



U.S. Fish & Wildlife Service

The 2010 North American Trumpeter Swan Survey



The 2010 North American Trumpeter Swan Survey

A Cooperative North American Survey



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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.

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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.

| Population and Flock | White Swans ^a | Cygnets | Total Swans | % Cygnets | Broods | Mean Brood Size | |
|----------------------------------|--------------------------|--------------------------|----------------|-----------|------------------|-------------------|-------|
| | | | | | | 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 |

^aTable 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.

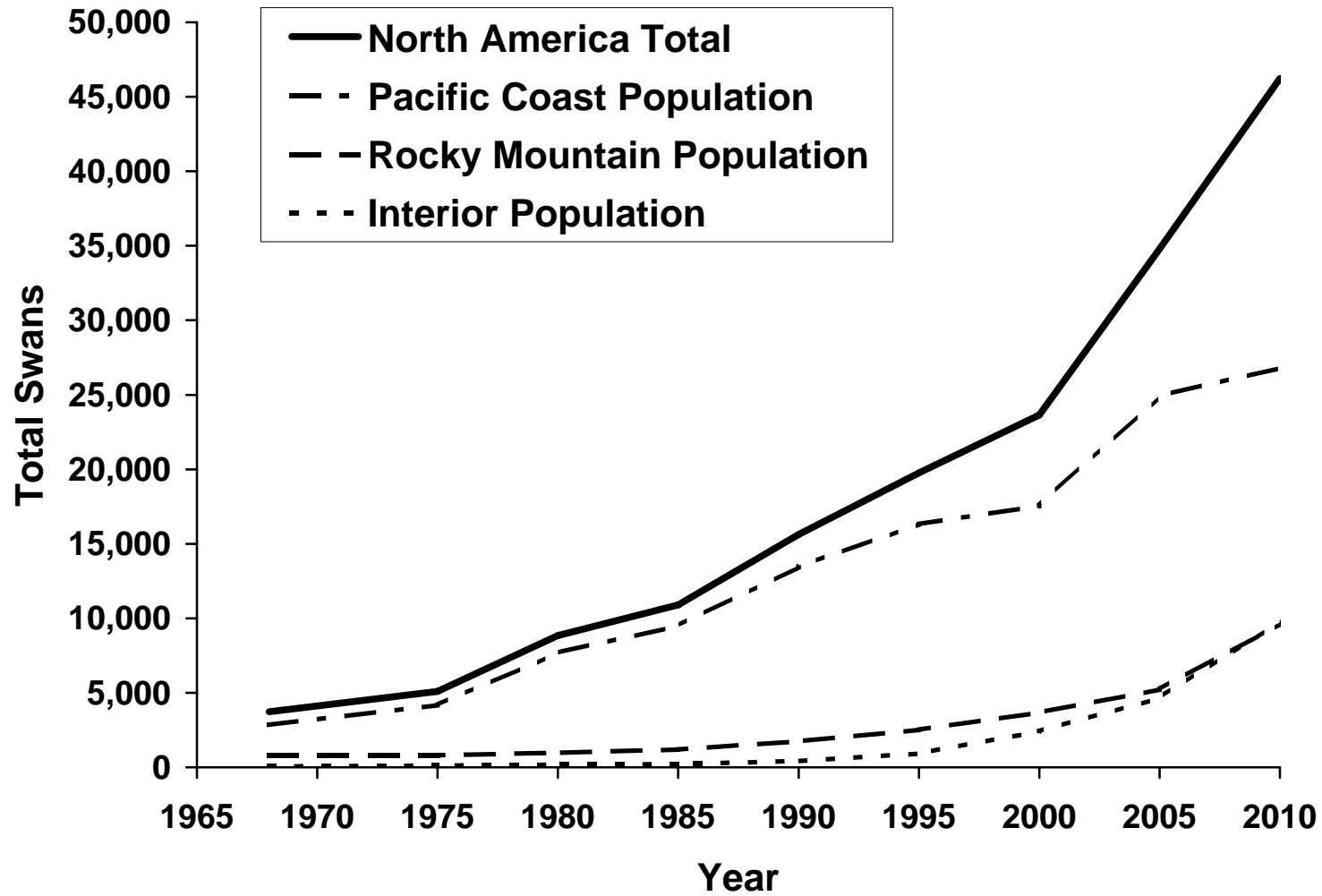


Figure 2. Total North American and population-specific trumpeter swan abundance estimates from quinquennial trumpeter swan surveys, 1968-2010.

