MBM 20 July 2018

Memorandum

To: Todd Sanders, Pacific Flyway Representative, USFWS DMBM

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Through: Eric J. Taylor, Chief, USFWS, MBM, Region 7

Subject: 2018 breeding ground survey for dusky Canada geese, Copper River Delta, AK

INTRODUCTION AND METHODS

An aerial survey on the Copper River Delta (CRD) has been completed annually since 1986 to estimate abundance of dusky Canada geese and trumpeter swans during the breeding season. The 2018 survey was conducted May 13-15 by the U.S. Fish and Wildlife Service (USFWS), Region 7 Migratory Bird Management (R7 MBM). The crew was comprised of pilot-observer Heather Wilson and right seat observer Dennis Marks (Appendix 1).

Standard aerial breeding pair survey techniques (USFWS and CWS 1987) were used in 1986–2018. Similar to most prior surveys, the survey platform was an amphibious Cessna 206. Transects (Fig. 1) were flown at an altitude of approximately 45 m and an airspeed of 150 km/hr. Pilot and right-seat observers counted geese and swans to a distance of 200 m from the transect centerline. Observations were recorded directly into a GPS-connected computer using customized survey software (John Hodges, USFWS R7 MBM). The same flight lines have been used since 1997, but minor changes to several East Delta transects were made in 2014 to increase safety near mountains; an adjustment was made to transect area to account for this in the analysis (Stehn and Platte, 2014; Hodges pers. comm.). Three strata (West Delta, East Delta and Egg Island, stratified by goose density; Fig. 1) were used to derive population index estimates. Within these strata, transects were spaced at intervals of 0.93 km (West Delta), 1.85 km (East Delta), and 0.78 km (Egg Island). Population indices for dusky Canada geese are presented in this report. Population indices for trumpeter swans and their nests will be reported later.

2018 data were summarized, checked and analyzed using a new R7 MBM survey analysis R package "AKaerial" (available at github.com/cfrost3/AKaerial). Data prior to 2018 was analyzed using the R7 MBM analysis Visual Basic package "PopEstimates" (Hodges, unpubl. USFWS data). Both approaches used a ratio estimation procedure (Caughley 1977). Differences in data treatment between analysis packages will be investigated and estimates revised as needed in the 2019 memo.

Calculation of population indices

Dusky Canada Geese-Aerial Indices
The aerial indices presented in Table 1 are defined as follows:

Indicated Total Bird Index	= 2 x (singles + pairs) + birds in flocks
Indicated Breeding Bird Index	= 2 x (singles + pairs)
Adjusted Breeding Bird Index	= Indicated Breeding Birds x 3.3416
Total Breeding Ground Index	= Adjusted Breeding Bird Index + Flocks + Middleton Island Count

These indices are based on the assumption that a single observed goose represents a pair, with the unseen mate on a nest; thus, single observations are doubled to represent the pair (USFWS and CWS 1987).

Dusky Canada geese breeding bird indices were adjusted to account for incomplete detection using methods described in the Dusky Canada Goose Management Plan (Pacific Flyway Council 2015). The adjustment is made using the ratio of nests (counted by ground crews) to indicated pairs (counted by aerial crews; Hodges and Eldridge 2007). The adjustment factor also incorporates nest detection rate of ground crews and renesting rate (Fondell et al. 2006). The final adjustment factor for indicated breeding birds is 3.3416 (SE = 0.3244) (Pacific Flyway Council 2015). The calculation is as follows:

3.3920 * (1 / 0.8323) * (1 / 1.2196) = **3.3416**

Where:

3.3920 (SE = 0.1685) is the ratio of nests detected by ground crews per indicated pairs detected by aerial survey crews,

0.8323 (SE 0.0659) is the nest detection rate for ground crews, and

1.2196 (SE 0.0322) is the renesting rate per pair prior to the aerial survey.

To derive a Total Breeding Ground Index, the adjusted breeding bird index for the CRD is added to the CRD aerial index of flocked birds plus the most recent count of adult birds on Middleton Island. Counts on Middleton are derived from a ground census, most recently completed in 2017 by the Alaska Department of Fish and Game (Petrula and Smith 2017).

