Midcontinent Greater White-fronted Geese in Alaska – 2007 Project Updates

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Introduction

Throughout their range midcontinent greater white-fronted geese (*Anser albifrons frontalis*; hereafter, white-fronts) are an important resource for subsistence and sport hunters and non-consumptive users. Waterfowl biologists in the U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, U.S. Geological Survey, and the University of Alaska have designed numerous studies on white-fronted geese in Alaska to provide relevant data to wildlife managers. Most of the recent work has focused on boreal nesting white-fronts in interior and northwest Alaska due to concerns of low survival and apparent regional declines in abundance in the 1990s (Spindler et al. 1999).

This report is an update of ongoing projects that monitor abundance, distribution, harvest, breeding biology, survival, and disease in midcontinent greater white-fronted geese that breed in Alaska, both in boreal, and tundra habitats. Recent changes in management strategies are also described.

Population Trends

Continental Breeding Pair Survey – Several aerial surveys provide data that help managers monitor population trends of midcontinent greater white-fronted geese in Alaska. Since 1964, the Continental Breeding Pair Survey has been flown in key waterfowl production areas in Alaska (Mallek and Groves 2007). This survey provides breeding pair and total bird indices for white-fronts in principal waterfowl production areas of interior and northwest Alaska (Fig. 1). The breeding pair index (2*singles + paired birds) and the total bird index (2*singles + paired birds + flocks) increased ten-fold during the period of 1964-1986 (Fig. 2) outpacing population growth on fall and winter surveys in the Central and Mississippi Flyways during the same period (Kruse 2007). Despite increases in the midcontinent population as a whole, the Alaska index dropped rapidly between the mid-1980s and early 1990s. Since the mid 1990s, the breeding pair and total bird indices in Alaska appear stable.

The total bird index is prone to high variability resulting from occasional observations of large flocks that are on route to tundra breeding sites to the north of the survey area. This effect was particularly apparent in 1986 and 2000 when several large flocks observed in the Yukon Flats stratum significantly inflated the total bird index for the entire interior and northwest Alaska region (Fig. 2). For this reason, the breeding pair index may be a more reliable long-term index to monitor the status of midcontinent white-fronts in Alaska.

2007 Breeding Pair Survey, Northwest Alaska – In an attempt to estimate the size of the white-front breeding population in northwest Alaska, Migratory Bird Management

(MBM) and the Selawik NWR conducted a breeding pair survey timed between arrival at the breeding site and early incubation in 2005-2007 (Fig. 3; Fischer et al. 2008). The timing of these surveys was approximately eight days earlier than the average survey date of the Continental Breeding Pair Survey in the Kotzebue Sound stratum (June 8). The design of this survey was based on the 1996-1997 expanded breeding pair survey effort (Platte 1999) which was intended to provide detailed distribution data within primary waterfowl production areas. Methodology in 2007 incorporated aerial detection techniques and analysis of survey timing.

Estimates of white-front indicated paired birds, and total birds are presented in Table 1. The 2007 survey yielded an estimate of 7,366 total white-fronts including 2,614 paired birds, adjusted for detection rate. The 2007 total was within 1% of the estimate in 2006. Mean total geese in 2005-2007 was down 40% from the mean of the 1996-1997 surveys. This decline is likely the result of differences in survey timing rather than a change in population size (Fischer et. al. 2008). Distribution of pairs was similar to previous years with highest densities in the "Upper Kobuk" and "Selawik" strata (Table 1, Fig. 4).

2007 Experimental Breeding Pair Survey, Kanuti NWR – Three experimental breeding pair surveys were conducted on the Kanuti NWR in spring 2007 to determine timing of white-front arrival, peak abundance of indicated breeding pairs, and feasibility of detecting geese in a boreal habitat (Harwood 2007). Eleven transects along and south of the Kanuti River were surveyed on May 10, 17, and 24 (Fig. 5). Proportion of indicated paired white-fronts was highest during the middle survey. Unlike breeding sites to the north and west, Kanuti NWR represents both a breeding site and a migration stopover to some segment of the observed population. To what extent the "resident" and "migratory" white-fronts comprise the birds observed during the three surveys is unknown. This pilot effort has shown that indeed paired geese can be detected on Kanuti NWR but the ambiguity in their ultimate breeding location raises the question as to whether a breeding pair survey is appropriate on Kanuti NWR. In 2008, refuge staff plans to conduct two breeding pair surveys in May, timed before and after a Migratory Bird Management "Expanded breeding pair survey.

Arctic Coastal Plain Survey – The Continental Breeding Pair Survey in Alaska provides population indices in many waterfowl production areas, but it does not sample waterfowl habitats on the North Slope where many midcontinent white-fronted geese breed. In 1986, a new survey effort was initiated on the Alaskan Arctic Coastal Plain (ACP) to fill this data gap (Mallek et al. 2007). Additionally, an earlier timed survey designed to monitor Arctic nesting eiders was initiated in 1992 (Larned et. al. 2006). In 2007, the two surveys were merged (Larned et al. 2008). The resulting breeding pair survey (new Arctic Coastal Plain Survey, ACP), similarly timed as the eider survey, and earlier than the former ACP survey, provides long-term estimates for many species, including white-fronts. The new ACP is better timed for white-fronts than the former ACP survey, particularly for the local breeding component of the population. For example, on average, the white-front pair index represents just 20% of the total indicated population in the former ACP Survey, compared to 50% in the new ACP survey. Presumably the later timed survey experienced a flush of failed breeders that were counted as flocked birds.

Trends derived from this survey are positive for both indicated paired birds, and indicated total birds (Larned 2008, Fig. 6). Estimates in 2007 set new records, with 78,870 paired, and 162,441 total indicated white-fronts.

Interior/Northwest Alaska Molting Survey – Boreal nesting midcontinent greater white-fronted geese molt in predictable locations in interior and northwest Alaska including Koyukuk, Kanuti, Innoko, and Selawik National Wildlife Refuges. Standardized aerial molting goose surveys have been conducted annually at Koyukuk NWR since 1994 (Spindler et al. 1999, Bryant 2007), in Innoko NWR since 2000, and Selawik NWR from 2000-2005 (Fig. 7). In 2001 the molt survey was expanded to include Kanuti NWR, but no surveys were completed in 2004 and 2005 due to forest fires in the region; thus annual counts are comparable only among Koyukuk/Nowitna, Innoko, and Selawik from 2000-2005. Survey efforts were attempted in Noatak Flats and Seward Peninsula in 2003 and 2004, but these efforts were discontinued in 2005 due to cost and scheduling conflicts. The molt survey was discontinued in Selawik NWR in 2006 due to budget constraints and low numbers of geese in the region. Annual estimates of adults and young from these survey efforts are presented in Fig. 8 and Table 3. Comparable estimates were obtained for Canada geese at these sites and are reported in Table 5.

Region-wide abundance of white-fronts (as measured by the molt survey in three index sites 2000-2005) varied considerably, ranging from 14,310 in 2002 to 30,159 in 2003 (Table 3). Of the index sites, Innoko supports 78% of adult white-fronts on average (Fig. 9); thus, the abundance of molting geese at Innoko drives the trend for the interior/northwest region. The 2007 estimate at Innoko was down 31% from the previous 7-year average of 16,396 geese (Table 3). Since productivity was high elsewhere in the interior, the Innoko molting goose estimate was likely lower than average because fewer failed breeding birds migrated to Innoko to molt in 2007. At Koyukuk NWR, abundance of molting white-fronted geese declined steadily from 1994-2001 raising concerns of local depletion (Fig. 8). By 2004, however, molt surveys at Koyukuk indicated an increase to levels observed in the mid 1990s. In 2007, the Koyukuk total goose index was 7% above the previous 13-year (1994-2006) average. Similarly, the Kanuti total goose index was 7% above the previous 4-year (2001-2003, 2006) average.

Assessment of population trend using molt survey estimates is difficult. Given the low proportion of goslings in most molt survey areas it is likely the molt survey monitors geese that have migrated from breeding sites outside of the survey area. Molt migration in geese generally involves non-breeders or failed breeders (Salomonsen 1968, Hohman et al. 1992) with highest numbers expected at molt sites in years of poor breeding success (Reed et al. 2003). Thus, abundance estimates derived from molt surveys represents a combination of population size and current breeding conditions, but it is difficult to separate the two. Important exceptions are Koyukuk and Kanuti NWRs, where on average 36% and 24% of white-fronts observed, respectively, are goslings (Table 4; Fig. 9) suggesting that a large proportion of adults present during molt surveys breed locally.

Starting in 2005, efforts were initiated to collect data that will be used to account for variability in the molt survey including age-ratio surveys at Alaskan fall staging areas, and monitoring water level and forage availability surveys at Innoko NWR. These efforts will continue in 2008.

Teshekpuk Lake Special Area Molting Goose Survey – The area north and east of Teshekpuk Lake on the Alaskan Arctic Coastal Plain has long been known to attract large numbers of molting geese. The first estimate of size and distribution of molting geese near Teshekpuk Lake came from Henry Hanson in 1957 and was later described by King (1970). Additional surveys were conducted during banding efforts in the 1970s (King and Hodges 1979). Since 1982, an aerial survey has been completed annually north and east of Teshekpuk Lake during the July molting period to document distribution and abundance of geese (Fig. 10). The 2007 white-front estimate was 45,747 adults and subadults, and 2,563 goslings (Mallek 2007). This survey has shown a dramatic increase in molting greater white-fronted geese since 1982, with a mean annual growth rate of nearly 14% per year (Fig. 11). It is assumed that white-fronted geese that molt in this area generally breed on the arctic coastal plain of Alaska (Mallek 2007); however, banding studies have shown that interior breeders occasionally migrate to the North Slope to molt (Martin 1998, Marks 2007, Bird Banding Lab unpubl. data).

The Teshekpuk Lake Special Area comprises a relatively small portion of white-fronted goose molting habitat on the North Slope; thus, inferences drawn from this survey should be limited to this immediate geographic area. Because white-fronts molt in many locations on the North Slope, changes in abundance as measured by the Teshekpuk survey could be attributed to a change in distribution rather than a change in abundance. Distribution of molting geese in the Teshekpuk Lake Special Area is currently being investigated by the Alaska Science Center and Migratory Bird Management.

Fall Inventory Survey- Alberta/Saskatchewan – The management plan for midcontinent greater white-fronted geese identifies the fall staging survey in Prairie Canada as the primary tool to assess range-wide population status. While the fall inventory is not an Alaskan project per se, an unknown portion of the birds counted during the survey breed in Alaska. The results of the fall staging survey impact hunting regulations, ultimately affecting status of Alaska breeding geese.

The 2007 fall inventory was up 2% from 2006 and 46% from the historical low in 2005 (Fig. 12; Warner et al. 2007). The 2007 survey yielded 764,300 white-fronted geese with an updated 3-year running average of 639,400 birds.

Productivity

Float Survey - Beginning in 1983, staff at Koyukuk/Nowitna NWR conducted annual post-breeding float surveys in late June-early July to monitor trends in productivity in greater-white fronted geese (Spindler et al. 2005). Since 1996, portions of the Dulbi, Kaiyuh, and Nowitna rivers (60, 176, and 143 miles, respectively), have been surveyed with consistent methods providing annual estimates of age ratios as an index to productivity. In 2007, apparent productivity, as measured by the proportion of young, was above the preceding 11-year average in all three river sections (Table 6, Figs. 13-14). The proportion of young was highest on the Nowitna, followed by the Kaiyuh, and the Dulbi. Proportion of young for the entire survey area averaged 0.54, 1996-2007. In 2007, age ratios (goslings/adults) on the Nowitna, Kaiyuh, and Dulbi rivers were 2.32, 1.78, 0.98, respectively. Average age-ratio from 1996-2007 for the entire study area was 1.23. Corresponding data for Canada Geese is presented in Table 7.

Delta Junction Fall Age Ratio –Annual population surveys and banding programs allow for monitoring of abundance and annual survival, but state-wide estimates of

productivity are difficult to measure. Unlike other goose populations in Alaska whose productivity is monitored on the nesting grounds, boreal nesting white-fronted geese breed in low densities throughout the region making nesting surveys logistically difficult and expensive. Koyukuk/Nowitna NWR conducts annual float surveys to estimate productivity, but inferences from these results are limited to the local region and are not necessarily representative of the midcontinent population in Alaska. We sought to measure white-front production for the entire interior/NW Alaska region to determine whether current survival rates are sustainable, and to provide an important covariate for analysis of molt survey results that may be influenced by variation in breeding success.

