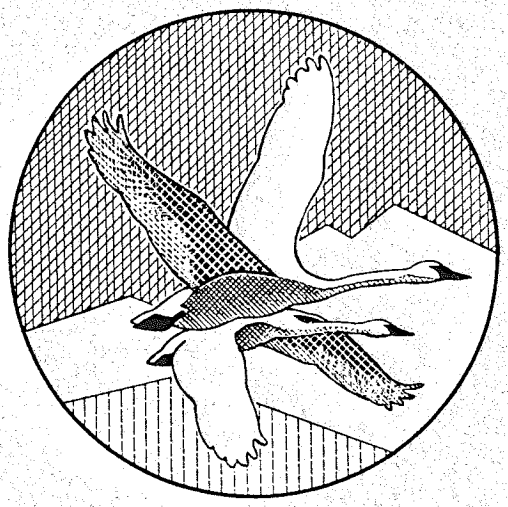
PROCEEDINGS AND PAPERS OF THE SIXTEENTH TRUMPETER SWAN SOCIETY CONFERENCE

Trumpeter Swans -- Restoration in the Heartland



3-6 February 1997
St. Louis, Missouri

Janissa R. Balcomb
Madeleine H. Linck
Alice Lindsay Price

Editors

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1999

Conference Co-Chair

Dave Graber
Donna Compton

Program Chair

Larry Gillette

Conference Sponsors

The Trumpeter Swan Society
Missouri Department of Conservation
Ducks Unlimited, Inc.
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Special thanks to:

Mike Arduser
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Tom Harting of Mrs. Allison's Cookies

Madeleine Linck

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PREFACE

The Sixteenth Trumpeter Swan Society Conference was held in St. Louis, Missouri, to highlight restoration of Trumpeter Swans in the heartland. Through the collective efforts of The Trumpeter Swan Society, the U. S. Fish and Wildlife Service, state game and nongame wildlife programs, and private citizen groups, we have been successful in restoring the Trumpeter Swan as a breeding species in the Midwest. Presentations emphasized how Trumpeters have been returned to breed in marshes from South Dakota east to Ontario and Ohio. Speakers shared experiences and findings from older, more established restoration programs along with status reports from newer programs in Iowa and Ohio. Other presenters reminded us how much still needs to be done before we can consider these Trumpeter Swans as a restored, migratory population. Some birds, especially from the High Plains flock out of Lacreek National Wildlife Refuge, have been migrating to Oklahoma, Arkansas, and Illinois. Despite these limited successes, most of the restored Trumpeters continue to spend the winter in northern areas where they are dependent on supplemental food. Good winter habitat is in short supply in the South. Establishing migratory traditions to these limited areas will be the most difficult part of the program to complete. Imagination and perseverance will be essential for success in the future.

Although we emphasized the Interior Population, we also heard speakers addressing the difficult problems facing the Rocky Mountain and Pacific Coast Populations of Trumpeters. Inadequate habitat within the existing winter range and the inability to get Trumpeters to migrate elsewhere have been major problems for the past decade, and it looks as though they will remain the major challenges confronting Trumpeters in these populations into the 21st century.

Two other species of swans occur in North America. How they are managed has a direct impact on Trumpeter restoration and management. Hunting of Tundra Swans has reduced the options that are available for promoting southerly migration among Trumpeters in the Rocky Mountain Population and for restoration in the Midwest. Mute Swans already occupy many wetlands in the Midwest and the East, and there were discussions about how the widespread wild nesting of this exotic species may affect Trumpeter restoration. Sessions were included at the conference on both species to assess the impact of their presence on the management on Trumpeters.

Trumpeters were once thought to be a wilderness species because they survived only in the remotest areas of the Rocky Mountains and Alaska for the first half of this century. Recent restoration efforts have shown that Trumpeters, like most species of wildlife, can adapt to living in close proximity with people if they are not harassed and adequate secure habitat is preserved. They nest on golf courses and small private farm ponds and winter on rivers within city limits. The Trumpeter's ability to live near people and our ability to use this adaptation may be critical in resolving the winter habitat problems for all three populations of Trumpeter Swans.

Larry Gillette
Program Chair

ACKNOWLEDGMENTS

The heart of any conference is information sharing, whether it be formally through the papers presented and during field trips or informally during coffee breaks, hospitality sessions, and dinner. The sharing of information allows our understanding of the resource to evolve, and, ultimately, allows us to do a better job of helping that resource. It is also during these conferences that new working relationships are formed and old ones are strengthened.

Only if you have been involved in the planning and organizing of a conference can you appreciate the effort required to conduct one. The Sixteenth Trumpeter Swan Society Conference was a success thanks to a team effort by a number of committed individuals.

Larry Gillette, as Program Chair, put together a stimulating program that was particularly pertinent to current Trumpeter Swan restoration issues in the Midwest. Larry also provided guidance throughout the planning period. Madeleine Linck was always available to take care of the many details that came up unexpectedly.

Missouri Department of Conservation staff, who volunteered to host and plan the logistics of the meeting, included Jim D. Wilson, Mike Arduser, Laurie Dohm, and Troy Gordon. Jim made arrangements for lunch at Raccoon Ranch and for the raptor show at the evening social. Mike Arduser arranged for the audio/video equipment, coordinated volunteers to help with registration details, solicited items for the raffle, and arranged for the field trip bus. Laurie Dohm registered attendees, worked audio/video equipment during the program sessions, and solicited items for the raffle. Sara Lenoe, a volunteer from the St. Louis Children's Zoo, and Troy Gordon also helped with the registration table and the audio/video equipment. The Conservation Employees Credit Union of Jefferson City, Missouri, allowed us to set up an operating account from which to conduct the business of the conference.

Ducks Unlimited, Inc. sponsored the evening social, a relaxing get-together after the first day of paper presentations. The World Bird Sanctuary provided an up-close and educational raptor show during the social. Martha Jordan organized and ran a very successful fund-raiser raffle during the banquet. Thanks to the many folks who donated wonderful art and wildlife-related items.

Beverly and Ray Kingdon, owners of Kitchen Ontario, arranged with Tom Harting, of Mrs. Allison's Cookies in St. Louis, to donate a variety of delicious cookies for coffee breaks.

Claire Hager hosted the field trip lunch at Raccoon Ranch and a tour of the amazing natural history displays in the family lodge. Julie Ziino, U. S. Army Corps of Engineers, graciously guided the field trip at the Riverlands Refuge in St. Charles County, and she arranged for use of the Corps of Engineers facility.

The effort given by the above people was in addition to their normal responsibilities. The conference could not have happened without their willingness to give generously of their time and talents.

The Wildlife Society generously provided partial funding for publication of this proceedings.

The Sixteenth Conference was sponsored by The Trumpeter Swan Society, the Missouri Department of Conservation, Ducks Unlimited, Inc., and The Wildlife Society.

David Graber and Donna Compton
Conference Co-chairs

TABLE OF CONTENTS

INTERIOR POPULATION

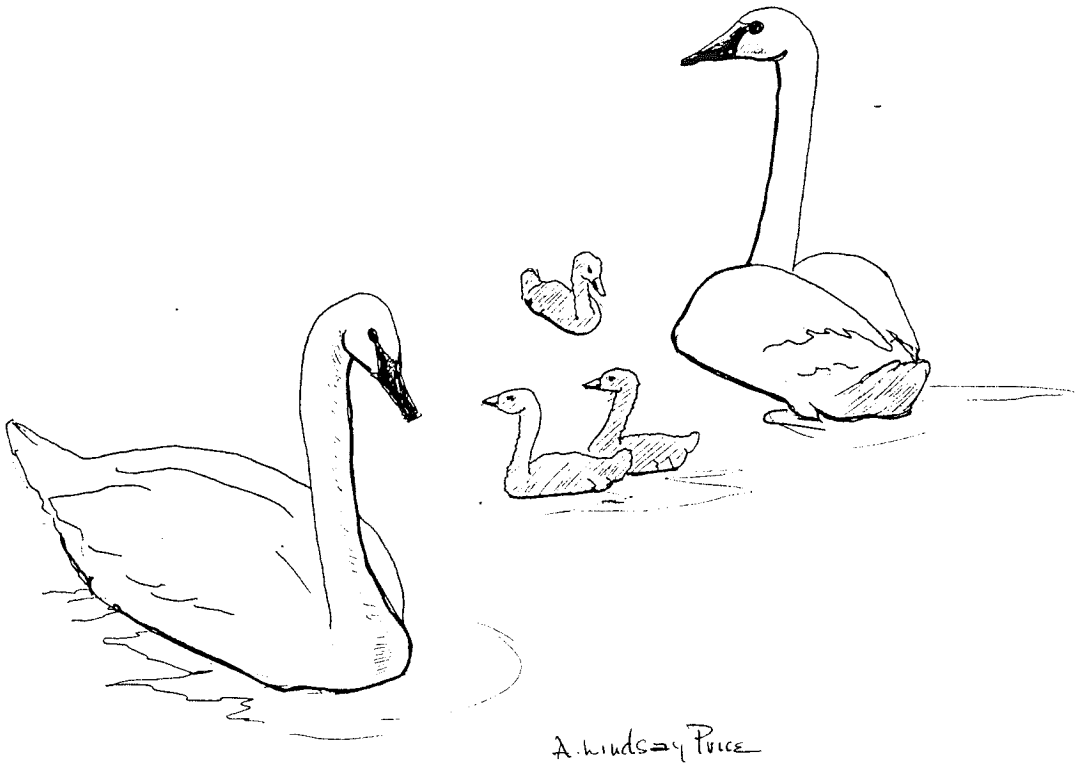
ROCKY MOUNTAIN POPULATION

PACIFIC COAST POPULATION

TUNDRA SWANS AND TUNDRA SWAN HUNTING

SWAN POTPOURRI

MUTE SWANS


A. Lindsay Price

TRUMPETER SWANS ONCE WINTERED ON THE LOWER MISSISSIPPI RIVER. WHY NOT NOW?

Harold Burgess, 808 South Kansas, Weslaco, TX 78596

Ruth Burgess, 808 South Kansas, Weslaco, TX 78596

Mary Bote, 6502 Zapata Dr., Houston, TX 77083

Great numbers of Trumpeter Swans (*Cygnus buccinator*) historically wintered on the Lower Mississippi River, the Gulf of Mexico, and their tributaries (Audubon 1838, Banko 1960, Bent 1925, Coale 1915, Corning 1929, McDermott 1942). Audubon wrote of the large numbers of Trumpeters that drifted down the Ohio and Arkansas Rivers to the Mississippi in winter.

McIlhenny (1897) wrote that Trumpeters were winter residents on the Louisiana coast and were more common than Whistling (Tundra) Swans (*Cygnus columbianus*). Beyer *et al.* (1907) wrote that, in the past, Trumpeters were more common than Whistling Swans in Louisiana and especially around the mouth of the Mississippi River.

Nehrling (1882) wrote, "Every winter there are great numbers [of Trumpeters] on Galveston Bay and the Gulf of Mexico." Dresser (1865) said that swans were common at Brownsville, Texas, where Armstrong collected Harvard's female Trumpeter, specimen #49836, across the Rio Grande at Matamoros, Tamaulipas, in 1909 (Phillips 1911, Coale 1915). Eldridge reported in Forbush (1912) that flocks of 75 to 1000 Trumpeters were seen over Lampasas, Texas, in the 1890s.

It is evident that Trumpeters once wintered in great numbers in Texas and Louisiana. Both states have ignored these historical facts. It is logical that either state could restore wintering Trumpeters by establishing a decoy-breeding flock, as we have recommended for Texas (Burgess 1992). If some members of Texas Parks and Wildlife and Louisiana Department of Wildlife and Fisheries wish to ignore the benefits of Trumpeter Swans and do not want them because Trumpeters are not huntable and Trumpeters might interfere with their traditional waterfowl hunting, they should not complain if states farther up in the migration corridor "shortstop" the migration with decoy-breeding flocks and supplementary feeding programs.

Probably the most concentrated area of wintering Trumpeters was the Mississippi River between the Ohio and Arkansas Rivers where local breeding swans decoyed migrating Trumpeters. S. P. Hildreth reported swans common on the Mississippi between New Madrid and Memphis on 20-22 May 1805 (Rogers and Hammer 1980). On 27 May 1808, Fortesque Cuming (Thwaites 1906) recorded a very large flock of swans on the low, sandy point of Devil's Elbow, a notorious hazard about 15 miles above Memphis, Tennessee. These had to be local Trumpeters as the migrants would have departed by March. The swans on Devil's Elbow were probably a molting group of subadults and other nonbreeding Trumpeters.

Rogers and Hammer (1980) postulated a Trumpeter Swan breeding colony in northeast Arkansas and the Yazoo River Basin in northwest Mississippi. But I believe that the range of their "Middle Mississippi Trumpeter Breeding Population" extended north to the junction of the Ohio River and took in the wetland basins and sunken lands on both sides of the Mississippi River.

In McKinley (1962), we find that Titian Ramsey Peale wrote in his Long Expedition Diary for 4 June 1819, on the Mississippi River below Ste. Genevieve, Missouri, "Saw first swan we have seen on this river ... It was walking on a sandbar and could not fly, probably casting its feathers." This was probably an early molter from the Middle Mississippi Trumpeter Swan breeding population.

The reports of Rhoads (1895) and Ganier (1929) indicated that swans were common at Reelfoot Lake in northwest Tennessee as late as 1926. Rhoads indicated that Trumpeters were more common than Whistling Swans. Ganier reported train car loads of swans killed and shipped from Reelfoot Lake until their breeding grounds were settled. I consider the Reelfoot Lake Flock a part of that Middle Mississippi Trumpeter Swan breeding population.

So what is the object of this discussion? It appears that a Trumpeter Swan breeding population once existed on the middle Mississippi River and that these local Trumpeters decoyed and held migrant Trumpeters in that area. Therefore, following Larry Gillette's (1995) proposal, we encourage the middle Mississippi states of Arkansas, Mississippi, Tennessee, Missouri, and southern Illinois to consider establishing decoy Trumpeter Swan breeding flocks in good habitats near the Mississippi River to attract wintering Trumpeters from the north and to help restore the Middle Mississippi Trumpeter Swan breeding and wintering populations.

By restoring Trumpeter Swans, states and agencies could improve their image, improve the quality of life, promote quality wetlands, promote recreation, and increase their ecotourism. These states have the locations and the authority, while The Trumpeter Swan Society has the knowledge and the technique necessary to restore Trumpeter Swans. We would like to cooperate.

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1996 STATUS REPORT FOR THE LACREEK TRUMPETER SWAN FLOCK

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ABSTRACT

A total of 115 Trumpeter Swans (*Cygnus buccinator*), including 23 cygnets, returned to Lacreek National Wildlife Refuge following the 1996 breeding season. This compares to 152 Trumpeters, including 34 cygnets, in 1995, 205 Trumpeters, including 61 cygnets, in 1994, and 164 Trumpeters, including 42 cygnets, in 1993. However, numerous Trumpeter Swans were found wintering on the Snake River in Cherry County, Nebraska, 55 km south of the refuge in December. During the summer aerial production survey, 207 Trumpeter Swans were observed, including 52 nesting pairs, 22 broods with 78 cygnets, and 23 nonbreeders in five flocks, compared to 214 Trumpeters, including 48 nesting pairs, 17 broods with 46 cygnets, and 61 nonbreeders in nine flocks in 1995. Cygnet production increased 73% over 1995, but the number of nonbreeding birds decreased by 62%, leaving the total number of swans about the same. Two pairs of swans nested on the refuge in 1996. One pair was unsuccessful, and the other pair hatched a brood of two cygnets with only one cygnet surviving to fledge. The discovery of a significant wintering population in Cherry County, Nebraska, in December 1996 accounts for the declining population on the refuge, and even though the hopes for a southern winter migration are diminished, these Trumpeters are surviving in the wild. Four of the seven Trumpeter Swans, marked in 1994 near Greenwater Lake Provincial Park, Saskatchewan, and another Trumpeter banded earlier were observed on Lacreek National Wildlife Refuge during November and December 1996 and remained to the end of the year. Another three Trumpeter Swans were shot on the Platte River in Nebraska in 1996. Two were killed, and one was rehabilitated, banded, and released. The perpetrator was caught and fined. A new trapping technique using a modified turkey trap is proving successful.

POPULATION REPORT

A total of 115 Trumpeter Swans (*Cygnus buccinator)*, including 23 cygnets, returned to Lacreek National Wildlife Refuge following the 1996 breeding season. This compares to 152 Trumpeters, including 34 cygnets, in 1995, 205 Trumpeters, including 61 cygnets, in 1994, and 164 Trumpeters, including 42 cygnets, in 1993 (Table 1). However, numerous Trumpeter Swans were found wintering on the Snake River in Cherry County, Nebraska, 55 km south of the refuge in December.

A total of 207 Trumpeter Swans was observed during the late summer aerial production survey, including 52 nesting pairs, 22 broods with 78 cygnets, and 23 nonbreeders in five flocks, compared to a total of 214 Trumpeters, including 48 nesting pairs, 17 broods with 46 cygnets, and 61 nonbreeders in nine flocks in 1995 (Table 2). Production increased 73% over 1995, but the number of nonbreeding birds decreased by 62%, leaving the total number of swans about the same.

Table 1. Breeding season peak population and production data for Trumpeter Swans wintering on Lacreek National Wildlife Refuge, 1981-96.

Breeding Season	Adults	Cygnets	Total
1996*	92	23	115
1995*	118	34	152
1994	144	61	205
1993	122	42	164
1992	138	62	200
1991	105	45	150
1990	164	61	225
1989	221	61	282
1988	169	78	247
1987	182	86	268
1986	166	63	229
1985	144	43	187
1984	190	47	237
1983	206	57	263
1982	167	48	215
1981	172	58	230

* See Table 1a.

Table 1a. 1996 winter population of Trumpeter Swans in South Dakota and Nebraska.

Location	Adults	Cygnets	Total
Lacreek NWR	58	7	65
Snake River	105	37	142
Blue Creek	2	3	5
Total	165	47	212

Fall Trumpeter Swan populations began building on 11 November 1996 with the arrival of 30 Trumpeter Swans when approximately 70% of refuge waters and most off-refuge wetlands froze over with the onset of cold weather. Cold weather (0 to 5 °C during the day, -6 to -12 °C during the night) persisted for the next 10 days and the increasing swan population peaked at 115 birds (92 adults with 23 cygnets in 10 broods) on 19 November 1996. A warm spell (0 to 8 °C) during late November - early December opened some frozen wetlands, allowing Trumpeters on the refuge to disperse. From 20 December through the end of the year, the remaining swan population stabilized at about 73 birds. In late December, a ranch hand reported 15 swans along the Snake River on the Miner Ranch in Cherry County, Nebraska. An aerial survey on 30 December revealed 142 Trumpeter Swans, including 37 cygnets in 14 broods, along 30 km of the Snake River east and west of Highway 61. The waterfowl survey on the refuge on 31 December 1996 revealed 65 swans, including seven cygnets in three broods, bringing the December wintering peak for the High Plains flock to 212 swans, including 47 cygnets in 17 broods (Table 1a). The total population for the 1996 High Plains wintering flock (Lacreek NWR/ Snake River) is comparable to the Lacreek peak population figures for 1994 and 1992 and offers a reasonable explanation for the declines in 1993, 1995, and 1996 on the refuge (Table 1). The total wintering population is now comparable to the summer breeding population, except for losses in cygnets and an increase in adults, leaving some doubt as to the extent of a winter migration. Some winter migration is probably still occurring because the winter population used to be significantly larger than the summer population. All this is still speculation at this point as the study continues.

Two Trumpeters were shot and killed and another was wounded on the Platte River near Oglala, Nebraska, in 1996. The perpetrators were observed by Nebraska Conservation Officer Dennis Thompson and were caught and fined. The wounded swan was caught and turned over to the Nebraska Wildlife Rescue Team, Inc. in Omaha for rehabilitation. The wounded bird was only wing-tipped and has fully recovered. The bird was banded and collared (R03, Green) and released 18 January 1997 on Blue Creek, north of Oshkosh, in Garden County, Nebraska.

Table 2. Breeding performance of Nebraska and South Dakota Trumpeter Swans, 1981-96.

Year	# Adults	# Pairs	# Broods	# Cygnets	Total
1996	129	52	22	78	207
1995	168	48	17	46	214
1994	164	54	32	85	249
1993	115	42	21	58	173
1992	126	48	30	102	228
1991	117	44	24	89	206
1990	127	41	22	68	195
1989	152	51	30	79	231
1988*	-	-	-	-	-
1987	110	34	23	81	191
1986	103	41	21	74	177
1985	95	40	22	63	158
1984	116	42	28	65	181
1983*	-	-	-	-	-
1982*	-	-	-	-	-
1981	104	30	16	54	158

* No data

PRODUCTION REPORT

The 1996 aerial production survey was conducted 3-5 September 1996. The survey included Bennett, Shannon, Pennington, Meade, Butte, Perkins, Ziebach, Haakon, Jackson, Mellette, and Todd Counties in South Dakota, Cherry, Sheridan, Garden, Grant, McPherson, and Arthur Counties in Nebraska, and Crook County in Wyoming. No swans were observed in Pennington, Haakon, or Mellette Counties in South Dakota, or in Crook County, Wyoming, this year. However, the swans normally associated with the Colony, Wyoming, site were seen just across the state line in Butte County, South Dakota. A total of 207 Trumpeter Swans was observed, including 52 nesting pairs, 22 broods with 78 cygnets, and 23 nonbreeders in five flocks. Even though the number of cygnets for 1996 is down from the all-time high of 102 in 1992, the 1996 cygnet numbers are comparable with production for the last 11 years. The total number of adults for 1996 is down from 1994 and 1995, but the number of breeding pairs, broods, and cygnets produced in 1996 remain stable (Table 2).

REFUGE PRODUCTION

Swan 54FA and her mate nested on Pool 8 in 1995 and hatched six cygnets but fledged only two. 54FA was banded AHY in 1991 and probably started nesting in 1993. The other two nesting pairs on Pool 7 each hatched four cygnets but lost all of them. The losses are considered to be due to the adults' inexperience. The pair on Pool 9 set up a territory but did not hatch any cygnets. In 1996, only two pairs set up nesting territories, one in Pool 9 and one in Pool 7. The pair on Pool 9 was unsuccessful. The pair on Pool 7 hatched two cygnets but only brought one to flight (Table 3). The number of nesting pairs and the number of cygnets to flight have declined on the refuge in recent years. The declines are assumed to be the result of many factors, including changes in population dynamics (more birds wintering off the refuge), natural mortality of the older more experienced nesting pairs on the refuge and their replacement by younger less experienced nesters, and recent management activities that resulted in some disturbance.

MIGRATION ATTEMPTS

Migration attempts have been suspected during the past few years due to a recent decline in wintering swans at Lacreek combined with increasing numbers of adult swans on the summer breeding grounds. However, the Trumpeter Swan breeding population appears to have stabilized at just over 200 during the last 2 years (Table 2), and even though the Lacreek wintering population continues to decline, a wintering population of over 140 swans was discovered in December 1996 along the Snake River in Cherry County, Nebraska (Table 1a).

Table 3. Production data for Trumpeter Swans on Lacreek NWR, 1983-96.

Year	Nesting Pairs	Broods	Hatched	Fledged
1996	2	1	2	1
1995	4	3	14	2
1994	3	3	13	2
1993	4	2	7	4
1992	5	3	11	5
1991	6	6	21	6
1990	5	4	18	8
1989	6	6	16	7
1988	6	5	15	8
1987	6	5	13	11
1986	6	6	19	19
1985	6	5	18	13
1984	5	5	15	7
1983	5	4	17	9

The Snake River population and the refuge population were counted on 30 and 31 December 1996, respectively, and their combined numbers account for the summer breeding population. Undoubtedly, there are some Trumpeters that are not seen during the summer aerial survey, and since a number of unmarked Trumpeter Swans are observed on the southern plains every year during the winter, some migration is probably taking place. Evidence of some winter migration is the report of 13 unmarked Trumpeter Swans at Fort Cobb State Park in Caddo County, southwest of Oklahoma City, Oklahoma, on 3 December 1994. The report indicated four white adults and nine "gray" swans. With the Snake River discovery, hopes for a more southern winter migration may be diminishing, but one must remember that the objective of migration is a self-sustaining population. If the High Plains flock can sustain itself over winter on the Snake River in Nebraska, the objective is being met.

Four out of the seven Trumpeter Swans (collars A00-A07) marked by Rhys Beaulieu (SERM) and Gerry Beyersbergen (Canadian Wildlife Service) in 1994 near Greenwater Lake Provincial Park, Saskatchewan, as well as a fifth Trumpeter Swan (collar 30AC) banded earlier, were observed on Lacreek National Wildlife Refuge during November and December 1996 and remained to the end of the year. Trumpeter Swans A03 and A04 have remained paired since they were first observed at Lacreek in 1994, A07 returned with an unmarked mate and one cygnet in the fall of 1996, and 30AC also returned again with an unmarked mate. None of the Wyoming banded birds (01R-05RC) have been seen since January 1993.

BANDING AND MARKING

Summer banding and marking continues in late June and early July when the subadults are flightless. Seven Trumpeter Swans were banded and collared in South Dakota in 1995 (85FA-91FA). Another seven Trumpeters were banded and collared in 1996, three in South Dakota (92FA-94FA) and four in Nebraska (yellow 98RA-99RA and green R00-R01).

Banding and collaring of subadults and adults will continue in the vicinity of the refuge to provide an increasing pool of marked birds in the environment to aid in observations. Banding at remote sites, more than 20 miles or so from the refuge, is becoming cost prohibitive in this era of down-sizing. Though many Trumpeter Swans are seen during the aerial surveys, the remote locations and the difficulty of determining land ownership and access is very time-consuming. Also, physical access is difficult as most of the wetlands used by nesting swans require off-road, cross-country travel. A second four-wheel-drive vehicle is required as the four-wheel-drive vehicle pulling the boat trailer is always at risk of getting stuck while trying to get the boat to the water. Many of the wetlands are not accessible to the airboat due to moist soil margins, shallow water, and dense cattails.

In an effort to mark more birds in less time, a turkey trap was employed on the refuge adjacent to the winter artificial feeding site in January 1994. The turkey trap, borrowed from South Dakota Game, Fish, and Parks, is a large circular structure with the appearance of a circus tent without sides. It is made of 2-inch mesh netting suspended by ropes between a center pole and poles around the perimeter. The netting is attached to the center pole with a steel ring that can slide down the center pole. This steel ring is tied to the center pole with a rope, and a blasting cap is placed into the rope. The trap is baited with grain, and, when enough birds are under the net, an electrical charge detonates the cap, breaking the rope, and the net collapses to capture the birds.

Although the trapping was successful, with 17 Trumpeters caught and banded, the trap was inappropriate for use with swans and geese because the 2-inch mesh was too large, allowing wings and necks to go through the mesh with horrendous entanglement problems. The concept proved acceptable, though, and a new net was constructed using 1-inch netting.

The new net was set up in January 1997 and tried on 21 January 1997. The 1-inch netting proved satisfactory, and 35 Trumpeter Swans were caught. Of the 35 caught, seven escaped under the edge, four were previously marked, and 24 birds were marked and banded (yellow 95FA-99FA and green S01-S20).

Birds escaping under the edge is a problem. Apparently, when several birds stand up together as a group, they lift the netting, and if they walk together towards the edge, the netting slides over their heads until they escape. A lip on the bottom of the netting that they will step on while walking may solve this problem. Overall, this appears to be a good trapping method that is much safer than cannon or rocket nets used for ducks, which can decapitate long-necked birds.

CONCLUSION

The High Plains flock of Trumpeter Swans is becoming self-sufficient by the use of natural wintering sites, and, even though the population is currently stable, the potential for future growth is evident in the production figures once stable wintering sites are established.

TRUMPETER SWAN RESTORATION IN ONTARIO

H. G. Lumsden, 144 Hillview Road, Aurora, ON L4G 2M5

INTRODUCTION

Wild production of Trumpeter Swans (*Cygnus buccinator*) in southern Ontario is steadily increasing. In 1993, the first released pair bred in the wild and raised six cygnets. In 1994, two pairs nested and raised three cygnets. In 1995, a total of nine cygnets were raised by four different pairs, and, in 1996, eight pairs raised 14 cygnets. A ninth pair built a nest but did not lay eggs.

We should reach the first Ontario Restoration Group goal of 15 wild breeding pairs on schedule by 1999. Dr. Brad White, geneticist at McMaster University, has advised us that, because of the inbred nature of Trumpeter Swan stocks, we should aim for 100 pairs of wild breeding Trumpeters to ensure a self-sustaining population.

The winter of 1995-96 was a hard one with a late, cold spring. Losses of both wild and captive Trumpeters were heavier than we had experienced in the past. In spite of this, our captive stock produced more eggs than in any previous year.

1996 PRODUCTION BY CAPTIVE TRUMPETERS

We started the 1996 breeding season with 23 pairs in the hands of cooperators and four pairs in the ownership of contributors. Fifteen pairs (56%) produced eggs. Four of these pairs laid two clutches. Eggs were removed as they were laid from eight pairs. These continuation clutches produced 75 eggs, an average of 9.4 eggs per bird. This clutch size is the same as in earlier years. Clutches which were not manipulated in this way averaged 6.3 eggs, and second clutches averaged 4.8 eggs. Total production was 137 eggs, 69 of which were incubated under Trumpeters and 68 taken into an incubator.

The Trumpeters hatched 28 cygnets (41%) and raised 19 to flight stage (68%). The incubators were less successful; only seven cygnets (10%) hatched, but all survived to flight stage. Two clutches, totaling 11 eggs, were started under Trumpeters, but the process was completed in an incubator. The female of one of these nests deserted because of interference by free-flying Trumpeters. The second pair and their eggs had to be moved in midsummer because they caused turbidity in the swimming pond at a boys' summer camp, creating unsafe conditions. None hatched in the incubator.

We close the 1996 breeding season with 26 cygnets which will be held for release in 1998. This is a great improvement over 1995 when we raised only 12 cygnets.

CAPTIVE BREEDING STOCK

We have had some losses to the breeding stock in 1995-96. Twelve birds were lost, three to dogs and a coyote, two to unknown causes, one each to enteric haemorrhage, kidney failure, cardiac arrest, and aspergillosis, one bird disappeared, one was blind and had to be destroyed, and one became tangled in a rope and drowned. Some of these losses have been replaced. Five swans have been acquired by gift or purchase.

For the 1997 breeding season, we have 22 pairs with cooperators and contributors and eight mature swans which should form pair bonds in the spring. There are four males and four females among these birds, giving us an even sex ratio. We shall need new cooperators to take care of some when they are paired.

SURVIVAL AND LOSSES

As in the past, we have used reports of sightings of wing tags numbers to keep track of survival of released swans. If a swan has not been reported for a year, we assume that it is dead, although sometimes such a bird subsequently turns up. The cooperation of naturalists who read numbers and report them is vital in our annual inventory. We use 1 September as the anniversary date for our estimates of survival. Some swans lose their wing tags, and some even lose their leg bands. This results in an underestimate of numbers.

We started the 1995-96 year with 82 Trumpeters flying free in southern Ontario. Of these birds, 19

have been found dead, three of which were wild hatched. As in the past, lead poisoning was the leading cause of death, accounting for five deaths. It was almost certainly a contributing factor in the loss of sixth which flew into hydro wires. This bird carried 20 ppm lead in its blood. Another may have been affected by lead when it drifted into the cold water intake at the Pickering Nuclear Generating Station. Three died of disease, three were killed in accidents, and three were found dead from unknown causes. One was killed by a coyote. The most disturbing loss of all was a breeding female, mother of five, killed by vandals at Hogg's Bay, near Wye Marsh. She was found in a shallow bay with her head cut off. Two more swans have not been recorded for over a year, and we assume that they are dead. Offsetting this loss, however, are two birds which had been missing for over two years and were presumed dead but which have reappeared.

Survival in September 1996, based on wing tag numbers reported during the year, gives a total of 62 birds. Another way of estimating survival is to subtract known losses, 19, from the number of swans, 82, estimated to be alive in September 1995. This gives a total of 63 birds. Using the inventory based on tag records and adding 36 swans released in 1996, our total comes to 98. However, one met an accidental death, and one was killed by a fox shortly after release, leaving us with 96 birds. To these must be added 13 swans known to be alive but which have lost their wing tags or escaped before they could be tagged. The production of 14 wild cygnets must also be added, giving a total of 123 free-flying Trumpeters in southern Ontario on 1 September 1996.

Since the restoration program began in 1982, we have released 164 Trumpeter Swans which were raised by Mute Swans (*Cygnus olor*), raised by their own parents, or hatched in incubators and raised in brooders.

NESTING BY WILD TRUMPETERS

In 1996, six pairs of Trumpeters nested and laid eggs in southern Ontario, and an additional pair built a nest but did not lay. In New York State, two pairs, which we assume are of Ontario origin, nested and hatched cygnets. These birds lacked wing tags, and the numbers on their leg bands have not yet been read.

These eight wild nesting pairs laid 43 eggs; however, two pairs needed help. A female, number 100, raised at Wye Marsh, nesting there for the fourth time, had two males over the years. In 1994 during migration, she became separated from her mate, Number 206, raised by Harold Hadley. She returned alone to Wye Marsh in the spring of 1995. She then paired with Number 238, which was raised at Aurora. They produced a brood, four of which migrated with them to Burlington Bay and Bronte in December 1995 and returned to Wye in the spring. Number 100 and Number 238 had a fierce fight, and Number 100 deserted the nest. The eggs were put into an incubator where three hatched. They were transferred to Bill Carrick's facility where all three were raised and survived to flight stage. The embryos in the remaining eggs did not hatch; four died at full term.

A second banded wild pair, breeding for the first time, built a nest near Metro Zoo and laid four eggs. The female became sick and deserted the nest, but the male took over incubation duties. Expecting failure, Bill Carrick removed the eggs and placed dummies in their place. Two good eggs were put in an incubator and, when close to hatching, were replaced in the nest. The male, who had sat for 14 days, hatched one cygnet, he was then rejoined by the recovering female. Unfortunately, the cygnet disappeared when about 3-weeks old.

Another wild pair which have lost their wing tags nested in the Stouffville reservoir. They laid six eggs and hatched two cygnets, which they raised. At Metro Zoo, another untagged pair had only one addled egg when the nest was checked after full term incubation.

At Wye Marsh, two more released pairs nested. The female, Number 224, raised by Bill Carrick from an egg laid by John Gartshore's pair, mated with Number 257, raised by a captive pair at Wye Marsh. This pair produced six eggs at Hogg's Bay, hatched five, all of which survived to 1 September. Number 224 was killed by vandals on 14 August, as reported above.

A second pair nested at the west end of Wye Marsh. A female, Number 205, raised by Harold Hadley, paired to Number 219, raised by Bill Carrick from an egg from John Gartshore. This pair laid five eggs and hatched all five, but had only two cygnets left on 1 September.

In New York State, Mike Pelletier reported that a pair nested on his marsh 64 km (40 miles) east of Rochester. They laid six eggs and hatched four cygnets, all of which survived to flight stage. Art Kirsch, New York Department of Environmental Conservation (NYDEC), visited the site and also saw the Trumpeter brood. This is the third year that a pair have spent the summer on Mr. Pelletier's marsh. Art Kirsch also reported three more Trumpeters and a single in another marsh.

A second brood in New York State was first reported by a graduate student, Jean Hickey, on the Perch River Wildlife Management Area near Watertown. Irene Mazzocchi (NYDEC) confirmed that they produced seven eggs and hatched two, which were still alive on 27 August. In 1985, two Trumpeters also visited this Wildlife Management Area, and there was a single bird there for a short time at the end of April or early May 1996.

In eastern Ontario, Annette Mess first reported a pair of Trumpeters to Shaun Thompson, Ministry of Natural Resources, and Don Cuddy, Natural Heritage Ecologist. A pair, presumably the same one, was seen on 23 April on Lower Beverly Lake by Mary Dobrik and on Big Rideau Lake by Jim and Winona Barker in June. The latter found a nest built by the Trumpeters, but the Trumpeters did not lay any eggs. Don Cuddy took some excellent coloured slides of the pair and of their nest.

Of the 43 eggs produced, the wild pairs hatched 20 (74%) and raised 14 cygnets (70%) to flight stage. Their mean clutch size was 5.4 eggs compared with 6.5 eggs laid by four pairs in 1995. The hatch and fledging rate for these wild Trumpeters was very similar to that of our captive pairs.

TRUMPETER SWANS IN THE KENORA DISTRICT

Trumpeter Swans from the Minnesota Restoration Program were first discovered breeding in the Kenora part of Ontario in 1989 by Dave Schneider. In the Kenora area, the spring of 1996 was late and cold, and ice disappearance was about the latest on record. It was not until about 13 May that the lakes started to break up. These conditions must have delayed Trumpeter observations. They normally start laying in late April. Doug Andersen reported three Trumpeter observations. A pair with one cygnet was on the 1995 nesting lake on 1 August, a single bird was on a small lake connected to Oak Lake on 3 August, and a pair was on Camp Lake on 8 August.

Disturbance during the breeding season, particularly from aircraft landing on a nesting lake, caused Trumpeters to abandon good habitat in Alaska. They are also sensitive to boating activity while nesting and before cygnets have fledged. The World Wildlife Fund (Canada) and the Ministry of Natural Resources, Kenora District, financially supported a public awareness program in the Kenora area. The printing of a brochure and poster was funded through the Endangered Species Recovery Fund and distributed to tourist outfitters, hunters, anglers, plane owners, and logging contractors in the area.

ACKNOWLEDGMENTS

The Ontario Trumpeter Swan Restoration Program is sponsored by the Ontario Federation of Anglers and Hunters. We are most grateful to our cooperators and contributors who care for breeding pairs of swans and provide the eggs and cygnets for release. Without their efforts, restoration would be very difficult and costly.

We are indebted to Our Lady of Grace Childcare Centre, Aurora, through Ms. Barbara Betts, for their generous contribution toward the restoration program at Wye Marsh. Scott Paper Ltd. continued financial help, paying the salary of Kelly Whitock who raised incubator hatched cygnets. Bill Carrick again provided facilities for hatching and raising cygnets and donated one mature bird for release. He helped to read tag numbers, banded swans, picked up sick birds, and provided facilities for holding swans. He is now working with Harry Hewick using ultra-light aircraft for induced migration of Trumpeters. We thank David Tomlinson for his help in catching swans, at which he is very skillful.

We are greatly indebted to Ray Nash for the generous gift of three mature Trumpeters which have been released at Metro Zoo. Frank Lattanzio of the Corporation of the City of St. Thomas Parks and Recreation Department has given three cygnets to the restoration program, for which we are most grateful. Beverly and Ray Kingdon and their friends played a vital role in winter feeding Trumpeter, which migrated from Wye Marsh to Burlington and Bronte on Lake Ontario, and, thereby, helped to consolidate their migratory tradition. We thank the Sur-gain Co. which supplied food for the wintering swans.

We are grateful to Al Johnston and Bob Murray for their conscientious care of breeding pairs of Trumpeters. They have had to withdraw from the program, and we thank them for their help. We welcome Harry Hewick as a new cooperator in the program. He now cares for a pair of our swans as well as his own birds. We are most grateful for the conscientious care lavished on the Trumpeters at Wye Marsh by Don Foxall and Mary Cameron and for Bob Whittam, Director of the Wye Marsh Wildlife Centre, for chairing the Restoration Advisory Committee and for help in every aspect of the program.

