

Teshkepkuk Lake Area Molting Goose Survey 2011-2013

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ABSTRACT This report summarizes the 30-32nd annual Teshkepkuk Lake Molting Goose Surveys, conducted on the Arctic Coastal Plain of Alaska, on 16-18 July 2011, 18-20 July 2012, and 17-18, 20 July 2013, respectively. Area-wide counts of adult Pacific brant (BLBR), greater white-fronted geese (GWFG), and snow geese (SNGO) all increased across years, while Canada Geese increased only in 2011. Counts for adults of these species (and goslings) by year, were as follows; 2011: BLBR 18,300 (260), CAGO 14,208 (3), GWFG 25,225 (6,747), SNGO 4,427 (665), 2012: BLBR 20,090 (1,058), CAGO 18,729 (27), GWFG 47,805 (8,770), SNGO 10,408 (618), and 2013: BLBR 23,725 (376), CAGO 14,708 (268), GWFG 48,850 (11,443), and SNGO 11,731 (50). Totals of tundra swans and (cygnets) were: 2011: 227 (112), 2012: 314 (33), and 2013: 355 (37). Counts of snowy owls throughout all areas surveyed in 2011-13 were 102, 76, and 2, respectively. We conducted ‘additional area’ surveys at Cape Simpson and the Piasuk River Delta (2011-2013). Total counts for adult Pacific brant observed in additional areas were 7,800 in 2011, 11,069 in 2012, and 15,936 in 2013.

KEY WORDS: aerial survey, molting geese, Teshkepkuk Lake, National Petroleum Reserve

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INTRODUCTION

This report summarizes results from the 2011-2013 Teshkepkuk Lake Molting Goose Surveys. The Teshkepkuk survey was initiated in 1976, repeated in 1977-78, and has been conducted annually since 1982, with the goal of monitoring abundance and distribution of molting geese that use the area north and east of Teshkepkuk Lake, located on the Arctic Coastal Plain (ACP) of Alaska. The significance of this area to molting geese was first documented by Henry (Hank) Hansen and Jim King in 1957 (King 1970). Past and current surveys have documented large concentrations of molting Pacific brant (*Branta bernicla nigricans*), Canada geese (*Branta canadensis*), white-fronted geese (*Anser albifrons frontalis*), and lesser snow geese (*Anser caerulescens*) in the area. This survey documents abundance and distribution of molting geese during mid-July the peak of the molting period along the Arctic Coastal Plain (King 1970, Derksen et al. 1979, 1981, King and Hodges 1979, Flint et al. 2007). The distribution of geese before and after the peak molting period may be different than the distribution during the survey. Furthermore, goose distribution during the survey period (mid July 1976-2013) has changed over time (Flint et al. 2007). Therefore, data collected during this survey should only be used to determine general trends (with limited temporal extent) of goose distribution during the peak molt, and should not be the sole source to determine goose distribution throughout the molt cycle in the area north and east of Teshkepkuk Lake. Several additional molting areas outside of the traditional Teshkepkuk survey

area were identified during a study conducted by the USGS Alaska Science Center (Lewis et al. 2009). All five of these “additional” molting areas were surveyed in 2010, and two (Cape Simpson and the Piasuk River Delta) have been flown each year since 2010.

STUDY AREA AND METHODS

Teshkepkuk Lake Traditional Survey Area

The traditional survey area includes approximately 197 lakes and several bay, shoreline, and creek segments located north and east of Teshkepkuk Lake (Fig. 1). Each lake is identified by a unique number. Observations of geese, swans, and loons are recorded for each lake. In 2011- 2012, surveys were flown in a Quest Kodiak amphibious-equipped turbine aircraft (N736), while the 2013 survey was flown in a Cessna 206 amphibious-equipped aircraft (N9623R). Dates and crew assignments for the three years were 2011: 16-18 July, pilot observer E. Mallek, observer C. Dau; 2012, 18-20 July, pilot observer E. Mallek, observer C. Dau; 2013: 17-18 July, pilot-observer E. Mallek, observer: H. Wilson, and 20 July, pilot-observer: H. Wilson, observer: C. Dau). The surveys were flown at 45-60 meters (150-200 feet) above ground level and at airspeeds of 130-190 kilometers per hour (80-110 knots). Aircraft navigation was accomplished by using an aerial photograph paper map with printed numbers as lake identifiers, electronic moving maps provided by GPS and/or ipad units, and/or a remote computer screen running a moving map program developed by John Hodges (USFWS-retired).



Figure 1. The Teshekpuk Traditional Survey Area for molting geese, including approximately 197 lakes and several bay, shoreline, and creek segments located north and east of Teshekpuk Lake.

The aircraft flight path was recorded by a laptop computer connected to the aircraft GPS. Shorelines of large lakes were flown so that feeding or loafing geese on land would be recorded. Surfaces of large lakes were also flown in a systematic fashion, providing complete coverage of each lake. Smaller lakes were flown so that the flight path over the lake provided an unrestricted view of the entire lake and shoreline. In 2011, observations from both observers were recorded directly into one laptop computer by the pilot/observer, while in 2012 and 2013, two independent computers were used. In both cases, observations were recorded via a remote microphone (as sound files) using a program ('Record')

developed by John Hodges. A second computer program, ('Transcribe') also developed by John Hodges, was used later to replay sound files and transcribe data to text files. The transcribed text files were then used for data analyses.

Additional Survey Areas

In 2011-2013, surveys were flown in two of five additional survey areas identified by USGS Alaska Science Center (ASC) as important brant molting areas; Piasuk River Delta and Cape Simpson (Fig. 2).

