Midcontinent Greater White-fronted Goose Banding in Alaska, 2016

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The mid-continent population of greater white-fronted geese (*Anser albifrons frontalis*) breeds in tundra habitats from the eastern shore of Hudson Bay to the west coast of Alaska and south into boreal forests and taiga of interior and northwest Alaska (Ely and Dzubin 1994). A banding program for greater white-fronted geese was initiated in the early 1960s to address the scarcity of harvest distribution data and lack of survival rate estimates. In Alaska, the banding program resulted in research partnerships with the University of Alaska, the U.S. Geological Survey, the University of Chihuahua, several National Wildlife Refuges (NWR), and the Division of Migratory Bird Management (MBM). Since 1969, more than 50,000 mid-continent greater white-fronted geese have been banded in major molting areas in interior, northwest, and Arctic Coastal Plain (ACP) of Alaska (Figures 1, 2 and 4, Appendix 3).

The harvest strategy employed in the management plan for mid-continent greater white-fronted geese was modified in 2015 to incorporate a combination of a fall inventory survey and harvest rate estimates that rely on annual banding programs (Sullivan 1998, updated in 2015). Estimates of midcontinent greater white-fronted goose harvest rate in interior Alaska exceeded 6% in some years in the late 1990s (Dooley 2016), the level that is currently used as a trigger for management restrictions (Sullivan 1998, updated in 2015) emphasizing the need for annual banding within each major geographic unit of the species range. Moreover, estimates of survival and recovery rate differ among regional sites (Dooley 2016) indicating the importance of geographic representation of the broad breeding distribution of this population.

In addition to monitoring survival and harvest rate, annual banding in combination with collar resighting and radio and satellite telemetry results have helped discover and verify flyway corridors, migration timing, and wintering areas used by mid-continent greater white-fronted geese that breed in Alaska (Ely et al. 2013). Further, band return analyses showed that geese in interior and northwest Alaska segments of the midcontinent population differ from those breeding in tundra habitats of Canada and Alaska, demonstrated by earlier initiation of autumn and spring migration, use of unique wintering areas in Mexico, and lower annual survival (Ely and Schmutz 1999, Spindler et al. 1999). For these reasons, annual banding activities are recommended in the Midcontinent Greater White-fronted Goose Management Plan (Sullivan 1998, updated in 2015) to assess population size and survival, and to monitor harvest rate and geographic and temporal distribution of the harvest.

A minimum annual sample of 1,000 banded white-fronts in interior/northwest Alaska over 10 years is needed to ensure a 90% chance of detecting a 5% difference in survival rate (Schmutz 2001; but see Future Banding section).

Hence, MBM has sought to band a minimum of 1,000 greater white-fronted geese annually in interior Alaska and from 2003-2011, an equal number on the ACP. Interior Alaska banding sites at Koyukuk-Nowitna and Selawik NWR have not been visited since 2002 and 2005, respectively, because of the paucity of large molting flocks and concern about disturbance to these small populations. Geese in Kanuti NWR, in interior Alaska, were banded in 1973-96, but few large flocks of have been observed there in subsequent years and were only banded in 2003 when satellite transmitters were installed. In 2002, the lower Noatak River Delta in northwestern Alaska was added to the banding locations as was the Seward Peninsula in 2004. However, small numbers of trappable geese in these and other historical banding areas make these locations difficult to band. Neck collars were used for many years to mark a portion of the banded population but have not been deployed since 2002 (except for VHF radio-collar studies in 2002, 2003 and 2008). Satellite transmitters were implanted into GWFG in 2001-2003 (42 in interior Alaska and 9 on the ACP) to further examine migration and staging (Webb 2006).

In 2016, our objective was to band a minimum of 1,000 GWFG in interior Alaska, specifically in the Innoko NWR. In an effort to evaluate annual survival rates in relation to body condition, timing and stage of molt, MBM has recorded morphometric body measurements on a subsample of white-fronts beginning in 2015. This effort was continued in 2016.

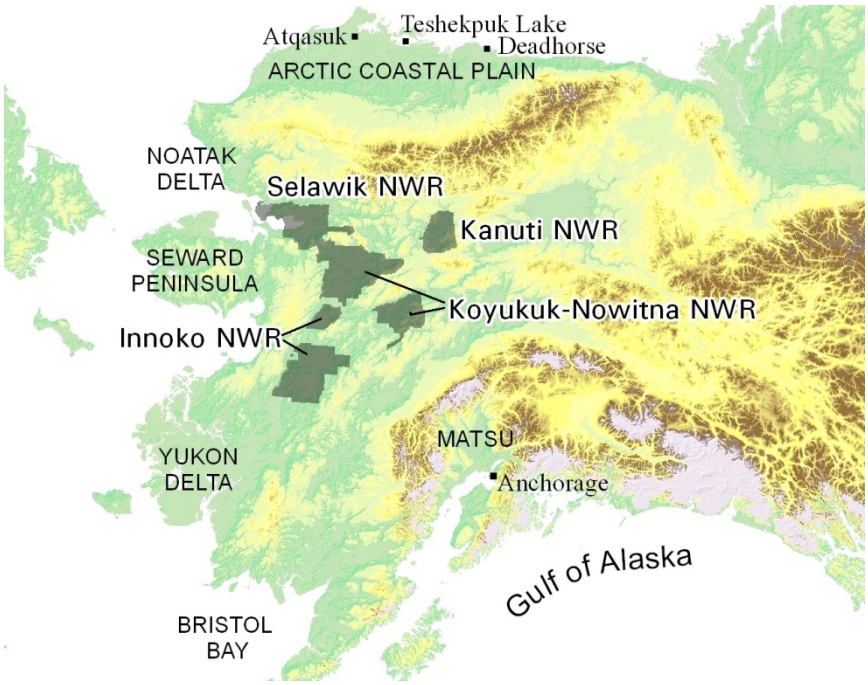

Figure 1. Location of past and current Migratory Bird Management, Anchorage, greater white-fronted goose banding areas in Alaska.

