

## Memorandum

To: Todd Sanders, Pacific Flyway Representative, USFWS DMBM

From: Dennis Marks, Wildlife Biologist, USFWS Region 7  
Heather M. Wilson, Wildlife Biologist-Pilot, USFWS Region 7

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

Subject: 2015 breeding ground survey for dusky Canada geese, Copper River Delta, AK

**INTRODUCTION AND METHODS**

The principal population management index for dusky Canada geese is based on an aerial breeding ground survey on the Copper River Delta (CRD) and ground counts on Middleton Island, Alaska (Pacific Flyway Council 2015). The aerial breeding ground survey on the CRD has been completed annually since 1986 with the exception of 2013. The 2015 aerial survey was conducted on 11 and 12 May by the U.S. Fish and Wildlife Service (USFWS), Region 7 Migratory Bird Management (R7 MBM). The crew was comprised of pilot Heather Wilson, and right seat observer Dennis Marks. Dennis Marks participated in the survey for the first time in 2015; Heather Wilson has participated in the survey since 2014.

Standard aerial breeding pair survey techniques were used (USFWS and CWS 1987). Similar to most prior surveys, an amphibious Cessna 206 was used in 2015. 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 geese and swans to a distance of 200 m from the transect centerline. Observations were recorded directly into a GPS-connected computer (John Hodges, USFWS R7 MBM). The same flight lines have been used since 1997, but minor changes to several transects were made in 2014 to increase safety near mountains. Three strata (West Delta, East Delta and Egg Island; Fig. 1) were used for deriving population estimates. 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, trumpeter swans and swan nests are presented in this report.

**Dusky Canada Geese**Aerial breeding ground 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 observed goose represents a pair, with

the unseen mate on a nest; thus, single observations are doubled to represent the pair.

The analysis was performed using a Visual Basic program (John Hodges, USFWS R7 MBM). The weighted average densities (ratio of means) of each index were calculated from all transects within each of the 3 strata (West Delta, East Delta and Egg Island). 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. Bird locations determined from the GPS-connected computer were assigned to the nearest transect. We assumed that all flight lines were flown as designed. In addition to the sample-based aerial survey on the Cooper River Delta, we conducted an aerial survey of the vegetated small islands on the leeward side of Egg Island. These numbers were not included in the index.

### Management Index

Aerial breeding ground indices are adjusted to account for birds missed by survey crews 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 ratio incorporates nest detection rate and renesting rate (Fondell et al. 2006). Together, this results in an adjustment to the breeding bird index of 3.3416 (SE = 0.3244; Pacific Flyway Council 2015, with recent refinement to improve precision per the current draft management plan). The calculation is as follows:

$$0.5 * 3.392 * (1 / 0.832) * (1 / 1.220) * 2 = \mathbf{3.3416}$$

Where:

0.5 = pairs per indicated breeding birds index

3.392 = ratio of nests detected by ground crews per indicated pairs detected by aerial survey crews

0.832 = nest detection rate for ground crews

1.220 = renesting rate per pair prior to the aerial survey

2 = birds per pair

To derive the Management 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 biennial ground census conducted by the Alaska Department of Fish and Game (Petrula and Smith 2014).

## **Trumpeter Swans**

### Population Indices

The population indices for swans are as follows:

Indicated Total Birds	= (2 x pairs) + single birds + birds in flocks
Indicated Breeding Birds	= (2 x pairs) + single birds
Swan Nests	= number of active swan nests (swans on or adjacent to nests)

These indices assume that all swans, regardless of nesting status, are highly visible to aerial observers; hence single observations are not doubled as with geese.

## **RESULTS AND DISCUSSION**

### **Dusky Canada Geese**

Dusky Canada goose aerial population indices and management indices are presented in Table 1 and Figure 2. The 2015 aerial indicated breeding bird index (4,201), aerial indicated total birds index (6,082), and total population estimate (17,699) are among the highest recorded in the 30 years of the survey and are 15%, 20%, and 15% higher, respectively, than indices reported in 2014. The recent 3-year (2012, 2014, 2015) average was 15,516 and was 15% greater than the previous 3-year average (13,499; Table 1). Population increases could be due in part to high production on CRD from 2008–2013 (Petrula and Smith 2014) and higher numbers on Middleton Island.

