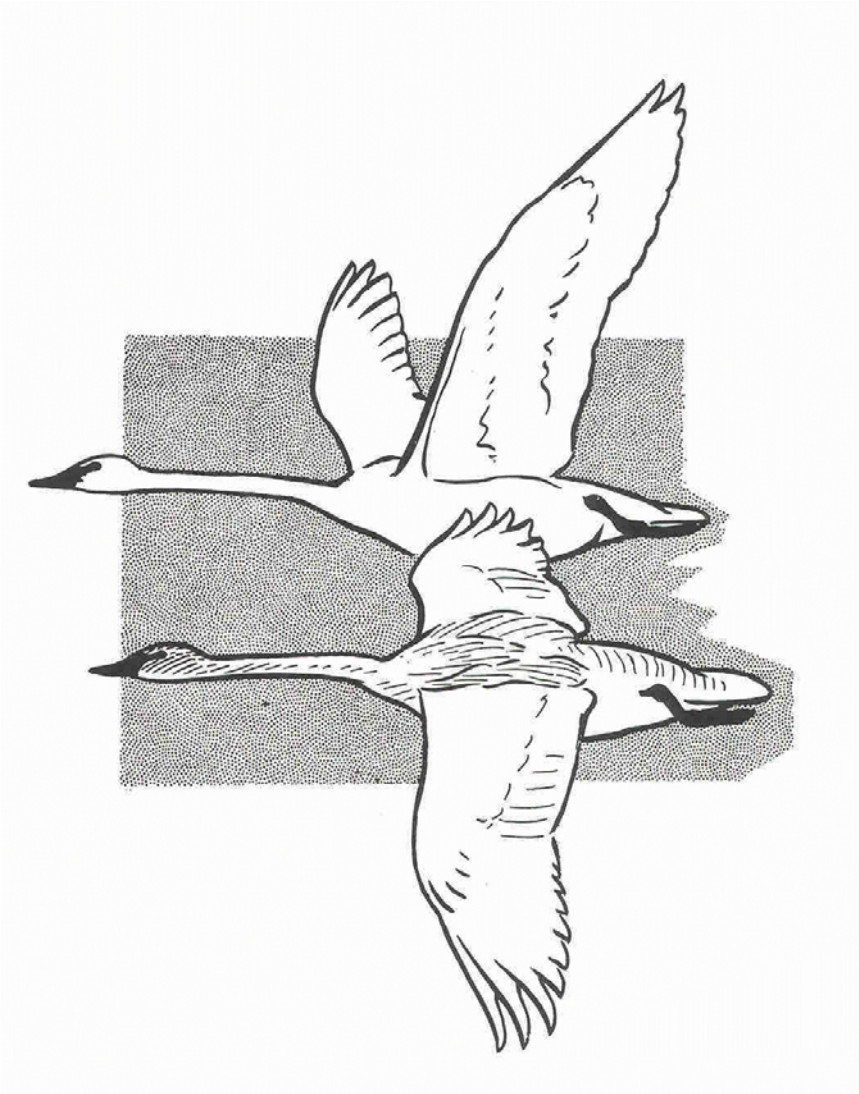
TRUMPETER SWAN SURVEY
of the
ROCKY MOUNTAIN POPULATION

WINTER 2009



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ROCKY MOUNTAIN POPULATION

WINTER 2009

U.S. Fish and Wildlife Service
Migratory Birds and State Programs
Mountain-Prairie Region
Lakewood, Colorado

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Abstract.– Observers counted 5,265 swans (white birds and cygnets) in the Rocky Mountain Population of trumpeter swans during January and February 2009, which was a 14% increase from the 4,637 counted during winter 2008. The number of white birds (4,377) and cygnets (888) increased 15% and and 10%, respectively, from counts last year. In the tri-state area, the number of total swans decreased dramatically in Montana (-54%), were slightly higher in Wyoming (+3%), and increased (+24%) to a record-high count in Idaho. The number of birds wintering in areas near restoration flocks was the highest since 1996. The numbers of birds at Ruby Lake National Wildlife Refuge (NWR) and Malheur NWR increased, whereas the count of birds near Summer Lake Wildlife Management Area (WMA) was nearly the same as that of last year. Reservoir levels in early February were dramatically higher than during winter 2008, and cumulatively were 7% above the long-term average. Generally, temperatures in the tri-state area during winter 2008-09 were about average, and precipitation was slightly above average.

The Rocky Mountain Population (RMP) of trumpeter swans (*Cygnus buccinator*) consists of birds that nest primarily from western Canada southward to Nevada and Wyoming (Fig. 1). The population is comprised of several flocks that nest in different portions of the overall range. The RMP/Canadian Flocks consist of birds that summer primarily in southeastern Yukon Territory, southwestern Northwest Territories, northeastern British Columbia, Alberta, and western Saskatchewan. The RMP/Tri-state Area Flocks summer in areas at the juncture of the boundaries of Montana, Wyoming, and Idaho (hereafter termed the tri-state area) and nearby areas (Fig. 2). The Canadian and Tri-state Area flocks winter sympatrically primarily in the tri-state area. In addition, efforts have been made to establish several RMP restoration flocks, such as those at Ruby Lake National Wildlife Refuge (NWR) in Nevada (i.e., Nevada flock) and those at Malheur NWR and Summer Lake Wildlife Management Area (WMA) and vicinity (i.e., Oregon flock), by translocating adult swans and cygnets from other portions of the RMP. These birds tend to winter in areas near those where they nest. These terms for the various groups of swans are consistent with the Pacific Flyway Management Plan for the RMP of Trumpeter Swans (Subcommittee on the Rocky Mountain Population of Trumpeter Swans 2008).

Although counts of swans wintering in the tri-state area have been conducted since at least the 1950s (Banko 1960), many early efforts were not well-coordinated and were variable. In an attempt to better coordinate the survey, in 1972 the U.S. Fish and Wildlife Service (Service) began the annual Mid-winter Trumpeter Swan Survey in the tri-state region. During the next decade, the area surveyed increased substantially, and by 1981 it was believed all known occupied wintering sites were included (Gale et al. 1988). Recent attempts to expand the wintering range of RMP trumpeter swans have resulted in the inclusion of yet more areas to the survey. Also, some areas may not be surveyed in a particular year due to weather or resource limitations (e.g., staff, money). Such survey modifications make individual counts from year-to-year less comparable, but the data are sufficient to reasonably depict trends in abundance.

Fig. 1. Approximate ranges of trumpeter swans during summer (from Moser 2006).