2016 Itinerary

Tuesday, July 5
In Anchorage. Unable to depart due to weather.

Wednesday, July 6
Travel/prep day. All Anchorage aircraft and personnel to Innoko Field Camp via Fairbanks. Plan crew logistics, prep aircraft and capture gear and safety meeting. Overnight at Innoko Field Camp.

Thursday, July 7
Banding at Innoko. Refuge personnel arrive from Galena, Alaska. Banded "W Lake" and one lake on the western side of banding area. Overnight at Innoko Field Camp.

Friday, July 8
Banding at Innoko NWR. Banded one lake site on the western side of banding area. Galena personnel return Galena. All others overnight at Innoko Field Camp. Clean, repair and stow gear.

Saturday, July 9
Travel day. Tule goose telemetry and camera testing flights in morning. Anchorage crews return to Anchorage via Fairbanks.

Personnel and Duties

Julian Fischer (FWS MBM Anchorage) Project coordinator, bander
Heather Wilson (FWS MBM Anchorage) Pilot, bander
Brad Shults (FWS MBM Anchorage) Pilot, bander

Brad Scotton (FWS Koyukuk-Nowitna-Innoko NWR) Pilot, bander
Jim Wittkop (OAS Anchorage) Pilot, bander
Tamara Zeller (FWS MBM Anchorage) Bander
Dennis Marks (FWS MBM Anchorage) Banding schedules
Alison Williams (FWS MBM Anchorage) Bander
Erik Osnas (FWS MBM Anchorage) Bander

METHODS

Trapping. MBM protocol for trapping geese consists of locating a flock of molting geese on a lake or river that is deep and wide enough for aircraft maneuvers, with suitable shoreline for trap setup (dry, flat and shaded), and with mild winds (ideally, having the most difficult portion of the drive into the wind but with not too long a swim against it). In 2016, lake water levels were average and we trapped on lakes, as opposed to 2015 when most geese were located on the Iditarod River due to low water levels on lakes throughout the area. We used one float-equipped Piper Supercub, two Cessna 206s on amphibious floats and one float-equipped Found Bush Hawk to locate and drive geese.

During setup, which took 20 to 30 minutes, one plane remained in the air to keep geese flocked up on the water and to herd disparate flocks together. A capture pen was set up with heavy netting about 15-20 feet in diameter around a group of trees so it was hidden and trees afforded some shade and security to captured geese. Two nylon mesh lead nets were deployed from both sides of the pen and lead to the shoreline. The long lead was set down the beach in the direction the geese were approaching, and a short lead, running from the capture pen perpendicular to the shore out into the water. The bottom edge of the pot net and the leads were staked down so geese could not escape underneath.

When setup was complete, the ground crew boarded aircraft, departed, landed and taxied behind the flock to begin moving geese toward the trap. The Supercub remained in the air to direct the operation and keep geese from going onshore prematurely. One or two crew members remained hidden on the ground near one or both ends of the leads ready to reveal themselves if geese came to shore beyond the end of either lead (only if instructed to do so by pilots, via hand held radio, as it is critical that persons on the shore not be seen by geese). Geese were driven to shore with aircraft and crew exited the aircraft and moved the flock into the pen on foot, taking care not to drive them too fast or too slow. After the capture pen entrance was closed, several crew members moved to the outside of the net to keep geese from bunching up on one side which can cause injury and overheating, while others set up the banding station. Crews avoided placing the banding station too close to the catch pen, as human movement and noise increase stress to geese. An evaluation is necessary to decide whether or not some of the geese need to be released immediately. In good conditions (cool, dry with shade and sufficient banders), approximately 500 geese is the maximum number that should be kept in the net during processing. Excess geese are released immediately upon capture.

Banding. Banders carefully closed the ends of a size 7B USGS metal leg band together squarely and smoothly. Bands wear more evenly if applied round and can rotate freely. Banders read band numbers to a data recorder who read back the data to verify accuracy. Sex was determined via cloacal exam; age was determined through plumage characteristics. Location coordinates, date, time, presence of brood patches or injuries, and other relevant observations were recorded. Prior to banding geese, all obstacles were removed between the banding site and lake shore (planes, equipment etc.) and leads are positioned to direct birds back into the water where they can cool off and flock up. Data were imported directly into BBL banding software, processed, checked and e-mailed to USGS Bird Banding Laboratory. MBM banding permit must be renewed every 3 years. The project was reviewed and approved by a Region 7 USFWS Institutional Animal Care and Use Committee (IACUC number 2016-010).

RESULTS and DISCUSSION

Banding sites were located in an established banding area near the confluence of the Iditarod and Innoko rivers where spring flooding recharges waterbodies creating productive molt habitat to large numbers of geese in the Innoko NWR (Figure 1; Appendix 1 for location details). Geese are found on both lakes and rivers, but lakes are preferred by geese when water levels are adequate, and as banding sites due to ease of operations for float plane maneuvers. However, in some years low lake water levels require that capture operations occur on banks of rivers and sloughs. Unlike 2015 when lakes were almost 2m lower than the previous year and most molting geese were located on the Iditarod River, in 2016 lake water levels were average and attracted large flocks of geese and enabled aircraft to maneuver. With a seasoned and well organized crew, another successful banding effort was completed in 2016. The goal to band a minimum of 1,000 geese in interior Alaska was met (Table 1). With two days of banding and two days of travel and preparation, 1,265 greater white-fronted geese were captured from three sites in interior Alaska: 1123 newly banded and 140 previously banded geese were recorded (Tables 1 and 2).

In 2016, second-year (SY) greater white-fronted geese made up 33% of all newly banded geese for all areas, higher than the previous 15 years and the 15-year mean of 21% (2002-2016, Table 3) . Fifty-six percent of newly banded greater white-fronted geese were male, virtually the same as the 15-year mean. All bands used were size 7B; no geese had tarsi large enough to require a size 8 band even though one bird appeared to be a tule white-fronted goose (*A.a. gambelli*).