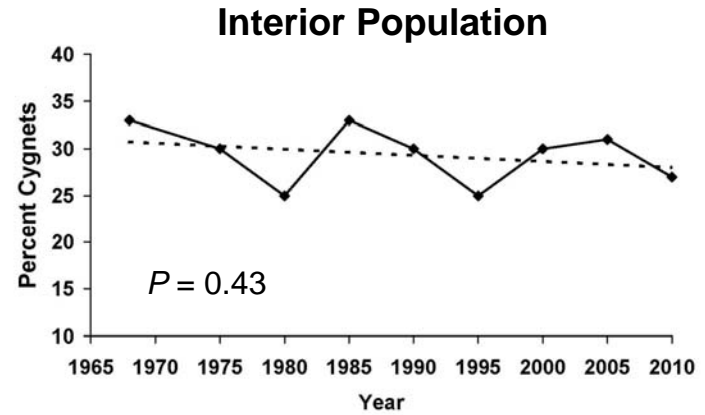
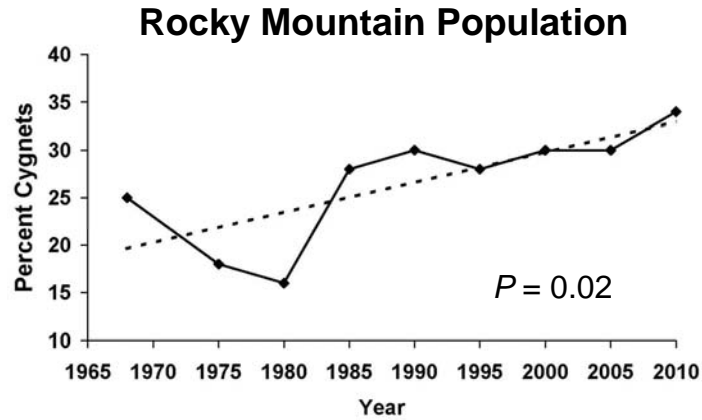
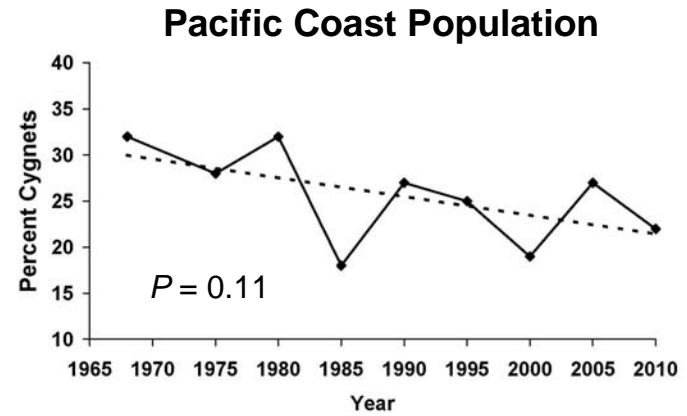
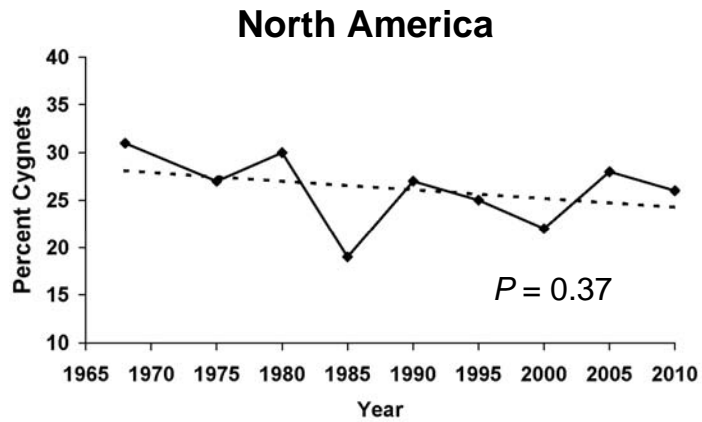


Figure 3. Age distribution (percent cygnets) of North American trumpeter swans observed during quinquennial trumpeter swan surveys, 1968-2010.