We are particularly indebted to Metro Toronto Zoo, which provided release facilities for 25 swans, and to Tim Burt, Curator of Birds, who helped with swan inventories at the zoo. In addition, the veterinary staff treated sick swans and necropsied dead birds. We thank Dr. Kay Mehren and Dr. Graham Crawshaw for the intensive care they offered these birds. We also thank Dr. Michael Taylor and Becky Atkinson of the Veterinary College, University of Guelph, for the surgery and care they extended to sick and injured swans, and to Dr. Douglas Campbell of the Canadian Cooperative Wildlife Health Centre who necropsied dead swans and gave us valuable diagnostic information. Dr. Joel Rumney of the North Simcoe Veterinary Service in Midland also provided care for sick swans at Wye Marsh. Dick Rogers of Arbrux Ltd. in Uxbridge again serviced our ice-aways at reduced cost.

OHIO'S TRUMPETER SWAN RESTORATION PROJECT - FIRST YEAR SUMMARY

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ABSTRACT

I review the first year of Ohio's Trumpeter Swan Restoration Project, including project goal, objectives, methods, results, and challenges. Ohio's project is proceeding in two phases: the first phase is to acquire captive-raised Trumpeters (*Cygnus buccinator*) greater than 2-years-old to jump start the reintroduction effort during the first 2 years, and the second phase is to collect Alaskan Trumpeter Swan eggs for 3 years for rearing and release in Ohio as 2-year-olds.

INTRODUCTION

The goals of Ohio's Trumpeter Swan Restoration Project are to restore Ohio's native wildlife diversity by reintroducing Trumpeter Swans (*Cygnus buccinator*) in Ohio and to increase appreciation and awareness of Trumpeter Swans and their role in Ohio's wetland wildlife ecosystems. The objective is to establish a breeding population of 15 pairs by the year 2006. These pairs, along with nonbreeding Trumpeter Swans, should number at least 50 birds, as specified in the Management Plan for the Interior Population of Trumpeter Swans (Subcommittee on the Interior Population of Trumpeter Swans 1997). Trumpeter Swans will be released in at least 10 sites in Ohio (Figure 1).

Prior to reintroduction efforts, the Ohio Division of Wildlife needed to confirm nesting of Trumpeter Swans in Ohio. Ohio has archeological evidence of Trumpeter Swans present in the Lake Erie marsh region (Mayfield 1972), northeastern Ohio, Cincinnati, Grand Lake St. Mary's (Coale 1915), and southern Ohio (Henninger 1919). There is no known evidence of nesting Trumpeter Swans in the state; however, Lumsden (1984), in a review of Trumpeter Swan nesting range, notes that French missionary Father Hennepin observed and recorded swans on the lower Detroit River and Lake St. Clair during August 1679. Cadillac also recorded swans in the Detroit area in the summer of 1701. Because the Detroit River marshes ran continuously south into the western Lake Erie marshes, it is probable that swans nested in these marshes as well. However, because of the impenetrable Black Swamp, they were never recorded as being present in the Lake Erie marshes, probably because they were extirpated before they could be recorded by British naturalists. Lumsden concluded that the nesting range of Trumpeter Swans probably extended much further east and most likely occurred in the large marshes surrounding all of the Great Lakes. He also states that Trumpeter Swans had probably disappeared before the arrival of the English settlers and naturalists because the Indians and French had shot them for food.

Based on this information, there is a high probability that Trumpeter Swans did nest in Ohio and were extirpated prior to being recorded as a nesting species. With this information in hand, the Ohio Division of Wildlife began planning the reintroduction effort in 1995. Several key partnerships were developed to assist in the project. The Cleveland Metropark Zoo (CMZ) agreed to purchase captive-reared Trumpeter Swans and to hatch and rear Alaskan eggs and cygnets. The International Center for the Preservation of Wild Animals (The Wilds) is providing veterinary expertise and serves as a rearing and conditioning facility until swans are ready for release.

METHODS

A two-phase approach is being used to restore Trumpeter Swans to Ohio. Phase One involves acquiring cygnets and subadults from avicultural sources to provide a source of swans greater than 23-months-old to release in select wetlands during the first 2 years of the project, 1996-97. The CMZ took the lead in purchasing birds from various sources. Birds were held at The Wilds prior to release. This phase was used to jump-start the reintroduction and raise public awareness and support. Release sites were selected based primarily on quality of wetland vegetation that would support

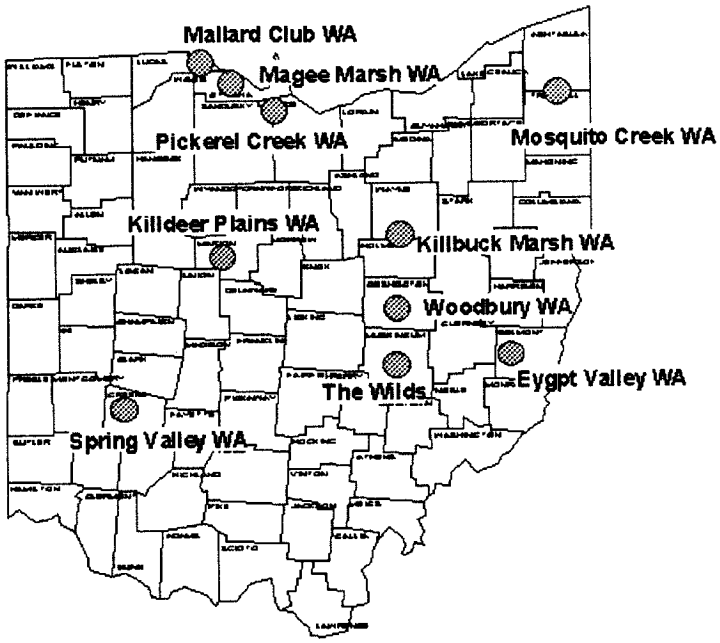

Figure 1. Sites in Ohio selected for Trumpeter Swan releases. Magee Marsh Wildlife Area (WA) was the site of the first releases in 1996. Killbuck Marsh WA is the proposed release site for 1997. The Wilds is the rearing and conditioning facility where swans are held until release.

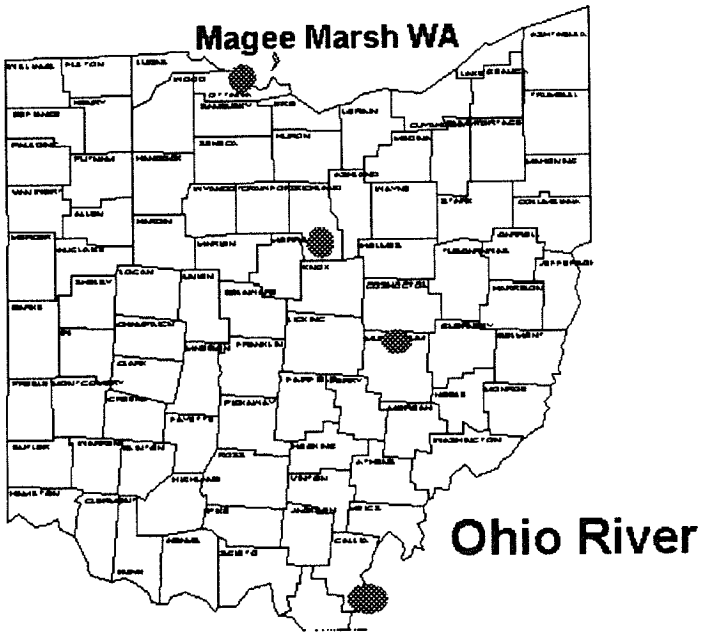

Figure 2. Location of May 1996 releases of 15 Trumpeter Swans at Magee Marsh Wildlife Area in northern Ohio and the three areas to which eight of the released birds moved by 1 February 1997.

Trumpeter Swans. Released swans were monitored from the ground once a week throughout the summer and less frequently as vegetation growth precluded observation. Aerial flights were used later in the summer and fall to track swan movements in the Lake Erie marsh region.

Phase Two involves securing eggs from Alaskan Trumpeter Swans during 1996-98 for releases in 1998-2000. The protocol for Alaskan egg collection followed Matteson *et al.* (1991). Each egg was candled with a non-electric tube-type field candler and "sniffed" to determine viability . At least two viable eggs were left in each nest where collection occurred. Collected eggs were placed in portable field incubators that operated either on battery power or direct current. Temperature in the incubators was maintained at 92-94 °F, and eggs were rotated several times during the flight back to Ohio. Eggs were incubated at the CMZ at 99.9 °F. Eggs were turned continuously.

Newly hatched cygnets were placed in a hatcher and weighed after hatching and daily. The protocol for captive-rearing cygnets followed Matteson *et al.* (1994).

All birds released were marked with green plastic collars and leg bands with white alphanumeric characters in addition to a U. S. Fish and Wildlife Service aluminum leg band.

RESULTS

Phase One

In 1995-96, the Cleveland Metropark Zoo purchased 22 Trumpeter Swans from Michigan (5), Ontario (11), Alaska (2), Utah (1), Ohio (1), South Dakota (1), and Bougie (1). Birds were held at The Wilds in two 40-acre ponds that were fenced and aerated. Magee Marsh Wildlife Area in Ottawa County was selected as the first release site. Magee Marsh is an 1821-acre Lake Erie coastal wetland that is rich in submergent aquatic and emergent vegetation.

The first release of eight Trumpeter Swans occurred on 11 May 1996, International Migratory Bird Day. Several weeks later another seven swans were released on Magee Marsh, for a total first-year release of 15.

The Trumpeter Swans took very well to the rich environment and survived the summer without incident. In September, one swan was found dead, with lead poisoning as the suspected cause. In December, two Trumpeter Swans were removed because it was discovered they were pinioned. Another swan was removed because it had developed no flight feathers. It is being rehabilitated and will be returned to Magee in the spring of 1997. As of 1 February 1997, four Trumpeter Swans had migrated to Keiger-Gavin Reservoir on the Ohio River in Gallia County, two had migrated to the Walhonding River in Coshocton County, and two had migrated to the Black Fork of the Mohican River in Richland County (Figure 2). The remaining three Trumpeter Swans had not been accounted for.

The remaining 10 Trumpeter Swans at The Wilds were wing-clipped in August and were to remain in the fenced ponds. However, all 10 swans remolted and took flight in October, but they have remained at The Wilds. Attempts have been made to recapture them in anticipation of the Spring 1997 release planned for Killbuck Marsh Wildlife Area.

Phase Two

In June of 1996, 50 eggs were collected from nests in Minto Flats in east-central Alaska. One to five eggs were collected from each of 18 nests. Clutch size averaged 5.0 ± 2.78 and ranged from three to seven eggs. The time from the beginning of collection to the eggs being placed in incubators in Cleveland was approximately 16.5 hours. In Ohio, 42 of the 50 eggs hatched, for a hatch rate of 84%. Hatching occurred from 5 to 18 days after returning. Therefore, most eggs were collected during their 15th to 28th day of incubation.

During the first 6 months at CMZ, nine cygnets died of various causes (genetic deformities, accident), leaving 33 juvenile swans, for a 66% survival rate. These swans were transported and released at The Wilds in December. All swans were marked with green collars to facilitate observation on the release site. These swans will be released in the spring of 1998.

DISCUSSION

The Ohio Trumpeter Swan Restoration Project has experienced its share of successes, challenges, and problems during its first year. However, less mortality at the Magee release site than expected and the successful migration of a majority of the swans to

safe wintering areas in Ohio are extremely positive indications that the program is on the right track.

Partnerships with the Cleveland Metropark Zoo and The Wilds have been extremely successful, with each entity providing unique experience and skills to ensure success of the program. Refinements are being planned, but the overall assessment is that the partnership is working well and providing a degree of accomplishment that would be unattainable by only one agency.

The real measure of success will be reaching the goal of 15 nesting pairs, but the next immediate indicator would be the return of wintering swans to the Magee Marsh release site and the subsequent nesting of swans. All indications to this point are that the swans have not migrated far (less than 300 miles) and should return to Magee.

ACKNOWLEDGMENTS

I would like to thank the Division of Wildlife staff at the Crane Creek Wildlife Research Station and Wildlife District Four for all of their efforts in the reintroduction program, for Stan Searles and the CMZ staff for their expertise in rearing the cygnets, Dr. Evan Blumer and the staff at The Wilds for their support, and for Ducks Unlimited for their wetland conservation work, which makes this whole program work.

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MICHIGAN 1996 TRUMPETER SWAN UPDATE

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The Michigan program is a portion of a larger Great Lakes region effort to restore 1000 Trumpeter Swans (*Cygnus buccinator*) to the central portion of the United States by the year 2000.

In 1986, a 3 year experiment utilizing Mute Swans (*Cygnus olor*) as foster parents was begun. A total of 44 viable Trumpeter Swan eggs was placed under Mute Swans. Thirty-one hatched, but only six cygnets fledged. The effort continued with the release of captive-reared 2-year-old Trumpeter Swans from 1989 through 1993. Small releases have occurred each year since, with a total of 137 Trumpeter Swans being released. About half of these were of Alaskan origin. The remainder were from regional zoological parks and private propagators.

The current distribution of Trumpeter Swans in Michigan essentially mirrors the pattern and magnitude of the original releases. The exception is northeastern lower Michigan and central Michigan where Trumpeters have failed to survive in reasonable numbers (Figure 1). The initial releases were relatively small, and mortality, due primarily to power line collisions and lead poisoning, was higher than anticipated (Figure 2). Our ability as biologists to pick ideal habitat was not always perfect, and the total number of birds released in an area was often too few. The release of six to 10 swans can no longer be recommended.

In Michigan, the first successful nesting of Trumpeter Swans in a century occurred in 1992 when two pairs nested and reared four young. The number of pairs successfully rearing a brood has increased steadily and numbered 16 pairs with 43 young in 1996. Average brood size was 2.69, down from 3.08 cygnets in 13 broods in 1995. Since 1992, 40 successful nesting efforts have resulted in the fledging of 127 cygnets (Figure 3).

A few truly wild Trumpeter Swans have begun to reproduce, with a substantial number potentially entering the breeding segment in the next 2 years. The 1996 fall flight in Michigan was estimated at 141 swans, with 16 successful pairs and 43 cygnets. We are about halfway to our year 2000 goal of 30 nesting pairs and 200 Trumpeter Swans.

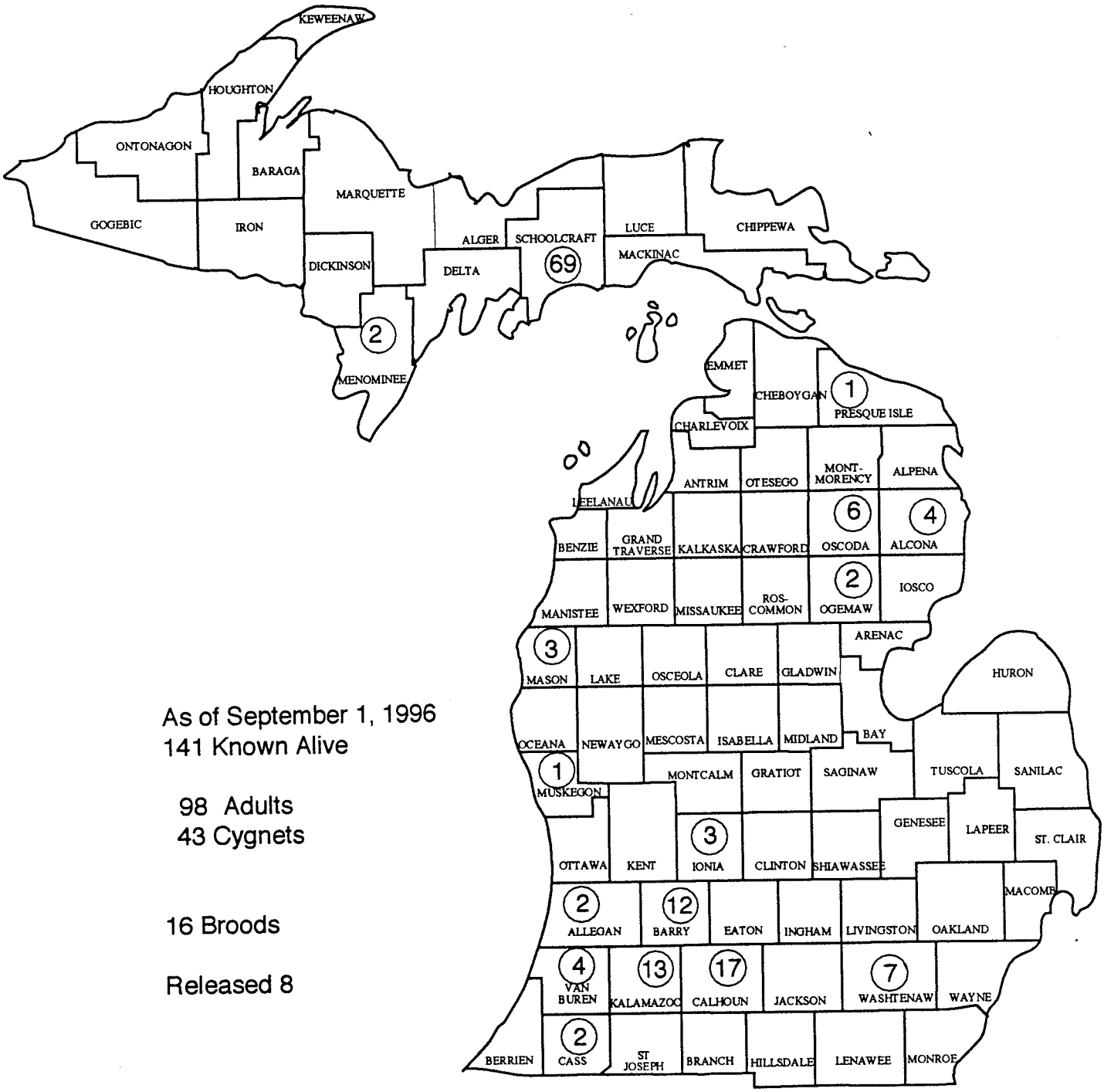

Figure 1. 1996 distribution of Trumpeter Swans in Michigan, estimates by county.

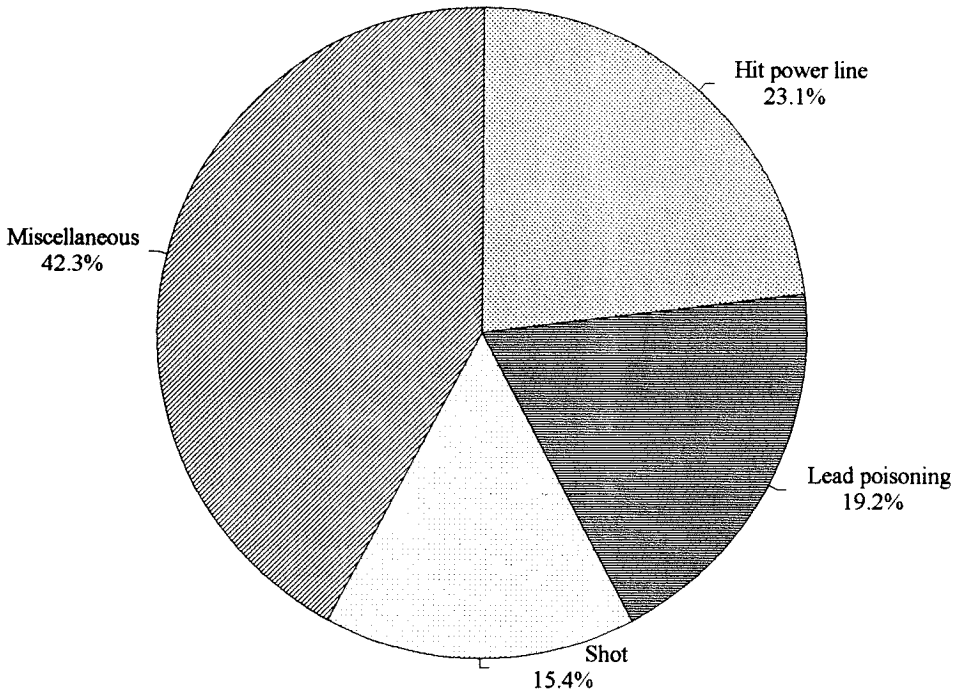

Figure 2. Causes of mortality of Trumpeter Swans in Michigan. Miscellaneous mortality includes enteritis, peritonitis, electrocution, trauma, gout, and unknown causes.

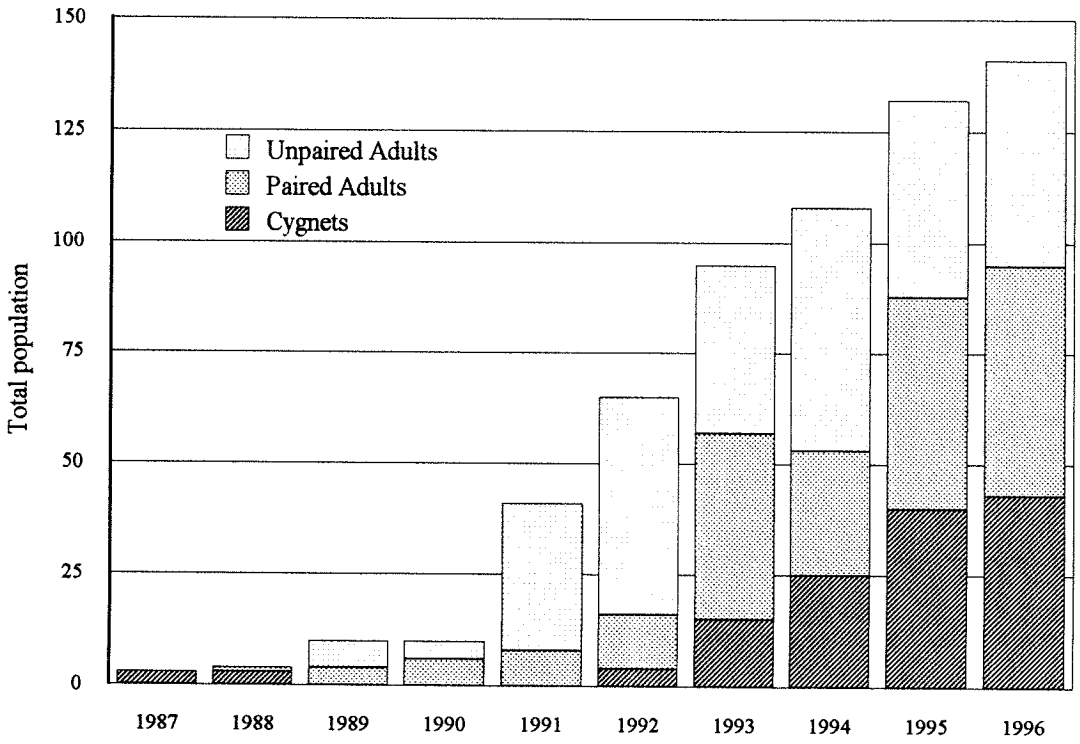

Figure 3. Trumpeter Swan population in Michigan, 1987-96, by age and mating status.

WHY IS IT SO HARD TO ESTABLISH A MIGRATORY POPULATION OF TRUMPETER SWANS?

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ABSTRACT

Eight individual programs to restore the Trumpeter Swan (*Cygnus buccinator*) to the upper Midwest have resulted in a collective population of about 1000 free-flying swans by the fall of 1996. Less than 20% of the overall population spends the winter far enough south to survive without human assistance. Most of the population does not migrate beyond the state or provincial boundaries where they were released, based on observations reported to The Trumpeter Swan Society office. A few swans have migrated repeatedly to the same locations in Oklahoma, Arkansas, Missouri, Illinois, and Indiana, while others have migrated once, then rejoined their more sedentary relatives, despite having located adequate wintering sites in the south. Why has it been so hard to establish a migratory tradition within this population of Trumpeters? This paper investigates some of the biological and political reasons for the present situation.

INTRODUCTION

Establishing a migratory population of Trumpeter Swans (*Cygnus buccinator*) is the goal of most of the restoration programs that are currently underway in the Midwest. However, by 1996, when almost 1000 swans were in the wild, only a small percentage were actually migrating any significant distance. There are biological and political reasons why it has been so difficult to get these swans to migrate on a consistent basis. Understanding these reasons may help in the development of solutions.

BIOLOGICAL REASONS

Many Trumpeters stay at northern sites because they are fed by people. In some cases, it is an intentional effort by a managing agency to increase the survival of the flock. In other cases, it is done by private citizens for their own enjoyment or concern for the welfare of the birds. In either case, the birds do not migrate. While this may be the single most important reason why Trumpeters have not been very successful in establishing migratory traditions in the Midwest, it is not the only reason.

Trumpeters do retain the instinct to migrate. Almost all newly released Trumpeters will migrate south if they don't find a place to spend the winter in the north. This has been demonstrated by swans that were released in Wisconsin, Minnesota, and Iowa. The first migration is a random search to find a wintering spot. The swans usually stop as soon as they find ample food and water.

Trumpeter Swans are very traditional in their use of nesting territories and wintering sites. An adult pair will use the same nesting site for decades. If a bird looses a mate, it will bring a new mate back to its territory. The pair may migrate to the same wintering area each year as long as the site remains attractive, but the fidelity to a wintering site does not appear to be as strong as the attachment to the nesting territory. This behavior appears to increase the survival of the birds. It enables them to retain a nesting territory, to start nesting earlier in the season, and to avoid potentially dangerous situations such as marshes contaminated with lead.

Trumpeters migrate primarily as a family unit, which consists of the adult pair, their young of the year, and occasionally a few of their offspring from the previous year. It is very difficult for other swans to join this group. The family breaks up in the spring when the adults return to their nesting marsh, at which time the newly independent cygnets may join a subadult flock.

The migration route is learned by the cygnets during their first trip. Once a migratory tradition has been broken by the localized extirpation of the flock, it is very difficult to get birds to reestablish the route. Even if a few swans survive, they will not lead a large flock back to the site, as geese or ducks can do. It can take generations to repopulate a wintering site.

Young Trumpeter Swans usually pair with older birds which have established territories and wintering sites. Therefore, a large sedentary population could reduce the speed with which

migratory flocks grow by continually bringing the subadults back into the sedentary group as they seek mates. I have witnessed this in Minnesota. I don't know what will happen as the population matures so that the original migrants become the older members of each pair.

Many of the natural wintering sites in the south have been drained or altered so that they are no longer suitable for Trumpeters. The best looking sites may have hidden dangers. In today's environment, mortality is much higher for Trumpeters that migrate in a random search for a place to spend the winter compared with swans that migrate to known sites or swans that spend the winter in northern regions where they receive supplemental food. Exposure to lead poisoning, shooting, and accidents all increase the risk for swans that must explore numerous wetlands to find a suitable wintering site.

Good aquatic habitat is in short supply in the central Mississippi River Valley. Mallards and geese have adapted to feeding in agricultural fields across the central Midwest, either out of necessity or preference, which has enabled them to stay farther north than they did historically. Trumpeter Swans have adapted to agricultural feeding on the West Coast, so they should be able to do so in the Midwest as well, but the process will be slow.

These are some of the biological or behavioral reasons why it is difficult, but not impossible, to establish migratory flocks of Trumpeters. We can compensate for the Trumpeters' behavior. However, first we must agree on what should be done.

POLITICAL REASONS

In my estimation, we have not reached a consensus on what we want to accomplish beyond "establishing a migratory population." The finer points of management could not be addressed in the recently prepared *Mississippi and Central Flyway Management Plan for the Interior Population of Trumpeter Swans* (Subcommittee on the Interior Population of Trumpeter Swans 1997) due to a lack of consensus. A few waterfowl managers are still concerned about the potential impact Trumpeters could have on existing waterfowl seasons. Restoration managers do not agree on how aggressively they should manage migrating Trumpeters, and even The Trumpeter Swan Society has not agreed on recommendations for management. We are at the point where any decision may be better than no decision at all.

One reason for our stagnation is our tendency to try to anticipate and address every potential problem before proceeding rather than emphasizing the opportunities provided by a restored population. What impact will Trumpeters have on existing hunting programs? Will feeding of Trumpeters cause swans to beg for food or to attack people? Will state agencies have to assume a greater work load because of Trumpeters? While the answers to these questions are important, the problems that may be encountered will not be insurmountable, and they should not be severe enough to negate the benefits that could be derived from a restored migratory population.

One of the best ways to keep costs down and avoid an excessive work load for government officials is to involve the public. There is a tremendous interest in Trumpeters. People want to help, but not just by giving contributions so professionals can have all the fun of doing the field work. The public wants to be involved in all the hands-on work, and they are willing to pay for the program and assume responsibility for it if we simply tell them what we want them to do. Asking people to contribute financially but to avoid all contact with the birds does not meet the hands-on need. Other papers presented at the sixteenth Trumpeter Swan Society Conference explain what it means to private citizens to be involved in one of these projects on a firsthand basis. These people are responsible for much of the progress that we have made in our restoration efforts to date. They are not unique.

The Trumpeter Swan is a protected species, yet it is managed by game departments in most southern states. Basically, it exists in limbo. Game managers are overextended almost everywhere, and the Trumpeter does not bring in additional revenue through the sale of hunting licenses. How can they be expected to start a management program without funding? Several state game agencies have found sources of funds for Trumpeter restoration. In other cases, we need to consider turning Trumpeter Swan management over to other sections or to private individuals who are in a better position to provide the time and money that is needed.

Since Trumpeters are protected, they may adapt to people in ways that other hunted species of waterfowl cannot. Too many managers consider this

type of adaptation to be undesirable based on experiences with other species of hunted wildlife. Since Trumpeters are protected, we have the opportunity to use techniques for management that are not suitable for other waterfowl. We need to take advantage of this situation more than we are.

There are a few fundamental questions that have been debated for years. We need to answer them once and for all. Five of these questions are listed below, along with some discussion on each one.

1. Should Trumpeters be kept out of intensively hunted areas?

   Most waterfowl managers see some benefit in restricting where Trumpeters migrate. Even though there is no reason why a Trumpeter should be mistaken for any other species of waterfowl, besides a Tundra Swan (*C. columbianus*), managers do not want to tempt fate or create situations where the waterfowl hunting community could be embarrassed by the actions of a few unscrupulous hunters. However, if the prime hunting areas are the most attractive places for swans, how will we keep them out?

2. Should Trumpeters be attracted to areas for public viewing?

   Trumpeters provide a tremendous opportunity for public education and recreation. Public viewing areas, where swans, ducks or cranes can be seen close up, are very popular in England and Japan. We could create similar areas in the Midwest using Trumpeter Swans as the featured wildlife. Locating such sites near urban areas could keep Trumpeters out of prime waterfowl hunting areas. Swans could be attracted to areas where the direct association with people is minimized and where other species of hunted waterfowl are excluded. This type of wildlife viewing has not been popular among wildlife managers in the U. S., but if human population growth continues unabated, how far removed are we from the conditions found in other countries?

3. Should Trumpeters be kept as free from human contact as possible?

   Trumpeters will frequent wetlands with a lot of human activity on the shore. As far as I know, there is no evidence that shows that close contact with people has an adverse impact on the behavior of Trumpeters if they are raised by swan parents, either in the wild or in captivity. Swans will become tamer with favorable exposures to people, and they may begin to look to people for food, but this condition can be reversed very easily with swan-reared birds. Most swan managers would prefer to avoid having people feed swans bread crumbs by hand. However, this type of situation can be avoided in a controlled situation. We need to encourage both the people and the swans to do what we want.

4. Are we willing to use supplemental feeding or live decoy swans to attract and hold Trumpeters?

   Using supplemental food is a proven way to attract all species of waterfowl. Most waterfowl managers have trouble with the thought of feeding waterfowl, which for the most part are hunted. There are federal regulations against baiting. Managers do not want state agencies to get involved in costly wildlife feeding programs, with good reason. However, Trumpeters are a protected species and are likely to remain so in most areas for the foreseeable future. The public has a long history of feeding wildlife as individual citizens at backyard feeders and as organized groups. Is it possible or advisable to let the public assume this role at specifically designated locations? Why not? Feeding has been an excellent tool for conditioning wildlife to learn to tolerate the human disturbances that they must tolerate in order to survive. We are not restoring Trumpeters into a pristine landscape. Using a few decoy swans is another technique for attracting Trumpeters to a specific location.

5. Should Trumpeters establish migration routes entirely on their own?

   Trumpeters have already demonstrated an ability to migrate, and, in a pristine environment, they should be able to establish a migratory route on their own. However, if we expect them to use certain sites while avoiding other equally attractive sites, we need to have some involvement. While I'm not advocating transporting birds between summer and winter habitat as I have in the past, I do advocate taking steps to attract and hold Trumpeters at suitable sites long enough for them to form an attachment. I also advocate activities that will increase the number of swans migrating to the site. Releasing subadult swans at wintering sites which are

already occupied by a limited number of Trumpeters is an example of what could be tried.

Probably no one agrees with all of the opinions expressed above, but we need to arrive at some form of consensus to avoid a continuation of the paralysis that presently grips the restoration program. A new management plan for Trumpeters is being submitted to the Mississippi and Central Flyways within the next month. It does not answer these questions, but instead it suggests that these are questions that each state needs to address. I hope this meeting will enable all of us who are interested in Trumpeters to gain enough information about the birds to make some of these decisions.

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DEVELOPING TRUMPETER SWAN WINTERING AREAS

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WINTERING FLOCK RESTORATION

The lack of good Trumpeter Swan (*Cygnus buccinator*) wintering areas and the extirpation of traditional migration routes to adequate wintering areas are believed to be serious limiting factors for restoration of Trumpeter Swans. A good Trumpeter wintering area should provide open water, aquatic plant food, and protection from disturbances and pollution. Supplemental food may be provided if the other elements are available.

Some experts have written that we have been restoring Trumpeters backwards, that perhaps we should have restored the Trumpeters on adequate southern areas and allowed their descendents to search north for nesting grounds. This appears to be a normal way for Trumpeters to pioneer.

But the first restoration sites were chosen as self-sufficient areas in which to develop endangered species survival flocks. Fjetland (1974) describes this effort on the national wildlife refuge system. Batt (1976) describes a similar effort by the Delta Waterfowl Research Station in Manitoba.

After the Trumpeter was delisted from The Redbook in 1968, there was little interest in Trumpeter restoration by the U. S. Fish and Wildlife Service or in the south. Interest was maintained in the north, where restoration was continued on a case by case basis.

Several proposals were made to develop wintering flocks in middle Mississippi River states. Dr. Donald Hammer, Senior Biologist with the Tennessee Valley Authority (TVA), and staff proposed to develop a breeding-wintering flock on their vast waters. Upon objections that Trumpeters were not known to nest in that area, they revised their proposal to provide breeding stock for approved areas, trained to migrate to and from TVA's wintering waters. Subtle opposition by state and Washington, DC, officials kept the proposal from being implemented.

In 1980, a proposal to restore a Trumpeter Swan breeding/wintering flock at Marais des Cygnes Management Area in east-central Kansas lost its state approval, as we understood it, due to a tirade against Trumpeter Swans at a Central Flyway meeting by the eastern Montana representative, who raised the spectre of closures to hunting. He cited, as an example, Wyoming's earlier closure of Snow Goose (*Chen caerulescens*) hunting in the Tristate Region, where Snow Geese were very rare, to protect the then endangered Trumpeter Swan.

This spectre of closure still persists in the minds of some state and flyway officials, in spite of everything we can do to reassure them. Flyway mechanisms exist for resolving such conflicts.

There is so little to lose and so much to gain for a state or an agency in restoring the magnificent Trumpeter Swan. It improves the state's image for it to be concerned with all of its wildlife. It is good to increase the biodiversity and quality of life. It is good to promote wetlands, and you can promote quality wetlands with Trumpeters, as Nebraska and Iowa have done. It is good to promote outdoor recreation and tourism, both from within the state and out-of-state, with something as worthwhile to see as Trumpeter Swans.

The Lacreek Trumpeter Swan Plan (Burgess *et al.* 1982) proposed an experimental transfer of Trumpeter families from Lacreek National Wildlife Refuge in South Dakota to the Mingo National Wildlife Refuge- Duck Creek Wildlife Management Area Wetland Complex in southeast Missouri. The expectations were that the adults would return to Lacreek and that the cygnets would be imprinted on the Mingo swamps as a wintering area. The first shipment of a family of two adults and three cygnets arrived at Mingo in September 1982. The adults made Mingo their new home, but the cygnets

disappeared. Between 1982 and 1987, 33 Trumpeters were transferred from the Lacreek High Plains Flock to Mingo.

Much about Trumpeter Swan ecology was learned in this experimental study, as described in Missouri's final report (Smith 1988). Of importance for developing a southern breeding flock was the fact that a breeding pair had been translocated a considerable distance southeast and still continued to nest.

Since the 1970s, Missouri has been involved in an aggressive wetlands acquisition and development program. Since 1973, the state has wintered at least 145 Trumpeter Swans from as far west as Alberta and as far east as Michigan. Many of these swans have used Missouri's new wetlands. Perhaps it is time to concentrate on the most attractive Trumpeter areas in Missouri and develop permanent wintering areas.

PROPOSAL FOR WINTERING AREA DEVELOPMENT

In order to develop Trumpeter Swan wintering areas, we would choose an area well below the 40th parallel and below 1000 feet elevation in eastern Kansas, Missouri, southern Illinois, eastern Oklahoma, Arkansas, or Tennessee with open unpolluted waters, ample winter food, and protection from unusual disturbances and high utility lines. We would obtain the support of the local people, the state natural resource agency or conservation department, the U. S. Fish and Wildlife Service, and the Flyway Councils. We would keep our plans simple, general, and very flexible.

We would provide large, attractive holding pens near potential swan wintering areas, putting clipped Trumpeter Swans in these pens as live-call decoys. If it's a breeding pair, that would be great. We might have luck with them nesting in the pen. If breeding pairs of Trumpeters are not available, we would use singles or injured flightless adults, other swans, or even white domestic geese until breeding Trumpeters were available. Preferably, we would put breeding or 2½-year-old Trumpeter pairs in winter pens in November and keep them flightless until the second year.

We would provide supplemental food, preferably wheat, in a Lacreek-type feeder, high enough above ground to discourage the use by other waterfowl. We would prefer an accessible, staffed site where essential services could be provided as needed.

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DEVELOPMENT OF A MANAGEMENT PLAN FOR THE INTERIOR POPULATION OF TRUMPETER SWANS

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INTRODUCTION

Several papers in this proceedings share various state, provincial, and private experiences concerning the Interior Population of Trumpeter Swans (*Cygnus buccinator*). Larry Gillette and Donna Compton provided additional information about early restoration efforts. It is obvious that there is a lot going on and considerable progress is being made, but we still need better planning, coordination, and management of this population as we move into the 21st Century. I believe that the best way I can quickly summarize the effort that went into development of the Interior Population Management Plan (IPMP), and the current status, is to present a chronology of significant events. A more detailed historical account of this population of Trumpeter Swans is included in the "Introduction" and "Background" sections of the IPMP.

CHRONOLOGY

1954

One of the earliest attempts to establish a local breeding flock of Trumpeter Swans was at the Delta Waterfowl Research Station in Manitoba during 1954 (Banko 1960). Captive breeding pairs were maintained, and limited production occurred. By 1972-73, three pairs were reported, but the number of swans apparently never became large enough to carry out a broader restoration effort. They eventually disappeared. During this period, other captive breeding programs were started at the Lacreek National Wildlife Refuge in South Dakota and at Hennepin County Parks in Minnesota.

1982

The establishment and expansion of the Lacreek flock proceeded under a management plan developed by the U. S. Fish and Wildlife Service (USFWS) and endorsed by the Central Flyway Council. During the period from 1982-87, about 30 birds from the Lacreek flock were moved to the Mingo National Wildlife Refuge in southeastern Missouri. Limited breeding and reproduction occurred, but these swans, too, eventually disappeared.