TABLE 1. Summary of newly banded greater white-fronted geese in 2016 for all banding sites in interior Alaska by location, date, age and sex.

		7 July		8 July	
		Site 1	Site 2	Site 3	Total
After Second Year	**Total**	**319**	**66**	**367**	**752**
	Female	141	25	139	305
	Male	178	41	228	447
Second Year	**Total**	**173**	**16**	**182**	**371**
	Female	88	11	95	194
	Male	85	5	87	177
Total		**494**	**82**	**549**	**1123**

Recaptures

Of the 1,265 greater white-fronted geese handled in 2016, 140 were previously banded birds (Table 2) comprising 11% of the total, higher than the 8% average for the past 15 years, but similar to years when only geese in Innoko NWR was banded (2012-2016, Table 3). No overly worn bands were observed or replaced in 2016.

TABLE 2. Numbers of recaptured greater white-fronted geese for each banding site for geese captured in the 2016 banding effort in interior Alaska.

	7 July		8 July	
	Site 1	Site 2	Site 3	Total
Female	36	1	14	51
Male	46	5	37	88
Unknown			1	1
Total	82	6	52	140

TABLE 3. Summary of newly banded and recaptured greater white-fronted geese by year for all Migratory Bird Management banding sites combined in Alaska 2002-2016. In 2012-2016, only Innoko NWR was visited.

	New Bands			Recaps		
Year	**# New bands**	**% SY**	**% Male**	**# recaps**	**% recaps**	**% Male**
2002	909	18	57	41	4	61
2003	2131	15	57	120	5	53
2004	2797	17	55	202	7	50
2005	2475	17	57	228	8	55
2006	2261	26	56	174	7	56
2007	2212	23	55	124	5	56
2008	2267	19	59	113	5	60
2009	2026	18	57	120	6	73
2010	2014	22	57	133	6	65
2011	2095	24	60	127	6	64
2012	1110	23	60	129	10	67
2013	1198	25	61	190	14	65
2014	1087	15	52	78	7	68
2015	965	21	62	155	14	72
2016	1123	33	56	140	11	62
15-yr mean	**1778**	**21**	**57**	**138**	**8**	**62**

Since 1941, over 10,000 recoveries of greater white-fronted geese banded in Alaska have been reported (Figure 2). Band returns from geese banded in Alaska have demonstrated a high degree of molting site fidelity and only a very limited degree of mobility between interior and North Slope populations. With few exceptions, greater white-fronted geese recaptured in Innoko and the ACP were originally banded in those locations.

Distribution of Recoveries

From band returns over the past several decades, it is known that birds from both Innoko and ACP molting areas have been hunted in more than 20 U.S. states, several Canadian provinces and territories and Mexico. For Innoko banded birds, 2000-2015, recoveries in Alberta, Texas, Saskatchewan and Mexico together accounted for about 77% of all greater white-fronted geese reported by hunters (Figure 3). While banding in Innoko NWR is focused on the mid-continent population, approximately 10% of recoveries occur in the Pacific Flyway.

Survival, Recovery, and Harvest Rate

A recent analysis by Dooley (2016) indicated that of the four major banding regions for mid-continent greater white-fronted geese (Eastern-Central Canada, Western Canada, North Slope Alaska, and Interior Alaska), the interior region had the lowest survival rate over the last 10-year period (0.783 [SE=0.010]), although the 95% confidence limits (0.764-0.801) overlapped those of the other regions except for Eastern-Central Canada (0.819-0.845). Recovery rate of midcontinent greater white-fronted geese from Interior Alaska during the same time period was 0.031 (SE=0.001, 95% CI=0.029-0.0345). Adult harvest hate, assuming a 0.75 reporting rate, was 0.041 (SE=0.002, 95% CI=0.038-0.045). This harvest rate estimate is below the 6% criteria, above which would result in a call for more restrictive harvest regulations per the revised management plan (Sullivan 1998, updated in 2015).

Injury, mortality

From telemetry performed in 2008, we now know that some of the geese that appear healthy upon release die soon after banding (Fischer 2010). Time spent in the pen prior to banding is likely related to survival (Schmutz et al. 2013, Schmutz and Ely 1999) and from past experience, unless conditions are ideal, having more than 500 geese in one pen, particularly at the Innoko sites where temperatures can be high, may increase the chance of injury and overheating. Limiting the number in the pen to around 500, setting up capture pens in dry and shaded sites, stationing observers around the capture pen to discourage concentrations of birds, and corralling processed birds directly back into lakes upon release and immediate removal of Canada geese from the pen, birds remain healthy upon release. Risk to geese is one important factor when deciding to retain the maximum number of geese and finish banding or to release more geese and conduct an additional drive. This decision will largely be dictated by weather, length of the drive and other factors just mentioned. In 2016, with ideal weather and site conditions and about 500 birds needed to finish, slightly more than 500 were retained and banded. One bird died during the 2016 banding effort.

Serious injury to the leg can result from installing too small a band. The tule white-fronted, a larger subspecies found in small numbers in western Alaska, and a very few large *frontalis*, require a size 8 band (inside diam.11/16") instead of the 7B band (inside diam.17/32") generally used. In 2016, no geese required a larger band.

Body Measurements

In an effort to evaluate annual survival rates in relation to body condition, and timing and stage of molt, we began conducting morphometric body measurements on a subsample of white-fronts in 2015. We again measured body mass and length of head, culmen, tarsus and ninth primary in 2016 (Appendix 5). This effort will be continued in future years.

Reporting Bands

The Bird Banding Lab, Patuxent Wildlife Research Center in Laurel, MD is encouraging all banders to publicize their web site reporting capability at: http://www.reportband.gov. People with recovered bands receive instant feedback through the site and receive a confirmation e-mail acknowledgement. The site also gives people the choice of receiving a band recovery certificate by e-mail rather than standard postal service.

