Aerial Survey of Molting Greater White-Fronted Geese, Canada Geese, and Swans on Innoko National Wildlife Refuge, Alaska, 2015.

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Introduction

The midcontinent population of greater white-fronted geese (*Anser albifrons*) breeds from the Canadian arctic to interior/northwest Alaska (Sullivan 1998, updated in 2015). Within interior/northwest Alaska, the Innoko National Wildlife Refuge (NWR) has, by far, the highest densities of molting midcontinent greater white-fronted geese (Marks and Fischer 2015). Conservation concern for the interior/northwest component of the midcontinent population was raised in the 1990s resulting from declines in local populations (Spindler et al. 1999), low annual survival (Ely and Schmutz 1999), and high harvest rate (Dooley 2016) relative to other geographic components of the population.

In response to these concerns, an aerial survey was instituted on the Innoko NWR in 2000 to monitor the population size, trend, and distribution of the boreal nesting component of midcontinent molting greater white-fronted geese (Kovach et al. 2010). The survey was intended to be a census of all molting geese present in the survey area and to monitor changes in distribution and age class (adult vs. juvenile) structure. Observations of Canada geese (*Branta canadensis*) and swans (*Cygnus spp*.) were also recorded. Following recommendations in (Kovach et al. 2010), the annual survey was redesigned to monitor geese within their core molting distribution. In addition to the annual core-distribution surveys, a bi-decadal (5-yr) expanded survey of the larger historic survey area is conducted to enable detection of distributional changes outside the core area (Wilson and Platte 2015). Here we report the results of the 2015 aerial count, compare these results with those from 2010-2014, and report growth rates from 2000 to 2015.

Methods

The Innoko molting goose survey consists of systematic transects within a predefined survey area on the Innoko NWR (Figure 1). Eleven distinct water bodies are also surveyed as part of the census (Figure 1). The survey design consists of 66 transects spaced 0.93 km apart and oriented east-west throughout the core survey area (789 km^2; Kovach et al. 2010; Figure 2). In addition, an expanded survey area, based on historical survey coverage, is flown every fifth year (1,905 km^2; Figure 3). Prior to 2010, all surveys were of the expanded area. With the exception of 2000 and 2012, amphibious Cessna 206 aircraft were used as a survey platform. A number of different pilots and observers have participated in the survey over the years (Table 1).

The two-person aerial crew navigates along transects at 300 feet above ground level (AGL) and at a speed of 90 knots. Each crew member records observations of greater white-fronted geese, Canada geese, and swans, and records age class (adult versus gosling/cygnet) out to 450 m on either side of the aircraft (Wilson and Platte 2015). Each observation is recorded via a Voice/GPS Record program (author: J. Hodges, USFWS) on laptop computers connected to the aircraft GPS, that assigns geographic locations to the voice recordings of aerial observations.

Surveys are typically conducted in early July and take 3 days to complete (Table 1). On average, the core survey area (flown in 2010, 2012-2015) requires approximately 16 hours to complete, not including ferry time from original duty station to the study area. The expanded survey area (2011, 2016, 2021, etc.) requires approximately 24 flight hours to complete.

Kovach et al. (2010) established weather limitations for conducting the survey. These limitations include: ceiling >500 feet, visibility >10 miles, winds <15 knots, and less than moderate turbulence. To achieve these conditions and improve comfort for the survey crew, flights are often conducted early in the morning when temperatures are cool and winds calm. It is helpful to base the survey from the Innoko field camp (63.63969 N, 153.80965 W) rather than out of McGrath where fuel is stored.

All flight tracks and bird sightings are added to an existing GIS geodatabase for Innoko molting goose surveys and transcribed observation data and GPS track files archived at Migratory Bird Management Anchorage, AK (As of 2015, K:\airdata\White fronted geese breeding and molting aerial surveys.gdb; K:\airdata\Innoko\molt\data(yr)).

Results and Discussion

In 2015, the core area was surveyed from July 4-7th (Table 1). Anna Anderson served as left-front pilot/observer and Tamara Zeller served as right-front observer. The survey took 18 hours to complete. This was longer than usual because of wildfire smoke and flight diversions to avoid areas of low visibility. Water levels were very low on the Innoko NWR in 2015, with many of the larger lakes in the southern portion of the survey area completely dry. The larger groups of geese that are typically observed on the large lakes were displaced to the Iditarod and Yetna rivers and were found along river bends often partially concealed under the vegetation or in the high grass.