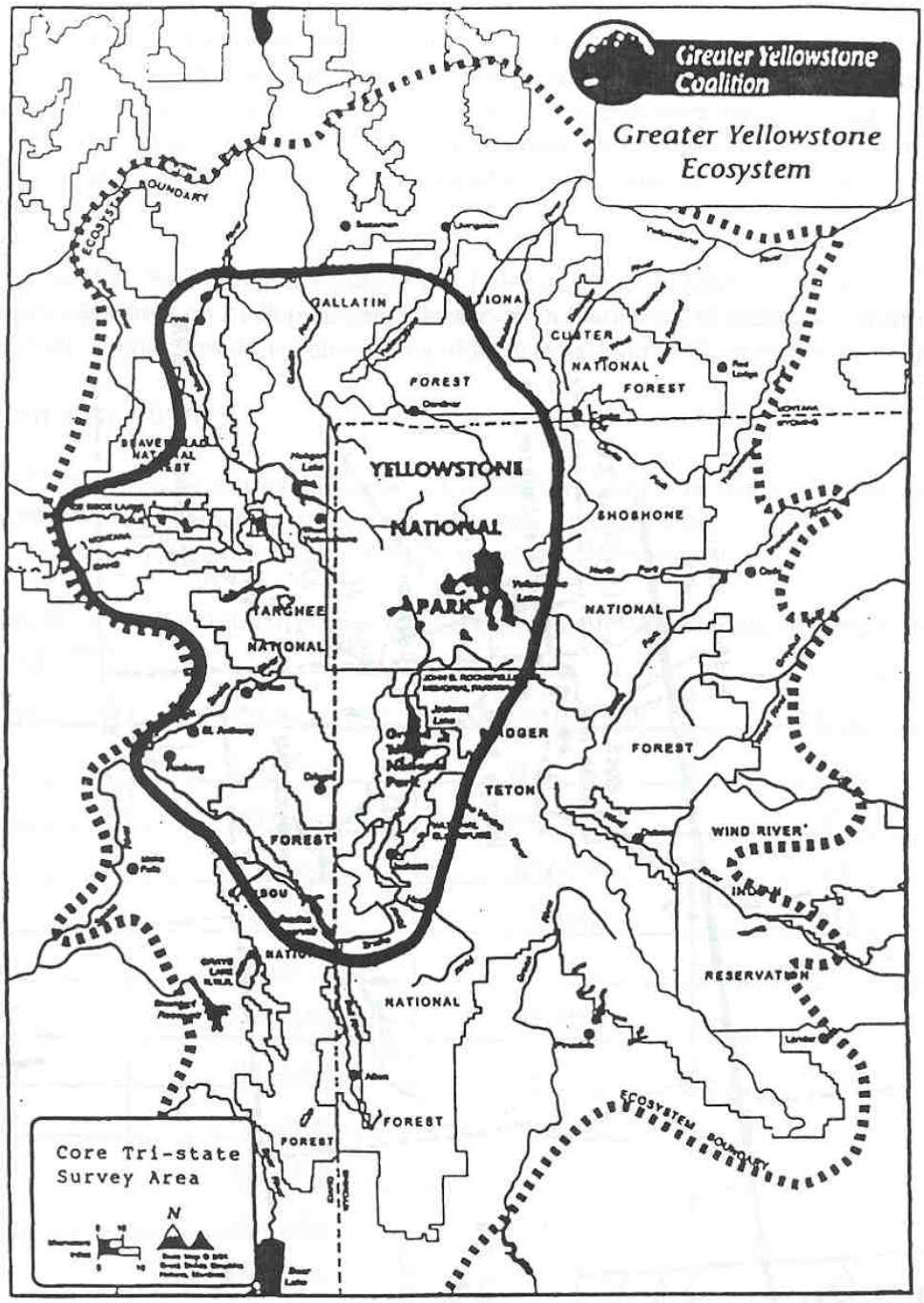

Fig. 2. Map showing the 'core' tri-state area of southeast Idaho, southwest Montana, and northwest Wyoming (provided by the Greater Yellowstone Coalition, Bozeman, Montana).

The Mid-winter Trumpeter Swan Survey is conducted annually in late January or early February. The survey is conducted cooperatively by several administrative entities and is intended to provide an annual assessment of the number of RMP trumpeter swans. Only data from 1972 to present, the time frame during which the Service has coordinated the survey, were analyzed for this report.

METHODS

The survey generally is conducted within a relatively short time frame (i.e., 1 week) to reduce the possibility of counting swans more than once due to movements of birds among areas. Aerial cruise surveys generally are used to count numbers of swans in the tri-state area, Nevada, at Malheur NWR, and in the Summer Lake WMA and vicinity; ground surveys are used to count the number of swans in isolated pockets of habitat not covered by aerial surveys. During aerial surveys, data are collected by observers seated in a single-engine, fixed-winged aircraft. Flying altitude varies with changes in terrain and surface winds, but generally averages 30-60 m above ground level, and flight speed is between 135-155 kph. One to two observers and the pilot count white (i.e., adults and subadults) and gray (i.e., cygnets) swans in known or suspected habitats. Counts are not adjusted for birds present but not seen by aerial crews, and have an unknown and unmeasured sampling variance associated with them. Ground surveys are used to verify species composition of some swan flocks, because trumpeter and tundra (*C. columbianus*) swans are difficult to differentiate during aerial surveys. Efforts are made to identify and exclude tundra swans from the survey counts. Generally about 30 hours of flight time and additional time spent conducting surveys on the ground are required to complete the survey.

Annual estimates of abundance for Canadian Flocks are determined by subtracting the count of the RMP/U.S. Breeding Segment in the previous fall (e.g., U.S. Fish and Wildlife Service 2008*a*) from the Mid-winter count. For the estimate of the size of the Canadian Flocks to be accurate, several conditions must be met. First, all swans must be correctly identified to species. Second, the Mid-winter count and the fall count of swans in the RMP/U.S. Breeding Segment must be accurate. Additionally, we must assume that mortality in the RMP/U.S. Breeding Segment between the time of the fall and winter surveys is negligible. Because of problems inherent in surveying biological populations, these conditions probably are seldom met. Thus, this methodology for estimating the size of the RMP/Canadian Flocks likely leads to somewhat biased estimates of the composition of the RMP. However, the counts using this methodology generally track those from the quinquennial trumpeter swan survey (U.S. Fish and Wildlife Service 2006), suggesting it produces a useful index to annual abundance for the Canadian Flocks.

To assess production for the RMP, we calculated the percentage of annual total swan counts that were cygnets. However, surveys in Nevada and Oregon did not separate counts into white birds and cygnets until 1992. Therefore, to allow an assessment over a longer time frame with data that are relatively comparable from year-to-year, we used only information from birds counted in the tri-state region. This subset contained a large majority (range = 87%-99%, $\bar{x}$ = 95%) of the total RMP counts during 1972-2008. Counts used for analyses in this report are provided in Appendix A.

RESULTS AND DISCUSSION

The 2009 Mid-winter survey was conducted between 14 January and 11 February. Aerial surveys in the tri-state area were completed on 3 and 4 February, and required about 26 hours to complete. Across most of the areas weather conditions were excellent during surveys. Winds were calm and temperatures were near or slightly above freezing. Fog caused some problems in a few localized areas in Idaho and Wyoming, but generally was not a factor during the survey.

Precipitation during December to February was 100% to 125% of average throughout much of the tri-state area (Joint Agricultural Weather Facility 2009). Water levels at 5 reservoirs (American Falls, Island Park, Jackson Lake, Palisades, and Minidoka Dam/Lake Walcott) cumulatively were at 69% of storage capacity on 1 February (data from U.S. Bureau of Reclamation 2009*a*), 27% above the level of last year and 7% above the 1972-2008 average (Fig. 3). Together, these reservoirs comprise about 97% of the water-storage capacity for reservoirs listed in the Snake River Basin in eastern Idaho and extreme western Wyoming (U.S. Bureau of Reclamation 2009*b*). Snowpack as of 1 February throughout much of the tri-state area and in southcentral Oregon was generally 70-109% of normal, and 70-129% of normal in northeastern Nevada (U.S. Department of Agriculture 2009).

The average streamflow on the Henrys Fork near Island Park Reservoir, Idaho, during 15 January to 15 February 2009 was 340 cfs, 12% below the 1972-2008 average for that recording station (U.S. Bureau of Reclamation 2009*a*) (Fig. 3). The December-February temperatures were near average throughout much of the primary wintering area in the tri-state region (Fig. 4) (Joint Agricultural Weather Facility 2009).

Historical Trends

Methods used to estimate trends in rates of change in RMP abundance were detailed in a previous report (U.S. Fish and Wildlife Service 2003), and will not be reiterated here. Briefly, however, we used least-squares regression on log-transformed counts to assess rates of change in counts of swans over time. Counts from the current Mid-winter survey (2009) were compared to results from 1972-2008, a practice used in Service survey reports for other waterfowl (e.g., Zimpfer et al. 2008, U.S. Fish and Wildlife Service 2008*b*). Because Nevada and Oregon did not separate total counts of swans into white birds and cygnets prior to 1992 (see above), analyses to assess trends for white birds and cygnets used only counts from the tri-state area.

The counts for total swans of the RMP suggested an increase ($P < 0.01$) of 5.8% per year during 1972-2008 (Table 1, Fig. 5). The number of white birds and cygnets counted in the tri-state region both increased ($P < 0.01$) at about 6% per year. Counts of birds in Montana (white birds + cygnets) increased slightly (+1.9% per year, $P < 0.01$), whereas rates of growth for birds wintering in Idaho and Wyoming (both +7.3% per year, $P < 0.01$) were much higher (Table 2, Fig. 6). Although the number of birds wintering in each of the 3 states in the tri-state region generally has

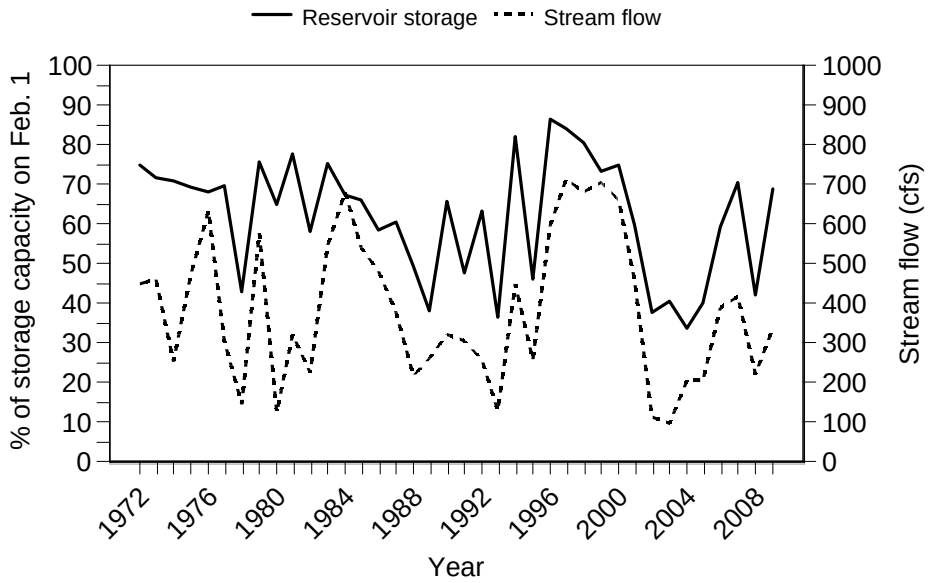

Fig. 3. Water storage for 5 reservoirs (see text) in the tri-state region on 1 February, and average streamflow between 15 January and 15 February on the Henrys Fork, 1972-2009.