Future Banding

In addition to the current focus on interior Alaska white-front banding, there may soon be a need to expand the Alaska effort. Prior to 2016, harvest management within the Central and Mississippi flyways was based solely on the prairie Canada fall survey. This survey may, at some point, become unreliable due to changing distributions and may not reflect changes in manageable subunits (Sullivan 1998, updated in 2015). In contrast, band recovery data provide consistent information to assess annual survival, harvest rates, temporal and geographic distribution of the harvest, and population size; banding data provide a means to assess the overall success of population management and can be applied at regional scales (Sullivan 1998, updated in 2015). According to the 2015 management plan, future white-fronted goose monitoring “will require banding a representative sample of geese on their breeding grounds in northern Canada and Alaska each year”. Further, “banded samples should be adequate to provide statistically valid results and have sufficient distribution across breeding areas if analyses (e.g., harvest, survival) are intended to represent the whole MCWFG population” (Sullivan 1998, updated in 2015). A recent banding allocation assessment by Dooley (2016) indicated that a 6% in change in annual survival of Interior Alaska greater white-fronted geese over a 5-year period could be detected with a confidence level of 90% if at least 500 geese are banded per year. A 4% change in survival over the same time period and confidence level would require greater than 2,000 geese banded per year. This level of banding would increase the cost of

the Interior Alaska banding effort by approximately 50%. At the present time, the banding goal for greater white-fronted geese in Interior Alaska will remain at 1,000 geese.

Acknowledgements

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Citations

Dooley, J. 2016. Midcontinent greater white-fronted goose survival analysis, banding allocation, and harvest potential. Unpubl. interim report for the Central Flyway Technical Committee, U.S. Fish and Wildlife Service, Vancouver WA.

Ely, C.R., Nieman, D.J., Alisauskas, R.T, Schmutz, J.A. and J.E. Hines. 2013. Geographic Variation in Migration Chronology and Winter Distribution of Midcontinent Greater White-Fronted Geese. The Journal of Wildlife management 77(6):1182-1191.

Ely, C.R. and A.X. Dzubin. 1994. Greater White-fronted Goose (*Anser albifrons*) *In* The Birds of North America, No. 131 (A. Poole and F. Gill, *Eds*.). The Academy of Natural Sciences, Philadelphia; and.: The American Ornithologists' Union, Washington, D.C. 31pp.

Ely, C.R. and J.A. Schmutz. 1999. Characteristics of midcontinent greater white-fronted geese from interior Alaska: distribution, migration ecology and survival. Unpubl. USGS report submitted to the Central Flyway Technical Committee.

Fischer, Julian B. 2010. Midcontinent greater white-fronted geese in Alaska – 2009 project updates. U.S. Fish and Wildlife Service, Migratory Bird Management, Waterfowl Management, Anchorage, Alaska

Schmutz, J. A., and C.R. Ely. 1999. Survival of greater white-fronted geese: Effects of year, season, sex and body condition. Journal of Wildlife Management 63:1239-1249.

Schmutz, Joel A., Julian B. Fischer, Heather M. Wilson, Craig R. Ely, Daniel M. Mulcahy, Dennis K. Marks. 2013. Adult Survival of Greater White-fronted Geese: Ecosystem Differences or Handling Effects? In Review. USGS Alaska Science Center, Anchorage, Alaska.

Schmutz, J. A. 2001. Memorandum regarding Sample sizes needed for monitoring survival with a banding program, 3 January 2001, USGS, Alaska Biological Science Center.

Spindler, M. A., J. M. Lowe, and J. Y. Fujikawa. 1999. Trends in abundance and productivity of white-fronted geese in the taiga of northwest and interior Alaska. Unpubl. report for the Central Flyway Technical Committee.

Sullivan, B. 1998, updated in 2015. Management plan for midcontinent greater white-fronted geese. Central Flyway Waterfowl Technical Committee. Denver, CO.

Webb, D. D. 2006. Temporal and spatial distribution of interior Alaska white-fronted geese (Anser albifrons frontalis) during fall migration and winter staging. M. S. Thesis, University of Alaska, Fairbanks.

