

Memorandum

16 June 2009

To: Pacific Flyway Study Committee

From: William Larned and Robert Stehn,
Migratory Bird Management, USFWS, Anchorage

Subject: Aerial survey of Dusky Canada geese on the Copper River Delta, Alaska.

The annual Dusky Canada goose survey on the Copper River Delta was flown on 22-23 May 2009. We repeated the same systematic flight lines as flown since 1997 using standard aerial transect survey protocol (USFWS & CWS, 1967). Timing was delayed a few days this year to match late-warming spring conditions. We flew a Cessna 206 on amphibious floats along east-west straight line transects at an altitude of approximately 45 m and airspeed of 150 km/hr. The left-seat pilot observer (William Larned) and the right-seat observer (Russ Oates) recorded all singles, pairs, and 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. Transect spacing (sampling intensity) varied among three strata with the West Delta sampled at 0.93 km (0.5 nautical mile) intervals, the East Delta at 1.85 km (1.0 nautical mile) intervals, and Egg Island at 0.78 km (0.42 nautical mile) intervals.

Population Indices

The aerial index measure includes the standard assumption that a single goose observed represents one member of a nesting pair with an undetected mate on a nest; therefore, doubling single bird observations more closely approximate the actual population size. Single geese on a nest are infrequently detected and not recorded. Population indices for geese were calculated as:

$$\text{Indicated Paired Birds} = 2 * (\text{n singles} + \text{n pairs})$$

$$\text{Indicated Total Birds} = 2 * (\text{n singles} + \text{n pairs}) + \text{birds in flocks.}$$

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

Conversion of Indices to Estimated Population

The Dusky Canada Goose Management Plan (Pacific Flyway Council 2008) presented justification and methodology to convert the aerial survey population indices to a population estimate (Hodges and Eldridge 2007, Eldridge et al. 2005). This process results in a population closer to the actual number of birds and is therefore more useful for waterfowl managers concerned with regulating harvests. The steps are:

- a) indicated breeding birds index changed to an 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) average 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: $0.5 * 3.39 * (1 / 0.832) * (1 / 1.2) * 2 = 3.3954$

Thus, we used the aerial index of indicated breeding birds * 3.3954 was used to estimate the CRD actual breeding population of geese. Assuming 100% visibility detection rate of flocks, the estimated numbers of Dusky geese observed in flocks on the CRD were added to the indicated breeding birds population estimate (Table 1). The number of adult geese observed on Middleton Island (Pacific Flyway Council 2008, Petrula et al. 2008) was also added as a third contribution to the total population. For those years without Middleton Island surveys, the same number of adult geese as seen in the most recent survey year was repeated to estimate the population size (Table 1). The actual Dusky goose fall population in wintering areas will vary from these annual estimates with any departure from average conversion factors, variation among years in the June to October adult mortality rate, and the addition of surviving goslings. The count of goslings and adults in the July helicopter production survey (Petrula 2008) does not contribute to the estimates of the mid-May goose population tabulated in this report.

Results

Survey timing, seasonal phenology, and observation conditions were all within a normal range. The aerial indices and the estimated population are tabulated and graphed for all years (Table 1, Fig. 1). The 2009 indicated total birds aerial index continued to decrease showing the lowest recorded number since the survey began in 1986. The 1986-2009 average annual growth rate of the total aerial index determined by log-linear

regression was 0.962 (-3.8% annual change) with an approximate 90% confidence interval of 0.952 to 0.972. With 24 years of decline, the average population index is now 40% ($=0.9621^{24}$) of its initial size in 1986. The indicated breeding birds index has also decreased with 2009 the lowest recorded in the history of the survey (Table 1, Fig. 1). Using only the last 10 years of aerial index data from 2000 to 2009, the average annual growth rates were 0.956 (0.914 to 0.999) for total indicated birds and 0.964 (0.924 to 1.006) for breeding birds.

Average growth rate 1986-2009 for the estimated total Dusky Canada goose population based on converted indicated pair aerial indices, birds in flocks, plus Middleton Island adults showed an average growth rate of 0.973 (-2.7% annual change) with an approximate 90% c.i. at 0.966 to 0.982. 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, 2000-2009, the total estimated population growth rate was 0.967 (0.931 to 1.005). In summary, all estimates of trend agree and indicate a consistent long-term decline in population size.

