U.S. Fish & Wildlife Service

The 2010 North American Trumpeter Swan Survey

Donna Dewhurst

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A Cooperative North American Survey

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Compiled by Deborah J. Groves
U.S. Fish and Wildlife Service
Division of Migratory Bird Management
Juneau, Alaska

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***Abstract**:* The North American trumpeter swan survey has been conducted approximately every 5 years since 1968 to assess the abundance, productivity, and distribution of trumpeter swans (*Cygnus buccinator*) in North America. The 2010 quinquennial survey was conducted May 2010-January 2011 by cooperators throughout Canada and the northern United States. Methods in 2010 varied among regions but were generally similar to prior surveys within regions. Notable exceptions included a change from complete censuses to stratified random sampling in Alaska and parts of Canada. Most cooperators performed aerial surveys, ground counts, or a combination of the two. The 2010 continental estimate of trumpeter swan abundance was 46,225 (*SE* = 1,172), an increase of 33% since 2005 and the highest recorded since the surveys began in 1968. The estimated average annual growth rate was +6.2% ($P <$ 0.0001) during 1968-2010 and +5.8% during 2005-2010. Cygnets comprised 26% of the total population in 2010. Each of North America's three recognized trumpeter swan populations reached record-high abundance levels in 2010. The 2010 total swan abundance estimates and percent changes from 2005 for the Pacific Coast, Rocky Mountain, and Interior populations were 26,790 (*SE* = 1,060) (+7%), 9,626 (*SE* = 500) (+84%), and 9,809 (+111%), respectively. Estimates of average annual growth rates and indices of production are presented for the three populations and their component flocks.

INTRODUCTION

The North American trumpeter swan survey is a cooperative, range-wide survey to monitor the status of trumpeter swans (*Cygnus buccinator*) in North America. It was first conducted in 1968, repeated in 1975, and has continued at 5-year intervals thereafter. It is intended to provide comprehensive assessments of trumpeter swan abundance and productivity throughout the entire breeding ranges of the three recognized North American populations: the Pacific Coast (PCP), Rocky Mountain (RMP), and Interior (IP) populations (Fig.1). This report summarizes results of the 2010 North American trumpeter swan survey and compares these data with previous quinquennial survey results (Moser 2006).

METHODS

The 2010 survey was a coordinated effort of federal, state, and provincial agencies and individuals across the U.S. and Canada (Appendix A). Cooperators were requested to assess the abundance and productivity of wild trumpeter swans that were present in their survey region during the breeding season, and to document the current boundaries of the trumpeters' summer range. Cooperators within each region determined their own survey design and methods to address the following goals:

1) Survey all areas with known or probable trumpeter swans via a census or sample;
2) Estimate abundance of adults and subadults (white swans), cygnets, and broods;
3) Record data per five social group categories: paired with cygnets, paired without cygnets, single with cygnets, single without cygnets, or members of a flock;
4) Conduct the survey in late summer when swans, especially families, are dispersed on the breeding grounds, and cygnets are incapable of flight but large enough to be readily counted.

The degree to which cooperators were able to meet these goals varied, depending mainly on the availability of staff and funding. Generally, survey methods, coverage, and timing were similar to those of previous quinquennial surveys, although a few exceptions occurred. Due to funding constraints, Saskatchewan and most of Manitoba were not surveyed in 2010. In Minnesota, the

survey was conducted in January 2011 when swans were concentrated in wintering areas. In Alaska and more than half of the Canadian portion of the RMP range, methods changed from complete censuses to stratified random sampling.

The 2010 survey was conducted between 15 May 2010 and 8 January 2011. The median starting and ending dates were 30 August and 8 September, respectively. (For comparison, the 2005 survey was conducted 15 May to 7 January with median starting and ending dates of 24 August and 14 September.) Most areas were surveyed aerially or by a network of ground observers (Appendix B). In Ontario, a mark-recapture technique was used, supplemented by partial aerial and ground counts. No efforts were directed at surveying captive swans in 2010.

Trends in abundance estimates for populations and flocks over the long term (in most cases 1968-2010) and between the last two survey periods (2005-2010) were calculated using regression of the natural logarithm of survey estimates on year. The estimated annual growth rates (regression slopes) from the long-term regressions were tested for equality to zero (*t*-test). In some regions, wild swan populations have been supplemented through restoration releases and thus reported growth rates may overestimate intrinsic growth. Mean brood size was calculated for each reporting area in one of two ways: where random sampling occurred, it was based on the estimated numbers of cygnets and broods alive at the time of the survey; otherwise it was calculated using broods of known size recorded during the survey. Mean brood size for each flock and population was calculated by weighting the means from the different reporting areas within that flock or population. Trends in age distributions (i.e., percentage of cygnets) of flocks were evaluated using linear regression.

Population and flock terminology in this report follows population-specific management plans (see Subcommittee on the Interior Population of Trumpeter Swans 1998, Pacific Flyway Council 2006, Subcommittee on Rocky Mountain Trumpeter Swans 2008). Most trumpeter swan reporting regions can be adequately located using their geographic titles and Figure 1, but additional descriptions for some regions are provided here. Tri-state Area Flock swans nest in southeastern Idaho, southwestern Montana, and western Wyoming; Canadian RMP swans nest in this population's range in Canada; and swans in the "Other U.S." flocks nest within the remaining RMP range. High Plains IP swans nest from the RMP's eastern boundary to the western borders of Ontario, Minnesota, and Iowa; Mississippi and Atlantic Flyway IP swans nest from the last-mentioned borders eastward.

RESULTS

North American Trumpeter Swans

The 2010 estimate of total trumpeter swan abundance (adults and cygnets) in North America was 46,225 (*SE* = 1,172), 33% higher than the 2005 estimate (34,803) and the highest estimate recorded since surveys began in 1968 (Tables 1, 2; Fig. 2). The North American population increased an average of 6.2% per year ($P < 0.0001$) during 1968-2010 and 5.8% per year during 2005-2010 (Table 2). All three of the recognized populations increased and reached record-high levels in 2010.

Cygnets comprised an estimated 26% of the total North American trumpeter swan population in 2010 (Tables 1, 3), 2% below the 2005 estimate (28%) and identical to the 1968-2005 average. No long-term trend in the percentage of cygnets was detected ($P = 0.37$; Fig. 3). The mean brood size in 2010 was 2.96 cygnets (Table 1), slightly lower than the 2005 value of 3.10.

The estimated summer range of trumpeter swans in North America in 2010 is shown in Figure 1. This range delineation likely omits some areas where trumpeters occurred, because not all potential trumpeter swan habitats were surveyed. For example, potential changes in trumpeter swan distribution in Saskatchewan and Manitoba cannot be determined because these areas were minimally or not surveyed in 2010. Also, it is unknown if trumpeter swan distribution has expanded in Alaska, because the 2010 survey area was the same as that used in 2005. In the Yukon/northwest British Columbia region, a few trumpeter swans have been documented in scattered locations beyond the 2010 survey area; the 2010 range was thus delineated using the 2010 survey results, additional documented occurrences, and data from the British Columbia Breeding Bird Atlas (J. Hawkings, Canadian Wildlife Service, pers. comm.; British Columbia Breeding Bird Atlas 2008). In Ontario, trumpeter swan distribution has been documented in the southern part of the province, but the northern part has not been surveyed.