To obtain an index to production we calculated age-ratios of fall migrating white-fronts near Delta Junction, Alaska in 2005-2007. There, white-fronts from throughout the interior/NW Alaska region congregate in fields of waste grain in late August (unpubl. satellite transmitter data, Bird Banding Lab unpubl. data; Steve Dubois ADFG pers. comm. 2005). Goose arrival, departure, and duration of stay in the Delta Junction vicinity varies among years, but in general white-fronts are present from the latter half of August through the first week of September (Steve Dubois, ADFG pers. comm. 2005). There is no evidence to suggest that white-fronts that breed on the Arctic Coastal Plain use this area in fall, thus age-ratios should reflect breeding success of the interior/northwest Alaska component of the midcontinent population. Sport hunting starts on September 1st, after which time displacement of birds by hunters and disproportionate hunting mortality of juvenile geese is expected; thus field activities were timed between arrival (based on discussions with area biologists) and September 1st.

In 2005 and 2006 data on flock size, family group size, and age-ratios were collected during morning and evening feeding periods on private farmlands. Due to private land status and variability in harvesting schedules among land owners each year, access to flocks of geese was not assured. Therefore, in 2007 efforts were directed towards roosting flocks on the Tanana River.

On August 28, Julian Fischer (MBM) and Karen Bollinger (MBM) conducted an aerial reconnaissance flight in a Cessna-206 on amphibious floats to locate roosting flocks on the Tanana River. This effort yielded approximately 2,000 geese located on river bars at three sites. On August 29-30 a crew traveled to the roost sites via river boat to collect age ratio data. This effort yielded age-ratio data from 6,991 geese (4,513 adults, 2,478 juveniles) resulting in an estimate of 35% juvenile geese (Table 8).

Parts Collection Survey – Age ratio of harvested geese is calculated annually through a Parts Collection Survey. These estimates are not directly comparable with age ratios calculated from float surveys or fall staging flocks because differential harvest mortality among age classes of geese reduce the proportion of young during the hunting season. Nonetheless, the Parts Collection Survey can provide an index to trends in range-wide productivity. In 2006 the ratio of juveniles to adults was 1.16 in the Central Flyway and 0.91 in the Mississippi Flyway (Kruse 2007). These estimates were both up from the previous year. While age-ratios calculated from hunter collected geese are not expected to match those calculated on the breeding grounds, trends in these estimates are surprisingly parallel to float surveys results on the Koyukuk NWR, and fall staging geese in Alaska (Fig. 15). Estimates in 2007 age ratios in the Central Flyway will be available in the latter half of 2008.

Breeding Biology

In 2005, the results of a 10-year study examining nesting biology and local movements of white-fronts in interior Alaska was presented in a final USFWS report (Spindler and Hans 2005). The objectives of the study were to identify preferred nesting and brood-rearing habitats, determine breeding chronology and susceptibility of nests to flooding, describe movements of female white-fronts and their broods, and evaluate return rates, mortality and predation on the breeding grounds.

Results included:

- 33% of nests were in uplands not susceptible to flooding
- 55% of nests were in open low scrub, 35% in needleleaf forest and woodland habitats, and 10% in graminoid-herbaceous meadows
- On average, nests were 273 m from nearest waterbody, 4.6 km from nearest rivers
- On average, nest initiation was 11 May, hatching 13 June
- Departure from brood rearing areas occurred in early August
- Geese marked in lower Koyukuk made a pre-migratory movement to Kotzebue Sound prior to southeast migration, whereas those marked on the upper Koyukuk, Kanuti, and Innoko Rivers migrated southeast directly
- Fall departure from west-central AK was usually complete by late August

Harvest

Subsistence – The Alaska Migratory Bird Co-management Council has not released any final harvest estimates since the 2005 version of this report was written (Fischer 2007a). Table 9 shows previously reported estimates. Preliminary estimates from 2004 and 2005 suggest harvest of white-fronts in most locations has not changed substantially from the 1990s, with the exception of Yukon Flats and the North Slope where reported harvest is higher. Whether this change is due to a higher reporting rate or represents a true change in harvest rate is not known. If preliminary estimates are any indication of actual harvest, then approximately 18,000 midcontinent greater white-fronted geese are shot each year in Alaska, with over 75% of the harvest taking place in the spring. Final harvest estimates are expected to be released by AMBCC within a year.

Sport – Since 1999, state and flyway estimates of waterfowl sport harvest are generated by the Harvest Information Program (HIP). Harvest of midcontinent white-fronts has tracked fairly well with the fall population index since 1999 (Fig. 16). Harvest estimates in the Central Flyway and in Canada are likely most relevant to boreal nesting white fronts in Alaska because band return data suggests that 64% of sport harvest of white-fronts from interior and northwest Alaska occurs in Texas and Canada (Ely pers. comm. 2004; Fig. 17). In 2006 white-front harvest in the U.S. portion of the Central Flyway was down from 2005 (2006: 83,384; 2005: 113,932; Fig. 16) and was 16% below the 1999-2005 average (Kruse 2007). Harvest in Alberta and Saskatchewan were also down from 2005 (2006: 15,838 and 34,809, respectively) and below the 1999-2005 average. Prior to last year, harvest in the Mississippi Flyway has been relatively consistent since 1999, but recent estimates show a 39% increase from the 1999-2005 average.

Distribution

Leg-band and neck collar data – Leg-band and neck collar data indicate that white-fronted geese from interior Alaska have different migration and winter

distributions than geese from other portions of the breeding range (Ely and Schmutz 1999, Anderson and Haukos 2003). For example interior/northwest Alaska birds are more likely to winter in Mexico and use spring staging grounds in northwestern Texas and Nebraska than geese from other breeding areas. Further, geese from interior/northwest Alaska initiate fall and spring migration earlier than other segments of the midcontinent population. Distribution analyses using band return data are ongoing and will be updated by Craig Ely (USGS-Alaska Science Center).

Satellite transmitters – From 2001 to 2003 satellite transmitters were deployed in 51 midcontinent greater white-fronted geese in Alaska to study migration pathways and timing of movements. Principal findings of this research showed that white-fronted geese from interior/northwest Alaska and the Arctic Slope had very little spatial and temporal overlap at fall staging areas in Alberta and Saskatchewan. Results of this research are presented in Webb (2006).

Leg-Banding Program

Goose banding is an effective tool to examine survival rates, migratory routes, and harvest distribution. A total of 40,939 midcontinent white-fronts have been banded in major molting areas in interior, northwest, and North Slope Alaska since 1969 (Fig. 18, Table 10). In 2007, staff from Migratory Bird Management, Innoko NWR, Koyukuk/Nowitna NWR, Selawik NWR, and the USGS-ASC banded 2,212 white-fronts at five sites on the Innoko NWR (1,043 bands) and four sites on the central North Slope (1,169 bands; Marks 2007).

Banding effort on the North Slope has been variable in recent decades. A total of 5,145 white-fronted geese were banded on the North Slope in 1975-1979 (King and Hodges 1979, Lobpries 1980) and an additional 1,085 geese were banded in 1990-1994 (USFWS unpubl. data). Banding on the North Slope resumed in 2003 with the goal of 1,000 geese per year in order to provide sufficient data to compare survival rates of geese in tundra habitats with boreal habitats, and to detect and quantify interchange between tundra nesting and boreal nesting geese in Alaska.

Preliminary analysis of recapture data from 1971-2007 suggests that white-fronts are faithful to molting sites. Of recaptured geese, 98% were in the same area where initially banded (Table 11). Moreover, less than 1% of recaptures occurred on the opposite side of the Brooks Range from where they were initially banded. These proportions are biased, however, because banding and recapture efforts have been unequal among years and locations with 71% of all banding occurring at Innoko and the North Slope in 1969-2007, and 90% of banding occurring at these two sites in 2003-2007. Thus, it is more likely that banded birds will be recaptured at Innoko or the North Slope because they are sampled more frequently and with greater effort. This is particularly true for Innoko, where the banding area is relatively small, and many of the same lakes are used for captures each year. In contrast, banding sites on the North Slope are vast, stretching for hundreds of miles and the same lakes are not typically revisited each year.

Examination of recapture data in 2004-2007, when banding efforts were similar on the North Slope and Innoko, showed that proportion of recaptures in the same area where originally banded was very similar to the longer-term data set (Table 12). For example, 95% of recaptured geese were in the same area as initially banded, and less than 4% of recaptures occurred on the opposite side of the Brooks Range from where they

were initially banded. One interesting exception is the Seward Peninsula, where 21% of recaptured birds were originally banded on the North Slope. Interchange among molting sites may occur more frequently among these sites relative to other areas. Molting sites on the Seward Peninsula are physically closer and more similar in habitat to the North Slope than other sites in interior and northwest Alaska.

The Bird Banding Lab (BBL) does not archive recapture records of birds that occur in the same 10 degree minute block where they were originally banded; therefore, the BBL database cannot be used to examine annual variation in use of molting sites. Thus, we consolidated all Alaska midcontinent white-fronted goose banding data in a Microsoft Access database in 2006, including all recorded live recaptures of white-fronted geese during banding operations regardless of distance between banding and recapture site. The database contains records of all white-fronted geese banded in Alaska from 1960-2004, and all midcontinent white-fronts banded in interior, northwest, and North Slope by MBM and Innoko NWR banding permit holders in 2005-2007.

Annual Survival

Leg-banding provides data necessary to calculate annual survival of midcontinent greater white-fronted geese in interior and northwest Alaska. A minimum annual sample of 1,000 banded white-fronts in interior/northwest Alaska is needed for 10 years to ensure a 90% chance of detecting a 5% difference in survival rate (Schmutz 2001). After 7 years of banding 1,000 white-fronts annually in interior/northwest Alaska, we have approximately an 80% chance of detecting a 10% change in survival.

Survival estimates for white-fronts suggests that low survival is not Alaska-wide, but is specific to one component of the population that occurs in boreal habitats of interior and northwest portions of the state. Joel Schmutz (USGS-ASC) used band recoveries from 2000-2006 to generate survival estimates for white-fronts from interior/northwest Alaska (Fig. 19). He found that during this period, mean survival rate was 0.67 (± 0.04 95% CI). This estimate was significantly lower than mean survival of white-fronts from Queen Maud Gulf, Canada during the 2000-2004 period (0.77; ± 0.05 95% CI). Indexed reporting rate (product of the probability a band will be recovered and probability a recovered band will be reported) among interior Alaska white-fronts during this period was 0.10. Patterns in reporting rates have remained similar to previous analyses, with lower reporting overall for interior Alaska birds, suggesting that their overall mortality is disproportionately more of the natural death or unreported harvest type than for white-fronts elsewhere in their range.

Band return data is available for the Alaskan Arctic Coastal Plain for the years 2003-2006. These data reveal an annual survival rate of 0.74 (± 0.10 95% CI). Survival of interior molting white-fronts during the same period (2003-2006) is 0.66 (± 0.08 95% CI). Indexed reporting rates among interior and Arctic Coastal Plain banded white-fronts, during 2003-2006, were 0.09 and 0.13, respectively.

The factors contributing to low estimates of annual survival and indexed reporting rates in boreal nesting white-fronts are currently unknown. Low survival rates may be related to the distinctive migration patterns and winter distribution unique to this component of the population. Unique migration timing and year-round distribution may lead to disproportionate mortality from factors such as sport harvest (see Harvest and Distribution sections), exposure to avian disease in the Rainwater Basin of Nebraska (see Disease section), poor habitat conditions in Mexico, subsistence harvest in Alaska, and/or natural predation on molting grounds. Alternatively, survival estimates from interior

boreal Alaska could be biased low if there is a higher incidence of capture-related mortality from banding activities relative to tundra habitats. The latter explanation is a critical first step in understanding the nature and extent of differential survival throughout the population. The USFWS and USGS will investigate this question in 2008.

Body Condition

The USGS-Alaska Science Center, in cooperation with FWS and CWS, is investigating the body condition dynamics in primary molting habitats of Alaska. Biologists have shown that body mass varies by year, sex, and site within Innoko NWR (Fig. 20). The relationship between condition and habitat quality is currently under investigation. Studies are also underway to determine whether morphological variation and site selection of molting white-fronts is related to winter distribution and survival. Preliminary data suggests that both survival and body condition are higher in Queen Maud Gulf than in Innoko (Fig. 21). An additional study was initiated in 2006 that investigated body condition dynamics and activity budgets during molt at Innoko NWR. Male and female greater white-fronted geese lose an average of 630 and 753 g of body, or approximately 25% of their body mass, during the flightless period (Ely and Terenzi 2007). Results from behavioral observations showed that geese spent most of their time feeding, and there was little variation throughout the day in their behavior. Ultimately, investigators will examine how changes in body conditions throughout the molt period are affected by water conditions, and whether these changes can explain variation in survival estimates.

