

Memorandum

9 July 2008

To: ARD, MBSP, USFWS Region 7, Anchorage

From: William Larned, Robert Stehn, Waterfowl Branch, Anchorage Field Station,  
and Russell Oates, Chief Migratory Bird Management

Subject: Report to the Pacific Flyway Study Committee on 1986-2008 surveys of Dusky  
Canada Geese on the Copper River Delta, Alaska.

The 23<sup>rd</sup> annual Dusky Canada Goose survey of the Copper River Delta was conducted on 17-18 May 2008. We used standard aerial transect survey protocols (USFWS & CWS, 1967) and the survey dates were comparable to other years. We flew a Cessna 206 on amphibious floats along east-west straight line transects at an altitude of approximately 45 m and an airspeed of 150 km/hr. The left-seat pilot observer and the right-seat observer recorded all singles, pairs, or flocks of geese within a fixed-width strip of 200 m on each side of the plane. Observations were voice-recorded directly to a laptop computer that simultaneously recorded geographic coordinates from the aircraft Global Positioning System. We have flown the same systematic flight lines since 1997. Transect spacing (sampling intensity) varied among three strata with the West Delta sampled at 0.93 km (0.5 naut.mile) intervals, the East Delta at 1.85 km (1.0 nm) intervals, and Egg Island at 0.78 km (0.42 nm) intervals.

### **Population Indices**

The aerial index measures include the standard assumption that a single goose observed represents one member of a nesting pair with an undetected mate on a nest; therefore single bird observations were doubled to more closely approximate the actual population size. If a single bird on a nest is observed, it was not recorded unless as a member of a pair. Geese on nests were infrequently detected. Population indices for geese were calculated as:

Indicated Total Birds = 2 \* (n singles + n pairs) + birds in flocks

Indicated Paired Birds = 2 \* (n singles + n pairs).

The average density for each aerial index measure was calculated from all transects within each of the 3 strata. Because transects are of unequal length, we used a ratio estimate to calculate the average density and variance (Caughley 1977). Average density multiplied by total stratum area resulted in the population index, and the population indices from the three strata were summed. Analysis was performed by a VisualBASIC program written by John Hodges, Migratory Bird Management, Juneau Field Station, USFWS. All flight lines were assumed flown as designed, and all bird locations were associated with the nearest flight line.

## Conversion of Indices to Estimated Population

The draft Dusky Canada Goose Management Plan (Pacific Flyway Council 2007) presented justification and methodology to convert the aerial survey population indices to a population estimate (Hodges and Eldridge 2007, Eldridge et al. 2005). The process results in a population closer to the actual number of birds and is therefore more useful for Pacific Flyway managers. The steps are:

- a) indicated breeding birds index changed to aerial pair index (= 0.5 aerial pairs per indicated breeding birds aerial index)
- b) ground nest density per aerial pair density (= 3.39 nests per aerial pair) based on 22 stratum averages of nest and aerial index density, 1993-2007 (Hodges and Eldridge 2007).
- c) nest detection rate (= 0.832 nests detected per actual nest, Youkey 1998)
- d) renesting rate (= 1.2 nests per pair, Fondell et al. 2006)
- e) birds per pair (= 2 birds per nest)

Multiplied together, the conversion factor is:

$$0.5 * 3.39 * (1 / 0.832) * (1 / 1.2) * 2 = 3.395.$$

Thus, the aerial index of indicated breeding birds \* 3.395 was used to estimate the CRD actual breeding population of geese. Assuming 100% visibility detection for flocks, the estimated number of Dusky Geese observed in flocks on the CRD was also added to the converted breeding birds population estimate (Table 1). The number of adult geese observed on Middleton Island (unpubl. data ADFG, Pacific Flyway Council 2007, Petruła et al. 2006) was also added as a third contribution to the total population. For those years without Middleton Island surveys, the same number of geese as seen in the most recent survey was used as the population size (Table 1). The actual Dusky Goose population in wintering areas will vary from these annual estimates with any departure from the average conversion factors, annual variation in June-September adult mortality rates, and the number of surviving goslings from annual production.

## Results

Survey timing, seasonal phenology, observation conditions, and observer experience were all within a normal range. We consider the survey results obtained this year to be reliable. The aerial indices and the estimated population were tabulated and graphed for all years (Table 1, Figs. 1 & 2). The 2008 indicated total birds aerial index continued to decrease showing the lowest recorded number since the survey began. The 1986-2008 average annual growth rate of the total aerial index determined by log-linear regression was 0.967 (-3.3% annual change) with a 90% confidence interval of 0.957 to 0.978. With 23 years of decline, the population index is now at 47% ( $=0.9674^{23}$ ) of its initial size in 1986. The indicated breeding birds index has also decreased and 2008 the second lowest recorded in the history of the survey (Table 1, Fig. 2). The average annual growth rate of the breeding birds aerial index was 0.972 (-2.8% annual change) with 90% c.i. of 0.964 to 0.980. Using only aerial index data 1998 to 2008, the last 10 years, the average annual growth rates were 0.994 (0.959 to 1.031) for total indicated birds and 1.000 (0.967 to 1.034) for breeding birds.