Pacific Coast Population (PCP)

The 2010 total trumpeter swan abundance estimate for the PCP was 26,790 ($SE = 1,060$), a 7% increase since 2005 (Tables 1, 2; Fig. 4). The estimated average annual growth rate was +5.5% during 1968-2010 ($P < 0.0001$) and +1.5% during 2005-2010. In 2010, 22% of PCP swans were cygnets, lower than the 27% observed in 2005 and 15% below the 1968-2005 average of 26% (Table 3). Regression analysis did not indicate a statistically significant long-term trend in the percentage of cygnets ($P = 0.11$; Fig. 3). The mean brood size in 2010 was 2.85 cygnets (Table 1), slightly lower than the 3.11 cygnets per brood observed in 2005.

Both the Alaska and Yukon/northwest British Columbia flocks reached record-high abundance levels in 2010. The 2010 estimate of total trumpeter swans in the Alaska flock was 25,347 ($SE = 1,010$), a 7% increase since 2005 (Tables 1, 2). The 2010 total swan estimate for the Yukon/northwest British Columbia flock was 1,443 ($SE = 323$), 17% higher than in 2005. Both flocks experienced below-average productivity in 2010 (Table 3). Additional flock information is provided in Tables 1-4.

Rocky Mountain Population (RMP)

The estimated abundance of trumpeter swans in the RMP reached a record high of 9,626 ($SE = 500$) in 2010, an 84% increase since 2005 (Tables 1, 2; Fig. 5). Estimated average annual growth rates during 1968-2010 and 2005-2010 were +6.3% ($P < 0.0001$) and +13.0%, respectively. Cygnets comprised 34% of the population in 2010, the highest proportion on record for the RMP and substantially higher than the 1968-2005 average of 26% (Table 3). The percentage of cygnets in the RMP has increased since 1968 ($P = 0.02$; Fig. 3). The mean brood size in 2010 was 3.39 (Table 1), 13% higher than in 2005 (3.00).

Results for the RMP were strongly influenced by the Canadian flock, which comprised 93% of the total RMP in 2010. The Canadian flock's 2010 estimate was 8,950 swans (*SE* = 500), a 90% increase since 2005 (Tables 1, 2). There were dramatic regional differences in the estimated growth within this area of Canada, ranging from 17% in the Yukon to over 150% in Alberta. The change in survey methodology was likely responsible for some of the apparent increase in British Columbia, Northwest Territories, and Alberta (Canadian Wildlife Service Waterfowl Committee 2011). A detailed analysis of aircraft flight tracks and swan sightings from 2005 versus 2010 in northeastern British Columbia indicated that the 2005 survey likely underestimated the population in that area (J. Hawkings, unpubl. data). Although the 2005 survey was intended as a census and covered as much habitat as funding allowed, the flight track analysis showed that survey coverage was not complete and likely missed substantial numbers of swans.

In contrast to the RMP Canadian flock, the Tri-state Area flock increased only 8% during 2005-2010 to a total of 487 swans in 2010. The flock was 17% below its peak (589) observed in 1990 and 17% lower than its population size (585) in 1968. The "Other U.S." flocks of trumpeter swans increased 232% during 2005-2010 to a total of 189 swans in 2010. Much of this increase was due to the release of captive stock as part of ongoing restoration efforts. Additional flock information is provided in Tables 1-4.

Interior Population (IP)

The 2010 estimate of total trumpeter swan abundance in the IP was 9,809, an increase of 111% since 2005 (Tables 1, 2; Fig. 6). The estimated average annual growth rate was +13.0% ($P < 0.0001$) during 1968-2010 and +16.1% during 2005-2010. In 2010, an estimated 27% of IP swans were cygnets, slightly lower than both the 2005 value (31%) and the 1968-2005 average (30%) (Table 3). No long-term trend in the percentage of cygnets was detected ($P = 0.43$; Fig. 3). The mean brood size in 2010 was 3.08 cygnets (Table 1), slightly lower than what was observed in 2005 (3.22).

Both the High Plains and the Mississippi/Atlantic Flyways flocks reached record-high abundance levels in 2010 (Tables 1, 2). The Mississippi/Atlantic Flyways flock showed an especially large increase, up 121% from 4,176 in 2005 to 9,236 in 2010. Part of this increase can be attributed to the release of 518 swans from captive stock during the 5-year period (J. Johnson, Kellogg Bird Sanctuary, pers. comm.). The 2010 count for the High Plains flock was 573 swans, a 22% increase since 2005. However, this count likely underestimated the flock's true abundance, because only one small area in the Canadian portion of its range was surveyed. This area, Riding Mountain National Park in Manitoba, hosted 49 trumpeter swans in 2010, 63% more than were observed there in 2005. Additional flock information is provided in Tables 1-4.

DISCUSSION

Trumpeter swans in North America continued to increase since the 2005 quinquennial survey and reached a new record level in 2010. All seven of the recognized flocks within the three populations increased since 2005, although at very different rates (range = +1.4% to +27.1% per year; Table 2). The Canadian RMP and the Mississippi/Atlantic Flyways flocks appear to have

responded rapidly to the availability of wetland habitats in their regions, and their populations nearly or actually doubled between 2005 and 2010. Other flocks, especially the Alaska and Tri-state Area flocks, experienced smaller increases. The Alaska flock, which now occupies a substantial portion of the forested wetland habitats in the state, may be starting to approach carrying capacity in some parts of its range, limiting its ability to expand at rates seen in previous years. However, growth rates continued to be high in areas of the state where substantial amounts of previously unoccupied habitat were available (Harwood 2010, Guldager 2011). The Tri-state Area flock also experienced limited growth, and the challenges it faces regarding availability and quality of summer and winter habitats remain a focus of management concern (Subcommittee on Rocky Mountain Trumpeter Swans 2008).

The 2010 estimated populations for the PCP, RMP, and IP can be compared with population objectives from their respective management plans (see Subcommittee on the Interior Population of Trumpeter Swans 1998, Pacific Flyway Council 2006, Subcommittee on Rocky Mountain Trumpeter Swans 2008). The PCP abundance objective of "not less than 25,000 swans" was met for the first time in 2010 when the population reached an estimated 26,790 swans. The RMP goal of "5% average annual growth in numbers of wintering birds" was likely achieved for the RMP overall, given the short- and long-term growth rates from this survey of +13% and +6.3%, respectively. However, growth was not equivalent among flocks within the RMP, and several flock-specific abundance, distribution, and productivity objectives were not met. The IP objective of "at least 2,000 birds and 180 successful breeding pairs by 2001" was reached by the time of the 2000 quinquennial survey (Caithamer 2001); the population in 2010 (9,809) exceeded the objective by nearly 500%. Consequently, most IP swan-release programs have now been discontinued. While significant accomplishments have been made towards reaching goals for all three populations, each management plan includes additional goals or objectives that have not been achieved.