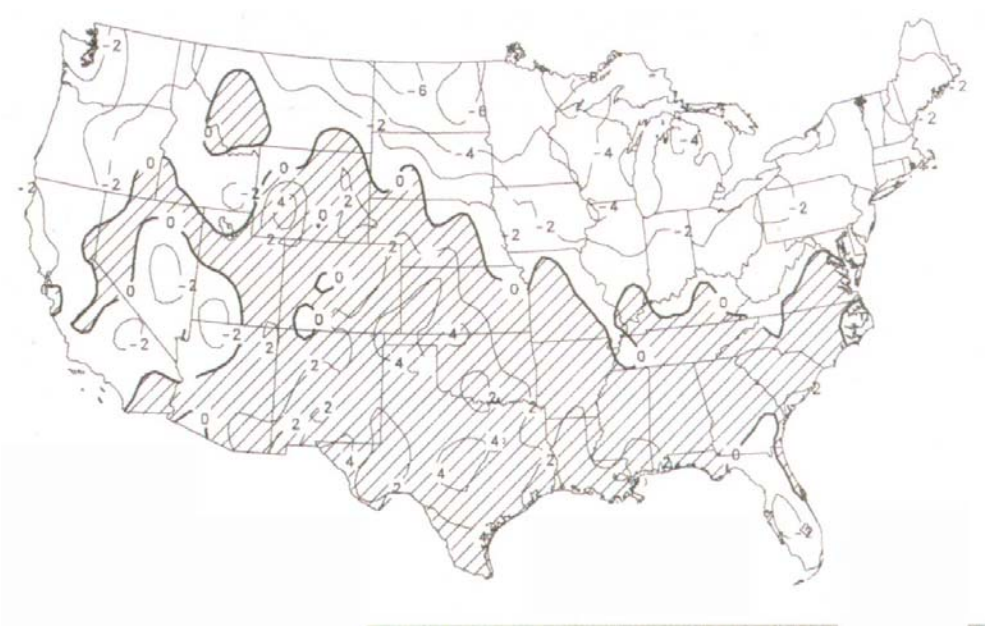

Fig. 4. Departure of average temperature from normal (°F) during December 2008 to February 2009 (Joint Agricultural Weather Facility 2009).

increased since 1972, the distribution of birds among the states has changed substantially. Whereas during the 1970s and early 1980s about 36% of wintering swans were counted in Montana, only about 15% of the birds wintering in the tri-state area have been counted there during the last decade (Fig. 7). In contrast, the percentage of birds in Idaho has increased from about 53% to about 69% during that same time period. The percentage of birds counted in Wyoming during winter also has increased, from about 11% to 16%.

Counts of total swans wintering in Nevada have fluctuated over time, but suggest an increase (P = 0.06) of about 1.0% per year during 1972-2008 (Table 2, Fig. 8). Counts in Nevada during the early 2000s generally were near historic highs. Trumpeter swans in Oregon primarily occur in 2 areas, Malheur NWR and the Summer Lake WMA and vicinity. Introductions of trumpeter swans to Malheur NWR began in the late 1930s; however, birds were not translocated to Summer Lake WMA until the winter of 1992. Analyzing trends for the Oregon Flock as a whole (Table 2) could lead to inappropriate inferences. Therefore, we analyzed data for Malheur NWR (1972-2008) separate from those for Summer Lake WMA. Results suggest a decline (-3.5% per year, $P < 0.01$) for birds wintering at Malheur NWR (Fig. 8, Appendix A). At Summer Lake WMA, most birds were translocated to the area during winter and generally remained in the area for only a few months after being translocated (M. St. Louis, Oregon Department of Fish and Wildlife, personal communication). Thus, in 1997, the winter following the termination of translocations to Summer Lake WMA, the number counted during the survey dropped sharply (Fig. 8). From 1997-2008, an average of about 31 birds has been observed during winter surveys (excluding years with incomplete surveys).

The percentage of the entire RMP estimated to be comprised of Canadian Flocks increased from about 19% during February of 1972 to 92% during February 2005, and then decreased during 2006 to 2008 (Table 3). The data fit a 2nd-order logarithm model ($P < 0.01$, adjusted $R^2 = 0.96$), suggesting that the percentage may plateau near 90% (Fig. 9). The number of swans estimated to be from Canadian Flocks exhibited a fairly steady increase since the early 1980s, and was nearly 5,000 birds in 2006, but declined to about 4,100 birds in 2008 (Table 3, Fig. 9).

Results from the 2009 survey

During the 2009 winter survey, observers counted 5,265 trumpeter swans in the RMP, which was a 14% increase from the count of last winter (4,637) (Table 1). The number of white birds increased 15%, whereas the count for cygnets increased 10% from that of last year.

The total number of swans in Montana decreased dramatically (-54%) compared to last year. The count in Wyoming increased slightly (+3%) from that of winter 2008, whereas the count of total swans in Idaho increased 24% to a record-high count of over 4,000 birds. Of the birds wintering in the tri-state area during winter 2009, about 4% were in Montana, 80% were in Idaho, and 16% were counted in Wyoming.

Table 1. Counts of trumpeter swans of the Rocky Mountain Population during winter, 1972-2009.

	Tri-state area			Oregon and Nevada[a]			Total RMP		
Year	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds[b]	Cygnets[b]	Total
1972	c	c	616			91			707
1973	c	c	581[d]			60			641
1974	553	156	709			61			770
1975	595	128	723			40			763
1976	623	102	725			55			780
1977	839	178	1017			46			1063
1978	695	179	874			27			901
1979	743	123	866			62			928
1980	767	172	939			86			1025
1981	1000	247	1247			98			1345
1982	952	266	1218			105			1323
1983	1025	207	1232			90			1322
1984	1128	332	1460			98			1558
1985	1326	190	1516			82			1598
1986	1304	299	1603			59			1662
1987	1196	386	1582			77			1659
1988	1314	408	1722			51			1773
1989	1452	291	1743			54			1797
1990	1591	416	2007			38			2045
1991	1589	342	1931			49			1980
1992	1642	397	2039	99	58	157	1741	455	2196
1993	1659	419	2078	121	36	157	1780	455	2235
1994	1753	543	2296	127	101	228	1880	644	2524
1995	2012	668	2680	93	30	123	2105	698	2803
1996	2129	580	2709	163	64	227	2292	644	2936
1997	2179	407	2586	77	18	95	2256	425	2681
1998[e]	1756	307	2063	64	29	93	1820	336	2156
1999	2698	772	3470	45[f]	10[f]	71	2743[f]	782[f]	3541
2000	2694	746	3440	50[f]	15[f]	84	2744[f]	761[f]	3524
2001	3198	719	3917	47[f]	11[f]	90	3245[f]	730[f]	4007
2002	3814	546	4360	48[f]	7[f]	67	3862[f]	553[f]	4427
2003[g]	3365	532	3897	62	15	77	3427	547	3974
2004[g]	3785	746	4531	46	7	53	3831	753	4584
2005	4147	1143	5290	59	12	71	4206	1155	5361
2006	4203	1209	5412	58	14	72	4261	1223	5484
2007[h]	3604	893	4619	56	26	82	3660	919	4701
2008[h]	3744	790	4545	74	18	92	3818	808	4637
2009	4287	873	5160	90	15	105	4377	888	5265

[a] Total counts not separated into white birds and cygnets prior to 1992.

[b] Not calculated prior to 1992 because of no counts for Oregon and Nevada.

[c] Not provided because counts for Yellowstone National Park not separated into white birds and cygnets.

[d] In Wyoming only Yellowstone National Park surveyed.