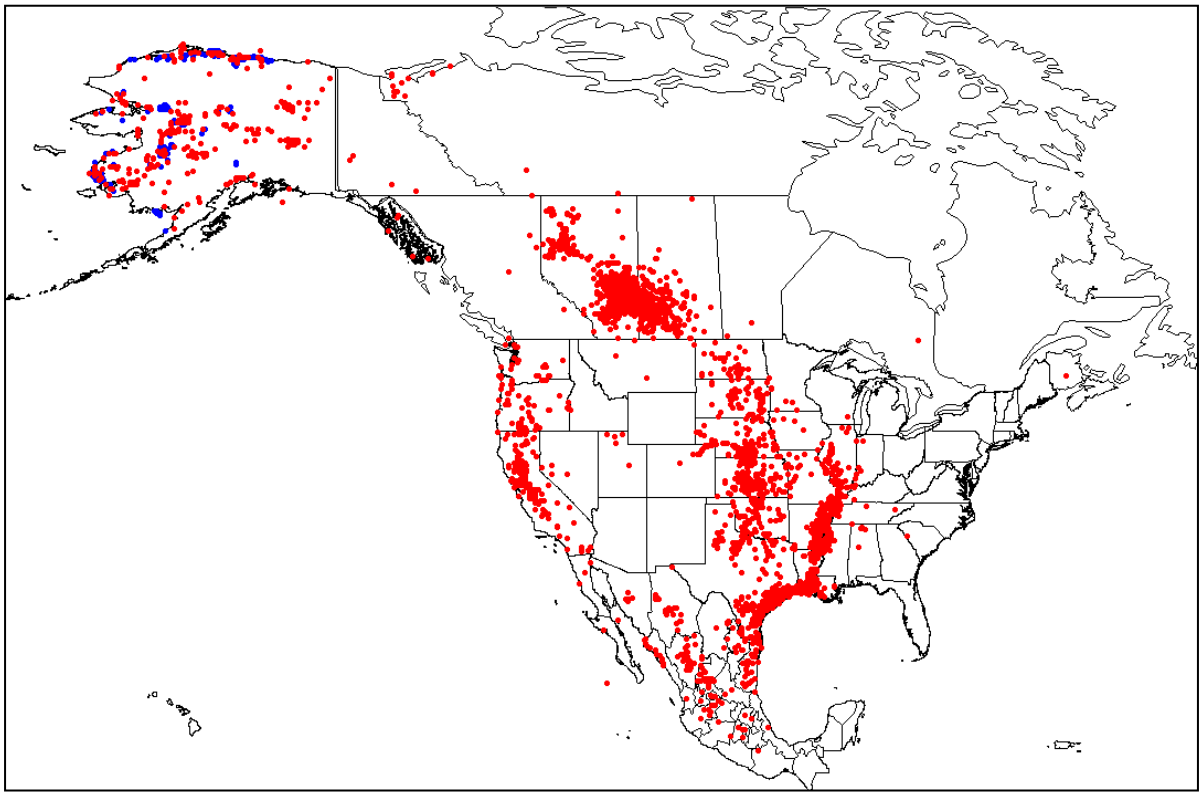
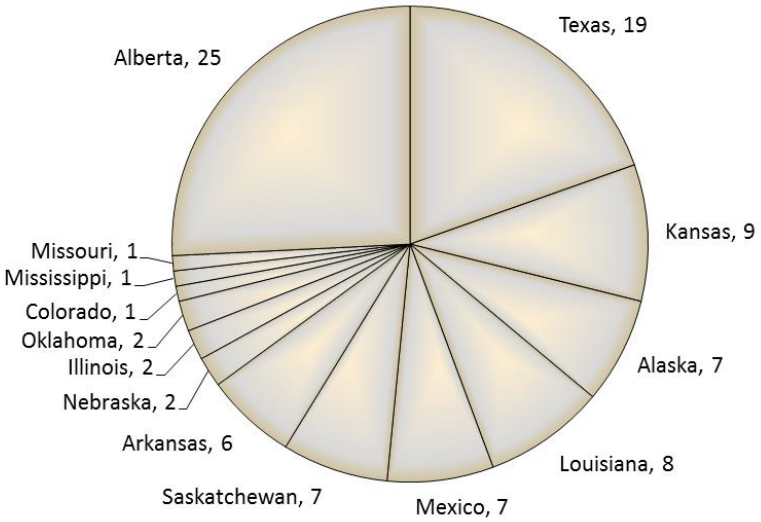


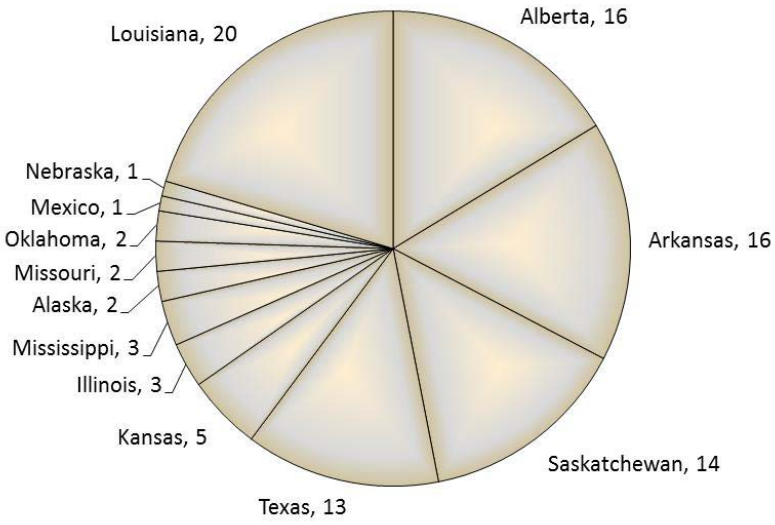
Figure 2. Distribution of recoveries of all greater white-fronted geese banded in Alaska, midcontinent and Pacific populations, 1941 to 2016. Banding locations in blue; individual recovery locations, red (n=10,791 recoveries). Data from Game Bird encounters database, USGS Bird Banding Laboratory, Pautuxant, MD.

Interior & Northwest Alaska



State/Province	Percent
Alabama	0.11
British Columbia	0.22
Indiana	0.06
Iowa	0.17
Kentucky	0.22
Minnesota	0.06
Montana	0.11
New Brunswick	0.06
North Dakota	0.44
Ontario	0.06
South Carolina	0.06
South Dakota	0.50
Tennessee	0.17

Arctic Coastal Plain Alaska



State/Territory	Percent
Alabama	0.06
California	0.06
Colorado	0.06
Indiana	0.24
Iowa	0.12
Kentucky	0.24
Minnesota	0.12
Montana	0.06
North Dakota	0.36
Northwest Territories	0.30
South Dakota	0.54
Tennessee	0.54

Figure 3. Distribution of recoveries of greater white-fronted geese banded in interior and arctic coastal plain, ACP, Alaska, 2000-2015. Numbers indicate percent of harvest by state or province. Table lists those with <1% of total harvested. N=1,802 birds reported for Interior and 1,657 for ACP; data from GameBirds encounter database, USGS Bird Banding Laboratory, Patuxent, MD, June 2015.