Average growth rate 1986-2008 for the estimated total Dusky Canada Goose population based on the converted aerial indices, birds in flocks, plus Middleton Island adults showed an average growth rate of 0.978 (-2.2% annual change) with 90% c.i. at 0.970 to 0.986. This estimate included the limited but positive influence of the growth of the Middleton Island goose population during the period from about 1985 to 2000. For the last 10 years, 1999-2008, the total estimated population indicated growth rate of 1.000 (0.970 to 1.031).

### **Management Implications**

The Flyway Management Plan specifies a management goal for Dusky Canada Geese to maintain a population of 10,000 to 20,000 birds. A 3-year running average population below 10,000 calls for Action Level 2 management. The 3-year running average is now at 10,446. The single year 2008 estimated population is 9,091 birds. This low population estimate, the third consecutive year of a decline in population size, and the long-term declining population trend indicates that some change in management is needed.

### **Literature Cited**

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Table 1. Aerial population indices and converted population estimates for Dusky Canada Geese, 1986-2008.

Year	Indicated total birds index	SE	Indicated breeding birds index	SE	3.395 * CRD breeding birds index	CRD birds in flocks	Middleton Island adults	Total estimated Dusky population	3-year running average
1986	5469	182	4811	198	16333	658	90	17081	
1987	5408	257	4294	209	14578	1114	<b>90</b>	15782	
1988	5296	186	4412	166	14979	884	90	15953	16272
1989	6582	288	4463	188	15152	2119	90	17361	16365
1990	5442	341	4482	233	15216	960	90	16266	16527
1991	3773	223	2861	182	9713	912	90	10715	14781
1992	6648	426	4472	145	15182	2176	<b>400</b>	17758	14913
1993	6334	253	4096	135	13906	2238	400	16544	15006
1994	5810	220	4226	129	14347	1584	400	16331	16878
1995	3685	165	3357	128	11397	328	400	12125	15000
1996	3509	136	2936	97	9968	573	<b>1456</b>	11997	13484
1997	4208	138	3379	90	11472	829	<b>1168</b>	13469	12530
1998	4814	179	3571	104	12124	1243	1168	14535	13334
1999	3068	114	2599	89	8824	469	1168	10461	12822
2000	3009	94	2477	65	8409	532	<b>1309</b>	10250	11749
2001	3157	103	2788	92	9465	369	1309	11143	10618
2002	3836	150	2966	88	10070	870	<b>1416</b>	12356	11250
2003	3083	113	2215	66	7520	868	1416	9804	11101
2004	3198	120	2712	97	9207	486	<b>1499</b>	11192	11117
2005	5050	313	3986	213	13532	1064	1499	16095	12364
2006	3412	166	3006	154	10205	406	<b>1453</b>	12064	13117
2007	2848	188	2456	157	8338	392	1453	10183	12781
2008	2512	192	2222	167	7544	290	<b>1287</b>	9121	10456