As the North American trumpeter swan population has continued to increase and expand its range since the first range-wide survey in 1968, the financial and logistic challenges of conducting the quinquennial survey have also increased. Some cooperators found it cost-prohibitive to survey the entire summer range in their regions in 2010, forcing them to select survey areas or methods that limited their ability to meet one or more of the survey objectives (e.g. summer distribution, brood size, or social group information). In Alaska and the RMP Canadian region, cooperators switched from complete censuses to sampling designs for the first time in 2010, in response to the increasingly large areas that needed to be covered. In Alaska, an increasing challenge has been to adequately assess potential growth and expansion of the trumpeter population where it overlaps tundra swan habitat in the state. Although cooperators did succeed in surveying a majority of the trumpeter swan range in 2010, several of them accomplished their part only with difficulty. Several expressed concern that limited budgets and competing priorities may preclude their participation in future surveys. The trumpeter's dramatic success in many areas has led to reduced interest in the survey by some cooperators who feel the need to redirect limited resources toward more pressing conservation needs. Other partners want to continue participation but struggle to deal with rising survey costs. The challenge to fund the survey is exacerbated by its 5-year cycle, which does not fit the annual or biennial funding cycle of most agency budgets. More problematic still, a recent policy change by the U.S. Fish and Wildlife Service's Migratory Bird Management Division now prohibits use

of Surveys, Monitoring, and Assessment Program funds to support recurring periodic migratory bird surveys. As this program was a significant source of funds for prior quinquennial trumpeter swan surveys, an alternative funding source for the 2015 survey needs to be determined.

Funding issues need to be resolved if completion of the next survey in 2015 is to be assured. The Fish and Wildlife Service, Canadian Wildlife Service, and other cooperators need to work together to consider the goals, costs, and benefits of the survey and to determine how funding will be obtained and allocated among regions. Consideration should be given to developing a single range-wide survey design, which could standardize data collection among regions and increase survey efficiency. To facilitate long-term funding support for this and other recurring periodic surveys, the Fish and Wildlife Service should consider creating base funding for a bundle of periodic surveys, each of which could occur in a different year on a rotating schedule.

ACKNOWLEDGMENTS

Data for the 2010 North American trumpeter swan survey were collected by numerous individuals employed by many agencies, volunteers, and citizens who reported incidental swan observations. The compiler apologizes for any cooperators omitted from Appendix A. Regional surveys were coordinated or summarized by A. Breault, B. Bortner, W. Calvert, S. Comeau, L. Gillette, D. Groves, J. Hawkings, D. Hoffman, C. Hoving, J. Ingram, J. Johnson, J. Leafloor, M. Linck, H. Lumsden, S. Matteson, D. Olson, D. Sherman, B. Swift, and G. Zenner. The cooperation of the Canadian Wildlife Service and the Trumpeter Swan Society was integral to survey completion. E. Taylor, R. Oates, T. Moser, R. Blohm, and N. Minor helped secure and administer Fish and Wildlife Service funding for the 2010 survey. The cover photograph was provided by D. Dewhurst. J. Cornely, J. Hawkings, J. Hodges, J. Johnson, D. Olson, and E. Taylor provided helpful comments on earlier drafts of this report.

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Table 1. Demographics of Pacific Coast, Rocky Mountain, and Interior populations of trumpeter swans during the 2010 North American trumpeter swan survey. Standard errors are presented in parentheses for estimates obtained from a statistical sample.

						Mean Brood Size	
Population and Flock	White Swans[a]	Cygnets	Total Swans	% Cygnets	Broods	x [b]	n [c]
Pacific Coast Population:							
Alaska	19,638 (923)	5,709 (411)	25,347 (1,010)	23	2,004 (140)	2.85[d]	660
Yukon and northwestern							
British Columbia	1,141 (294)	302 (68)	1,443 (323)	21	104 (24)	2.89[d]	41
Total Pacific Coast Population	20,779 (969)	6,011 (417)	26,790 (1,060)	22	2108 (142)	2.85[d]	701
Rocky Mountain Population:							
Canadian	5,773 (295)[e]	3,177 (310)[e]	8,950 (500)	35	---[f]	3.43	418
Tri-state Area	380	107	487	22	35	3.06	35
Other U.S. Flocks	163	26	189	14	9	2.89	9
Total Rocky Mountain Population	6,316 (295)	3,310 (310)	9,626 (500)	34	---[g]	3.39	462
Interior Population:							
High Plains	384	189	573	33	71	2.67	71
Mississippi and Atlantic Flyways	6,770	2,466	9,236	27	---[g]	3.24	176
Total Interior Population	7,154	2,655	9,809	27	---[g]	3.08	247
North American Total	34,249 (1,013)	11,976 (519)	46,225 (1,172)	26	---[g]	2.96	1,410

[a] Adult and subadult swans.

[b] Weighted mean based on number of broods of known size observed in each survey area.

[c] Number of broods of known size observed.

[d] Mean based on the estimated total numbers of cygnets and broods.

[e] Standard error estimated by dividing reported 95% confidence interval by 2.

[f] Estimate of the total number of broods was not reported.

[g] Insufficient data available.

Table 2. Estimates of total trumpeter swan abundance and average annual growth rates from quinquennial North American surveys, 1968-2010 [a].

Population and Flock	Year of Survey									Total Percent Change 2005-2010	Annual Growth Rate 2005-2010	Annual Growth Rate[b] 1968-2010
	1968	1975	1980	1985	1990	1995	2000	2005	2010			
Pacific Coast Population:												
Alaska	2,847	4,170	7,696	9,459	13,337	15,823	17,155	23,692	25,347 (1,010)[c]	+7%	+1.4%	+5.4%**
Yukon and northwestern												
British Columbia				41	119	492	397	1,236	1,443 (323)[c]	+17%	+3.1%	+15.1%*[d]
Total Pacific Coast Population	2,847	4,170	7,696	9,500	13,456	16,315	17,552	24,928	26,790 (1,060)[c]	+7%	+1.5%	+5.5%**
Rocky Mountain Population:												
Canadian	106	131[e]	379	614	1,117	2,076	3,183	4,718	8,950 (500)[c]	+90%	+13.7%	+11.6%**
Tri-state Area	585	537[e]	485	507	589	364	426	453	487	+8%	+1.5%	-0.6%
Other U.S. Flocks	120	131	111	74	41	77	56	57	189	+232%	+27.1%	-0.7%
Total Rocky Mountain Population	811	799[e]	975	1,195	1,747	2,517	3,665	5,228	9,626 (500)[c]	+84%	+13.0%	+6.3%**
Interior Population:												
High Plains	64	116	164	158	185	240	370	471	573	+22%	+4.0%	+5.0%**
Mississippi and Atlantic Flyways	0	0	12	51	237	687	2,060	4,176	9,236	+121%	+17.2%	+24.7%**[f]
Total Interior Population	64	116	176	209	422	927	2,430	4,647	9,809	+111%	+16.1%	+13.0%**
North American Total	3,722	5,085	8,847	10,904	15,625	19,759	23,647	34,803	46,225 (1,172)[c]	+33%	+5.8%	+6.2%**

[a] Estimates for 1968-2005 were from Moser (2006).

[b] Asterisks denote significance of regression slopes at the following *P*-values: * = $P < 0.05$, ** = $P < 0.0001$.

[c] Population estimate was obtained from a statistical sample. Standard error of the estimate is shown in parentheses.

[d] Annual growth rate 1985-2010.

[e] Estimates reported in 1975 were obtained in 1974 or 1975.

[f] Annual growth rate 1980-2010.

Table 3. Age distribution (percent cygnets) of North American trumpeter swans during quinquennial surveys, 1968-2010[a].