Survey Conditions

Snow and ice conditions have varied considerably between years on the Copper River Delta. In 2018, similar to 2017 (and 2016, which was very early; Appendix 1), southcentral Alaska

experienced a warm spring, resulting in little snow cover, open waterbodies and early vegetative emergence. This differed from historical surveys where significant amounts of snow and ice were typically observed throughout the survey area (Eldridge pers. comm.). As usual, we sought to time the survey such that it was late enough for geese to be present and incubating in the nesting area, yet early enough that flights were completed before emerging alder leaves reduced detection of geese. Based on communications with the National Forest Service in Cordova (Docken and Gabrielson, USFS Cordova, pers. comm.) the survey was started 2 days earlier relative to the mean of all previous survey initiation dates (1986–2017, 15 May, range 9–22 May) and 2 days later than the mean for the past 5 years (13 May). Few leaves were present on alders in the northernmost transects of the West Delta stratum, and only a small amount of growth, in the form of buds, was observed on trees in the rest of the survey area. Therefore, vegetation was not a noticeable visual obstruction. During most of the 2018 survey, skies were partly cloudy to overcast with occasional light rain, and wind was between 5–10 mph. On the first partial day of surveying (Egg Island stratum), heavy overcast with moderate wind and rain may have resulted in less than ideal lighting. Overall, however, survey conditions, based on landscape phenology and weather, were good to excellent in 2018.

RESULTS AND DISCUSSION

Dusky Canada goose indices are presented in Table 1 and Figure 2. The Total Breeding Ground Index of 10,823 (95% CI=9,086–12,560), was the lowest recorded since 2010 (Table 1) and was 13% (95% CI= -28% to 3%) below the 10-year (2009–2018) average of 12,418 (95% CI= 11,676–13,160). The most recent 10 year (2009–2018) average annual growth rate of the Total Breeding Ground Index was 1.054 (95% CI= 1.009–1.100, R^2=0.623) while the long term (1986–2018) average annual growth rate was 0.991 (95% CI=0.982–0.999, R^2=0.128). Growth rates were calculated using log-linear regression.

The Pacific Flyway Management Plan for the dusky Canada goose specifies the population is to be managed to sustain a population of 20,000 geese (Pacific Flyway Council 2015). The plan identifies three action levels, based on 3-year averages of the Total Breeding Ground Index. The recent 3-year (2016–2018) average population index of 12,511 was 25% above the 10,000 population index to maintain management Action Level 1, and 67% above the 7,500 population index to maintain “standard” (no change) hunting season regulations (Pacific Flyway Council 2015).

ACKNOWLEDGEMENTS

We thank U.S. Forest Service personnel Nick Docken, Melissa Gabrielson and Erin Cooper for logistical support during the survey and information on phenology. Bill Eldridge, Jack Hodges, Bob Stehn and Todd Sanders (MBM) assisted with analyses of historical data. Chuck Frost (MBM) updated the analysis in 2018. Julian Fischer, Michael Swaim, Erik Osnas, and Eric Taylor provided suggestions on the memorandum.

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Table 1. Population indices for dusky Canada geese, Copper River Delta and Middleton Island, Alaska, 1986–2018.