[e] 1998 counts for the Tri-state area and Total RMP are biased low because aerial survey of Yellowstone National Park not conducted due to hazardous weather; counted by snowmobile with incomplete coverage.

[f] Counts biased low because white-bird and cygnet counts for Malheur NWR not available.

[g] Oregon/Nevada and Total RMP counts biased low due to incomplete surveys at Summer Lake WMA.

[h] White bird and cygnet counts for Tri-state area and Total RMP biased low because 122 birds in 2007 and 11 birds in 2008 in Idaho were not classified as white birds or cygnets.

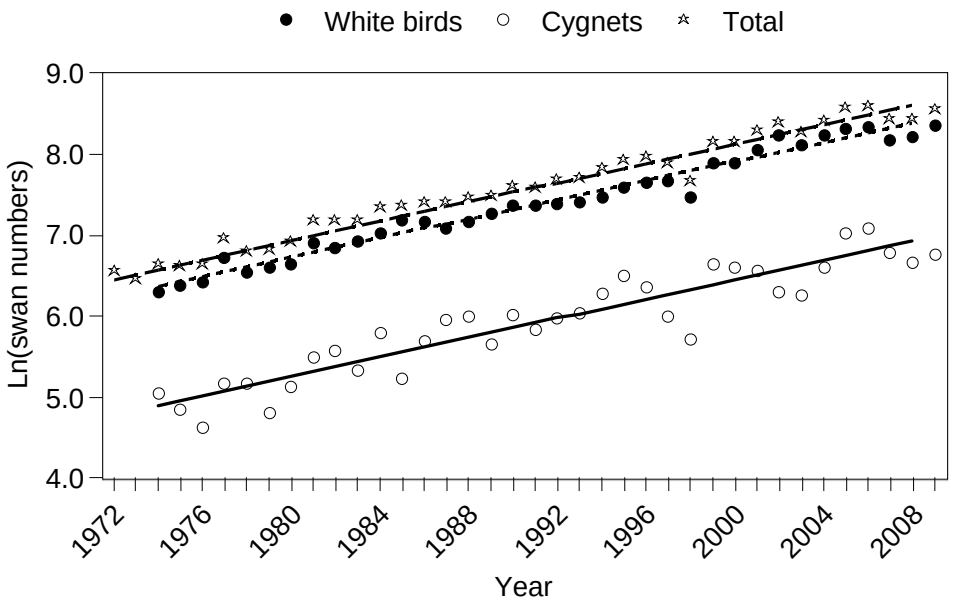

Fig. 5. Rates of change for counts of swans in the RMP during the Mid-winter Trumpeter Swan Survey, 1972-2009 (dotted and solid lines depict trends for white birds and cygnets, respectively, for swans counted in the tri-state region [see text]; dashed line depicts total RMP swans).

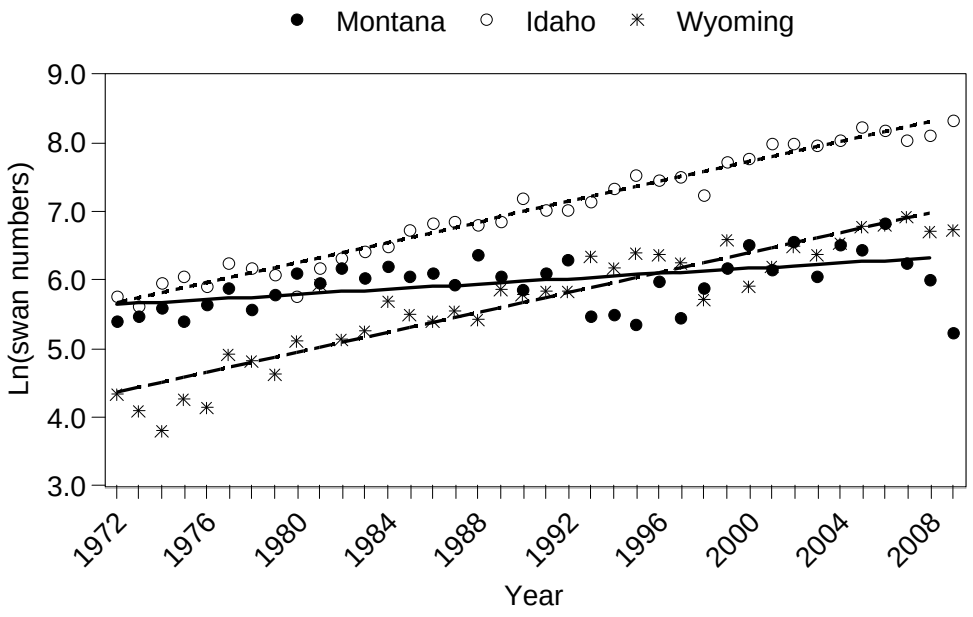

Fig. 6. Rates of change for counts of total swans in states of the tri-state region during the Mid-winter Trumpeter Swan Survey, 1972-2009 (solid, dotted, and dashed lines represent trends for Montana, Idaho, and Wyoming, respectively).

Table 2. Counts of trumpeter swans of the Rocky Mountain Population in individual states during winter, 1972-2009.

	Montana			Idaho			Wyoming			Oregon[a]			Nevada[a]		
Year	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total
1972	209	14	223	303	14	317	.b	b	76			50			41
1973	212	28	240	222	58	280	b	b	61[c]			32			28
1974	233	40	273	282	109	391	38	7	45			36			25
1975	192	32	224	333	94	427	70	2	72			15			25
1976	253	34	287	308	67	375	62	1	63			30			25
1977	315	43	358	395	126	521	129	9	138			17			29
1978	194	68	262	392	96	488	109	15	124			7			20
1979	304	26	330	353	81	434	86	16	102			41			21
1980	374	80	454	250	70	320	143	22	165			65			21
1981	352	36	388	370	110	480	278	101	379			77			21
1982	390	90	480	429	137	566	133	39	172			65			40
1983	363	59	422	493	122	615	169	26	195			52			38
1984	389	109	498	503	162	665	236	61	297			63			35
1985	393	31	424	701	144	845	232	15	247			51			31
1986	380	73	453	744	183	927	180	43	223			33			26
1987	314	63	377	690	255	945	192	68	260			49			28
1988	438	153	591	694	209	903	182	46	228			24			27
1989	342	90	432	817	141	958	293	60	353			36			18
1990	319	38	357	1025	300	1325	247	78	325			23			15
1991	385	70	455	918	211	1129	286	61	347			31			18
1992	438	114	552	892	249	1141	312	34	346	67	56	123	32	2	34
1993	168	70	238	1020	246	1266	471	103	574	91	36	127	30	0	30
1994	199	48	247	1164	397	1561	390	98	488	114	94	208	13	7	20
1995	153	61	214	1391	475	1866	468	132	600	72	27	99	21	3	24
1996	319	82	401	1336	390	1726	474	108	582	140	49	189	23	15	38
1997	204	30	234	1555	272	1827	420	105	525	46	9	55	31	9	40
1998	290	68	358	1200	200	1400	266[d]	39[d]	305[d]	31	7	38	33	22	55
1999	335	153	488	1754	500	2254	609	119	728	16[e]	2[e]	34	29	8	37
2000	519	155	674	1881	513	2394	294	78	372	15[e]	6[e]	40	35	9	44
2001	373	96	469	2404	549	2953	421	74	495	16[e]	7[e]	55	31	4	35
2002	600	104	704	2636	357	2993	578	85	663	7[e]	5[e]	24	41	2	43
2003	375	58	433	2490	382	2872	500	92	592	28[f]	8[f]	36[f]	34	7	41
2004	583	92	675	2591	563	3154	611	91	702	8[f]	0[f]	8[f]	38	7	45
2005	508	119	627	2954	828	3782	685	196	881	27	10	37	32	2	34
2006	713	211	924	2714	873	3587	776	125	901	36	14	50	22	0	22
2007	466	49	515	2294[g]	664[g]	3080	844	180	1024	38	16	54	18	10	28
2008	382	25	407	2694[g]	616[g]	3321	668	149	817	49	16	65	25	2	27
2009	168	21	189	3393	740	4133	726	112	838	53	15	68	37	0	37

[a] Counts for Oregon and Nevada were not separated into white birds and cygnets until 1992.

[b] Not provided because counts for Yellowstone National Park not separated into white birds and cygnets.

[c] Counts for Yellowstone National Park only; remainder of Wyoming not surveyed.

[d] Counts for Wyoming biased low because aerial survey of Yellowstone National Park not conducted due to hazardous weather; counted by snowmobile with incomplete coverage.

