28	(5)	40	68
4	Ikpikpuk River Delta	70.79931	-154.40269	20	15	35	22		26	48
4	Ikpikpuk River Delta	70.79643	-154.46014	20	10	30	24		18	42
4	Ikpikpuk River Delta	70.79255	-154.45675	10	8	18	21		15	36
4	Ikpikpuk River Delta	70.80112	-154.46075	100	100	200	212	(6)	171	383
4	Ikpikpuk River Delta	70.80079	-154.49122	14	15	29	17	(1)	23	40
4	Ikpikpuk River Delta	70.79012	-154.57931	30	30	60	20	(1)	21	41
4	Ikpikpuk River Delta	70.78869	-154.57746	80	80	160	99	(4)	100	199
4	Ikpikpuk River Delta	70.78790	-154.57656	90	90	180	108	(3)	140	248
4	Ikpikpuk River Delta	70.78589	-154.47933	18	20	38				
4	Ikpikpuk River Delta	70.78286	-154.40063	30	30	60	30	(1)	26	56
4	Ikpikpuk River Delta	70.78308	-154.39253	70	70	140	57	(1)	54	111
4	Ikpikpuk River Delta	70.77709	-154.38008	50	50	100	52	(4)	46	98
4	Ikpikpuk River Delta	70.77710	-154.38299	50	50	100	74	(2)	29	103
4	Ikpikpuk River Delta	70.77876	-154.40616	80	80	160	86	(1)	73	159
4	Ikpikpuk River Delta	70.77674	-154.45814	12	0	12				
4	Ikpikpuk River Delta	70.77634	-154.46318	4	7	11				

Appendix H. Continued.

Section	Location	Latitude	Longitude	Visual Estimate			Photo Count			
				No. Adults	No. Young	Total	No. Adults[a]		No. Young	Total
4	Ikpikpuk River Delta	70.77517	-154.48172	20	20	40	29	(1)	51	80
4	Ikpikpuk River Delta	70.77881	-154.50855	20	20	40	20	(1)	13	33
4	Ikpikpuk River Delta	70.77971	-154.51315	50	50	100	57		47	104
4	Ikpikpuk River Delta	70.78239	-154.49005	10	19	29				
4	Ikpikpuk River Delta	70.77472	-154.57541	20	20	40	24	(1)	31	55
4	Ikpikpuk River Delta	70.77013	-154.57462	35	35	70	44		39	83
4	Ikpikpuk River Delta	70.76701	-154.58006	30	30	60	34		32	66
4	Ikpikpuk River Delta	70.76768	-154.58357	4	7	11				
4	Ikpikpuk River Delta	70.76584	-154.56824	2	4	6				
4	Ikpikpuk River Delta	70.76585	-154.55401	10	17	27				
4	Ikpikpuk River Delta	70.76685	-154.54738	20	24	44				
4	Ikpikpuk River Delta	70.76713	-154.41922	50	50	100	80	(1)	54	134
4	Ikpikpuk River Delta	70.77148	-154.41364	20	20	40	14		20	34
4	Ikpikpuk River Delta	70.77083	-154.42788	20	20	40	34		23	57
4	Ikpikpuk River Delta	70.76998	-154.42864	15	15	30	16		7	23
4	Ikpikpuk River Delta	70.75544	-154.41044	50	50	100	90	(2)	44	134
4	Ikpikpuk River Delta	70.75505	-154.42277	30	0	30				
4	Ikpikpuk River Delta	70.75221	-154.45968	50	30	80	36		57	93
4	Ikpikpuk River Delta	70.75178	-154.46476	20	20	40	28	(3)	30	58
4	Ikpikpuk River Delta	70.74528	-154.55048	30	30	60	29		27	56
4	Ikpikpuk River Delta	70.74451	-154.54737	20	20	40	14		23	37
4	Ikpikpuk River Delta	70.74359	-154.54245	30	30	60	38	(1)	40	78
4	Ikpikpuk River Delta	70.74094	-154.45878	100	100	200	118		79	197
4	Ikpikpuk River Delta	70.73020	-154.46568	60	60	120	72	(2)	118	190
5	Alpine West	70.38426	-151.13382	14	27	41				
5	Alpine West	70.35969	-151.18960	8	0	8				
5	Fish Creek Delta	70.37986	-151.28372	50	70	120	44		87	131
5	Fish Creek Delta	70.40338	-151.38065	20	20	40	20		30	50
5	Fish Creek Delta	70.39497	-151.41133	4	10	14				
5	Fish Creek Delta	70.41837	-151.41693	30	35	65	30	(1)	50	80
5	Fish Creek Delta	70.40464	-151.50307	12	20	32				
5	Fish Creek West	70.43772	-151.94182	10	22	32				
5	Kolikpik River Mouth	70.45363	-151.95702	6	11	17				
5	Atigaru Point	70.53827	-151.75927	7	0	7				
5	Kogru River	70.54016	-152.51419	10	23	33				
5	Kogru River	70.54056	-152.52007	8	14	22				
5	Kogru River	70.54179	-152.52840	5	0	5				
5	Kogru River	70.55012	-152.67726	30	40	70	30	(3)	53	83
5	Kogru River	70.55169	-152.62046	15	0	15				
5	Kogru River	70.57128	-152.54046	12	21	33				
5	Saktuina Point	70.57412	-152.16016	22	0	22				
5	Saktuina Point	70.56653	-152.11278	20	27	47				
5	Saktuina Point	70.59038	-152.21803	14	25	39				
5	Saktuina Point	70.58827	-152.15877	6	15	21				