We recorded 52 indicated breeding geese on the small islands between Egg Island and the West Delta but these were not added to the breeding birds index (no flocked geese were observed there in 2015).

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 management index. From 2009 to 2011, the three-year population averages were below 10,000 birds triggering implementation of Action Level 2. From 2012 to 2014, three-year averages were above 10,000. The recent 3-year (2012, 2014, 2015) population average of 15,516 is 55% above the 10,000 population required to maintain management Action Level 1 (Pacific Flyway Management Council 2015).

### **Trumpeter Swans**

Population indices for trumpeter swan singles and pairs, total swans, and active nests were 571, 675, and 141, respectively (Table 2). Data for swans are variable but all indices show increasing trends from 1986-2015 (Fig. 3). Swan results from the spring Copper River dusky survey may provide an alternative partial measure of the regional trumpeter swan breeding population (Groves et al. 2009).

## **Snow, Ice, Survey Conditions and Transect Replication**

Snow and ice conditions vary between years on the Copper River Delta. In 2015, southcentral Alaska experienced a warm spring compared to most years. Based on communications with the National Forest Service in Cordova, the timing of data collection was moved five days earlier relative to the mean (1986–2012) initiation date (16 May, range 9–22 May) to ensure the survey was completed before vegetation leaf-out reduced detection of geese. As in 2014, no snow was observed in the study area, somewhat unusual as some snow and ice are usually observed (Eldridge pers. comm.). Survey conditions were good to excellent in 2015.

On 11 May, we surveyed transects 18-31 of the East Delta strata under heavy overcast and occasional light rain. The number of geese counted there represented 38% of the total count. On 12 May, we conducted a replicate survey of these lines in better light. The replicate survey count was 16% higher than the previous survey primarily due to a greater number of flocks. Excluding flocks, the replicate survey was 3% higher than the first estimate. The replicate survey was used in the overall calculation for the management index.

## **ACKNOWLEDGEMENTS**

We thank Erin Cooper, U.S. Forest Service, for logistical support during the survey and information on phenology. Jack Hodges, Bill Eldridge and Bob Stehn assisted with historical data and analyses. Bob Platte, Julian Fischer, Todd Sanders, and Eric Taylor provided help in completing this report.