[e] Counts biased low because white-bird and cygnet counts for Malheur NWR not available.

[f] Counts biased low due to incomplete surveys at Summer Lake WMA.

[g] Counts biased low because 122 birds in 2007 and 11 birds in 2008 not classified as either white birds or cygnets.

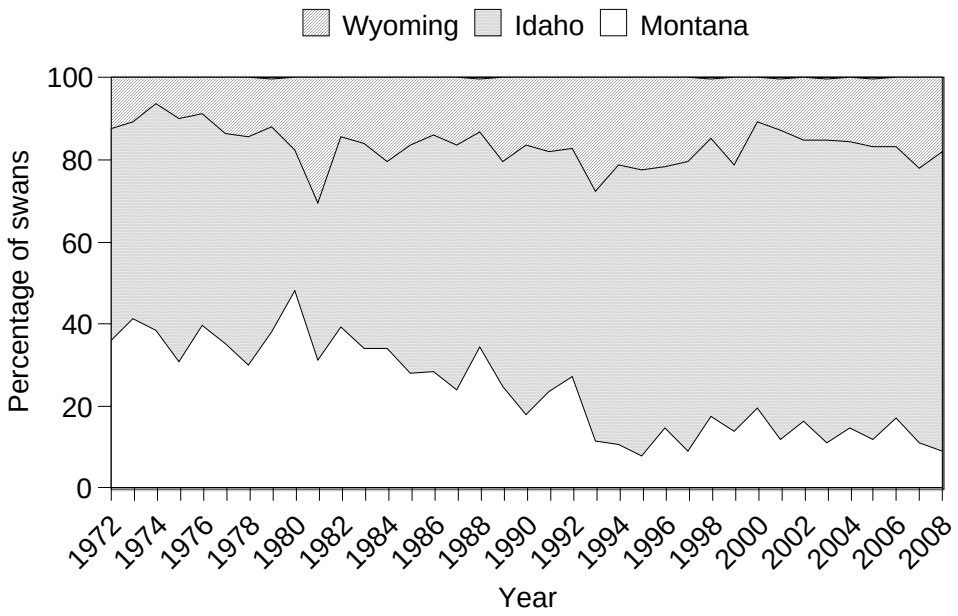

Fig. 7. Proportions of total swans counted in each of the states comprising the tri-state region during the Mid-winter Trumpeter Swan Survey, 1972-2008.

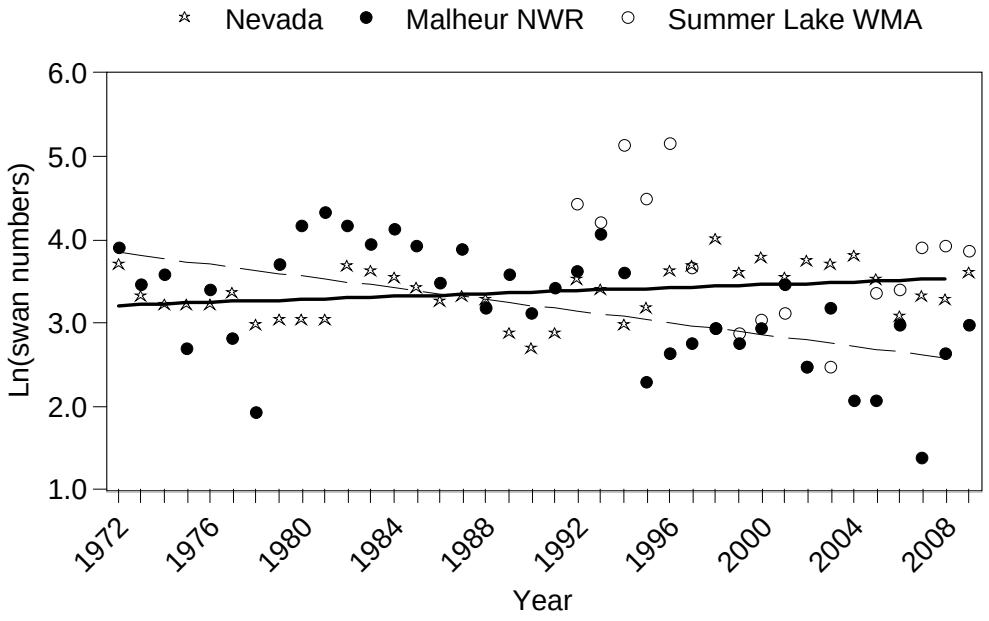

Fig. 8. Rates of change in counts of total swans in Nevada (stars and solid line) and Oregon (Malheur NWR [closed circles and dashed line] and Summer Lake WMA [open circles]) during the Mid-winter Trumpeter Swan Survey, 1972-2009. Data for Summer Lake WMA in 2002 and 2003 are from incomplete surveys.

Table 3. Estimates of swan abundance for flocks comprising the Rocky Mountain Population of Trumpeter swans, 1972-2009.

Year	Mid-winter count	U.S. Breeding Flocks[a]	Canadian Flocks	Percent Canadian Flocks
1972	707	572	135	19.1
1975	763	581	182	23.9
1978	901	544	357	39.6
1981	1345	582	763	56.7
1984	1558	547	1011	64.9
1985	1598	563	1035	64.8
1986	1662	575	1087	65.4
1987	1659	452	1207	72.8
1988	1773	611	1162	65.5
1989	1797	659	1138	63.3
1990	2045	598	1447	70.8
1991	1980	626	1354	68.4
1992	2196	555	1641	74.7
1993	2235	563	1672	74.8
1994	2524	354	2170	86.0
1995	2803	454	2349	83.8
1996	2936	427	2509	85.5
1997	2681	458	2223	82.9
1998	2156	427	1729	80.2
1999	3541	469	3072	86.8
2000	3524	417	3107	88.2
2001	4007	481	3526	88.0
2002	4427	487	3940	89.0
2003	3974	371	3603	90.7
2004	4584	417	4167	90.9
2005	5361	417	4944	92.2
2006	5484	510	4974	90.7
2007	4701	507	4194	89.2
2008	4637	527	4110	88.6
2009	5265	459	4806	91.3

[a] From U.S. Fish and Wildlife Service 2008*a*. Counts are from the previous calendar year (e.g., the 2009 value is from the Fall 2008 survey).

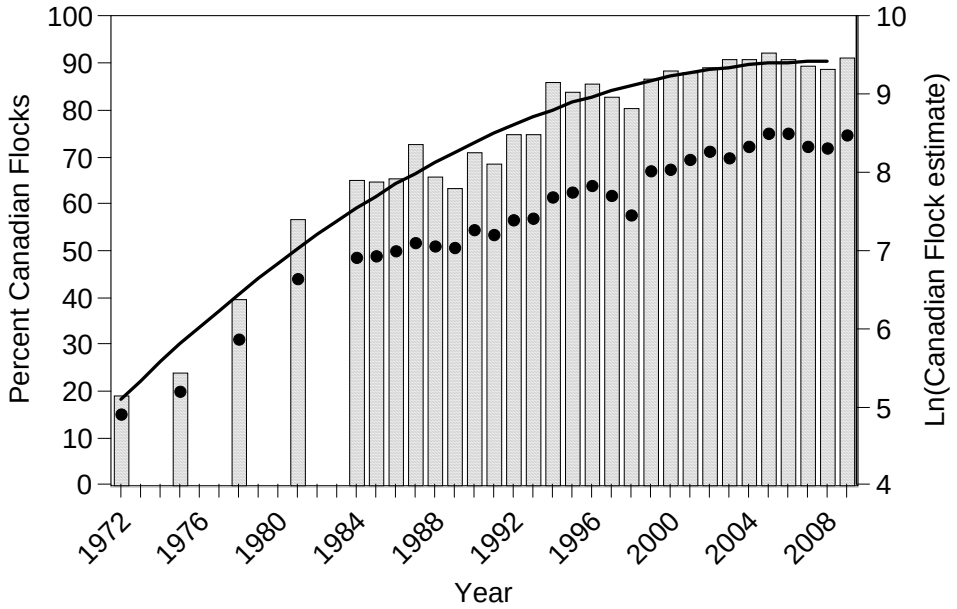

Fig. 9. Percent (bars and solid line) and counts (solid dots) of the entire RMP estimated to be comprised of Canadian Flocks during the Mid-winter Trumpeter Swan Survey, 1972-2009.