1984

The North American Management Plan (NAMP) for Trumpeter Swans was completed by the Migratory Bird Management Office, USFWS, with assistance from the flyway councils. It was signed by the Chairman of the Pacific Flyway Council as it pertained to the Pacific Population and Rocky Mountain Population, but deferred to the other flyways pending input on the Interior Population (IP).

1986

The Mississippi Flyway Technical Section, through an ad hoc committee, revised the section on the IP in the NAMP.

1984-94

During the 10 years from 1984-94, Trumpeter Swan restoration efforts proceeded under individual management plans prepared by the states, provinces, and private organizations and approved by the flyway councils.

1994

There was recognition of the need for better coordination of ongoing restoration programs. During September 1994, The Trumpeter Swan Society (TTSS) hosted a meeting in Iowa for interested parties to develop a consensus for future restoration efforts and management of the growing IP. The group recommended the establishment of a Drafting Committee (DC) to prepare a draft management plan for the IP. The DC was to consist of 12 members, three each from the Mississippi and Central Flyways and two each from the USFWS, TTSS, and the private sector. The two flyway councils approved the recommendation, and the appointments were made. The members were Joe Johnson (Michigan), Dave Graber (Missouri), and Sumner Matteson (Wisconsin) for the Mississippi

Flyway; Marvin Kraft (Kansas), Spencer Vaa (South Dakota), and Rolf Kraft for the Central Flyway; Jeff Haskins and Steve Wilds for the USFWS Regions; Russ Studebaker (Oklahoma) from the private sector; and Larry Gillette and Harvey Nelson for TTSS. The flyway technical section representatives and other members of the DC requested that TTSS assume the responsibility for facilitating the effort.

1995

The DC met in Kansas City, Missouri, in September to begin preparation of the plan. I was selected chairperson to coordinate the process over the next 2 years. Administrative support was provided by the TTSS office. During 3 days of discussion, agreement was reached on the scope of the plan, priority management issues, primary goals and objectives, and procedures for carrying out the effort. A working outline was prepared and modified as we proceeded. Responsibilities were assigned to DC members for completing specific sections of the plan. Time frames were established for completion of the first draft and review by the flyway technical sections and other cooperators. Most business was conducted by telephone, fax, and express mail, and through further discussions at flyway technical section meetings. The objective was to have the final plan completed and ready for submission to the two flyway councils for approval by August 1996 or March 1997.

1996

The first draft was reviewed with the Mississippi, Central, and Atlantic Flyway Technical Sections and their respective swan committees during February and at the flyway council meetings at Tulsa, Oklahoma, in March. A second draft was presented to the joint flyway council meetings at Kansas City, Missouri, in July. Larry Gillette or I participated in those meetings. The drafts also were reviewed by TTSS board of directors. A grant of $5000 was received from the World Wildlife Fund to help cover expenses for preparation of the IPMP, associated meetings, and travel costs.

During each of these steps in the revision and review process, comments were requested and analyzed by the DC. In essence, the first drafts were the product of the DC, whereas subsequent versions became a joint product with the respective technical section swan committees. There was some concern about format and the statement of goals and objectives, but the primary concerns were about specific management issues and proposed strategies. There was a general consensus among the DC members that at this stage it should be more of a conceptual plan than a strategic management plan. When updated in five years, there may be additional supporting information available to provide more specific implementation guidelines and management recommendations. By then, we should know more about the application of suggested population and distribution objectives, compatibility with other waterfowl hunting programs, winter habitat requirements, and how the swans respond.

The 15 July 1996 draft was considered near final but not ready for submission to the two flyway councils for approval at the July meetings. It was decided that the final plan should be completed by January 1997, circulated to the flyway technical sections prior to their winter meetings, and approval sought at the March 1997 flyway council meetings.

1997

This schedule was maintained. The final review draft went to the DC on 18 December 1996. Additional revisions were made. The final version of the plan was mailed on 17 January to the following:

- Central and Mississippi Flyway Technical Section representatives,
- Atlantic Flyway Technical Section Swan Committee,
- USFWS flyway representatives,
- USFWS regional migratory bird coordinators,
- Canadian Wildlife Service,
- TTSS board of directors, and
- other participating organizations.

We are now ready to enter the implementation stage in accordance with the stated goal, objectives, and management strategies, and to address the management issues identified.

There are many hurdles yet to overcome as we proceed. There are some policy decisions that need to be made. There are management recommendations that require the support of participating federal, state, provincial agencies, and private organizations. Some activities will require new funding and a strong cooperative effort. There are information gaps that need to be filled, some

requiring new research. It will be important to observe more closely what the swans themselves do as this population grows and specific flocks extend their winter migration further.

I hope that the discussions, suggestions, and specific recommendations that will be forthcoming from this conference and the meeting of the TTSS board of directors will provide valuable guidance for future actions.

The development of the IPMP has been an interesting and challenging experience. I want to acknowledge the effort devoted to this task by the members of the DC and their willingness to arrive at a consensus on critical issues so that this document could be completed on schedule. I also want to thank the members of the swan committees of the Central and Mississippi Flyway Technical Sections for their suggestions and support in obtaining final approval. We will now need everyone's collective support during the implementation process.

1997-98

Following the conference, the IPMP was approved by the Central Flyway Technical Section in February 1997 and by the Central Flyway Council in March 1997. The Mississippi Flyway Technical Section suggested some minor revisions that were subsequently made, and the IPMP was approved by the Mississippi Flyway Council in March 1998. The revised copy was approved by the Central Flyway Council in May 1998. The final IPMP is being printed and should be available for general distribution by August 1998.

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ADVANTAGES AND DISADVANTAGES OF A WINTERING CONGREGATION OF TRUMPETER SWANS ON THE MISSISSIPPI RIVER, MONTICELLO (WRIGHT COUNTY), MINNESOTA

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The Mississippi River at Monticello, Minnesota, is currently the primary wintering site for the Hennepin Parks restored population of Trumpeter Swans (*Cygnus buccinator*), as well as substantial numbers of swans released by the Minnesota Department of Natural Resources (MN DNR). Several miles of the river are kept open by a nuclear power plant. Residents living on the river regularly feed the swans and numerous other waterfowl and provide invaluable observations on individual swans and family groups.

Hennepin Parks began releasing swans in 1979, and, in the early years, there were substantial losses due to shooting, lead poisoning, and accidents, especially during attempted migrations. Late in the winter of 1986, two Hennepin Parks (HP) marked birds stopped briefly at Monticello. Since then, the number of swans spending the entire winter at Monticello has steadily grown (Compton 1996, Sheila Lawrence, pers. comm.). In the winter of 1992-93, 28 HP Trumpeters and 22 MN DNR Trumpeters wintered in Monticello. In the winter of 1993-94, numbers increased to 32 HP birds, 29 MN DNR birds, and many unmarked birds, for a minimum of 82 individuals. This wintering population reached 100 individual swans in December 1994. In December 1995, there were 163 swans, and, in December 1996, there were estimated to be 190-200 individuals (Sheila Lawrence, pers. comm.).

Below is a discussion of the advantages and disadvantages of this growing winter flock at Monticello. On the positive side, such a wintering congregation provides the following advantages:

- a way to monitor numbers of swans, survival of adults, and numbers of cygnets, since many of the breeding territories are unknown or difficult to access for breeding surveys.

- the opportunity to monitor problems such as ice on collars and to capture ill and injured birds. During the summer, weak, lead-poisoned waterfowl tend to die hidden and undiscovered in the wetlands.

- a setting where lone subadults and recently widowed swans can find a mate in time for the next breeding season.

- a reduction of hazards such as lead poisoning, power line collisions and hunting accidents. Survival is demonstrated by the number of returning birds and increasing numbers of unmarked birds, which suggests survival of cygnets. There has been less than five percent mortality per winter (Donna Compton and Sheila Lawrence, pers. comm.). Monticello as a wintering tradition maximizes the growth of the restored population by reducing mortality.

- an opportunity for the general public to see the Trumpeter Swan population and learn more about its management. Trumpeter Swans as watchable wildlife should generate interest and support of nongame wildlife programs. It could also provide an opportunity for the business community to capitalize on the birding attraction much like Bald Eagle (*Haliaeetus leucocephalus*) and Tundra Swan (*C. columbianus)* watching along the Mississippi River in southeastern Minnesota (Wabasha County) and Alma (Buffalo County), Wisconsin.

There are, however, obvious disadvantages to such a large flock, as follows. Staying north at this latitude during the winter months is historically unnatural. The artificial availability of open water and food discourages the swans from pioneering southward. However, several birds have wintered at Monticello over the years and have since gone south to winter in Oklahoma and Missouri. The birds are unnaturally dependent upon human provision of food such as shelled corn rather than surviving on the availability of natural aquatic vegetation. Winter feeding is controversial.

The survival of the birds at Monticello is directly related to the nuclear power plant remaining in operation throughout the winter. Occasional short-term freeze-ups have occurred due to temporary power plant shutdowns and ice jams

caused by high water and bridge construction on the river. Several losses of birds have been attributed to sudden freeze-ups or blizzard conditions (Sheila Lawrence, pers. comm.). Wind chill conditions play a role in ice buildup on collars, causing potential hazards for the individual bird. Should there be a major shutdown at the power plant, there may be the potential for large losses. Hennepin Parks does maintain several winter swan refuges to the southeast of Monticello in Hennepin County.

As is true of most wildlife populations, concentrating a majority of the individuals of a population means increased vulnerability to losses due to a disease outbreak. However, with winter conditions and the fast moving current of the river, the threat should be minimal at this location.

There is also the consideration of the cost of feeding of such large amounts of corn. However, so far, all food has been privately provided, although at great cost to several individuals.

There is the disadvantage of the potential of "taming" wild bred swans. It has been suggested that winter feeding could lead to training birds to seek handouts from humans which would lead to increased numbers of nuisance bird complaints. Sheila Lawrence has generally found that, in her observations of Monticello Trumpeters, the swans are overall very skittish. The birds appear only to accept her feeding when it is kept to the same routine. Even a minor change in Sheila's clothing can cause the birds to back off.

With the migration tradition to Monticello established, the Trumpeter Swan flock in Minnesota has grown steadily. It is becoming increasingly difficult to distinguish between HP and MN DNR birds due to the mixing of the flocks and the growing number of unmarked individuals. While there are disadvantages to maintaining birds in a northern location, so far, the advantages appear to outweigh the disadvantages. The birds are clearly taking advantage of a new habitat type created by man.

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THE MONTICELLO SWANS

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I have lived on the Mississippi River in Monticello, Minnesota, since 1984. Our stretch of the Mississippi has been a winter home for hundreds of ducks and geese since the start up of a nuclear power plant in the 1960s. During the winter, the warm water discharge keeps the river open for several miles downstream. It is the largest area of open water in this region. The first year we lived here, the power plant was shut down in the fall and was not started up until February. The river completely froze over, and the waterfowl disappeared. Three days after the power plant was restarted, the ice was gone off the river, and the Mallards (*Anas platyrhynchos*) came back. Three weeks later, flocks of geese began returning from their migration, probably the first migration many of them were forced to take.

The following winter the ducks and geese never left. Because they were fun to watch, I started putting corn out for them. Besides the geese and Mallards, we also have mergansers, goldeneyes, and several eagles that winter here. Best of all from my standpoint, for the past 10 years, we have been graced with the presence of Trumpeter Swans (*Cygnus buccinator*), as well as an occasional Tundra Swan (*C. columbianus*).

In the spring of 1986, I saw my very first Trumpeters, an adult and a cygnet. They stayed around for a day. I had never seen such magnificent birds flying free before. I had only seen swans in the zoos and parks, and now they were practically in my backyard. Fifteen Trumpeter Swans wintered here in 1987-88. Of the original 15, at least two, and possibly three, are back this year. They have been coming to Monticello for 10 years. There are three, possibly four, generations of Trumpeters wintering at Monticello. I have had the privilege of watching them grow from that small flock of 15 in 1987 to over 200 this year (Figure 1).

Of the 105 different Trumpeter Swan bands I have kept track of during the past 10 years, 68 have been swans from Hennepin Parks, 35 were from the Minnesota Department of Natural Resources (MN DNR) and two were from Wisconsin Department of Natural Resources (Table 1). 209 cygnets have come to Monticello over the past 10 years (Table 2). One Hennepin Parks pair (54NA and 55NA) has brought 22 cygnets to winter here. MN 7 has brought 19 cygnets, and her daughter, MN 9, has also brought 19.

In the winter of 1994-95, the highest Trumpeter Swan count was 113, with an average of about 90 swans per day. In 1995-96, the high count was 168, with an average of 150 swans per day. This year, 1996-97, the highest count was 204, with an average of over 190 swans. This includes 50 banded swans, 54 cygnets, and over 100 unmarked swans wintering at Monticello.

Of all the Trumpeter Swans that have wintered at Monticello during 1987-97, there have been 15 known mortalities (Table 3). Five died of lead poisoning, three died from collisions, two were missing after the river froze over, one died of stress, three died of unknown causes, and one swan died when he got his leg tangled in a rope that was tied to a cement block.

I observe swans every day from mid-November to mid-March. In the fall, I watch them reestablish their pecking order, which changes from year to year. What a show they put on, all that displaying and trumpeting. In February, when the courting rituals are at their peak, it's really wild around here for a couple days. The fights are mostly display, but occasionally they do have very aggressive encounters.

With the exception of one year, they have never shown any aggression towards me. In that year, a Wisconsin female would continually display to me, as if I were a family member of hers. Once in a while, some of the swans would accept her challenges and come after us. She kept getting me in trouble that year, but it was fun.

I have followed one female, MN 7, for 10 years. She is remarkable. MN 7 and her first mate, MN 8, were raised at the Minnesota Zoo and donated to the MN DNR for their restoration program. As the "visitors couple" at Tamarac National Wildlife Refuge, they

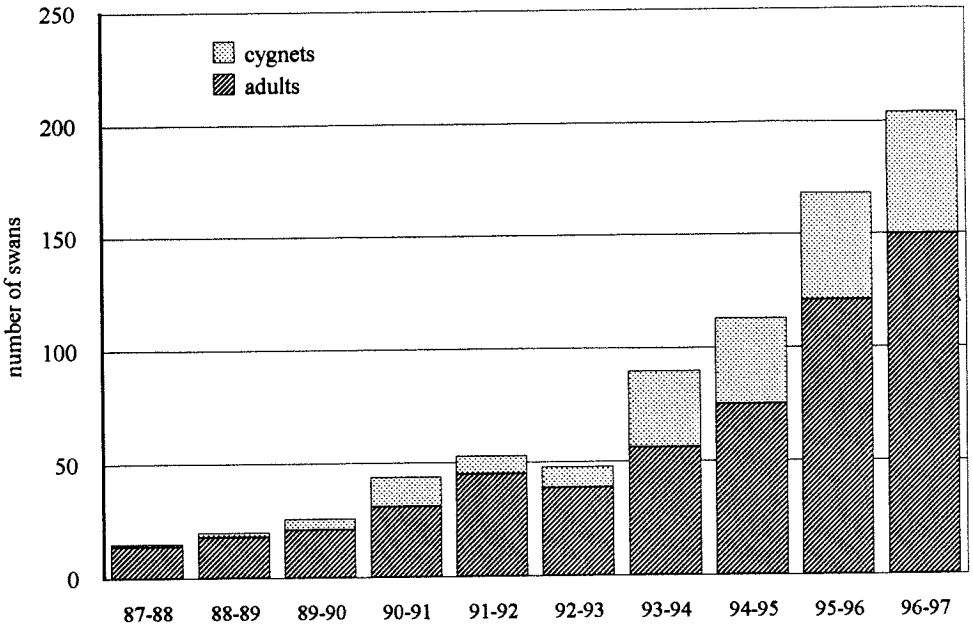

Figure 1. Number of Trumpeter Swans wintering at Monticello, Minnesota, 1987-97.

were the only swans allowed to mingle with the public. MN 7 and MN 8 were released in 1987 at the age of three. When they arrived at Monticello, they quickly became the "visitors couple" of our neighborhood. If you didn't have their corn out in time, they would come to the house looking for you. Everybody on the river knew them and had an interest in them. They made a great pair. She was a busybody and liked excitement, always instigating little battles even though she couldn't fight worth a darn. MN 8, on the other hand, was mellow and easygoing, but he defended her faithfully.

The third year, they returned to Monticello with a cygnet. They were such proud parents, parading up and down the shoreline, showing off their new addition. MN 8 was a wonderful father and never left his cygnet's side. MN 7, on the other hand, didn't let having a cygnet stop her from carrying on as usual. As fate would have it, that same winter, MN 8 died when he hit a bridge on a windy day. As a result, MN 7 lost her place in the pecking order and became withdrawn.

The next year, in 1990, MN 7 arrived with a new mate, MN 28, plus seven cygnets. How happy and excited she was. The way she carried on, you could tell she was saying, "We're going to be high in the pecking order this year. I am back on top." I later found out that she had six cygnets and adopted one. Knowing MN 7, she probably kidnapped the cygnet to help boost her status. MN 28 was big and strong and a very good fighter. This allowed MN 7 to have a great year to maintain her position of dominance in the flock. The next year, they brought three cygnets to Monticello, and she was still up in the pecking order.

The following two years were, in my observation, the hardest on MN 7, for she had lost her second mate, MN 28, to a power line collision in northern Minnesota where they nested. She showed up in Monticello alone. I was told in the fall of 1993 that she had a new mate and cygnets, but, once again, she came to Monticello alone. For those two years, she hung around with another widow, MN 129, and they were on the bottom of the pecking order. It was during these years that I would watch her start a disturbance, and, while the other swans were still carrying on, she'd use the diversion to go for the corn and eat as fast as she could before being chased away.

In the spring of 1994, she found her next mate at Monticello, an unmarked swan who was not willing to fight or defend her. They have had eight cygnets

Swan	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	# of years
MN 7	x	x	x	x	x	x	x	x	x	x	10
MN 8	x	x	collision								3
11NC	x	cancer									1
MOTHER	x	lead									1
54NA	x	x	x	x	x	x	x	x	x	x	10
55NA	x	x	x	x	x	x	x	x	x	x	10
85NA	x										1
50NC	x	x	x	x	collision						4
15NC	x	x	x	x	x	shot					5
44NC	x	x	x	x	x	x	x	x			8
46NC	x	lead									1
48NC	x	lead									1
25NC		x	x	x	x	x	x				6
20NC		x		x	x	shot					3
53NC		x									1
05NC		x									1
MN 16		x	x	x	x	x	x	x	x	x	9
76NA			x	x	x	wing clip	x	x	x	x	7
51NC			x	x	x	shot					3
73NA			x	x							2
MN 9	cyg:7+8		x	x	x	x	x	x	x	x	8
69NC				x	x	x	x	x	x	shot	6
72NC				x	x						2
61NC				x	x	shot					2
56NC				x							1
67NC				x							1
MN 28				x	x	pwr line					2
MN 129				x	x	x	x	x	to Okla.		5
MN 119				x	x	pwr line					2
MN 104				x	x	x	x	x	x	x	7
MN 133				x	x	x	x				4
MN 143				x	x						2
WI 4KU				x	lead						1
85NC					x	x	x-missing				3
82NC					x						1
62NC					x						1
MN 116					x	x	x	x	x	x	6
MN 118					x	x	x				3
MN 160					x	x	x	x	x	x	6
MN 30					x						1
MN 136					x						1
83 NC						x	x	refuge	missing		2
0A3						x	x	x	entangle		4
0A4						x	x	x	x	x	5
MN 159						x	x	x	missing		3
MN 162						x	x	x	x	x	5

Table 1a. Histories of individual marked swans wintering on the Mississippi River at Monticello, Minnesota, 1987-97.

Swan	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	# of years
WI25KN						x	wing clip				1
0A0							x	x	x	x	4
0A1							x	x	shot		2
MN 170							x				1
MN 180							x				1
MN 185							x	x	x	x	4
MN 178							x	x	x	x	4
MN 168							x	x	x		3
0A5								x	x	x	3
0A6								x	x	x	3
0A7								x	x	x	3
0A8								x	x	x	3
0A9								x	x	x	3
1A0								x			1
1A7								x	x	x	3
1A8								x			1
2A7								x	x	x	3
2A8								x	x	x	3
MN 186								x	x	x	3
MN 187								x	x	x	3
MN 191								x	x	x	3
MN 201								x	x		2
MN 213								x			1
MN 223								x			1
90NC								x	x		2
2A6								x	refuge	x	2
3A9									x	x	2
4A0									x-dead		1
92NC									x	x	2
2A2									x		1
2A4									x		1
0A2									x		1
2A3									x		1
3A4									x	x	2
154 Red									x	x	2
MN 166									x	x	2
MN 189									x	x	2
MN 192									x	x	2
MN 220									x	x	2
MN 206									x-dead		1
MN 224									x	dead	1
5A5									x		1
4A4									x	x	2
MN 240										x	1
7A1										x	1
7A2										x	1

Table 1b. Histories of individual marked swans wintering on the Mississippi River at Monticello, Minnesota, 1987-97.

Swan	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	Number of Years
6A7										x	1
3A0										x	1
5A2										x	1
4A8										x	1
4A9										x	1
6A9										x	1
6A1										x	1
6A3										x	1
7A0										x	1
7A3										x	1
7A4										x	1
7A7										x	1
7A8										x	1

collision = flew into bridge
lead = lead poisoning
missing = missing, lost in blizzard, or missing after river froze up
wing clip = wings clipped
pwr line = hit power line

Table 1c. Histories of individual marked swans wintering on the Mississippi River at Monticello, Minnesota, 1987-97.

together, including five this year. Perhaps because of increased competition, or possibly because of her age plus her mate's unwillingness to fight, MN 7 has mellowed some. She is still feisty but knows her place. MN 7 will be 13-years old; she is on her fourth mate and has successfully reared 19 cygnets through the past 8 winters.

In 1990, the year after MN 8's death, a female with a MN DNR wing tag 9 showed up at Monticello. It appears that someone in the DNR also had a soft spot in their heart for MN 7 and MN 8, for they saved the MN 9 for their only cygnet. In 1993, MN 9 and her first mate, MN 170, brought five cygnets to Monticello. In 1994, she lost MN 170 and returned with MN 104 and three cygnets. MN 9 and MN 104 have been together for 3 years now and have had 14 cygnets together, including seven this year. They are a quiet couple and keep to themselves. MN 9 will be 8-years old; she is on her second mate and has brought 19 cygnets to winter at Monticello during the past 4 years. In my conversation with the swans, I've been heard to say to a cygnet belonging to MN 9, "You quit biting MN 7. Shame on you, that's your Grandma!"

The river is always changing, and it has frozen over three times in the past 10 years, including this year. Variations in water level and cold temperatures affect these freeze-ups. Some have lasted up to 2 weeks, but there have always been areas of open water available to the birds. These conditions confuse the swans and are hard on them in various ways, but they do adapt. When possible, I will bring food to the swans to help sustain them during the freeze-ups. I have found that the swans tolerate extreme cold very well. From what I have observed, I would say that ice causes them the most distress, whether it's a river trying to freeze over or ice on their collars.

I have frequently seen collars with 5 inches of ice encasing them. Sometimes, when a swan with a heavily ice-encrusted collar puts its head down, its collar slides all the way down its neck to its head. The weight of the iced collar holds the swan's head on the ground, causing the swan to flip over. Since its head does not have enough strength to lift the block of ice, the swan is forced to flop around and fight the collar until it somehow manages to get the collar back towards its chest area. Some swans drag their weighted heads into the water where the ice floats, thus allowing the collars to right themselves.

Swan Pair	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	total cygnet	# of years
54NA+55NA	1	2	2	2	1	1	3	3	2	5	22	10
MN7+MN8/MN28/unm	0	0	1	7	3	0	0	3	0	5	19	10
44NC+unk/25NC	0	0	2	0	2	2	2	3			11	8
15NC+umn		0	0	2	1						3	4
73NA+unm			0	1							1	2
MN129+unk				0	1	0	0	6			7	5
MN116+MN118					0	1	4	0	0	0	5	6
0A3+0A4						5	5	0	7	0	17	5
69NC+unm				0	0	0	4	4	0		8	6
83NC+85NC					0	0	4				4	3
MN9+MN170/MN104			0	0	0	0	5	5	2	7	19	8
MN162+unm						0	1	4	2	2	9	5
0A0+0A1/unm							0	1	2	0	3	4
90NC+unm								2	4		6	2
76NA+unm			0	0	0	clipped	0	0	3	2	5	7
2A7+unm								0	1	2	3	3
92NC+unm									4	6	10	2
MN168+MN159							0	0	4		4	3
MN185+unm							0	0	3	0	3	4
MN178+unm							0	0	0	3	3	4
MN192+unm									0	3	3	2
MN189+unm									0	1	1	2
MN166									0	2	2	2
unmarked swans							6	7	12	16	41	5
TOTAL	1	2	5	12	8	9	34	38	46	54	209	

0 = paired but with no cygnets
unm = unmarked
unk = mate unknown
/ = multiple mates

Table 2. Number of cygnets seen with known pairs of Trumpeter Swans during the winter, from 1987 to 1997, at Monticello, Minnesota.

There are times when natural acts such as preening, tucking their heads in, walking, and even flying are impossible because of these iced collars. With iced collars, they will fly with their heads up instead of in the normal straight out position.

These instances occur during the bitterness of extreme wind chills. I don't believe that icing occurs only in Monticello. From my understanding, icing can happen wherever there is extreme cold accompanied with wind and, of course, water. I have seen large amounts of ice on the old yellow collars, but the newer green collars seem to be even worse. I ask that those responsible for collaring birds take this issue seriously. In this age of technology, there should be a kinder way of marking these beautiful birds. These collared swans have been dealt a terrible injustice. I know they deserve better.

One day, as the ice piled up on the Mississippi River, the river froze, and a swan that was unable to fly because of a heavily iced collar took refuge in my neighbor's yard, along with 17 other swans. During the harsh night, with -70 °F wind chills, the swan was not able to tuck his head in for protection. He fled from where the ice had pulled out some of his chest feathers. The next day, we attempted to

Year	Adults	Cygnets	Total	# of deaths	Cause of death
87-88	14	1	15	1	lead
88-89	18	2	20	1	lead
89-90	21	5	26	1	collision
90-91	31	13	44	3	lead
91-92	45	8	53	0	
92-93	39	9	48	0	
93-94	56	34	90	2	freezeup
94-95	75	38	113	2	collision
95-96	121	47	168	5	1-stress 1-entangled 3-unknown
96-97	150	54	204	0	

Table 3. Winter population size and mortality in Trumpeter Swans wintering on the Mississippi River at Monticello, Minnesota, 1987-97.

capture him. Sensing their vulnerability, the other swans took flight when they saw us. The swan with the iced collar did his best to follow, but the weight of the ice allowed him to escape only out onto the frozen river, where we dared not go. His only hope was to cross a treacherous field of ice to reach an open area of water a half-mile upriver. He was severely hindered in his ability to walk and to protect himself from the elements or from predators because of the block of ice that he carried around his neck.

I am happy to report that he did survive. When the river opened a week later, he returned. His collar was still heavy with ice, but the mass of ice was gone from his chest. I could identify him by his plastic leg band. What satisfaction it was to watch the last of the ice break free from his collar. The weight now gone, restricted no more, he instantly started dipping and preening; life was good once again. This swan survived, but how many others have not?

Although the swans have had to endure some harsh conditions, generally speaking, life is pretty good for them at Monticello. The swans that winter here appear to be thriving. I know that swan releases are part of the increase. It is the steady increase of unmarked swans which indicates to me that many of the cygnets are surviving and that some are having families of their own.

I have always done what I felt was best for the swans and have done whatever I could to help them. I know and understand the controversies concerning feeding swans at Monticello, and I will cooperate with whatever master plan both Hennepin Parks and the Minnesota DNR agree upon. However, at this time, I do not permit trapping on our property for the purpose of banding the swans. I would not feel right in betraying their trust. Anyway, I do not believe that the swans would fall for the trap. These are birds that panic when a pop can floats by. These are birds that cry out in alarm for hours if a corn bucket tips over. They are always alert and excitable. Any variation in their routine puts them on edge.

The Trumpeter Swan is an extraordinary bird. They have been part of the human experience since the beginning of time. They have their place in history, culture, and myth. They have the ability to inspire art and poetry. They sound like a trumpet and have wings like an angel's. We are blessed to have them among us.

I realize that few people have had the opportunity to follow a group of Trumpeters over a 10-year span. I feel very fortunate that I have been able to be a part of their lives. They have given me experiences which I will always cherish. I thank those responsible for the restoration efforts being made for these wonderful swans.

PUBLIC PARTICIPATION IN THE RESTORATION OF THE TRUMPETER SWANS WITHIN THE INTERIOR POPULATION

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ABSTRACT

Personal histories of three individuals from the public domain who have participated in the restoration program of the Trumpeter Swan are presented.

INTRODUCTION

All three presenters agree that the only way we might shape the diverse approaches to public participation in the Trumpeter Swan (*Cygnus buccinator*) restoration is to turn the statement implied in our title into a question. Consequently, we will each respond with personal histories of our roles by relating brief scenarios as bit-players in this great ecological drama.

We do this with the hope that we will in some ways put a face on public participation. For our purposes here, we will define "public" in the broadest sense of the word, that is, from the original Latin meaning of "populace." To define "non-public," we take the term in its narrowest sense to mean anyone connected with a public or private agency who is actively and professionally involved in the Trumpeter's restoration. Thus, "public" may mean someone in the natural sciences, such as the medical doctor with whom I went to southern Oklahoma to search for swans, or, it may mean a fifth-grade girl who is reading E. B. White's *The Trumpet of the Swan* (1970). "Public" may also include a hunter with a gun looking up at white birds flying overhead and scrolling through his hunting regulations to find out if they are Snow Geese (*Chen caerulescens*). One fact none of us who knows of the migration of Trumpeter Swans must not forget is that many, no doubt most, of the public is not aware of the existence of swans in the wild.

The answer to the question of how any individual may be informed and may move from the vast arena of the general public to be nudged from a neutral stance into the realm of knowledge and participation has the potential for numerous responses, possibly as many as the individuals who live on the Trumpeter Swan's migratory corridor. With our three unique responses, however, there is a common thread. It is that we had learned something of the Trumpeter through information put out by The Trumpeter Swan Society, we had knowingly seen Trumpeters in parks and zoos, and we witnessed the swans in the wild.

The fact that the three of us, as individuals representing the public, are together has been brought about through a series of accidental sightings of swans and encounters with one another. All these occurrences are apparently as random as a yearling swan's swerving flight into new territory. We three, however, have a common bond. It is an inherent love of animals, "biophilia" E. O. Wilson (1984) calls it, and each of us has a particular fondness for Trumpeter Swans. We admire them not just for their magnificence but for their importance to our land's natural heritage, one which was almost lost by the 1930s.

ALICE PRICE

My personal history, or story, begins on Valentine's Day of 1991. It was then, alerted by Al Stacey, an Oklahoma nongame wildlife manager, that there were Trumpeter Swans in the area, that Russell Studebaker and I first witnessed free-flying Trumpeter Swans. Our first sighting was of that great and heroic swan from Hennepin Parks, 59NC, his mate, and one cygnet. This experience gave me a focus for a book which I had been researching on the swan species of the world.

There was one more sighting of the Trumpeter pair on a private lake near Tulsa. They disappeared just after Christmas of 1991. The next fall, we searched for the Minnesota swans. No luck. In January, on the coldest day of the Oklahoma year in 1993, we heard from an Audubon Society friend that the word was out that there were swans about seventy-five miles north and west of Tulsa near Bartlesville, Oklahoma. They were on a ranch lake in Osage County. The Osage is a vast sprawling landscape of ranches and oil wells. It is the historical home of the Osage Tribe who have Trumpeter Swans figuring in their traditions and legends as an emblem of both warlike strength and peaceful beauty. The Osage is also where the last remnants of tallgrass prairie edge the eastern vegetation to begin the Great Plains.

We found 59NC again with his mate, 55NC, and four cygnets. This made our third sighting, and, as far as we are aware, the winter half of a third successful migration. Since then they have completed three more successful round trips and are now on the winter leg of a seventh migration. While we were leaning over the barbed wire fence watching the swans from a distance, down the road came Janine Kyler. The swans were on her and her family's land. I recognized her at once as someone who understands the language of swans.

Since first witnessing the swans in the wild and reporting their presence to TTSS, I became actively interested in the Society's mission to restore a sustainable population of Trumpeter Swans to the conterminous United States. Like the swans who migrate north and south, I have been fortunate to learn more about them by living in Oklahoma in the winter and the Great Lakes region of Michigan in summer. I have had the singular opportunity to meet people such as Roswell Van Deusen, retired director of Kellogg Bird Sanctuary, and Joe Johnson, present director, both of whom have been active in the Trumpeter's restoration to Michigan.

Consequently, my individual role has been nearly, but not totally, that of a "closet naturalist", a pejorative term John James Audubon used for book-bound people like me. I have used any abilities I may have to write about the Trumpeters, to depict them in drawings and photographs, and to speak of them on local television and in libraries and halls whenever I have the opportunity. Furthermore, through my book, *Swans of the world in nature history, myth, and art* (Price 1994), I have received many letters from readers with an incipient interest in swans. I respond eagerly with the hope that they, too, will fall over the edge into the kingdom of the swan.

To sum up any role which I have played in Trumpeter Swan restoration as one of the public, I might say that my part has been that of spreading information. You will hear from Janine Kyler and Russell Studebaker that they, too, have helped to disseminate information, but they have also contributed some elements unique to their own lives and situations.

JANINE KYLER

As a private Oklahoma landowner living on the winter end of the Trumpeter's migratory route, I think the most important part I can play is to help make their winter stay a successful and safe one.

To prepare for the swans' arrival every fall, I make an effort to clear our 28-acre lake of any hazardous debris which might be carelessly left from summer activities. I particularly search for lead sinkers, trot lines, and fishing line. I do so with the hope that the Trumpeters will be safe while they are here.

I try to get information out to any people living in the area. I talk to teachers and students in the schools nearby. I make numerous phone calls to game wardens to let them know when the swans are coming and when they are here. I also talk to the pumpers, the men who check on the oil wells all over this region of Oklahoma. The pumpers are a great help because they travel into areas where swans might go but where very few other people might be.

In our area, food sources for the swans may be short, particularly if there has been a summer drought. I supplement their natural diet with corn. I am the only one who ever goes beyond the fence near the lake's edge. I always try to wear the same sweater. If anyone from the outside comes to visit, I ask them to remain on the house side of the lake.

The lake is large enough that it generally will not freeze over entirely. There are times when ice must be broken to give the swans open water. One winter, I was helped in my ice-breaking chores by a Bald Eagle (*Haliaeetus leucocephalus*). The eagle swooped down, broke his descent with his wings, and then hit the ice with his talons, as if he was

trying to break it. The swans have never seemed to have any problem with the eagle.

The swans generally leave the ranch on their return migration by early March. During the month of February, I begin to supplement their diet with breeder pellets.

We have seen swans in our area before, but, in 1993, the swans from Minnesota chose to stay on our family's lake. They wintered over. I took pictures of the first family to arrive, 59NC , his mate, and their cygnets. Through these photos, I have an ongoing record of their behavior. I report the date of their arrival and the number in the group to the Society. I let Minnesota know when they leave. I also report any unusual happenings or injuries I might see. When 59NC and his family were joined by T10, a swan from Wisconsin, and his family, I reported that to the Society immediately. This fall, 15 swans arrived, 59NC's family, T10's family, and a previous female cygnet of 59NC's, now grown, with what might be her mate.

This winter, we had what so far has been our worst tragedy. The game warden called to notify me that he had seen two dead swans on a ranch near our land. He could not go on private land, but I could. I collected the bodies from the ice. Their green collars were missing, but I had already noticed that two subadults were missing from the flock. One of 59NC's and one of T10's. I took the two bodies to a veterinarian in Bartlesville who x-rayed them. They had been shot. I kept the two bodies frozen until the game warden arrived and I could bury them officially. I contacted local newspapers that these protected birds had been killed. I notified the U. S. Fish and Wildlife Service representative of their shooting. I put out posters all over the area announcing that The Trumpeter Swan Society was offering a reward for information leading to the arrest and conviction of the killers. The reward is $500, but state and federal officials right at this moment are trying to get funds to add to that reward.

The swans are still there. As their migration time draws near, you can be sure their diet will be supplemented. There never has been an animal in my life as special as those birds are.

RUSSELL STUDEBAKER

My participation in Trumpeter Swan restoration as a private citizen began through my interest in waterfowl and aviculture. In the mid-1980s, the City of Tulsa passed a bond issue for the repair and improvement of several park sites, one of which was $500,000 for Swan Lake Park. This 2½-acre lake is located in a midtown, historical residential neighborhood. It has been a popular attraction with the public with its swans and ducks for almost three generations.

The improvements to the park and lake included draining and dredging, and the lake would be drained for over a year. Swan Lake Park was under my management and supervision, was located within about four blocks of my park office, and was also in the neighborhood where I lived.

Since the mid-1960s, I had taken a personal interest in Swan Lake Park and had fed and cared for the waterfowl at the end of the work day after my regular park duties. The waterfowl at the lake consisted of Mute Swans (*C. olor*) and a few other birds, Canada Geese (*Branta canadensis*) , a few pair of Mallards (*Anas platyrhynchos*), Wood Ducks (*Aix sponsa*), Mandarin Ducks (*Aix galericulata*), and some domestic ducks. Also in the late 1960s, I became a member of The International Wild Waterfowl Association and attended several of their annual conferences and European tours. All of this led me to hear some notable waterfowl authorities and aviculturists of the day, such as Dr. Jean Delacour, Dr. S. Dillion Ripley, Dr. Bill Conway, John Griswold, and Glenn Smart.

As I was very involved with the master plan for Swan Lake Park, the idea come to me that this would be an excellent time to create a new collection of waterfowl. Other than the Mute Swans, I had purchased the other desirable waterfowl that was on the lake. So I formed an organization in 1986 which became incorporated as The Swan Lake Waterfowl Society and whose basic objectives were to propagate and maintain the collection of birds, develop an ecological habitat, provide passive recreation and education for the public, and to preserve the area.

One of the major items to determine was what kinds of waterfowl to put in the newly renovated Swan Lake. I chose to use native North American waterfowl for the new collection which would be purchased from licensed breeders of captive stock. The pair of Mute Swans would be sold, and all the domestic ducks would be eliminated. A flyer was designed with the 32 species named, along with their cost, and was circulated in the neighborhood and

promoted within the city in order to find sponsors of the birds. In less than two years, the almost $7,000, including the $2,000 for the pair of young Trumpeters, was given by individuals, families and organizations for the 100 birds. This was one place that the public could see and hear Trumpeters, since at that time about the only other Trumpeters in the state were in zoos.

Alice Lindsey Price was one of the original people on the Swan Lake Waterfowl board that I had selected, and she was the one who told me about The Trumpeter Swan Society. Soon after, our organization became a TTSS member. Another one of our original waterfowl society board members was Allen Stacey, who was a wildlife biologist for the Oklahoma Department of Wildlife Conservation.

In the winter of 1991, Allen Stacey called Alice and me to go with him to see three Trumpeters that were on Mannford Lake, a short distance west of Tulsa. This was our first sighting of Hennepin Park's famous 59NC, and, at that time, he was with another mature adult swan and a gray cygnet.

Then, in January of 1993, we were alerted by field trip members of the Tulsa Audubon Society about a flock of Trumpeters, a pair and their four young, that were on a small pond in the Osage country west of Bartlesville, Oklahoma. When we went to see them, they were Hennepin Park's 59NC, its mate, and their cygnets. This pair had begun to migrate and winter on a 10,000-acre ranch on a lake behind Janine Kyler's house. We became friends with Janine and shared with her what information we knew about these Trumpeters and about TTSS.