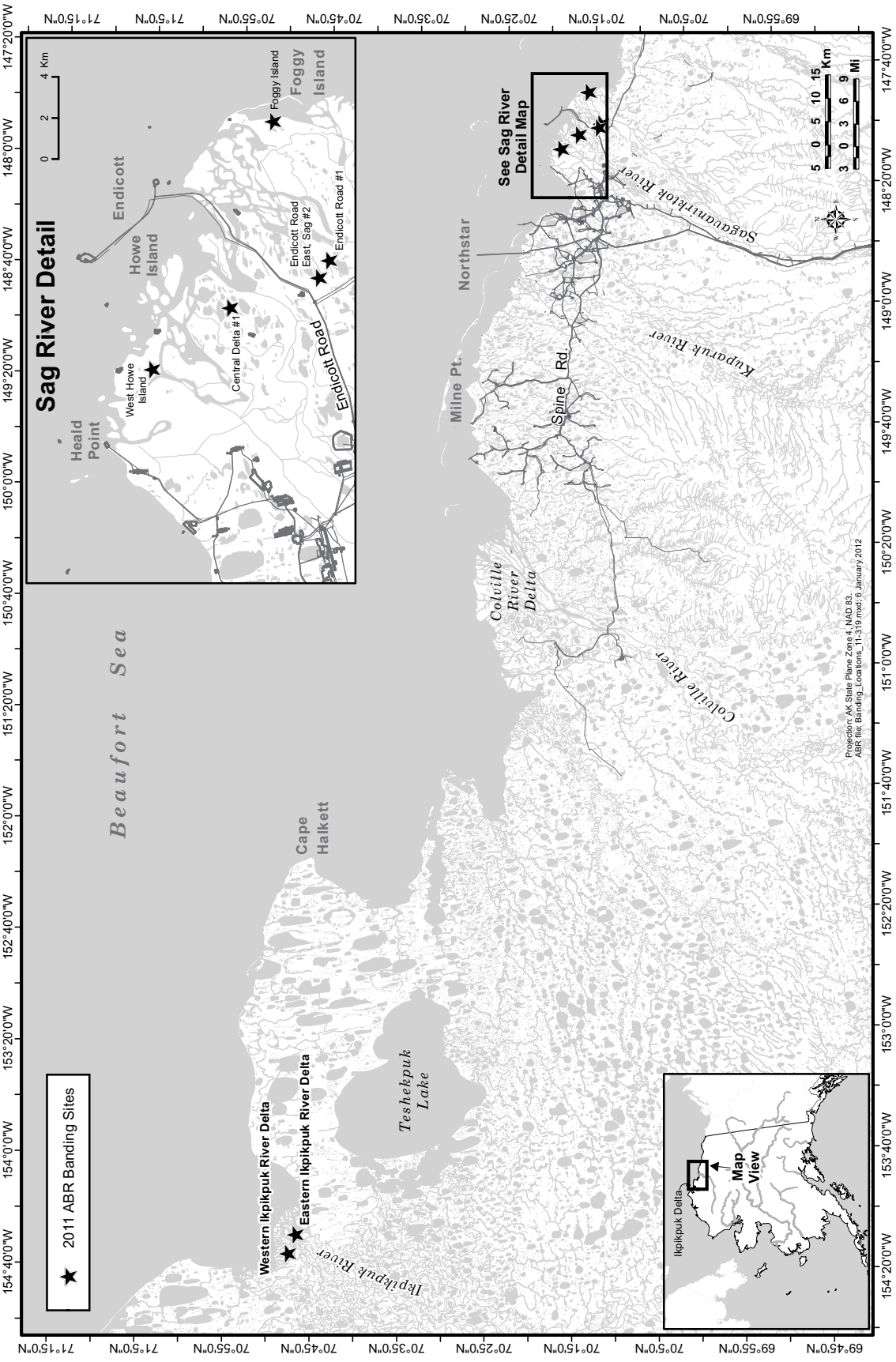
Appendix H. Continued.