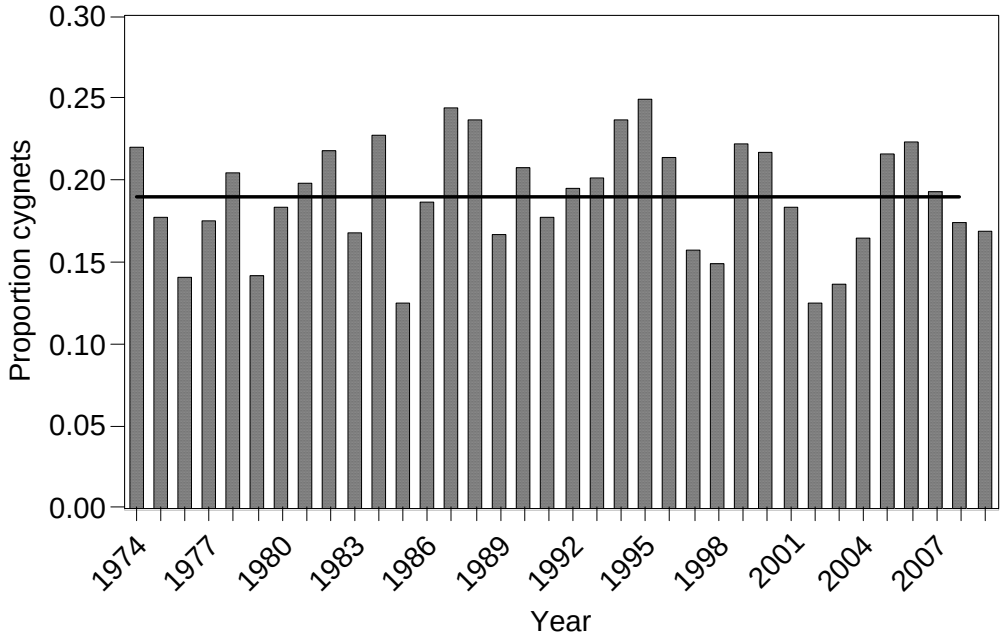

Fig. 10. Proportion of cygnets counted in the tri-state region during the Mid-winter Trumpeter Swan Survey, 1974-2009. The solid line depicts the 1974-2008 average.

The number of swans in Nevada (37) was higher than that of last year, and slightly higher than counts from the last few winters (Table 2, Appendix A). A period of cold weather occurred prior to the survey, resulting in normal ice coverage on the marsh at Ruby Lake NWR. Open water was available on spring-fed ponds and spring outflow areas. The total count was near the long-term average (31 swans). The number of swans counted at Malheur NWR (20) increased from that of last winter (Appendix A). The count at Summer Lake WMA (48) was nearly identical to that of last year (51).

The estimated number of swans from Canadian Flocks was 4,806 birds, about 700 more swans compared to the estimate from winter 2008 and the third-highest recorded. The estimate indicated about 91% of the RMP counted in winter 2009 was comprised of swans from Canadian Flocks (Table 3, Fig. 9). After increasing steadily from the early 1970s to the late 1990s, the proportion has remained near 90% (range = 88.0%-92.2%) for the last 10 years.

The proportion of cygnets for swans counted in the tri-state region during winter 2009 was 0.169. This value was 11% lower than the 1974-2008 average (0.190) (Fig. 10). This marked the third consecutive year production declined, the last two years of which were below average.

In summary, RMP trumpeter swans appeared to increase by nearly 6% annually between 1972 and 2008. Most of the increase over that time was attributable to increases in the number of birds in the Canadian Flocks, which estimates suggest comprise approximately 90% of the population. Although estimates of the size of the Canadian Flocks from the winter RMP surveys typically are greater than those from the quinquennial surveys, the estimates appear to track each other (U.S. Fish and Wildlife Service 2006). The results suggest that annual estimates of the size of the Canadian Flocks from the winter RMP surveys are reasonable, but may slightly overestimate their abundance.

The survey results from the 2009 Mid-winter survey suggest an increase of almost 600 birds from the count of last year. This was the third-highest count recorded and followed 2 years of apparent declines. Relatively mild conditions and plentiful surface water in streams contributed to a record-high count of swans in Idaho, whereas the number of birds seen in Montana declined dramatically. Although the number of swans counted in Wyoming was slightly higher compared to that of last year, the number of birds in Yellowstone National Park both this year (90) and during winter 2008 (72) have been only about one-half of the 2002-2007 average (161 birds).

The 14% increase in total swans this year cannot be explained by an increase in production during summer 2008. The index to recruitment this winter declined 3% from that of last winter, and was the third consecutive year the index has decreased. Other factors such as immigration and emigration into and out of the survey area, and potentially changes in annual survival, also could influence large changes in annual abundances, both up and down, such as was encountered this winter. However, without additional information regarding these factors, causes for these large and biologically implausible annual changes will remain unexplained.

Regarding restoration flocks, individual areas had either about the same number of swans or an increase compared to last year. Collectively, these areas have had successive increases since 1995, and the count for 2009 was the highest since 1996. This trend is encouraging, but until the last few years tundra swans had not been present at Ruby Lake NWR. The large number of tundra swans that now inhabit the area during winter could potentially impact food availability for nesting trumpeter swans, which could impact their recruitment in the future.

ACKNOWLEDGMENTS

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Appendix A. Counts of trumpeter swans of the Rocky Mountain Population during winter, 1972-2009.

	Montana			Idaho			Wyoming (outside Yellowstone NP)		
Year	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total
1972	209	14	223	303	14	317	16	4	20
1973	212	28	240	222	58	280	a	a	a
1974	233	40	273	282	109	391	7	0	7
1975	192	32	224	333	94	427	40	2	42
1976	253	34	287	308	67	375	30	1	31
1977	315	43	358	395	126	521	86	0	86
1978	194	68	262	392	96	488	63	4	67
1979	304	26	330	353	81	434	15	3	18
1980	374	80	454	250	70	320	63	6	69
1981	352	36	388	370	110	480	37	10	47
1982	390	90	480	429	137	566	76	19	95
1983	363	59	422	493	122	615	81	12	93
1984	389	109	498	503	162	665	87	11	98
1985	393	31	424	701	144	845	78	8	86
1986	380	73	453	744	183	927	91	25	116
1987	314	63	377	690	255	945	85	18	103
1988	438	153	591	694	209	903	115	28	143
1989	342	90	432	817	141	958	197	39	236
1990	319	38	357	1025	300	1325	169	46	215
1991	385	70	455	918	211	1129	225	47	272
1992	438	114	552	892	249	1141	204	30	234
1993	168	70	238	1020	246	1266	293	64	357
1994	199	48	247	1164	397	1561	253	74	327
1995	153	61	214	1391	475	1866	327	91	418
1996	319	82	401	1336	390	1726	344	84	428
1997	204	30	234	1555	272	1827	346	102	448
1998	290	68	358	1200	200	1400	109	15	124
1999	335	153	488	1754	500	2254	317	71	388
2000	519	155	674	1881	513	2394	207	65	272
2001	373	96	469	2404	549	2953	368	63	431
2002	600	104	704	2636	357	2993	447	72	519
2003	375	58	433	2490	382	2872	354	58	412
2004	583	92	675	2591	563	3154	462	58	520
2005	508	119	627	2954	828	3782	561	166	727
2006	713	211	924	2714	873	3587	655	111	766
2007	466	49	515	2294[h]	664[h]	3080	700	155	855
2008	382	25	407	2694[h]	616[h]	3321	603	142	745
2009	168	21	189	3393	740	4133	638	110	748

[a] Counts not available.

[b] Total counts not separated into white birds and cygnets prior to 1992.

[c] Swans first translocated to Summer Lake WMA in 1992.

[d] Count biased low because aerial survey not conducted due to hazardous weather; snowmobile count with incomplete coverage only.

[e] Count biased low due to incomplete survey coverage.

[h] Counts biased low because 122 birds in 2007 and 11 birds in 2008 not classified as white birds or cygnets.

Appendix A. (cont.)