Afterwards, we frequently called Janine about what the swans were doing, and I led and conducted tour groups of members of the Swan Lake Waterfowl Society and other interested parties up to see them on her lake. Most of the trips were successful, but there were times when they either did not show up or had flown out to other ponds or lakes on the ranch.

Then another milestone event took place. Although the captive Trumpeters had nested for several years at Swan Lake, they had not successfully hatched their eggs. In 1994, two Trumpeter eggs from the Tulsa Zoo were placed under the pen at Swan Lake when her own eggs proved infertile. She hatched the eggs, and one cygnet was raised. 1995 was an even better year as the Swan Lake pair hatched three of their own cygnets. It created a great deal of interest with the public and the Tulsa media, and it was a traffic-stopper for the public who were able to watch the cygnets growing up on the lake.

The three cygnets grew up, and, after they began to fly the length of the lake, they were taken to the Tulsa Zoo and kept in a covered holding pen. After a couple of weeks, the two female cygnets were picked up and taken by car to the Minnesota Department of Natural Resources. They were to be released as 2-year-olds on Heron Marsh, Minnesota.

Due to space limitations at the zoo, the male was transferred to a private holding facility in October. Larry Gillette proposed that we try releasing him on the wintering grounds with the migrant Trumpeters. This male cygnet was banded 5A3, and, finally, the Oklahoma Department of Wildlife approved his release, which was in early January 1995. We nicknamed him Sasquatch, for the mythical bigfoot creature.

The release was a bit shaky for both us and Sasquatch, but, after a few days, he integrated into the flock, although he was definitely at the lower end of the pecking order of both migrating families, 59NC and Wisconsin's T10 (formally 79KU). In late February of 1996, the Trumpeters started their migration back north, a little earlier than in previous years, and 5A3, Sasquatch, left with the flock.

We all were very curious where he had arrived in the north, but no one had seen him. Then, we got a call from Donna Compton many weeks later. This cygnet had dropped out of the flock on his journey north stopping at Neosho Falls, Kansas. The landowners had some Canada Geese on their lake. This is a straight distance of about 90 to 100 miles, as the crow flies, from his release in Oklahoma. In all probability, he did not have sufficient time to build up his full flying strength due to the fact that he had been penned for so long before his release.

Then, around Easter of 1996, Sasquatch returned on his own back to Janine's lake in Oklahoma. I strongly suspect that the Canada Geese where he stopped in Kansas were aggressive and harassed him out of their territory. He returned to his only known "safe home" at Janine Kyler's, where he stayed all summer. This fall, 14 Trumpeters arrived at her lake, and 5A3 was there to greet them.

Those of us who have been keeping up with the swans are excited about this spring. I am curious

about 5A3's journey north. Will he follow the 59NC family to Minnesota, or will he choose to go with Wisconsin's T10 family? And what will be his tradition in a few years after he has paired with a mate? Whose migration route will be taken, his or hers? It is these questions and yearly and cyclical activities that have added a new dimension and continued interest in these magnificent birds for me.

Little did I realize that my original interest in waterfowl would eventually result in the release of the world's rarest swans into the wild and contribute to their numbers. To have the opportunity to observe migrating Trumpeters during their winter stay and to see their increase in numbers in Oklahoma is a dream that I never thought possible.

There have been other pleasures, like visiting the TTSS headquarters and knowing and communicating with the Hennepin Park-TTSS staff of Larry Gillette, Donna Compton, and Madeleine Linck.

In conclusion, it has taken a long time and a great deal of work from many biologists and other dedicated individuals to accumulate the knowledge and succeed with the Interior Population of Trumpeters. I am especially thankful, and have a great deal of pride, that I was able to contribute, to learn, and to be a small part of this program of restoration of the Trumpeter.

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THE RAINBOW CONNECTION OF THE SWANS

Steve Wilson, 2766 Hickory Ave., Mt. Pleasant, IA 52641

In the spring of 1995, the Sanctuary Wetlands Association (S.W.A.N.) established a "Rainbow Connection of the Swans" between Tom Ellsworth's Van Allen fourth grade class in Mt. Pleasant, Iowa, and their sister school, Mrs. Hart's fourth grade class in Clarendon, Arkansas. Each classes raised over $350 to cover the cost of purchasing one Trumpeter Swan cygnet for each location. Two additional cygnets per school, supplied by the association, were hand-raised by the students through the summer.

At the end of the summer, the three cygnets raised by Iowa's students, plus six other swans raised by the association, were trucked to a protected wintering site supplied by cooperator Scott Griffith east of Clarendon, Arkansas, where they were united with the three cygnets raised by the Arkansas class. The following spring, the swans were trucked back north, mimicking the migratory cycle. This pattern will be repeated until mated pairs have successfully nested in Iowa (2000). At that time, selected pairs and cygnets will be allowed to full-feather for flight and be soft-released in Arkansas or Iowa in the fall.

Will they migrate back to Iowa on their own in the spring? We all hope so. Imagine the excitement of greeting the returning swans as they sail in on great white wings trumpeting our shared victory. If, however, they do not migrate, the flock will be moved to selected sites to serve as foundation stock for local flocks and to allow efforts to establish migratory populations to continue. (Ultra-light, anybody?)

The S.W.A.N. is also working to create a wetland park complex to polish the waste water of the City of Mt. Pleasant, Iowa, on high bottom ground along the Skunk River. The park will contain up to 100 water-covered acres utilizing the projected average flow of 1.5 million gallons of water per day. The utilization of this water for wetlands creates the need to monitor water quality closely, and it also offers the following significant opportunities.

1. There will be a constant supply of water at a usable elevation so we can create stable wetlands above historical flood levels without pumping. This allows growing wetland crops (e.g. wild rice, lotus), protects the nests of waterfowl from flooding, and saves pumping costs. The elevation also allows seasonal drainage to facilitate the harvest of wetland crops and to control muskrat and beaver denning in levies.
2. The water will be warm enough and of sufficient quantity that it can be used to maintain open water for wintering resident and migratory swans and geese.
3. The new wetland will be almost free of lead shot contamination. Since lead poisoning from the ingestion of lead shot is the primary cause of death in the upper Midwest Trumpeter Swans, this is a significant benefit.
4. The wetland will further purify the waste water. The water the wetland is to receive from the city will be treated by the city treatment plant to meet the standards for direct discharge into the river. The reduction of ammonia, bacteria, and other contaminates that generally occurs in a wetland will serve as an enhancement to the required treatment.
5. The wetland plants and irrigated row crops will utilize nutrients in the waste water.
6. The wetland park will beautify an essential process while turning waste into a resource. As the human population and appetite grow and the scope of human activity increases, we must come to realize that wastes are mismanaged resources. The utilization of human wastes today and, especially, tomorrow is as basic and essential to closing the loop in recycling resources as the utilization of animal manure in the past. As we enhance the waste water treatment process and search for economically viable utilization of wetlands and waste waters, we hope to fill the air with the fragrance of lotus blossoms, fill our stomachs with wild rice, and fill the skies with swans trumpeting the celebration of the bounty of sound resource management.

Some of the activities planned for this wetland complex include the following:

1. waste water polishing,
2. wetland park,
3. waterfowl refuge,
4. wetland agriculture,
5. aviculture (endangered waterfowl of the world),
6. water gardens,
7. butterfly gardens,
8. upland bird food plots,
9. bird feeding (small birds),
10. prairie restoration plots with seed production,
11. canoeing,
12. photography,
13. school field trips, and
14. box turtle habitat (Box turtles are endangered in Iowa.)

After reading an article in the *Journal of the Society of Wetland Scientists* that reported on a survey taken on the East Coast to determine what people valued most about wetlands and how much they were willing to pay to support wetland restoration, we decided to survey the residents of Henry County, Iowa (Figure 1), to see how their responses compared. We also used the survey as an opportunity to continue our introduction of SWAN Park to the public and attempt to get some pledges of support.

As the return of surveys began to taper off at around 400, a preliminary tally of the results was made (Table 1). The message was clear and could hardly be more encouraging. Eighty-nine percent of those responding indicated support for the project, and the ranking of possible benefits and uses for wetlands mirrored the objectives of our association and our plans for SWAN Park (Table 2). Over $20,000 in pledges were received.

A REAP grant was included as one of the possible funding options on surveys given to industrial workers. REAP is an existing Iowa program where funds are granted to successful applicants for environmental enhancements. Eighty-one percent approved of state tax funding from the general fund when the REAP grant option was included. Where preexisting tax-funded options were not mentioned, the sentiment was strongly in favor of private donations.

Only cities, towns, and counties are eligible for land acquisition projects, and, therefore, the association approached the Henry County Conservation Board in January 1996 to see if we could put together a

Table 1. Results of survey of people of Henry County, Iowa, regarding their wetland values, in order of importance.

Individual responses were tallied using the following points: most important = 2, important = 1, not important = 0, exclude = -1.

1.	Water quality	604
2.	Wildlife refuge	516
3.	Waterfowl habitat	511
4.	Education	510
5.	Restoration of rare species	505
6.	Flood control	479
7.	Birding	436
8.	Wetland agricultural research	394
9.	Photography	289
10.	Fishing	287
11.	Picnicking	255
12.	Interaction/ wildlife	249
13.	Camping	217
14.	Canoeing	183
15.	Hunting	85
16.	Motor boating	10

Table 2. The Sanctuary Wetlands Association objectives.

1. To create, enhance, and preserve wetland sanctuaries for the benefit of wild waterfowl.
2. To encourage private groups and landowners to create wetland sanctuaries.
3. To manage sanctuaries to encourage mutually safe close encounters between wildlife and people.
4. To propagate the wild waterfowl of the world to preserve the species and to allow for the study and the appreciation of waterfowl.
5. To research and to utilize symbiotic agricultural techniques that allow waterfowl and people to benefit from the creation of agricultural wetland habitat complexes.
6. To educate the public about wetlands and waterfowl through cooperative programs with schools and colleges.
7. To respect the rights of private ownership and to acquire land only from willing sellers for wetland sanctuaries and to emphasize the need for privately owned and managed wetlands.
8. To work with others in pursuing these goals in a positive attitude of cooperation.

management agreement that would allow the association and, possibly, other conservation organizations to participate on a park board.

These survey results will be valuable in helping guide all those who may become involved in how to prioritize the management of the park.

We followed up on the signed surveys that indicated no support to learn what the concerns were. We have found these visits to be very rewarding and the concerns to be thoughtful. Many of them came from neighbors who wanted to know how we were going to manage mosquitoes and deer and possible depredation of crops by geese. They were concerned about possible odor problems and dust control if traffic was significantly affected. We were able, in many instances, to address the concerns, but some of them required that we do some more homework. We will be good neighbors, and we will not harbor populations of mosquitoes or deer or waterfowl that will be allowed to inflict injury on our neighbors.

WETLANDS SURVEY

1. HOW DO YOU FEEL ABOUT WETLANDS RESTORATION IN HENRY COUNTY? (your county)

A. MORE NEED TO BE DONE B. ENOUGH HAS BEEN DONE

C. TOO MUCH HAS BEEN DONE D. NEED TO KNOW MORE TO REPLY

2. IF A WETLAND WAS TO BE CONSTRUCTED OR RESTORED IN HENRY COUNTY, RANK THE IMPORTANCE YOU WOULD GIVE THE POSSIBLE BENEFITS AND USES LISTED BELOW.

M=MOST IMPORTANT I=IMPORTANT N=NOT IMPORTANT E=EXCLUDE

___ WATER QUALITY ENHANCEMENT

___ MOTOR BOATING

___ BIRDING/WILDLIFE OBSERVATION

___ RESTORATION OF RARE SPECIES

___ FLOOD CONTROL

___ WETLAND AGRICULTURAL RESEARCH

___ FISHING

___ CAMPING

___ WATERFOWL HABITAT

___ CANOEING

___ HUNTING

___ WILDLIFE REFUGE

___ PHOTOGRAPHY

___ EDUCATION

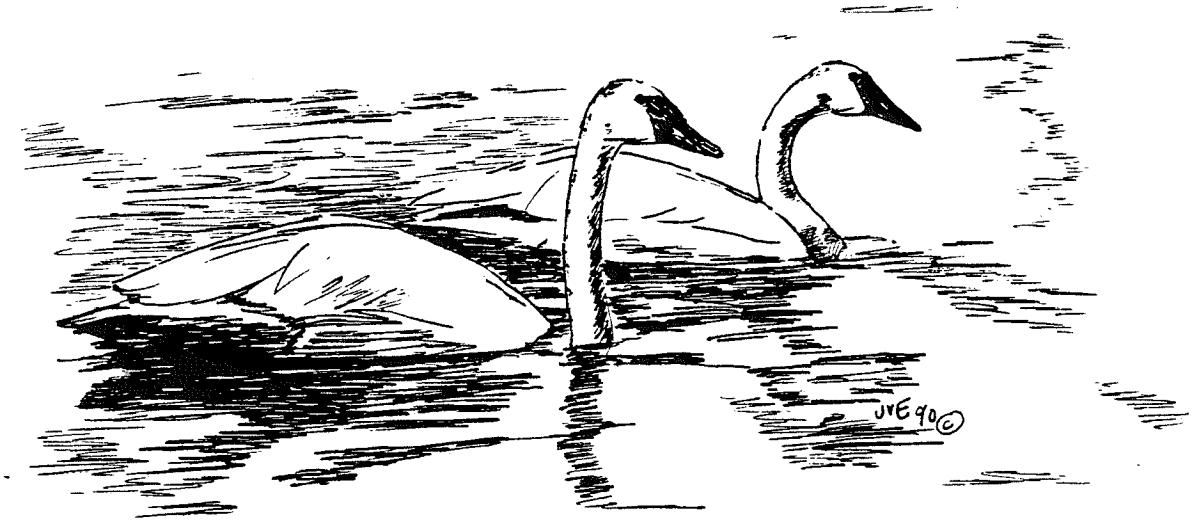
___ INTERACTION WITH WILDLIFE (CONTROLLED HAND FEEDING OF WILD GEESE)

___ PICNICKING

3. WETLAND RESTORATION CAN BE EXPENSIVE. HOW MUCH WOULD YOU BE WILLING TO PLEDGE PER YEAR FOR THE NEXT FIVE YEARS FOR A SIZABLE WETLAND PARK COMPLEX IN HENRY COUNTY? (your county)

$_____.00

Figure 1. Survey of people of Henry County, Iowa, regarding their wetlands values.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RECENT CHANGES IN DISTRIBUTION AND ABUNDANCE OF THE ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS

Ruth E. Shea, 3346 E. 200th N., Rigby, ID 83442

INTRODUCTION

Efforts to rebuild a more secure distribution of the Rocky Mountain Population (RMP) of Trumpeter Swans (*Cygnus buccinator*) were initiated by the U. S. Fish and Wildlife Service (USFWS) and the Pacific Flyway Council in 1987. Program objectives evolved from the North American Management Plan for Trumpeter Swans (USFWS 1984) and conclusions from an analysis by Gale *et al.* (1987) of factors involved in the decline of the Tristate flocks after 1967 (Lockman 1988).

Gale *et al.* (1987) concluded that two major problems faced the RMP, vulnerability of increasing numbers of Canadian Trumpeters that depended on extremely harsh wintering sites in the Tristate Region and low productivity and occasional high winter mortality of the resident Tristate flocks. These problems were identified as chronic symptoms of a fundamental disorder, the extirpation of historic migrations to more productive winter and spring habitats. Several environmental and management factors were found to have exacerbated the high mortality and low productivity of the Tristate flocks, and actions were recommended to achieve short-term improvements. To repair the underlying damage to the population's distribution, a long-term program was recommended to rebuild migrations and gradually phase out supplemental feeding at Red Rock Lakes National Wildlife Refuge (RRLNWR) in Montana.

Range expansion was initiated in 1987 to recreate habitat use patterns that would give RMP Trumpeters access to more productive, lower elevation wintering sites and nesting areas. Access to a variety of milder winter and spring prenesting habitats would allow resident Tristate Trumpeters to return to their nesting territories with the energy reserves essential for successful reproduction. Dispersal of Trumpeters, though hazing and translocations, to better quality wintering sites was also expected to reduce the vulnerability of all flocks to winter mortality (Gale 1988, Lockman 1988).

RANGE EXPANSION ACTIONS

Since 1987, 1477 RMP Trumpeter Swans have been translocated from the Tristate Region to habitats in Oregon (641), southern Idaho (611), western Wyoming (119), and Utah (106). Translocations began with 43 swans moved from RRLNWR to Grays Lake National Wildlife Refuge (NWR) and Fort Hall, Idaho, in 1988-89. High mortality along the Henrys Fork River at Harriman State Park, Idaho, in February 1989 focused increased attention on risks to swans that wintered in the vicinity (Gale 1989).

In 1990, fall trapping began at Harriman and RRLNWR (Drewien *et al.* 1992), and translocations increased greatly to 373 (20 summer, 353 fall). This accelerated effort occurred in response to a dangerous situation created by the near-total decline of aquatic plants at Harriman during Winter 1989-90 (Vinson 1992) and the resulting concentration of over 800 swans, representing 40% of the RMP, at the RRLNWR winter feeding ponds.

This situation led to the termination of supplemental feeding in 1992 to reduce the risk of disease and increase the potential to disperse both the migrant Canadian and resident Tristate Trumpeters from the area (Subcommittee on Rocky Mountain Trumpeter Swans 1992, Niethammer *et al.* 1994, Gomez and Scheuering 1996).

RMP MIDWINTER DISTRIBUTION AND ABUNDANCE

Since 1972, the USFWS midwinter RMP Trumpeter Swan survey has provided extensive aerial coverage of the core Tristate Region. With additional data from expansion sites where wintering Trumpeters have recently increased, this survey has provided the best available assessment of RMP abundance and trend (Table 1, Figure 1). Each September, the USFWS also coordinates a survey of the RMP U.S. flocks. By subtracting the September count of the RMP U. S. flocks from the subsequent midwinter RMP survey data, managers have estimated the abundance and trend of the RMP Canadian flocks.

Table 1. Distribution of Trumpeter Swans in February, 1989-97, in the core Tristate Region and at expansion sites. (Data are from USFWS midwinter RMP Trumpeter Swan surveys. Prior to 1989, expansion sites were not surveyed because there was no recent history of use by Trumpeter Swans.)

Location	1989	1990	1991	1992	1993	1994	1995	1996	1997
MONTANA	432	357	455	552	238	247	214	401	234
Centennial Valley (incl. RRLNWR) [a]	301	307	322	398	0	51	43	102	22
Madison River/Hebgen Lake [a]	131	50	132	150	234	195	148	266	212
Yellowstone River [b]	0	0	1	4	4	1	23	33	no
WYOMING	353	325	347	346	574	488	600	582	525
Yellowstone National Park [a]	117	110	75	112	217	161	182	154	77
Jackson Hole [a]	22	19	51	31	80	69	101	101	75
IDAHO	958	1325	1129	1141	1266	1561	1866	1726	1827
Island Park (incl. Harriman State Park) [a]	632	897	464	308	439	624	602	649	473
Henrys Fork (Pinehaven-Idaho Falls), Camas [a]	124	144	168	329	362	206	424	354	393
Teton River [a]	156	270	213	228	256	580	480	500	486
South Fork Snake River [a]	38	10	70	84	83	93	194	127	176
Fort Hall [b]	8	4	78	128	85	37	117	63	223
Bear River drainage [b]	0	0	0	0	3	1	1	14	53
Snake River below Minidoka/Silver C. [b]	no	no	136	64	38	20	48	19	23
Summer Lake/ Malheur - OREGON [b]	33	20	26	123	127	210	99	189	55
Ruby Lake area - NEVADA [b]	18	15	18	32	30	20	24	38	40
UTAH	3	7	20	9	0	0	0	0	18
Fish Springs National Wildlife Refuge [b, c]	3	7	20	9	0	0	0	0	
Bear River Bird Refuge, Bear Lake [b, c]									18
TOTAL RMP	1797	2049	1995	2203	2235	2526	2803	2936	2699
[a] **Core Tristate Region**	1713	1984	1665	1812	1868	2168	2390	2479	2212
[b] **Expansion Sites**	84	65	330	391	367	358	413	457	475
(Relocated <4 months prior to survey)	(0)	(0)	(353)	(255)	(160)	(180)	(72)	(170)	(90)
Cygnets - portion of population	16.7%	20.7%	17.7%	20.9%	20.4%	25.5%	24.9%	21.9%	16.0%

[c] Utah data from Fish Springs NWR for 1989-96 and a partial count of Trumpeter Swans at Bear River Migratory Bird Refuge and Bear Lake area for 1997.

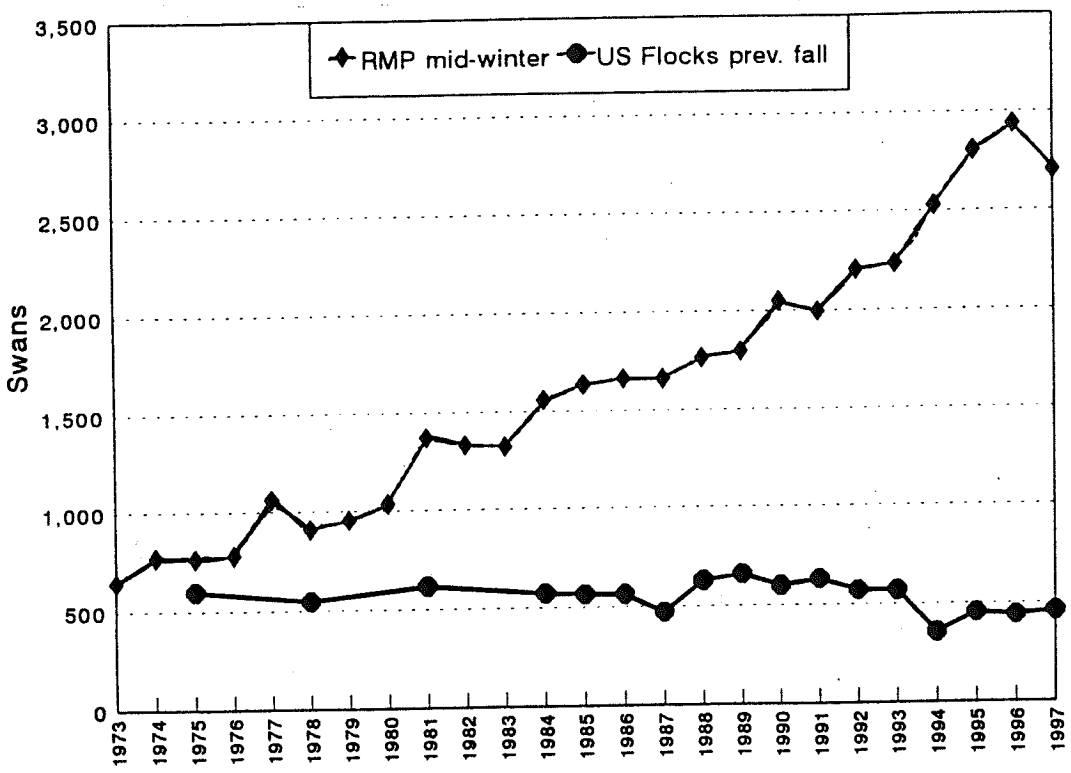


Figure 1. Trumpeter Swan population trends for the entire Rocky Mountain Population (midwinter survey) and for the U. S. flocks within the RMP (previous fall survey). Data are from USFWS and state sureveys of the Tristate Region and portions of Oregon, Nevada, and Utah.

Since 1974, the RMP Canadian flocks have grown from approximately 127 to 2500, while the U. S. flocks have declined from 596 to 459 (USFWS 1997).

In February 1997, the midwinter RMP survey (USFWS 1997) found 2699 Trumpeters (2268 adults and 431 cygnets), an 8.1% decline from the 2936 Trumpeters (2292 adults and 644 cygnets) reported in 1996. Within the entire survey area, adults showed no increase in 1997 despite substantial cygnet recruitment in 1996.

Within the core Tristate Region, wintering swans declined from 2479 in 1996 to 2212 in 1997 (Table 1). Declines occurred primarily in the Red Rock Lakes and Island Park areas, where efforts to disperse swans have focused, and in adjacent high elevation sites in Yellowstone National Park and the Madison River drainage of Montana. Overall, the number of Trumpeters found wintering at expansion sites increased, particularly at Ft. Hall, Idaho. The decline of Trumpeters wintering in Oregon was due primarily to difficult survey conditions caused by abundant water (Martin St. Louis, pers. comm.), and, unlike recent years, no swans were translocated to Oregon in the 4 months prior to the survey.

Although the mortality rate of RMP Trumpeters between February 1966 and February 1997 is unknown, no unusual mortality was known or suspected in Canada or the U. S. The reduction in numbers found by the 1997 midwinter RMP survey most likely reflects dispersal out of the survey area resulting from the range expansion program. Increased dispersal is consistent with substantial changes in swan behavior observed at Harriman during Fall 1996 and subsequent observations of marked Trumpeters.

In contrast to recent years, during Fall 1996, swan numbers at Harriman remained unusually low (<200), even with minimal hazing, and resulted in reduced trapping success (Drewien *et al.* 1997). Swan behavior was characterized by increased avoidance of the area, particularly by families,

substantial movement of neck-banded swans out of Harriman, and increased reactions to hazing and other disturbance.

These welcome changes likely resulted from several interacting factors, including early disturbance due to the timing of the trapping period and fishery research studies on the river, reduced habitat at Harriman due to high river flows and drawdown and freezing of the lakes, and the cumulative effects of 7 years of aversive conditioning at Harriman and the forced exposure of swans to alternate habitats.

Conspicuous southerly movement of Trumpeters through eastern Idaho was also observed early in November. Neck-band observations indicated most of these birds had bypassed Harriman or passed through quickly. During the winter, marked Trumpeters were observed in eastern Wyoming, Colorado, Utah, western Idaho, Nevada, Arizona, and California. Unfortunately, monitoring was inadequate to estimate minimum numbers of marked and unmarked Trumpeters wintering outside the Tristate Region. The challenges of effectively monitoring a dispersed RMP are compounded by the difficulty of detecting relatively small numbers of Trumpeters as they intermingle with huge flocks of Tundra Swans (*C. columbianus*), a task that Patten and Heindel (1994) termed "perhaps the most underrated field identification problem in North America."

Further evidence of dispersal outside the surveyed wintering sites has recently come from observations of marked Trumpeters at spring staging areas. Of 41 neck-banded Trumpeters reported by volunteer observers in Canada during March and April 1997, only 12 (29.3%) had been detected wintering in the Tristate Region the previous winter. Of the remaining 29 (71.7%), 18 (43.9%) had not been found at all during Winter 1996-97 and 11 (26.7%) had only been detected in the Tristate Region during fall and/or spring migration or had been found at expansion sites during the winter. Eleven (26.8%) of the 41 individuals reported in Canada had not been seen in over 24 months, and four (9.7%) had not been seen in over 48 months. Locating wintering areas of these swans and identifying other associated Trumpeters would help clarify the magnitude and destination of dispersal that is occurring.

STATUS OF THE RMP U. S. FLOCKS

In September 1996, the USFWS Trumpeter Swan survey of the RMP U. S. flocks found 459 swans, including 381 adults and 78 cygnets (USFWS 1996). This total included the Tristate flocks as well as swans in the vicinity of Malheur NWR and Summer Lake in Oregon and Ruby Lakes NWR in Nevada. Over the past decade, these flocks have averaged 20.7% cygnets at fledging (Table 2). Although their productivity has improved since the 1970s and early 1980s (Gale *et al.* 1987), increased mortality associated with termination of feeding, winter severity, and translocations caused a decline to 354 swans, consisting of 303 adults and 51 cygnets, in 1993. High cygnet production (33.5%) in 1994 contributed to the increase in adults (372) in 1995.

In September 1996, the Tristate flocks contained 379 swans, including 316 adults and 63 cygnets (Table 3). Adults increased by 27% after declining to a 50-year low of 248 in 1994. Adult numbers are now similar to those that existed during the late 1940s and in 1986 (Figure 2). Most of the decline of the Tristate flocks occurred within the Montana (Centennial Valley) flock (Figure 3) and was directly related to the termination of feeding and translocation of Centennial Valley swans to Oregon, Idaho, and Wyoming.

Table 2. Rocky Mountain Population/ U. S. flock trends, 1987-96. Data are from USFWS September surveys.

Year	Adults	Cygnets	Total	% cygnets
1987	434	194	628	30.1
1988	512	146	658	22.2
1989	535	63	598	10.5
1990	432	147	579	25.4
1991	463	108	571	18.9
1992	473	97	570	17.0
1993	303	51	354	14.4
1994	302	152	454	33.5
1995	372	66	438	15.1
1996	381	78	459	17.0
Mean	420.7	110.2	530.9	20.7

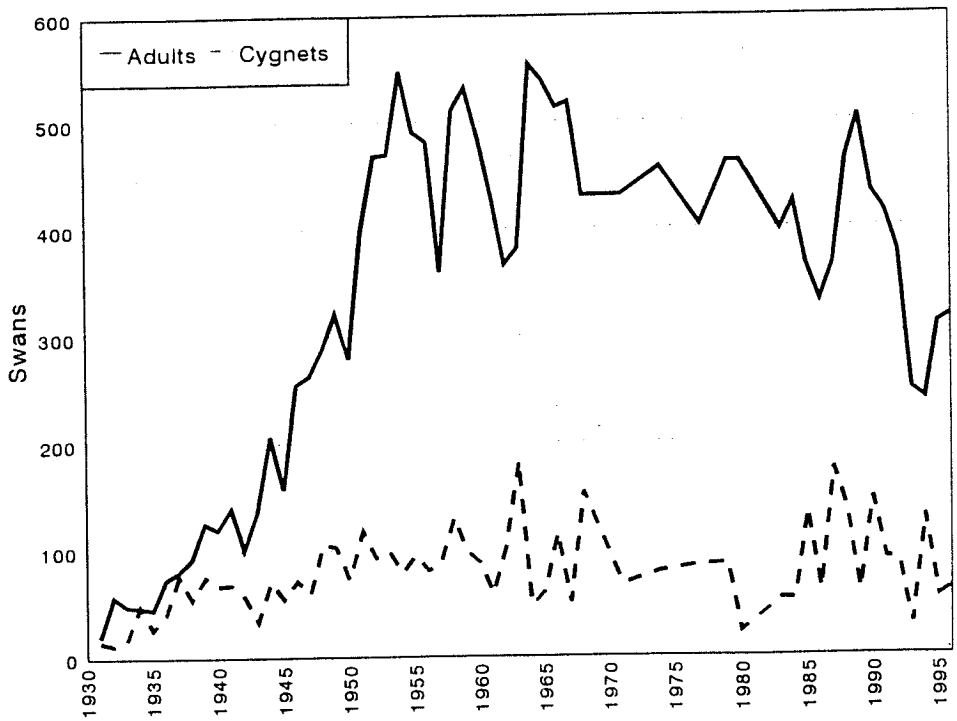
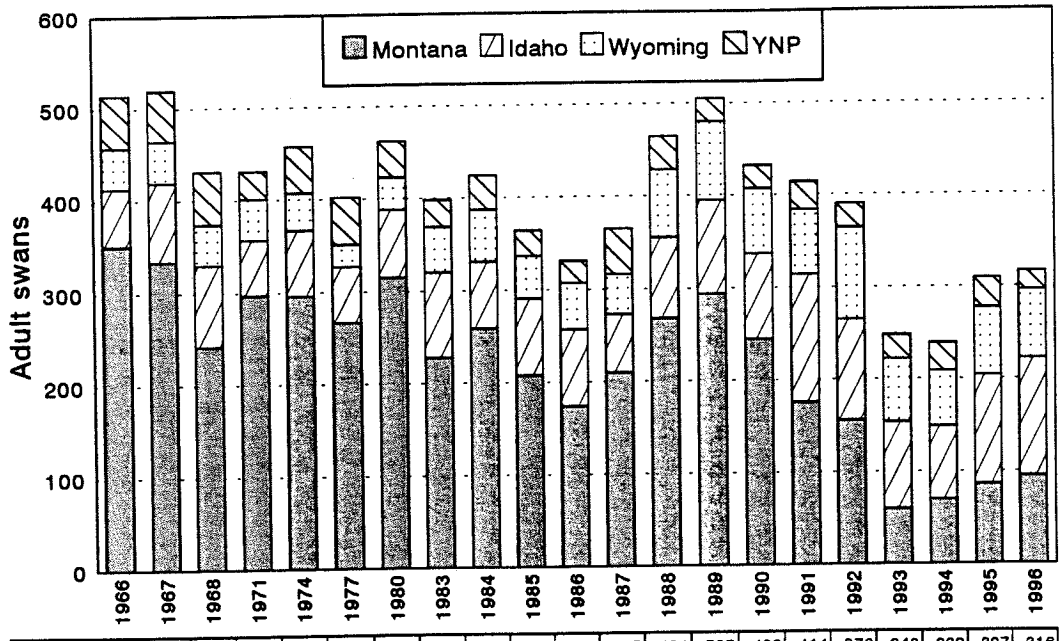


Figure 2. Population trend of Trumpeter Swan Tristate flocks, adults and cygnets, 1931-96. (Data are from USFWS September surveys.)



	1966	1967	1968	1971	1974	1977	1980	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total	514	519	431	431	457	403	462	398	424	364	331	365	464	505	432	414	376	248	239	307	316
YNP	57	55	57	30	50	51	39	29	37	27	24	49	36	25	25	30	26	26	30	32	20
Wyoming	44	45	44	44	40	24	35	49	56	46	50	43	73	85	70	70	99	68	60	73	74
Idaho	62	85	88	60	71	60	73	92	72	83	83	63	87	101	92	138	109	94	79	118	127
Montana	351	334	242	297	296	267	315	228	259	208	174	210	268	294	245	176	156	60	70	86	95

Figure 3. Trends of adult Trumpeter Swans in the Tristate flock, 1966-96. (Data are from USFWS September surveys.)

Table 3. Results of USFWS Trumpeter Swan survey of the Rocky Mountain Population/U. S. flocks, 21-26 September 1996.

Area	Adults	Cygnets	Total
Centennial Valley	85	34	119
Other Montana	10	2	12
Montana Subtotal	95	36	131
Island Pk/Targhee NF	54	6	60
Ashton area and south	73	14	87
Idaho Subtotal	127	20	147
Yellowstone NP	20	1	21
Jackson Hole	51	6	57
Other Wyoming	23	0	23
Wyoming Subtotal	94	7	101
Tristate Region (MT, ID, WY Total)	316	63	379
Oregon	49	10	59
Nevada	16	5	21
U. S. flocks	381	78	459

CONCLUSIONS

1. The increasing dispersal of migrant Canadian Trumpeters has reduced the potential risks that high winter mortality in the Tristate Region posed to these flocks when range expansion began. Swans that persist in wintering at marginal sites in the Tristate Region will occasionally incur substantial mortality during severe winters. These potential losses, however, no longer threaten the long-term welfare of the Canadian flocks, as long as those that disperse to other wintering areas experience adequate survival. The need to continue trapping and moving Canadian Trumpeters to new sites to diversify their habitat use patterns has diminished. Aggressive hazing at Harriman continues to be important to reinforce the behavioral changes that have occurred and prevent excessive numbers of swans from again congregating in this sanctuary.

2. Due to their much more restricted distribution and lower numbers, the Tristate flocks remain vulnerable to high winter mortality. From 1935-86, their winter survival in Montana and Idaho was highly dependent upon winter feeding at RRLNWR and habitat availability in the Henrys Fork River at Harriman (Gale *et al.* 1987). These resources are now nonexistent or greatly diminished. Continued efforts are needed to expose resident Tristate swans to more productive winter and spring habitats and insure adequate survival en route to, as well as at, those sites. Increased monitoring is needed to determine wintering areas and survival of these resident swans.

3. The size of the nesting population that can persist in the Tristate Region without winter feeding is unknown. However, in the 4 years since feeding was terminated, cygnet production to fledging in Tristate flocks has averaged 20.0% despite a variety of local factors that have caused losses of nests and cygnets. If productivity can be maintained or increased and if high winter mortality can be avoided through survival at more suitable habitats, the Tristate flocks have good potential to increase. Nesting could rebuild in the Centennial Valley, increase substantially at Grays Lake and Bear Lake NWRs in Idaho and the Green River drainage of Wyoming, and gradually expand from western Wyoming, across Idaho to southern Oregon, and north to Montana's Flathead Valley.

4. As the RMP disperses in winter, the traditional midwinter survey will become increasingly less able to provide an accurate assessment of the trend of the entire population or of the Canadian flocks. If wintering numbers in the Tristate Region continue to decline or fluctuate, it will be important to develop techniques that can determine whether the population is declining or is increasing and dispersing. It will also be important to assess the extent to which dispersing swans are successfully establishing new traditions or simply making one-time explorations that end with fatal consequences.

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The Editors.]

ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS: THE WINTER RANGE EXPANSION PROGRAM

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ABSTRACT

The Trumpeter Swan (*Cygnus buccinator*) Range Expansion Program was continued during the winter of 1996. The winter was generally warmer and water flows were higher than in most years. Fewer swans were present at Harriman State Park, Idaho, in 1996. Because numbers were below the objective level set for the Henrys Fork and because of equipment damage, the trapping program was terminated earlier than planned. Ninety Trumpeter Swans were relocated, 33 to Preston, Idaho, and 57 to Bear River Migratory Bird Refuge, Utah.

INTRODUCTION

Efforts to capture Trumpeter Swans (*Cygnus buccinator*) at Harriman State Park (HSP) on Henrys Fork of the Snake River in eastern Idaho were continued in 1996 for the seventh consecutive winter. These efforts were again handled by Rod Drewien and Ruth Shea under a contract between the U. S. Fish and Wildlife Service (USFWS) and the Hornocker Wildlife Institute, University of Idaho, Moscow. Kent Clegg provided his services and equipment under terms of a contract between Clegg and the U. S. Bureau of Reclamation. Most of the equipment used on the project and some of the manpower was provide by USFWS, Idaho Department of Fish and Game, and the Utah State Division Wildlife Resources.

The Pacific Flyway Management Plan for the Rocky Mountain Trumpeter Swan Population (RMP) recommended capturing and translocating swans to selected winter sites in Oregon, Idaho, Utah, and Wyoming (Subcommittee on Rocky Mountain Population Trumpeter Swans 1992). Successful translocation would establish traditions for Trumpeters to utilize new winter sites and help disperse the excessive concentration on the Henrys Fork.

BACKGROUND

Before a discussion of what took place this year, it might help to review how we got to this point. Aggressive winter trapping and hazing efforts began in 1990-91 in order to disperse swans from HSP and Red Rocks Lakes National Wildlife Refuge (RRLNWR), 20 miles northwest of HSP in the Centennial Valley of Montana. These efforts were based on work in the early 1980s by Ruth Shea, Dr. Oz Garton, and Dr. Joe Ball, under contract with the USFWS, to identify the causes of the continuing poor productivity and decline of the Tristate flocks. This culminated in the review and analysis of all past data (Gale *et al.* 1987). Some key conclusions were:

1. the low productivity and high mortality of the Tristate flocks were symptoms of a much broader and fundamental problem, the historic destruction of essential migrations and habitat use pattern,
2. restoration of viable Tristate flocks would require rebuilding their migrations to suitable winter/spring habitats, terminating winter feeding, and increasing their productivity,
3. productivity of resident flocks could be increased by correcting various site-specific problems at nesting territories,
4. both the Tristate and Canadian flocks would remain highly vulnerable as long as they depended almost exclusively upon marginal winter habitats in the Tristate Region, and
5. although artificial feeding was reducing winter mortality and increasing productivity of the Centennial Valley flocks, it would have to be terminated in order to restore movements to suitable winter/spring habitats.