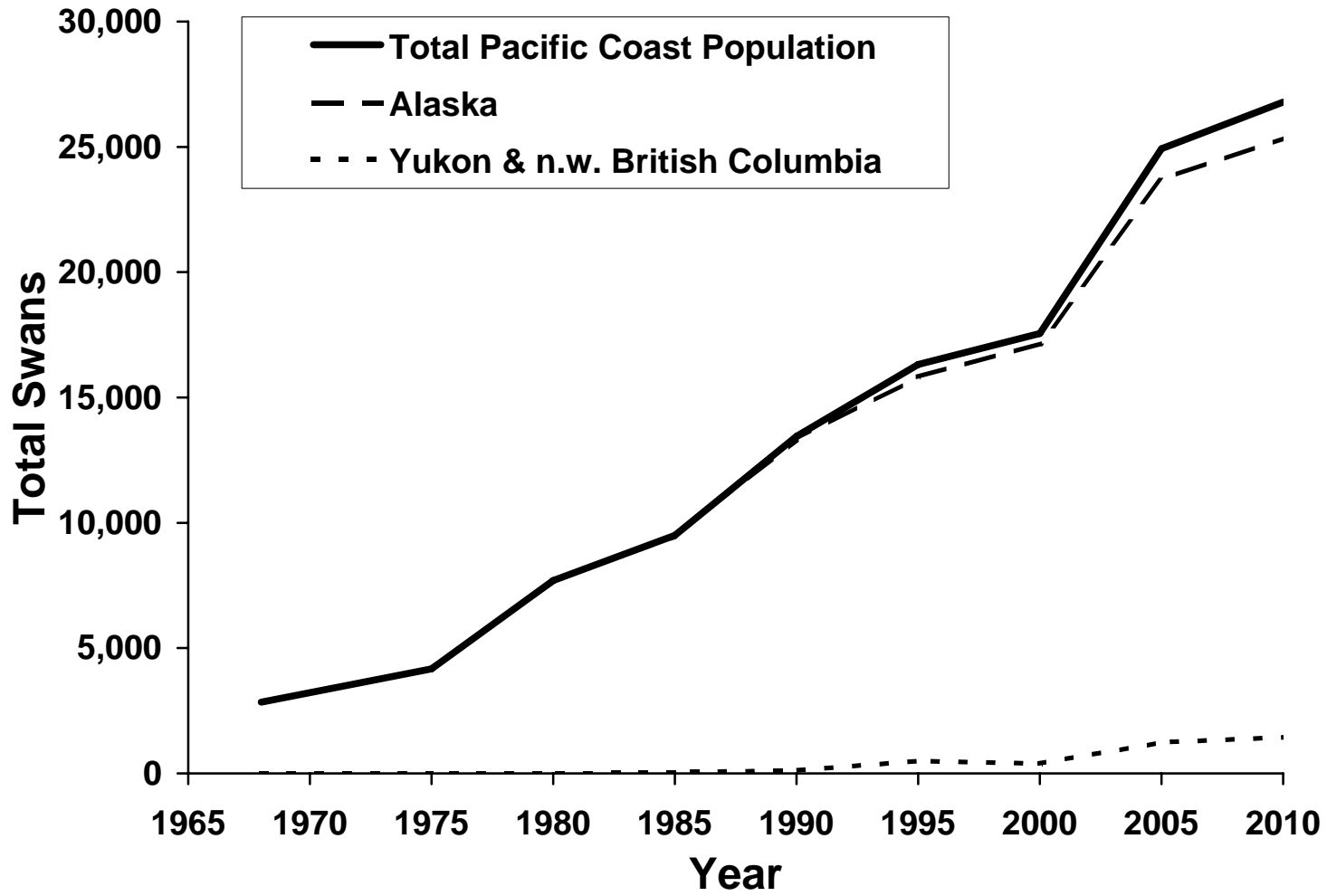


Figure 4. Pacific Coast Population trumpeter swan abundance estimates from quinquennial trumpeter swan surveys, 1968-2010.