Management Implications

The Flyway Management Plan specifies a population management goal for Dusky Canada geese at 10,000 to 20,000 birds. The 3-year running average is now at 8,682 (Table 1) and 2009 estimated population (6,709) is the lowest recorded number since the survey began in 1986. A 3-year running population average below 10,000 requires management agencies implement specific management procedures (Action Level 2) to ensure conservation and protection of Dusky Canada geese. The 2009 population estimate represents the fourth consecutive year of a decline in population size (Fig. 1). The 2009 population estimate combined with the long-term (1986-09) population decline, warrant agencies implement appropriate changes in harvest management.

Literature Cited

- Caughley, G. 1977. Sampling in aerial survey. *J. Wildl. Manage.* 41:605-615.
- Eldridge, W., D. Logan, J. Hodges, J. Fode, D. Youkey, and J. Crouse. 2005. Preliminary analysis of nest numbers related to aerial observations of breeding pairs of dusky Canada geese on the Copper River Delta, Alaska. Unpubl. report, USFWS, Anchorage.
- Fondell, T.F., J.B. Grand, D.A. Miller, and R.M. Anthony. 2006. Renesting by dusky Canada geese on the Copper River Delta, Alaska. *J. Wildl. Manage.* 70:955-964.
- Hodges, J. and W. Eldridge. 2007. Methods used to analyze aerial Dusky Canada goose data in relation to the ground nest surveys on the Copper River Delta. Unpubl. report, 17 Dec 2007, USFWS, Anchorage. 9pp.
- Pacific Flyway Council. 2008. Pacific Flyway management plan for the dusky Canada goose. Dusky Canada Goose Subcommittee, Pacific Flyway Study Comm. [c/o USFWS], Portland, OR. Unpubl. report. 38pp. + appendices.
- Petrula, M.J. 2008. Dusky goose production survey – 2008. Unpubl. report, Alaska Dept. Fish and Game, Anchorage. 5 pp.
- Petrula, M.J., T. Rothe, D. Rosenberg, and D. Crowley. 2008. Canada goose survey on Middleton Island – 2008. Unpubl. report, Alaska Dept. Fish and Game, Anchorage. 3 pp.
- USFWS and CWS. 1967. Standard Operating Procedures for aerial waterfowl breeding ground population and habitat surveys in North America. Unpubl. report, April 1967, U.S. Fish and Wildlife Service, Canadian Wildlife Service. 51pp.
- Youkey, D. 1998. Dusky Canada goose (*Branta canadensis occidentalis*) nest distribution, habitat use, population size, and production on the Copper River Delta, Alaska, 1998. Unpubl. report, USDA, Chugach National Forest, Cordova, AK. 8pp.

Table 1. Aerial population indices and converted population estimates for Dusky Canada geese, 1986-2009.

| Year | Indicated total birds index | SE | Indicated breeding birds index | SE | 3.3954 * CRD breeding birds index | CRD birds in flocks | Middleton Island adults | Total estimated Dusky population | 3-year running average |
|------|-----------------------------|-----|--------------------------------|-----|-----------------------------------|---------------------|-------------------------|----------------------------------|------------------------|
| 1986 | 5469 | 356 | 4811 | 389 | 16335 | 658 | 80 | 17073 | |
| 1987 | 5408 | 504 | 4294 | 409 | 14580 | 1114 | 84 | 15778 | |
| 1988 | 5296 | 364 | 4412 | 325 | 14981 | 884 | 90 | 15955 | 16269 |
| 1989 | 6582 | 565 | 4463 | 369 | 15154 | 2119 | 75 | 17348 | 16360 |
| 1990 | 5442 | 669 | 4482 | 457 | 15218 | 960 | 93 | 16271 | 16525 |
| 1991 | 3773 | 437 | 2861 | 356 | 9714 | 912 | 249 | 10875 | 14831 |
| 1992 | 6648 | 835 | 4472 | 284 | 15184 | 2176 | 473 | 17833 | 14993 |
| 1993 | 6334 | 495 | 4096 | 265 | 13908 | 2238 | 473 | 16619 | 15109 |
| 1994 | 5810 | 432 | 4226 | 253 | 14349 | 1584 | 473 | 16406 | 16953 |
| 1995 | 3685 | 323 | 3357 | 250 | 11398 | 328 | 473 | 12199 | 15075 |
| 1996 | 3509 | 267 | 2936 | 190 | 9969 | 573 | 1456 | 11998 | 13534 |
| 1997 | 4208 | 271 | 3379 | 176 | 11473 | 829 | 1168 | 13470 | 12556 |
| 1998 | 4814 | 350 | 3571 | 203 | 12125 | 1243 | 1168 | 14536 | 13335 |
| 1999 | 3068 | 224 | 2599 | 174 | 8825 | 469 | 1168 | 10462 | 12823 |
| 2000 | 3009 | 184 | 2477 | 128 | 8410 | 532 | 1309 | 10251 | 11750 |
| 2001 | 3157 | 202 | 2788 | 181 | 9466 | 369 | 1309 | 11144 | 10619 |
| 2002 | 3836 | 294 | 2966 | 173 | 10071 | 870 | 1416 | 12357 | 11251 |
| 2003 | 3083 | 222 | 2215 | 129 | 7521 | 868 | 1416 | 9805 | 11102 |
| 2004 | 3198 | 235 | 2712 | 190 | 9208 | 486 | 1499 | 11193 | 11118 |
| 2005 | 5050 | 614 | 3986 | 418 | 13534 | 1064 | 1499 | 16097 | 12365 |
| 2006 | 3412 | 326 | 3006 | 301 | 10207 | 406 | 1453 | 12066 | 13119 |
| 2007 | 2848 | 188 | 2456 | 157 | 8339 | 392 | 1453 | 10184 | 12782 |
| 2008 | 2512 | 192 | 2222 | 167 | 7545 | 290 | 1317 | 9152 | 10467 |
| 2009 | 1768 | 165 | 1513 | 103 | 5137 | 255 | 1317 | 6709 | 8682 |