Section	Location	Latitude	Longitude	Visual Estimate			Photo Count			
				No. Adults	No. Young	Total	No. Adults[a]		No. Young	Total
5	Garry Creek South	70.60657	-152.37544	5	0	5				
5	Garry Creek South	70.60936	-152.39168	23	0	23				
5	Garry Creek	70.62554	-152.43497	10	20	30				
5	Garry Creek	70.62659	-152.47953	10	20	30				
5	Garry Creek	70.61782	-152.49683	6	9	15				
5	Garry Creek	70.61866	-152.49451	8	15	23				
5	Garry Creek	70.61839	-152.52662	10	14	24				
5	Garry Creek	70.62855	-152.46073	8	5	13				
5	Garry Creek	70.62128	-152.45128	40	0	40				
5	Garry Creek	70.62384	-152.58253	500	0	500				
5	Garry Creek	70.62271	-152.63553	10	10	20				
5	Garry Creek	70.62503	-152.65157	30	0	30				
5	Garry Creek	70.62486	-152.67061	50	0	50				
5	Garry Creek	70.62431	-152.69723	150	0	150				
5	Garry Creek	70.62129	-152.71559	50	80	130	60	(1)	102	162
5	Garry Creek	70.62548	-152.60494	40	0	40				
5	Garry Creek	70.65121	-152.46874	10	30	40				
5	Garry Creek	70.64884	-152.46933	6	20	26				
5	Garry Creek	70.64568	-152.46970	18	50	68				
5	Garry Creek	70.64357	-152.46937	8	8	16				
5	Garry Creek	70.65598	-152.46243	12	15	27				
5	Garry Creek	70.66068	-152.46333	16	0	16				
5	Garry Creek	70.66785	-152.46555	2	6	8				
5	Garry Creek	70.66632	-152.47915	30	40	70	33	(1)	69	102
5	Garry Creek	70.66782	-152.47673	20	30	50	21		45	66
5	Garry Creek	70.68103	-152.46774	16	25	41				
5	Garry Creek	70.69482	-152.47915	225	0	225				
5	Garry Creek	70.65477	-152.47605	22	50	72	35		75	110
5	Garry Creek	70.64082	-152.52911	100	0	100				
5	Garry Creek	70.64461	-152.53076	35	0	35				
5	Garry Creek	70.64915	-152.53131	60	25	85	65		18	83
5	Garry Creek	70.65650	-152.53524	75	0	75				
5	Garry Creek	70.65471	-152.54621	450	0	450				
5	Garry Creek	70.63164	-152.54415	30	30	60	24		28	52
5	Garry Creek	70.64454	-152.55531	40	0	40				
5	Garry Creek	70.65403	-152.56216	375	0	375				
5	Garry Creek	70.65656	-152.55392	30	30	60	23		29	52
5	Garry Creek	70.64617	-152.57235	130	0	130				
5	Abraham BM	70.74344	-152.43210	6	0	6				