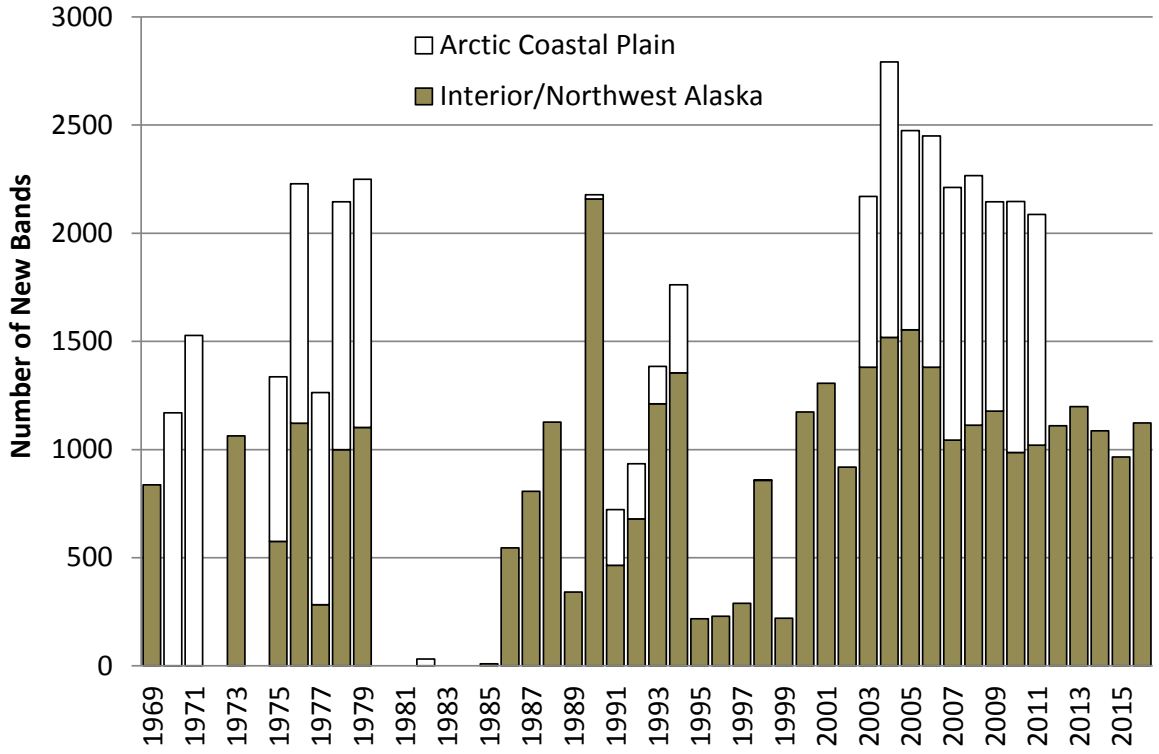


Figure 4. Numbers of greater white-fronted geese banded each year by region, Arctic Coastal Plain and interior and northwest Alaska. Migratory Bird Management (MBM), USFWS Region 7, Alaska, 1969-2016.

APPENDIX 1. Banding locations for all interior Alaska banding sites in the 2016 USFWS banding effort.

Date	Site	Bandit Map Description	Dec Deg		Deg Min Sec	
7-Jul	"W" Lake	~50 mi NE Shageluk, Alaska	63.15599	158.56551	63 9' 22"	158 33' 56"
7-Jul	Lake 2	~50 mi NE Shageluk, Alaska	63.10437	158.7912	63 6' 16"	158 47' 28"
8-Jul	Lake 3	~50 mi NE Shageluk, Alaska	63.09524	158.70545	63 5' 43"	158 42' 20"

APPENDIX 2. Summary of Migratory Bird Management GWFG Banding Projects in Alaska 1997–2016.

1997 - FWS aluminum leg bands and neck collars installed. Koyukuk only.
1998 - FWS aluminum leg bands and neck collars installed. Innoko, Koyukuk and Selawik.
1999 - FWS aluminum leg bands only. Innoko and Selawik
2000 - FWS aluminum leg bands and neck collars installed. Innoko and Koyukuk.
2001 - FWS aluminum leg bands, satellite implants (Innoko 6, Koyukuk 3, Selawik 3), avian cholera: throat swabs (*Pasteurella multocida* carrier) and blood samples (for antibodies, prior exposure).
2002 - FWS aluminum leg bands and neck collars installed, satellite implants (Innoko 10, Koyukuk 3, Selawik 4, Noatak 5), VHF radio collars, blood samples and throat swabs (see above).
2003 – Interior/NW: aluminum leg bands, satellite implants (Kanuti 4, Noatak 4), VHF radio collars (Ely USGS only), subcutaneous VHF radio implants (17 at Noatak), blood/throat swabs.
ACP**:** First ACP banding since 1994, to supplement satellite data and expand survival estimates. Satellite implants (9), blood/throat swabs for cholera testing.
2004 - FWS aluminum leg bands only. Innoko, Noatak, Selawik, Seward Peninsula and ACP.
2005 - FWS aluminum leg bands only. Innoko, Noatak, Seward Peninsula and ACP.
2006 - FWS aluminum leg bands and avian influenza sampling (cloacal swabs). Innoko, Seward Peninsula and ACP.
2007 - FWS aluminum leg bands and avian influenza sampling (cloacal and oral-pharyngeal swabs). Innoko and ACP.
2008 - FWS aluminum leg bands, AI sampling (cloacal and oral-pharyngeal swabs plus blood); 200 capture survival birds measured, bled, and 200 radio collars installed. Innoko and ACP.
2009 - FWS aluminum leg bands, AI sampling (cloacal and oral-pharyngeal swabs plus blood); 449 birds swabbed, 199 bled. Innoko and ACP.
2010 - FWS aluminum leg bands, AI sampling (cloacal and oral-pharyngeal swabs plus blood); 371 birds swabbed, 195 bled. Innoko and ACP.
2011 - FWS aluminum leg bands only. Innoko and ACP. No H5N1 detected in AK; AI sampling terminated post 2010.
2012 - FWS aluminum leg bands only. Innoko only.
2013 - FWS aluminum leg bands only. Innoko only.
2014 - FWS aluminum leg bands only. Innoko only.
2015 - FWS aluminum leg bands only. Innoko only. Sample of morphometric measurements taken.
2016 - FWS aluminum leg bands only. Innoko only. Sample of morphometric measurements taken.