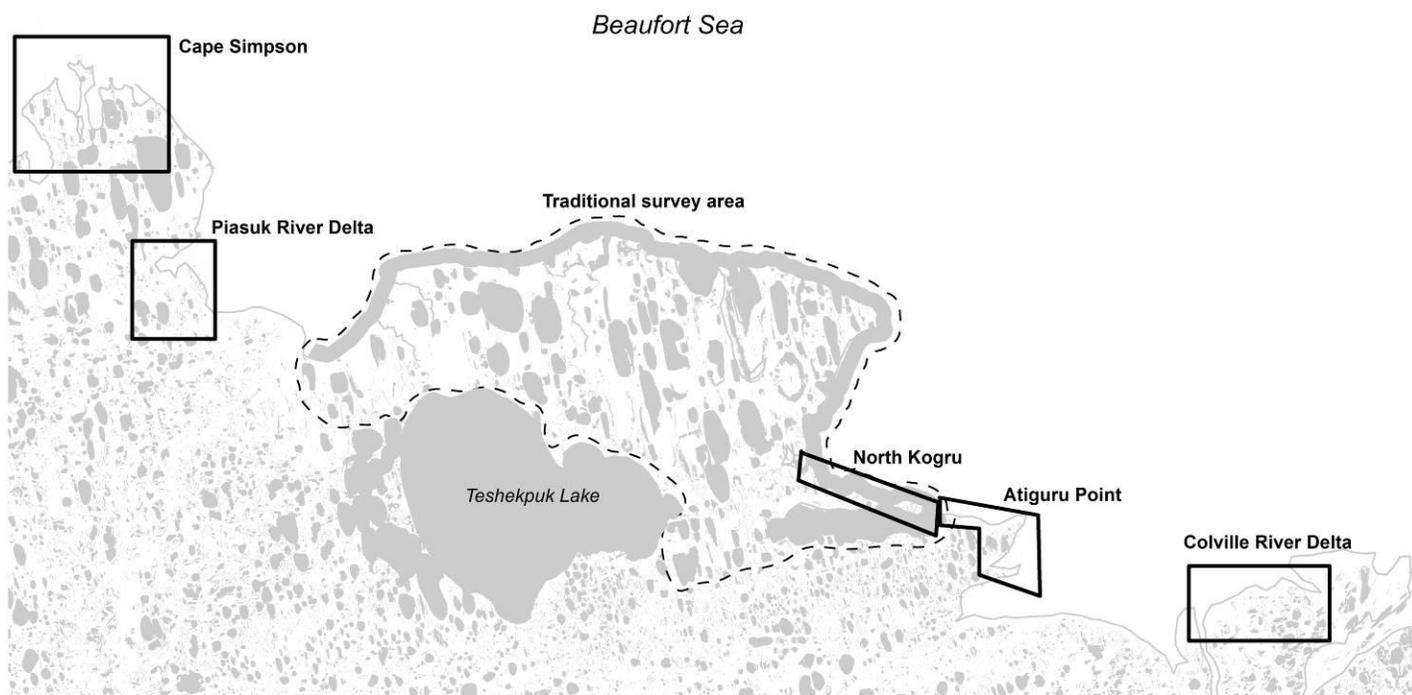


Figure 2. Additional survey areas (solid-framed polygons) identified by USGS Alaska Science Center (ASC) as important brant molting areas based on radio telemetry data (Lewis et al. 2009, 2011, Flint et al. 2014). Important additional areas; Cape Simpson, Piasuk River Delta, North Kogru Coast, Atiguru Point (and Eskimo Islands), and Colville River Delta, are shown in relation to the traditional Teshekpuk survey area (broken outline).

These additional areas were identified during a study conducted by the USGS ASC using intensive aerial surveys and telemetry of Pacific brant (Lewis et al. 2009). Individual lakes within most of these additional survey areas were not assigned unique numbers (as in the traditional survey area) due to the complexity and small size of some of the wetlands. Complex wetlands (e.g., Piasuk River Delta) were flown in a manner to achieve best coverage, although exact routing varied among years (see Appendix 1a), while areas with larger bodies of water (e.g., Cape Simpson) were flown using the same technique as the traditional survey (e.g., coverage of individual lakes, as described above). Aircraft speeds, altitude, and navigation as well as data recording techniques were identical to the techniques used in the traditional survey area.

RESULTS

Observations totals (2011-2013) for geese and goslings in the Teshekpuk Traditional Survey Area, as well as the Cape Simpson and Piasuk River Delta additional areas are provided in Table 1. Figure 3 illustrates the number of adult geese counted from 1981-2013 at the Teshekpuk traditional

survey area by species. Observation totals for loons, geese, and swans (2011-2013), by lake, at the Teshekpuk Traditional Survey Area are provided in Appendices 2a-c.

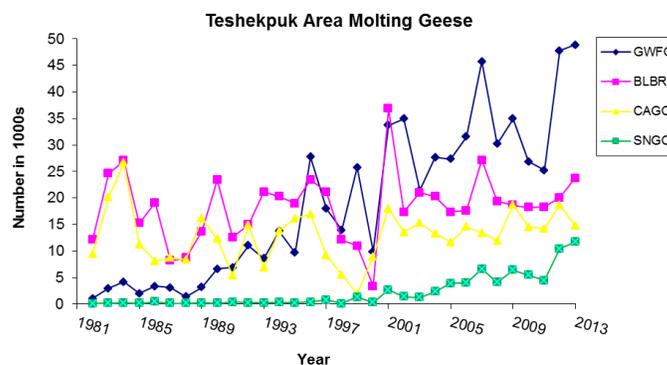


Figure 3. Observations of molting adult geese on the Teshekpuk traditional survey (1982-2013). BLBR = Black Brant, CAGO = Canada goose, GWFG = Greater white-fronted goose, and SNGO = Snow goose.

2011 – Teshekpuk Traditional Survey Area

The 2011 survey was conducted over three days between 16-18 July. Totals of 62,160 adult geese and 7,675 goslings

were observed. Pacific brant accounted for 27% of the geese observed (18,300 adults and 260 goslings), while white-fronted geese accounted for 46% of the geese observed (25,225 adults and 6,747 goslings). Canada goose totals were 14,208 adults and 3 goslings and accounted for 20% of the geese observed. Lesser snow geese accounted for 7% of the geese observed (4,427 adults and 665 goslings). Tundra swan (*Cygnus columbianus*) totals were 227 adults and 112 cygnets. Pacific loon (*Gavia pacifica*), red-throated loon (*Gavia stellata*), and yellow-billed loon (*Gavia adamsii*) totals were 263, 38, and 5, respectively. 2011 observation totals for geese, swans, and loons, by individual lake, are provided in Appendix 2a.

2012 – Teshekpuk Traditional Survey Area

The 2012 survey was conducted over two days, 18-19 July. Totals of 97,032 adult geese and 10,473 goslings were observed. Pacific brant accounted for 20% of the geese observed (20,090 adults and 1,058 goslings), while white-fronted geese accounted for 53% of the geese observed (47,805 adults and 8,770 goslings). Canada goose totals were 18,729 adults and 27 goslings and accounted for 17% of the geese observed. Lesser snow geese accounted for 10% of the geese observed (10,408 adults and 618 goslings). Tundra swan totals were 314 adults and 33 cygnets. Pacific loon, red-throated loon, and yellow-billed loon totals were 155, 19, and 5, respectively. 2012 observation totals for geese, swans, and loons, by individual lake, are provided in Appendix 2b.