	Yellowstone NP			Malheur NWR[b]			Summer Lake WMA[c]			Nevada[b]		
Year	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total
1972	a	a	56			50						41
1973	a	a	61			32						28
1974	31	7	38			36						25
1975	30	0	30			15						25
1976	32	0	32			30						25
1977	43	9	52			17						29
1978	46	11	57			7						20
1979	71	13	84			41						21
1980	80	16	96			65						21
1981	241	91	332			77						21
1982	57	20	77			65						40
1983	88	14	102			52						38
1984	149	50	199			63						35
1985	154	7	161			51						31
1986	89	18	107			33						26
1987	107	50	157			49						28
1988	67	18	85			24						27
1989	96	21	117			36						18
1990	78	32	110			23						15
1991	61	14	75			31						18
1992	108	4	112	25	13	38	42	43	85	32	2	34
1993	178	39	217	44	15	59	47	21	68	30	0	30
1994	137	24	161	30	7	37	84	87	171	13	7	20
1995	141	41	182	9	1	10	63	26	89	21	3	24
1996	130	24	154	11	3	14	129	46	175	23	15	38
1997	74	3	77	11	5	16	35	4	39	31	9	40
1998	157[d]	24[d]	181[d]	13	6	19	18	1	19	33	22	55
1999	292	48	340	a	a	16	16	2	18	29	8	37
2000	87	13	100	a	a	19	15	6	21	35	9	44
2001	53	11	64	a	a	32	16	7	23	31	4	35
2002	131	13	144	a	a	12	7[e]	5[e]	12[e]	41	2	43
2003	146	34	180	19	5	24	9[e]	3[e]	12[e]	34	7	41
2004	149	33	182	8	0	8	a	a	a	38	7	45
2005	124	30	154	8	0	8	19	10	29	32	2	34
2006	121	14	135	15	5	20	21	9	30	22	0	22
2007	144	25	169	4	0	4	34	16	50	18	10	28
2008	65	7	72	12	2	14	37	14	51	25	2	27
2009	88	2	90	17	3	20	36	12	48	37	0	37

[a] Counts not available.

[b] Total counts not separated into white birds and cygnets prior to 1992.

[c] Swans first translocated to Summer Lake WMA in 1992.

[d] Count biased low because aerial survey not conducted due to hazardous weather; snowmobile count with incomplete coverage only.

[e] Count biased low due to incomplete survey coverage.

Appendix B. Site-specific counts of trumpeter swans of the Rocky Mountain Population during the Mid-winter Trumpeter Swan Survey, 2009.

State or Area	White birds	Cygnets	Total	Pilot/observer/notes
Montana				
Hebgen Lake area				P: N. Cadwell; O: D. Smith (2/3)
Cougar Creek	0	0	0	
Between Quake Lake and Hebgen Lake	0	0	0	
Madison River Arm	4	0	4	
North Spring (Grayling Arm)	0	0	0	
South Fork Arm	0	0	0	
South Fork Madison River/Buttermilk Creek	0	0	0	
Subtotal	**4**	**0**	**4**	
Madison River Valley				P: D. Chapman; O: J. Warren (2/4)
Odell Creek Area	30	1	31	
Walsh Ponds (south)1	0	0	0	
Walsh Ponds (north)1	0	0	0	
Madison River, south of Ennis	25	3	28	
Madison River, north of Ennis	13	0	13	57/1/58 from YNP survey
Ennis Lake	0	0	0	Mostly frozen
Subtotal	**68**	**4**	**72**	
Chain of Lakes	0	0	0	
Cliff Lake	0	0	0	
Wade Lake	0	0	0	
Goose Lake	0	0	0	
Smith Creek (Hidden Lake outlet)	0	0	0	
Subtotal	**0**	**0**	**0**	
Centennial Valley/Red Rock Lakes NWR				
Red Rock River below Lower Lake Dam	0	0	0	
MacDonald Pond	27	0	27	
Culver Pond	31	5	36	
Elk Springs Creek	0	0	0	
Swan Lake	0	0	0	
Shambow Pond	0	0	0	
Red Rock River, Lima	0	0	0	
Subtotal	**58**	**5**	**63**	
Paradise Valley				P: N. Cadwell; O: D. Smith (2/3)
Armstrong's Spring Creek	0	0	0	
Bailey's	0	0	0	
Brockway	0	0	0	
DePuys	0	0	0	
Brandis	0	0	0	
Nelson's Spring Creek	0	0	0	
Sacagawea Park	0	0	0	
Yellowstone River 1 mile north of Emigrant	0	0	0	
Beaver Creek	0	0	0	

Yellowstone River - 6 mile	0	0	0	
Yellowstone River - Pray	0	0	0	
Yellowstone River - entry to Dry Creek	0	0	0	
Dana's	0	0	0	
Emigrant Pond	12	0	12	
PMD Ranch	26	12	38	
Subtotal	**38**	**12**	**50**	
Wyoming				
Upper Snake River (Flagg Ranch to Wilson Bridge)				P: D. Stinson; O: S. Patla (2/3-4)
Polecat Creek	0	0	0	
Flagg Ranch to Jackson Lake	0	0	0	
Jackson Lake	0	0	0	Frozen
Jackson Lake to Moran Junction	18	1	19	Partially frozen
Moran Junction to Deadman's	0	0	0	
Deadman's to Moose	8	0	8	
Moose to Gros Ventre Junction	8	3	11	
Gros Ventre Junction area	15	2	17	
Gros Ventre Junction to Wilson Bridge	4	0	4	
Gros Ventre River, Highway 89 to Snake River	0	0	0	
Subtotal	**53**	**6**	**59**	
Gros Ventre River upriver of Kelly				
Kelly Warm Springs, Grand Teton National Park	0	0	0	
Lower Slide Lake	0	0	0	
Upper Gros Ventre	0	0	0	
Subtotal	**0**	**0**	**0**	
Lower Snake River (Wilson Bridge to Alpine)				
Wilson Bridge to South Park Bridge	2	0	2	
Evan's Gravel pit ponds	2	0	2	Partially open
South Park Bridge to Hoback	7	0	7	
North Wilson	10	1	11	
Fish Creek, Wilson to Snake River	53	5	58	
Boyles Hill area	26	7	33	Ground count (Bill Long)
Spring Creek	38	15	53	
Crane Creek	31	2	33	
Lower Flat Creek, Snake River to Jackson	18	9	27	
Rafter J Ponds	4	1	5	
Valley Springs, Captive Swan Pond/Pen Highway 89	15	3	18	
Hoback to Astoria Bridge	4	4	8	
Astoria Bridge-Elbow	4	0	4	
Elbow to Alpine/Palisades Reservoir	4	1	5	
Bailey Lake	14	2	16	
Kelly Swan Facility	2	2	4	
Bondurant pond near Hoback River	a			
Subtotal	**234**	**52**	**286**	
National Elk Refuge				
Flat Creek main marsh	23	4	27	
Gros Ventre River, Kelly to Highway 89	0	0	0	

Romney pond area	0	0	0	
Lost Spring	11	1	12	
Subtotal	**34**	**5**	**39**	
Salt River (Alpine to Afton)				
Palisades Reservoir, WY Alpine	0	0	0	
Palisades Reservoir to Freedom Road	46	2	48	
Freedom Road to Narrows	5	0	5	
Thayne area	0	0	0	No swans in Flat Creek Pond
Narrows to Grover/Auburn Highway	0	0	0	
Grover/Auburn Highway to Swift Creek	82	6	88	
Swift Creek to Headwaters	0	0	0	
Subtotal	**133**	**8**	**141**	
Pinedale				
New Fork Boulder to Pinedale	2	0	2	
Boulder Fish Hatchery	0	0	0	
Daniel Fish Hatchery/Forty Rod Creek	12	1	13	
Warren Bridge to Kendall Bridge, Green River	2	0	2	Added in 2009
Kendall Bridge to Green River Lakes	0	0	0	Added in 2009
Subtotal	**14**	**1**	**15**	
Green River (Warren Bridge to Highway 28 Bridge)				
Fontenelle Dam-CCC Bridge	10	0	10	
CCC Bridge to Pilot Farm	70	12	82	
Pilot Farm-Refuge Headquarters	45	8	53	
Refuge to Big Sandy	11	3	14	
Big Sandy to Big Island	2	0	2	1 swan S. of Big I. by Stauffer Bridge
Flaming Gorge Reservoir	8	3	11	Also 4 tundras in Linwood Bay
Subtotal	**146**	**26**	**172**	
Dubois area				
Wind River and spring ponds, Dubois	0	0	0	
Dinwoody Lake	14	8	22	FWS ground count 2/4
Bull Lake	10	4	14	FWS ground count 2/4
Wind River, Dinwoody to Crowheart	0	0	0	
Subtotal	**24**	**12**	**36**	
Yellowstone National Park				
Slough Creek	0	0	0	P: N. Cadwell; O: D. Smith (2/3)
Tern Lake	0	0	0	
Broad Creek, near White Lake	0	0	0	
White Lake	0	0	0	
Beach Springs Lagoon	0	0	0	
Shoshone Geyser Basin	0	0	0	
Lewis River	0	0	0	
Buela Lake	0	0	0	
Yellowstone River	0	0	0	
Lewis - Shoshone Channel	0	0	0	
Lewis Lake	0	0	0	
Falls River	0	0	0	
Shoshone Lake	0	0	0	