Management Plan Update

In July, 2005 a subcommittee of biologists and managers from state, federal and provincial agencies revised the Midcontinent Greater White-fronted Goose Management Plan. The impetus behind revising the plan was a substantial decline in the midcontinent population from over one million birds in 1998 to about 600,000 by 2002. A population decline was planned and expected after implementation of liberal harvest frameworks in 1998, but the magnitude of the change was not desirable. Changes to harvest guidelines in the revised management plan are expected to reduce the likelihood of rapid declines in fall indices resulting from liberal hunting regulations.

Key changes to the management plan are listed below:

1. The population objective was increased from 600,000 to 650,000 as measured by the fall staging survey in prairie Canada.
2. Three harvest frameworks were defined – restrictive, base, and liberal
    a. The threshold triggering restrictive regulations is 500,000 and will be activated if any single-year index is at or below that level (previously based on the 3-year running average)
    b. The population must be restored to 600,000 based on the 3-year running average before base regulations are resumed
    c. The threshold triggering liberal regulations was raised from 700,000 to 800,000 based on the 3-year running average
3. Prescribed restrictive regulation guidelines are now included for all jurisdictions
4. Management strategies, tasks, and appendices are updated

Disease

Two white-fronted goose disease investigations were conducted in Alaska since 2001. The first was a study on avian cholera, the second was the H5N1 High Pathogenic Asian Avian Influenza surveillance program. A summary of results are described below.

Avian Cholera - Band return data show that Alaska breeding midcontinent greater white-fronted geese migrate through Nebraska's Rainwater Basin (Ely and Schmutz 1999) where outbreaks of avian cholera are common (Samuel et al. 2005). A three-year study was initiated in 2001 to:

1) quantify prevalence of greater white-fronted geese in interior/northwest Alaska with recent exposure to *Pasteurella multocida*, the bacterium responsible for causing avian cholera; and
2) detect occurrence of avian cholera carriers in the population based on pharyngeal swab cultures

Serum and oral swab samples were collected from captured geese in several sites in interior and northwest Alaska in July, 2001-2003 to assess whether white-fronted geese are exposed to avian cholera, determine the likelihood that these geese act as carriers of the disease agent, and to compare results to other goose populations. The results of this work were published in the Journal of Wildlife Diseases (Samuel et al. 2005). The key finding was that greater white-fronted geese in interior and northwest Alaska may be exposed to avian cholera during the winter or spring, but are unlikely to play a significant role as carriers of the bacterium causing avian cholera. Analysis of serum samples showed that approximately 4% of the sampled geese had antibody levels to *P. multocida* indicative of recent exposure to the bacteria. While antibodies in serum samples indicated exposure to *P. multocida*, the bacteria itself was not present in swab samples indicating that the geese are not likely carriers. It is noteworthy that sampling occurred in years when there were no major outbreaks in the spring staging areas; thus, the impact of a major outbreak to the Alaska breeding population is unknown.

Avian Influenza - Recently, a virulent strain of avian influenza, Asian HPAI H5N1, spread from Southeast Asia into central Asia, Europe and Africa, and has been identified in wild birds. Migratory birds are considered a possible vector for entry of the virus into the Americas and individual birds crossing between Alaska and Asia or populations mixing in staging areas are thought to pose some risk for the introduction of the virus to Alaska and North America (Interagency Avian Influenza Working Group 2006). As a result, the Interagency Avian Influenza Working Group developed criteria to rank the Migratory Bird species that occur in Alaska according to the risk they pose of carrying the Asian HPAI H5N1 virus. From this list, 29 species were selected for targeted sampling for the surveillance program. Swab samples were collected from these species state-wide to test for avian influenza virus. While greater white-fronted geese were not selected as a target species in 2006 and 2007, standard banding operations provided an opportunity to collect samples from live captured and subsistence harvested white-fronts. Those efforts showed that in 2006, white-fronts had the second highest rate (3.7%) of low pathogenic avian influenza of all target species. In 2007, white-fronts had low incidence of any avian influenza, similar to the pattern seen in all species sampled last year. In 2008, white-fronts were chosen as a target species for sampling due to its high rate of low pathogenic virus measured in 2006. Sampling in 2008 will occur at Innoko and the North Slope coinciding with banding efforts.

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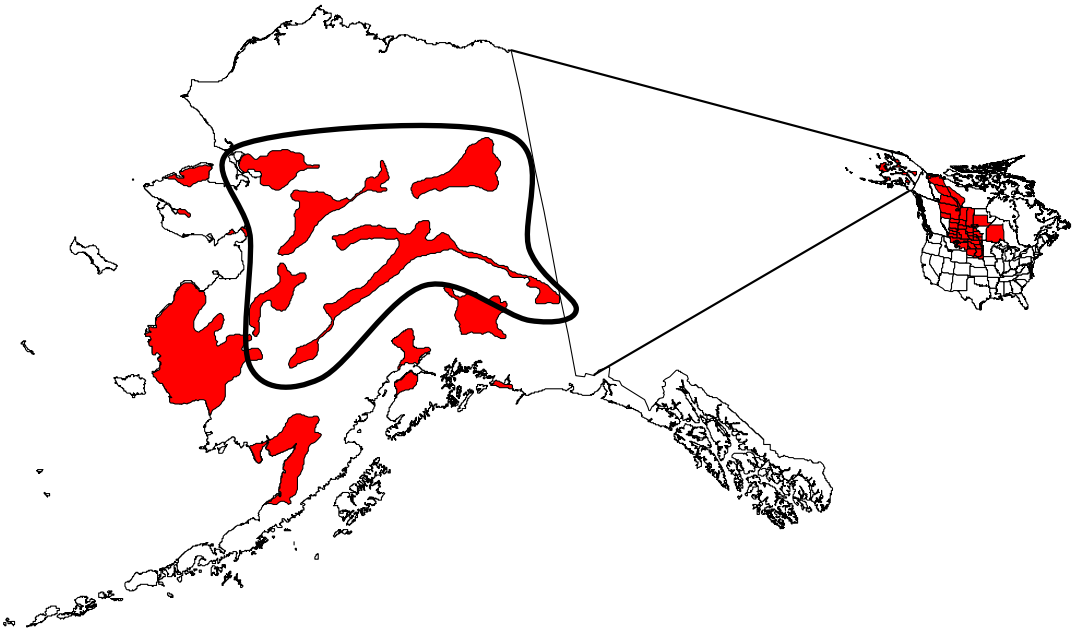


Figure 1. Location of five interior and northwest Alaska strata (encircled polygons) relative to all surveyed areas (red) in the Continental Breeding Pair Survey.

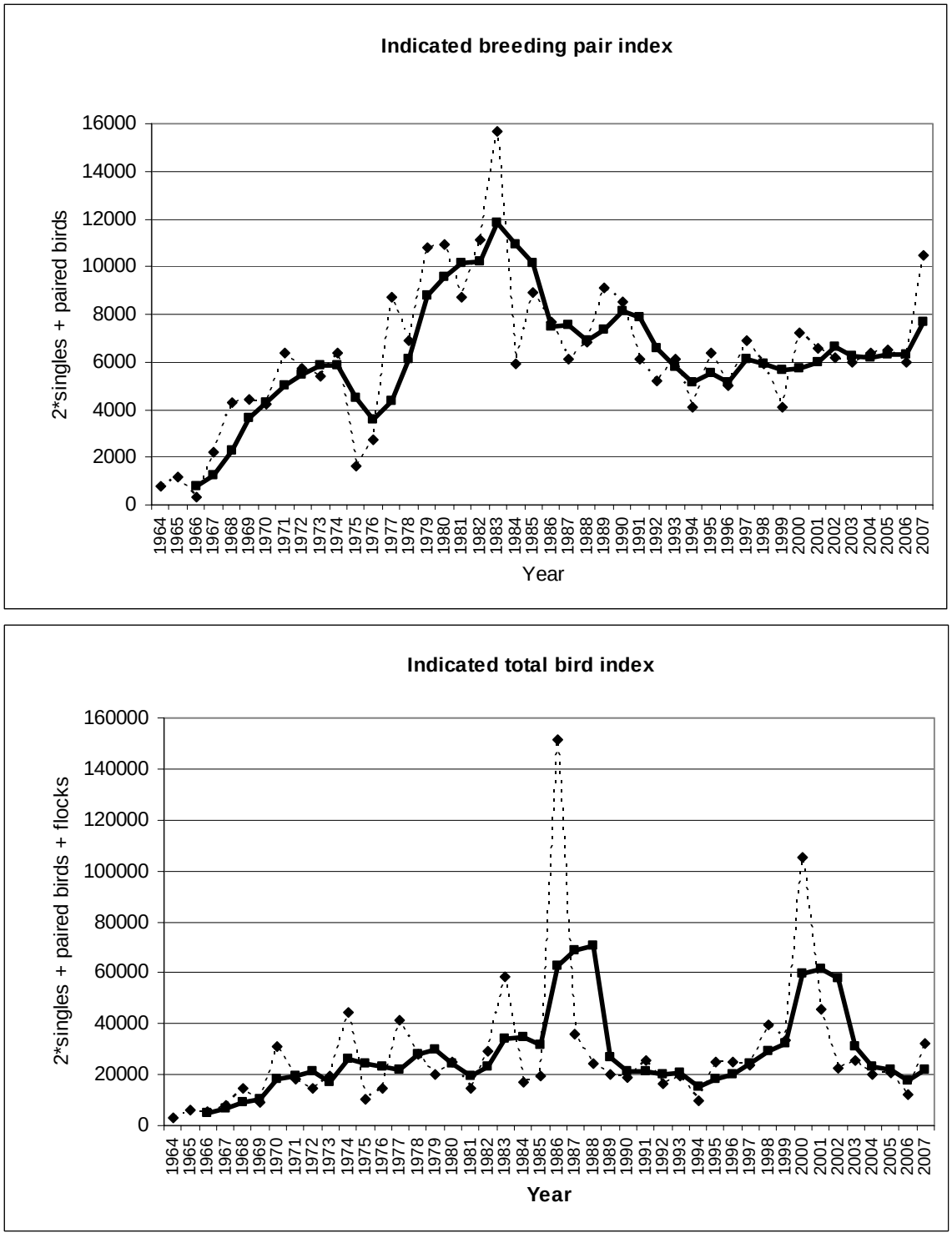


Figure 2. Breeding pair (upper) and total bird (lower) indices of midcontinent greater white-fronted geese estimated during spring breeding pair surveys in interior and northwest Alaska, 1964-2007. Point estimates connected with dashed lines, 3-year running averages connected with solid bold lines. Indices derived from strata 3-6, and 11 in the Continental Breeding Pair Survey (Mallek and Groves 2007).

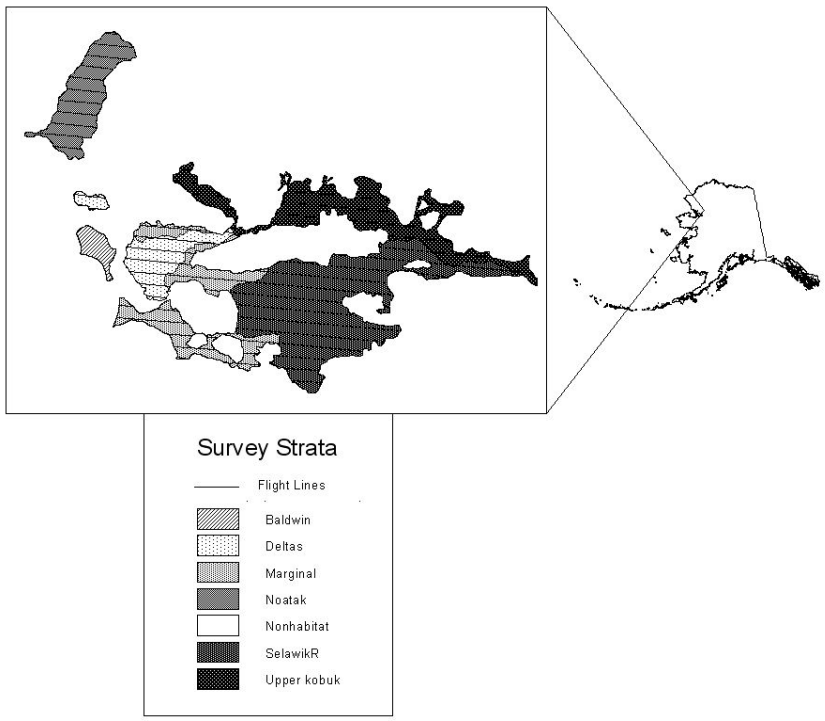


Figure 3. Location of white-fronted goose breeding pair survey flight lines and strata in northwest Alaska, 1996-1997, 2005-2007.