2013 – Teshekpuk Traditional Survey Area

The 2013 survey was conducted over three days, 18-19, and 20 July. Totals of 99,014 adult geese and 12,137 goslings were observed. Pacific brant accounted for 22% of the geese observed (23,725 adults and 376 goslings), while white-fronted geese accounted for 54% of the geese observed (48,850 adults and 11,443 goslings). Canada goose totals were 14,708 adults and 268 goslings and accounted for 14% of the geese observed. Lesser snow geese accounted for 11% of the adult geese observed (11,731 adults and 50 goslings). Tundra swan totals were 355 adults and 37 cygnets. Pacific loon, red-throated loon, and yellow-billed loon totals were 127, 13, and 5, respectively. 2013 observation totals for geese, swans, and loons, by individual lake, are provided in Appendix 2c.

2011 – Additional Survey Areas (Piasuk and

Simpson)

The Piasuk River Delta and Cape Simpson additional survey areas were flown on 18 July 2011 (Figs. 2, 3) with totals of 12,875 adult geese and 1,520 goslings observed. Pacific brant totals were 7,800 adults and 30 goslings. Pacific brant numbers and percentages (adults + goslings) by area were Cape Simpson 5,125 (66%) and 2,705 at the Piasuk River Delta (34%). White-fronted geese, Canada geese, and lesser snow geese adults and (goslings) at Cape Simpson and the Piasuk River were 2,115 (663), 732 (10), 863 (303) and 17 (0), 12 (5), 1,336 (509), respectively. 2011 observation totals for geese and swans in the additional areas are provided in Table 1.

2012 – Additional Survey Areas (Piasuk and Simpson)

The Piasuk River Delta and Cape Simpson additional survey areas were flown on 20 July 2012 with totals of 11,993 adult geese and 267 goslings observed. Pacific brant totals were 11,069 adults and 71 goslings. Pacific brant numbers and percentages (adults + goslings) by area were Cape Simpson 7,407 (67%) and 3,733 at the Piasuk River Delta (35%). White-fronted geese and lesser snow geese adults and (goslings) at Cape Simpson and the Piasuk River were 2,786 (1,024), 664 (77) and 245 (8) and 3,348 (259), respectively. No Canada geese were observed on the Piasuk River Delta in 2012, but 1,207 adults and 38 juveniles were observed at Cape Simpson. 2012 observation totals for geese in the additional areas are provided in Table 1.

2013 – Additional Survey Areas (Piasuk and Simpson)

The Piasuk River Delta and Cape Simpson additional survey areas were flown on 20 July 2013 with totals of 29,708 adult geese and 1,195 goslings observed. Pacific brant totals were 15,936 adults with no goslings observed. Comparable numbers of Pacific brant were recorded in the Cape Simpson area (8,194; 48%) and at the Piasuk River Delta (7,742; 56%). White-fronted geese, Canada geese, and lesser snow geese adults and (goslings) at Cape Simpson and the Piasuk River were 3,631 (596), 444 (5), 1,440 (54) and 792 (291), 60 (15), 7,405 (234), respectively. 2013 observation totals for geese the additional areas are provided in Table 1.

Table 1. Observations of adult geese and goslings at the Teshekpuk Traditional survey Area, and additional survey areas (Piasuk River Delta and Cape Simpson), 2011-2013. BLBR = Black Brant, CAGO = Canada goose, GWFG = Greater white-fronted goose, and SNGO = Snow goose.

Location	Year	BLBR		CAGO		GWFG		SNGO	
		BLBR	goslings	CAGO	goslings	GWFG	goslings	SNGO	goslings
Teshekpuk	2011	18,300	260	14,208	3	25,225	6,747	4,427	665
	2012	20,090	1,058	18,729	27	47,805	8,770	10,408	618
	2013	23,725	376	14,708	268	48,850	11,443	11,731	50
Piasuk River Delta	2011	2,705	0	12	5	17	0	1337	1336
	2012	3,733	0	0	0	245	8	3348	3348
	2013	7,742	0	60	15	792	291	7405	7405
Cape Simpson	2011	5,095	30	732	10	2115	663	866	863
	2012	7,336	71	1207	38	2786	1024	664	664
	2013	8,194	0	444	5	3631	596	1440	1440

DISCUSSION

Teshekpuk Traditional Survey Area

Pacific Brant

The importance of this survey area to molting Pacific brant is well documented (King 1970, King and Hodges 1979, Mallek 2011, Flint et al. 2007, 2014, Lewis et al. 2009). The 2011-13 counts of adult Pacific brant show an increase in this area (2011 – 18,300, 2012 – 20,090, 2013 – 23,725). Goslings observed from 2011-13 were (2011 – 260, 2012 – 1,058, 2013 – 376). In 2013, approximately 14% of the total Pacific flyway mid-winter population index (MWI) were observed in the survey area. The MWI was incomplete in 2011 and 2012. Thus, the proportion of Pacific brant present in the Teshekpuk Lake survey area is unknown (Olson and Trost 2013 Pacific Flyway Databook).

Although the Teshekpuk Lake survey clearly shows the importance of this area to brant, the annual indices cannot be used to estimate the proportion of the Pacific flyway population that uses this area *throughout their life*. Some brant may use this area only once in their life time (e.g., as a second-year bird), other brant may molt here occasionally (e.g., after nest failure), and some brant may use this area many times (e.g., local breeders, or adult non-breeder; Bollinger and Derksen 1996). Therefore, the number or proportion of the population of brant that use this area in a

specific year or averaged over multiple years is likely a biased indicator (low) of the overall use of this area by the Pacific flyway population.

Canada Geese

Use of the survey area by molting Canada geese is highly variable (Fig. 3) and appears to correspond to use by Pacific brant. The 2011-2013 counts of adult and gosling (in parentheses) for Canada geese were 14,208 (3), 18,729 (27), and 14,708 (268), respectively. The total count for 2013 was 14,976, as compared to the previous ten-year (2001-2010) mean of 14,587.

White-fronted Geese

Molting white-fronted geese observed on the Teshekpuk area survey are believed to nest on the Arctic Coastal Plain of Alaska (ACP). Although the estimated population of white-fronted geese during the nesting season on the ACP has grown over the last two decades (Stehn et al. 2013), the molting population in the Teshekpuk Lake survey area has had substantially more growth (Fig. 4). The 2011-2013 counts of adult and gosling (in parentheses) white-fronted geese were 25,225 (6,747), 47,805 (8,770), and 48,850 (11,443), respectively. Gosling counts are useful indices of production and population trend for the ACP.

Snow Geese

Use of the survey area by snow geese is relatively low when compared to other species of geese. However, use of the survey

area by snow geese is increasing. In 2011-2013 adult and (gosling) snow goose numbers were 4,427 (665), 10,408 (618), 11,731 (50).