[a] Blue phase adult Snow Geese listed in parentheses

Appendix I. Distribution and composition of Snow Goose groups based on visual estimates during brood-rearing surveys, Barrow to Fish Creek, Alaska, 1995–1997 and 1999–2011.

Section Year	Total Groups	Brood Groups	Adults Without Broods	Adults With Broods	Total Adults	Goslings	Total Birds in Brood Groups	Total Birds
Dease Inlet								
1995	3	3	0	23	23	39	62	62
1996	1	1	0	3	3	6	9	9
1997	2	2	0	5	5	8	13	13
1999	1	1	0	2	2	3	5	5
2000	1	0	1	0	1	0	0	1
2001	1	1	0	4	4	7	11	11
2002	2	1	22	12	34	9	21	43
2003	4	4	0	44	44	53	97	97
2004	4	3	3	67	70	91	158	161
2005	5	2	27	16	43	16	32	59
2006	2	2	0	106	106	145	251	251
2007	6	5	19	48	67	71	119	138
2008	4	2	2	36	38	10	46	48
2009	7	2	35	18	53	17	35	70
2010	4	0	107	0	107	0	0	107
2011	7	7	0	205	205	206	411	411
Mean	3	2	14	37	50	43	79	93
SD	2	2	28	53	54	59	112	108
Smith Bay								
1995	6	6	0	154	154	164	318	318
1996	3	1	57	10	67	6	16	73
1997	8	6	21	87	108	127	214	235
1999	21	16	88	467	555	560	1,027	1,115
2000	22	19	102	513	615	753	1,266	1,368
2001	17	10	379	234	613	145	379	758
2002	23	20	76	1,437	1,513	1,063	2,500	2,576
2003	33	32	20	1,736	1,756	2,003	3,739	3,759
2004	46	43	156	2,470	2,626	3,234	5,704	5,860
2005	54	34	2,418	1,413	3,831	1,139	2,552	4,970
2006	113	111	13	6,861	6,874	7,688	14,549	14,562
2007	88	73	1,091	3,939	5,030	3,287	7,226	8,317
2008	247	194	2,423	9,056	11,479	8,051	17,107	19,530
2009	118	13	11,526	506	12,032	76	582	12,108
2010	81	10	6,762	535	7,297	143	678	7,440
2011	235	196	3,514	9,395	12,909	8,927	18,322	21,836
Mean	70	49	1,790	2,426	4,216	2,335	4,761	6,552
SD	76	64	3,191	3,194	4,565	3,109	6,285	7,016
Harrison Bay								
1995	4	4	0	21	21	29	50	50
1996	3	2	50	50	100	73	123	173
1997	12	2	363	6	369	3	9	372
1999	9	6	190	46	236	61	107	297
2000	19	10	382	110	492	157	267	649
2001	13	8	43	114	157	89	203	246
2002	12	6	17	142	159	78	220	237
2003	11	8	18	172	190	154	326	344
2004	19	4	903	107	1,010	131	238	1,141
2005	15	7	550	84	634	176	260	810
2006	37	30	198	623	821	911	1,534	1,732
2007	25	5	985	102	1,087	96	198	1,183
2008	28	10	1,166	263	1,429	245	508	1,674
2009	37	5	2,948	83	3,031	62	145	3,093
2010	38	4	3,745	38	3,783	51	89	3,834
2011	59	36	2,347	635	2,982	1,048	1,683	4,030
Mean	21	9	869	162	1,031	210	373	1,242
SD	15	10	1,153	193	1,189	307	497	1,314



Appendix J. Locations on the Ikpikpuk River delta and on the Sagavanirktok River delta at which Snow Geese were banded in 2011.