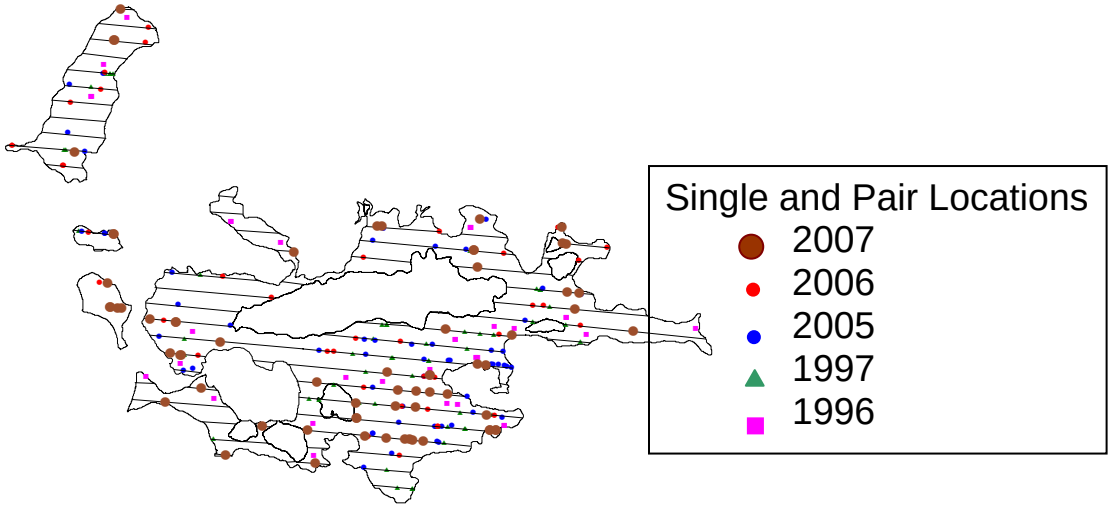


Figure 4. Locations of the 2005-2007 survey transect lines, and indicated white-front pairs (singles and pairs), 1996-1997 (Platte 1999a), and 2005-2007 (Fischer et al. 2008).

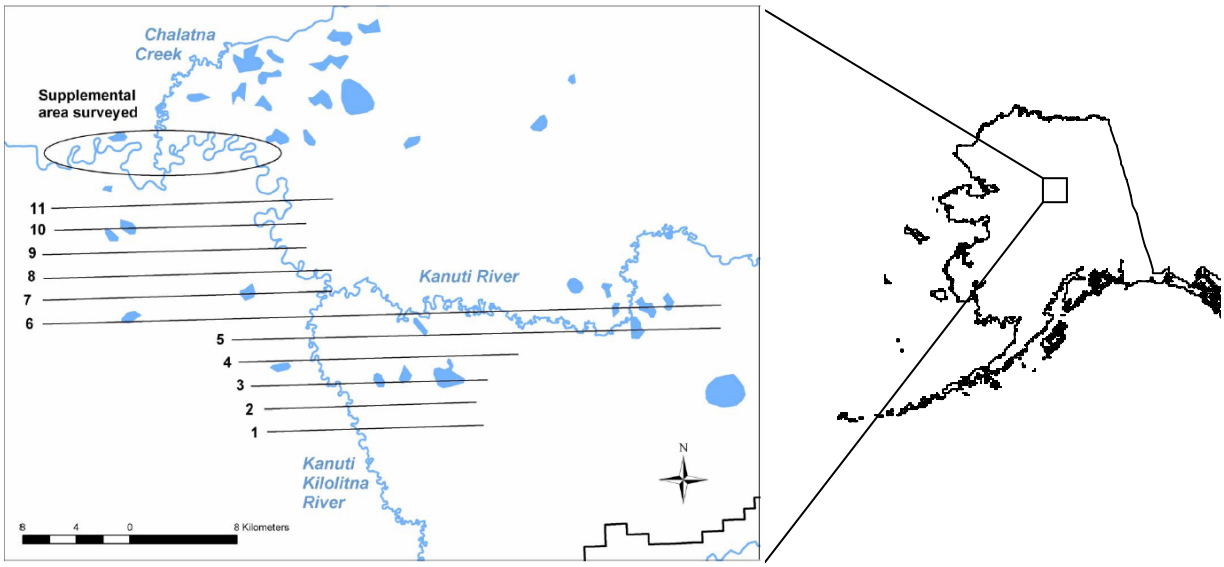
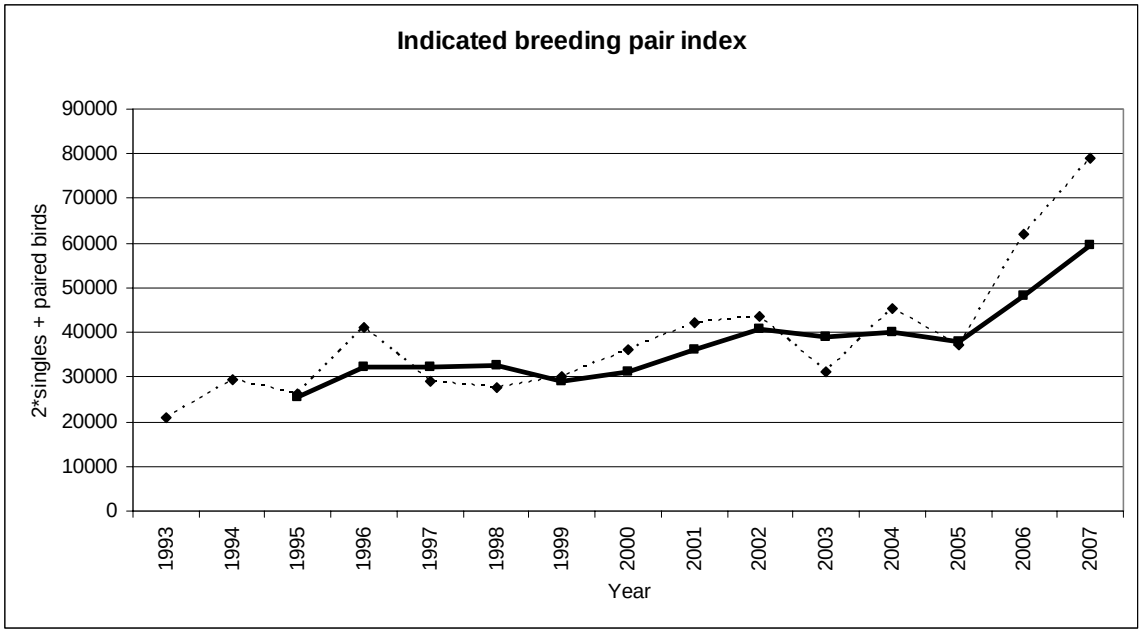


Figure 5. Locations of transects during spring breeding pair surveys at Kanuti National Wildlife Refuge on May 10, 17, and 24, 2007 (Harwood 2007).



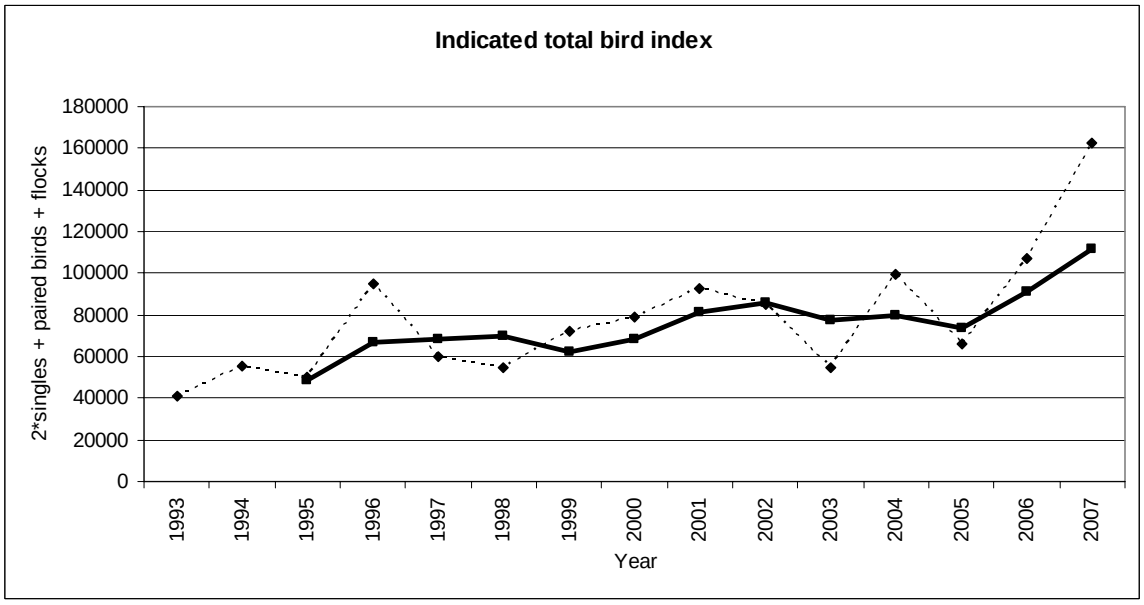


Figure 6. Indicated paired bird (upper) and total bird (lower) indices of midcontinent greater white-fronted geese estimated during breeding pair surveys on the Arctic Coastal Plain, Alaska, 1993-2007. Survey design was modified in 2007; thus, estimates presented here differ from those previously reported by Mallek et al. (2007). Point estimates connected with dashed line, 3-year running average connected with solid bold line (Larned et. al. 2008).

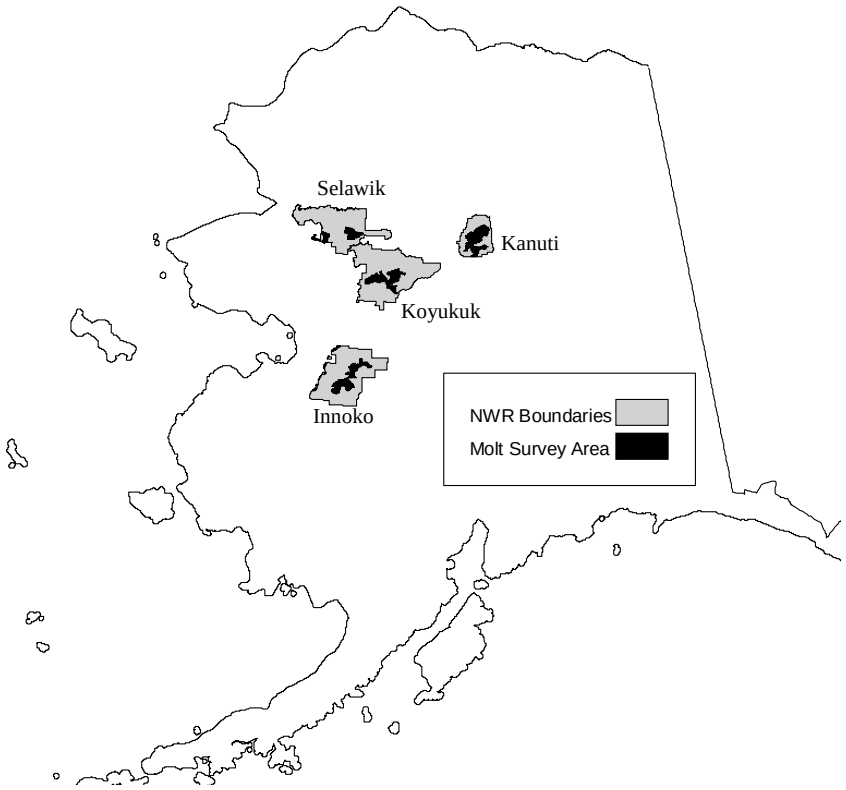


Figure 7. Coordinated molting goose survey area, interior/northwest Alaska, 2000-2007.