	Aerial indicated total birds index	SE	Aerial indicated breeding birds index	SE	Adjusted aerial breeding bird index[1]	SE	Birds in flocks	SE	All CRD birds (breeding + flocked)	Middleton Island geese[2]	Total breeding ground index[3]	SE	3-year mean[5]
1986	5,469	356	4,811	389	16,076	2,035	658	161	16,735	80	16,815	2,041	
1987	5,408	504	4,294	409	14,349	1,956	1,114	273	15,463	84	15,547	1,975	
1988	5,296	364	4,412	325	14,743	1,800	884	217	15,627	90	15,717	1,813	16,026
1989	6,582	565	4,463	369	14,914	1,905	2,119	519	17,033	75	17,108	1,975	16,124
1990	5,442	669	4,482	457	14,977	2,114	960	235	15,937	93	16,030	2,127	16,285
1991	3,773	437	2,861	356	9,560	1,513	912	223	10,472	249	10,721	1,530	14,620
1992	6,648	835	4,472	284	14,944	1,736	2,176	533	17,120	473	17,593	1,816	14,781
1993	6,334	495	4,096	265	13,687	1,599	2,238	548	15,925	-	16,398	1,690	14,904
1994	5,810	432	4,226	253	14,122	1,613	1,584	388	15,706	-	16,179	1,659	16,723
1995	3,685	323	3,357	250	11,218	1,375	328	89	11,546	-	12,019	1,378	14,865
1996	3,509	267	2,936	190	9,811	1,146	573	148	10,384	1,456	11,840	1,156	13,346
1997	4,208	271	3,379	176	11,291	1,245	829	239	12,120	1,168	13,288	1,268	12,382
1998	4,814	350	3,571	203	11,933	1,344	1,243	242	13,176	-	14,344	1,366	13,157
1999	3,068	224	2,599	174	8,685	1,026	469	106	9,154	-	10,322	1,031	12,651
2000	3,009	184	2,477	128	8,277	911	532	121	8,809	1,309	10,118	919	11,595
2001	3,157	202	2,788	181	9,316	1,090	369	82	9,685	-	10,994	1,093	10,478
2002	3,836	294	2,966	173	9,911	1,124	870	198	10,781	1,416	12,197	1,141	11,103
2003	3,083	222	2,215	129	7,402	839	868	131	8,270	-	9,686	849	10,959
2004	3,198	235	2,712	190	9,062	1,087	486	114	9,548	1,499	11,047	1,093	10,977
2005	5,050	614	3,986	418	13,320	1,908	1,064	329	14,384	-	15,883	1,936	12,205
2006	3,412	326	3,006	301	10,045	1,404	406	149	10,451	1,453	11,904	1,412	12,945
2007	2,848	188	2,456	157	8,207	955	392	67	8,599	-	10,052	958	12,613
2008	2,512	192	2,222	167	7,425	913	290	70	7,715	1,317	9,032	916	10,329
2009	1,768	165	1,513	103	5,056	600	255	98	5,311	-	6,628	608	8,571
2010	2,714	193	2,324	131	7,766	873	390	99	8,156	1,249	9,405	878	8,355
2011	3,736	326	2,845	202	9,507	1,145	891	183	10,398	-	11,647	1,160	9,227
2012	4,093	365	3,498	270	11,689	1,452	595	119	12,284	1,188	13,472	1,457	11,508
2013[4]							no survey						
2014	5,054	435	3,649	256	12,193	1,463	1,404	311	13,598	1,780	15,378	1,496	13,499
2015	6,082	513	4,201	280	14,038	1,656	1,881	391	15,919	-	17,699	1,669	15,516
2016	4,062	296	3,476	263	11,615	1,432	586	101	12,201	1,029	13,230	1,436	15,436
2017	3,702	286	3,174	243	10,606	1,314	528	158	11,134	2,345	13,479	1,323	14,803
2018	3,177	304	2,264	139	7,564	869	913	167	8,478	-	10,823	886	12,511

[1] Aerial indicated breeding bird index x 3.3416 (visibility bias adjustment)

[2] Adult geese; surveys were conducted approx. every other year. Dashes indicate prior counts were used in that year

