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Memorandum

To: Robert Trost, Pacific Flyway Representative, USFWS Region 9

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Subject: 2012 breeding ground survey for dusky Canada Geese, Copper River Delta, AK

INTRODUCTION AND METHODS

The Copper River Delta (CRD) dusky Canada geese survey was conducted on 20 May 2012 by the Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Anchorage, Alaska. The 2012 survey was delayed 4 days relative to the mean (2004-11) survey initiation date (16 May, range 9-23 May) due to the record snowfall over the 2011/12 winter and resulting late spring. Weather and visibility were good. As in 2011, William Larned was the pilot/left seat observer and William Eldridge was the right seat observer.

Standard U.S. Department of Interior survey techniques were used and were the same as previous CRD surveys (USFWS and CWS 1967). A Kodiak Quest amphibious airplane was used in 2012 for the first time on this survey, replacing the Cessna 206. The standard east-west transects were flown (Fig. 1) at an altitude of approximately 45 m and an airspeed of 150 km/hr. Pilot and right-seat observer counted target species to a distance of 200 m from the transect centerline. Observations were recorded directly into a laptop computer connected to the airplane Global Positioning System through a survey program (John Hodges, USFWS, Migratory Bird Management, Juneau Field Station) and geographic coordinates were recorded for each observation. The same flight lines have been used since 1997 (Fig. 1). Three strata (Fig. 1) were used for population estimates for West Delta, East Delta and Egg Island. Transects were spaced on these strata at intervals of 0.93 km (0.5 nautical mile), 1.85 km (1.0 nautical mile), and 0.78 km (0.42 nautical mile), respectively. All observed species of geese, plus trumpeter swans, swan nests, moose, and brown and black bears were recorded during this survey. Population indices for dusky Canada geese, trumpeter swans, and swan nests are presented in this report.

Dusky Canada Geese

Population Indices

The population indices presented in Tables 1 and 2 are defined as follows:

$$\begin{aligned}\text{Indicated Total Birds} &= 2 \times (\text{singles} + \text{pairs}) + \text{birds in flocks} \\ \text{Indicated Breeding Birds} &= 2 \times (\text{singles} + \text{pairs})\end{aligned}$$

These indices are based on the assumption that a single goose observed represents a pair, with the unseen mate on a nest, so single observations are doubled to account for the pair. Geese seen on nests were not counted.

The analysis was performed using a Visual Basic program (John Hodges, USFWS, Migratory Bird Management, Juneau Field Station). The average densities of each aerial index were calculated from all transects within each of the 3 strata. A ratio estimation procedure was used to estimate the variance of the average densities (Caughley 1977). Average density was multiplied by total stratum area to calculate the population index for each of the three strata, which were summed for the total index. We assumed that all flight lines were flown as designed. Bird locations determined from the voice/GPS location were assigned to the nearest transect.

Conversion of population indices to an estimated population

The Dusky Canada Goose Management Plan (Pacific Flyway Council 2008) presents methodology to convert the aerial survey population indices, plus estimates from a Middleton Island boat survey to a population estimate that should better represent the actual population number, minus current year production. Three components are used to estimate the population: 1) CRD indicated breeding birds index from the May survey; 2) CRD flocked bird estimate from the May survey; and 3) Middleton Island adult birds from a late June boat survey. The results from the July production survey conducted by the Alaska Department of Fish and Game are not included in this estimate. The following steps and correction factors (which change annually with additional data) were used in determining the annual population estimates for 2012 and previous years:

CRD Breeding Bird Component

- 1) The indicated breeding birds index from the May survey is changed to an aerial breeding pair index (= 0.5 aerial pairs per indicated breeding birds aerial index).
- 2) The ratio of the ground nest density and aerial pair density (3.39 nests per aerial pair) is used to calculate total number of nesting pairs to correct for pairs not seen on the May aerial survey (see Hodges and Eldridge 2007). This value was determined by analyses of six years (1993-07) of paired, random, ground nest plots and aerial survey data.
- 3) The nest detection rate (0.832 nests detected per actual nest) corrects for nests undetected

on ground plots (Youkey 1998).

- 4) The average renesting rate (1.2 nests per pair) corrects for the number of extra nests counted on ground plots due to renesting (Fondell et al. 2006).
- 5) Birds per pair (= 2 birds per nest)

The conversion factor is determined by multiplying the above values as follows:

$$0.5 * 3.39 * (1 / 0.832) * (1 / 1.2) * 2 = 3.3954$$

The resulting factor is multiplied by the aerial indicated breeding bird index (Table 2) to determine the breeding bird component of the total CRD dusky Canada goose population estimate.