Appendix K. Band histories of Snow Geese recaptured at the Ikpikpuk, Piasuk, Colville, and Sagavanirktok banding sites, 2000–2008, 2010, and 2011. Histories are excluded for birds banded and recaptured at the same site. No birds were banded on the Ikpikpuk River delta in 2010, and no birds were banded on the Colville River delta in 2011.

Band				Banding Site				Recapture Site			
Number	Age[a]	Sex[b]	Color	Location	Lat	Long	Date	Location	Lat	Long	Date[c]
1367–96306	L	M	White	Howe Island, AK	70.16667	-147.66667	7/29/1993	Piasuk River delta	70.85028	-154.73139	8/5/2000
4007–59960[d]	L	F	White	Banks Island, NT	72.33333	-125.33333	7/14/1996	Ikpikpuk River delta	70.80306	-154.50083	8/4/2001
4007–90572	L	M	White	Atkinson Point, NU	67.66667	-102.83333	7/13/1998	Ikpikpuk River delta	70.80306	-154.50083	8/4/2001
4007–59960[d]	L	F	White	Banks Island, NT	72.33333	-125.33333	7/14/1996	Ikpikpuk River delta	70.80306	-154.50083	7/31/2002
1277–05671	ASY	M	White	Banks Island, NT	72.33333	-125.00000	7/19/1994	Ikpikpuk River delta	70.80306	-154.50083	8/1/2002
1557–09503	L	F	White	MacKenzie Delta, NT	69.33333	-135.16667	8/2/1999	Ikpikpuk River delta	70.80306	-154.50083	8/2/2002
1557–09583[d]	L	F	White	MacKenzie Delta, NT	69.33333	-135.16667	8/2/1999	Ikpikpuk River delta	70.80306	-154.50083	8/2/2002
1557–64441	AHY	M	White	Banks Island, NT	72.83333	-124.00000	7/18/2001	Ikpikpuk River delta	70.80306	-154.50083	8/2/2003
1587–48941	AHY	M	White	Banks Island, NT	72.33333	-125.16667	7/16/2002	Ikpikpuk River delta	70.80306	-154.50083	8/2/2003
1557–09583[d]	L	F	White	MacKenzie Delta, NT	69.33333	-135.16667	8/2/1999	Ikpikpuk River delta	70.80306	-154.50083	8/3/2003
4007–47492	AHY	U	White	Wrangel Island, Russia	71.50000	-179.50000	8/4/2002	Ikpikpuk River delta	70.79667	-154.35750	8/3/2003
4007–47318	HY	M	White	Wrangel Island, Russia	71.50000	-179.50000	8/3/2002	Ikpikpuk River delta	70.80306	-154.50083	8/2/2005
1587–12548	L	M	White	Wapusk National Park, MB	58.50000	-93.33333	7/23/2001	Ikpikpuk River delta	70.80306	-154.50083	8/3/2005
1707–34532	AHY	M	White	Banks Island, NT	72.83333	-123.66667	7/13/2004	Ikpikpuk River delta	70.80306	-154.50083	8/3/2005
1707–35147	AHY	F	White	Banks Island, NT	72.33333	-123.16667	7/15/2004	Ikpikpuk River delta	70.80306	-154.50083	8/3/2005
1557–12367	AHY	M	White	Banks Island, NT	72.66667	-123.16667	7/16/2000	Piasuk River delta	70.82402	-154.68031	8/4/2005