[3] Bias adjusted breeding bird index + flocked geese + Middleton Island geese

[4] Survey not completed due to aircraft technical issues and weather

[5] Three-year mean derived from current and two prior surveys

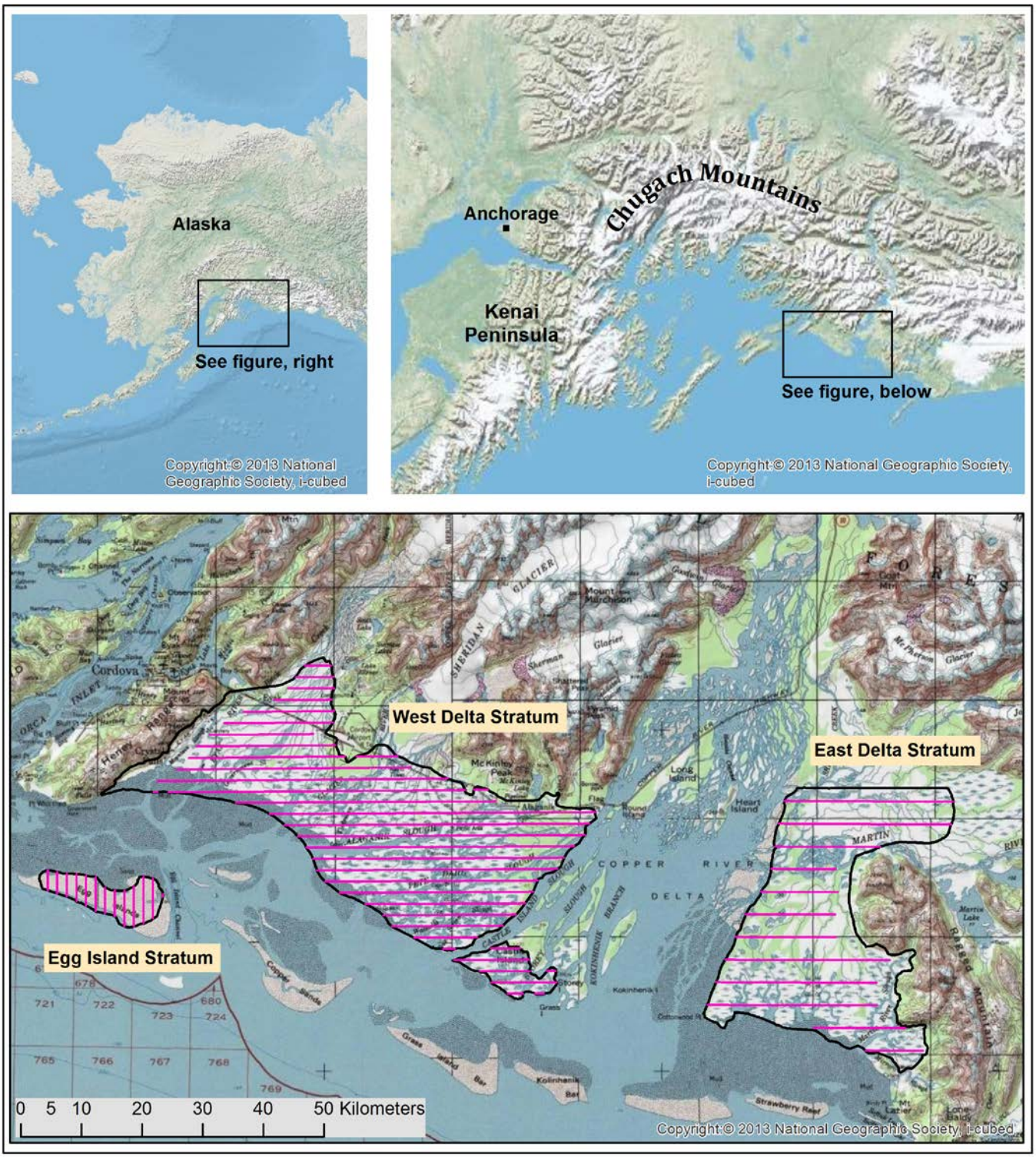

Figure 1. Location maps, survey units and transect lines for the 2018 breeding ground survey for dusky Canada Geese, Copper River, AK.