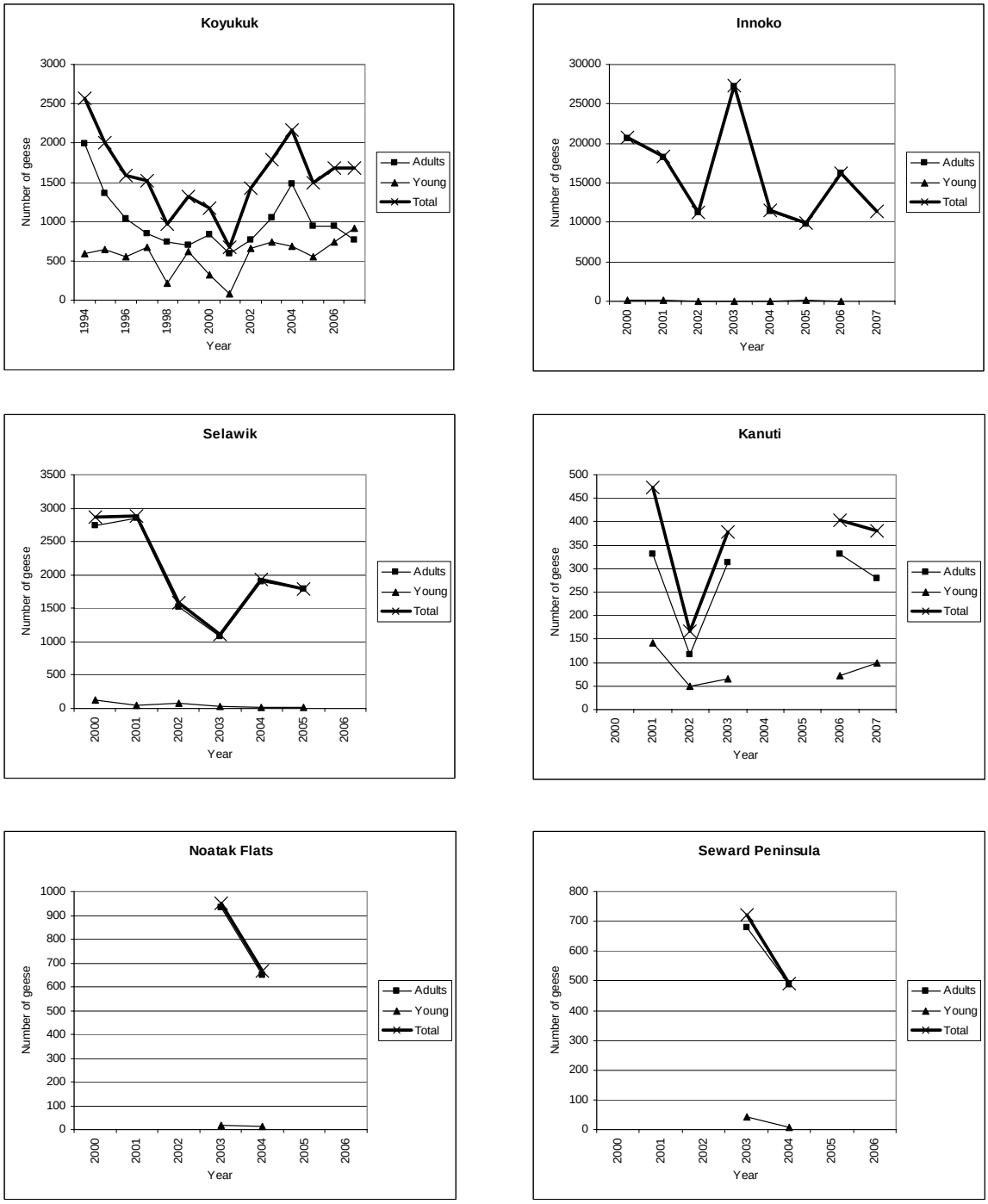
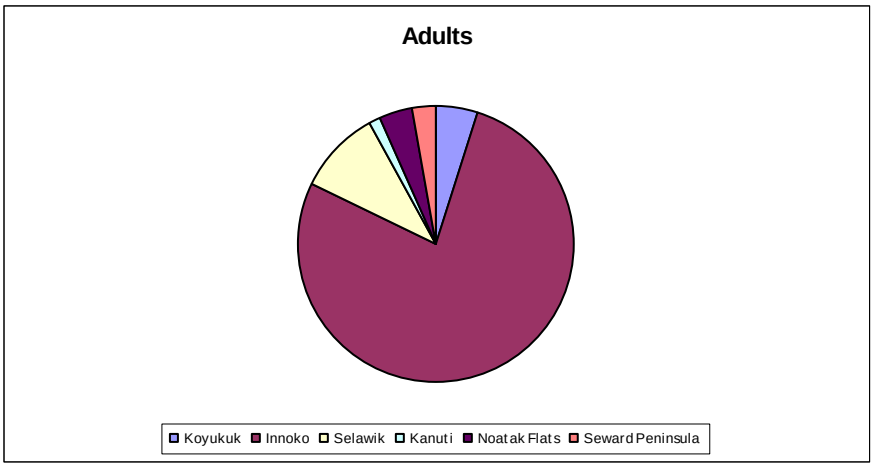
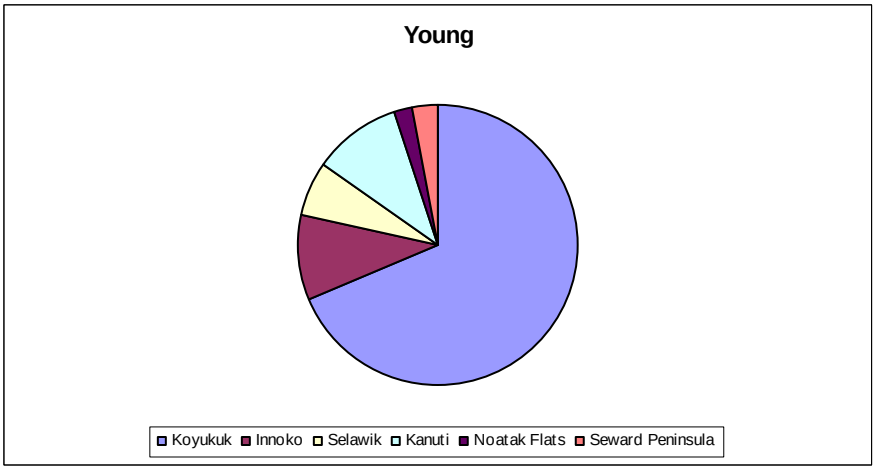


Figure 8. Abundance of midcontinent greater white-fronted geese at molting sites in interior/northwest Alaska, 2000-2007 (Bryant 2007, Harwood 2007; Selawik NWR unpubl. data, Innoko NWR/MBM unpubl. data).





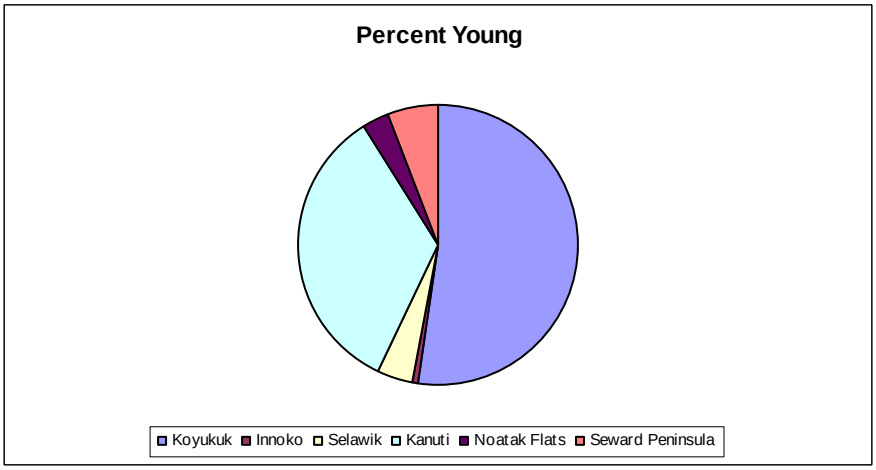


Figure 9. Distribution of midcontinent greater white-fronted goose adults, young, and percent young at major Alaska molting areas. Figures based on means: 2000-2007 at Koyukuk and Innoko; 2000-2005 at Selawik; 2001-2003, 2006-2007 at Kanuti; and 2003-2004 at Noatak and Seward Peninsula.

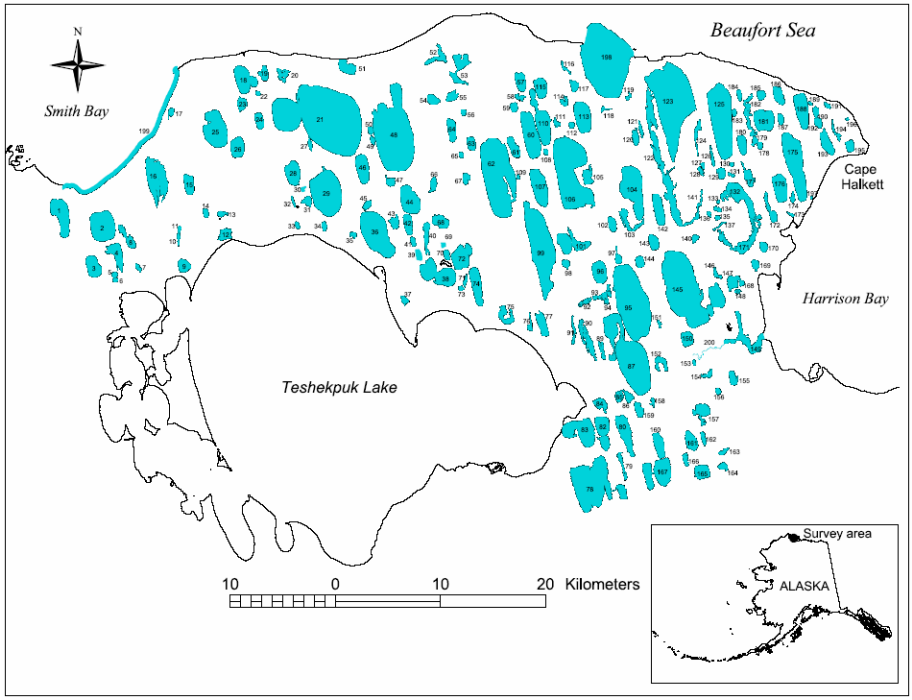


Figure 10. Lakes sampled in the Teshekpuk Lake area molting goose survey (Mallek 2007).

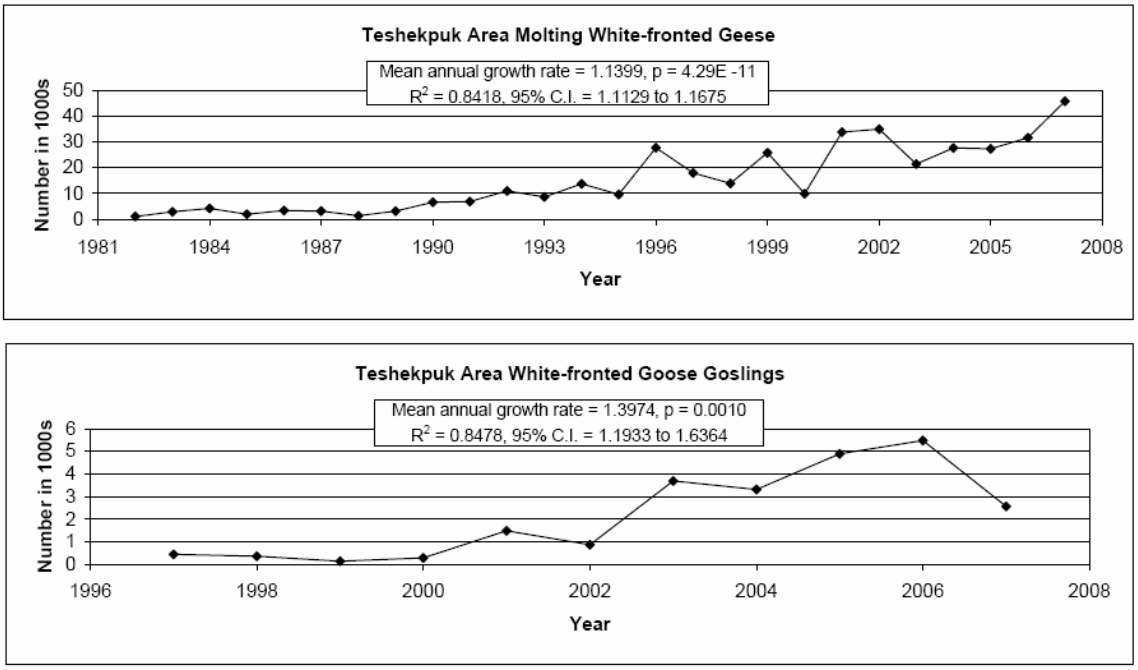


Figure 11. Numbers of adult greater white-fronted geese observed in the Teshekpuk Lake molting survey area, 1982-2007 (Mallek 2007).