Things changed for the worse due to the 1989 die-off of swans at HSP, the petition to the list the RMP as threatened, and the 1990 collapse of the vegetation

in the Island Park area. This, in turn, brought about the Trumpeter Swan expansion program.

WEATHER AND HABITAT CONDITIONS

November 1996 was warmer than in previous winters, with an average high of 40.2 °F and an average low of 16.8 °F. No days were recorded with subzero temperatures. Precipitation was recorded on 11 days and included 33 inches of snow and 1.98 inches of rain. In contrast, Rod Drewien's records show that temperatures plunged to -15 °F in early December and 44 inches of snow fell between 1-10 December, when trapping was terminated (Drewien *et al.* 1997).

Water flows in the Henrys Fork at HSP during the trapping period were higher than during the winters of 1990-94 but were similar to flows during 1995. Swan habitat in Golden and Silver Lakes in HSP was reduced in 1996 due to fall drawdowns to repair water control structures. Low water levels caused the lakes to freeze early and, with reduced abundance of macrophytes, limited their attractiveness to the birds.

RESULTS

Capturing and Translocating Swans

Wintering swan numbers at HSP from November to 14 December 1996 were lower than the objective level, ±200 or 10% of the RMP, established as the desired winter flock level by the Subcommittee on Rocky Mountain Trumpeter Swans. The population objective level at HSP was finally achieved in 1996, at least for the short-term, and because of equipment failures, I stopped the trapping program on 10 December.

Drewien *et al.* reported that during the trapping period, 93 Trumpeter Swans were captured, including 78 adults (84%) and 15 immatures (16%). The mean proportion of immatures utilizing HSP was 9.8% (131 immatures out of 1334 swans), based upon eight surveys conducted between 30 October and 14 December 1996. Twenty of the adults captured (26%) were classified as yearlings based upon presence of gray juvenile plumage on their napes.

Ninety Trumpeters were translocated, including 33 to Preston, Idaho, and 57 to Bear River Migratory Bird Refuge in Utah (20 in November, 37 in December). Three others were released at HSP, including a possible member of a local breeding pair and two birds captured on 7 December. It was not felt that it was worthwhile to transport the two swans to Utah. Two immature Tundra Swans were caught and banded in November and shipped to Utah.

Of 93 Trumpeters trapped, 12 were recaptures, including 10 that had been banded previously at HSP (one in 1990, two in 1991, three in 1992, one in 1993, three in 1994), one that had been banded at RRLNWR, and one from Alberta, Canada (1993). Nine were moved to Preston, Idaho, and three to Bear River Refuge. One swan, banded in 1991, had lost its collar and was remarked.

All translocated birds were marked with Rhodamine B dye (on the left wing for Bear River, on the back for Preston) and green neck bands, with the exception of the 20 birds released at Bear River Refuge in November, all of which had white neck bands and most of which had radio collars. The yellow neck bands intended for marking swans released in Utah in December were not used because their inside diameter was too small. Earlier this fall, Wyoming Game and Fish also released five cygnets in the Green River drainage with Rhodamine B on the right wing and no neck bands.

During the seven winters of trapping, 1280 Trumpeters have been captured, 1103 at HSP and 177 at RRLNWR, and moved to new sites in Idaho, Oregon, Utah, and Wyoming. The 177 captured at RRLNWR included 116 captured by the team lead by Drewien during the winter of 1990 and 61 swans caught by refuge personnel and moved to southern Idaho in the winter of 1991. Of the 1219 Trumpeters captured and translocated, 1097 (90.0%) were caught by night-lighting, 92 (7.5%) by bait trapping, and 30 (2.5%) from snowmobiles.

Movements

Sixteen adult and seven juvenile Trumpeter Swans released at Bear Lake National Wildlife Refuge (NWR), Idaho, in Spring 1996 have been sighted at Jackson, Wyoming (2), Yellowstone Lake (2), and east of Idaho Falls (1). At least 10-12 remained at Bear Lake NWR until freeze-up on 28 November. Two mortalities have been documented to date. Since freeze-up, three birds (red collar U03, red collar U05, and green collar E37), which had been together most of the late summer and fall, were

found southeast of Porterville, California, on 3 January 1997 and were still together as of 25 January.

Thirty-one adult and two juvenile swans from the Preston release have been seen at Wheatland, Wyoming (1,) Daniel, Wyoming (1), Salt River, Wyoming (2), Swan Valley, Idaho (1), HSP (4), Cache Valley, Utah (3-5), and Bear River Club, Utah (2). At least 10 remained in the Riverdale/Preston vicinity in mid-December. No mortalities have been reported.

As of 15 December 1996, Ruth Shea's monitoring efforts had obtained 554 sightings of 225 unique individuals, excluding swans released in Utah. "In view of the unusual distribution of Trumpeters in the Tristate Region, the lack of sightings from outside the core Tristate Region is problematic. Only one neck banded Trumpeter, a Canadian migrant that was shot on Bear River Refuge, has been reported south of Idaho" (Ruth Shea, pers. comm.). Table 1 summarizes observations of marked Trumpeter Swans made between October 1996 and January 1997, both within and outside of the core Tristate Region.

CONCLUSIONS

Has the range expansion worked? I think it's too early to say. The population objective level at HSP was reached this year, at least for the short-term. However, efforts at making the habitat less attractive should be continued to make sure swan numbers do not increase. I guess the real question is, Where have these birds gone if there are 3000+ birds in this population? We know that some of the birds are definitely in California, but where are the rest? Ruth feels that "although data from within the Tristate Region indicate that RMP Trumpeters are becoming increasingly mobile and moving southward, observations this year of Trumpeters in other areas have been fewer than before range expansion efforts began." She suspects, and I would agree, that observer interest has waned over the years and that Trumpeters are very difficult to detect among large Tundra flocks. But it now appears they are definitely expanding their range beyond the Tristate Region.

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Table 1. Percent of observations of marked Trumpeter Swans within and outside of the traditional core wintering area, from 1 October 1996 through 10 January 1997. These data represent 420 locations of 253 individual swans. These data are somewhat dependent on the number of observers in each area; there were relatively few observers in the northeast and southeast quadrants of the core area during this period.

LOCATION	OBSERVATIONS
Core Area	
NW[a]	49% (297)
NE[b]	5% (23)
SE[c]	2% (10)
SW[d]	18% (74)
Outside Core Area	25% (106)

[a] Red Rock Lakes National Wildlife Refuge, Hebgen Lake, Ennis Lake, Island Park area of Idaho, Harriman State Park, Henrys Fork downstream to Ashton, Buffalo River area, Sheridan Reservoir

[a] Yellowstone National Park

[a] Teton National Park, Jackson Hole Area, National Elk Refuge

[d] Henrys Fork from Ashton to the confluence with the South Fork of the Snake River, South Fork of the Snake River from Palisade Dam to the confluence with the Henrys Fork, the main stem Snake River downstream to Idaho Falls, Teton River and vicinity, Camas National Wildlife Refuge, Mud Lake Wildlife Management Area, Market Lake Wildlife Management Area

TRUMPETER SWAN ROCKY MOUNTAIN POPULATION RANGE EXPANSION AND TUNDRA SWAN HUNTING: IS THERE A MIDDLE GROUND?

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Trumpeter Swans (*Cygnus buccinator*) are divided into three populations for management purposes in North America. Two of these populations occur within the Pacific Flyway, the Pacific Coast Population (PCP) and the Rocky Mountain Population (RMP). Both populations have exhibited continued population growth during the last 30 years (Caithamer 1996). Presently, there are no conflicts between the PCP and Tundra Swan (*C. columbianus*) hunting, primarily because outside of Alaska there is no hunting of Tundra Swans within the migration and winter range of the PCP and within Alaska the seasons are conducted north of the Trumpeter Swan breeding range. Management concerns have developed regarding the impacts of Tundra Swan hunts on Trumpeter Swans within the range of the RMP. The purpose of this presentation is to provide the views of the U. S. Fish and Wildlife Service (USFWS) regarding this situation.

Federally authorized hunting of Tundra Swans began in Utah in 1962. The Utah season was the first sport hunting of any swans authorized subsequent to the signing of the Migratory Bird Treaty in the United States. This Tundra Swan season has been extended to include portions of Montana, Nevada, and Alaska in the Pacific Flyway. Tundra Swan hunting has proven popular with hunters, and the opportunity to harvest a Tundra Swan is regarded as a trophy opportunity by most hunters. The management and hunt plans for Tundra Swans are the subject of a separate paper in this proceedings and, thus, not addressed in detail here.

The USFWS formalized general policies for Trumpeter/Tundra Swan management in 1989 (Hartwig 1989). The evolution of the general policies that serve as the basis of this statement were presented at a previous conference of The Trumpeter Swan Society (Bartonek 1984). In general, I would describe the policy as containing three separate parts.

1. A strong commitment to flyway management for all waterfowl species. This commitment includes recognition that the USFWS would continue to give strong consideration to recommendations forwarded by flyway councils based on endorsed programs.
2. Continued support for Tundra Swan hunting opportunities when consistent with approved flyway management and hunt plans.
3. General support of cooperative, multi-state programs for the restoration of migratory Trumpeter Swan populations.

Additionally, this policy guidance recognized that there would be times and places where the various interests and objectives of different constituencies would not conform to a single course of action. In these instances, the USFWS announced its intent to develop solutions on a case-by-case basis. RMP Trumpeter Swans proved to be one of those cases.

Presently, the chief focus of RMP Trumpeter Swan management is to constructively address the problem of increasing numbers of Trumpeter Swans wintering in the Tristate Region of Idaho, Montana, and Wyoming. A secondary, but related, concern is for the status of the breeding segment of the RMP that nests within the Tristate Region. Dispersal of the undesirable winter concentration of Trumpeter Swans, without causing adverse population impacts, has been the focus of these efforts. One of the many problems faced by this effort has been the potential for harvest of Trumpeter Swans in Tundra Swan seasons in states that might logically be expected to encounter Trumpeter Swans dispersed from the Tristate Region. The USFWS has focused on the development of Cooperative Flyway Management Plans as a mechanism for achieving consensus about goals, objectives, and strategies for the management of many migratory goose and swan populations. Efforts are currently underway to revise the RMP Trumpeter Swan Management Plan. In the current draft, the management plan acknowledges the difficulties posed by dispersing Trumpeter Swans into states or areas with an existing Tundra Swan

season. The draft plan endorses Bartonek *et al.*'s 1995 environmental assessment (Swan EA) and its preferred alternative as the best approach to addressing this situation.

The 1995 Swan EA considered four alternatives to address the situation that had developed in the Tristate Region in concert with the ongoing Tundra Swan seasons. These four alternatives were:

1. allow for the limited take of Trumpeter Swans in a restructured Tundra Swan season (preferred alternative),
2. no change from the existing hunting season regulations,
3. severely restrict or close Tundra Swan hunting, and
4. cease active Trumpeter Swan range expansion efforts.

Consideration was given to all four alternatives, and the USFWS subsequently endorsed the preferred alternative with a finding of no significant impact. The USFWS believes this alternative represents the middle ground between the competing interests of Trumpeter Swan restoration and Tundra Swan hunting. There is no doubt that this alternative was a compromise between several opposing viewpoints regarding this situation.

The compromise reached under the preferred alternative contained several changes to existing Tundra Swan seasons, allowed for the first limited legal harvest of Trumpeter Swans since the signing of the Migratory Bird Treaty, and was conditional on the development and implementation of an acceptable harvest monitoring procedure that would detect the presence of Trumpeter Swans in the Tundra Swan harvest. The USFWS is committed to this 5-year course of action and will likely base future management strategies for similar situations on the results of this 5-year experiment. The results obtained to date are encouraging and are described in other papers in this proceedings.

The one factor related to this situation not addressed in the 1995 Swan EA is the potential impact and role of the active translocation effort to Utah. The USFWS has been an active participant in this effort and believes that this action and attendant study were undertaken consistent with the policy guidelines previously discussed. At present, the number of transplanted swans killed as a result of translocations during the hunting season is a matter of concern. The USFWS and the Pacific Flyway states will review this program during the coming months and attempt to reconcile the various issues raised during the first year of this study.

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THE UTAH TRUMPETER SWAN REINTRODUCTION PROGRAM: PROPOSAL TO EVALUATE REINTRODUCTION SUCCESS

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ABSTRACT

We propose to reintroduce Trumpeter Swans (*Cygnus buccinator*) from the Rocky Mountain Population to Utah to encourage the establishment of a migratory pathway to southern wintering grounds. Our local goal is to evaluate whether wetlands around the Great Salt Lake, Utah, can serve as staging and/or wintering grounds and whether multiple translocations to Utah can support and enhance the long-term survival of Trumpeter Swans. We suggest a research program that will evaluate reintroduction success.

INTRODUCTION

Observed and projected increases in extinction rates within recent years (e.g. Myers 1988, Wilson 1989) focus attention on the value of biological diversity and techniques of conserving this diversity. Translocation, the "intentional release of individuals to the wild in order to establish, reestablish, or augment a population" (IUCN 1987, Griffith *et al.* 1989), of rare species appears to be an increasingly important conservation technique because habitats are becoming increasingly more fragmented due to human activity. Species with limited dispersal abilities or migratory knowledge are primarily affected by habitat degradation and fragmentation such that translocations may be the only solution for the conservation of those species (Griffith *et al.* 1989).

Reintroduction is the introduction of a species, obtained through a captive breeding program or captured in the wild, into its historical range (IUCN 1987). The goals of reintroductions are to:

1. enhance the long-term survival of the species,
2. reestablish an ecological and/or cultural keystone species,
3. increase or maintain biodiversity, and/or
4. provide long-term economic benefits to local people (Kleiman *et al.* 1994).

The conservation of species through reintroductions, however, can only be successful if certain criteria are met (Kleiman *et al.* 1994) and the introduced individuals are appropriately monitored after release (Sarrazin and Barbault 1996). Unfortunately, monitoring of reintroduced species usually does not occur or monitoring data are not published and, therefore, are not readily accessible.

Kleiman *et al.* (1994) suggested 13 criteria to plan and execute species reintroduction. They suggested that species introductions should only proceed if:

1. there is a need to augment the wild population,
2. the existing wild population is not jeopardized,
3. the released individuals are genetically similar to the original population, and
4. knowledge of the species' biology exists.

They also suggested that:

5. the causes of decline be removed,
6. the habitat is sufficiently protected and of good quality, and
7. the habitat is not saturated with potential competitors.

Finally, the authors suggested that:

8. the local human population should not be negatively impacted,
9. community support needs to exist,

10. government and non-government organizations need to be supportive and involved,
11. sufficient resources need to exist for the program,
12. reintroduction technology is known or in development, and
13. the program needs to comply with legislation and regulations.

Reintroductions should never be attempted without proper preparation (criteria evaluation), long-term monitoring, and follow-up data analysis. Much can be lost if the job is done haphazardly or introduction effects are not observed and analyzed for statistical and biological significance. Reintroduction programs contribute to ecology through conservation of species and extinction avoidance and through the understanding of ecological processes at the individual, population, and community level. Reintroductions, for example, create unique opportunities to assess the impact of introduced species on an established community (Sarrazin and Barbault 1996).

The persistence of the Rocky Mountain Population (RMP) of Trumpeter Swans (*Cygnus* buccinator) is still questionable, even though the population has increased from 66 recognized individuals in 1933 (Banko 1960) to approximately 3000 individuals in 1996 (U. S. Fish and Wildlife Service, pers. comm.). Apparently, 90 percent of the RMP winter in the Tristate Region (Subcommittee on Rocky Mountain Trumpeter Swans 1992), located at the junction of Idaho, Wyoming, and Montana borders. Because the RMP is concentrated during the winter, the persistence of the population is threatened by disease, harsh winters, and long-term deterioration of resources due to overgrazing by waterfowl and drought. Although the Tristate Region provides only limited resources during winter, most Trumpeter Swans apparently do not migrate further south to more favorable habitats.

We propose to reintroduce RMP Trumpeter Swans to Utah to encourage reestablishment of a migratory pathway to southern wintering grounds. We will evaluate whether the long-term survival of Trumpeter Swans is enhanced by multiple translocations to possible staging and/or wintering grounds in Utah. This is done by evaluating the reintroduction criteria as suggested by Kleiman *et al.* (1994) and by establishing a rigorous monitoring program. We suggest a proposal that will evaluate reintroduction success, keeping in mind that the reintroduction may not only positively or negatively affect Trumpeter Swans, but that Trumpeter Swans may positively or negatively affect the established local ecology of the Great Salt Lake wetlands.

METHODS

Study site

The Bear River Migratory Bird Refuge (BRMBR), located on the delta of the Bear River flowing into the Great Salt Lake, Utah, includes 74,000 acres of marshes, uplands, and open water areas. Dikes divide the refuge into five primary units that contain about 5000 acres each. Craner (1964) found that sago pondweed (*Potamogeton pectinatus*) and widgeon grass (*Ruppia maritima*) were the most abundant aquatic plants at BRMBR. Tundra Swans (*C. columbianus*) use the refuge as a staging area. Only a few Trumpeter Swans have been observed on BRMBR in the past.

Criteria evaluation

At this time, we propose a research program for criteria 5, 6, and 7, as listed above, because all other criteria are supported and do not currently need further research.

Criteria 5: Reintroduction of a species can only be successful if the causes of decline are removed.

Banko (1960) suggested that the RMP almost became extinct in the 1930s due to overharvesting of the swans for their valuable skins. Even though hunting may have been the primary cause for the decline, we cannot ignore alternative hypotheses for the low numbers in 1933, such as destruction of high quality breeding, staging, and wintering areas, or a catastrophic disease wiping out most of the population. Nevertheless, we will evaluate the vulnerability of Trumpeter Swans to hunting because Tundra Swans are hunted in Utah and Trumpeter Swans can easily be mistaken for Tundra Swans. Once Trumpeter Swan vulnerability to hunting is known, appropriate measures can be implemented in the Utah Tundra Swan hunting program.

We will examine Trumpeter Swan interactions with hunters by:

1. comparing vulnerability of Trumpeter and Tundra Swans to hunting and examining

possible mechanisms for differential vulnerabilities,
2. examining if hunting pressure drives Trumpeter Swan movement patterns and habitat selection, and
3. examining hunter attitudes towards Trumpeter Swans and analyzing management options that minimize hunting mortality of Trumpeter Swans.

Criteria 6: Reintroduction can only be successful if the habitat is sufficiently protected and a quality food resource exists.

Trumpeter Swans are herbivorous (Mitchell 1994). Evaluation of the aquatic vegetation at BRMBR and vicinity is crucial to understanding whether the translocation site can support the swans during staging or wintering. We will examine habitat suitability for translocated Trumpeter Swans by analyzing their habitat selection and foraging patterns. This will be done by:

1. creating isocline maps of BRMBR, including coverage of emergent and submergent macrophyte species and density and biomass of sago pondweed tubers. Water depth will also be mapped because water depth determines the maximum sediment depth at which an individual can forage.
2. measuring environmental variables at Trumpeter Swan foraging locations, obtained through visual observation and radio-tracking collared birds, and comparing them to random points on the refuge, and
3. describing the carrying capacity of BRMBR for Trumpeter Swans by quantifying sago pondweed tuber biomass consumption to detect a potential bottleneck for survival in the annual cycle.

Criteria 7: Reintroduction of Trumpeter Swans can only be successful if the habitat is not saturated with potential competitors.

Ecological theory suggests that species with similar body sizes may not exist in the same habitat and feed on the same resources (MacArthur 1958, Hutchinson 1959, Brown 1984, Belovsky 1986, Wiens 1989). Rather, one species will always be slightly more efficient in exploiting the resources and will outcompete the other species when resources are limiting. Alternatively, similar species may not compete when resources are abundant. In this case, similar species will be indifferent to each other and are able to coexist. At this time, we do not know how abundant resources are at BRMBR (Criteria 4) and how Trumpeter and Tundra Swans will react to potential resource limitation. We do know that a minimum of 30,000 Tundra Swans staged at BRMBR in November 1996 and that up to 15,000 Tundras winter on the refuge (Utah Division of Wildlife Resources, pers. comm.). Tundra Swans, like Trumpeter Swans, feed almost exclusively on sago pondweed tubers when staging or wintering on the refuge. Thus, resources may become limiting, especially during the winter months when ice-up occurs. Hutchinson (1959) suggested that species need to differ by at least three percent in body size measurements for coexistence in a resource limiting environment. Trumpeter and Tundra Swans are quite similar in body size measurements, differing less than three percent in body size measurements (Limpert and Earnst 1994, Mitchell 1994). It is likely that the two swan species will negatively affect each other through competition when resource limitation occurs.

We propose to examine mechanisms for coexistence between Trumpeter Swans and Tundra Swans by:

1. determining if and when resources are limiting during the fall and winter months,
2. observing any direct behavioral interactions between Trumpeter and Tundra Swans that could cause active or passive displacement from a feeding area, and
3. identifying potential indirect competitive interactions by observing differences in foraging efficiencies and differences in resource exploitation patterns (Brown 1989a, 1989b).

Monitoring

We are monitoring Trumpeter Swans day and night on BRMBR and vicinity through direct observations and radio telemetry. We have contacted wildlife managers in Utah, Nevada, California, and Idaho to report any sightings of Utah-released birds. Sighting data will suggest if a migratory route has been established.

SUMMARY

We propose a research program that evaluates criteria for successful reintroduction of Trumpeter Swans to Great Salt Lake wetlands. We especially

focus on evaluating food resources, observing interactions with Tundra Swans, and analyzing effects of Tundra Swan hunting on Trumpeter Swan survival. We also propose to monitor intra- and interstate migrations of Utah-released Trumpeter Swans to evaluate the establishment of a migratory path to southern wintering grounds.

ACKNOWLEDGMENTS

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TRUMPETER SWAN RANGE RESTORATION IN WYOMING

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ABSTRACT

Historically, remnant populations of Trumpeter Swans (*Cygnus buccinator*) existed in and near Jackson Lake, as reported by the Hayden expedition in September 1872. With the security offered by the Red Rock Lakes National Wildlife Refuge and Yellowstone National Park, the Tristate Subpopulation of swans began a slow increase. The Wyoming flock numbered 125 birds in September of 1995. That same year, 22 territories were occupied, with 12 pairs of swans actually nesting. Typically, the Wyoming flock produces 19 cygnets annually, and at that level apparently is providing stability to this flock. In an effort to increase nesting pairs and wintering birds in the state, Wyoming established a management plan and objectives. That plan states a goal of 70 territorial pairs by the year 2005, up from 30 occupied territories in 1995. Wild swans captured at Harriman State Park on the Henrys Fork River, Idaho, were transplanted to Wyoming beginning in 1990. Some 119 adults and cygnets were released on potential wintering sites in the state. In years to follow, a summer trapping effort at Red Rock Lakes National Wildlife Refuge captured 25 adults and cygnets and moved them to the Green River at Seedskadee National Wildlife Refuge in an effort to reestablish nesting pairs. By 1994, no nesting pairs had been established, and little winter range fidelity occurred as a result of the previous releases. Captive breeding and release of 80-day-old cygnets over the 3-year period from 1994 through 1996 created higher summer occupancy of territories than any previous release. An increased number of Trumpeters were observed on the Green River by the summer of 1996. Captive-reared cygnets of Red Rock Lakes origin have migrated as far as 600 miles and returned the following spring. Each year, the cygnets released as part of the Wyoming program have migrated outside the current range of the Tristate flock and the Rocky Mountain Population.

INTRODUCTION

The Hayden party, while exploring the Snake River in northwestern Wyoming, reported the presence of many beaver ponds and of Trumpeter Swans *(Cygnus buccinator)* on the Snake River near Jackson Lake (Bennett 1998). Many early explorers did not report Trumpeter Swans elsewhere in Wyoming in the late 1800s, and only a remnant population existed in the Yellowstone region, as noted by Hayden in 1875. This population of swans was labeled the Tristate population because it inhabited the area of northwestern Wyoming, eastern Idaho, and southern Montana. These birds were tied to the area around Yellowstone National Park (YNP) and survived the market hunting era by living in this remote and often harsh environment.

The harshness of the region resulted in few people using the area, thus providing a refuge for the last of the Trumpeter Swans. With the increased protection offered by Yellowstone National Park and the establishment of Red Rock Lakes National Wildlife Refuge, swan numbers began increasing in the Tristate Region.

The average number of Trumpeter Swans in the Tristate Subpopulation averaged 532 total birds for the period 1954-93 (Shea 1995). The Wyoming flock consisted of 105 adults and 17 cygnets in September of 1995, making up 23 percent of the Tristate Subpopulation. Yellowstone National Park summers 28 percent of the Wyoming flock, and the remaining 72 percent of the Wyoming flock summer in territories in Grand Teton National Park (GTNP), adjacent national forest, and private land in northwestern Wyoming. Cygnet production follows a similar trend with a larger number of young produced on territories outside YNP than within the park, 88 percent compared to 12 percent. Production for the entire Wyoming flock averages 19 cygnets annually.

In 1995, 22 pairs of swans occupied territories outside YNP, and 12 laid clutches. Of the pairs that laid clutches, five incubated but failed to hatch any

eggs, two hatched eggs but failed to fledge any young, and five successfully hatched and fledged young (Stevenson 1996). The number of occupied territories in 1995 was slightly less than the 7-year average of 23, and the number of total nesting pairs was average. The number of young fledged averaged 0.89 young per nesting pair over the period 1989-95. By 1995, the number of young increased to 1.25 young per pair.

The Wyoming flock is plagued with low productivity, yet the population is relatively stable. Population numbers stabilized by 1988. Surveys in 1985 indicated 70 adult birds, and by 1995 the population numbered over 100. Cygnet production continues to be low, but, in years with moderate winters, good water years, and mild springs, cygnets are produced and recruited into the population. The Wyoming flock is primarily sedentary, nesting in harsh mountain environments and wintering in lower elevation warm spring complexes often less than 50 miles apart.

In 1990, managers implemented a two-prong plan directed at increasing numbers of swans in the Wyoming flock. The plan stated two objectives, the first being to expand wintering areas and second to increase numbers of nesting birds wintering on winter ranges outside the current range of the Wyoming flock. Population goals were first established in 1994. Population estimates that same year suggested some 30 occupied territories existed in the current population, and a goal was established of 70 occupied territories by the year 2005.

HISTORICAL PERSPECTIVE

Efforts to increase winter distribution of swans was first initiated in 1990 with releases of a limited number of winter trapped and transplanted swans onto potential wintering sites in the Salt River drainage. These transplanted birds used the Salt River winter habitats but migrated out of Wyoming and used nesting areas in eastern Idaho.

In December of 1990, some 12 adults and 30 cygnets were released in a hard release on the Salt River. None of the adults were observed in later years, and 84 percent were never observed in Wyoming again. Of the cygnets released, four of the 30 (13 percent) were observed back on the Salt River in later years. Winter trapping and transplants to Wyoming winter ranges created consistent winter use patterns in 10 percent of the released birds but did not establish Wyoming nesting pairs linked to those Wyoming winter ranges. Seventy-eight percent of all released birds were not seen in Wyoming after the year of release.

In July of 1991, a group of 23 molting adults (7 males and 16 females) captured in Idaho were transplanted to Grays Lake National Wildlife Refuge (NWR), Idaho. The following winter, 74 percent of the released birds were observed on the Salt River in Wyoming. Those same birds appeared to have established a link between Grays Lake NWR summer habitats and winter habitat in Wyoming. These birds planted on suitable nesting areas discovered and utilized available winter range habitat that lay less than 20 miles from the summer habitat. Some 32 neck banded swans were observed wintering on the Salt River during surveys in November 1995.

A winter release of cygnets in December of 1990 showed the greatest success, as indicated by returning birds. The adult summer release on suitable nesting areas in Idaho, in proximity to a winter range in Wyoming, did result in almost immediate and consistent use of that winter range. The method, however, did not establish nesting birds in Wyoming associated with these Wyoming winter habitats even though suitable nesting habitat was available in Wyoming adjacent to these winter ranges.

In November of 1992, the same technique was used to increase swan use of other wintering sites in Wyoming. Some 36 birds (17 adults and 19 cygnets) were hard released on the Green River. A total of nine birds that were hard released in 1992 were observed in later years. Four were repeat users of Seedskadee National Wildlife Refuge (SNWR) in following winters. Two of these birds developed a summer use pattern and were observed between 1992 and 1994 on the Green River. These two birds were apparently summering and wintering in the state through 1995, some 3 years following the release. One of these birds remained in the area during later years, and the other was observed in the area near Jackson, Wyoming, in May of 1995. These two birds were adults when released on the Green River in July of 1992. A total of 95 percent of the adults were not seen in years following the release. The cygnets, however, did apparently create a use pattern, and 31 percent were observed again on the

Green River at SNWR. Three of the four cygnets using the area were observed summering in Canada the year following the release, suggesting they were originally Canadian stock.

Early Wyoming releases utilized wild trapped and transplanted birds of both adult and cygnet age classes. Of the releases through 1992, 119 birds were released, of which 33 were adults and 86 cygnets. Of these, only 12 birds (10 percent) were observed in later years, and the greatest proportion were not observed in Wyoming again. Of the 12 birds observed, 11 (92 percent) were released as cygnets in the initial release. A total of 8 cygnets (9 percent) remained true to the release site, returning to that site in following winters.

Winter range use has been established in two of the Wyoming wintering areas. The Salt River has had the greatest increase in birds and the Green River at SNWR to a lesser degree. Only two of the 119 released birds ever remained in Wyoming as a result of hard releases of wild birds during the summer or winter.

In 1994, Wyoming developed a management plan establishing management goals at a desired level of 70 territorial pairs by the year 2005. Techniques utilized to date have attempted to increase distribution of wintering birds, hoping that some birds would nest in Wyoming and, thereby, expand summer distribution.

Early releases established some winter use patterns for birds transplanted to the new locations. Some 3-4 years later, transplanted birds had not established nesting pairs in Wyoming associated with the available winter ranges. Essentially, the birds using the Wyoming winter ranges were Idaho birds transplanted to Grays Lake NWR or Canadian stock that was transplanted during the winter trap and removal of birds from the Henrys Fork. Adults transplanted to SNWR showed little winter range fidelity to the new winter range in later years. Cygnets were apparently the birds that established fidelity to their winter transplant site and used that site in successive winters. It is logical to assume that cygnets and adults trapped on wintering areas had already completed one leg of the migration to the Henrys Fork when captured. These birds were trapped and moved further south by vehicle. Knowledge of the natal site and the partial migration from that site to the wintering area may have resulted in many of the cygnets leaving the wintering area and attempting to return to the natal area. Adults that are highly traditional probably returned to their original migration patterns. Few of those birds were seen in following years on the wintering sites to which they had been transplanted.

In attempts to create winter use of Wyoming winter range sites by Wyoming birds, an effort was initiated in 1993 to develop a captive flock, hatch captive eggs and/or salvage eggs, and release the cygnets on suitable summer nesting areas in Wyoming. Using cygnets imprinted on summer natal areas, in this case the release sites, might assure that those birds returned there to nest after migrating to wintering areas. The assumptions were premised on earlier studies of waterfowl nesting fidelity.

Much of the waterfowl literature discusses female Anatidae returning to natal areas, yet no similar summaries have been established for natal fidelity in Cygnus. In the Genera Anser, information suggests that last year's young return with the adults to the natal areas the following spring, thereby learning and perpetuating traditional migration routes (Bellrose 1976). Plans were formulated to test the use of cygnets to reestablish migrations in the Tristate Subpopulation.

Wyoming embarked on a captive-rearing program in an effort to provide cygnets for this project to reestablish migration. This effort addressed the second objective by establishing nesting swans outside of the current Tristate Subpopulation boundaries that were migratory to wintering areas outside of the current winter distribution of the Tristate Subpopulation.

CAPTIVE BREEDING

In cooperation with a private nonprofit group, the Wyoming Wetland Society (WWS), a fund was established for the propagation and release of captive-reared cygnets. Salvaged wild eggs were also used, and the young raised from these eggs were reared in captivity then released into the wild. The effort was patterned after work done earlier in the Minnesota swan restoration program.

Instead of releasing 2-year-old birds (18-20 months), as was typical of early release programs in Minnesota and other eastern states, a release program of entirely cygnets was implemented. The idea was to release only cygnets to the upper Green

River and allow the birds to drift down drainage to wintering areas that they might discover, either in Wyoming or more southern states along the Green River corridor. This down-drainage drift would create a migratory tradition and become the seed for future migrations.

RELEASE SITE SELECTION

The Green River was selected as the potential release site because it was an open-ended valley that would allow the unsupervised cygnets to drift down the drainage as winter ice-up conditions forced migration. The upper Green River has no winter habitat, so the birds would be forced to migrate.

Earlier work by Lockman *et al.* (1985) described the Green River as suitable nesting habitat with little winter habitat. The Green River drainage and the Snake River drainage are separated by the Gros Ventre mountain range. That mountain range is the separation line between the current range of the sedentary Tristate flock and unoccupied summer and winter habitat to the south. The two flocks, newly established birds in the Green River drainage and those already in the Snake River valley, would be adjacent and could possibly be linked once the southern migration was established using the Green River corridor.

The Green River flows southerly from its headwaters in the Wind River Mountains. The drainage opens towards the great basin area known as the Colorado Plateau. That plateau extends into southern Utah, Colorado, Arizona, and New Mexico and would offer more moderate climate and suitable wintering areas.

METHODOLOGY

Inventoried wetlands in the Green River drainage were checked for a suitable soft-release site. A release site was considered suitable if it had ponds with a loafing area with good visibility, a pond small enough to fence but large enough to provide room for flight, and a site with adequate aquatics for foraging. An ideal release site would be a core wetland associated with other wetlands in close proximity. Wetlands on private, national forest, and Bureau of Land Management land were also checked for suitability (Stevenson 1995, 1996). Various sites were inventoried, and a site on Bureau of Land Management lands in the New Fork Pothole area was selected. The New Fork Potholes region is part of an ongoing North American Waterfowl Joint Ventures project initiated in 1993.

Cygnets were hatched and raised at a captive breeding facility operated by the Trumpeter Swan Fund (TSF) working under the nonprofit WWS. Eggs were also salvaged from sites which had failed historically or which were threatened by flooding.

In 1994, a pair produced and raised the first four cygnets to be released. In 1995 and 1996, pairs were manipulated to increase clutches. The first five eggs laid were removed, a wooden egg left in the nest, and the eggs moved to incubating Mute Swans (*C. olor*). In an effort to increase hatching success, these Trumpeter Swan eggs were incubated by Mute Swans for the first 10 days before being placed in incubators. No eggs were incubated full-term and hatched by Mute Swans.

Cygnets that hatched in incubators were imprinted at hatch on a puppet combined with vocalizations taped from adult Trumpeter Swans with cygnets. At 10 days of age, cygnets were placed in 8' x 8' brooder boxes, manufactured using 1" chicken wire and a small loafing platform. These pens were placed inside a larger pen occupied by a lone adult or a nonproductive pair. This method allowed the cygnets to bond to an adult that would later be used as a foster bird in the soft-release pen.

The cygnets were held in the brooder box pen until 3-weeks of age and then released into the larger pen with the adult or pair. All adults accepted or tolerated the cygnets. Cygnets were held in these pens until 70-80 days of age, at which time they had achieved a weight of between 12-15 lb. Weight was critical because smaller birds tended to go through the hog panels that were used in the soft-release pens.

Cygnets were captured on the day they were to be taken to the release site and banded with the USFWS leg band and a second split-design color-coded leg band. These color-coded leg bands, used in 1994, lost their anodizing after one year and/or birds lost the band. Later in the program, that design band was replaced with a new, riveted design. Color coding allowed birds to be monitored as to year of release to determine survivability.

Cygnets were also marked on the right wing, using a red Rhodamine B base diluted with ethyl alcohol. That dye, when dry, appeared dark pink and was

noticeable on free flying birds from over half-a-mile away. Early released birds, when sitting on water, were hard to identify ,so dye was brought up onto the shoulder of the bird to facilitate observation of marked birds. The dye remained on the birds until the following year wing feather molt, and, on some birds, the dye was retained for a second year. The dye was visible on the yearlings on the underwing coverts at the wrist joint. Numerous reports were received from waterfowl hunters of marked birds along the migration path simply because of the color markings.

Cygnets were released into the soft-release pen without an adult in 1994, then with clipped or pinioned foster adults in 1995 and 1996. Cygnets became flighted between 110- to 120-days-old, and they often flew out of the fenced area before it was opened. Cygnets were provided pellet turkey feed in garbage can feeders, which provided a transition to the diet of primarily aquatic plants by 100-days of age.

Once flighted, the birds practiced flights inside the pen and later began to explore wetlands in proximity to the release site. When an adult was placed with the cygnets, as was done in 1995 and 1996, the adult was removed when the cygnets began leaving the adult and exploring on their own. Cygnets generally stayed in the area of the release site and began exploring at greater and greater distances as shallower ponds began freezing in the area. Freezing conditions reduced foraging options, and the birds initiated migration.

Migrations occurred in mid-November of 1994, mid-December of 1995, and early December of 1996. The 1994 birds left the area without adults, whereas the 1995 and 1996 cygnets grouped with some other birds during migration. Migrations were into southwest Utah in 1994, accomplishing a 600-mile migration, and released birds returned to the release area the following summer. The 1995 migration was a shorter migration, to SNWR, where some of the older birds left the cygnets and migrated to wintering areas used in 1994 and 1995. In 1996, some of the released cygnets were observed at SNWR, on the Green River, at Ouray National Wildlife Refuge in Utah, and some wintered elsewhere. The 1995 birds were also observed back on the summer release site when three of those birds molted on the release pond.

Monitoring of survival and migration is by means of the colored wing mark when the birds are cygnets and later using the color-coded leg bands. The color-coded leg bands allow monitoring of the age class of birds, not individuals. Only one of the birds was neck banded after it returned during molt the following summer. No cygnets were marked with neck bands in an effort to reduce any possible mortality that might result from the collar or ice-up of the collar on wintering areas.

SUMMARY

Several release techniques were used in Wyoming in an effort to establish, or reestablish, migrations from the Tristate Region and to create new nesting populations not associated with the core wintering areas. These efforts were initiated to give some depth to the Wyoming flock to prevent loss of the flock as a result of a single catastrophic event.

Early releases utilized birds captured on wintering areas in Idaho comprised of adults and cygnets (119), summer molting groups comprised of adults and cygnets (25) and summer release of captive-raised cygnets (23). All released birds migrated to and wintered in areas not previously used by the Rocky Mountain Population. No known nesting occurred nor were any territories established by wild stock transplanted to other locations. Captive-reared cygnets released in potential nesting habitats not only imprinted on those sites, but also apparently created links to wintering areas outside the Tristate Subpopulation range and then returned to the release sites as if they were natal areas. Wild birds caught and released on summer and winter sites showed little site fidelity.

As a result of the 23 cygnets released in the program, an increase in Trumpeters summering in the Green River drainage was noticed by 1996. Several generations of birds were apparent, and preliminary pair bonding was occurring. Three cygnets migrated and returned to summer and to molt on a nearby wetland. Apparent strong site fidelity was established by captive-reared Red Rock Lakes stock. These swans linked wintering areas outside the Tristate Region with summer nesting sites also outside the range of the Tristate Subpopulation.