We counted a total of 10,017 greater white-fronted geese adults and 323 young (Table 2). Numbers of adults were 34% below the previous mean (2000-2014). Counts of Canada geese and swans are also presented in Table 2.

Since the beginning of the survey in 2000, counts of geese and swans, and proportions of young to adults, have varied annually (CV range: 0.35-1.48; Table 2). We attribute this variation to a combination of variability in nesting success, conditions on molting grounds, and sampling error. We believe differences in detection and estimation between observers and varying water-levels and environmental conditions on survey grounds also contributes to inter-annual variation. Within the core survey area, the long-term (2000-2015) average annual growth rates were -2%/yr for greater white-fronted geese and +3%/yr for Canada geese (Table 2). There are relatively few observations of swans in the core survey area (average n = 30, 2000-2015). Average annual growth rate of swans was -5%/yr (2000-2015).

Overall distributions of geese and swans from 2010-2015 were relatively similar among years (Figure 4). Molting greater white-fronted geese were most abundant along the Iditarod River, the lower Netletna River, and in the Grouch Creek area, with fewer observations on the northern lakes. Canada geese were spread throughout the survey area. However, in 2015 most small family groups and large groups of failed breeders and/or non-breeders occupied sloughs and rivers in the southern survey area due to the low water levels.

Table 1. Survey dates, crews, and aircraft used for aerial surveys of molting geese on Innoko NWR, 2000-2015. Bold font indicates surveys conducted after redesign (see Kovach et al. 2010).

Year	Dates	Survey	Pilot	Observer	Aircraft
2000	9-11 July	Expanded	J. Sarvis	B. Aston	Cessna 185-floats
2001	5-7 July	Expanded	E. Mallek	B. Aston	Cessna 206-amphib
2002	6-7 July	Expanded	E. Mallek	L. Lysne	Cessna 206-amphib
2003	4-5 July	Expanded	E. Mallek	S. Charbonnet	Cessna 206-amphib
2004	5-6 July	Expanded	E. Mallek	S. Charbonnet	Cessna 206-amphib
2005	3-5 July	Expanded	E. Mallek	H. Wilson	Cessna 206-amphib
2006	3-6 July	Expanded	K. Bollinger	R. Corcoran	Cessna 206-amphib
2007	4-7 July	Expanded	K. Bollinger	R. Corcoran	Cessna 206-amphib
2008	5-9 July	Expanded	K. Bollinger	S. Kovach	Cessna 206-amphib
2009	6-7 July	Expanded	P. Anderson	S. Kovach	Cessna 206-amphib
***2010**	**5-7 July**	**Core**	**P. Anderson**	**D. Whitworth**	**Cessna 206-amphib**
2011	**3-5 July**	**Expanded**	**H. Wilson**	**D. Whitworth**	**Cessna 206-amphib**
2012	**29 June -1 July**	**Core**	**H. Wilson/W. Larned**	**H. Wilson/W. Larned**	**Quest Kodiak-amphib**
2013	**5-7 July**	**Core**	**H. Wilson**	**D. Whitworth**	**Cessna 206-amphib**
2014	**5-7 July**	**Core**	**H. Wilson**	**A. Anderson**	**Cessna 206-amphib**
2015	**4-7 July**	**Core**	**A. Anderson**	**T. Zeller**	**Cessna 206 amphib**

**Redesigned survey flown beginning in 2010.*

Table 2. Geese and swan estimates in the core survey area 2000–2015. Estimates from 2000-2009 and 2011 are from the core area only; estimates from the expanded survey in those years is not presented.