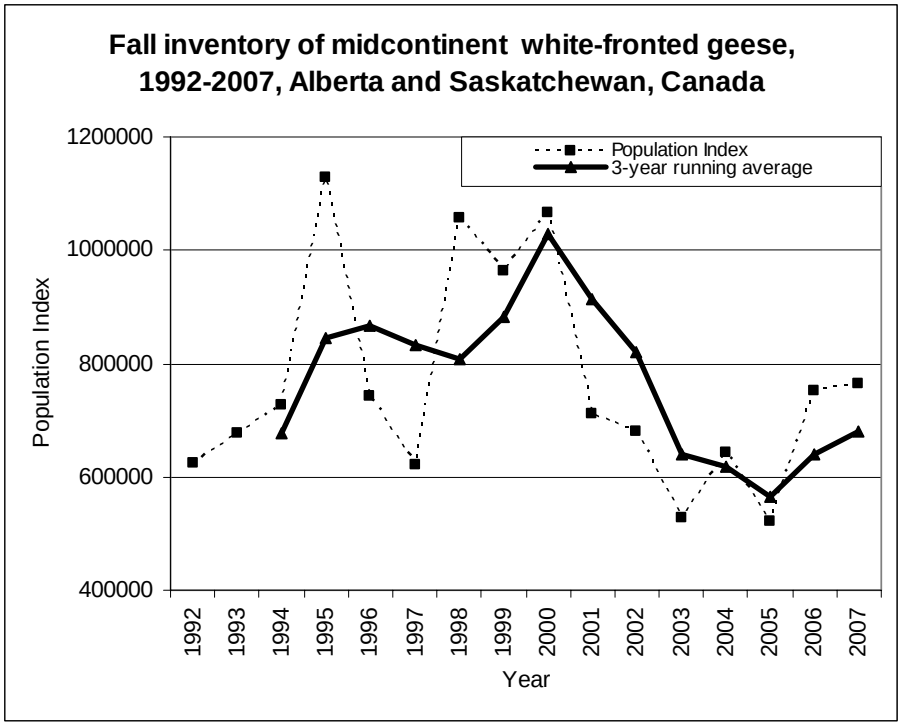


Figure 12. Midcontinent greater white-fronted goose population index based on fall inventory surveys in Alberta and Saskatchewan, 1992-2007 (Warner et al. 2007).

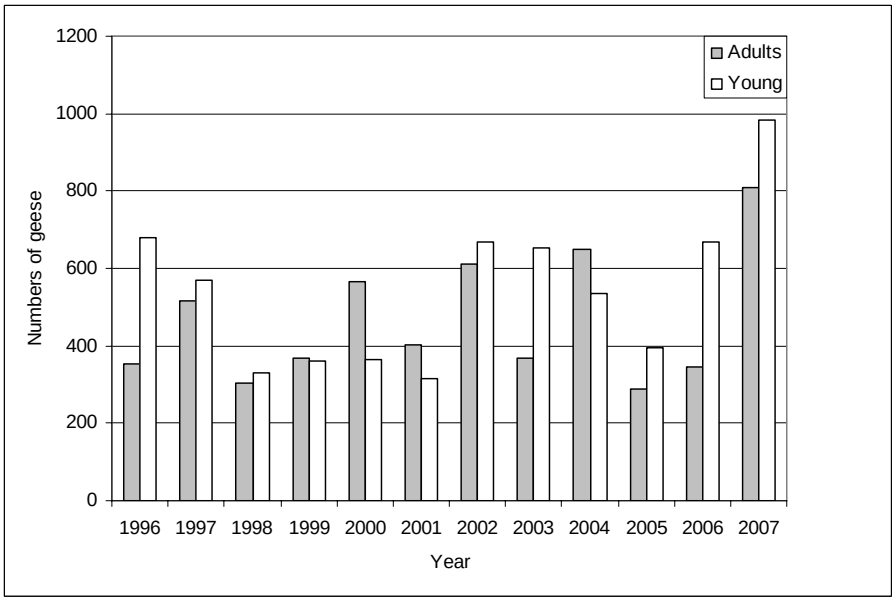


Figure. 13. Numbers of adult and gosling white-fronted geese observed during float surveys of 379 river miles: Dulbi (60), Kaiyuh (176), and Nowitna (143) rivers in interior Alaska, late June-early July, 1996-2007. (Data from J. Bryant, Koyukuk/Nowitna NWR).

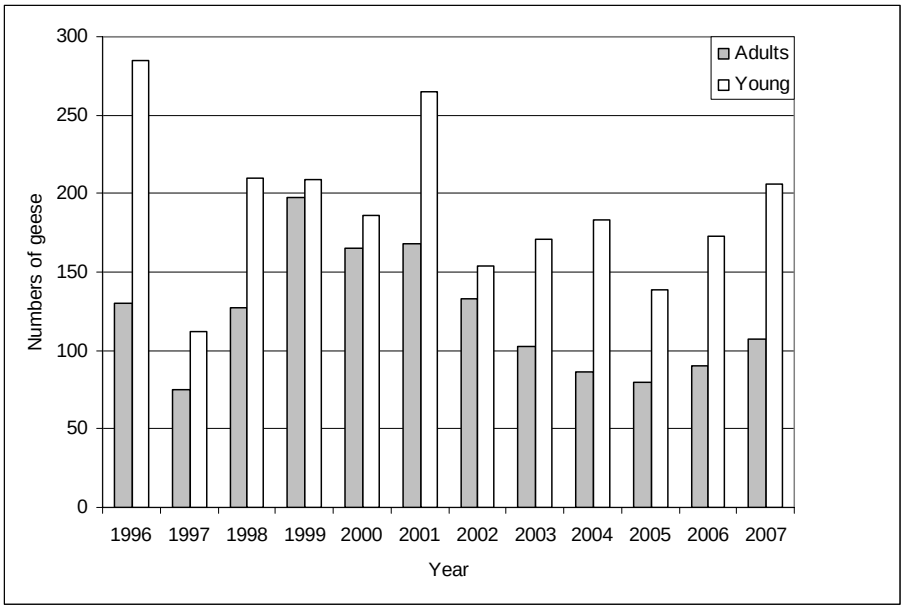


Figure. 14. Numbers of adult and gosling Canada geese observed during float surveys of 379 river miles: Dulbi (60), Kaiyuh (176), and Nowitna (143) rivers in interior Alaska, late June-early July, 1996-2007. (Data from J. Bryant, Koyukuk/Nowitna NWR).

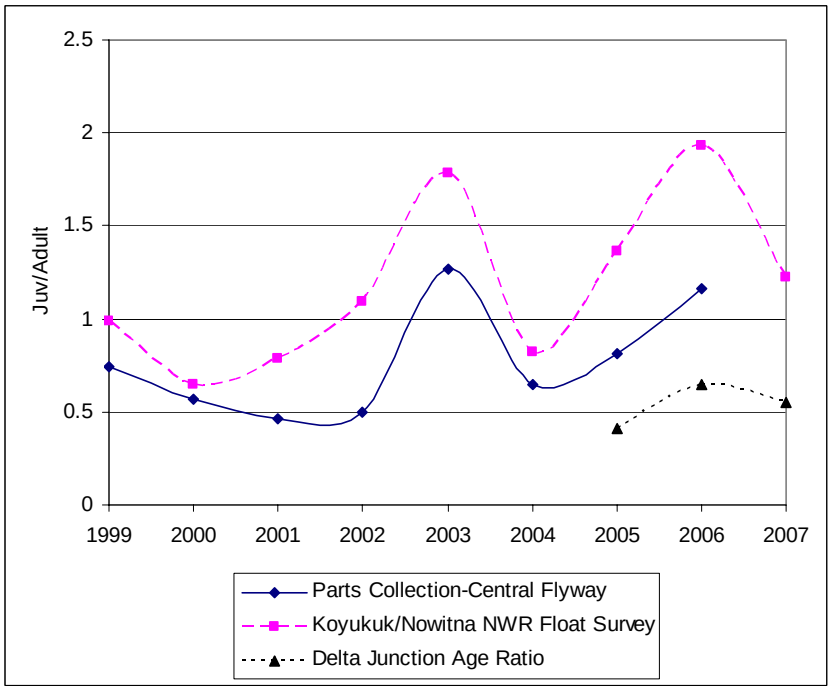


Figure 15. Comparison of age ratios (juveniles/adults) of midcontinent greater white-fronted geese calculated from Parts Collection Surveys during the regular harvest season in the Central Flyway (Kruse 2007), July float surveys in the Koyukuk/Nowitna NWR (Bryant unpubl. data), and August age-ratio surveys in Delta Junction, Alaska.

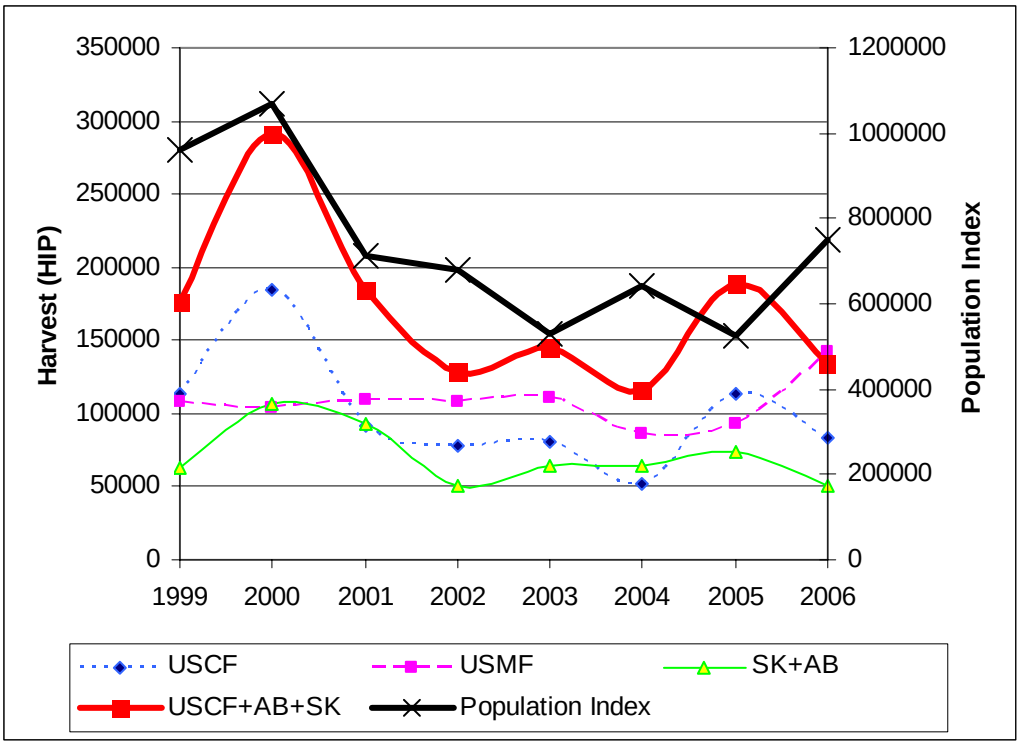


Figure 16. Estimated harvest of white-fronted geese in the U.S. portions of the Central (USCF) and Mississippi Flyways (USMF), and Saskatchewan (SK) and Alberta (AB), Canada, 1999-2006 (Kruse 2007, U.S. Fish and Wildlife Service 2007) relative to the fall population index (Warner et al. 2007). Most harvest of Alaska breeding midcontinent white-fronted geese occurs in the U.S. Central Flyway States, Alberta, and Saskatchewan.