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**Table 1.** Aerial population indices for dusky Canada geese for the Copper River Delta aerial dusky Canada goose survey, 1986–2015.

	Aerial indicated total birds		Aerial indicated breeding birds		Adjusted aerial breeding	Birds		CRD breeding and	Middleton Island	Total birds		3-year mean
	index	SE	index	SE	bird index <sup>1</sup>	in flocks	SE	flocked	geese <sup>2</sup>	index <sup>3</sup>	SE	
1986	5,469	356	4,811	389	16,076	658	161	16,735	80	16,815	2,041	
1987	5,408	504	4,294	409	14,349	1,114	273	15,463	84	15,547	1,975	
1988	5,296	364	4,412	325	14,743	884	217	15,627	90	15,717	1,813	16,026
1989	6,582	565	4,463	369	14,914	2,119	519	17,033	75	17,108	1,975	16,124
1990	5,442	669	4,482	457	14,977	960	235	15,937	93	16,030	2,127	16,285
1991	3,773	437	2,861	356	9,560	912	223	10,472	249	10,721	1,530	14,620
1992	6,648	835	4,472	284	14,944	2,176	533	17,120	473	17,593	1,816	14,781
1993	6,334	495	4,096	265	13,687	2,238	548	15,925	473	16,398	1,690	14,904
1994	5,810	432	4,226	253	14,122	1,584	388	15,706	473	16,179	1,659	16,723
1995	3,685	323	3,357	250	11,218	328	89	11,546	473	12,019	1,378	14,865
1996	3,509	267	2,936	190	9,811	573	148	10,384	1,456	11,840	1,156	13,346
1997	4,208	271	3,379	176	11,291	829	239	12,120	1,168	13,288	1,268	12,382
1998	4,814	350	3,571	203	11,933	1,243	242	13,176	1,168	14,344	1,366	13,157
1999	3,068	224	2,599	174	8,685	469	106	9,154	1,168	10,322	1,031	12,651
2000	3,009	184	2,477	128	8,277	532	121	8,809	1,309	10,118	919	11,595
2001	3,157	202	2,788	181	9,316	369	82	9,685	1,309	10,994	1,093	10,478
2002	3,836	294	2,966	173	9,911	870	198	10,781	1,416	12,197	1,141	11,103
2003	3,083	222	2,215	129	7,402	868	131	8,270	1,416	9,686	849	10,959
2004	3,198	235	2,712	190	9,062	486	114	9,548	1,499	11,047	1,093	10,977
2005	5,050	614	3,986	418	13,320	1,064	329	14,384	1,499	15,883	1,936	12,205
2006	3,412	326	3,006	301	10,045	406	149	10,451	1,453	11,904	1,412	12,945
2007	2,848	188	2,456	157	8,207	392	67	8,599	1,453	10,052	958	12,613
2008	2,512	192	2,222	167	7,425	290	70	7,715	1,317	9,032	916	10,329
2009	1,768	165	1,513	103	5,056	255	98	5,311	1,317	6,628	608	8,571
2010	2,714	193	2,324	131	7,766	390	99	8,156	1,249	9,405	878	8,355
2011	3,736	326	2,845	202	9,507	891	183	10,398	1,249	11,647	1,160	9,227
2012	4,093	365	3,498	270	11,689	595	119	12,284	1,188	13,472	1,457	11,508
2013 <sup>4</sup>	-	-	-	-	-	-	-	-	-	-	-	-
2014	5,054	435	3,649	256	12,193	1,404	311	13,598	1,780	15,378	1,496	13,499
<b>2015</b>	<b>6,082</b>	<b>513</b>	<b>4,201</b>	<b>280</b>	<b>14,038</b>	<b>1,881</b>	<b>391</b>	<b>15,919</b>	<b>1,780</b>	<b>17,699</b>	<b>1,669</b>	<b>15,516</b>