1587–48943	AHY	F	White	Banks Island, NT	72.33333	-125.16667	7/16/2002	Piasuk River delta	70.82402	-154.68031	8/4/2005
1367–96343	L	M	White	Howe Island, AK	70.16667	-147.66667	7/30/1993	Piasuk River delta	70.94277	-154.63463	8/5/2005
1707–36303	AHY	M	White	Banks Island, NT	72.83333	-124.16667	7/15/2005	Ikpikpuk River delta	70.80306	-154.50083	8/2/2006
1557–07792	AHY	M	White	Banks Island, NT	72.33333	-125.33333	7/18/1998	Ikpikpuk River delta	70.80306	-154.50083	8/3/2006
1587–47339[d]	L	F	White	MacKenzie Delta, NT	69.33333	-135.16667	7/31/2001	Ikpikpuk River delta	70.80306	-154.50083	8/3/2006
4007–48092	HY	M	White	Wrangel Island, Russia	71.50000	-179.50000	8/4/2002	Ikpikpuk River delta	70.80306	-154.50083	8/3/2006
1707–34127	SY	M	White	Banks Island, NT	72.83333	-124.16667	7/12/2004	Ikpikpuk River delta	70.80306	-154.50083	8/3/2006
1707–34821	SY	F	White	Banks Island, NT	72.33333	-123.16667	7/14/2004	Ikpikpuk River delta	70.80306	-154.50083	8/3/2006
1557–10015	SY	M	White	Banks Island, NT	72.83333	-124.83333	7/10/2000	Ikpikpuk River delta	70.80306	-154.50083	8/4/2006
1707–34119	SY	F	White	Banks Island, NT	72.83333	-124.16667	7/12/2004	Ikpikpuk River delta	70.80306	-154.50083	8/4/2006
4007–49657	HY	M	White	Wrangel Island, Russia	71.50000	-179.50000	8/6/2004	Ikpikpuk River delta	70.80306	-154.50083	8/4/2006
4007–49901	AHY	M	White	Wrangel Island, Russia	71.50000	-179.50000	8/6/2004	Ikpikpuk River delta	70.79139	-154.38778	8/3/2007
1727–55532[d]	L	F	White	Wrangel Island, Russia	71.50000	-179.50000	7/23/2005	Ikpikpuk River delta	70.80306	-154.50083	8/4/2007
1847–11195	AHY	M	White	Sikskik Island, NT	72.50000	-124.66667	7/15/2006	Ikpikpuk River delta	70.79139	-154.38778	8/4/2007
1707–71015	L	M	White	Ikpikpuk River delta, AK	70.80306	-154.50083	8/4/2005	Colville River delta	70.42361	-150.21389	8/1/2008
1587–47339[d]	L	F	White	Richard Island, NT	69.33333	-135.16667	7/31/2001	Ikpikpuk River delta	70.80306	-154.50083	8/2/2008
1727–55532[d]	L	F	White	Wrangel Island, Russia	71.50000	-179.50000	7/23/2005	Ikpikpuk River delta	70.80306	-154.50083	8/2/2008
1847–12407	AHY	F	White	Banks Island, NT	72.83333	-124.16667	7/15/2007	Ikpikpuk River delta	70.80306	-154.50083	8/2/2008
1847–50672	AHY	M	White	Johnson Point, NU	67.83333	-100.66667	8/2/2007	Ikpikpuk River delta	70.80306	-154.50083	8/2/2008
1707–71975	L	M	White	Ikpikpuk River delta, AK	70.80306	-154.50083	8/4/2006	Sagavanirktok River delta	70.32667	-148.10528	8/4/2008

Appendix K. Continued.