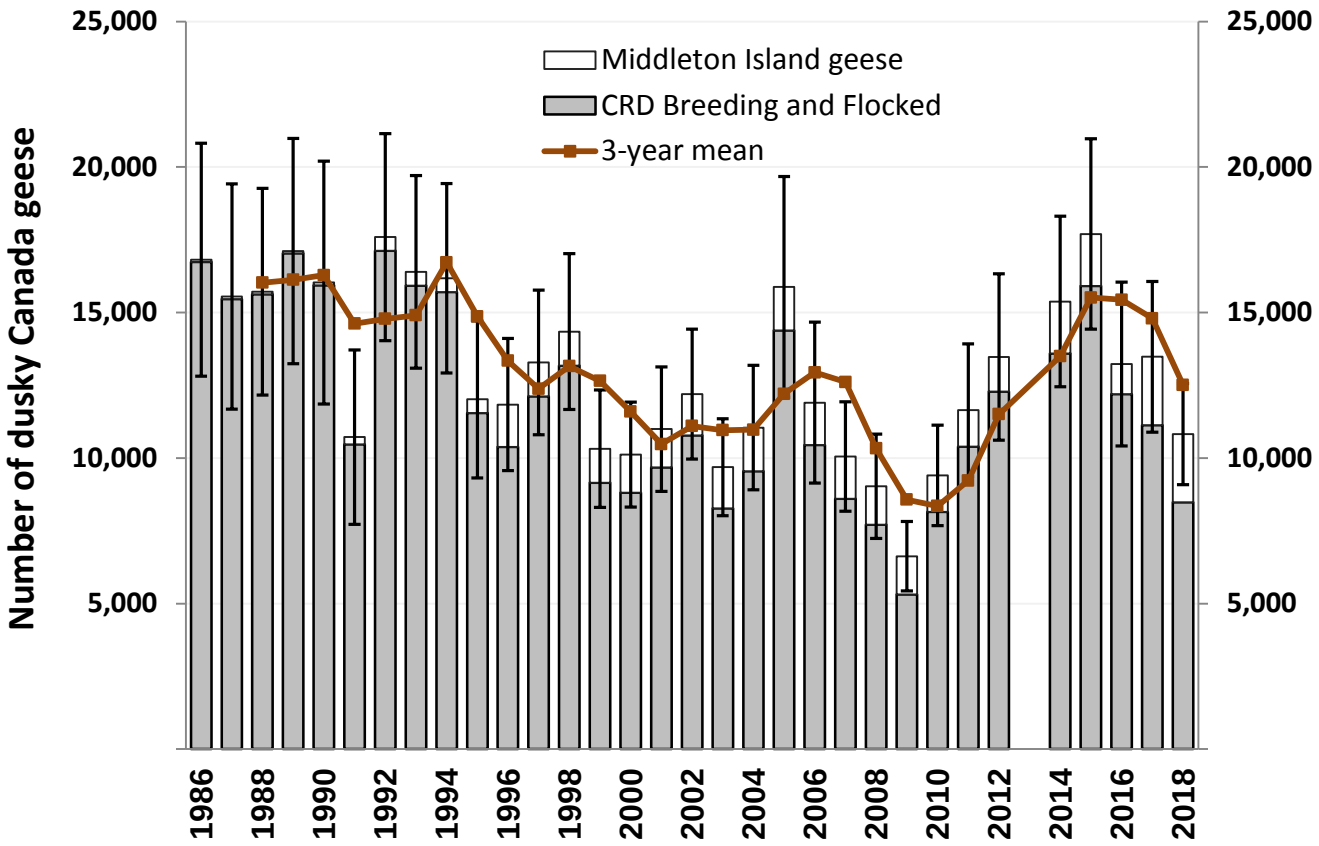

Figure 2. Total breeding ground index for dusky Canada geese, Copper River Delta and Middleton Island, Alaska, 1986–2018 with 95% CI. The 3-year running average is indicated by the solid line. The most recent 10 year (2009–2018) average annual growth rate was 1.054 (95% CI=1.009–1.100, R^2=0.623); the long-term (1986–2018) average annual growth rate was 0.991 (95% CI=0.982–0.999, R^2=0.128). Growth rates were calculated using log-linear regression.

Appendix 1. Observers and start and end dates for the breeding ground survey for dusky Canada Geese, Copper River, AK 1986–2018. Pilot is listed first of the two observers.

			Survey dates in May	
Year	Observers		Start	End
1986	BB	CL	19	21
1987	"	BE	15	16
1988	"	"	16	18
1989	"	"	16	17
1990	"	"	15	18
1991	"	"	16	17
1992	"	"	16	17
1993	"	"	13	14
1994	"	"	16	17
1995	BL	"	16	17
1996	"	"	13	15
1997	"	"	14	15
1998	"	"	12	13
1999	CD	"	17	18
2000	"	"	16	17
2001	BL	"	15	16
2002	CD	"	16	18
2003	BL	"	14	15
2004	"	"	13	14
2005	"	RO	9	10
2006	"	"	16	17
2007	KB	BE	16	17
2008	BL	RO	17	18
2009	"	"	22	23
2010	BL	BE	16	18
2011	"	"	16	17
2012	"	"	21	21
2013		no survey		
2014	HW	BL	12	13
2015	HW	DM	11	12
2016	"	"	3	4
2017	"	"	10	11
2018	"	"	13	15

Observer ident.			No. surveys	
BE	Bill Eldridge		22	
BL	Bill Larned		15	
BB	Bill Butler		9	
HW	Heather Wilson		5	
DM	Dennis Marks		4	
RO	Russ Oates		4	
CD	Chris Dau		3	
KB	Karen Bollinger		1	
CL	Cal Lensink		1	