Additional Survey Areas

In an effort to monitor brant population sizes and use of areas outside the Teshekpuk Traditional Survey Area (Flint et al. 2007), five additional survey areas were flown in 2010 (Mallek 2011). Only two of these areas (Cape Simpson and the Piasuk River Delta; areas deemed to contain the highest densities of molting brant), were flown annually thereafter. The additional three, lower density, locations will be flown on a 5-year rotation, with the next survey of these areas slated for 2015. Although surveys at Cape Simpson and Piasuk (2010-2013) achieved relatively consistent coverage, annual variation in flight paths (Appendix 1a) warranted formalization of survey design in these areas. In an effort to improve repeatability, we updated the survey plans for these areas (see Appendix 1b); tightening the boundaries for each sampling area, adding lake numbers, and establishing transect lines where appropriate (i.e., in complex wetlands such as at Piasuk).

In 2010, 5,530 brant (adults + goslings) were observed at Cape Simpson and 5,141 (adults + goslings) at the Piasuk River. By 2013 there were ~2,600 more brant at each of these locations (2,664 and 2,601, respectively). Brant numbers at these sites vary annually, but both have increased 16-18%/year since 2010 (Table 1). While it is apparent that these areas are of significant value to Pacific Flyway brant, historical information suggests they were relatively unused prior to the 1990's (Ritchie et al. 2013, J. King pers. comm. in Flint et al. 2014). In contrast, recent data indicates molting brant are increasing in these areas, as well as in areas farther to the west (this report, Ritchie et al. 2013, Flint et al. 2014, Tape et al. 2014). Birds utilizing the Cape Simpson and Piasuk areas are known to move between these "additional" areas and the Teshekpuk Traditional Survey Area (Flint et al. 2014), likely taking advantage of newly available habitat (Tape et al. 2014). It is unknown what other areas, currently unsurveyed, may be of increasing importance to molting brant across the ACP. Radio telemetry flights along the coast from Prudhoe Bay to Teshekpuk in 2008 did not detect molting brant east of the Colville River Delta (P. Flint, pers. comm.). However, regular surveys conducted west of the Piasuk River Delta (ABR Inc.) indicate increasing numbers of molting/brood-rearing brant (Ritchie et al. 2013). Gaining a clearer understanding of the distribution and abundance of molting brant across the ACP would be useful in modeling the overall population dynamics of Pacific brant. In working towards this goal, we suggest further research, marking, continued annual monitoring, and the development of a

broader survey plan which would incorporate data from multiple western ACP aerial surveys (e.g., Ritchie et al. 2013, this survey), and include implementation of expanded, intermittent surveys across the ACP.

CONCLUSION

The importance of the Teshekpuk Lake survey area to molting geese has been well documented, and has been one of the primary justifications for protection of the area from oil development (U.S. BLM 2008, 2013). From 1998 to 2008, no leasing was considered in the Teshekpuk Special Use Area (TLSA), in part, due to the sensitivity of molting brant in the area. In 2008, a new Record of Decision by BLM stated the area was intended for leasing, with a 10-yr delay (U.S. BLM 2008). Under this regime, lease sales would be allowed starting in 2018. In 2013, a new Record of Decision returned the status to no leasing, with a concurrent moratorium on non-safety related infrastructure (U.S. BLM 2013). Molting geese are highly susceptible to disturbance (Derksen et al. 1992), and in some years molting habitat provided by the TLSA is extremely important to the global population of Pacific brant. Clearly, continued protection of this area from disturbance associated with oil development is warranted.

Data collected from the additional survey areas, specifically Cape Simpson and the Piasuk River Delta, indicate that these areas are also of high value to molting Pacific brant. Accordingly, the 2013 Record of Decision by the BLM also changed the status of the Piasuk and Cape Simpson areas to "no leasing", although infrastructure was deemed allowable (U.S. BLM 2013). Continued protection of these additional areas (and possibly others) should be reviewed, as annual monitoring continues and expanded surveys are developed.