APPENDIX 3 . Summary of all greater white-fronted geese banded by MBM in Alaska by region, 1969-2016. Numbers are totals of new bands reported. Excluded are 1 goose from Yukon Flats NWR and 23 from the Tanana-Kuskokwim region banded 1960-64. Data from Bird Banding Lab database, Patuxent Wildlife Research Center.

	Innoko	Kanuti	Koyukuk	Noatak	ACP	Nowitna	Selawik	Seward Peninsula	Total
1969	500			71				266	**837**
1970					1170				**1170**
1971					1527				**1527**
1972									**0**
1973		302	761						**1063**
1974									**0**
1975			575		761				**1336**
1976			1122		1107				**2229**
1977			282		981				**1263**
1978			1000		1146				**2146**
1979			1102		1147				**2249**
1980									**0**
1981									**0**
1982					31				**31**
1983									**0**
1984									**0**
1985	9								**9**
1986	545								**545**
1987	604	171				32			**807**
1988	944	56	2				125		**1127**
1989	22		224			4	91		**341**
1990	1158	340	443		20		217		**2178**
1991	138	302			257		25		**722**
1992	577		27		255		75		**934**
1993	686	291	171		173		64		**1385**
1994	567	141	451		407		196		**1762**
1995		73	145						**218**
1996		119	110						**229**
1997			289						**289**
1998	515		78		2		264		**859**
1999	168						52		**220**
2000	1082		92						**1174**
2001	918		132				257		**1307**
2002	628		98	176			17		**919**
2003	1311	13		56	790				**2170**
2004	976			182	1274		182	178	**2792**
2005	1150			198	921			206	**2475**
2006	1140				1069			241	**2450**
2007	1043				1169				**2212**
2008	1113				1154				**2267**
2009	1178				968				**2146**
2010	987				1160				**2147**
2011	1020				1067				**2087**
2012	1110								**1110**
2013	1198								**1198**
2014	1087								**1087**
2015	965								**965**
2016	1123								**1123**
Total	**24,462**	**1,808**	**7,104**	**683**	**18,556**	**36**	**1,565**	**891**	**55,105**

APPENDIX 4. Summary of banding permittees in Alaska, by banding location and year, 1969-2016. Key to permit office abbreviations, next page. From Bird Banding Lab database, Patuxent Wildlife Research Center, Laurel, MD.

	Innoko	Kanuti	Koyukuk	Noatak	ACP	Nowitna	Selawik	Seward Pen
1969	JUN			JUN				JUN
1970					JUN			
1971					JUN			
1972								
1973		JUN	JUN					
1975			JUN		JUN			
1976			JUN		JUN			
1977			JUN		JUN			
1978			JUN		JUN			
1979			JUN		JUN			
1980								
1981								
1982					JUN			
1983								
1984								
1985	INN							
1986	INN							
1987	INN	KAN				NOWI		
1988	INN/SEL	KAN	SEL				SEL	
1989	INN		KOY			NOWI	SEL	
1990	INN/USGS	KAN	KOY		FAI		SEL	
1991	INN	KAN			ANC/USGS		SEL	
1992	INN		KOY		ANC/FAI		SEL	
1993	ANC	KAN	ANC		ANC/TROY		ANC	
1994	ANC	KAN	ANC		ANC		SEL	
1995		KAN	KOY					
1996		KAN	KOY					
1997			FAI					
1998	FAI		FAI		HEL		FAI	
1999	ANC						ANC	
2000	ANC		ANC					
2001	ANC		ANC				ANC	
2002	ANC/USGS		ANC	ANC			ANC	
2003	ANC/USGS	ANC		ANC	ANC			
2004	ANC			ANC	ANC		ANC	ANC
2005	ANC			ANC	ANC			ANC
2006	ANC				ANC			ANC
2007	ANC				ANC			ANC
2008	ANC				ANC			ANC
2009	ANC				ANC			
2010	ANC				ANC			
2011	ANC				ANC			
2012	ANC							
2013	ANC							
2014	ANC							
2015	ANC							
2016	ANC							

APPENDIX 4 (continued). Key to abbreviations for table of summary of GWFG banding in Alaska, by region and permittee. From Patuxent Wildlife Research Center, Laurel, MD.

Permit Holder	
ANC	MBM Anchorage
FAI	MBM Fairbanks
USGS	USGS Alaska Science Center
INN	Innoko NWR
JUN	MBM Juneau
ADFG	Alaska Fish and Game
YD	Yukon Delta NWR
SEL	Selawik NWR
B	Alaska Pen/Becherof NWR
KAN	Kanuti NWR
KOY	Koyukuk NWR
NOWI	Nowitna NWR
T	Togiak NWR
TROY	Troy Ecological Research
LEN	Cal Lensink
HEL	James Helmericks

APPENDIX 5. Morphometric measurements of greater white-fronted geese from 2016 banding effort at Innoko NWR. Weight is in KG, lengths in mm.