<sup>1</sup> Aerial indicated breeding bird index x 3.3416 (visibility bias adjustment)

<sup>2</sup> Surveys conducted approximately every other year.

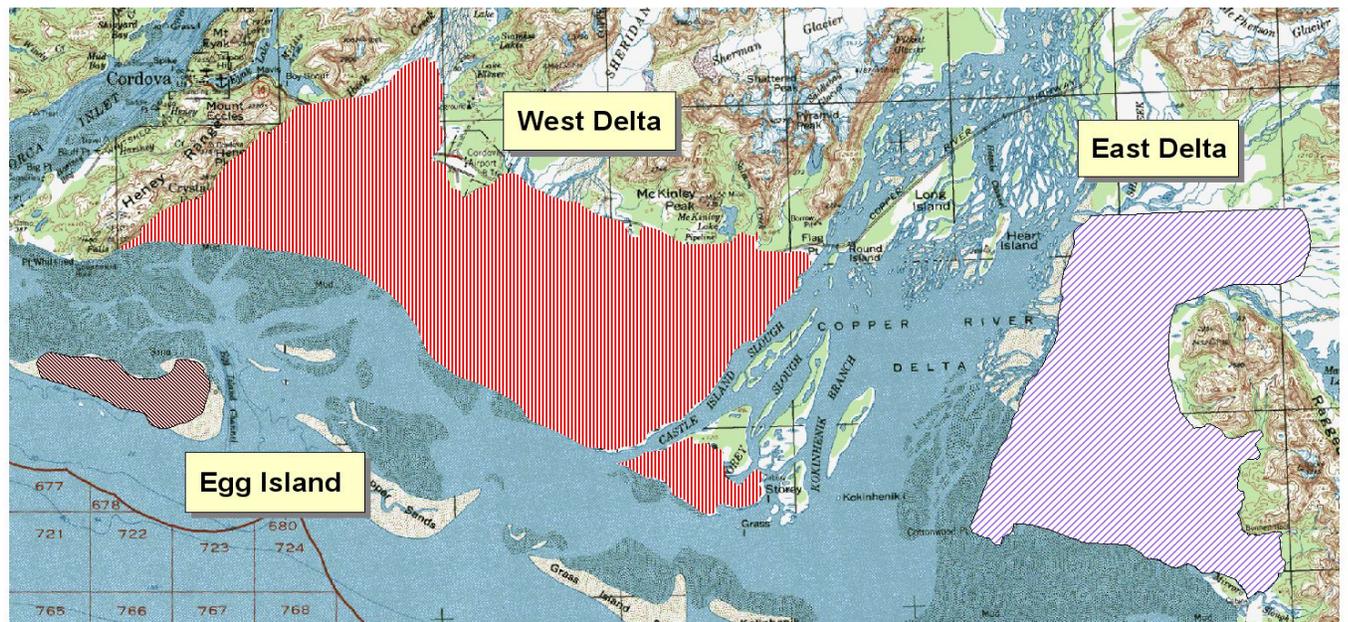
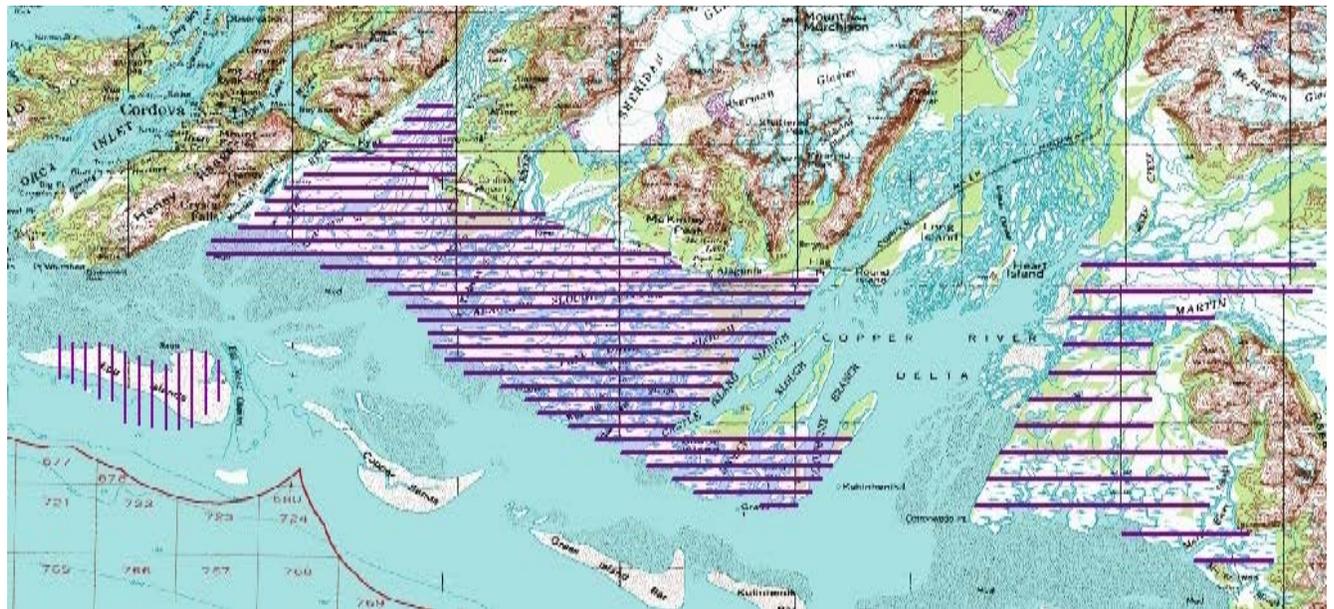
<sup>3</sup> Bias adjusted breeding bird index + flocked geese + Middleton Island geese

<sup>4</sup> Survey not completed due to aircraft technical problems and weather delays