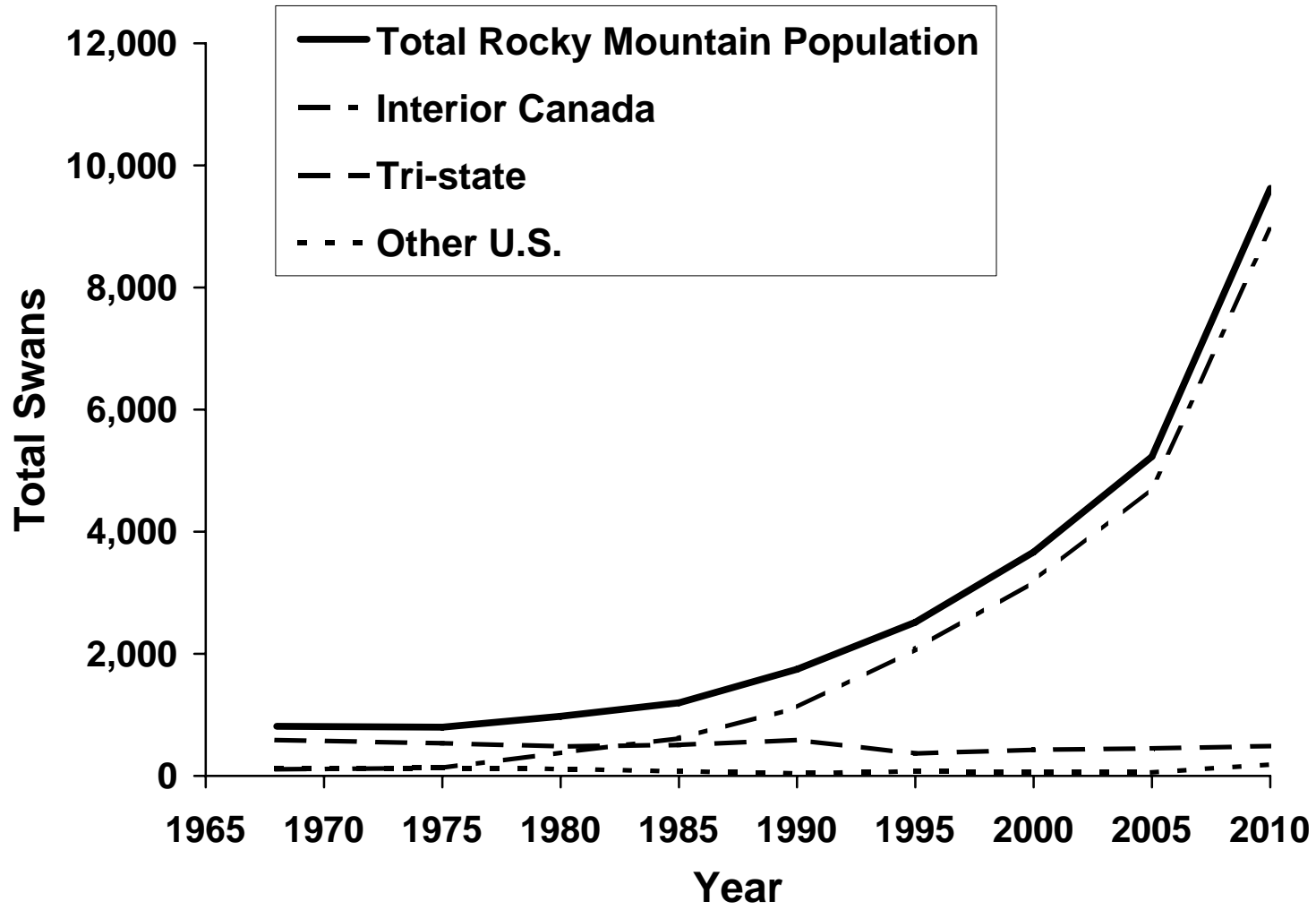


Figure 5. Rocky Mountain Population trumpeter swan abundance estimates from quinquennial trumpeter swan surveys, 1968-2010.