Band Number	Band	AGE	SEX	Date	Site	Culmen	Tarsus	9th prim	Weight	Remarks
209706614	Recap	ASY	M	07/07/16	A	57.3	77.1	177	2.33	
209706908	Recap	ASY	M	07/07/16	A	55.4	77.1	189	2.28	
209707564	Recap	ASY	M	07/07/16	A	55.7	76.5	160	2.08	
209707895	Recap	ASY	M	07/07/16	A	52.9	78.1	102	2.25	
209707949	Recap	ASY	F	07/07/16	A	52.1	76.0	156	2.07	Brood patch
209708978	Recap	ASY	M	07/07/16	A	59.8	78.2	163	2.23	
209709000	Recap	ASY	M	07/07/16	A	56.1	76.4	187	2.32	
209771736	New	ASY	F	07/07/16	A	51.0	72.2	149	2.06	Brood patch
209771906	New	SY	F	07/07/16	A	54.8	72.0	147	1.94	
209771922	New	ASY	M	07/07/16	A	57.6	78.0	165	2.33	
209771925	New	SY	F	07/07/16	A	51.7	75.5	151	1.88	
209771930	New	SY	F	07/07/16	A	52.6	73.3	161	1.97	
209771935	New	ASY	M	07/07/16	A	54.3	77.0	90	2.08	
209771936	New	ASY	M	07/07/16	A	59.8	76.0	115	2.16	
209771942	New	SY	F	07/07/16	A	48.7	69.2	160	1.71	
209771943	New	SY	M	07/07/16	A	57.3	82.0	167	2.24	
209771947	New	ASY	M	07/07/16	A	54.8	75.0	163	2.18	
209771953	New	ASY	F	07/07/16	A	55.1	75.6	153	2.01	
209771957	New	ASY	M	07/07/16	A	53.0	76.0	168	2.18	
209771965	New	SY	M	07/07/16	A	57.0	73.8	159	2.26	
209771979	New	SY	F	07/07/16	A	54.5	69.9	157	1.82	
209772006	New	SY	F	07/07/16	A	53.6	77.5	157	1.96	
209772035	New	ASY	F	07/07/16	A	50.8	74.6	123	2.00	
209772070	New	SY	F	07/07/16	A	50.3	66.5	134	1.95	
209772073	New	SY	M	07/07/16	A	50.0	77.4	93	2.19	
209772091	New	ASY	M	07/07/16	A	57.7	76.3	140	2.40	
209772092	New	ASY	M	07/07/16	A	57.9	78.6	123	2.19	
209772097	New	ASY	M	07/07/16	A	55.5	75.0	177	2.25	
209771924	New	ASY	M	07/07/16	A	55.6	79.4	176	2.19	
209771933	New	ASY	F	07/07/16	A	53.6	74.6	123	2.25	
209771950	New	ASY	M	07/07/16	A	59.7	76.0	31	2.56	
209771988	New	SY	F	07/07/16	A	52.0	72.0	150	1.99	
209771720	New	ASY	M	07/07/16	A	54.3	78.7	166	2.21	
209771774	New	ASY	M	07/07/16	A	54.0	78.6	180	2.38	
209771769	New	ASY	M	07/07/16	A	55.0	72.4	126	2.12	
209771787	New	ASY	M	07/07/16	A	52.7	7.3	163	1.96	
193771126	Recap	ASY	M	07/07/16	A	56.4	77.6	188	2.43	
209771750	New	ASY	M	07/07/16	A	57.2	73.1	90	2.30	
209771753	New	ASY	M	07/07/16	A	57.0	77.0	112	2.16	
209771797	New	SY	M	07/07/16	A	51.7	69.6	161	2.11	
209771793	New	ASY	M	07/07/16	A	54.5	79.5	100	2.44	
209771794	New	ASY	M	07/07/16	A	59.6	75.4	184	2.12	
209771757	New	ASY	M	07/07/16	A	52.0	71.3	145	2.06	
209771748	New	ASY	M	07/07/16	A	54.8	75.9	141	2.18	
209771735	New	ASY	M	07/07/16	A	53.3	73.9	176	2.02	
209771740	New	ASY	M	07/07/16	A	51.8	71.4	152	1.94	
209771781	New	ASY	F	07/07/16	A	49.2	86.2	177	1.81	
209708484	Recap	ASY	F	07/07/16	B	55.2	740.0	162	2.23	Brood patch
209771543	Recap	ASY	F	07/07/16	B	55.1	75.6	59	1.96	Brood patch
209772020	New	ASY	M	07/07/16	B	53.8	70.1	152	1.79	
209772021	New	ASY	F	07/07/16	B	59.0	87.6	59	2.88	
209772024	New	SY	F	07/07/16	B	51.4	6.8	87	1.26	
209772026	New	SY	M	07/07/16	B	56.3	76.8	120	2.09	
209772028	New	ASY	F	07/07/16	B	50.3	72.9	114	2.00	
209772029	New	ASY	M	07/07/16	B	54.5	73.6	102	2.17	
209772043	New	ASY	M	07/07/16	B	58.0	76.9	96	2.43	
209772068	New	ASY	M	07/07/16	B	61.8	78.1	160	2.30	
209772083	New	ASY	M	07/07/16	B	56.1	74.0	70	1.95	
209772103	New	ASY	M	07/07/16	B	53.0	78.0	176	2.21	
209772134	New	ASY	F	07/07/16	B	54.1	70.0	53	1.95	
209772143	New	ASY	M	07/07/16	B	53.3	74.3	140	2.07	
193760716	Recap	ASY	M	07/08/16	C	56.2	77.5	189	2.36	
209708743	Recap	ASY	M	07/08/16	C	56.4	74.5	134	2.25	
209772617	New	SY	F	07/08/16	C	57.3	76.2	128	1.86	
209772618	New	ASY	M	07/08/16	C	53.7	77.0	156	2.16	
209772645	New	ASY	F	07/08/16	C	51.6	70.2	128	1.74	
209772648	New	SY	M	07/08/16	C	58.8	81.0	140	2.41	
209772651	New	SY	F	07/07/16	C	54.9	71.6	179	1.86	
209772653	New	ASY	M	07/07/16	C	55.3	74.5	183	2.27	
209772663	New	SY	M	07/08/16	C	60.9	79.6	83	2.16	
209772664	New	SY	F	07/08/16	C	48.7	7.2	123	2.06	
209772685	New	ASY	F	07/08/16	C	53.9	7.1	176	1.96	
209772686	New	ASY	F	07/08/16	C	51.2	76.5	168	2.14	