Wyoming continues to strive to increase numbers of swans nesting and wintering outside the Tristate Subpopulation core range. The population objectives

stated in the 1994 planning documents are a goal that appears attainable once breeding pairs establish and begin producing young, but over a longer period of time than first stated. Over time, linking the sedentary population in the Snake River drainage with the more migratory flock in the Green River area will help provide stability to this subpopulation. This effort will insure Trumpeter Swans are always a part of Wyoming's avifauna.

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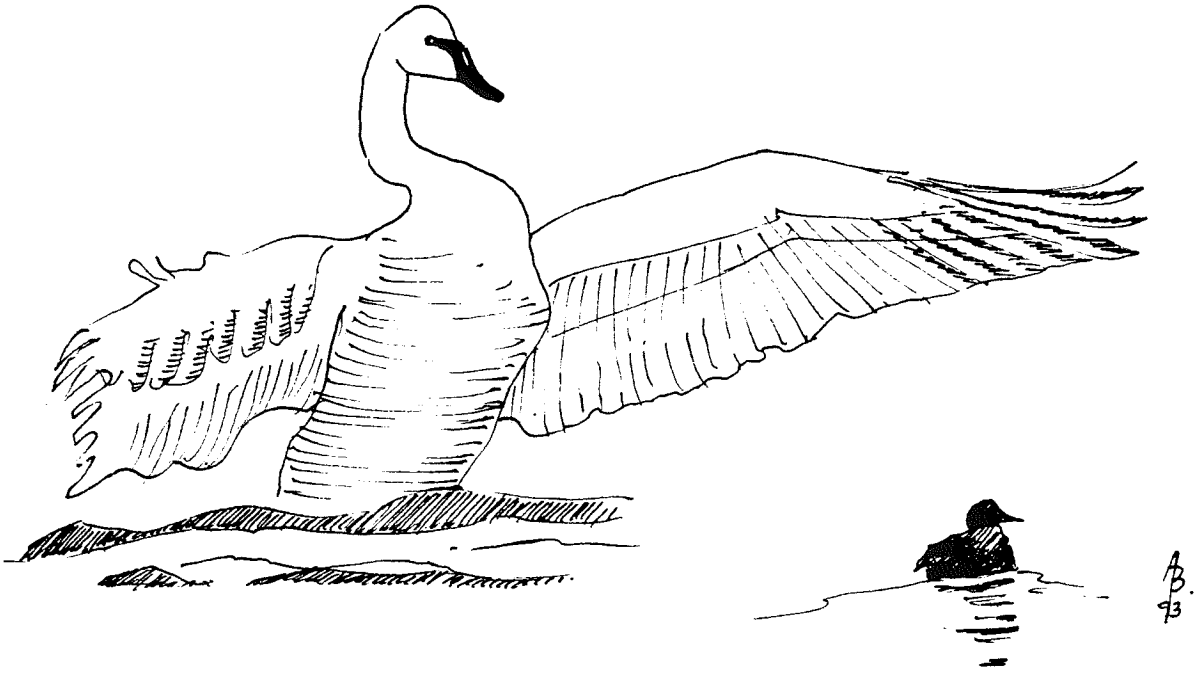
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1995 CENSUS OF TRUMPETER SWANS ON ALASKAN NESTING HABITATS

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ABSTRACT

The sixth complete census of Trumpeter Swans (*Cygnus buccinator*) on their Alaska summering grounds was completed in 1995. Over 700 hours of flight time was expended by numerous survey crews to fly 90 726 km of survey tracks, compared to 82 645 km surveyed in 1990. Surveys were conducted over all the potential swan habitat depicted on 674 USGS 1:63 360 scale maps, compared to 625 in 1990. The adult/subadult population was comprised of 7946 paired birds (+13% compared to 1990), 859 singles (+33%), and 3184 birds in flocks (+56%), making a total of 11 989 white swans (+23%). There were 3834 cygnets (+7%), accounting for 24% (27% in 1990) of the total population of 15 823 swans (+19%). 1218 broods were found (+8%), for an average brood size of 3.1 (3.2 in 1990). Although the population of Trumpeters summering in Alaska continues to follow a logistic growth curve, a comprehensive Alaska Trumpeter Swan management plan is still needed to ensure that they remain an integral part of each geographical unit of their present distribution. The continual loss of Pacific Coast wintering habitat is of special concern. In Alaska, a combined program of complete censuses every 5 years and random sampling for interim years is recommended to provide the high quality data needed for the best management of this resource.

INTRODUCTION

The U. S. Fish and Wildlife Service (USFWS) conducted complete censuses of Trumpeter Swan (*Cygnus buccinator*) summer populations in Alaska in 1968, 1975, 1980, 1985, 1990, and 1995 (Hansen *et al.* 1971, King 1976, King and Conant 1981, Conant *et al.* 1988, Conant *et al.* 1992). Because of the projected increase in the summer population, many survey crews and aircraft were needed at the outset to ensure completion of the 1995 census. A total of over 700 hours of flight time was expended to fly 90 726 km of survey tracks over all the potential Trumpeter Swan habitat. The survey was initiated on 31 July and terminated on 29 August. The primary survey aircraft used were a specially modified turbine-powered deHavilland Beaver, Cessna 185s, Cessna 206s, and Piper Supercubs. The integrated computer system developed in 1985 to enter all attribute data and digitize the latitude and longitude of each observation was converted to IBM format in 1990 and was used again this year. Various map overlays and summaries of all Trumpeter survey data are available upon request from the Migratory Bird Management Office (MBMO) of the USFWS in Juneau, Alaska.

SURVEY AREAS

A total of 674 U. S. Geological Survey (USGS) quadrangle maps were censused in 11 separate Trumpeter Swan nesting areas in Alaska (Figure 1). Most of these 11 units were delineated on the basis of significant geographical features such as large drainages and mountain ranges.

METHODS

The aerial survey technique used small aircraft to put observers over all known or suspected Trumpeter Swan summer habitat (King 1973). Observations were recorded directly on 1:63 360 scale USGS maps. Generally, a system of parallel tracks were flown within each quadrangle map at an altitude of 150-180 m above ground. Pilot-biologists were responsible for navigation, for ensuring that all habitat was adequately searched, and for finding all swans. Consideration was given to factors such as

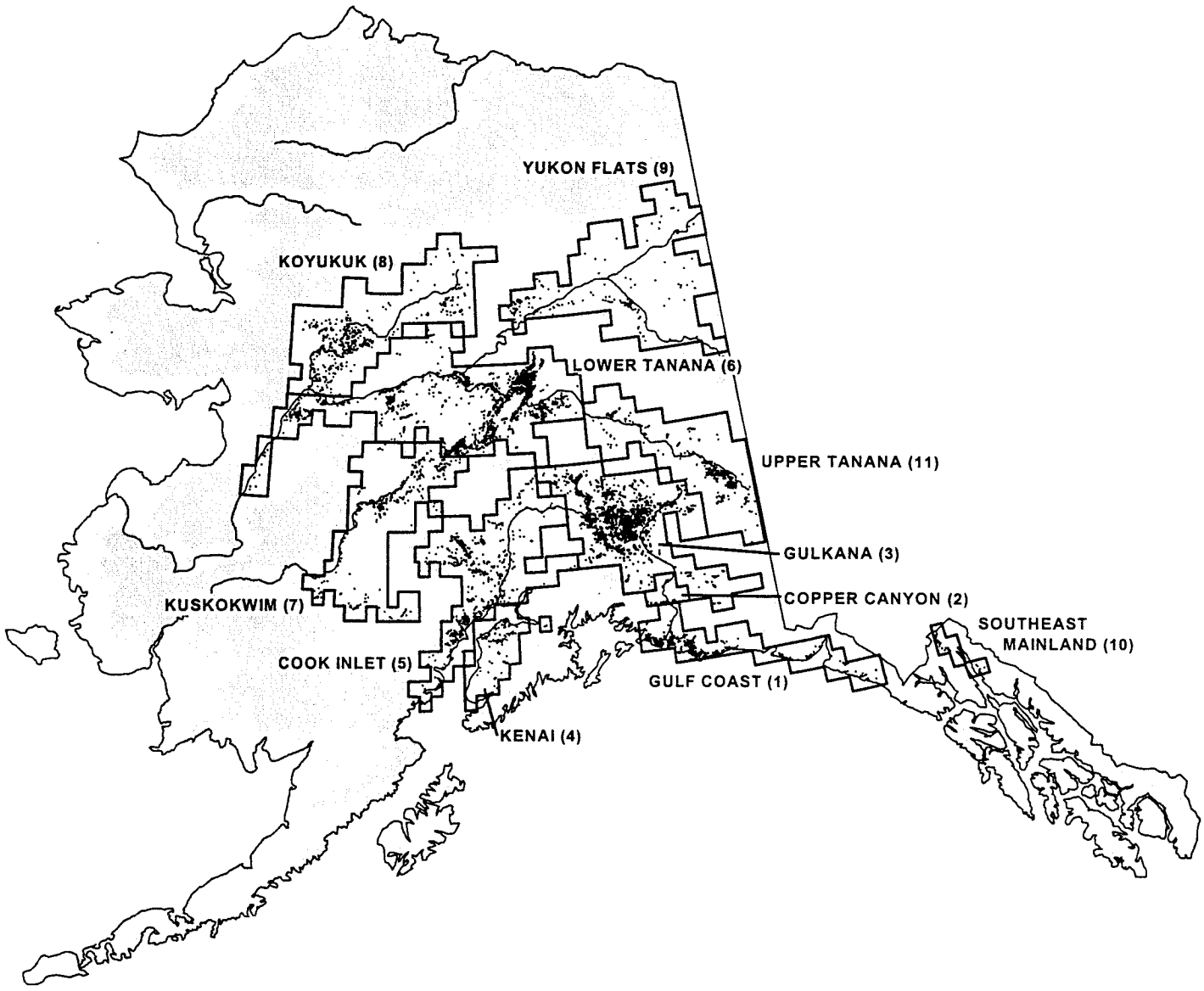


Figure 1. Eleven delineated units used to survey summering Trumpeter Swan in Alaska, covering 674 USGS maps of 1:63360 scale. Each of the 5395 points represents a swan observation made during the 1995 census.

sun glare and observer experience. The primary observer was responsible for tracking the flight path on the maps, making swan observations, and recording them by type, number, and precise location. When non-wildlife pilots did the flying, all of these duties were performed by the primary observers. In some cases, secondary observers were used to increase detections made from the aircraft. Figure 2 defines the protocol followed by all contributors to the Alaska swan database.

Swan attribute data from completed maps were entered into an IBM-compatible PC computer. The exact latitude and longitude of each sighting was determined from the original survey maps with a IBM compatible/Altek digitizing system in Juneau. These coordinates were then merged with the attribute data. The combined data are stored in a IBM-compatible PC in Juneau, which serves as the primary data storage bank for all Trumpeter census data for Alaska. Transparent map overlays, points on computer-generated maps of any scale

Table 2. Protocol used for state wide Trumpeter Swan surveys in Alaska

TRUMPETER AND TUNDRA SWAN SURVEY PROTOCOL-1995

The Alaska Region of the U.S. Fish and Wildlife Service (USFWS) has, over the years, developed field survey techniques and data archival procedures for Trumpeter and Tundra Swan surveys conducted in Alaska. An efficient, computer based data storage and retrieval system has evolved from which many useful products can be derived. The following protocol has been developed to enhance the standardization of data gathering and entry into the state-wide data base. This growing stockpile of Alaskan Swan data is increasing in value. We encourage all collectors of swan data to follow this protocol and contribute to the standard data base. All data and inquiries should be submitted directly to:

U.S. Fish and Wildlife Service
Migratory Bird Management
3000 Vintage Blvd., Suite 240
Juneau, AK 99801-7100

Keep in mind that, since the computer data entry system is specifically designed around the swan survey protocol, even slight deviations from the protocol can present major setbacks. Following these guidelines as closely as possible will help facilitate an efficient operation and reduce errors resulting from interpretation of non-standard data. Computer generated products can only reflect the quality of the data entered.

PROTOCOL:
Trumpeter Swans - Survey completely all swan habitat within whole U.S. Geological Survey (USGS) 1:63,360 scale maps.

Tundra Swans - Survey completely all swan habitat within whole or 1/4 quadrants of USGS 1;63,360 scale maps.

1. Sample units should consist of an entire 1:63,360 scale topographic map, or a one-quarter block of the map. Quarter blocks consist of NW, NE, SE, and SW quadrants of a map. Cover all known or suspected swan habitat within each sample unit (whole map or 1/4 map). The sample unit serves as a subsample of available habitat with known boundaries that can be surveyed on a regular basis. For areas where 1:63,360 scale maps are unavailable, 1:250,000 scale maps can be used, but record data sequentially for each sample unit (1:63,360 map or 1/4 map).

2. Record flight line enroute to assure complete coverage of the map. Include a date (month/day/year) each time a flight line enters the sample unit. Display of flight lines with occasional directional arrows on the base maps also helps the person digitizing the observations (see example below).

3. Mark each observation on the map with a small dot to indicate the precise location. Do not circle observation numbers as this tends to obscure both numbers and observation points. Number all observations per sample unit (complete or 1/4 map) sequentially, and record the appropriate attributes along the map margin (do not use alpha characters, e.g., 1a, 1b, etc.). Recording data on separate sheets is not recommended. Where swans are dense it is important to concentrate your efforts on accurate counts and less precise positions.

4. Record the names of all pilot(s) and all observer(s) directly on each map.

5. Use this standard set of abbreviations for recording attributes on map margins (see example below).

Pr = Pair (do not use "P" or "2")
S = Single (do not use "1")
Flk = Flock (do not use "F" orF1")
\+ = and
N = Nest
( ) = eggs

a. Pr. (pair)
b. Pr + 6 (pair + 6 young)
c. Flk 7 (flock of 7)
d. S (single)
e. S + 5 (single + 5 young)
f. O + 4 (no adults, 4 young)
g. Pr. + N (pair + nest)
h. S + N (single + nest)
i. N(5) (nest w/5 eggs)

The following suggestions are offered to help avoid some typical problems we have encountered both during swan surveys and during the swan map digitizing.

1. Before submitting maps for digitizing, make absolutely sure all numbered attribute data have corresponding numbered observation points on the map and visa-versa. The "map review" is best done soon after the survey (preferably the same day) so that the observer can recall any omitted data.

2. Include only swan attribute data in the sequential list (i.e., do not include incidental species such as geese, moose, etc.).

3. Plot and number observations only within the map boundaries. Any observations made outside map boundaries should be transferred to the appropriate map.

4. Do not include observations from more than one sample unit in a sequential numbering system (i.e., each 1:63,360 quad or 1/4 quad must have its own, discreet attribute numbering system). When 1:250,000 scale maps are used, include a new numbering sequence for each 1:63,360 scale quad or 1/4 quad unit.

5. When submitting maps for digitizing, include only one original or copy of each map. If data were gathered on two maps, transcribe them onto one map with one sequential numbering system.

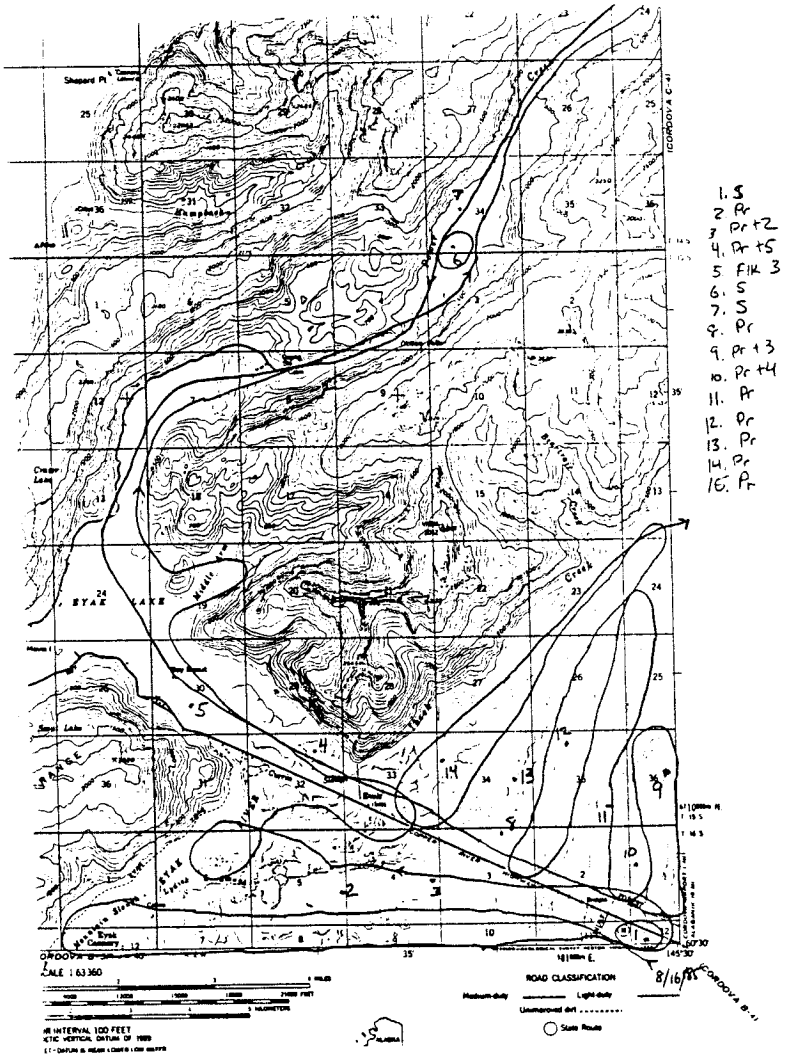
6. Try not to fold maps, and do not send maps folded (use tubes for mailing).

7. Try to get into the habit of recording all observations with the map oriented so that North is at the top (see example below).

8. Original survey maps are desirable to reduce possible transcription errors and reduce the field work. They must be legible and should be sent by certified mail or via an express mail service or at least copies kept at field stations to guard against loss during transit.

If you have any questions regarding the protocol described above, please call (907)586-7244 before submitting survey maps for digitizing.

Here is an example (reduced) of how a typical survey map should be submitted.



(e.g. Figure 1), tabular summaries, and computer-drawn graphs are examples of products that can be easily produced. Figure 3 shows examples of mapping products (reduced in size) that are available.

RESULTS

15 823 Trumpeter Swans were observed during the 1995 surveys, up 19% from 1990. Results of the six statewide Trumpeter Swan censuses, conducted approximately every 5 years since 1968, show how the population has increased in size (Table 1, Figure 4). Numbers for single plus paired swans and the subtotal for all white swans (birds more than 1-year old) best show this population growth.

In 1995, there were 3184 swans in flocks, 7946 paired adults, and 859 single swans observed, making a total of 11 989 white swans. Compared to 1990, the number of swans in flocks was up 56%, paired adults was up 13%, single swans was up 33%, and total white swans was up 23%.

The trend in numbers of white swans recorded for the six statewide counts varies by unit (Table 1, Figure 5). Increases in the density of swan numbers since 1975 is demonstrated by the increase in white swans recorded in units 1, 3, 5, and 6. Continued expansion of Trumpeters into the peripheral habitat in unit 3 and units 6-11 is shown in Table 1. This expansion is also evident by the increase in number of USGS maps surveyed within unit 3 and units 5-9.

Trumpeter Swan production, as measured in late summer, is summarized in Table 2 for the six census years. Average production is indicated by the values for average brood size, percent juvenile, and percent of pairs with broods. The number of cygnets and the number of broods both increased slightly, up 7-8% from 1990 to 1995. In 1995, there were 3834 cygnets, comprising 24% of the total population, compared to 27% of the population in 1990. 1218 broods were found, for an average brood size of 3.1 (3.2 in 1990).

Statewide distribution of all observation points for each of the six census years is shown in Figure 6. Figure 7 gives a comparison of the distribution patterns by unit for 1990 and 1995.

DISCUSSION

The 1995 census documented a slight decrease in the statewide annual rate of production from the 1990 census and from the overall average of the six censuses. Significant decreases were noted in the Gulf Coast, Cook Inlet, Yukon Flats, and Upper Tanana (units 1, 5, 9, and 11) probably due primarily to the cool wet summer weather in those areas. Other areas, notably Gulkana, Lower Tanana, Kuskokwim, Koyukuk, and Southeast Mainland (units 3, 6, 7, 8, and 10) experienced average or slightly above average rates of production, mainly the result of an early spring breakup (Conant and Groves 1995).

The summering population of Trumpeter Swans continues to increase in Alaska but below the exponential rate of increase experienced in recent years. This continued growth is best reflected by the increase in the number of white swans recorded since 1968 (Figures 4, 8, and 9). Obviously, the population increase can not be sustained indefinitely, but it is still not apparent when the total summering population of Trumpeter Swans in Alaska will stabilize or even reverse.

A comparison of the population projections from 1990 and from 1995 shows that peak numbers projected now will be lower than previously predicted (Figure 10). The habitat appears to be saturated in the Gulf Coast (unit 1), Copper Canyon (unit 2), Kenai (unit 4), and Cook Inlet (unit 5) areas. For other units, various rates of increase have occurred (Figure 5). There appears to be a large amount of summer habitat (approximately 23 000 km^2) available on the Yukon Flats (unit 9) which is just beginning to fill with swans. The density of swan use in some of what is apparently the best habitat is still increasing (Gulkana, unit 3). Peripheral habitat is still being pioneered noticeably in the Gulkana (unit 3), Lower Tanana (unit 6), Kuskokwim (unit 7), Koyukuk (unit 8), and Upper Tanana (unit 11) areas.

If the earth is indeed warming as some suggest, more habitat may become available, and the increase may be sustained for some unknown period of time. Past or future limiting factors are not readily apparent, although there is continual loss of wintering habitat. Planned additional analyses of these data for the adequacy of each census coverage and population

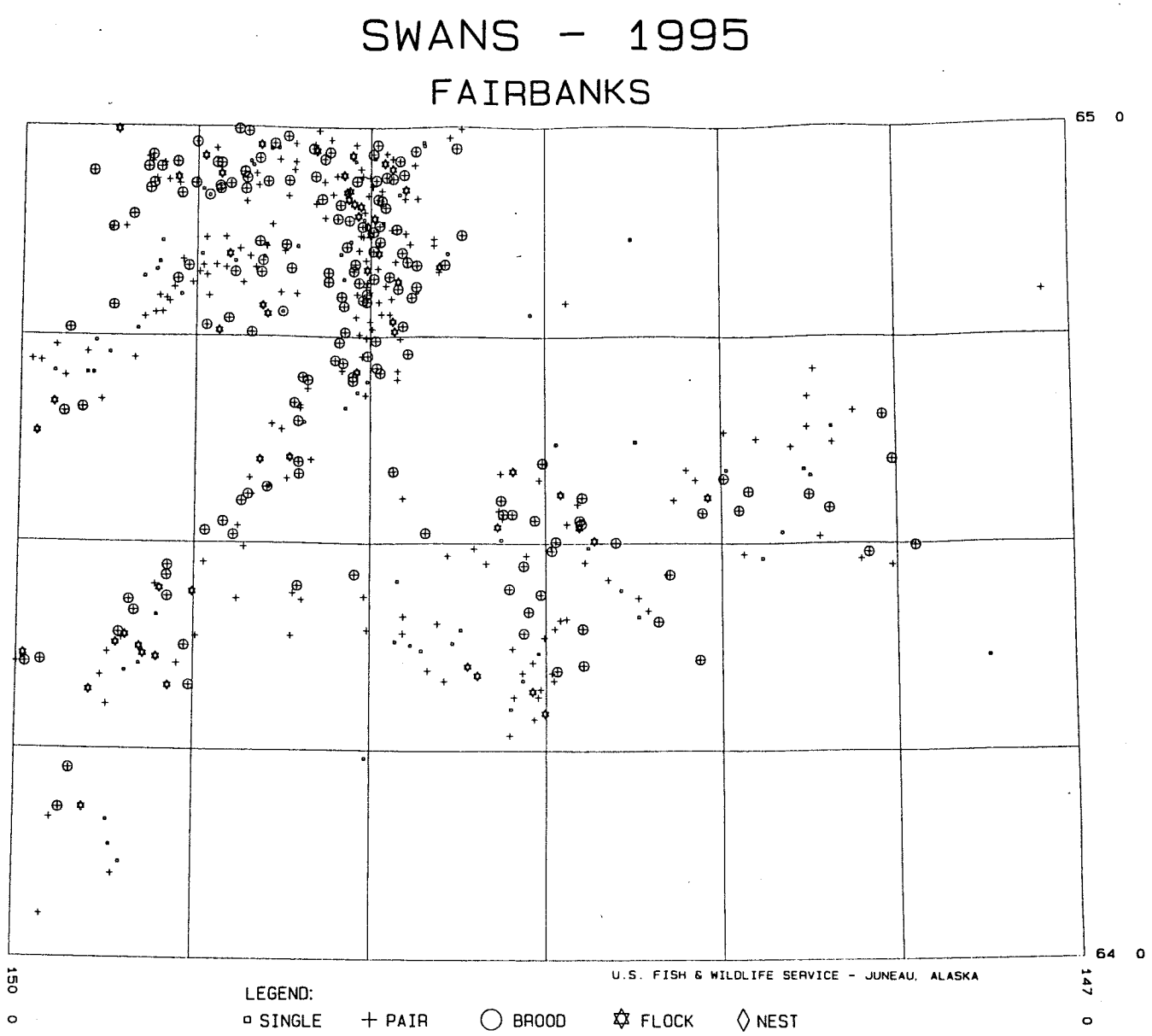


Figure 3a. Example of an overlay (reduced in size) for a U. S. Geological Survey 1:250 000 scale map, one of several mapping products that are available from the Alaska swan database.

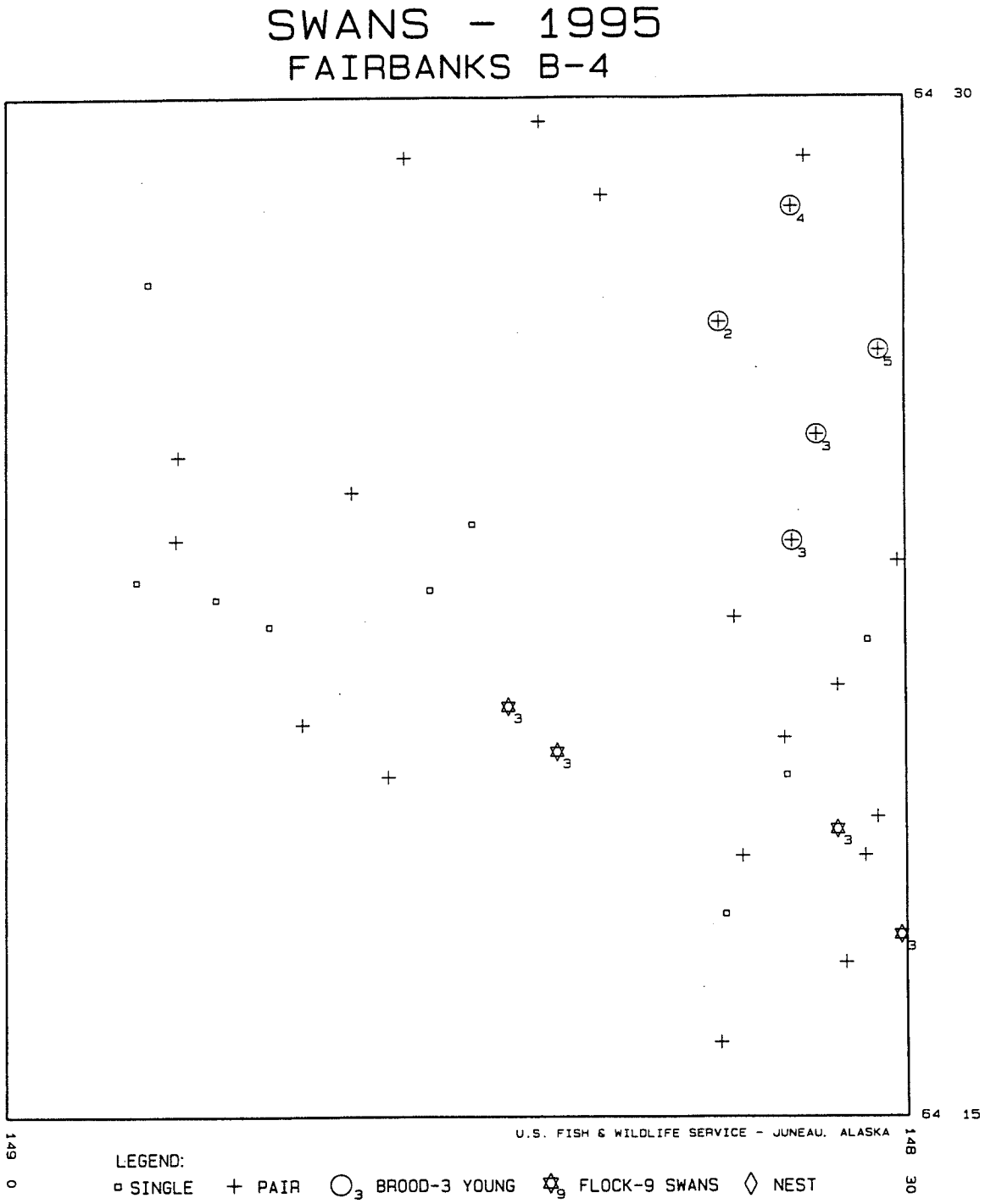


Figure 3b. Example of an overlay (reduced in size) for a U. S. Geological Survey 1:63 360 scale map, one of several mapping products that are available from the Alaska swan database.

Table 1. Summary of six Alaska Trumpeter Swan censuses, conducted in August and early September between 1968 and 1995, by census unit.

Unit	Year	White Swans in Pairs	White Swans as Singles	White Swans in Flocks	Total White	Cygnets	Total Swans
1 Gulf Coast	68	442	29	191	662	363	1025
	75	442	32	190	664	193	857
	80	586	52	266	904	351	1255
	85	778	76	440	1294	164	1458
	90	666	59	205	930	434	1364
	95	628	72	295	995	150	1145
2 Copper Canyon	68	56	5	53	114	44	158
	75	56	2	72	130	49	179
	80	70	4	33	107	33	140
	85	74	8	108	190	11	201
	90	88	7	0	95	21	116
	95	76	7	15	98	21	119
3 Gulkana	68	288	31	81	400	190	590
	75	556	43	155	754	284	1038
	80	1026	42	632	1700	660	2360
	85	1736	143	595	2474	533	3007
	90	2142	225	776	3143	778	3921
	95	2332	280	965	3577	1002	4579
4 Kenai	68	86	3	27	116	65	181
	75	72	5	29	106	39	145
	80	90	12	8	110	65	175
	85	92	5	40	137	51	188
	90	114	5	7	126	78	204
	95	130	11	29	170	79	249
5 Cook Inlet	68	224	19	50	293	124	417
	75	340	36	60	436	181	617
	80	608	38	186	832	369	1201
	85	800	66	454	1320	241	1561
	90	904	79	162	1145	516	1661
	95	838	91	269	1198	330	1528
6 Lower Tanana (Fairbanks)	68	224	21	94	339	137	476
	75	518	21	185	724	388	1112
	80	746	16	585	1347	773	2120
	85	1202	113	426	1741	503	2244
	90	2070	179	559	2808	1072	3880
	95	2268	219	987	3474	1315	4789
7 Kuskokwim (McGrath)	68						
	75	20	6	4	30	7	37
	80	60	0	22	82	63	145
	85	122	0	62	184	55	239
	90	386	21	141	548	233	781
	95	454	42	134	630	248	878
8 Koyukuk	68						
	75	94	6	45	145	35	180
	80	124	4	27	155	104	259
	85	206	23	29	258	45	303
	90	366	40	86	492	133	625
	95	524	56	158	738	228	966
9 Yukon Flats (Ft. Yukon)	68						
	75	2	0	0	2	1	3
	80	2	0	0	2	4	6
	85	10	0	0	10	3	13
	90	66	8	22	96	56	152
	95	200	26	107	333	90	423
10 S.E. Mainland	68						
	75	2	0	0	2	0	2
	80	6	0	3	9	11	20
	85	16	1	7	24	16	40
	90	34	1	23	58	50	108
	95	58	2	18	78	61	139
11 Upper Tanana (Fairbanks)	68						
	75						
	80	6	1	4	11	4	15
	85	84	14	43	141	64	205
	90	220	23	58	301	224	525
	95	438	53	207	698	310	1008
Total	68	1320	108	496	1924	923	2847
	75	2102	151	740	2993	1177	4170
	80	3324	169	1766	5259	2437	7696
	85	5120	449	2204	7773	1686	9459
	90	7056	647	2039	9742	3595	13337
	95	7946	859	3184	11989	3834	15823

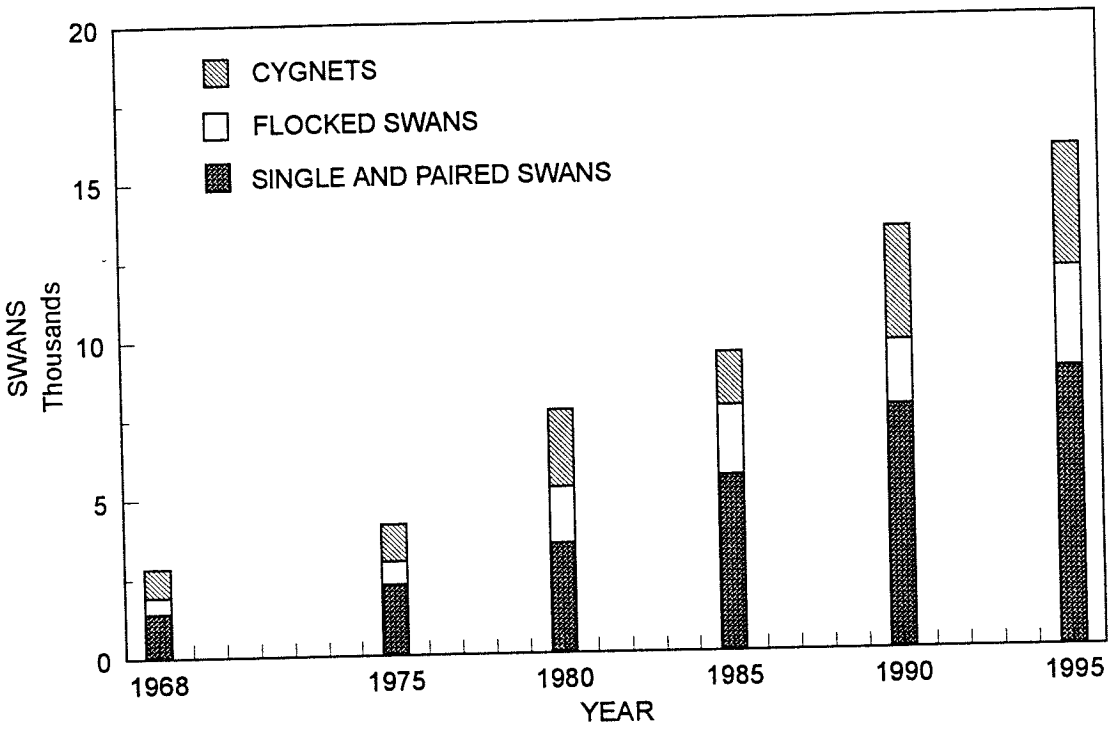


Figure 4. The number of Trumpeter Swans recorded in Alaska during six statewide summer censuses from 1968 to 1995 by age and adult group size.

modeling for survival rates may increase our understanding.

A factor which may be slowing, and could ultimately reverse, the present trend is the exclusion of swans from good habitat by human appropriation and disturbance, especially on the rapidly urbanizing wintering grounds in the Pacific Northwest. This obviously has happened to some of the swan habitat on the breeding grounds in the Cook Inlet (unit 5) area, as well. There, swans are being displaced from good lake and pond habitat because of recreational use (Timm and Wojeck 1978). Prior to 1985, the number of Trumpeter Swans in the Cook Inlet unit increased despite this displacement, due to the ability of Trumpeters to utilize beaver ponds and marshy areas not yet selected by people. However, since 1985, the numbers have failed to follow the population growth curve evident in most other similar units.

As the human population in Alaska also increases and becomes more mobile, the loss of swan habitat will accelerate. A rapidly expanding tourist industry presents an additional challenge for effective swan conservation in Alaska. A comprehensive Trumpeter Swan management plan is still needed for Alaska summering habitat as well as for the Pacific wintering grounds. Trumpeters should be allowed to flourish and remain an integral part of the avifauna of each geographical unit within their present distribution for their intrinsic value and the benefit of people.

The amount of area censused within the Trumpeter Swan summer range in Alaska continues to increase. The area surveyed was represented by 177 maps in 1968, 278 in 1975, 306 in 1980, 425 in 1985, 625 in 1990, and 674 in 1995. However, that factor is not the primary reason for the increase in the numbers of swans recorded. Personnel conducting statewide swan surveys have, over the years, been involved with other detailed waterfowl surveys and, hence, knew where any significant expansion of the summer swan population was occurring. The main factors responsible for the increase were the increase in density on the previously censused high quality habitat (Gulkana and Lower *(text continues on page 95)*

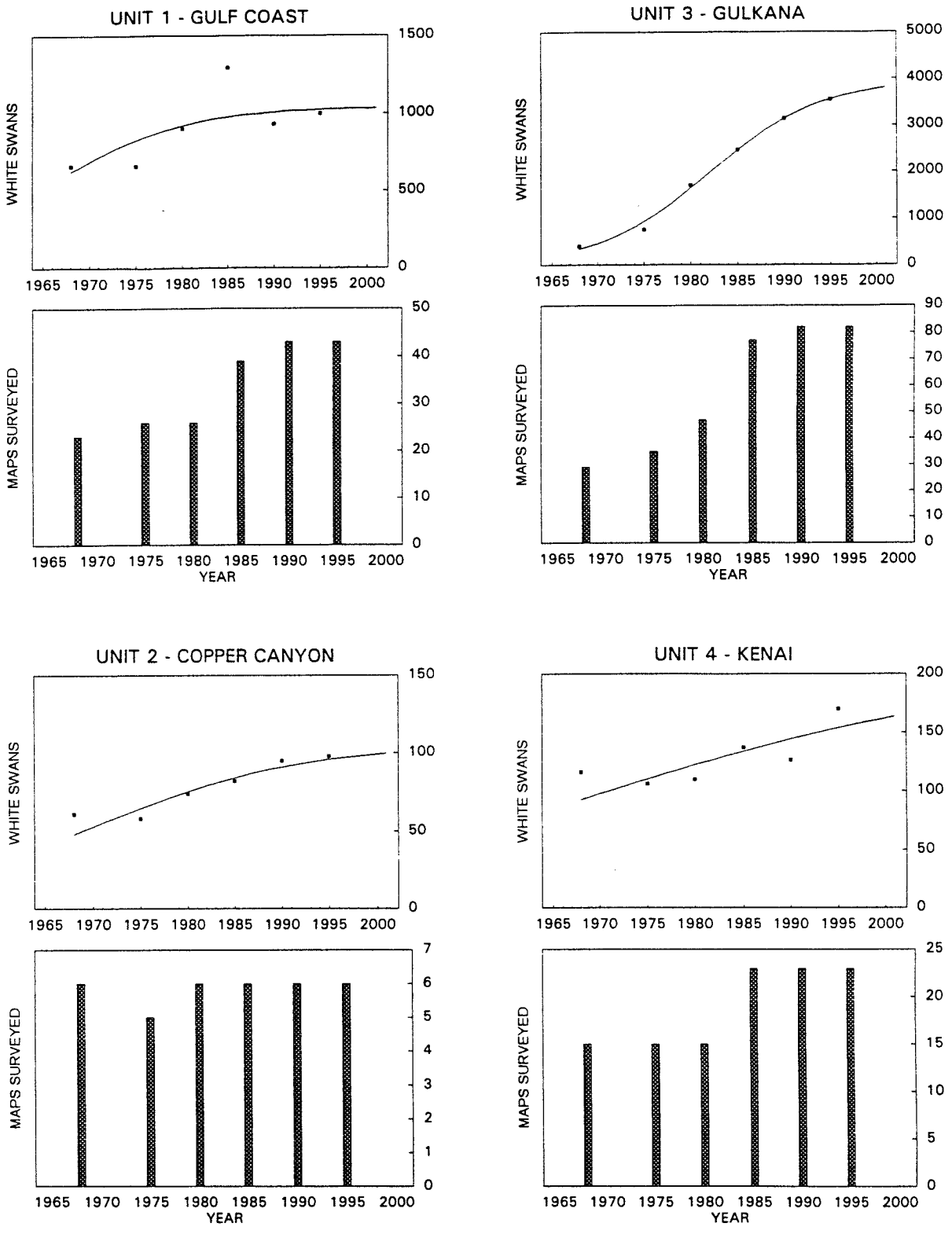


Figure 5a. Number of white phase Trumpeter Swans recorded within each unit, for units 1-4, during six censuses between 1968 and 1995, with fitted growth curves, and compared to the number of map areas covered by each census.