CRD Flocked Bird Component

The number of birds in flocks is expanded by stratum and summed for the entire delta (Table 1). We assume that 100% of flocked birds (3 or more birds together) are observed.

Middleton Island Adult Bird Component

The number of adult geese observed on Middleton Island during late June ground surveys was added as a third population component (Pacific Flyway Council 2008). For those years without Middleton Island surveys, the number of adult geese as seen in the most recent prior year with data was used. The Middleton Island survey conducted in late June 2012 recorded 1,188 adult geese (Petrula et al. 2012).

The total dusky Canada goose population estimate = CRD breeding bird component + CRD flocked bird component + Middleton Island adult bird component.

Trumpeter Swan

Population Indices

We assume that 100% of swans and swan nests are seen on transect. Unlike geese, we count swans on nests as single birds or as a pair if another single bird is seen close to one on a nest. The population indices for swans are as follows:

Total Birds	=	(2 x pairs) + single birds + birds in flocks
Singles and Pairs	=	(2 x pairs) + single birds
Swan Nests	=	number of active swan nests

The same population analysis program described above for dusky Canada geese was used to calculate the population indices for trumpeter swans which are presented in Table 2.

RESULTS AND DISCUSSION

Dusky Canada Geese

Population. The three components of the dusky Canada goose estimate, the population estimate, and the 3-year average for all years are presented in Table 1 and Fig 2. The 2012 indicated breeding birds index (3,498± 270), indicated total birds index (4,093±365), and total population estimate (13,660) were the highest recorded since 2005 (Table 1). Population increases could be due in part to four consecutive years of high production on CRD (Petrula 2011). Additional data are needed to confirm if the upward trend (2009-12) represents a change of the long-term (1986-09) decline.

The Pacific Flyway Management Plan for the Dusky Canada Goose specifies the population is to be sustained within a range of 10,000 to 20,000 geese. The plan identifies three action levels for increasingly intensive management efforts to benefit the population of dusky Canada geese. From 2009-11, the three-year population average was <10,000 birds thereby triggering implementation of Action Level 2 management procedures. These actions, in conjunction with good production during the last four years, may have contributed to the higher 2012 population indices. The 3-year (2010-12) population average is 11,663, 17% above the 10,000 population level but less than the 12,500 population threshold required to resume Action Level 1 hunting seasons (Pacific Flyway Management Plan 2008:26)

Barrier Island Nesting. A relative new development is the increase in dusky densities on Egg Island. Egg Island was formerly a high density dusky nesting area but had decreased in value possibly due to gull and coyote predation. It appears that dusky Canada geese may be coming back to Egg Island; however, the increase this year could also be related to restricted nesting opportunities on the main delta due to deep and persistent snow cover. During July production surveys, Petrula (2011) observed large numbers of adults and young on Egg Island since 2008 but suggested it was the result of geese moving off the mainland after hatch. Another encouraging development is the possible colonization of Grass Island located just north and east of Egg Island as numerous pairs and one nest were observed. Although smaller and much less vegetated than Egg Island, Grass Island was not used in previous years by significant numbers of dusky Canada geese. Again, these observations could be related to restricted nesting site availability on the mainland. Grass Island should be monitored and considered for inclusion in the total index if numbers similar to those observed this year continue or increase.

Differences in Observability between Survey Platforms. No formal study was conducted to compare results from the Cessna 206 and Kodiak Quest; however, both the biologist-pilot and observer thought there was no observable difference in bird behavior at the approach of the aircraft. Probably more than 90% of dusky Canada geese remained on the ground during the survey with both aircraft. Some restriction in visibility on the observer side may have occurred

due to placement of the relatively wide windscreen frame in front of the right side window on the Kodiak. Our 2012 survey crew also included a third observer seated in a left rear seat. Observations from the rear seat observer will be compared to those of the pilot in a later report.

Snow and Ice Conditions. We did not analyze quantitative data for snow and ice conditions on the Copper River Delta for this report; however, the record snowfall for south-central Alaska in 2012 left the Delta with considerably more snow and ice cover on nesting areas than normal and was among the highest years in memory. The northern 4 transects of the East Delta near the Martin River drainage were 100% snow covered but paired geese were observed on gravel bars in the open streams. The eastern-most 1-2 miles of the West Delta were snow covered which has been rarely seen previously during this survey. Many ponds retained black ice throughout the Delta. We do not know the impacts of the restricted nesting site availability due to snow or ice or late spring on Dusky nesting or production.