Bechler Lake	0	0	0	
Bourndary Creek	0	0	0	
Bechler River	0	0	0	
Firehole River	6	1	7	
Madison River (Madison Jct. to Park boundary)	57	1	58	
Richard's Pond	0	0	0	
Gibbon Meadow	13	0	13	
Nymph Lake	2	0	2	
Elk Park	0	0	0	
North Twin Lake	0	0	0	
Nez Perce Creek near Culex Basin	0	0	0	
Nez Perce Creek near Cowan Creek	0	0	0	
Alum Creek	8	0	8	
Gibbon River north of Madison Junction	0	0	0	
Mud Volcano	2	0	2	
Subtotal	**88**	**2**	**90**	
Idaho				P: G. Clark; O: M. Fisher(2/3-4)
Island Park Area				
Warm Springs (west side of Henrys Lake)	0	0	0	Frozen
Henrys Lake flats	16	5	21	
Big Springs, North Fork, Mack's Inn Area	1	0	1	
Mack's Inn to Island Park Reservoir	34	3	37	
Island Park Reservoir	0	0	0	Frozen
Island Park Reservoir inlet	6	7	13	
Trude Ranch Pond	0	0	0	
Icehouse Reservoir	0	0	0	Frozen
Sheridan Creek, mouth to Sheridan Reservoir	2	0	2	
Sheridan Reservoir	25	13	38	
Sheridan Creek cabin and pond	0	0	0	
Subtotal	**84**	**28**	**112**	
Buffalo River Area				
Buffalo River	10	0	10	
Tom's Creek	0	0	0	Frozen
Elk Creek/Trudes Siding pond	33	4	37	
Subtotal	**43**	**4**	**47**	
Harriman State Park (HSP) Area				
Island Park Dam through Box Canyon	27	4	31	
Box Canyon - HSP north boundary	57	6	63	
HSP north bounday - Osborne bridge	206	10	216	
Golden Lake	7	1	8	
Thurmon Creek	11	4	15	Frozen
Silver Lake	0	0	0	Frozen
Osborne Bridge - Pinehaven	166	26	192	
Pinehaven	26	3	29	
Fish Pond	0	0	0	Frozen
Henrys Fork below Pinehaven - Forest boundary	11	1	12	
Subtotal	**511**	**55**	**566**	

Henrys Fork, HSP to Warm River				
Warm River	6	1	7	
Subtotal	**6**	**1**	**7**	
Lower Henrys Fork Area				
Warm River confluence to Ashton Dam	29	10	39	
Ashton Dam to Chester Dam	212	49	261	
Chester Dam to Highway 33	131	29	160	
Highway 33 - Menan Buttes	2	0	2	
Ashton Ponds	0	0	0	Frozen
Willow Creek Area farmstead ponds	41	12	53	
Mikesell Reservoir 1 & 2	4	2	6	Frozen
Arcadia Reservoir, Upper	0	0	0	Frozen
Arcadia Reservoir, Lower	0	0	0	Frozen
Sand Creek WMA and area	4	0	4	
Singleton Ponds	0	0	0	Frozen
Texas Slough	97	50	147	
Bannock Jim Slough	46	3	49	
Mud Lake WMA	0	0	0	Frozen
Camas NWR	0	0	0	Frozen
Camas Creek	0	0	0	Frozen
Subtotal	**566**	**155**	**721**	
Teton River Basin				
Teton River to Wilford Dam	18	5	23	
Wilford Dam to Newdale Bridge	19	2	21	
Newdale Bridge to Teton Dam site	138	28	166	
Teton River Canyon	15	0	15	
Teton Basin	201	50	251	
North Fork Teton River	0	0	0	
South Fork Teton River	0	0	0	Frozen
Subtotal	**391**	**85**	**476**	
South Fork of the Snake River				
Swan Valley (Palisades Reservoir to Conant Valley)	481	92	573	
Canyon (Conant to Heise)	198	55	253	
Delta (Heise to Menan Buttes)	71	28	99	
Dry bed (Heise to Menan)	16	10	26	Dry
Subtotal	**766**	**185**	**951**	
Main Stem of the Snake River				
Menan B uttes to Idaho Falls	37	3	40	
Dry Bed	0	0	0	
Idaho Falls to Fort Hall (Ferry Butte)	34	9	43	
Blackfoot Marsh	0	0	0	Frozen
Subtotal	**71**	**12**	**83**	
Fort Hall Bottoms to American Falls Reservoir				
American Falls Reservoir shoreline	312	63	375	
Kinney Creek	0	0	0	
Portneuf River (Am. Falls Res. to Hwy 86)	22	4	26	

Mouth of Portneuf River	0	0	0	
Spring Creek to American Falls Reservoir	288	95	383	
Jimmie Creek	7	3	10	
Snake River - Tilden Bridge	20	6	26	
Clear Creek and Ross Fork	10	1	11	
Diggie Creek	11	2	13	
Flying Y oxbows	6	0	6	
Subtotal	**676**	**174**	**850**	
Snake River below American Falls Dam				
Springfield Reservoir	6	0	6	
American Falls Reservoir (except Fort Hall)	0	0	0	
American Falls Dam - Minidoka NWR	2	0	2	Open only to Mass Rcks SP, frozen below
Minidoka NWR	0	0	0	Ground count
Minidoka Dam - C.J. Strike Reservoir	17	8	25	Ground count
Hagerman National Fish Hatchery	0	0	0	Ground count
Bruneau Dunes State Park				Frozen
Bruneau Dunes - C.J. Stike Reservoir	0	0	0	Ground count
Faulkner Pond				Frozen
White Arrow Pond (Bliss)	12	2	14	Ground count
Pioneer Reservoir (King Hill)	0	0	0	Ground count
Snake River at King Hill	0	0	0	Ground count
Silver Creek (Picabo area)	57	19	76	Ground count
Subtotal	**94**	**29**	**123**	
Grays Lake NWR Area				Frozen
Big Springs	0	0	0	
Shorty's Homestead	0	0	0	
Blackfoot Reservoir	69	2	71	
Chub Springs, southwest of refuge	6	1	7	
Chesterfield Reservoir				Frozen
Subtotal	**75**	**3**	**78**	
Soda Springs Area				
Woodall Springs	3	0	3	
Alexander Reservoir and Siding	0	0	0	
Miller Ponds	4	0	4	
Government Dam	0	0	0	Frozen
Soda Creek	16	0	16	
Soda Canal	0	0	0	
Subtotal	**23**	**0**	**23**	
Bear River Reaches				
Alexander Reservoir	3	2	5	Frozen
Alexander Reservoir - Gentile Valley Bridge	36	7	43	
Gentile Valley Bridge - old cheese factory	0	0	0	
Gentile Valley Bridge to Oneida Dam	46	0	46	
Montpelier Reserveroir (rearing pond)	0	0	0	Frozen
Oneida Narrows	0	0	0	
Oneida Narrows to Riverdale Bridge	0	0	0	

Riverdale Bridge to Utah border	2	0	2	
Subtotal	**87**	**9**	**96**	
Bear Lake National Wildlife Refuge				Frozen
West Canal Unit				
Rainbow Unit				
Outlet Canal				
Subtotal	**0**	**0**	**0**	
Nevada				
Ruby Lake NWR	37	0	37	J. Mackay (2/3)
Franklin Lake				Dry
Oregon				
Malheur NWR				
Refuge total	17	3	20	R. Roy (1/14)
Summer Lake Wildlife Management Area				
Summer Lake WMA	36	12	48	M. St. Louis (2/11)

[a]Blank denotes area not surveyed.

Appendix C. Personnel who conducted the 2009 Mid-winter Trumpeter Swan Survey.

Montana (Red Rock Lakes NWR, Centennial Valley, Madison Valley)
Observer: J. Warren (Red Rock Lakes NWR)
Pilot: D. Chapman (Montana Aircraft, Inc.)

Montana (Hebgen Lake Area and Paradise Valley)
Observer: D. Smith (Yellowstone National Park)
Pilot: N. Cadwell (Elkhorn Aviation)

Idaho
Observer: M. Fisher (Southeast Idaho Refuge Complex)
Pilot: G. Clark (AvCenter)

Wyoming
Observer: S. Patla (Wyoming Game and Fish Department)
Pilot: D. Stinson (Sky Aviation)

Wyoming (Yellowstone National Park)
Observer: D. Smith (Yellowstone National Park)
Pilot: N. Cadwell (Elkhorn Aviation)

Ruby Lake NWR and vicinity
J. Mackay (Ruby Lake NWR)

Malheur NWR
R. Roy (Malheur NWR)

Summer Lake WMA
M. St. Louis (Oregon Department of Fish and Wildlife)