Band Number	Age[a]	Sex[b]	Color	Banding Site Location	Lat	Long	Date	Recapture Site Location	Lat	Long	Date[c]
1587–47889[d]	AHY	F	White	Banks Island, NT	72.33333	-125.16667	7/12/2002	Sagavanirktok River delta	70.27250	-147.96833	8/5/2008
1847–07721	AHY	F	White	Wrangel Island, Russia	71.50000	-179.50000	7/28/2007	Sagavanirktok River delta	70.30556	-148.06139	8/6/2008
4007–31559[e]	–	–	White	Alaska	–	–	7/28/2001	Colville River delta	70.41806	-150.26389	7/31/2010
1707–36717	AHY	M	White	Banks Island, NT	72.91667	-124.08333	7/15/2005	Colville River delta	70.41806	-150.26389	7/31/2010
1707–36786	AHY	M	White	Egg River, NT	72.41667	-124.41667	7/16/2005	Colville River delta	70.41806	-150.26389	7/31/2010
1937–13503	AHY	F	White	Sagavanirktok River delta, AK	70.32667	-148.10528	8/4/2008	Colville River delta	70.41806	-150.26389	7/31/2010
1937–13587	AHY	M	White	Sagavanirktok River delta, AK	70.32667	-148.10528	8/4/2008	Colville River delta	70.41806	-150.26389	7/31/2010
1937–13929	AHY	F	White	Sagavanirktok River delta, AK	70.30556	-148.06139	8/6/2008	Colville River delta	70.41806	-150.26389	7/31/2010
4007–18251[f]	AHY	M	White	Banks Island, NT	72.41667	-124.91667	7/16/1995	Colville River delta	70.45167	-150.75000	8/1/2010
1557–63578[e]	–	–	White	Northwest Territories	–	–	7/16/2001	Sagavanirktok River delta	70.32667	-148.10528	8/1/2010
0867–24342	AHY	F	White	Ikpikpuk River delta, AK	70.80306	-154.50083	8/1/2002	Sagavanirktok River delta	70.32667	-148.10528	8/1/2010
1847–02008	AHY	M	White	Ikpikpuk River delta, AK	70.80306	-154.50083	8/1/2007	Sagavanirktok River delta	70.32667	-148.10528	8/1/2010
1847–03273	AHY	F	White	Ikpikpuk River delta, AK	70.79139	-154.38778	8/4/2007	Sagavanirktok River delta	70.32667	-148.10528	8/1/2010
1847–03293	AHY	M	White	Ikpikpuk River delta, AK	70.79139	-154.38778	8/4/2007	Sagavanirktok River delta	70.32667	-148.10528	8/1/2010
1937–12866	L	M	White	Sagavanirktok River delta, AK	70.32667	-148.10528	8/4/2008	Colville River delta	70.45167	-150.75000	8/1/2010
1587–47889[d]	AHY	F	White	Banks Island, NT	72.91667	-124.25000	7/12/2002	Sagavanirktok River delta	70.27250	-147.96833	8/2/2010
1587–49538	AHY	M	White	Banks Island, NT	72.91667	-123.75000	7/17/2003	Sagavanirktok River delta	70.27250	-147.96833	8/2/2010
1587–53532	L	F	White	Ikpikpuk River delta, AK	70.80306	-154.50083	8/1/2003	Sagavanirktok River delta	70.27250	-147.96833	8/2/2010
1847–01857	L	M	White	Ikpikpuk River delta, AK	70.80306	-154.50083	8/4/2006	Sagavanirktok River delta	70.27250	-147.96833	8/2/2010
1937–13300	AHY	F	White	Kalubik Creek, AK	70.42361	-150.21389	8/1/2008	Sagavanirktok River delta	70.25306	-147.99417	8/2/2010
1727–52708	AHY	M	Blue	Coral Harbor, NU	63.75000	-85.58333	7/25/2007	Sagavanirktok River delta	70.30556	-148.06139	8/3/2010
1557–07190	AHY	M	White	Banks Island, NT	72.41667	-125.25000	7/15/1998	Sagavanirktok River delta	70.18278	-147.24278	8/4/2010
1587–48067	AHY	M	White	Banks Island, NT	72.91667	-124.25000	7/11/2002	Sagavanirktok River delta	70.20167	-147.26917	8/4/2010
0977–24139	AHY	F	White	Ikpikpuk River delta, AK	70.80306	-154.50083	7/31/2002	Sagavanirktok River delta	70.20167	-147.26917	8/4/2010
1847–10341	AHY	M	White	Banks Island, NT	72.91667	-124.08333	7/12/2006	Sagavanirktok River delta	70.18278	-147.24278	8/4/2010
1847–03024	AHY	F	White	Ikpikpuk River delta, AK	70.79139	-154.38778	8/4/2007	Sagavanirktok River delta	70.20167	-147.26917	8/4/2010
1587-49993	SY	F	LSGO	Banks Island, NT	72.91667	-124.08333	7/20/2003	Sagavanirktok River delta	70.32667	-148.10528	7/27/2011
1937-22605	L	F	LSGO	Dewey Soper Bird Sanctuary, NU	66.58333	-73.08333	8/8/2010	Sagavanirktok River delta	70.32667	-148.10528	7/27/2011
1937-28676	HY	F	LSGO	Wrangel Island, Russia	71.46167	-178.87667	7/28/2009	Sagavanirktok River delta	70.29194	-148.02889	7/27/2011
1557-10869	SY	M	LSGO	Banks Island, NT	72.91667	-124.08333	7/12/2000	Ikpikpuk River delta	70.80306	-154.50083	7/30/2011
1847-11289	AHY	F	LSGO	Banks Island, NT	72.58333	-124.75000	7/15/2006	Ikpikpuk River delta	70.80306	-154.50083	7/31/2011
1557-09443	L	M	LSGO	MacKenzie Delta, NT	69.41667	-135.25000	8/1/1999	Ikpikpuk River delta	70.79139	-154.38778	8/1/2011
1707-33556	AHY	M	LSGO	Banks Island, NT	72.41667	-125.25000	7/11/2004	Ikpikpuk River delta	70.79139	-154.38778	8/1/2011