Population and Flock	1968	1975	1980	1985	1990	1995	2000	2005	2010	1968-2005 Average
Pacific Coast Population:										
Alaska	32	28	32	18	27	24	19	27	23	26
Yukon and northwestern British Columbia	---	---	---	15	37	39	26	30	21	29[b]
Total Pacific Coast Population	32	28	32	18	27	25	19	27	22	26
Rocky Mountain Population:										
Canadian	29	33[c]	27	30	32	30	32	31	35	31
Tri-state Area Flock	26	15[c]	5	27	25	15	24	22	22	20
Other U.S. Flocks	18	18	31	8	27	14	13	14	14	18
Total Rocky Mountain Population	25	18[c]	16	28	30	28	30	30	34	26
Interior Population:										
High Plains	33	30	27	40	34	21	28	23	33	30
Mississippi and Atlantic Flyways	---	---	0	14	27	26	30	32	27	22[d]
Total Interior Population	33	30	25	33	30	25	30	31	27	30
North American Total	31	27	30	19	27	25	22	28	26	26

[a] Estimates for 1968-2005 were from Moser (2006).

[b] 1985-2005 average.

[c] Estimates reported in 1975 were obtained in 1974 or 1975.

[d] 1980-2005 average.

Table 4. Social status of adult and subadult trumpeter swans observed during the 2010 North American trumpeter swan survey[a].

Population and Flock	Paired (%)	Single (%)	In Flocks (%)	No. of Swans Categorized
Pacific Coast Population:				
Alaska	72.7	8.1	19.2	19,638
Yukon and northwestern				
British Columbia	61.0	10.9	28.1	1,141
Total Pacific Coast Population	72.0	8.3	19.7	20,779
Rocky Mountain Population:				
Canadian	---	---	---	0
Tri-state Area	57.4	7.9	34.7	380
Other U.S. Flocks	34.4	1.2	64.4	163
Total Rocky Mountain Population	50.5	5.9	43.6	543
Interior Population:				
High Plains	70.9	4.4	24.7	384
Mississippi and Atlantic Flyways	51.3	1.4	47.3	355
Total Interior Population	61.4	3.0	35.6	739
North American Total	71.2	8.0	20.8	22,061

[a] Table entries exclude adults for which social status was not determined.

Figure 1. Approximate summer range of Pacific Coast, Rocky Mountain, and Interior populations of trumpeter swans, as reported by 2010 North American Trumpeter Swan Survey cooperators. The range in British Columbia was delineated using data from the 2010 survey and the British Columbia Breeding Bird Atlas (2008). Alaska, Saskatchewan, and Manitoba ranges were based on 2005 survey data.

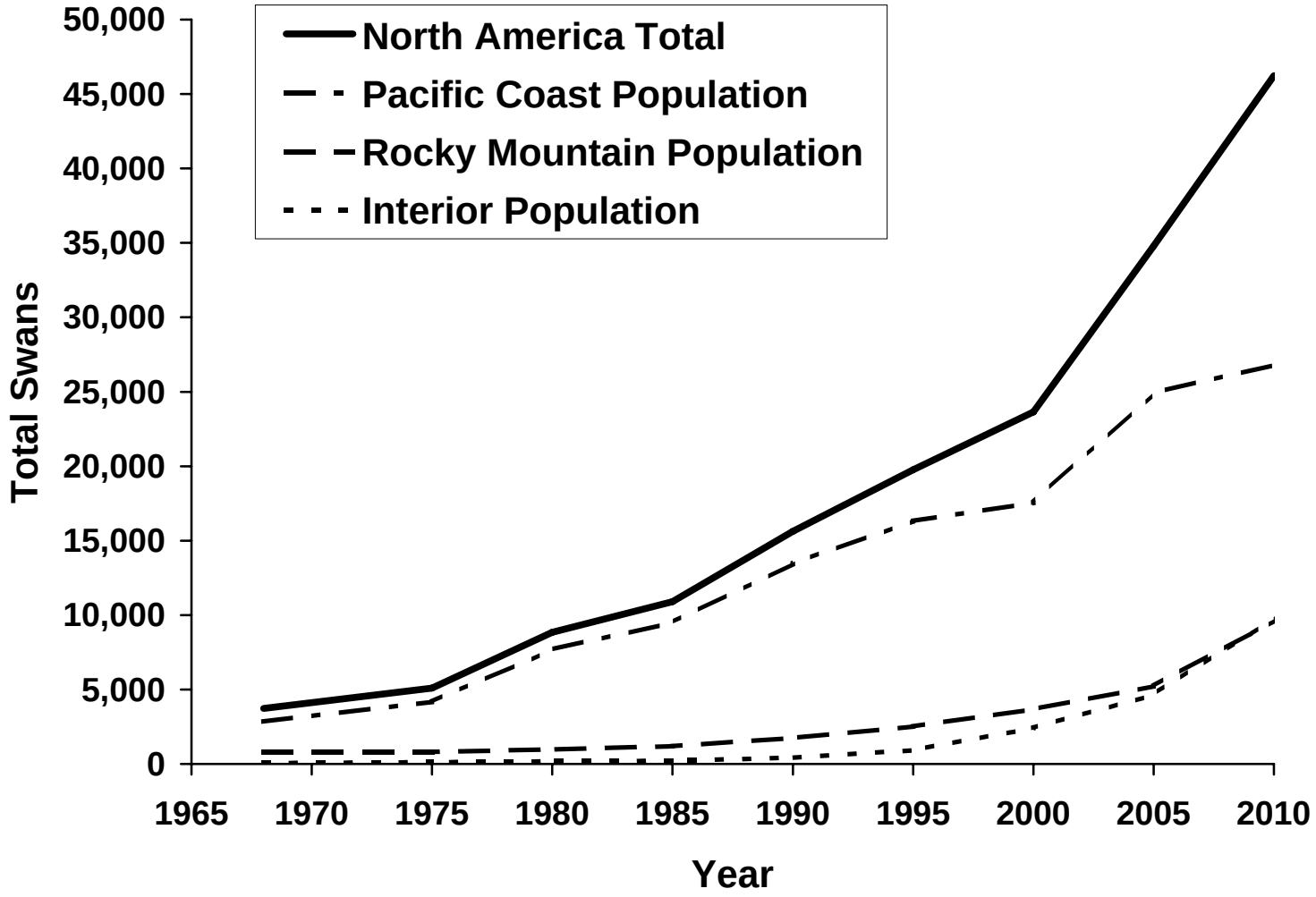

Figure 2. Total North American and population-specific trumpeter swan abundance estimates from quinquennial trumpeter swan surveys, 1968-2010.