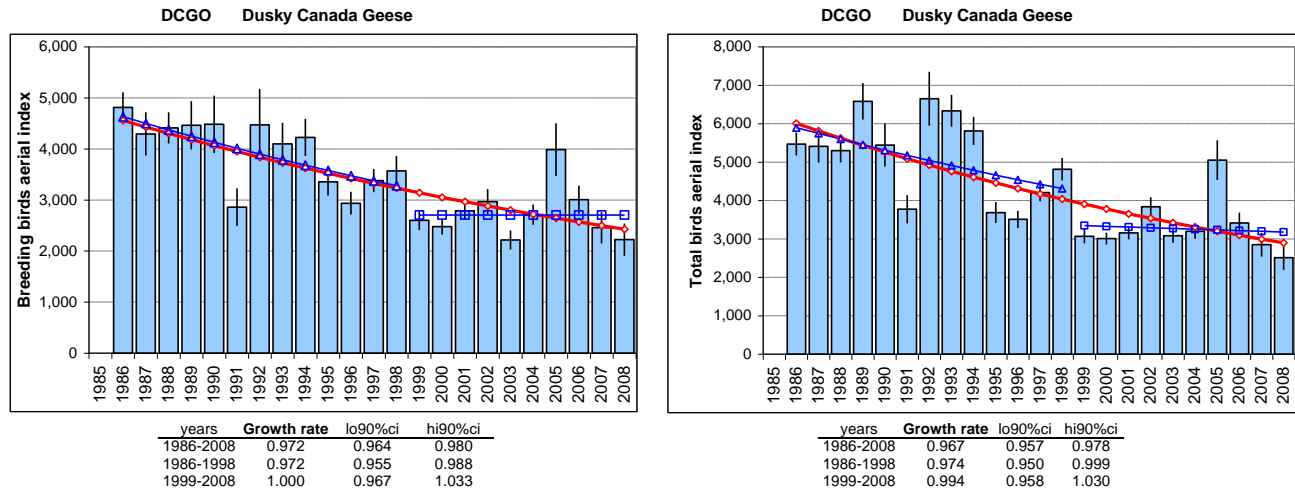


Figure 1. Aerial index measures for indicated breeding birds (2 n singles + 2 n pairs) and indicated total birds (2 n singles + 2 n pairs + flocks) of Dusky Canada geese observed on the Copper River Delta.

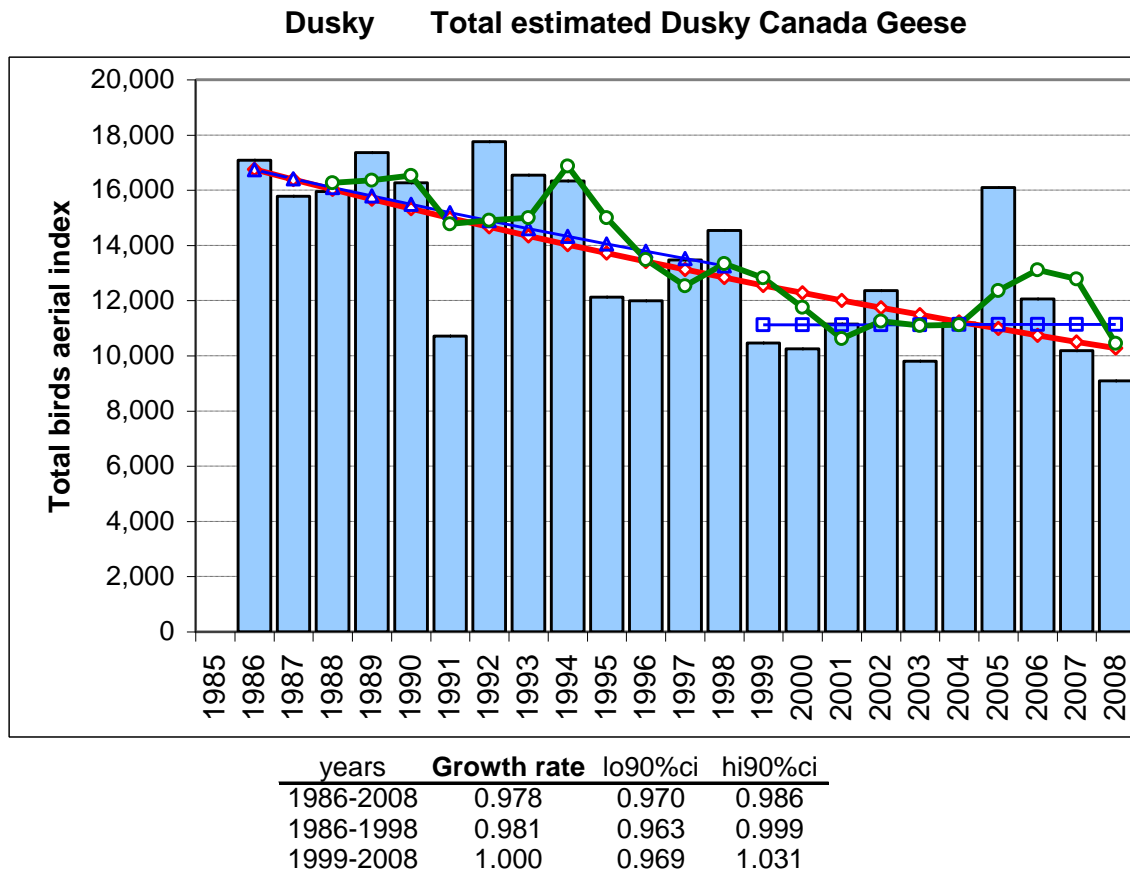


Figure 2. Estimated total population size of Dusky Canada geese based on indicated breeding birds x 3.395, birds in flocks on the CRD, plus Middleton Island adults. The 3-year running average is indicated by the green line.