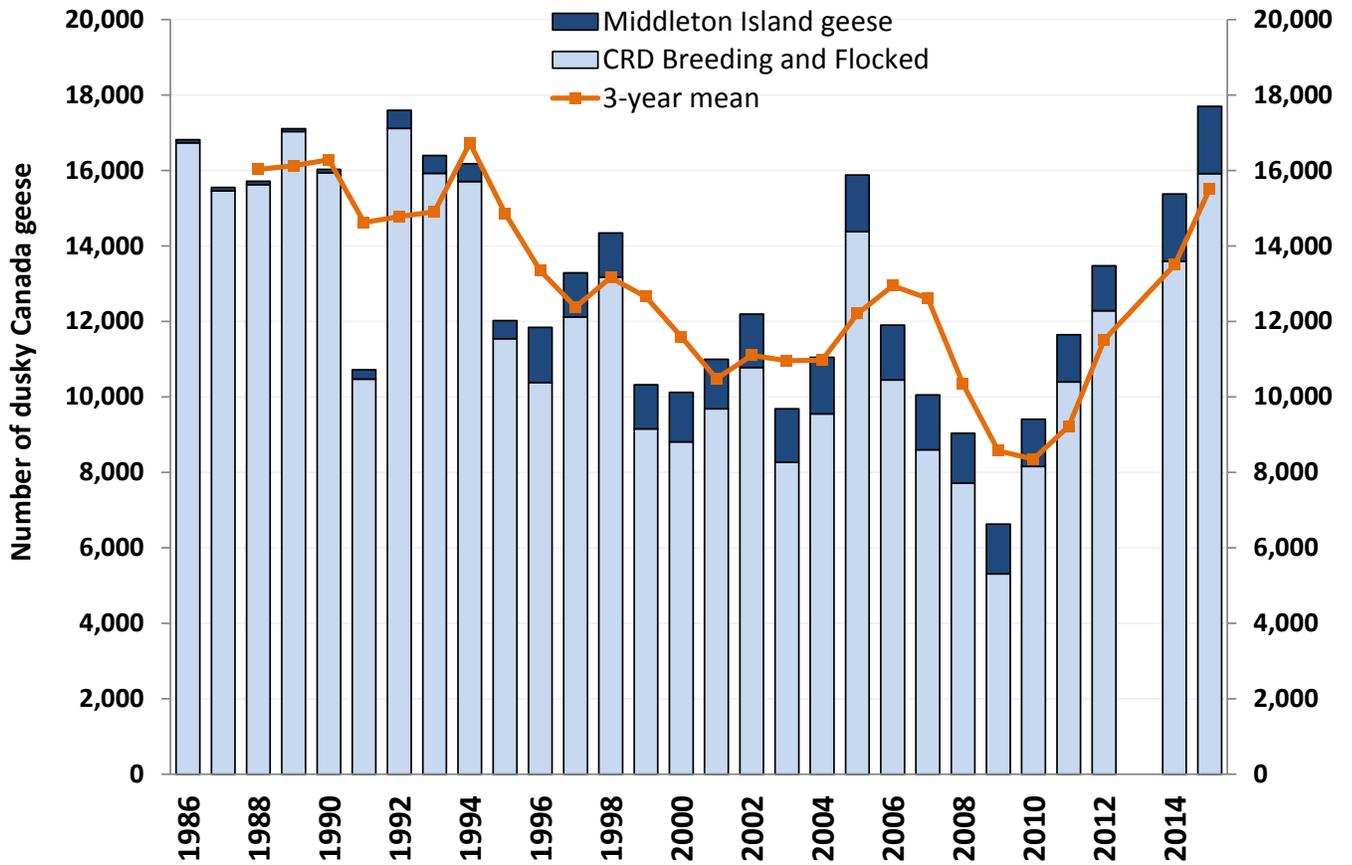
**Table 2.** Population indices for trumpeter swan singles and pairs, total swans, and active nests for the Copper River Delta aerial dusky Canada goose survey 1986–2015.

<b>Survey Year</b>	<b>Swan Singles and Pairs</b>	<b>Total Swans</b>	<b>Swan Nests</b>
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
2013			
2014	367	397	192
<b>2015</b>	<b>571</b>	<b>675</b>	<b>146</b>