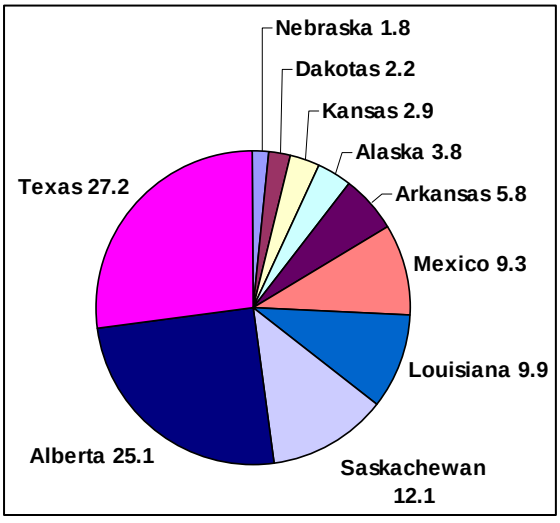


Figure 17. Distribution of sport harvest of midcontinent greater white-fronted geese that breed in interior and northwest Alaska, 1990-2002 (Ely pers. comm. 2004). Numbers indicate proportion of harvest by state or province. Results based on recoveries of leg-banded geese from interior and northwest Alaska.

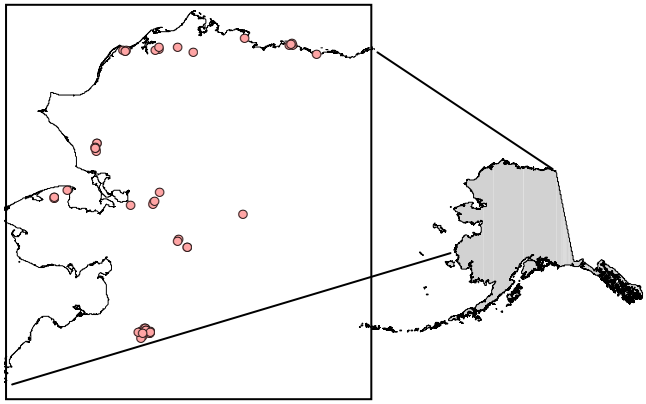


Figure 18. Midcontinent white-front banding locations in Alaska, 2000-2007.

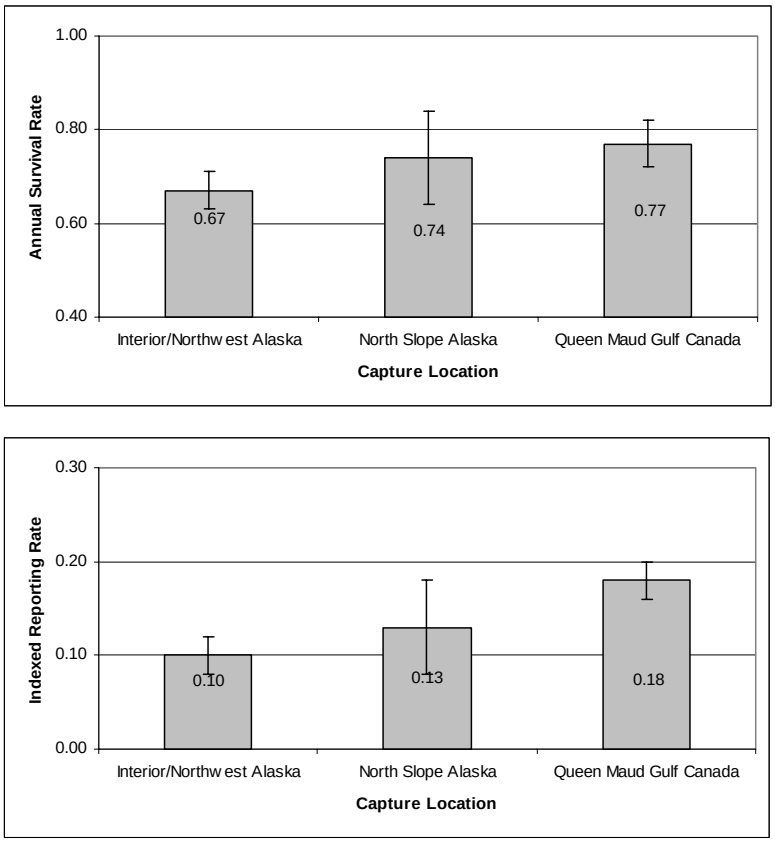


Figure 19. Annual survival estimates and indexed reporting rate of midcontinent white-fronted geese in Alaska and Canada. Estimates are derived from geese with leg-bands only and include all adults and sexes. Estimates based on bands deployed in interior and northwest Alaska, 2000-2006; Queen Maud Gulf Canada, 2000-2004; and North Slope Alaska, 2003-2006.

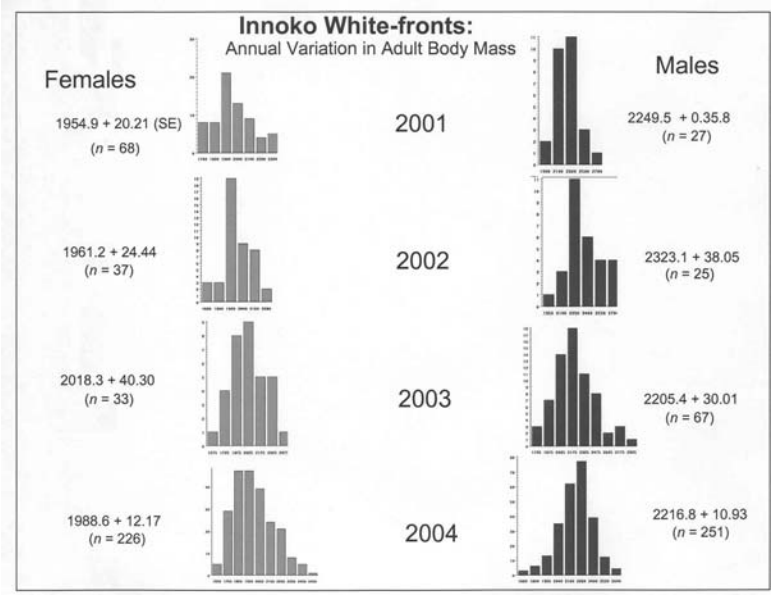


Figure 20. Inter-year and sex differences in adult body mass of midcontinent greater white-fronted geese at Innoko, Alaska (Craig Ely, unpubl. data).

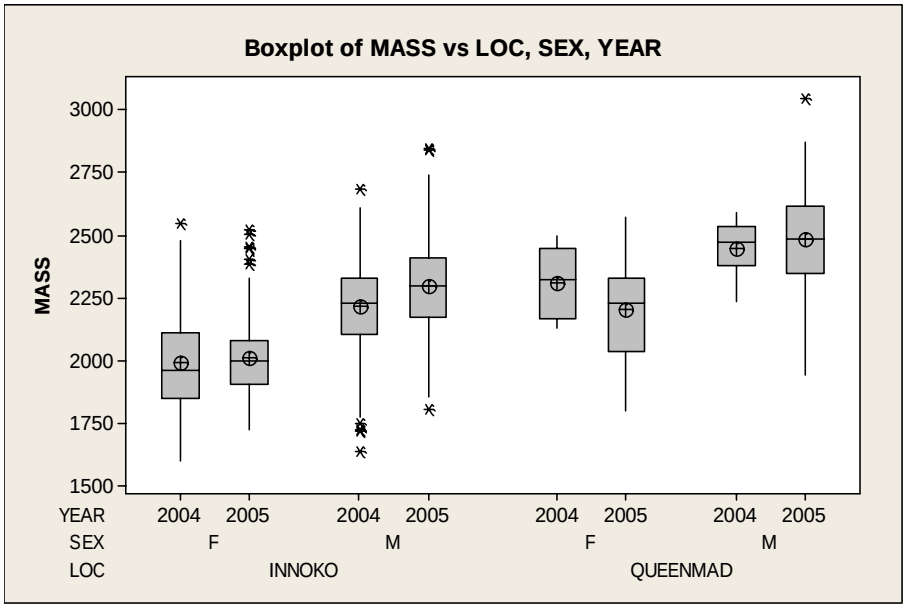


Figure 21. Inter-population variation in body mass of adult white-fronted geese from Innoko NWR, Alaska and Queen Maud Gulf, Nunavut Canada. (Ely and Terenzi 2007).

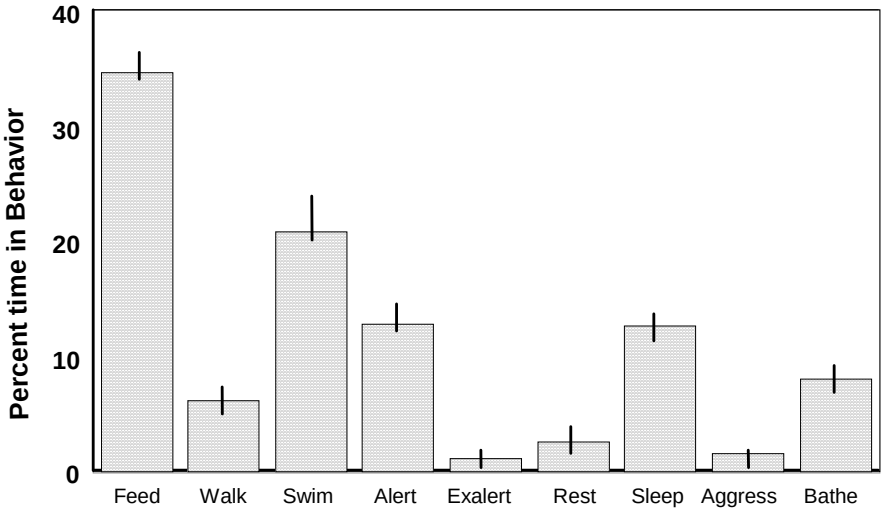


Figure 22. Proportion of time spent in different behaviors (all time periods combined) by molting greater white-fronted geese on Innoko NWR in 2006 (Ely and Terenzi 2007).

Table 1. Aerial population indices of indicated breeding birds, 2*(n singles + n pairs), and indicated total birds (including birds in flocks) observed for greater white-fronted geese in the Selawik region, 1996-1997, 2005-2007. Adjusted indices were calculated based on 2007 detection rates for singles, pairs, and flocks applied to all years of surveys. The 2007 data does not include the left-rear observations made on double-count transects (Fischer et al. 2008).

Year	Transect km2 observed	Breeding bird index	SE breeding bird index	Adj. breeding birds pop	SE breeding birds	Total bird index	SE total bird index	Adj. total pop	SE adj. total pop
Noatak R - 1,896 km^2									
1996	100.3	151	71	187	89	1286	414	1381	439
1997	103.3	294	159	353	180	2111	673	2266	712
2005	101.4	150	66	197	87	729	215	807	232
2006	101.8	298	95	335	108	633	290	688	308
2007	93.5	162	96	201	116	750	274	819	294
Deltas - 1,413 km^2									
1996	74.3	76	55	94	68	152	92	174	104
1997	71.7	118	64	140	78	296	145	327	157
2005	74	267	145	314	173	401	170	455	197
2006	67.2	168	78	209	100	505	282	563	302
2007	55.6	305	141	378	182	407	174	485	212
Marginal - 2,207 km^2									
1996	112	79	55	98	70	985	525	1052	554
1997	123.4	72	47	100	65	72	47	100	65
2005	117.6	75	53	93	65	695	407	745	429
2006	122.5	72	50	89	63	1568	696	1664	734
2007	113.2	273	88	308	102	721	324	780	343
Upper Kobuk - 3,255 km^2									
1996	176.7	258	139	303	157	2303	966	2456	1019
1997	143.4	182	142	211	159	1317	680	1406	718
2005	143.9	317	149	386	182	883	387	981	418
2006	156.7	208	77	238	92	1309	575	1397	607
2007	143.1	546	142	621	165	728	231	812	253
Selawik R - 6,076 km^2									
1996	315.9	654	178	769	212	7021	2086	7471	2199
1997	335.3	1522	261	1809	318	7648	1274	8256	1352
2005	323.8	1351	275	1593	325	3977	670	4358	721
2006	339.6	787	192	943	233	2737	577	2995	618
2007	294.8	948	244	1105	290	4143	1227	4469	1299
Baldwin Peninsula – 386 km^2									
1996									
1997	35.4	0	0	0	0	0	0	0	0
2005									
2006	39.8	19	20	21	21	19	20	21	21
2007	35.7	108	53	131	66	249	126	279	137
Total (without Baldwin) - 14,848 km^2									
1996	779.2	1218	249	**1451**	295	11747	2396	**12534**	2527
1997	777.1	2187	346	**2613**	411	11443	1601	**12355**	1697
2005	760.7	2160	355	**2583**	424	6685	916	**7346**	985
2006	787.8	1533	246	**1814**	298	6752	1145	**7307**	1214
2007	700.2	2234	342	**2614**	410	6749	1331	**7366**	1415

Table 2. Estimates of indicated paired and total midcontinent greater white-fronted geese, and percent paired birds in Kanuti NWR during three surveillance surveys (Harwood 2007) and one operational survey, May 2007 (Mallek and Groves 2007). Indicated paired birds was calculated by two times the number of singles plus the number of birds in pairs; total indicated birds was calculated by indicated paired birds plus flocked birds.