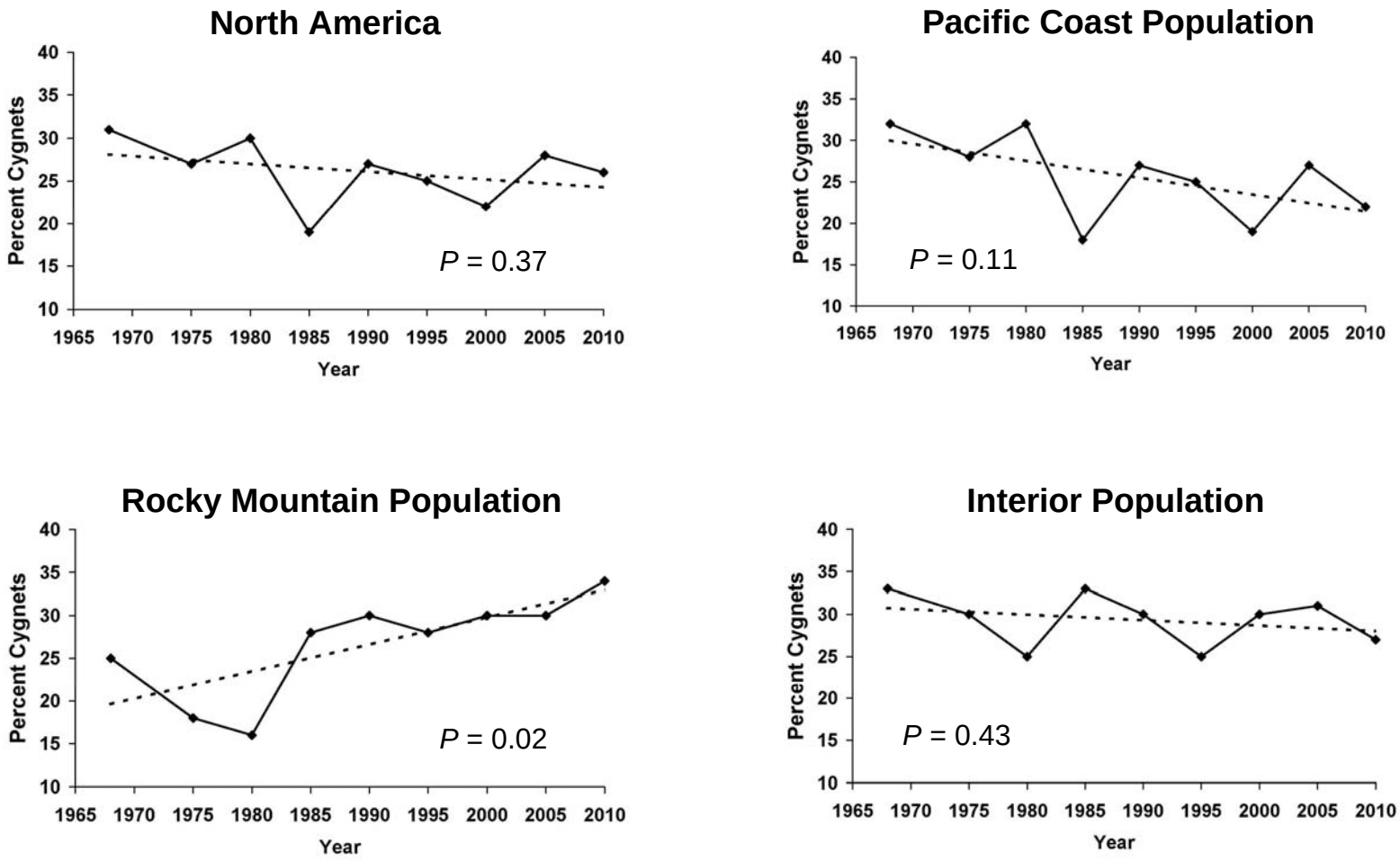

Figure 3. Age distribution (percent cygnets) of North American trumpeter swans observed during quinquennial trumpeter swan surveys, 1968-2010.

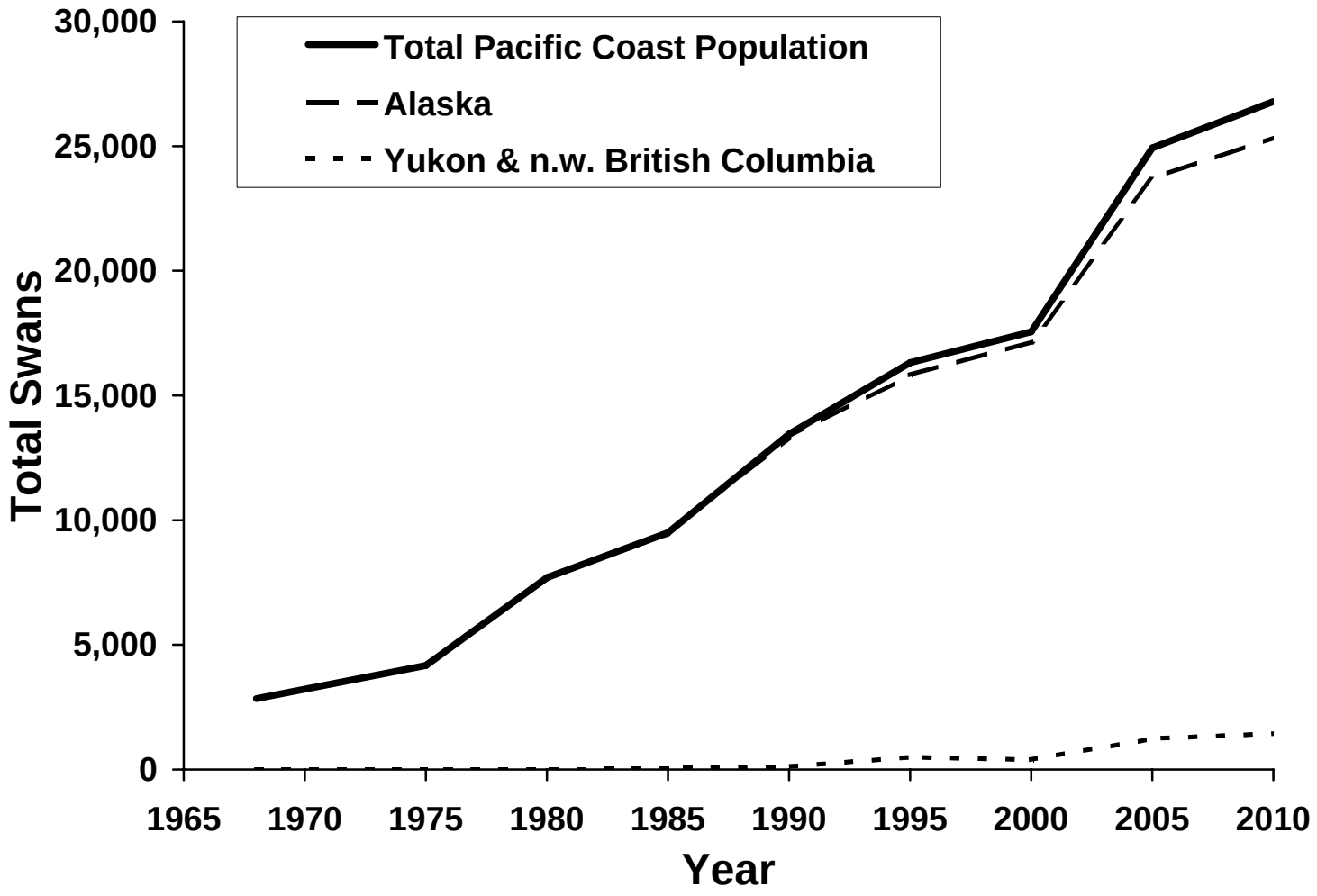

Figure 4. Pacific Coast Population trumpeter swan abundance estimates from quinquennial trumpeter swan surveys, 1968-2010.