Year	Canada Geese			Greater White-Fronted Geese			Tundra & Trumpeter Swans		
	Adults	Young	(% Young)	Adults	Young	(% Young)	Adults	Young	(% Young)
2000	625	25	(4.0%)	20,480	80	(0.4%)	1	0	(0.0%)
2001	4,784	25	(0.5%)	18,214	137	(0.8%)	13	3	(23.1%)
2002	3,886	14	(0.4%)	11,268	19	(0.2%)	15	1	(6.7%)
2003	8,216	132	(1.6%)	27,148	17	(0.1%)	1	0	(0.0%)
2004	4,625	35	(0.8%)	11,317	17	(0.2%)	17	0	(0.0%)
2005	3,147	148	(4.7%)	9,670	74	(0.8%)	1	0	(0.0%)
2006	5,981	144	(2.4%)	16,138	66	(0.4%)	71	17	(23.9%)
2007	5,226	926	(17.7%)	11,695	117	(1.0%)	38	16	(42.1%)
2008	5,118	99	(1.9%)	21,608	27	(0.1%)	40	13	(32.5%)
2009	4,421	1	(0.0%)	14,356	1	(0.0%)	36	1	(2.8%)
2010	1,871	40	(2.1%)	11,675	30	(0.3%)	35	6	(17.1%)
2011	3,063	201	(6.6%)	12,428	302	(2.4%)	63	2	(3.2%)
2012	5,138	49	(1.0%)	8,784	58	(0.7%)	31	0	(0.0%)
2013	2,524	66	(2.6%)	14,898	245	(1.6%)	30	1	(3.3%)
2014	6,706	274	(4.1%)	19,238	130	(0.7%)	48	0	(0.0%)
2015	5,720	561	(9.8%)	10,071	323	(3.2%)	33	4	(12.1%)
Average	**4,441**	**171**	**(3.9%)**	**14,937**	**103**	**(0.7%)**	**30**	**4**	**(13.5%)**
SE	474	61		1289	26		5	1	
CV	0.43	1.43		0.35	1.00		0.71	1.48	
Growth Rate	**0.03**	**0.12**		**-0.02**	**0.09**		**-0.05**	**n/a**	