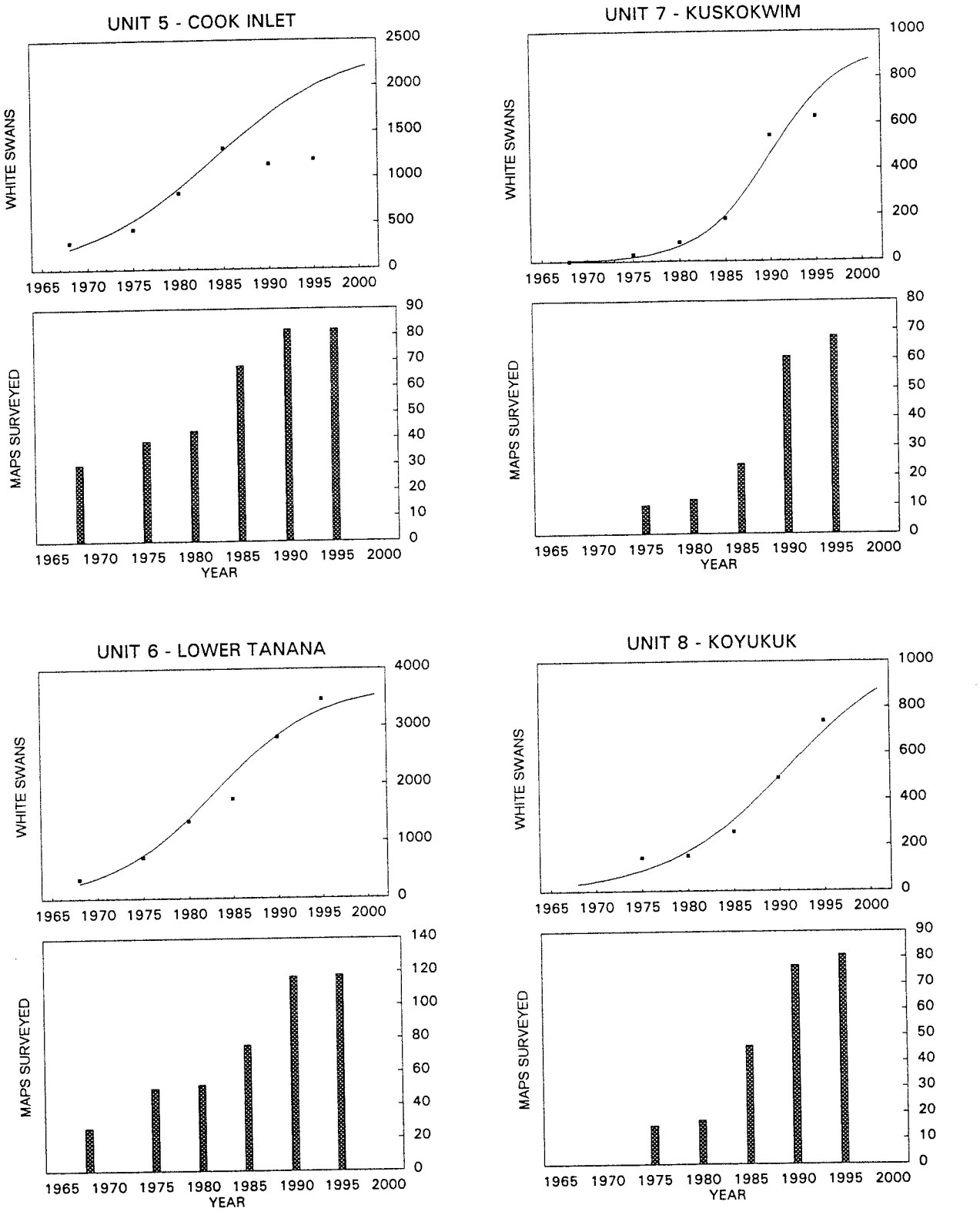


Figure 5b. Number of white phase Trumpeter Swans recorded within each unit, for units 5-8, during six censuses between 1968 and 1995, with fitted growth curves, and compared to the number of map areas covered by each census.

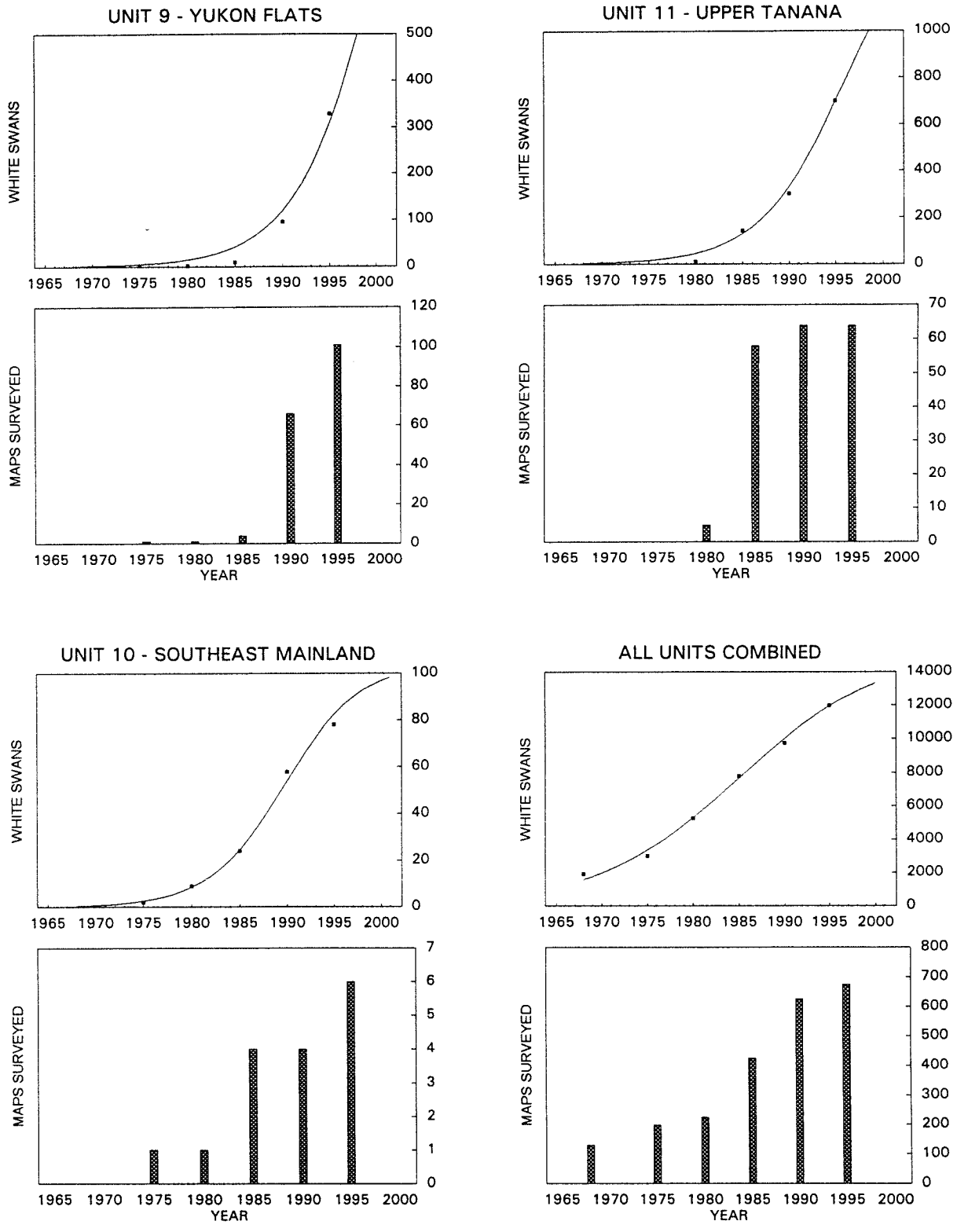


Figure 5c. Number of white phase Trumpeter Swans recorded within each unit, for units 9-11, and for all units combined during six censuses between 1968 and 1995, with fitted growth curves, and compared to the number of map areas covered by each census.

Table 2. Summary of Trumpeter Swan production, from six censuses conducted in Alaska in August and early September between 1968 and 1995, by census unit.

Unit	Year	Number of Cygnets	Number of Broods	Average Brood Size	Percent Juvenile	Number of Pairs	Percent Pairs w/ Broods
1 Gulf Coast	68	363	93	3.9	35	221	41
	75	193	61	3.2	23	221	27
	80	351	99	3.5	28	293	33
	85	164	57	2.9	11	389	14
	90	434	125	3.5	32	333	37
	95	150	57	2.6	13	314	18
2 Copper Canyon	68	44	13	3.4	28	28	39
	75	49	16	3.1	27	28	57
	80	33	10	3.3	24	35	29
	85	11	3	3.7	5	37	8
	90	21	9	2.3	18	44	20
	95	21	7	3.0	18	38	18
3 Gulkana	68	190	52	3.7	32	144	36
	75	284	93	3.1	27	278	33
	80	660	194	3.4	28	513	36
	85	533	191	2.8	18	868	22
	90	778	276	2.8	20	1071	25
	95	1002	310	3.2	22	1166	26
4 Kenai	68	65	21	3.1	36	43	49
	75	39	15	2.6	27	36	42
	80	65	19	3.4	37	45	42
	85	51	16	3.2	27	46	35
	90	78	23	3.4	38	57	40
	95	79	29	2.7	32	65	42
5 Cook Inlet	68	124	36	3.4	30	112	29
	75	181	61	3.0	29	170	36
	80	369	103	3.6	31	304	34
	85	241	85	2.8	15	400	21
	90	516	157	3.3	31	452	34
	95	330	107	3.1	22	419	25
6 Lower Tanana (Fairbanks)	68	137	42	3.3	29	112	33
	75	388	112	3.5	35	259	42
	80	773	202	3.8	36	373	54
	85	503	179	2.8	22	601	29
	90	1072	336	3.2	28	1035	32
	95	1315	426	3.1	27	1134	37
7 Kuskokwim (McGrath)	68						
	75	7	3	2.3	19	10	30
	80	63	16	3.9	43	30	53
	85	55	18	3.1	23	61	30
	90	233	68	3.4	30	193	34
	95	248	71	3.5	28	227	30
8 Koyukuk	68						
	75	35	16	2.2	19	47	34
	80	104	36	2.9	40	62	55
	85	45	16	2.8	15	103	13
	90	133	50	2.7	21	183	26
	95	228	85	2.7	24	262	31
9 Yukon Flats (Ft. Yukon)	68						
	75	1	1	1.0	33	1	100
	80	4	1	4.0	67	1	100
	85	3	1	3.0	23	5	20
	90	56	18	3.1	37	33	55
	95	90	25	3.6	21	100	25
10 S.E. Mainland	68						
	75	0	0	--	--	1	--
	80	11	2	5.5	55	3	67
	85	16	3	5.3	40	8	38
	90	50	10	5.0	46	17	59
	95	61	19	3.2	44	29	66
11 Upper Tanana (Fairbanks)	68						
	75						
	80	4	1	4.0	27	3	33
	85	64	19	3.4	31	42	45
	90	224	53	4.2	43	110	48
	95	310	82	3.8	31	219	37
Total	68	923	257	3.6	32	660	37
	75	1177	378	3.1	28	1051	35
	80	2437	683	3.6	32	1662	40
	85	1686	588	2.9	18	2560	23
	90	3595	1125	3.2	27	3528	31
	95	3834	1218	3.1	24	3973	30
6 Year Average				3.2	27		33

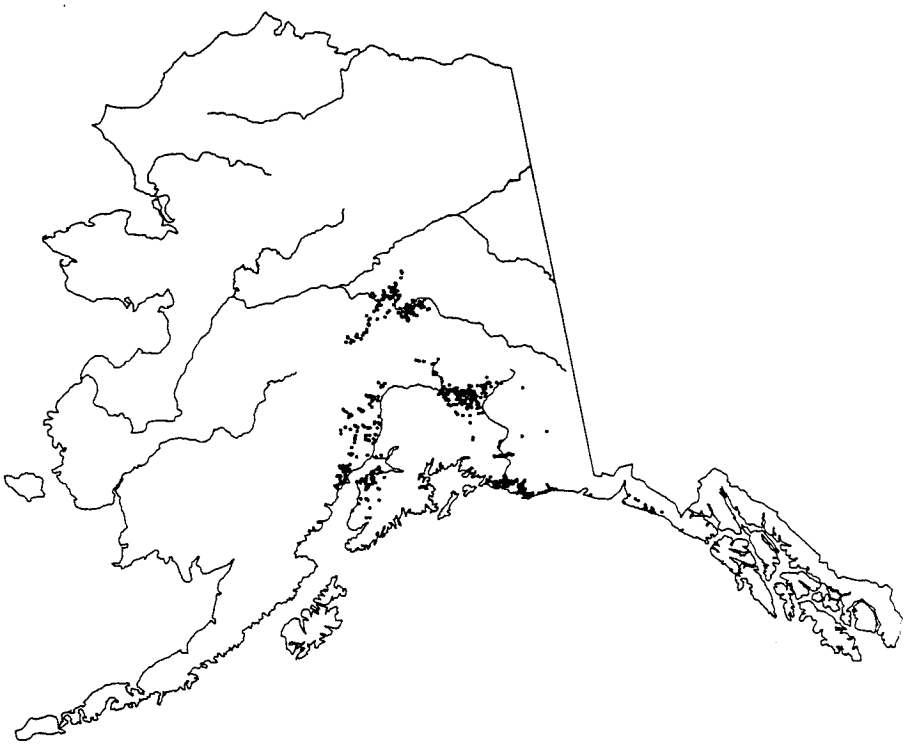


Figure 6a. 1968 Trumpeter Swan distribution in Alaska, based on 838 swan locations.

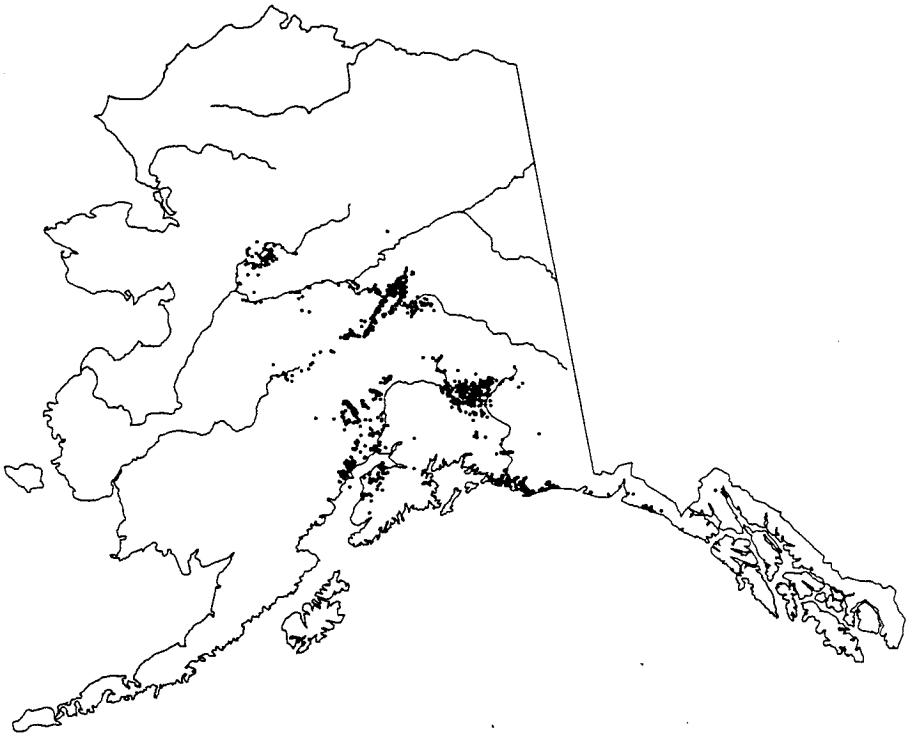


Figure 6b. 1975 Trumpeter Swan distribution in Alaska, based on 1329 locations.

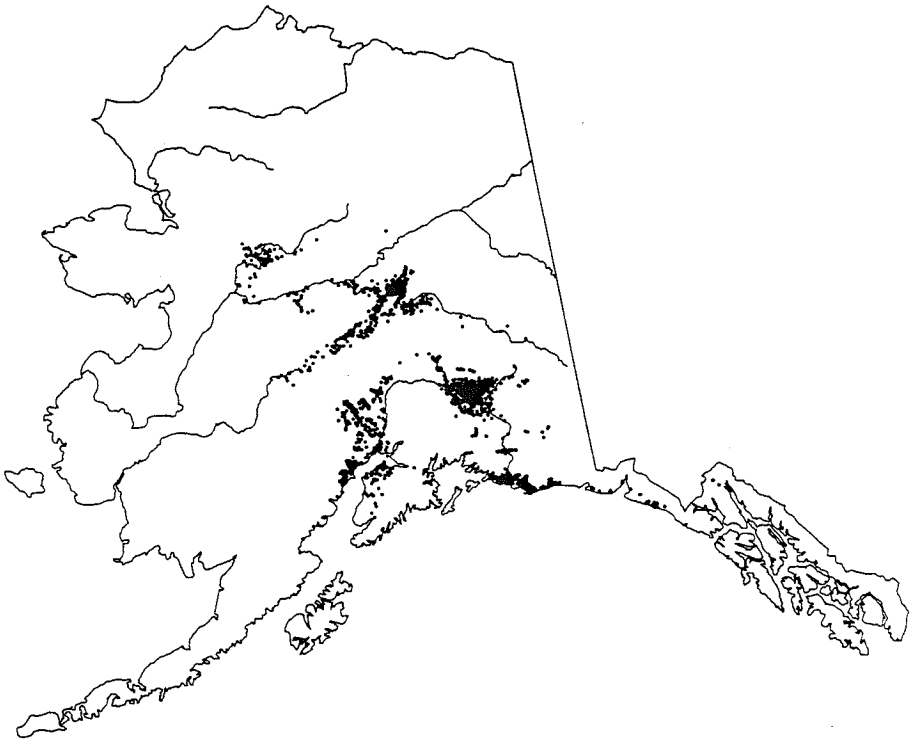


Figure 6c. 1980 Trumpeter Swan distribution in Alaska, based on 2043 swan locations.

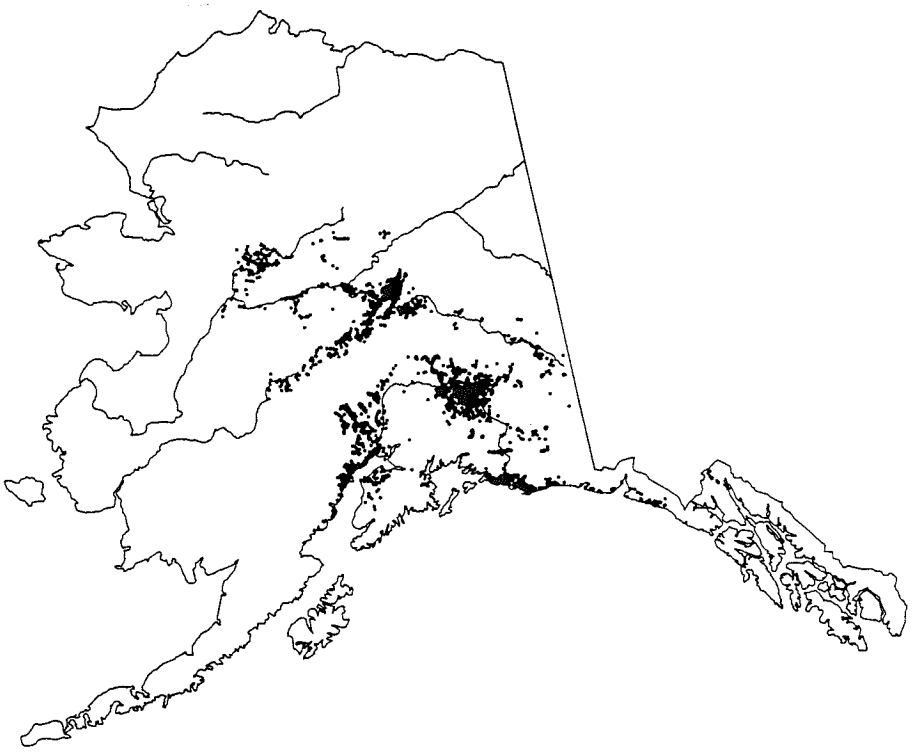


Figure 6d. 1985 Trumpeter Swan distribution in Alaska, based on 3327 swan locations.

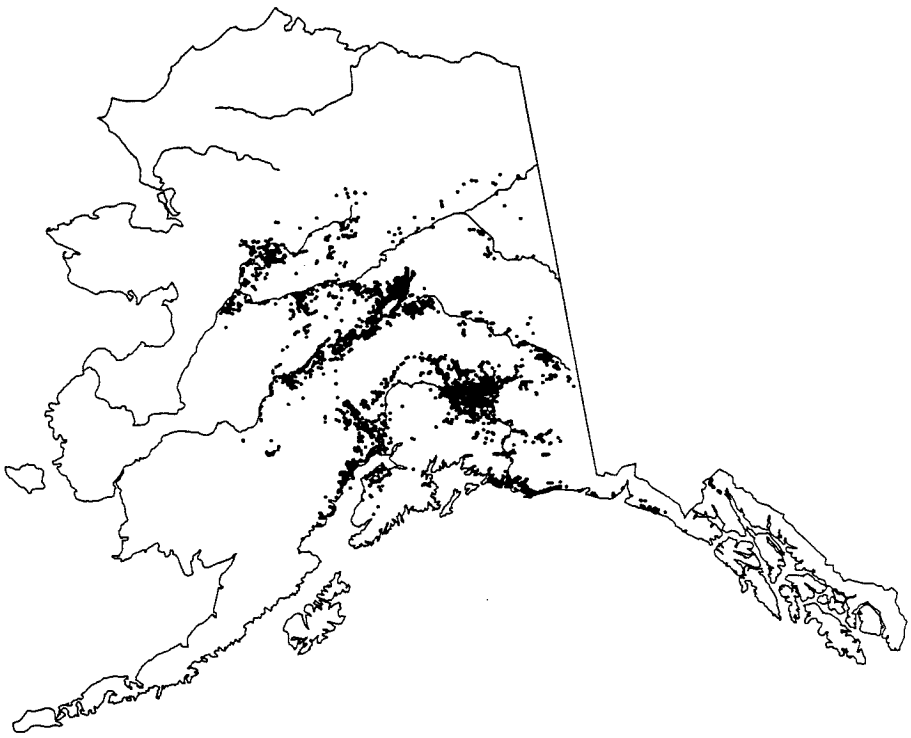


Figure 6e. 1990 Trumpeter Swan distribution in Alaska, based on 4503 swan locations.

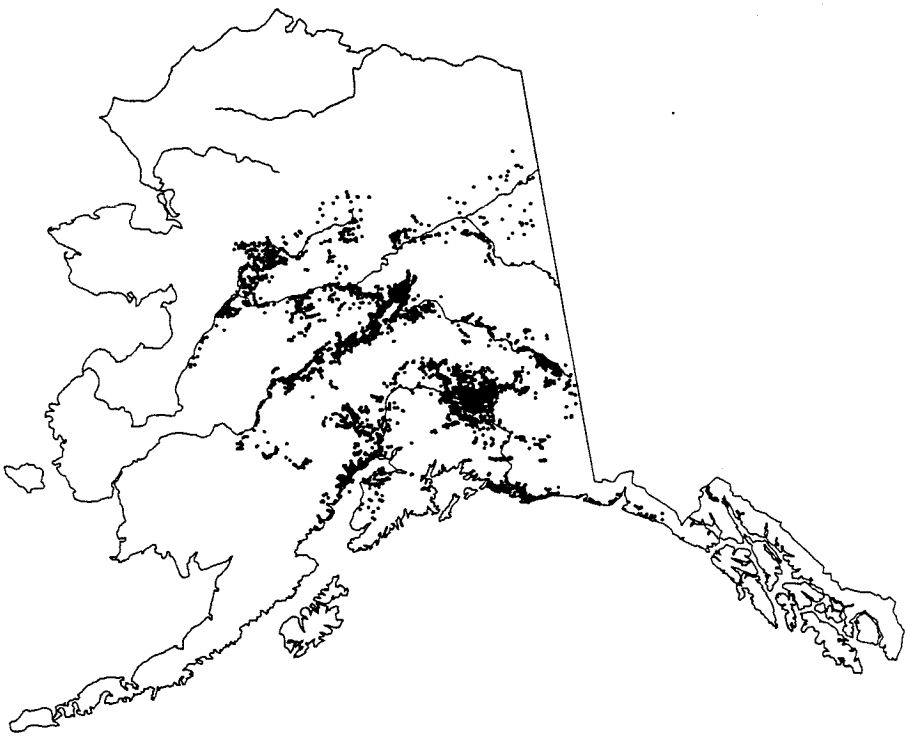


Figure 6f. 1995 Trumpeter Swan distribution in Alaska, based on 5395 swan locations.

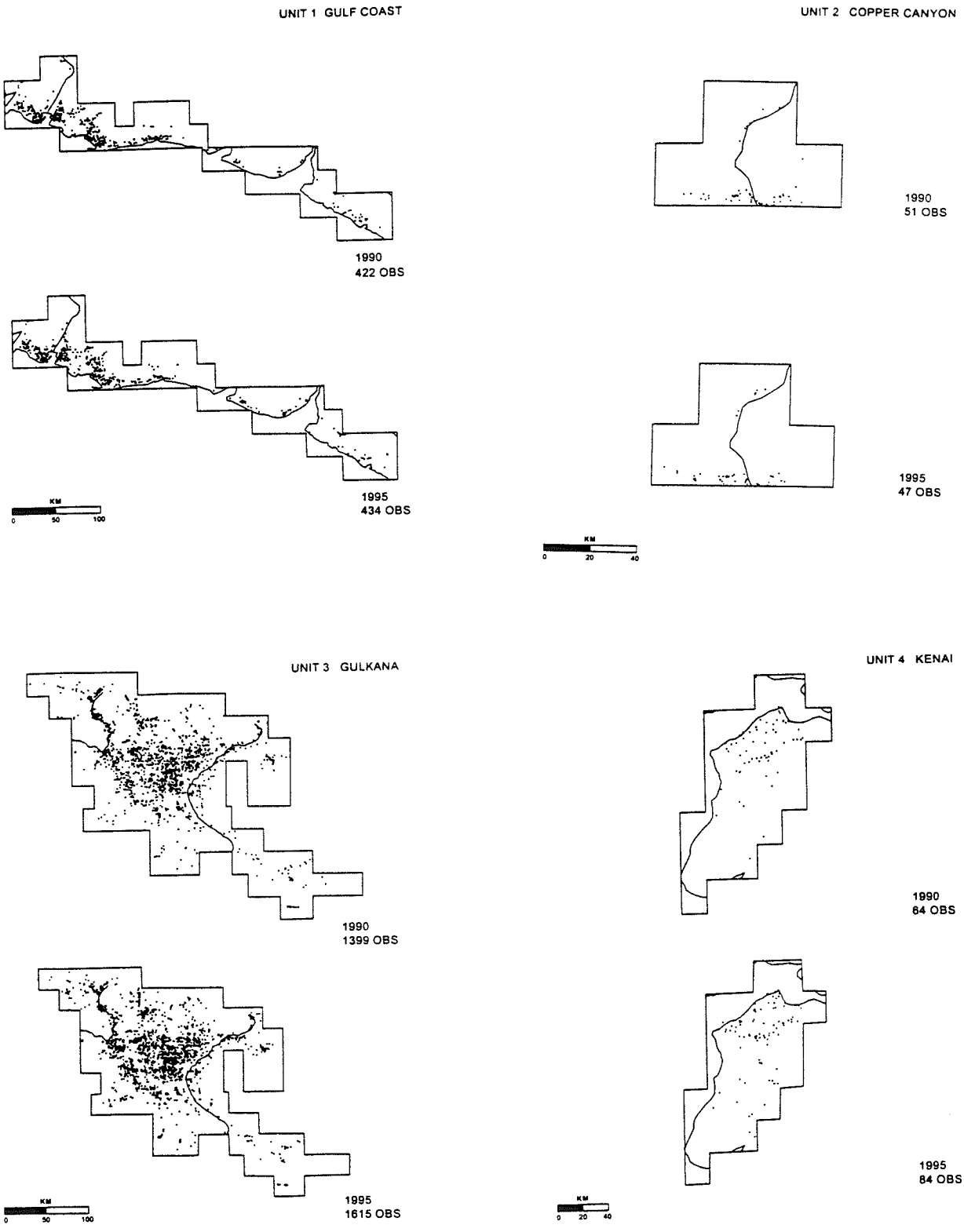


Figure 7a. Comparison of Trumpeter Swan distribution in 1990 and in 1995, by unit for units 1-4,as depicted by point locations from censuses in Alaska.

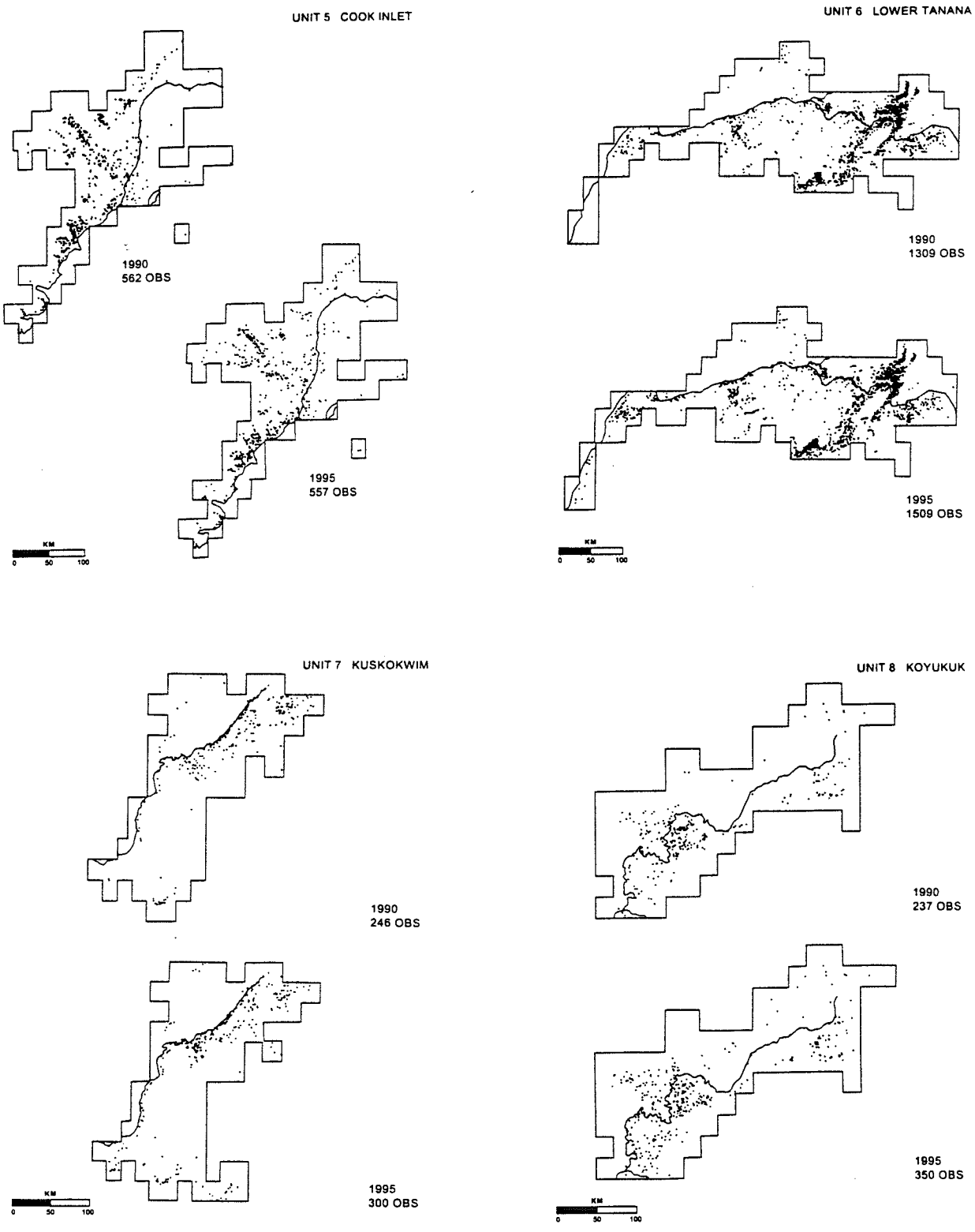


Figure 7b. Comparison of Trumpeter Swan distribution in 1990 and in 1995, by unit for units 5-8,as depicted by point locations from censuses in Alaska.

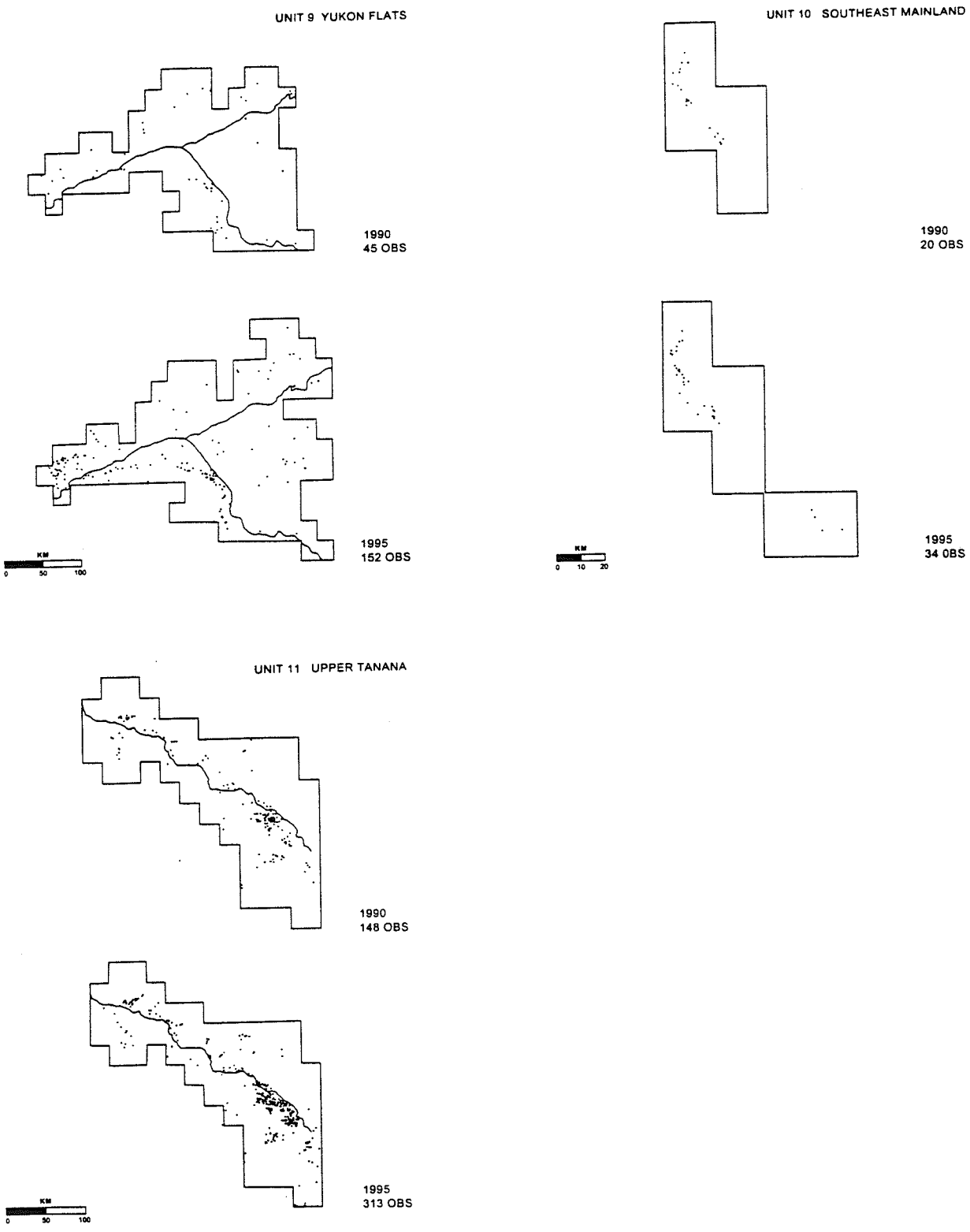


Figure 7c. Comparison of Trumpeter Swan distribution in 1990 and in 1995, by unit for units 9-11,as depicted by point locations from censuses in Alaska.

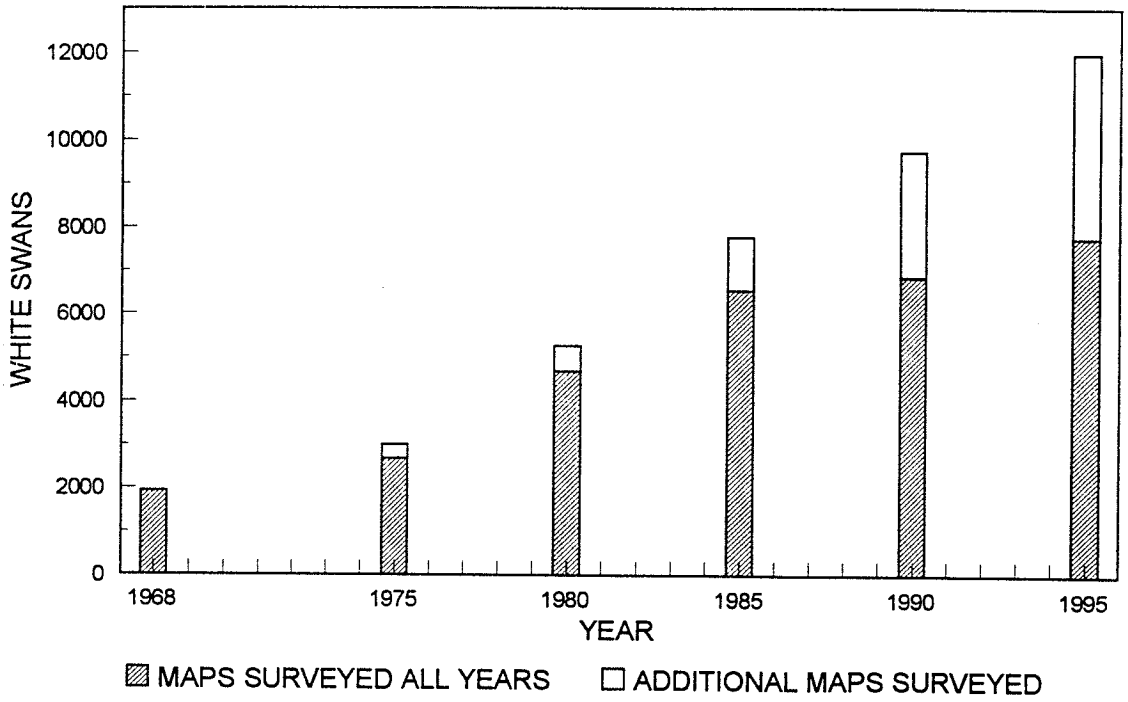


Figure 8. The number of white phase Trumpeter Swans in Alaska in high density habitats, as represented by map areas surveyed in all years of censusing, and in peripheral habitats, as represented by all other map areas surveyed.