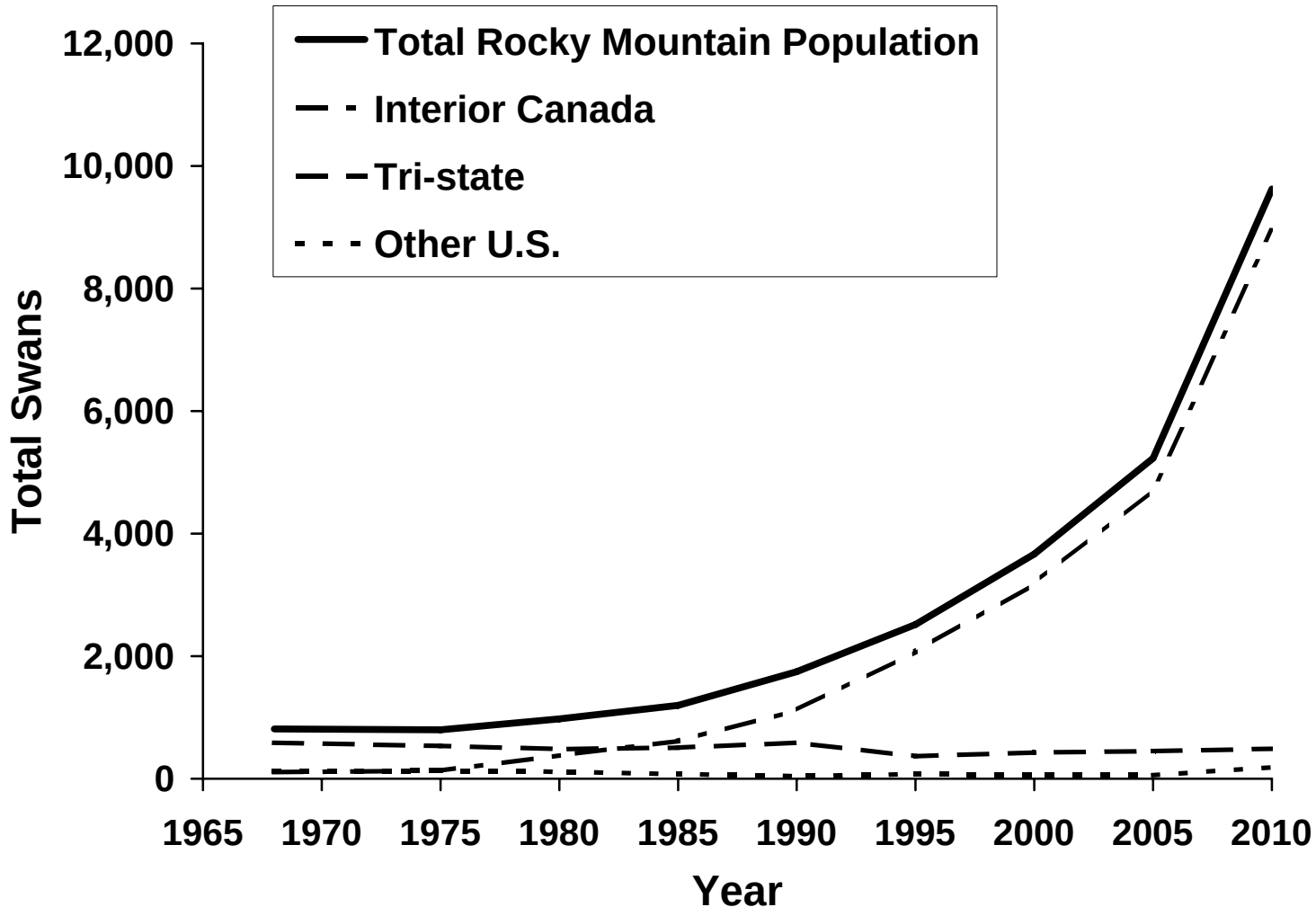

Figure 5. Rocky Mountain Population trumpeter swan abundance estimates from quinquennial trumpeter swan surveys, 1968-2010.

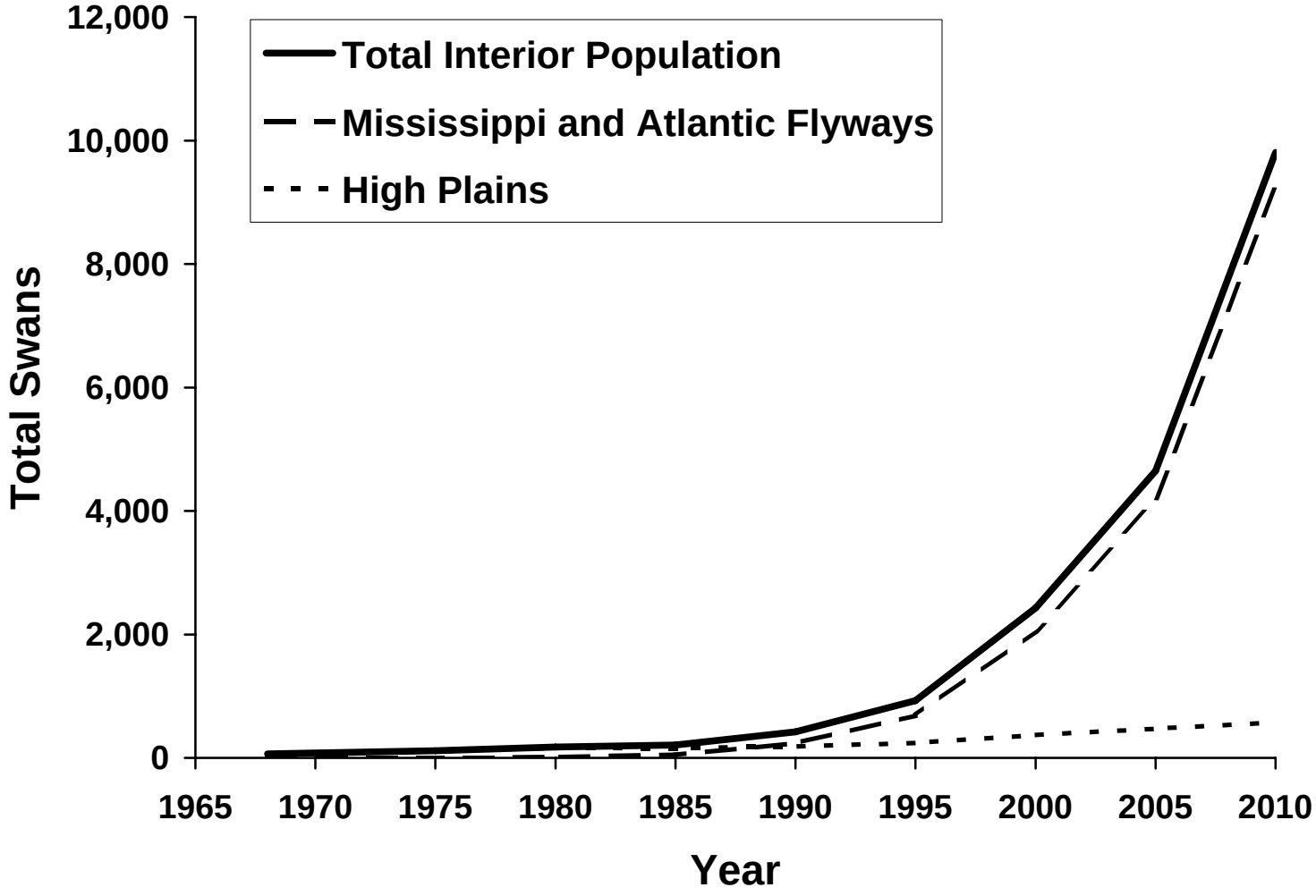

Figure 6. Interior Population trumpeter swan abundance estimates from quinquennial trumpeter swan surveys, 1968-2010.