Trumpeter Swans

The three population indices for trumpeter swans are presented in Table 2 and Fig. 3. Data for swans are variable but the trend for swan singles and pairs from 1986-2012 showed a significant increase ($p=.005$). Indices for total swans and swan nests also showed increasing trends but were not significant (Fig. 3). We cannot explain the high variability of the swan data. Nonetheless, we believe these data could be used to track long term changes in swan singles and pairs. Because the Chugach National Forest swan spring breeding and fall productivity surveys have been canceled and because index trends from this survey are similar to those surveys (Groves et al. 2009), swan results from the spring Copper River dusky survey may provide an alternative partial measure of the regional trumpeter swan breeding population.

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Table 1. Aerial population indices and converted population estimates for dusky Canada geese, 1986-2012.

Year	Indicated total birds index	SE	Indicated breeding birds		3.3954 * CRD			Middleton Island adults	Total estimated	
			index	SE	breeding birds index	CRD birds in flocks	CRD Breeding and Flocked		Dusky population	3-year running average
1986	5,469	356	4,811	389	16,335	658	16,993	80	17,073	
1987	5,408	504	4,294	409	14,580	1,114	15,694	84	15,778	
1988	5,296	364	4,412	325	14,981	884	15,865	90	15,955	16,269
1989	6,582	565	4,463	369	15,154	2,119	17,273	75	17,348	16,360
1990	5,442	669	4,482	457	15,218	960	16,178	93	16,271	16,525
1991	3,773	437	2,861	356	9,714	912	10,626	249	10,875	14,831
1992	6,648	835	4,472	284	15,184	2,176	17,360	473	17,833	14,993
1993	6,334	495	4,096	265	13,908	2,238	16,146	473	16,619	15,109
1994	5,810	432	4,226	253	14,349	1,584	15,933	473	16,406	16,953
1995	3,685	323	3,357	250	11,398	328	11,726	473	12,199	15,075
1996	3,509	267	2,936	190	9,969	573	10,542	1,456	11,998	13,534
1997	4,208	271	3,379	176	11,473	829	12,302	1,168	13,470	12,556
1998	4,814	350	3,571	203	12,125	1,243	13,368	1,168	14,536	13,335
1999	3,068	224	2,599	174	8,825	469	9,294	1,168	10,462	12,823
2000	3,009	184	2,477	128	8,410	532	8,942	1,309	10,251	11,750
2001	3,157	202	2,788	181	9,466	369	9,835	1,309	11,144	10,619
2002	3,836	294	2,966	173	10,071	870	10,941	1,416	12,357	11,251
2003	3,083	222	2,215	129	7,521	868	8,389	1,416	9,805	11,102
2004	3,198	235	2,712	190	9,208	486	9,694	1,499	11,193	11,118
2005	5,050	614	3,986	418	13,534	1,064	14,598	1,499	16,097	12,365
2006	3,412	326	3,006	301	10,207	406	10,613	1,453	12,066	13,119
2007	2,848	188	2,456	157	8,339	392	8,731	1,453	10,184	12,782
2008	2,512	192	2,222	167	7,545	290	7,835	1,317	9,152	10,467
2009	1,768	165	1,513	103	5,137	255	5,392	1,317	6,709	8,682
2010	2,714	193	2,324	131	7,891	390	8,281	1,249	9,530	8,464
2011	3,736	326	2,845	202	9,660	891	10,551	1,249	11,800	9,346
2012	4,093	365	3,498	270	11,877	595	12,472	1,188	13,660	11,663

Table 2. Population indices for trumpeter swan singles and pairs (singles + 2 x pairs), total swans (singles + 2 x pairs + flocked birds), and nests (active swan nests), 1986-2012.