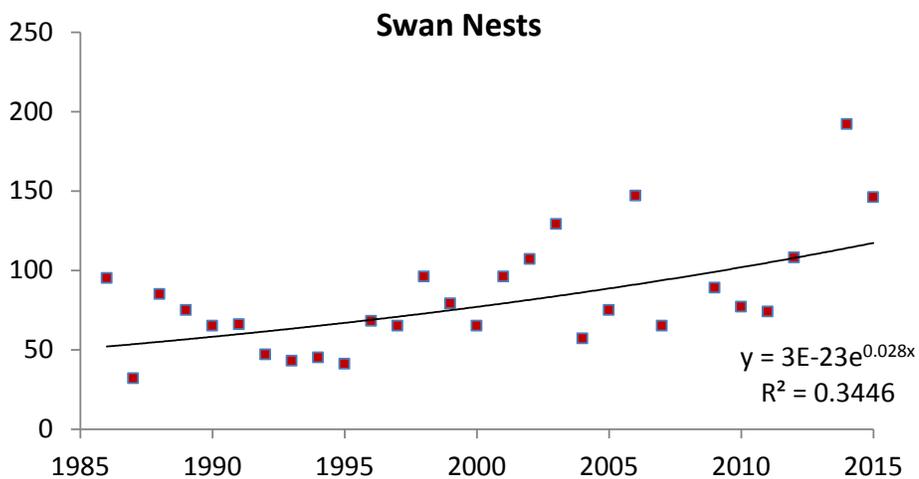
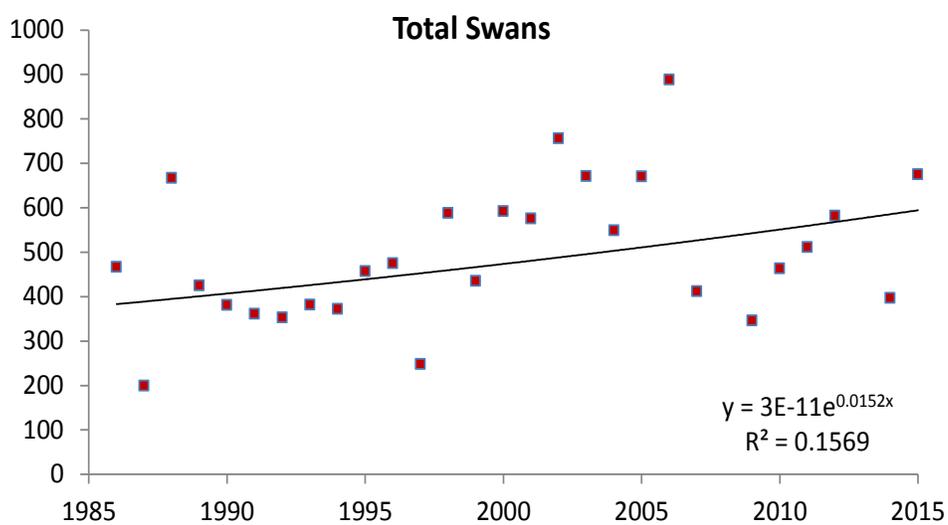
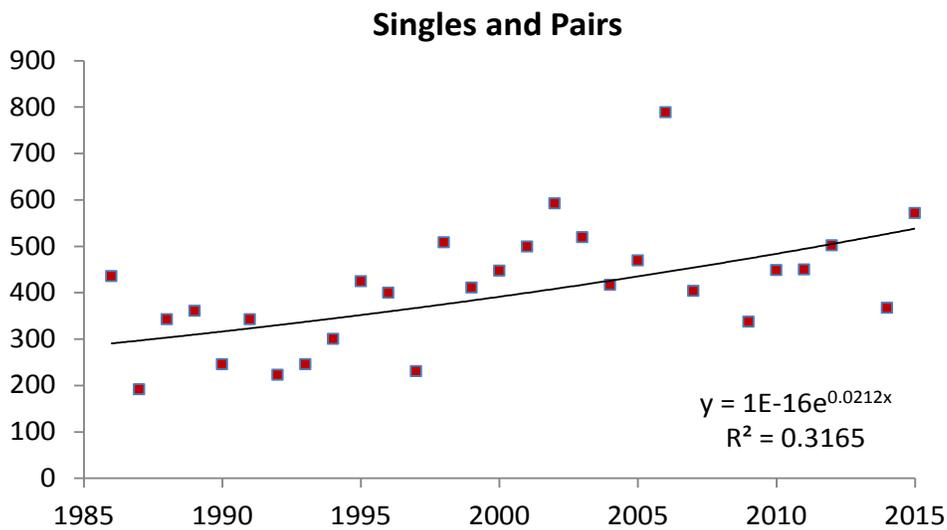
<sup>1</sup>Survey not completed due to aircraft problems and weather delays.



**Figure 1.** 2015 transect lines (top) and stratified survey units (bottom) for the Copper River Delta aerial dusky Canada goose survey.



**Figure 2.** Management indices for dusky Canada geese, Copper River Delta and Middleton Island, Alaska, 1986–2015.



**Figure 3.** Population indices for trumpeter swan singles and pairs, total swans, and active nests for the Copper River Delta, Alaska, 1986–2015.