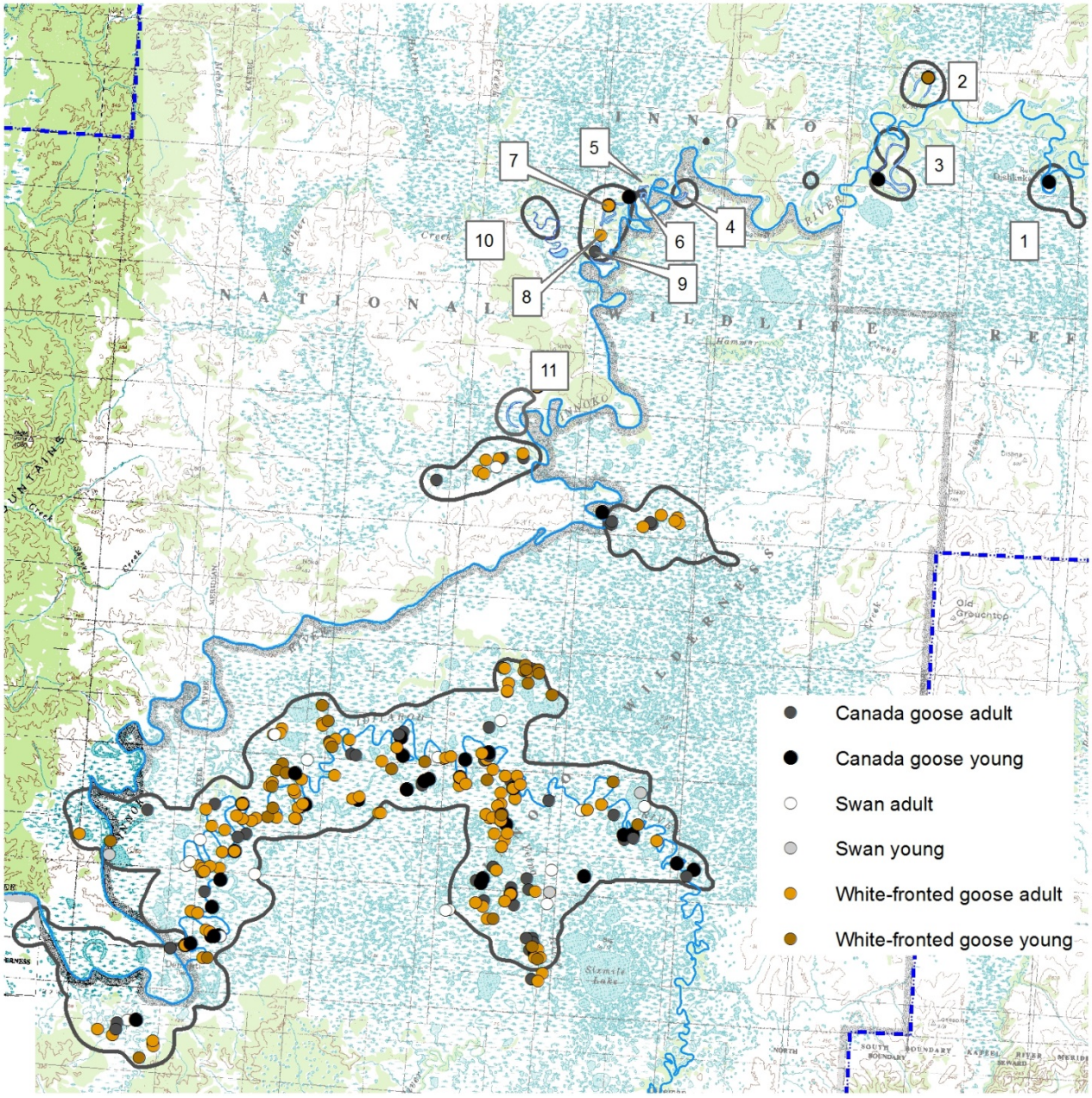

Figure 1. Survey area and locations of geese and swans sighted in 2015, Innoko NWR.

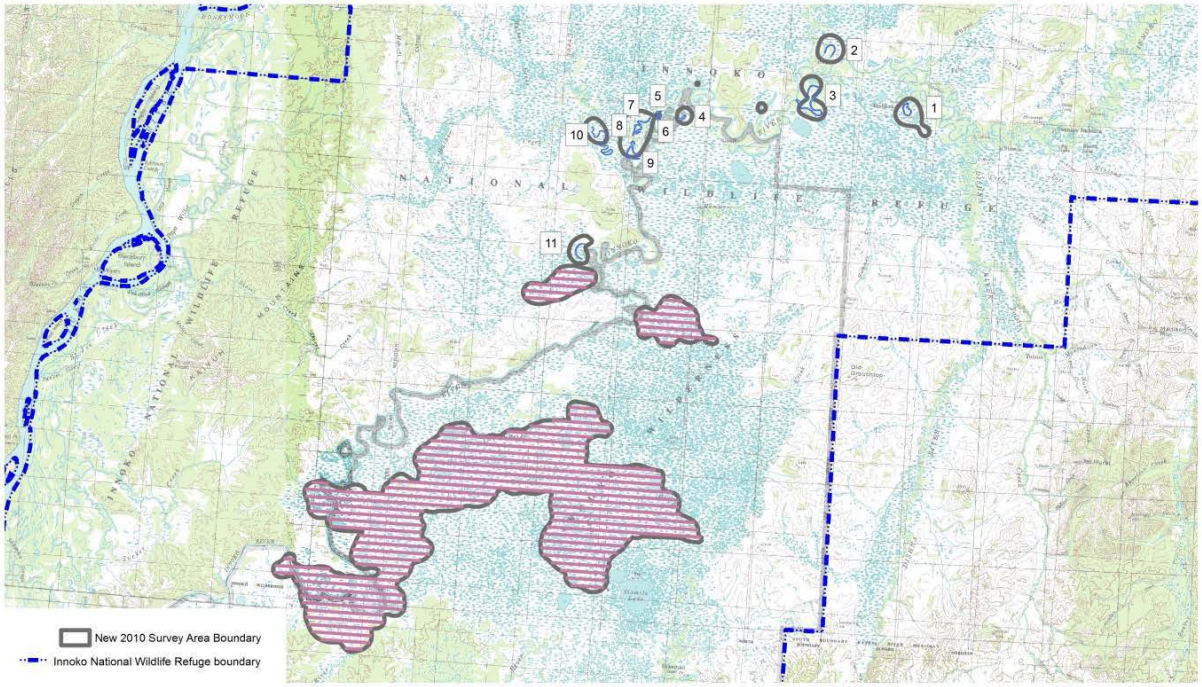

Figure 2. Survey area, transects, and lakes searched for molting geese in the core area which is designated with purple transect lines. The core area boundaries are outlined in grey. The core area of the survey was flown in 2010 and 2012-2015.