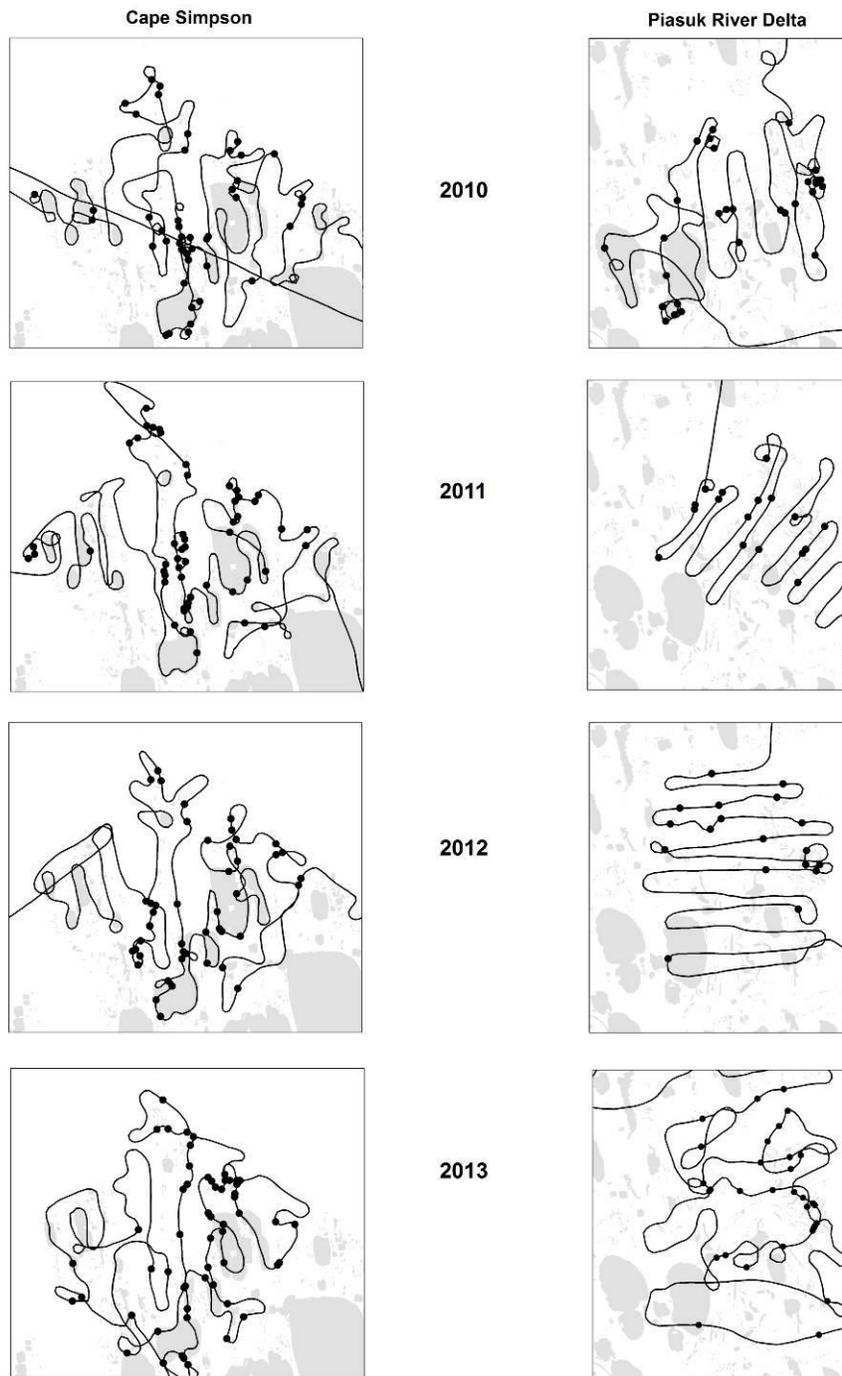
ACKNOWLEDGEMENTS

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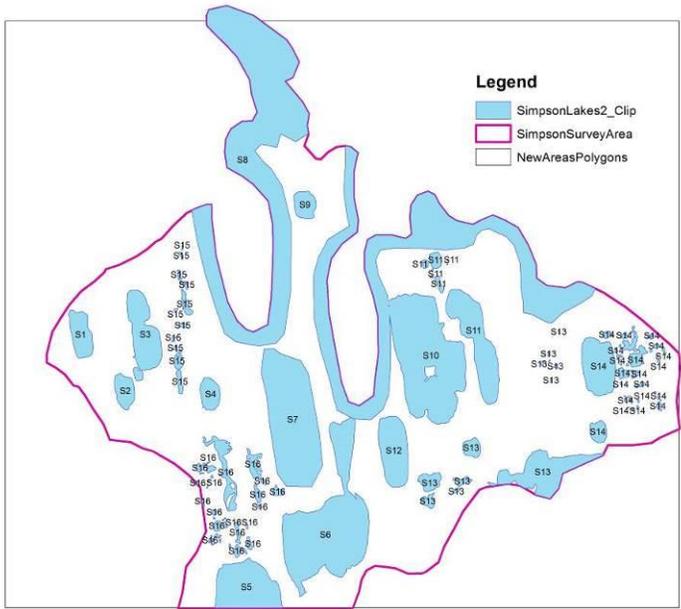
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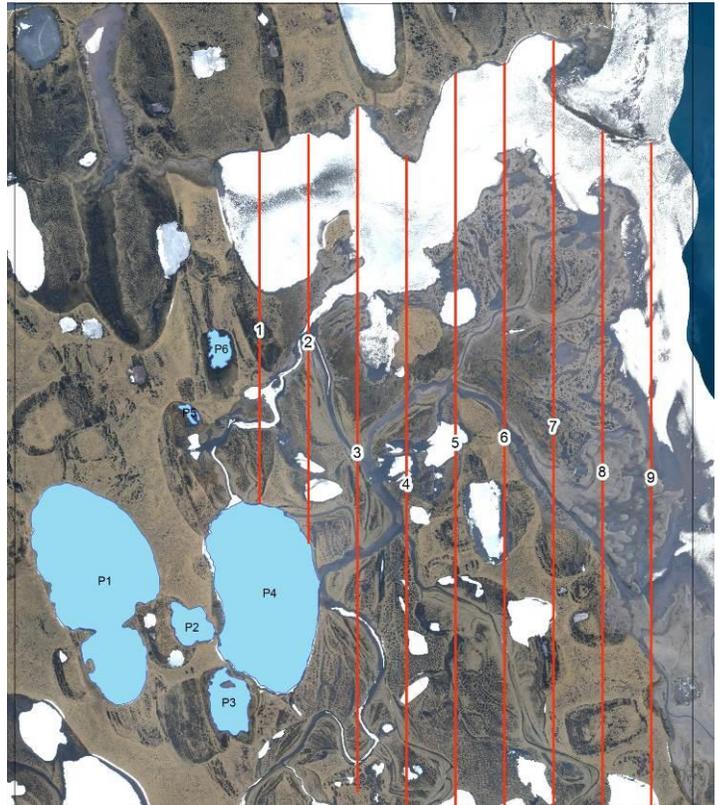
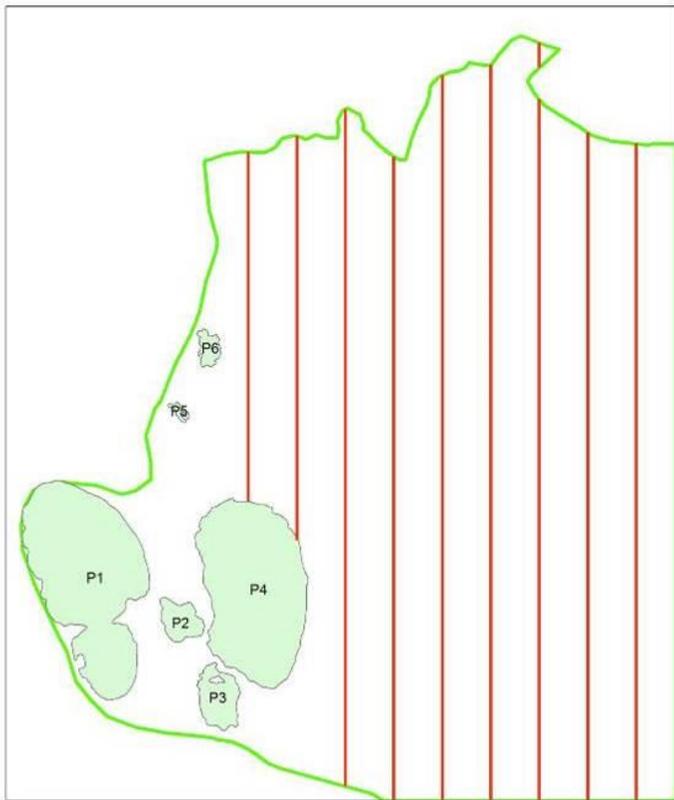
Appendix 1a. Flight paths and locations of goose observations (black dots) in the additional survey areas of Cape Simpson and Piasuk River Delta (2010-2013), west of the Teshekpuk traditional survey area, Alaska. Coverage of both areas was relatively complete in all years, although annual variation in flight paths was high; particularly in complex wetlands.



Appendix 1b. Proposed lakes, transects, and boundaries for the Cape Simpson and Piasuk River Delta 'additional areas' annual surveys; schematic and satellite views.



Cape Simpson



Piasuk River Delta

Appendix 2a. Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2011.