Year	Swan Singles and Pairs	Total Swans	Nests
1986	435	467	95
1987	191	199	32
1988	342	667	85
1989	360	425	75
1990	245	381	65
1991	342	361	66
1992	222	353	47
1993	245	382	43
1994	300	372	45
1995	424	457	41
1996	399	475	68
1997	230	248	65
1998	508	588	96
1999	410	435	79
2000	447	592	65
2001	499	576	96
2002	592	756	107
2003	519	671	129
2004	416	549	57
2005	469	670	75
2006	788	888	147
2007	403	412	65
2009	337	346	89
2010	448	463	77
2011	449	511	74
2012	501	582	108

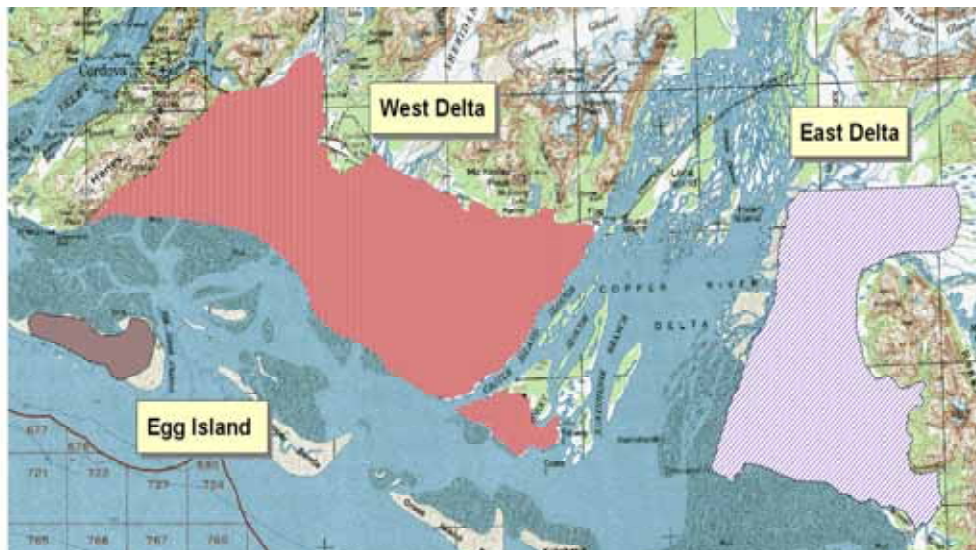


Figure 1. Flight lines and stratification for the Copper River Delta Aerial Survey.