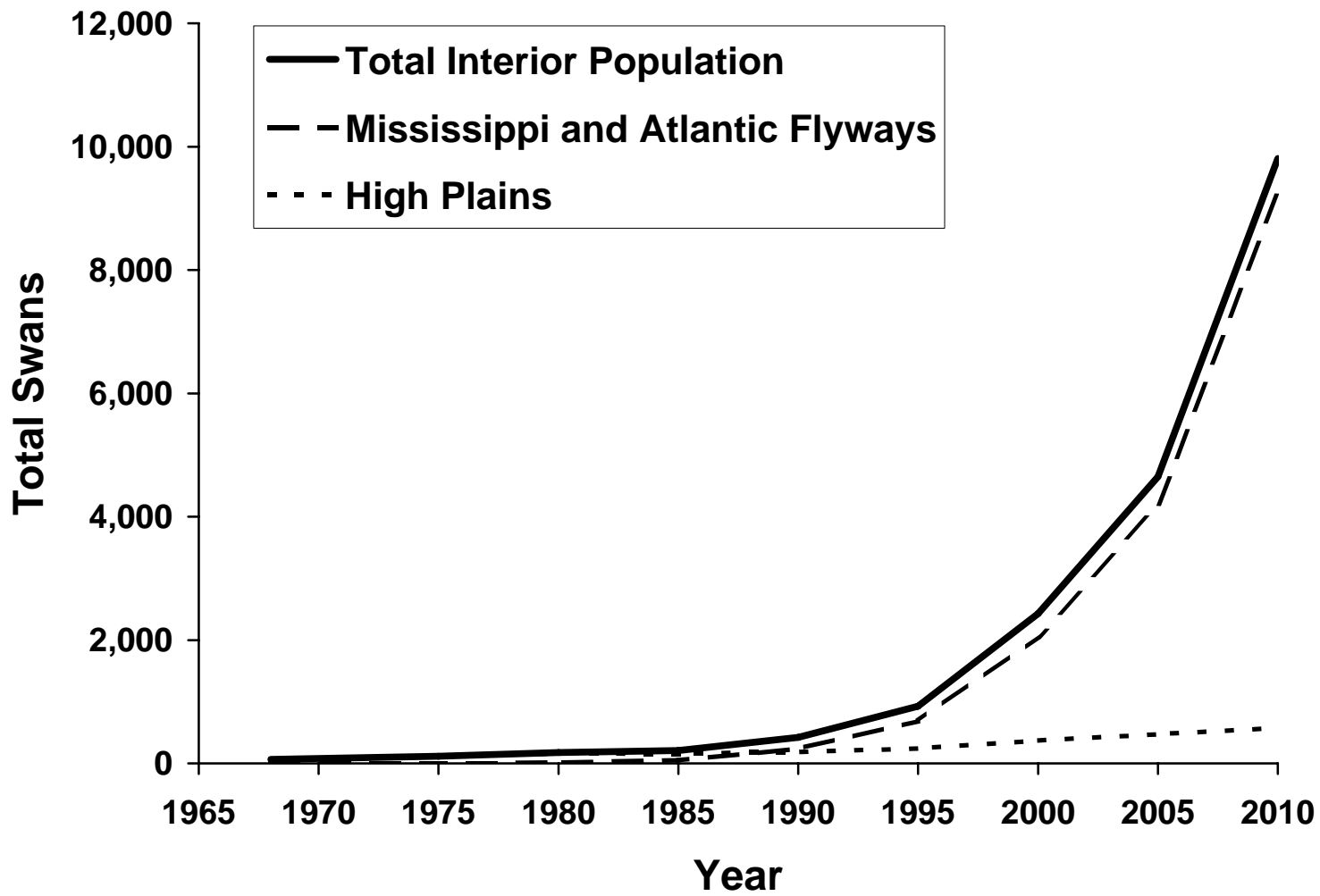


Figure 6. Interior Population trumpeter swan abundance estimates from quinquennial trumpeter swan surveys, 1968-2010.

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 |

^aSurvey method (1= aerial, 2=ground, 3=other, 5=combination of methods).

^bExtent 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 | Fledged 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 |

^cNumber of broods observed to estimate mean brood size.

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

February 2012



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