LAKE No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
1	2	5			162	124	1				2			296
2					33	19		1			1			54
3					287	24			6	15				332
4					106	12					2			120
5							2	2						4
6					11	7	2							20
7					3		1				2	4		10
8					132	11	13				6	4	2	168
9					74	5	1				3		1	84
10							4							4
11							3							3
12					4	8								12
13					20		6				3			29
14					27	24	5							56
15			20		148	50	2							220
16					118	134								252
17							3				2	3		8
18			218		241	95			208					762
19					73	40								113
20	215	50							65	30				360
21	16		355		1388	270	1	1	613	14	9			2667
22					2	2	1				2			7
23					80		1				1	2		84
24					119	17								136
25			20		149	39	2		12		2			224
26					82	34	6	2						124
27							4							4
28	25				296	87	4				1			413
29	20		450		223		3							696
30					30		2							32
31	16	17			45	51	1				1			131
32					20						2	2		24
33														0
34							1							1
35					1		6	6			2			15
36	187	2	18		583	147								937
37					4	4	6							14
38			65		12	21	1							99
39					87	5	1							93
40	10		15		365	92	8				8			498
41					27	31	1							59
42	4				34	48								86
43					20	10	8							38
44	85		65		327	66	1		215					759
45														0
46	150		4		54	14			250					472
47					2						3			5
48	143		373		1060	96	3	3	373	5	4			2060
49											2	2		4
50														0
51	85				617	597			16	8	2			1325
52	390	4	1380		76	75	1		15	20	6	10		1977

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = w hite-fronted goose, GWFGB = w hite-fronted goose gosling, PALO = Pacific loon, RTLO = red-thoated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra sw an, SWANC = tundra sw an cygnet, YBLO = yellow -billed loon.

Appendix 2a (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2011 (continued).

LAKE No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
53			1215		95									1310
54			45		627	189			2	3				866
55	505		830		1186	357			2	5	4	2		2891
56					35	30					1			66
57			1		146	7	1							155
58											3	5		8
59														0
60					12	9								21
61	33		40		875	35								983
62	1368		206		776	53	5				2			2410
63					350				75					425
64					5		3				4	3		15
65					18									18
66					262	95	3							360
67			20		16	10								46
68			15		270	19			16		2	3		325
69					12	4								16
70	2	3			2		3	1			2			13
71							3							3
72	8				324	36	1							369
73							2				2	4		8
74	4		25		84	71	4		98	13	1			300
75					36	25	6				2	2		71
76							3				4	2		9
77					62	23	13				3			101
78					162	240	12				19	4		437
79					3		6				4			13
80	4	10					4				7	5		30
81											2			2
82								1			2	2		5
83	15	10			110	87		2			14	2		240
84							5							5
85					162	6			2	2	1			173
86					30		3				1	4		38
87	50	22	292	3	835	464	1		114	64				1845
88									4	10				14
89					4	7	12		8	12				43
90					171	14	4				2			191
91					65	20	6				1	2		94
92														0
93					4	8	1							13
94					165		4				2			171
95			148		96	30			21	33	2	4		334
96			75		53	21	1							150
97					16	16								32
98			10		85	22	1				1			119
99	303	5	565		632	9	2		12					1528
100			90		280	35			12	8				425
101					64	28	2							94
102	2	4			7	2								15
103							4	2			2	3		11
104	393		70		905	50		1	95		2	2	2	1520

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = w hite-fronted goose, GWFGB = w hite-fronted goose gosling, PALO = Pacific loon, RTLO = red-thoated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra sw an, SWANC = tundra sw an cygnet, YBLO = yellow -billed loon.

Appendix 2a (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2011.

LAKE No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
105					446									446
106	1230		757		400	5			25					2417
107	250		510		420				3					1183
108	30		18		80									128
109							2							2
110	3		1175		290	91			4					1563
111											2	3		5
112			70		8	10								88
113	150		316		107	34		1	5					613
114					282	1	2				2			287
115	2	3	530						5	5				545
116	155	5	468		95	45			4		1			773
117					22	21		1						44
118	989	10	444		3	6			35	40				1527
119														0
120														0
121														0
122	73		138		35						2			248
123	156													156
124	4		55											59
125	254		95		358	68								775
126														0
127														0
128														0
129	12				12	9	1							34
130														0
131														0
132					145						2			147
133	55													55
134														0
135	29													29
136	20													20
137	70													70
138														0
139	1000													1000
140			70		136	3								209
141	157	1	45				1							204
142	245		218		70			1						534
143			25		165		2							192
144	12		18		178		4							212
145	265		447		217	43		1	10	2	2	1		988
146					110									110
147					156	3								159
148					20						1			21
149	4170	20	406		1161	612		1	591	93				7054
150					76	63			50		3	3		195
151							1							1
152			5		52	29			32	46	4			168
153														0
154					5	5	3							13
155	140				174		2		2	6	1	5		330
156					43	15					2	3		63

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = w hite-fronted goose, GWFGB = w hite-fronted goose gosling, PALO = Pacific loon, RTLO = red-thoated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra sw an, SWANC = tundra sw an cygnet, YBLO = yellow -billed loon.

Appendix 2a (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2011.

LAKE No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
157					125	80								205
158														0
159	1						2				1			4
160					62	76					3			141
161	295	20	108		323	90		1						837
162	227	3	285		526	78	2		106	72				1299
163											1	3		4
164							3				2			5
165					20	10					6			36
166	2		2				2				1			7
167	20	10	10		315	270	4	1			9	6		645
168														0
169			110		120			1						231
170	250		40					1	10					301
171	365		10		162	26								563
172	303		140		40	10	1		4		2			500
173														0
174	10						1							11
175	150		80		111	32	2				2			377
176	30		100		358	30			2					520
177					82	4					1			87
178	4	6												10
179														0
180	2				170	40								212
181	178		110		2	8					2			300
182	8													8
183														0
184					45	60								105
185			20						1					21
186	400		175		40	20								635
187											2			2
188					55	42								97
189														0
190					10	15					1			26
191														0
192														0
193	735	5			10						6	3		759
194					4		3				2	3		12
195	315				52	2								369
196														0
197														0
198	526	25	33		231	198	1	3						1017
199					92	118	2	4	23	28				267
200	943	20	265		65				999	7	2			2301
201					47	40								87
206	15		180		200				172	56	2	3		628
207	10				142	120			40	60				372
208			100		303	34	2		70	8	2	3		522
209	5				63									68
Grand Total	18300	260	14208	3	25225	6747	263	38	4427	665	227	112	5	70480
	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	SWAN	SWANC	YBLO	

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = w hite-fronted goose, GWFGB = w hite-fronted goose gosling, PALO = Pacific loon, RTLO = red-thoated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra sw an, SWANC = tundra sw an cygnet, YBLO = yellow -billed loon.