	Kanuti Surveillance			Continental BPS Koyukuk/Kanuti
	5/12/2007	5/16/2007	5/24/2007	5/23/2007
Indicated Pairs (2*singles+2*pairs)	26	18	12	2600
Indicated Total (2*singles+2*pairs)+flocks	255	85	149	5500
Percent Pairs	**10.2**	**21.2**	**8.1**	**47.3**

Table 3. Abundance of midcontinent greater white-fronted geese during molting surveys in interior/northwest Alaska, 1994-2007 (Bryant 2007, Harwood 2007, Selawik NWR unpubl. data, Innoko NWR/MBM unpubl. data).

Year	Koyukuk		Innoko		Selawik		Kanuti		Noatak		Seward Peninsula	
	Adults	Young	Adults	Young	Adults	Young	Adults	Young	Adults	Young	Adults	Young
1994	1988	588	--	--	--	--	--	--	--	--	--	--
1995	1358	645	--	--	--	--	--	--	--	--	--	--
1996	1037	555	--	--	--	--	--	--	--	--	--	--
1997	848	671	--	--	--	--	--	--	--	--	--	--
1998	743	219	--	--	--	--	--	--	--	--	--	--
1999	705	618	--	--	--	--	--	--	--	--	--	--
2000	840	325	20684	121	2741	129	--	--	--	--	--	--
2001	593	78	18246	137	2844	45	332	142	--	--	--	--
2002	764	663	11273	19	1518	73	117	50	--	--	--	--
2003	1053	739	27243	17	1071	36	313	65	934	16	680	43
2004	1480	680	11420	42	1907	23	--	--	650	15	486	6
2005	944	545	9761	76	1786	10	--	--	--	--	--	--
2006	936	744	16146	66	--	--	332	71	--	--	--	--
2007	763	915	11252	177	--	--	280	100	--	--	--	--
Mean	1004	570	15753	82	1978	53	275	86	792	16	583	25

Table 4. Mean number of midcontinent greater white-fronted goose adults and young, and percent young at major Alaska molting areas, 2000-2007.

	Koyukuk	Innoko	Selawik	Kanuti	Noatak Flats	Seward Peninsula
Mean Adults	1004	15753	1978	275	792	583
Mean Young	570	82	53	86	16	25
% Young	36.2	0.5	2.6	23.8	2.0	4.1

[1] Means based on 2000-2005 at Selawik; 2001-2003, 2006-2007 at Kanuti; and 2003-2004 at Noatak and Seward Peninsula.

Table 5. Abundance of Canada geese during molting surveys in interior/northwest Alaska, 1994-2007 (Bryant 2007, Selawik NWR unpubl. data, Kanuti NWR unpubl. data, Innoko NWR/MBM unpubl. data).

Year	Koyukuk		Innoko		Selawik		Kanuti		Noatak		Seward Peninsula	
	Adults	Young	Adults	Young	Adults	Young	Adults	Young	Adults	Young	Adults	Young
1994	24	36	--	--	--	--	--	--	--	--	--	--
1995	60	6	--	--	--	--	--	--	--	--	--	--
1996	107	166	--	--	--	--	--	--	--	--	--	--
1997	54	97	--	--	--	--	--	--	--	--	--	--
1998	38	31	--	--	--	--	--	--	--	--	--	--
1999	68	128	--	--	--	--	--	--	--	--	--	--
2000	97	91	653	28	5143	82	--	--	--	--	--	--
2001	24	2	4777	40	4077	138	67	54	--	--	--	--
2002	25	28	3903	114	2576	224	87	122	--	--	--	--
2003	41	61	8216	132	1411	138	51	122	469	0	651	21
2004	44	39	4625	35	2803	252	--	--	346	28	753	23
2005	63	84	3153	162	988	217	--	--	--	--	--	--
2006	112	99	6027	144	--	--	203	95	--	--	--	--
2007	21	19	5414	974	--	--	124	190	--	--	--	--
Mean	56	63	4596	204	2833	175	106	117	408	14	702	22

Table 6. Greater white-fronted geese observed during float surveys of 379 river miles on the Dulbi (60), Kaiyuh (176), and Nowitna (143) rivers in interior Alaska, late June-early July, 1996-2007 (Data from J. Bryant, Koyukuk/Nowitna NWR).

	Dulbi River			Kaiyuh River			Nowitna River			Total--379 River Miles		
Year	Adults	Young	Prop. Young	Adults	Young	Prop. Young	Adults	Young	Prop. Young	Adults	Young	Prop. Young
1996	198	207	0.51	50	182	0.78	106	290	0.73	354	679	0.66
1997	352	259	0.42	120	125	0.51	45	187	0.81	517	571	0.52
1998	130	87	0.40	16	38	0.70	159	207	0.57	305	332	0.52
1999	190	201	0.51	138	104	0.43	39	57	0.59	367	362	0.50
2000	409	149	0.27	61	48	0.44	94	168	0.64	564	365	0.39
2001	270	77	0.22	34	3	0.08	100	237	0.70	404	317	0.44
2002	382	248	0.39	53	131	0.71	175	288	0.62	610	667	0.52
2003	164	137	0.46	91	256	0.74	112	261	0.70	367	654	0.64
2004	413	312	0.43	158	23	0.13	77	200	0.72	648	535	0.45
2005	223	253	0.53	32	64	0.67	35	78	0.69	290	395	0.58
2006	187	178	0.49	52	128	0.71	108	363	0.77	347	669	0.66
2007	631	617	0.49	87	155	0.64	91	211	0.70	809	983	0.55
Mean	296	227	0.43	74	105	0.55	95	212	0.69	465	544	0.54

Table 7. Canada geese observed during float surveys of 379 river miles on the Dulbi (60), Kaiyuh (176), and Nowitna (143) rivers in interior Alaska, late June-early July, 1996-2007 (Data from J. Bryant, Koyukuk/Nowitna NWR).

	Dulbi River			Kaiyuh River			Nowitna River			Total--379 River Miles		
Year	Adults	Young	Prop. Young	Adults	Young	Prop. Young	Adults	Young	Prop. Young	Adults	Young	Prop. Young
1996	49	62	0.56	15	95	0.86	66	128	0.66	130	285	0.69
1997	40	48	0.55	14	27	0.66	21	37	0.64	75	112	0.60
1998	22	28	0.56	42	55	0.57	63	127	0.67	127	210	0.62
1999	64	97	0.60	59	27	0.31	74	85	0.53	197	209	0.51
2000	15	26	0.63	49	47	0.49	101	113	0.53	165	186	0.53
2001	42	54	0.56	0	0	--	126	211	0.63	168	265	0.61
2002	34	33	0.49	35	61	0.64	64	60	0.48	133	154	0.54
2003	36	42	0.54	6	28	0.82	61	101	0.62	103	171	0.62
2004	33	34	0.51	0	0	--	53	149	0.74	86	183	0.68
2005	58	89	0.61	0	0	--	22	50	0.69	80	139	0.63
2006	18	28	0.61	11	16	0.59	61	129	0.68	90	173	0.66
2007	26	59	0.69	18	24	0.57	63	123	0.66	107	206	0.66
Mean	36	50	0.58	21	32	0.61	65	109	0.63	122	191	0.61

Table 8. Age-ratio of fall staging white-fronted geese in Delta Junction, Alaska, 2005-2007.

Year	Dates	Mean # Adults	Mean # Juv.	Total Sample	Mean Proportion Juv[1]	Grand Mean Proportion Juv.[2]	Mean Age Ratio[3]	Grand Mean Age Ratio[4]
2005	21-23 Aug.	64	26	812	**0.29**	**0.29**	**0.42**	**0.41**
2006	29-30 Aug.	89	58	4271	**0.41**	**0.40**	**0.72**	**0.65**
2007	30-31 Aug.	69	38	6991	**0.36**	**0.35**	**0.59**	**0.55**

[1] Juveniles/total geese averaged among all flocks
[2] Total juveniles/total geese
[3] Juveniles/adults averaged among all flocks
[4] Total juveniles/total adults

Table 9. Regional subsistence harvest estimates for midcontinent greater white-fronted geese in Alaska (Alaska Migratory Bird Co-Management Council Website 2006; USFWS Koyukuk/Nowitna unpubl. data).

Region	Year(s)	Mean Annual Harvest
Northwest Arctic	1997-1998	2,871
Koyukuk/Nowitna	1998-2002	440
Kanuti	1999-2000	74
Innoko	2000	396
Upper Tanana River	2000	27
Yukon Flats	2000	1,420
North Slope	1992-1993	364
Total		5,592

Table 10. Numbers of midcontinent white-fronted geese leg-banded in interior, northwest, and Arctic Coastal Plain, Alaska, 1969-2007.

Year	Innoko	Kanuti	Koyukuk	Noatak	Arctic Coastal Plain	Selawik	Seward Peninsula
1969	500	0	0	71	0	0	266
1970	0	0	0	0	1170	0	0
1971	0	0	0	0	1527	0	0
1972	0	0	0	0	0	0	0
1973	0	302	761	0	0	0	0
1975	0	0	575	0	761	0	0
1976	0	0	1122	0	1107	0	0
1977	0	0	282	0	981	0	0
1978	0	0	1000	0	1146	0	0
1979	0	0	1102	0	1147	0	0
1980	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0
1982	0	0	0	0	31	0	0
1983	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0
1985	9	0	0	0	0	0	0
1986	545	0	0	0	0	0	0
1987	604	171	0	0	0	0	0
1988	944	56	2	0	0	125	0
1989	22	0	224	0	0	91	0
1990	1158	340	443	0	20	217	0
1991	138	302	0	0	257	25	0
1992	577	0	27	0	255	75	0
1993	686	291	171	0	173	64	0
1994	567	141	451	0	407	196	0
1995	0	73	145	0	0	0	0
1996	0	119	110	0	0	0	0
1997	0	0	289	0	0	0	0
1998	515	0	78	0	2	264	0
1999	168	0	0	0	0	52	0
2000	1082	0	92	0	0	0	0
2001	918	0	132	0	0	257	0
2002	628	0	98	176	0	17	0
2003	1311	13	0	56	790	0	0
2004	976	0	0	182	1274	182	178
2005	1150	0	0	198	921	0	206
2006	1140	0	0	0	1069	0	241
2007	1043	0	0	0	1169	0	0
Total	**14671**	**1808**	**7104**	**683**	**14197**	**1565**	**891**

Table 11. Numbers and locations of recaptured midcontinent white-fronted geese during banding operations in interior, northwest, and North Slope Alaska, 1971-2007.

	Recapture Location						
Banding Location	Innoko	Kanuti	Koyukuk	Noatak	N. Slope	Selawik	Seward
Innoko NWR	979	0	12	1	2	0	1
Kanuti NWR	0	292	0	0	1	0	0
Koyukuk NWR	5	0	362	2	2	3	0
Noatak NP	11	0	0	35	0	0	0
North Slope	1	0	0	0	905	0	9
Selawik NWR	1	0	3	3	0	4	0
Seward Peninsula	0	0	0	0	0	0	32
Total Recaptures	997	292	377	41	910	7	42
Proportion recaptured in original banding area (by area)	0.982	1.000	0.960	0.854	0.995	0.571	0.762
Proportion recaptured in original banding area (total)	**0.98**						
Proportion of recaptures on same side of the Brooks Range where originally banded	**0.99**						

Table 12. Numbers and locations of recaptured midcontinent white-fronted geese during banding operations in interior, northwest, and North Slope Alaska, 2004-2007.

	Recapture Location				
Banding Location	Innoko	Noatak	N. Slope	Selawik	Seward
Innoko NWR	262	0	0	0	1
Noatak NP	4	7	0	0	0
North Slope	1	0	41	0	9
Selawik NWR	0	2	0	0	0
Seward Peninsula	0	0	0	0	32
Total Recaptures	267	9	41	0	42
Proportion recaptured in original banding area (by area)	0.981	0.778	1.000	--	0.762
Proportion recaptured in original banding area (total)	**0.95**				
Proportion of recaptures on same side of the Brooks Range where originally banded	**0.96**				