Appendix A. Participants and cooperators in the 2010 North American trumpeter swan survey.

Adams, C.	New York State Department of Environmental Conservation
Anderson, C.	Private
Anderson, P.	U.S. Fish and Wildlife Service
Barber, J.	Ohio Department of Natural Resources
Becker, D.	Confederated Salish and Kootenai Tribes
Bisson, A.	Ontario Ministry of Natural Resources
Bogaczyk, B.	U.S. Forest Service
Bollinger, K.	U.S. Fish and Wildlife Service
Boyko, E.	Private
Breault, A.	Canadian Wildlife Service
Brewer, D.	Private
Butler, T.	Private
Calvert, W.	Canadian Wildlife Service
Carey, C.	Oregon Department of Fish and Wildlife
Carter, D.	Private
Chapman, D.	Private
Chapman, G.	Ontario Ministry of Natural Resources
Clairmont, S.	Confederated Salish and Kootenai Tribes
Comeau, S.	U.S. Fish and Wildlife Service
Corace, G.	U.S. Fish and Wildlife Service
Cornely, J.	The Trumpeter Swan Society
Cross, D.	Alberta Sustainable Resource Development
Dastyck, J.	U.S. Fish and Wildlife Service
Denlinger, L.	U.S. Fish and Wildlife Service
Deutsch, C.	Private
DeVries, B.	U.S. Fish and Wildlife Service
Donohue, A.	Simpson Air
Dubovsky, J.	U.S. Fish and Wildlife Service
Dufford, S.	U.S. Fish and Wildlife Service
Eckler, J.	New York State Department of Environmental Conservation
Fletcher, R.	Private
Foerster, S.	Cataraquai Conservation Authority
Fontaine, A.	Alberta Sustainable Resource Development
Frechette, J.	Private
Fredrickson, A.	Private
Freeman, C.	Private
Frerichs, T.	U.S. Fish and Wildlife Service
Fullman, M.	U.S. Forest Service
Garcia, M.	Private
Gibson, C.	Private

Appendix A (continued).

Gillette, L.	Three Rivers Park District
Goodwin, A.	Private
Granley, J.	Airborne Helicopters
Groves, D.	U.S. Fish and Wildlife Service
Haddix, J.	U.S. Army
Hale, G.	Alberta Sustainable Resource Development
Hall, D.	Private
Hall, W.	Wisconsin Department of Natural Resources
Hawkings, J.	Canadian Wildlife Service
Heakes, T.	Canadian Wildlife Service
Hebert, M.	Alpine Aviation
Heckbert, M.	Alberta Sustainable Resource Development
Heerkens, S.	New York State Department of Environmental Conservation
Henderson, C.	Minnesota Department of Natural Resources
Hince, T.	Wye Marsh Wildlife Centre
Hindle, M.	Parks Canada Agency
Hobson, D.	Alberta Sustainable Resource Development
Hoffman, D.	Iowa Department of Natural Resources
Hogg, S.	Private
Hoving, C.	Michigan Department of Natural Resources and Environment
Ingram, J.	Canadian Wildlife Service
Intini, K.	Private
Jernigan, L.	Private
Johnson, B.	Alberta Sustainable Resource Development
Johnson, J.	Kellogg Bird Sanctuary
Johnston, B.	Parks Canada Agency
Jones, N.	Private
Kanaga, P.	Canadian Wildlife Service
Keall, D.	Private
Kee, J.	Private
King, R.	Private
Kingdon, B.	Private
Kingdon, R.	Private
Klaczek, M.	Canadian Wildlife Service
Lainhart, R.	Private
Larned, W.	U.S. Fish and Wildlife Service
Leafloor, J.	Canadian Wildlife Service
Lee, M.	Private
Lemon, J.	Private
Li, Z.	Canadian Wildlife Service

Appendix A (continued).

Linck, M.	Three Rivers Park District
Looft, J.	Alberta Sustainable Resource Development
Loss, M.	Minnesota Department of Natural Resources
Lumsden, D.	Private
Lumsden, H.	Ontario Ministry of Natural Resources (retired)
MacIntyre, E.	Eastern Georgian Bay Stewardship Council
Mallek, E.	U.S. Fish and Wildlife Service
Mandel, C.	Private
Mannsperger, G.	Alpine Aviation
Manthey, P.	Wisconsin Department of Natural Resources
Markus, C.	Private
Martin, B.	Highland Helicopters
Matiatos, D.	U.S. Fish and Wildlife Service
Matteson, S.	Wisconsin Department of Natural Resources
McIntyre, C.	National Park Service
Meyers, P.	Private
Mitchell, C.	U.S. Fish and Wildlife Service
Morgan, T.	Alberta Sustainable Resource Development
Moriarty, J.	Ramsey County Parks
Moser, T.	U.S. Fish and Wildlife Service
Mosley, M.	Ontario Ministry of Natural Resources
Mossop, M.	Canadian Wildlife Service
Moyles, D.	Alberta Sustainable Resource Development
Munroe, S.	Trans Canada Pipelines
Neudecker, G.	U.S. Fish and Wildlife Service
Oates, R.	U.S. Fish and Wildlife Service
Oien, C.	Private
Olson, D.	U.S. Fish and Wildlife Service
Olson, S.	Private
Patla, S.	Wyoming Game and Fish Department
Piddington, T.	Airborne Helicopters
Prihoda, D.	Private
Quinlan, R.	Alberta Sustainable Resource Development
Roetker, F.	U.S. Fish and Wildlife Service
Rogers, N.	Private
Russell, M.	Alberta Sustainable Resource Development
Sallows, T.	Parks Canada Agency
Sarchuk, B.	Parks Canada Agency
Schneider, I.	Ontario Ministry of Natural Resources
Sheldon, J.	Private

Appendix A (continued).