[a] Age: Refers to age at time of banding. L = local, not flight-capable gosling; HY = flight-capable hatch-year bird; AHY = after-hatch year; ASY = after second year

[b] Sex: Refers to sex at time of banding. F = female, M = male

[c] Data are current through 15 December 2011.

[d] Bird recaptured on multiple occasions at the same banding site.

[e] At the time of this report, only preliminary banding information is available from the Bird Banding Lab.

[f] Band destroyed and replaced with a new band 1937-26878.

Appendix L. Number of Snow Geese of each sex banded and number recaptured at each colony location on the Arctic Coastal Plain. Total banded birds excludes the most recent banding year (2010 for the Colville River delta; 2011 for the Ikpikpuk and Saganavirktok River deltas), because those birds could not have been recaptured.

Colony	Capture Type	Year(s)	Female	Male
Colville River Delta	Banded	2008	359 (51.2)	342 (48.8)
	Recaptured	2010	39 (61.9)	23 (38.1)
Ikpikpuk River Delta	Banded	2000–2008	4,196 (51.3)	3,985 (48.7)
	Recaptured	2001–2011	759 (70.7)	315(29.3)
Sagavanirktok River Delta	Banded	2008–2010	1,277 (50.8)	1,239 (49.2)
	Recaptured	2010–2011	285 (62.9)	168 (37.1)

Appendix M. Band returns[a] of Arctic Coastal Plain Snow Geese that may be considered peripheral to or east of the main loci for wintering and spring use areas of the earlier Sagavanirktok River delta birds and the Western Arctic Snow Goose population. Numbers are reported by age of birds at the time of banding.

	Adults		Goslings	
Location	Females	Males	Females	Males
Arkansas	4	2	15	11
Illinois		1	1	
Kansas	5	5	7	5
Kentucky	1		1	
Louisiana	1	2	2	3
Mississippi		1		2
Manitoba			1	2
Nunavut			1	
Total	11	11	28	23

[a] Data are current through 31 December, 2011.