Appendix 2b. Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2012.

LAKE No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
1					201	65	1				3			270
2	2	4			167	33					3			209
3					450	40					2			492
4					92	69					1		1	163
5											2	2		4
6					16	9	6							31
7							3							3
8					333	31					2			366
9					104	2	2				3		1	112
10							1				1			2
11							1							1
12	20	10			282	115			20	25				472
13					8	6	8				4	5		31
14					40	56	1							97
15			40		4	3	2				2			51
16														0
17							5				2			7
18			350		606	25			285					1266
19	25	10			156	103								294
20					25									25
21	115	2	220		2128	540		4	634		13			3656
22							2							2
23					340	16			53		2			411
24					260									260
25					338	128	3		10		2		1	482
26					45	44	2				6			97
27					4	5	3				12	3		27
28			15		615	39					4	3		676
29			183		573	21		3			2			782
30					35		2				2			39
31			8		37	16								61
32					10		2				1			13
33	10	20			260	70					2			362
34											4			4
35					30		1				4			35
36	35	20	50		447	100		2						654
37							1							1
38			267		482	95	2		17	12	1			876
39	6		15		199	52			17	5				294
40	16		43	5	603	49	1		53		2			772
41					60	20	2				1			83
42					8	6					2	1		17
43					356	24	2		5					387
44	10		47		920	107			76		2			1162
45					35	29								64
46			30		105				340					475
47			58		175				125					358
48	76		154		1072	52	2	3	553	6	18			1936
49														0
50														0
51			20		808	224			30					1082
52	775	20	85		969	508					9	2		2368

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = w hite-fronted goose, GWFGB = w hite-fronted goose gosling, PALO = Pacific loon, RTLO = red-thoated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra sw an, SWANC = tundra sw an cygnet, YBLO = yellow -billed loon.

Appendix 2b (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2012.

LAKE No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
53	12		630								1			643
54	300		14		527	51					2			894
55	1300				175	225								1700
56			550		450									1000
57			38		117	56			3		2			216
58					55	80					2	2		139
59														0
60			481		30	5					2			518
61	495		305		780									1580
62	388		325		963	113	1		25		2	2		1819
63			18		550				150		12			730
64														0
65			5		35									40
66					518	44	1		19	7				589
67					221	9								230
68			20		421	17			20					478
69					343	32								375
70					129	36			2	10	2			179
71							2				2			4
72			15		155	102	1		22	3				298
73														0
74	79	2	60		864	30			188	20	4			1247
75							5				1	1		7
76							6				4			10
77					386	65	5				2			458
78					446	225	8				19	2		700
79							2							2
80							2				4			6
81					21	21					3			45
82					22	32		1			4			59
83					551	96	1	3	2		13	1		667
84					23	16	6				2			47
85					415		2				2			419
86					223	20	2							245
87			155	15	421	166	1		5					763
88														0
89					2	1	1				3			7
90					19		1				2			22
91														0
92														0
93					520		4				2			526
94					6	10					2			18
95	201	9	445	6	1033	257			19	50				2020
96			50		48				4					102
97			3		103	53	2							161
98					345	11			6	4				366
99	365		1085		1714	45			95		2			3306
100	2	3	50		2	4			10					71
101					556	82								638
102							3							3
103					59	39	6				2			106
104	200		183		895				200					1478

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = white-fronted goose, GWFGB = white-fronted goose gosling, PALO = Pacific loon, RTLO = red-throated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra swan, SWANC = tundra swan cygnet, YBLO = yellow-billed loon.

Appendix 2b (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2012.

LAKE No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
105	180		8		565						2			755
106	1337		1070		873				55		2			3337
107	995		465		874	26	1							2361
108	275		150		40	40								505
109											2			2
110	600		1042		32				35	25	5			1739
111											2			2
112			98		65									163
113	150		635		89				4					878
114					627	1	1		50		2			681
115	40		345											385
116	102	8	1025		213	324			1					1673
117			125				1							126
118	305	10	773		27	26			37	30				1208
119														0
120														0
121	40		80											120
122	75		428		225	100	1							829
123	8		182		30									220
124	35		55		25									115
125	34		447	1	588	96					3			1169
126							2							2
127			17											17
128														0
129	15				283	17					2			317
130					140						2			142
131							2							2
132	843		299		151	78								1371
133														0
134	75		250		206	237					3			771
135	550	20			40	20								630
136			2		68	28								98
137	122				4	7								133
138														0
139														0
140														0
141	18		551								1			570
142	185		15		115	10			1		2			328
143	65		33		220				4					322
144			20		510		1		6	5	1			543
145	187		477		1599	205		1	34		1			2504
146			10								2			12
147	85		27											112
148														0
149	3390	850	167		1518	436			2297	90	5			8753
150	15		25		421	13			587		3			1064
151							2				2			4
152	93	15	168		865	287	3		143	35				1609
153														0
154					450		2							452
155					148	11	3							162
156					443	19								462

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = w hite-fronted goose, GWFGB = w hite-fronted goose gosling, PALO = Pacific loon, RTLO = red-thoated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra sw an, SWANC = tundra sw an cygnet, YBLO = yellow -billed loon.

Appendix 2b (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2012.

LAKE No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
157					60						2			62
158					1						2			3
159					14	20					2			36
160											4			4
161	65		58		875	20		1	15		2			1036
162	275		577		698	17			117		4			1688
163							4				2	1		7
164							1							1
165							1				2			3
166					13		5				4			22
167			5		814	296	1				6			1122
168											1			1
169					285						1			286
170	50		30		188	10			35					313
171					20									20
172	50		90		279	21			8		4	5		457
173	132		140											272
174														0
175	595		150		763	116		1			1			1626
176	30		172		369	6					1			578
177					61	18					5			84
178	15		8											23
179	40				16	20								76
180					50	316					2			368
181	800		200											1000
182			195		1		1							197
183														0
184					200	112	2				4			318
185			10		20	10								40
186	85													85
187	10		55		450									515
188														0
189														0
190					110	99								209
191														0
192					110	43								153
193	295													295
194							1				2			3
195	900				45						1			946
196														0
197														0
198	135		807		30	20							1	993
199			2		303	322			260	156			1	1044
200	2108	18	645		1281	50			3135	10				7247
201					313	184					2			499
205					300									300
206	229	3	320		433	238			243	55	1			1522
207	25	34			172	106			178	60				575
208			259		536	100	3		175	10	5	3		1091
Grand Total	20090	1058	18729	27	47805	8770	155	19	10408	618	314	33	5	108031
	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	SWAN	SWANC	YBLO	

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = white-fronted goose, GWFGB = white-fronted goose gosling, PALO = Pacific loon, RTLO = red-throated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra swan, SWANC = tundra swan cygnet, YBLO = yellow-billed loon.