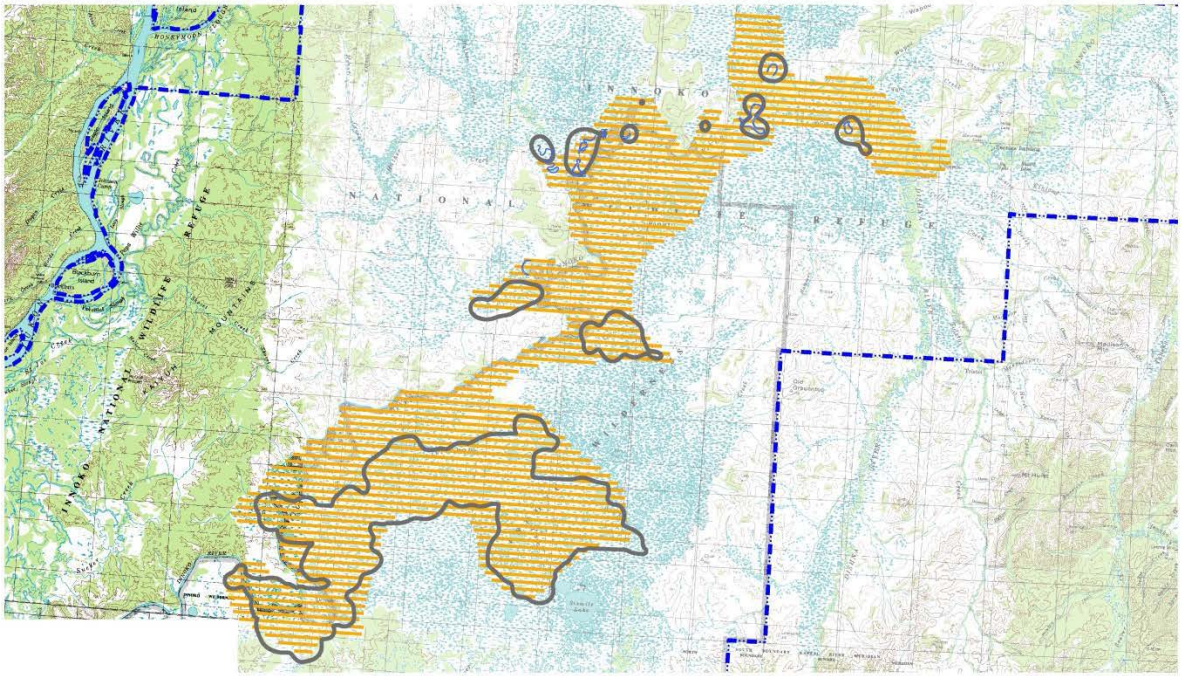

Figure 3. Survey area, transects, and lakes searched for molting geese in the expanded area which is designated with yellow transect lines. The core area boundaries are outlined in grey. The expanded survey was flown in 2001-2009 and 2011.