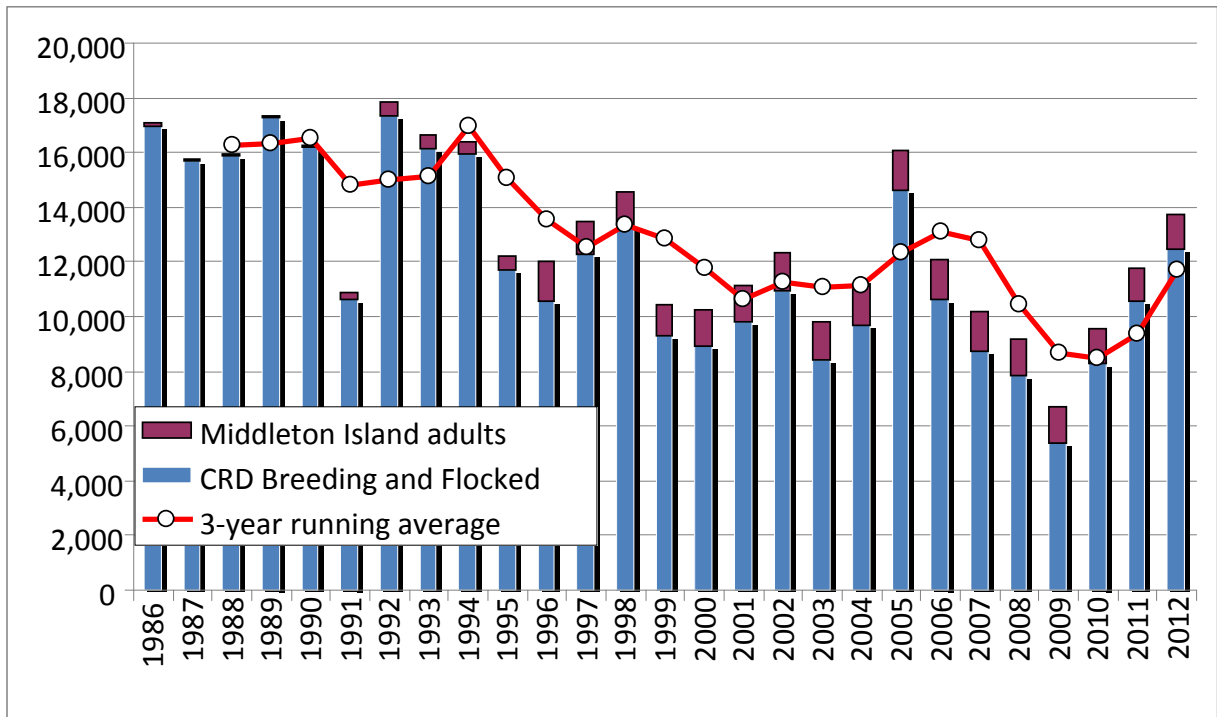


Figure 2. Population index conversion for the aerial survey of Dusky Canada Geese with Middleton Island adult bird estimate and 3-year running average, 1986-2012.

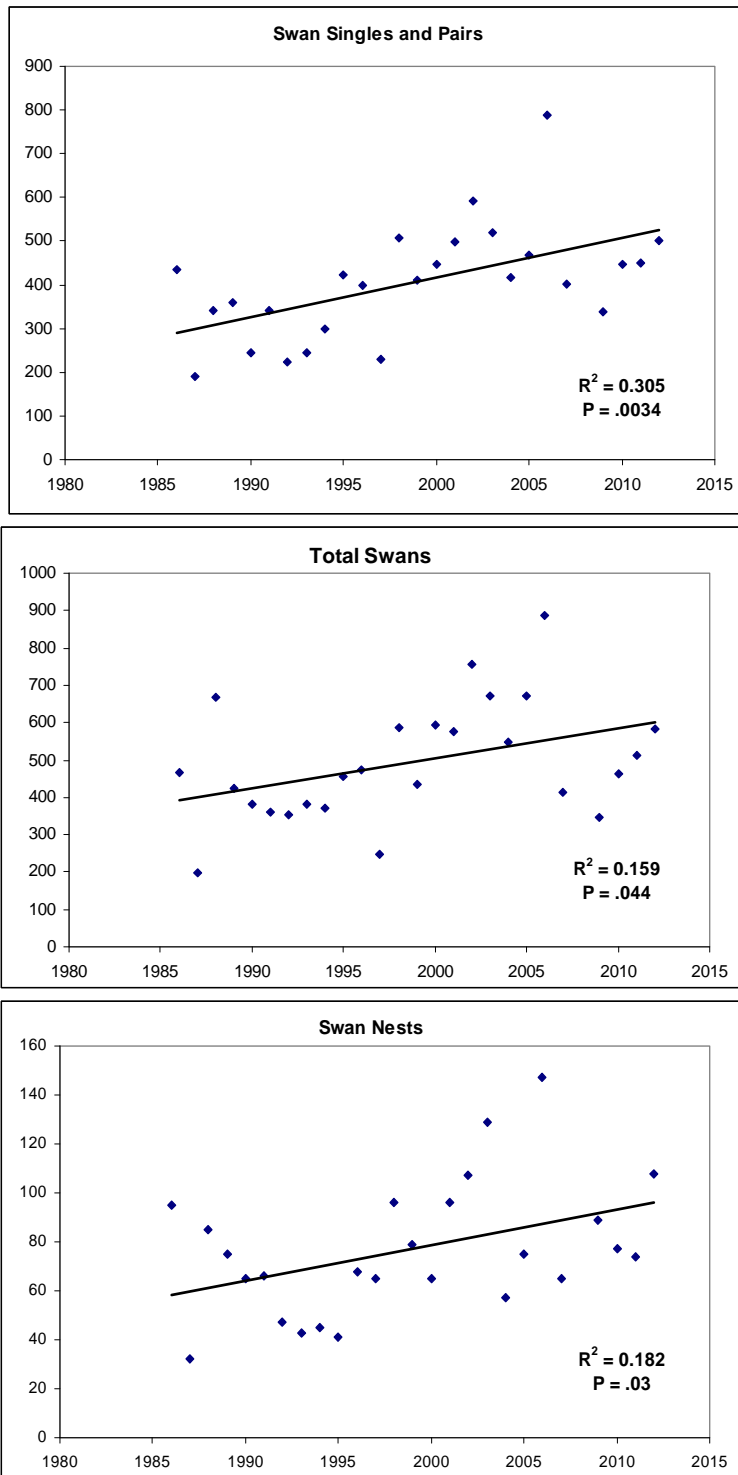


Fig 3. Population indices for trumpeter swan pairs, total birds, and nests.