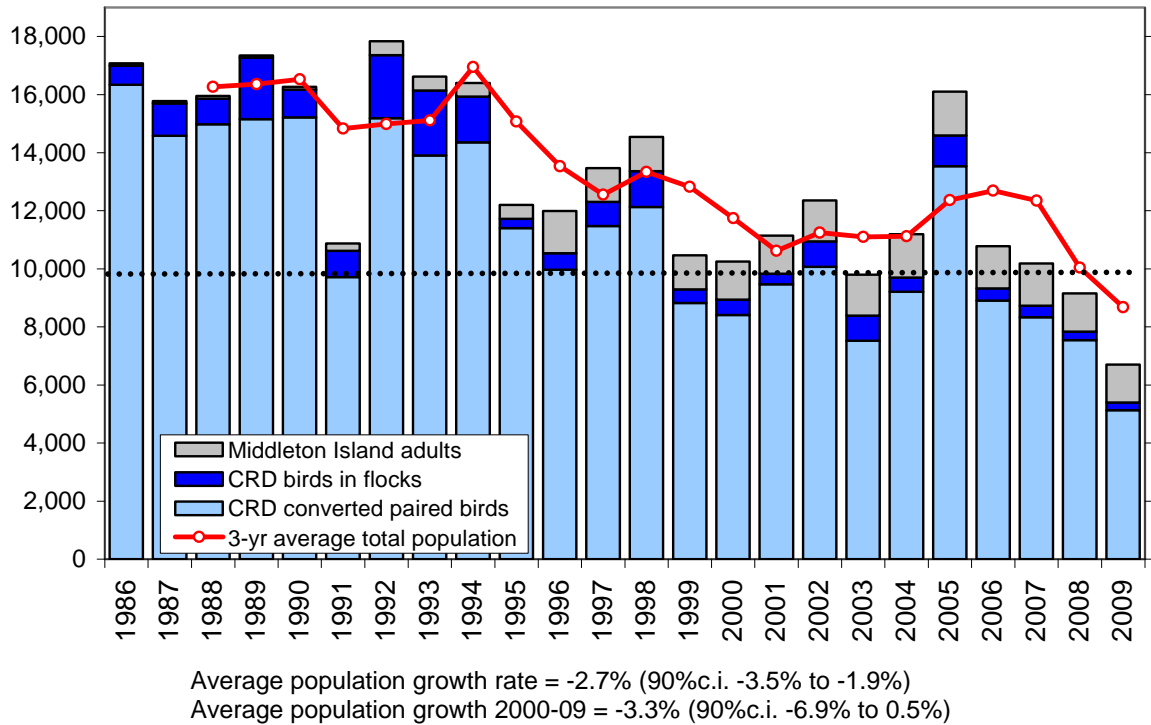


Figure 1. Estimated total population size of Dusky Canada geese based on indicated breeding birds x 3.3954, birds in flocks on the CRD, plus Middleton Island adults. The 3-year running average is indicated by the red line.