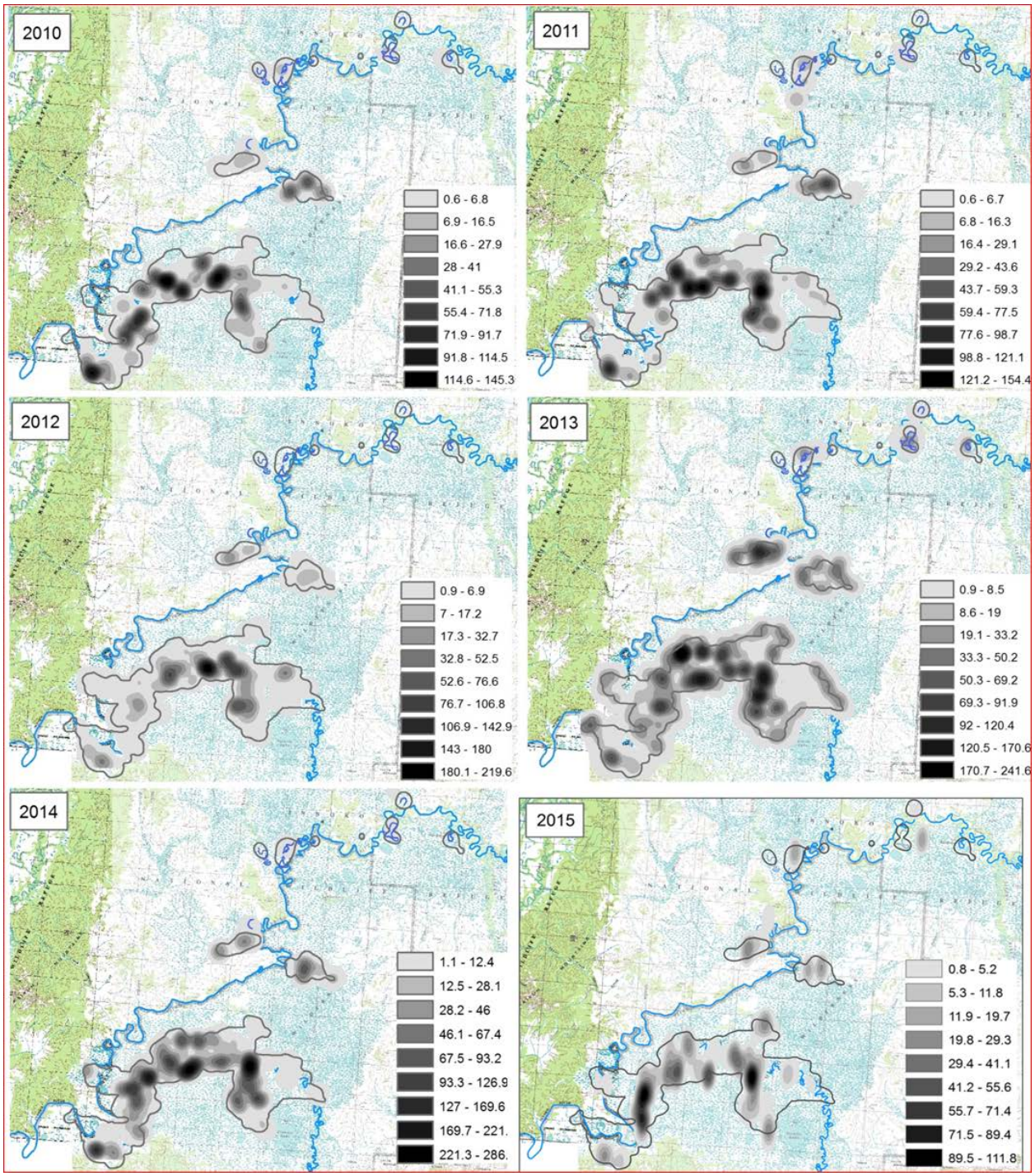

Figure 4: Kernel density estimates for greater white-fronted geese per square kilometer, 2010-2015. The class values are based on Natural Breaks classification in ArcGIS. The data for the northern lakes area searched in 2012 are not shown.

Acknowledgements

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

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Appendix A. Data collection and archiving procedures.

1. **<u>Data Collection/Transcribing</u>.** Per Kovach et al. (2010:
   - **YEAR**, **MONTH**, **DAY**, **SEAT** (LF, RF, or BOTH), **OBSERVER** (pilot and observer names using three letter initials). Example: "2014, 7, 3, lf, hmw".
   - **TRANSECT** (Assigned number. For NW Lakes use "101" for LAKE 1, "102" for LAKE 2, etc.)
   - **WINDDIR** (Compass degrees (e.g., 290))
   - **WINDSPD** (Knots)
   - **SKY** (Per aviation surface observation abbreviations, e.g., OVC030, CLR, SCT065)
   - **SPECIES** (AOU species codes followed by A for adult or Y for young; e.g., CAGOA, CAGOY, GWFGA, GWFGY, SWANA, SWANY; as well as location of transect beginnings and ends; e.g., TBEG, TEND)
   - **COUNT** (Number of adult (A) and young (Y) Canada and greater white-fronted geese & swans)
   - **WATER_LEVEL** ("High"= grazing lawns covered, "Medium" = grazing lawns present, "Low" = extensive amounts of exposed mud below grazing lawns)
   - **AIRCRAFT** (Make, model, N-number)
   - **NOTES** (*Temperature* (e.g., 80F), *Major storms/Weather fronts* (3 days before or after survey), Smoke/Fires, and any deviations from survey design).

2. **<u>Data Archiving.</u>**
   - All flight tracks and bird sightings should be added to the existing GIS geodatabase for Innoko Molting Goose surveys**: R7 Migratory Bird Management, K:\airdata\White fronted geese breeding and molting aerial surveys.gdb**
   - A final copy of transcribed observation data (both observers) and flight track files should be archived at: **R7 Migratory Bird Management, K:\airdata\Innoko\molt\data(yr)**