Appendix 2c. Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2013.

Lake No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
1					374	55								429
2					102	63					33			198
3					979	26	1							1006
4					257	5	3				1			266
5					2						1			3
6														0
7							2				2			4
8					82	4	4				8	5		103
9					32	4					2			38
10					38	13	2							53
11											2	2		4
12											15			15
13							8				4	1		13
14					105						1			106
15			47	2	79	41					1			170
16											3			3
17														0
18			362		1032	10			366					1770
19					20	10					4			34
20														0
21			282		1779	275			693		3			3032
22					2									2
23					230				110		2	3		345
24					534	19								553
25					382	102	1		12		2	3		502
26					82		8							90
27											1			1
28					775	55					3			833
29					355	22					7			384
30			75											75
31					66	20	1				1			88
32					105						2	3		110
33														0
34														0
35							1				4			5
36			150		514	83	3	2			2			754
37														0
38			145		274	136	2		17	20	6			600
39					115	35								150
40	2				408	127			16		1			554
41														0
42					23	38	1				2			64
43					48	12	3							63
44			314		1211	233			11					1769
45					70	20			1					91
46	22		30		51	15			268					386
47			9		87	25	2		50					173
48	238		248		1173	99	5	1	366		3			2133
49														0
50			25		210			2			2			239
51	120		135		1305	37			21		7			1625
52	25				10	9								44

BLBR = brant, BLBRB = brant gosling, CAGO = Canada goose, CAGOB = Canada goose gosling, GWFG = w hite-fronted goose, GWFGB = w hite-fronted goose gosling, PALO = Pacific loon, RTLLO = red-thoated loon, SNGO = snow goose, SNGOB = snow goose gosling, SWAN = tundra sw an, SWANC = tundra sw an cygnet, YBLO = yellow -billed loon.

Appendix 2c (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2013.

Lake No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
53	1205				749	1930			30					3914
54	5		12		689	2250								2956
55	126	5	562		180	532					2	4		1411
56			46		210				6					262
57			190		20									210
58					232			2			6			240
60			378		309	232					8			927
61	174		105		1895				90		2			2266
62	429	13	585		828	71					2			1928
63					105		1		3		2			111
64											5	3		8
65	15				131				8				1	155
66					146	73	3				2			224
67			162	2	114	15			2					295
68					260		2		20		6			288
69			4		35						3			42
70	2	2	25		252	4								285
71											2			2
72			29		204	34			12		1			280
73					34	12								46
74	59	20			492	291	2		84	5	9			962
75					35	5	6				2			48
76											2			2
77					255	51	2				8	2		318
78	4				256	41	12				16	1		330
79							1				2			3
80					14		3				5			22
81					11						3			14
82							1				4			5
83	6	6			288	101					14	1		416
84					247						1	2		250
85					6	5	1				2			14
86														0
87	119	42	234		834	861	1		35		2			2128
88					2	4	1				7			14
89					3		3				3	2		11
90					392		3		30		6			431
91					210		2				2			214
92											1			1
93					280									280
94							3				1			4
95			600		618	520			34					1772
96			76		182		1							259
97					24	7					4			35
98					2	7								9
99	27		1183		1253									2463
100	362	4	50		868	45			40					1369
101					32	41	3				2			78
102			3		59	27	1							90
103					9		2							11
104	260		330		768	5			165					1528
105			25		372	30					2			429

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Appendix 2c (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2013.

Lake No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
106	2971		1148		1648				137					5904
107	553		275		1148	7					2			1985
108			35		110									145
109					1						2			3
110	397		558		38	58			3		4			1058
111											2			2
112			122		265									387
113	385		185	25	87	59			45					786
114					550				27					577
115	100		886						8	15				1009
116	248	25	23		138	86	1				4			525
117	74		40											114
118	1160	100	404	5	36	99			9	5	1			1819
119														0
120								1						1
121			70											70
122	110		156											266
123	147		138		30	9								324
124														0
125	148		429		1040	44	1				1			1663
126							3				2	3		8
127					120									120
128														0
129	13		1		70						1			85
130											2			2
131											2			2
132	295		44		75	10					2			426
133	232		12											244
134	174													174
135					10	5								15
136	12													12
137	70				25	25								120
138	140				16	38								194
139	220				5									225
140	45		73		150		2				1			271
141	72		247		70				5					394
142	210		146		72						4			432
143					182	18								200
144					415		1							416
145	277	6	534		1873	134	3		284		8			3119
146	2	3			3	2					2	1		13
147			8		210	27								245
148														0
149	6455	150	727	70	725	231	1		5367					13726
150	1				131	8			148		1			289
151											2			2
152					124	36			12					172
153														0
154					262		3		4		1			270
155					795						2			797
156					81	9					2			92

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Appendix 2c (continued). Observations of geese, swans, and loons by lake from Teshekpuk Lake are molting goose survey 2013.

Lake No.	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	TUSW	TUSWC	YBLO	Total
157														0
158											2			2
159					76	10	1		1					88
160			14	25	127	28					10			204
161	20		270	50	2704									3044
162	20		12		144	3			10					189
163					4	3	2				1			10
164											1			1
165					321	7					1			329
166			51	89	172	339	2				2	1		656
167					410	141					7			558
168					10	30								40
169			10		167						2			179
170	90		40		166	15								311
171	127				4	10								141
172	484				339	15			150		2			990
173	36		35											71
174					7	25								32
175	359		264		601	33					3			1260
176	220		90		824	25								1159
177	1				81									82
178	45													45
179														0
180					556	10								566
181	250		40				1				2			293
182	147		20											167
184					65	25								90
185														0
186	306		90		2	4								402
187			125		416									541
188					20	50					3			73
189					2	2								4
190					153	296								449
191					0									0
192					33	11								44
193	475		18		63									556
194	15				32						1			48
195	825		50		534									1409
196	35				351									386
197														0
198	374		224		13						2		2	615
199					157	28		4	175				2	366
200	2185		375		721	40			2447					5768
201			8		195	28	1				2			234
206			275		637	54		1	231		2			1200
207					321	140			50					511
208			15		979	352	4		126	3				1479
209					122	27			2	2				153
Grand Total	23725	376	14708	268	48850	11443	127	13	11731	50	355	37	5	111688
	BLBR	BLBRB	CAGO	CAGOB	GWFG	GWFGB	PALO	RTLO	SNGO	SNGOB	SWAN	SWANC	YBLO	

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