Sherman, D.	Ohio Department of Natural Resources
Sherony, D.	Private
Skevington, J.	Private
Sladek, M.	Private
Snavely, N.	Minnesota Department of Natural Resources
Snyder, B.	Private
St. Louis, M.	Oregon Department of Fish and Wildlife
Stambaugh, C.	Alberta Sustainable Resource Development
Stavne, R.	Alberta Sustainable Resource Development
Stepnisky. D.	Alberta Sustainable Resource Development
Sterrenbur, L.	Private
Street, S.	Wye Marsh Wildlife Centre
Swift, B.	New York State Department of Environmental Conservation
Tate, D.	Parks Canada Agency
Taylor, E.	U.S. Fish and Wildlife Service
Thomson, D.	Alberta Sustainable Resource Development
Vanderschuit, W.	Parks Canada Agency
Vaniman, M.	U.S. Fish and Wildlife Service
Venor, B.	Private
Wallace, B.	Private
Wallace, M.	Private
Warren, J.	U.S. Fish and Wildlife Service
Welchert, D.	Private
Wicklund, M.	Private
Williamson, H.	U.S. Fish and Wildlife Service
Wilson, H.	U.S. Fish and Wildlife Service
Witten, M.	Wye Marsh Wildlife Centre
Zatko, A.	Canadian Helicopters
Zenner, G.	Iowa Department of Natural Resources
Zroback, E.	Private
Zroback, E.	Private
Zroback, F.	Ontario Ministry of Natural Resources
Zuehlke, D.	Private
	Union Slough National Wildlife Refuge
	Upper Mississippi National Wildlife Refuge

Appendix B. 2010 North American trumpeter swan survey results by area.

Population	Flock	Region	State or Province	2010 Start	2010 End	Method[a]	Coverage[b]	Adults	Cygnets	Total Swans	Percent Cygnets
Pacific Coast	Pacific	AK	AK	3-Aug-10	25-Aug-10	1	2	19,638	5,709	25,347	22.5
Pacific Coast	Pacific	YK/nw BC	YK/BC	27-Jul-10	11-Aug-10	1	2	1,141	302	1,443	20.9
Rocky Mountain	Canadian	YK/ne & se BC/AB/NT	YK/BC/AB/NT	7-Jul-10	14-Sep-10	1	2	5,773	3,177	8,950	35.5
Rocky Mountain	Tri-state Area	MT	MT	17-Sep-10	21-Sep-10	1	1	130	30	160	18.8
Rocky Mountain	Tri-state Area	WY	WY	13-Sep-10	16-Sep-10	1	1	149	48	197	24.4
Rocky Mountain	Tri-state Area	ID	ID	13-Sep-10	14-Sep-10	1	1	101	29	130	22.3
Rocky Mountain	Other U.S.	Turnbull NWR	WA	Sept	Sept	2	1	2	5	7	71.4
Rocky Mountain	Other U.S.	Ruby Lake	NV	Not surveyed							
Rocky Mountain	Other U.S.	Malheur	OR	6-Jun-10	6-Jun-10	2	3	6	1	7	14.3
Rocky Mountain	Other U.S.	Summer Lake	OR	3-Sep-10	3-Sep-10	5	1	11	0	11	0.0
Rocky Mountain	Other U.S.	OR - other	OR	3-Sep-10	3-Sep-10	5	3	11	0	11	0.0
Rocky Mountain	Other U.S.	Flathead Valley	MT	26-Sep-10	26-Sep-10	1	1	95	20	115	17.4
Rocky Mountain	Other U.S.	Blackfoot Valley	MT	Sept	Sept	2	1	38	0	38	0.0
Interior	High Plains	SD	SD	30-Aug-10	8-Sep-10	1	1	36	12	48	25.0
Interior	High Plains	NE	NE	30-Aug-10	1-Sep-10	1	1	312	162	474	34.2
Interior	High Plains	WY	WY	8-Sep-10	8-Sep-10	1	1	2	0	2	0.0
Interior	High Plains	MB	MB	25-Aug-10	25-Aug-10	1	3	34	15	49	30.6
Interior	High Plains	SK	SK	Not surveyed							
Interior	MS&AT Flyway	ON	ON	May	Jan-11	5	2	683	210	893	23.5
Interior	MS&AT Flyway	MN/w ON	MN/ON	5-Jan-11	8-Jan-11	5	1	4,480	1,590	6,070	26.2
Interior	MS&AT Flyway	WI	WI	June	Sept	5	1	672	328	1,000	32.8
Interior	MS&AT Flyway	MI	MI	15-Aug-10	30-Sep-10	5	3	580	176	756	23.3
Interior	MS&AT Flyway	IA	IA	10-Aug-10	1-Sep-10	2	1	213	84	297	28.3
Interior	MS&AT Flyway	OH	OH	31-Aug-10	31-Aug-10	5	3	117	52	169	30.8
Interior	MS&AT Flyway	NY	NY	1-Jul-10	31-Aug-10	5	1	25	26	51	51.0

[a]Survey method (1= aerial, 2=ground, 3=other, 5=combination of methods).

[b]Extent of survey coverage (1=believed complete census, 2=sample of entire range, 3=census of part of range).

Appendix B. 2010 North American trumpeter swan survey results by area (continued).

Population	Flock	Region	State or Province	Pairs with Cygnets	Pairs without Cygnets	Total Pairs	Singles with Cygnets	Singles without Cygnets	Flocked Adults	Flocks	Total Broods	Mean Brood Size	n for Brood Size[c]
Pacific Coast	Pacific	AK	AK	1,938	5,200	7,138	66	1,525	3,771	605	2,004	2.85	660
Pacific Coast	Pacific	YK/nw BC	YK/ BC	104	244	348	0	124	321	68	104	2.89	41
Rocky Mountain	Canadian	YK/ne & se BC/AB/NT	YK/ BC/AB/NT									3.43	418
Rocky Mountain	Tri-state Area	MT	MT	12	17	29	1	11	60	8	13	2.31	13
Rocky Mountain	Tri-state Area	WY	WY	13	42	55	1	11	27	8	14	3.43	14
Rocky Mountain	Tri-state Area	ID	ID	7	18	25	1	5	45	5	8	3.62	8
Rocky Mountain	Other U.S.	Turnbull NWR	WA	1	0	1	0	0	0	0	1	5.00	1
Rocky Mountain	Other U.S.	Ruby Lake	NV										
Rocky Mountain	Other U.S.	Malheur	OR	1	2	3	0	0	0	0	1	1.00	1
Rocky Mountain	Other U.S.	Summer L.	OR	0	0	0	0	0	11	1	0	----	----
Rocky Mountain	Other U.S.	OR - other	OR	0	1	1	0	2	7	2	0	----	----
Rocky Mountain	Other U.S.	Flathead Valley	MT	7	13	20	0	0	55	2	7	2.86	7
Rocky Mountain	Other U.S.	Blackfoot Valley	MT	0	3	3	0	0	32	3	0	----	----
Interior	High Plains	SD	SD	7	8	15	0	0	6	2	7	1.71	7
Interior	High Plains	NE	NE	58	47	105	1	16	85	19	59	2.75	59
Interior	High Plains	WY	WY	0	1	1	0	0	0	0	0	----	----
Interior	High Plains	MB	MB	5	10	15	0	0	4	1	5	3.00	5
Interior	High Plains	SK	SK										
Interior	MS&AT Flyway	ON	ON										
Interior	MS&AT Flyway	MN/w ON	MN/ON										
Interior	MS&AT Flyway	WI	WI	99	77	176					99	3.31	99
Interior	MS&AT Flyway	MI	MI								64	2.89	28
Interior	MS&AT Flyway	IA	IA	27	25	52	0	0	109	22	27	3.11	27
Interior	MS&AT Flyway	OH	OH	15	14	29	0	5	54	6	15	3.47	15
Interior	MS&AT Flyway	NY	NY	7	3	10	0	0	5	1	7	3.71	7

[c]Number of broods observed to estimate mean brood size.

U.S. Department of the Interior
U.S. Fish & Wildlife Service

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