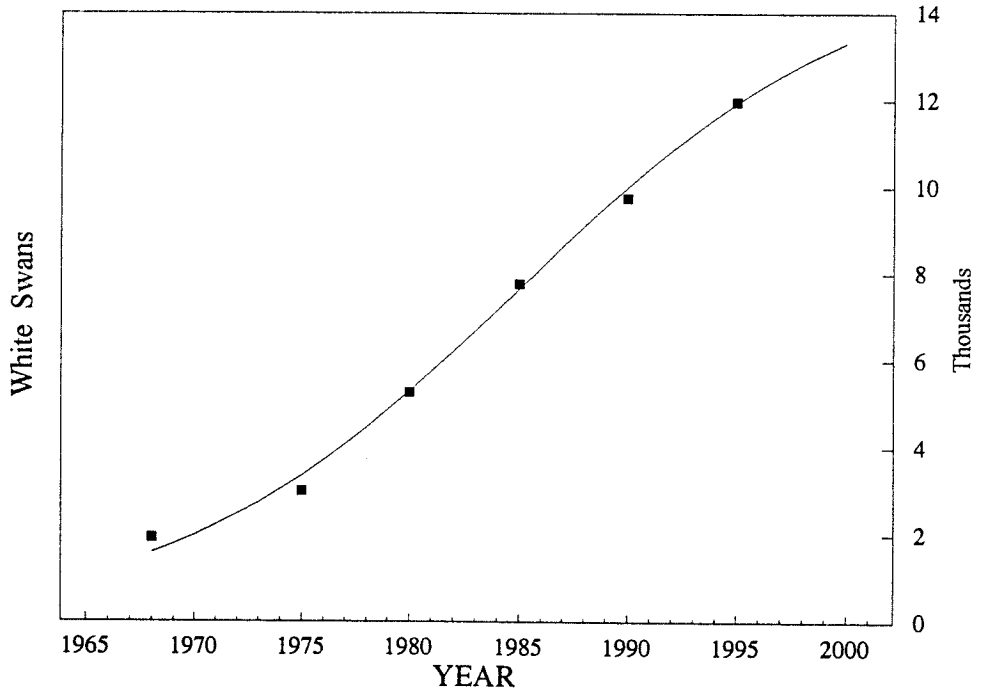


Figure 9. The number of white phase Trumpeter Swans recorded in Alaska during statewide summer censuses from 1968 to 1995, with a fitted growth curve.

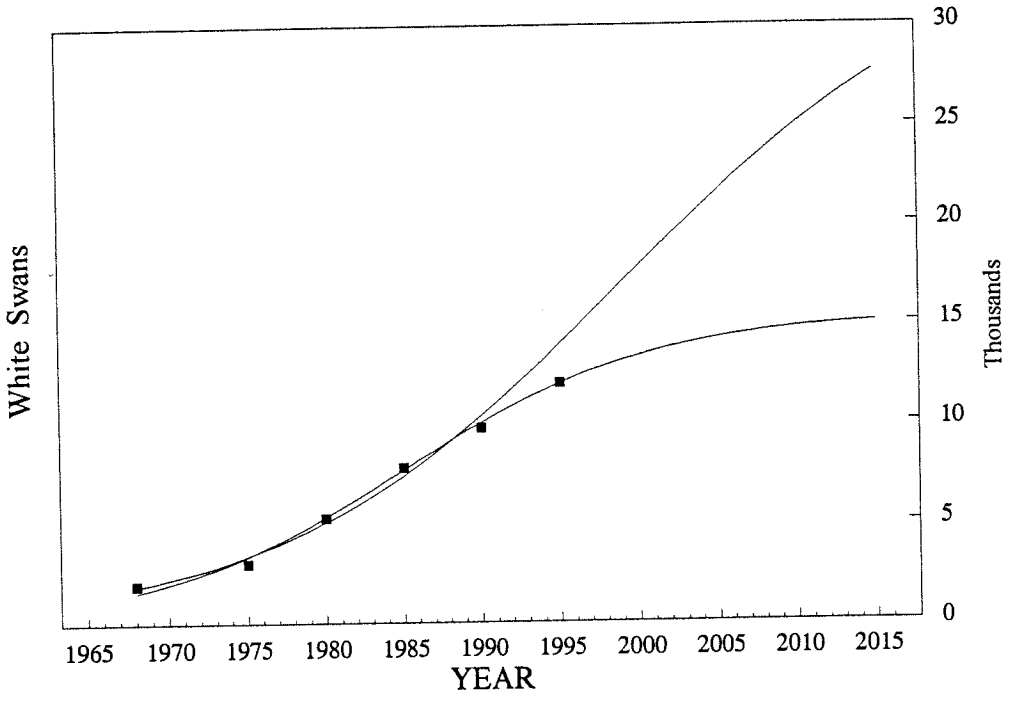


Figure 10. Comparison of the logistic growth curves fitted to the numbers of white phase Trumpeter Swans recorded on statewide summer censuses including the 1995 data (bottom curve) and excluding the 1995 data (top curve).

(text continued from page 83) Tanana units) as well as the expansion of swan range into peripheral habitat (Upper Tanana, Kuskokwim, and Yukon Flats units). Although the rate of increase was surprising, the pattern of expansion of habitat use was expected. It resulted from a rapidly increasing population (Figures 4, 8 and 9), the consequence of a number of recent years of good production.

Alaska hosts nesting populations of both Trumpeter Swans and Tundra Swans (*C. columbianus*) during the summer. The Trumpeter Swan census in Alaska is geographically based on general habitat type. All swans sighted during the census are plotted. Species are not differentiated from the air. In Alaska, Trumpeters mostly summer in the south coastal and interior taiga habitat while Tundra Swans summer mainly on the western and northern coastal tundra. There is some overlap of these habitats and the range of both species. There are an unknown but probably small number of Trumpeters outside the Trumpeter census area and some Tundra Swans within it. With populations of both Trumpeter and Tundra Swans growing, the amount of overlap is probably increasing. This census probably does not miss many Trumpeters but does include some Tundra Swans. Limited observations from the ground and helicopters suggest that only the Koyukuk (unit 8) contains substantial numbers of Tundra Swans during the survey periods. More ground and/or helicopter studies are needed to determine the percent of Tundra Swans included and Trumpeters omitted in this and other units.

Swans are quite visible from the air. The census is an exhaustive attempt to find and plot on maps all swans present, but an unknown proportion was missed. Poor light, pilot and observer fatigue, poor weather conditions, heavy cover, and other factors can cause swans to be missed. It is believed that the proportion missed is less than 10 percent of the total present. Repetitive air surveys, perhaps using a helicopter and/or ground study, could help evaluate the number of swans missed on a single fixed-wing air survey.

It is practical to monitor Trumpeter Swan populations in Alaska accurately with this census

method. An integrated computer system for data entry, storage, and retrieval is in place. All swan data contributed on USGS maps in the prescribed format can be easily entered directly into this system. Computer generated map overlays can be quickly and accurately produced to meet planning and other swan data needs. Data manipulation and analysis are greatly facilitated with this system. Conversion to the ARC/INFO GIS format could further enhance the utility of the data by providing a format for the merging of the swan database with others, such as land ownership.

A stratified random sampling scheme was developed and used (Hodges *et al.* 1986) to better monitor the total Trumpeter population on Alaskan breeding grounds between the census years. Unfortunately, this survey was not repeated and only nonrandom sampling was used from 1987-89 and 1991-94 (Groves *et al.* 1994). A random sample could easily be re-employed to gather Trumpeter population data between census years.

We hope those wishing to continue or start collecting standardized Trumpeter population data will contribute to the computer-based storage system. A detailed data collecting protocol has been developed and is available upon request. A continued complete census every 5 years is recommended to maintain the continuity of this impressive data set for better management of this magnificent international resource.

An Alaska Trumpeter Swan Atlas is available upon request (Conant *et al.* 1996). This two-volume set is a hard copy compendium of Trumpeter Swan information from the Alaska swan database. Volume I gives an overview of the Trumpeter Swan survey program in Alaska with tabular and graphic displays of all Trumpeter data through 1995. Volume II is a collection of reduced scale map overlays for all of the 1:250 000 and 1:63 360 scale USGS maps from the 1995 census in Alaska. A statewide conservation plan is envisioned as a Volume III addition to this set.

ACKNOWLEDGMENTS

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Logistic support was provided by the Koyukuk NWR, Gulkana Management Office of Bureau of Land Management (BLM), and the USFS Cordova Ranger District. Deborah Groves served as a primary observer on one survey crew and digitized all of the map data. John I. Hodges converted the attribute and digitizing programs to the IBM format.

This census would not have been possible without the enthusiastic support of these individuals in the Alaska Regional Office of the USFWS: David B. Allen, Regional Director, Glenn W. Elison, Assistant Regional Director/Refuges and Wildlife, Robert Leedy, Chief/MBMO, Robin West, Migratory Bird Coordinator, and George Constantino, Associate Manager/Refuges.

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TRUMPETER SWANS IN THE COMMUNITY - COMOX VALLEY, BRITSH COLUMBIA

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Trumpeter Swans (*Cygnus buccinator*) find suitable winter habitat in many of the estuaries along the coast of British Columbia. Trumpeter Swans overwintering in the Comox Valley, on Vancouver Island, relied heavily on the 1000-hectare Comox Harbour at the mouth of the Courtenay River. Over the years, this estuary has lost the abundance of aquatic vegetation which supported these birds throughout the winter. The agricultural lands adjacent to the estuary have become critical to the survival of the swans. The swans primarily use the estuary for roosting purposes and for a minor source of food. Increased feeding activity occurs when the surrounding agricultural fields are covered with snow. The Trumpeter Swans, when on agricultural land, feed on waste vegetables (potatoes, carrots, parsnips, and corn) and the perennial grasses grown for livestock.

The Comox Valley Waterfowl Management Project (CVWMP) has been managing the overwintering Trumpeter Swan population in the Comox Valley since 1991. The project is funded by the Canadian Wildlife Service and is administered by Ducks Unlimited Canada. The CVWMP was established to address the local farmers concerns of the impact Trumpeter Swans have on agricultural operations and to determine management strategies which would not impede normal farm practices.

Weekly swan counts, conducted throughout the winter by the local natural history society, show swan numbers have been increasing each year. For the past 3 years, Trumpeter Swan counts have peaked at 1191, 1971, and 2141 for 1993, 1994 and 1995 respectively. On 17 December 1996, the number of Trumpeter Swans in the Comox Valley had already reached 2009 (1659 white, 350 grey). Each year, the peak usually occurs in mid-February.

The majority of agricultural land in the Comox Valley is used to grow perennial grasses for livestock (dairy cattle, beef cattle, and sheep). There are also a few mixed-vegetable producers who use the majority of their land for potato production. As a result, the Comox Valley has thousands of acres in cultivated crops which are an attractive source of food for the swans. Unfortunately, the local agriculture producers are unwilling to continue to support the ever-increasing swan population alone. Although the CVWMP has been working with these farms, the farmers feel the responsibility of supporting these swans lies on the shoulders of all citizens and visitors to the Comox Valley.

The CVWMP farm programs have been very successful at minimizing swan grazing impacts on forage grasses. There are now over 40 farms cooperating with the CVWMP on swan management initiatives. Farmers may cooperate with the project under the Cover Crop Program or the Swan Hazing Program or both.

The cover cropping (lure) program promotes the use of cover crops as an alternate low-cost food source for the swans, and reimburses cooperators $25 per acre if they allow swans to feed on these crops throughout the winter. These cover crops also provide agriculture benefits, including soil stabilization, nitrogen retention, and soil enrichment. Each year, 10 farms participate in this program, and, together, they plant approximately 500 acres of annual rye grass, winter wheat, oats, barley, and fall rye. These crops are strategically located throughout the Comox Valley to help alleviate swan impacts on the valuable perennial forages normally used by the swans. Cover crops are planted on harvested vegetable fields during late summer and early fall. The CVWMP has been using various planting methods to maximize establishment and winter growth of these crops.

The swan hazing program implements a number of techniques to minimize Trumpeter Swan use of perennial forage grasses. The most effective devices to deter swan feeding on grass fields include trained dogs, black flags, barrels, multicoloured pennants, and cracker shells. Each method has varying degrees of effectiveness depending on field size and condition and weather conditions. Abandoned methods include electronic devices, which were expensive and protected only small areas, air horns, and flagging and flash tape, which required high maintenance. The CVWMP has swan hazing agreements with over 30 farm cooperators, jointly protecting over 1500 acres of perennial grass fields.

The success of the hazing program also depends largely on the proximity and condition of the cover crops or other areas where the swans can feed without disturbance.

Government funding for the project is always at risk of being reallocated, reduced, or discontinued. The CVWMP has been spurring on local organizations, businesses, and municipal governments to become actively involved in supporting swan management efforts.

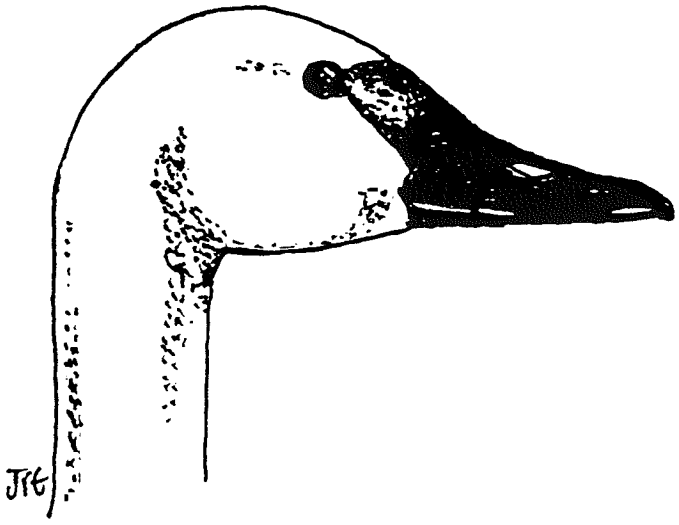
The community has responded by hosting a Trumpeter Swan Festival. The Fourth Annual Trumpeter Swan Festival will be held from 1 February to 8 February. The festival coincides with the City of Courtenay's "Trumpeter Swan Week," their official name for the first full week in February. The nonprofit Trumpeter Swan Sentinel Society (TSSS) has undertaken the task of organizing the festival each year. The society promotes the Comox Valley as "a wonderful place to spend the winter, 2000 Trumpeters can't be wrong." The festival involves many community groups, businesses, schools, municipal governments, the tourism industry, and the agriculture industry. Farmers in the Comox Valley are actually discussing the establishment of swan viewing structures, with an admission fee, on their farms.

The TSSS aims to educate the community on the needs of the overwintering swans and the important role agriculture plays in the health of the population. They inform the public that,if agriculture is not a viable industry in the Comox Valley, then the swans stand to lose a very important food source. The society promotes a "Buy Local Produce" theme through their annual Harvest Banquet, co-sponsored by the Farmers' Institute and the Farmers' Market Association. The theme for the evening is "Think Like a Swan - Eat Locally Grown Foods." This helps the farmers economically through increased farmgate sales and increases demand for their product. Proceeds from the banquet and the festival are used each year to put on the next year's festival.

The Trumpeter Swan Sentinel Society has also established a wildlife legacy fund. Contributions and surplus festival monies will be put into this fund. This legacy fund will be used to reimburse farmers for the planting of cover crops in the event current funding is discontinued.

Trumpeter Swan management initiatives must continue in the Comox Valley if Trumpeter Swans and agricultural producers are to live in harmony. The local community, by being actively involved in helping find long-term solutions, has shown the farmers that they are willing to help share the costs associated with having these birds in the community. The Trumpeter Swans, which were sometimes called "field maggots and thieves" by farmers, are now being used to promote local farm products and bring community support to the agriculture industry.

For technical information on the Comox Valley Waterfowl Management Project, please contact the author.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MANAGEMENT AND HUNT PLANS FOR TUNDRA SWANS

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The Migratory Bird Treaty (1916) and the subsequent Migratory Bird Treaty Act (1918) serve as the legal basis for migratory bird management in the United States. Beginning in the late 1940s, the management of waterfowl was formalized into the four flyway system that, with modifications, exists today. The flyway management approach recognizes the shared responsibilities for stewardship between the states and the federal governments in the United States, Canada, and Mexico. The international commitments of the Migratory Bird Treaty are also addressed by including Canada and Mexico in most flyway council deliberations. The direct participation by Canada and Mexico varies among flyways. This general system has proven to be an effective process to coordinate management activities and develop goals and objectives for migratory bird management.

The concept of flyway or management unit plans to guide population management, particularly of geese, swans, cranes, doves and pigeons, developed under the auspices of the flyway management approach. These species were seen as more geographically distinct than most duck populations and, thus, more amenable to specific flyway/unit management. Most management plans are cooperatively developed within the respective flyway technical committees with participation by both state and federal technical personnel. When there are biological factors that warrant broader consideration, such as overlap in distribution between or among flyways, joint flyway technical committees coordinate plan development. Flyway councils generally approve management plans on a flyway-specific basis. The federal governments of the United States, Canada, and Mexico do not generally sign plans, although, when considering specific issues, they view recommendations from councils based on these plans with substantial weight.

The objective of this paper is to review the current management and hunt plans for Tundra Swans (*Cygnus columbianus*). Management agencies recognize two populations of Tundra Swans in North America, eastern and western (Figure 1), each of which is managed under a specific plan. The distribution of the eastern population encompasses all four flyways, while the western population is restricted entirely to the Pacific Flyway (Figure 1).

MANAGEMENT AND HUNT PLANS FOR THE WESTERN POPULATION OF TUNDRA SWANS

The current management plan for western Tundra Swans was approved by the Pacific Flyway Council in March 1983. The plan contains the following goal and objectives.

Goal

To ensure the maintenance of the western population of Whistling (Tundra) Swans at a size and distribution which will provide for their continued benefits to society.

Objectives

A. Maintain a 3-year average population index of at least 38,000 swans, as estimated by the midwinter waterfowl survey.

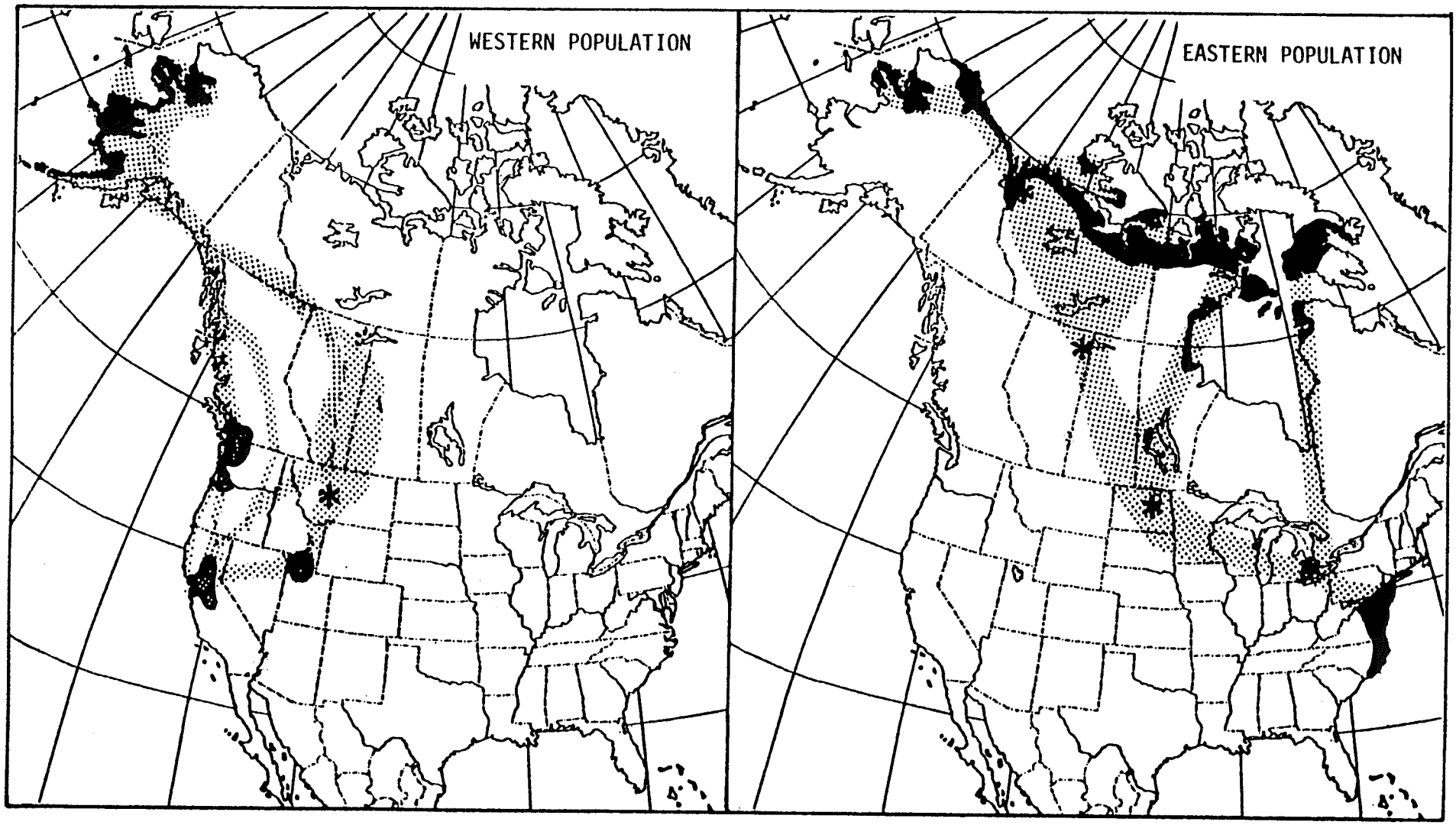

Figure 1. Approximate distribution of the western and eastern populations of tundra swans (*Cygnus columbianus*) in North America.

B. Maintain current patterns of distribution throughout the swan's range.

C. Provide breeding, migration, and wintering habitats of sufficient quantity and quality to maintain the desired numbers and distribution of swans.

D. Provide for aesthetic, educational, scientific, and hunting uses of these swans.

In addition to establishing these general goals and objectives, the plan reviews the current status and biology of the population, identifies current problems, and recommends management actions. Key problems identified in the plan include the need to incorporate subsistence harvest into harvest management programs, the threat posed by oil, gas and mineral exploration and development on the breeding grounds, wetland loss on migration and wintering areas, and the continuing threat posed by disease (avian cholera) on some key wintering areas, particularly California. Additional problems relate to depredation on agricultural crops and habitat destruction caused by concentrated feeding activity of swans in certain wetland habitats. The plan assigns lead responsibilities to the cooperating management agencies for specific management practices and identifies information needs to improve the management program.

The Pacific Flyway developed a separate hunt plan, most recently updated in 1989, to provide structure and general frameworks for conducting Tundra Swan hunting in the Pacific Flyway. This plan reviews historical harvest and survey data and establishes general procedures and guidelines for conducting Tundra Swan hunts.

General Guidelines

1. Daily and seasonal bag limit is one bird.
2. State/province must issue a nontransferable permit and non-reusable tag.
3. The season must be conducted within the regular duck and/or goose season.
4. Hunts must be consistent with management plans.
5. Hunt proposals require Pacific Flyway Council endorsement.
6. All hunts must undergo a 3-year experimental evaluation.

Participation Requirements

1. Each state/province must submit a hunt plan proposal at least 45 days prior to the appropriate flyway technical meeting.
2. Hunt proposals must include:
   a. location of the proposed hunt,
   b. number of permits requested and anticipated harvest,
   c. season dates,
   d. description of the permit process,
   e. survey methodology for determining harvest characteristics as listed under section 3 below, and
   f. size, age, composition, and timing of staging/migration use of swan flocks in the hunt area for at least 2 years prior to experimental requests.
3. After each year a hunt is conducted, the following information must be submitted to the swan committee chair for compilation into the annual flyway reports:
   a. number of applications for permits,
   b. number of permits issued,
   c. percentage of permittees hunting,
   d. estimated number of hunter days,
   e. estimated retrieved harvest,
   f. estimated crippling loss, and
   g. percentage of gray swans in bag.

There is also a formula for permit allocation that apportions 10% of the allowable harvest to production areas, 70% to migration areas, and 20% to wintering areas. Determination of the allowable harvest was based on observed rates of population growth and the current status of the population relative to the population objective in the management plan.

The 1996 Midwinter Survey provided a population index of 96,832 Tundra Swans in the western population. This population has grown continuously, although erratically, since the initiation of the survey in 1948. Some of the variation is due to the nature of the midwinter survey. Recognizing the host of factors that can influence these counts, the plans call for the use of a 3-year average for management decisions. The most recent 3-year average is 76,000, exactly twice the

Table 1: ESTIMATED HARVESTS (RETRIEVED) OF WESTERN AND EASTERN POPULATIONS OF TUNDRA SWANS, 1962-95.

	WESTERN POPULATION					EASTERN POPULATION						TOTAL
YEAR	UTAH	NEVADA	MONTANA	ALASKA	TOTAL (west)	MONTANA	N. DAKOTA	S. DAKOTA	N. CAROLINA	VIRGINIA	TOTAL(east)	East + West
1962	320				320						0	320
1963	392				392						0	392
1964	335				335						0	335
1965	336				336						0	336
1966	491				491						0	491
1967	246				246						0	246
1968	520				520						0	520
1969	1,377	87			1,464						0	1,464
1970	1,078	208	179		1,465						0	1,465
1971	1,109	102	91		1,302						0	1,302
1972	1,028	124	150		1,302						0	1,302
1973	1,191	109	101		1,401						0	1,401
1974	1,377	190	259		1,826						0	1,826
1975	1,383	188	266		1,837						0	1,837
1976	1,109	206	139		1,454						0	1,454
1977	1,575	84	214		1,873						0	1,873
1978	1,152	90	146		1,388						0	1,388
1979	1,293	214	275		1,782						0	1,782
1980	1,156	103	250		1,509						0	1,509
1981	1,619	301	177		2,097						0	2,097
1982	1,244	161	139		1,544						0	1,544
1983	1,168	169	218		1,555	34					34	1,589
1984	1,194	229	221		1,644	22			313		335	1,979
1985	673	145	185		1,003	19			2523		2542	3,545
1986	947	196	200		1,343	41			2302		2343	3,686
1987	600	94	280		974	27			2498	117	2642	3,616
1988	854	78	260		1,192	25	191		2468	117	2801	3,993
1989	694	81	302	16	1,093	41	511		2128	133	2813	3,906
1990	874	67	275	15	1,231	59	474	339	2855	128	3855	5,086
1991	774	62	79	8	923	52	704	444	2940	205	4345	5,268
1992	450	29	221	16	716	37	833	814	2609	187	4480	5,196
1993	337	55	290	18	700	18	712	545	2773	130	4178	4,878
1994	768	89	326	29	1,212	62	690	483	3750	194	5179	6,391
1995	348	69	182	47	646	51	789	198	2833	217	4088	4,734
TOTAL	30,012	3,530	5,425	149	39,116	488	4,904	2,823	29,992	1,428	39,635	78,751
AVERAGES	857	126	201	19	1,118	35	545	403	2,307	143	1,132	2,250

population objective. The retrieved harvests of Tundra Swans in both the western and eastern populations demonstrate that the total harvest of Tundra Swans remains very small relative to the current population levels (Table 1).

MANAGEMENT AND HUNT PLANS FOR THE EASTERN POPULATION OF TUNDRA SWANS

The original management plan for the eastern population of Tundra Swans was approved by all four flyway councils in 1982. The plan called for a population goal of 60,000-80,000 birds based on a 3-year average of the midwinter survey estimates for the Atlantic Flyway. A sport hunting plan adopted in 1988 provides guidelines for harvest. Prior to adoption of the hunt plan, an environmental assessment, Proposed Hunting Regulations on Whistling (Tundra) Swans - September 1984, authorized hunting. Both the management and hunt plans are scheduled for update and revision every 5 years.

An ad hoc committee, appointed by all four flyways and including members from both the U. S. and Canada, began to revise the plans in the fall of 1993. The revision process has proceeded slowly, probably due to the lack of impending crisis. However, committee deliberation has resulted in several significant management strategies. These include a cut in sport harvest permits (9800, down from 10,800), independent validation of the midwinter survey Tundra Swan estimate, post-season leg banding, and development of a computer simulation model for the population. The revision should be completed in 1997.

The draft of the revised management plan calls for a single population goal of 80,000 swans in the eastern population and continued use of the Atlantic Flyway midwinter survey average to index population size. The latest 3-year midwinter survey average is 81,626, slightly above the population goal. Recommendations called for improved precision of the midwinter survey and the fall production surveys. Strategies for maintaining traditional population distributions, reducing non-hunting mortality, and restoring habitat quality remain in the draft plan; however, the plan strives for increased simplification to facilitate implementation of management actions. Another change is to recognize subsistence harvest of eastern population swans and add strategies to obtain an estimate of mortality from this source. Research strategies are updated and re-prioritized. A post-season leg banding program in the Atlantic Flyway and the development of a model for population simulation increase to highest priority and will be implemented. Color-marking and radio-tracking studies to delineate the breeding range is urged.

The ad hoc committee reviewed the status of the effects of sport and subsistence hunting programs. The original hunt plan called for a harvest rate objective of 10 percent, which was believed to be reasonable from existing western population harvest programs. The observed average harvest during 1993-95 was 6 percent, and this has appeared to be sufficient to stabilize the population. The draft hunt plan calls for a harvest rate objective of 5 percent. Initial work with the computer simulation model suggests that this rate should allow for some growth in the eastern population.

PROTECTION OF TRUMPETER SWANS IN TUNDRA SWAN SEASONS

The U. S. Fish and Wildlife Service (USFWS) has previously developed a general policy statement regarding Trumpeter Swan (*C. buccinator*) harvest and Tundra Swan hunting (Hartwig 1989). This policy supported the restoration of migratory Trumpeter Swan populations and the maintenance of existing Tundra Swan hunting seasons. At present, the USFWS has not adopted a national approach toward the reconciliation of the occasional harvest of a Trumpeter Swan during an approved Tundra Swan season. Therefore, the harvest of a Trumpeter Swan during a Tundra Swan season is a violation in the Central and Atlantic Flyways at this time. The USFWS is convinced that the number of such occurrences remains very low, with the possible exception of some areas within the Pacific Flyway. However, the USFWS recognizes that, as range expansion efforts continue, such incidents are likely to become more frequent. The USFWS supports both the continued restoration of migratory Trumpeter Swans throughout their former range and the continuation of Tundra Swan hunting seasons in accordance with approved flyway management and hunt plans. With the 1995 environmental assessment (EA), the USFWS has recently approved a general swan season in Montana, Utah, and Nevada to facilitate both Trumpeter Swan range expansion and continued Tundra Swan hunting opportunities (Bartonek *et al.*). The USFWS believes this approach holds the greatest promise for

a long-term solution. Before advocating this approach nationally, the USFWS would like to evaluate the hunt during the experimental period described in the EA and to hear from the concerned interests. While enforcement and prosecutorial discretion have been effectively used to manage this issue in other parts of the country to date, we recognize that it is not the long-term solution as Trumpeter Swans expand into areas of Tundra Swan hunting. The USFWS will work with the respective flyway councils and other concerned interests during the next several years to evaluate possible solutions.

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AN EVALUATION OF TUNDRA SWAN HUNTING IN THE CENTRAL FLYWAY AND CONCERNS ABOUT TRUMPETER SWAN POPULATION RESTORATION

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ABSTRACT

Tundra Swan (*Cygnus columbianus*) harvest data are examined for North Dakota, South Dakota, and the Central Flyway portion of Montana. Central Flyway concerns about Trumpeter Swan (*C. buccinator*) population restoration are reviewed.

INTRODUCTION

Federal frameworks governing migratory bird hunting allowed the Central Flyway states of North Dakota, South Dakota, and Montana (Central Flyway portion) the opportunity to hold Tundra Swan (*Cygnus columbianus*) hunting seasons starting in 1983. At that time, the U. S. Fish and Wildlife Service (USFWS) offered North Dakota 1000 permits and 500 each for South Dakota and Montana. Montana selected its first season in 1983, whereas North Dakota and South Dakota held inaugural seasons in 1988 and 1990, respectively.

The number of Tundra Swan hunting permits has varied by state and over time. Montana has had 500 permits allocated annually since 1983 but generally has issued less than half that each year due to the small number of waterfowl hunters in the state. The average number of permits issued annually in Montana for the period 1983-95 was 175. In North Dakota and in South Dakota, hunter interest in the permits is high, and all allocated permits have been issued to hunters every year, up through the 1995 season.

In 1991, the USFWS approved experimental Tundra Swan seasons for North Dakota and South Dakota, which allowed additional Tundra Swan hunting permits for each state. There were 400 permits allocated to North Dakota in 1988, 1000 in 1989 and in 1990, and 2000 each year from 1991 to the present. In South Dakota, 500 permits were allocated during its first season in 1990, 1000 in 1991, and 1500 each year from 1992 to the present. Reports summarizing the experimental seasons (Johnson and Kohn 1995, Vaa 1995) have been submitted to the USFWS by both states, and the seasons are now considered operational.

METHODS

Post-hunt harvest surveys were used in each state to obtain harvest data, including whether or not a swan was harvested, unretrieved harvest, date and location of kill, number of days hunted, and age of the harvested bird. All hunters who possessed a Tundra Swan permit were queried by a harvest survey questionnaire.

RESULTS

Response rate by hunters to the questionnaire was approximately 90%. Harvest in Montana, retrieved and unretrieved, during 1983-95 averaged 40 birds per season. In North Dakota, the average annual retrieved and unretrieved harvest during 1988-95 was 705 birds. In South Dakota, the average annual retrieved and unretrieved harvest during 1990-95 was 559 birds. The average annual harvest for the three states combined during the most recent 6-year period (1990-95) was 1414 Tundra Swans (Table 1).

Unretrieved harvest averaged 14.5% in North Dakota and 20.2% in South Dakota during 1990-95. Age ratios in the harvest were 0.13 immatures per adult in North Dakota and 0.17 immatures per adult in South Dakota from 1990-95. Peak harvest periods

Table 1. Tundra Swan harvest summary for North Dakota (ND), South Dakota (SD), and Montana (MT), 1990-95.

		1990	1991	1992	1993	1994	1995	Average
Permits Issued	ND	1000	2000	2000	2000	2000	2000	1833
	SD	500	1000	1500	1500	1500	1500	1250
	MT	173	204	217	212	232	291	221
	Total	1673	3204	3717	3712	3732	3791	3304
Total Kill (Retrieved Unretrieved)	ND	575	813	979	787	775	900	805
	SD	407	515	955	689	589	198	559
	MT	62	53	37	22	64	60	50
	Total	1044	1381	1971	1498	1428	1158	1414

were mid-October in North Dakota and the last week of October in South Dakota and Montana.

In Montana, the area open to Tundra Swan hunting is the entire Central Flyway portion of the state. The highest harvest occurs in Phillips and Sheridan Counties. In North Dakota, Tundra Swan hunting occurs north and east of the Missouri River. Kidder, Stutsman, and Ramsey Counties have the highest harvest. In South Dakota, the northeastern quarter of the state is open to Tundra Swan hunting, and Day and Marshall Counties have the highest harvest.

DISCUSSION

Tundra Swan hunting is closely tied to wetlands containing beds of sago pondweed (*Potamogeton pectinatus*). A study in North Dakota during the autumn migrations in 1988 and 1989 (Earnst 1994) found that the number of foraging Tundra Swans per wetland was over four times higher on wetlands with sago pondweed than wetlands without it. Hunters commonly position themselves on "passes" between such wetlands in an attempt to bag a swan. Also, a growing number of hunters are using swan decoys in an attempt to take the birds over water.

Tundra Swan hunting has become a popular waterfowling activity in Montana, North Dakota, and South Dakota. For example, during 1994 in South Dakota, hunters from 28 states applied for available permits.

There have been no reported cases of conflict between Tundra Swan hunting and Trumpeter Swan (*C. buccinator*) restoration. The seasons have been well received by the general public and hunters. The Central Flyway states of Montana, North Dakota, and South Dakota look forward to future seasons in compliance with the *Eastern Population Tundra Swan Sport Hunt Plan* (Ad Hoc Tundra Swan Committee 1997).

Concerns about Trumpeter restoration

The main concern of the Central Flyway to Trumpeter restoration centers on possible conflicts with hunting programs, especially Tundra Swan hunting seasons in North Dakota, South Dakota, and Montana and Snow Goose (*Chen caerulescens*) seasons in mid-latitude and southern states. As Trumpeter populations expand in number and range, it is likely that a small number will be taken during these seasons. The position of the Central Flyway is such incidental take shall not be grounds for any changes in existing hunting programs. The Flyway believes the long-term probability of success for Trumpeter restoration will not be stymied due to the incidental take of small numbers of Trumpeters. It also believes hunting programs can be maintained while Trumpeter restoration proceeds. Possible conflicts with hunting programs and the management strategies to deal with these concerns are detailed in the management plan for the Interior Population of Trumpeter Swans (Subcommittee on the Interior Population of Trumpeter Swans 1997).

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BRECKENRIDGE

INDUCED MIGRATION USING ULTRALITE AIRCRAFT

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In September 1989, I attended part of the twelfth Trumpeter Swan Society Conference in Minneapolis, Minnesota, and screened some film of Canada Geese (*Branta canadensis*) in flight following a boat and an aircraft. William Lishman, pilot of the aircraft, also attended. I suggested that it was feasible to use this same technique to induce Trumpeter Swans *(Cygnus buccinator*) to follow an aircraft. Young swans could then be led cross-country, introducing them to their first migratory flight.

Harry Lumsden, Lishman, and I prepared a proposal organizing a migration flight with Canada Geese as surrogates to Trumpeter Swans. This would provide experience in the logistics of cross-country migratory flight with birds following aircraft.

Trumpeter Swans, at that time, were expensive and scarce in Ontario. Bill Sladen donated seven hybrid swan eggs produced from a cross between a Trumpeter Swan and a Tundra Swan (*C. columbianus*). Lishman flew to Virginia to collect the eggs, which duly hatched, and the young were imprinted on a dummy aircraft.

In the meantime, an article appeared in *Equinox* magazine reporting on the presentation at The Trumpeter Swan Society conference, outlining Lishman's accomplishments getting geese to follow his aircraft, quoting Lishman's lifelong desire to "fly with the birds," and mentioning his previous attempts to accomplish this by chasing ducks with his aircraft.

This statement aroused a half dozen citizens to write to the Canadian Wildlife Service demanding that he be prosecuted for harassing birds under the Migratory Bird Convention Act.

The CWS investigated our activities and organized four separate raids, at my establishment, at Lishman's, and at two of our associate aviculturists'. Lishman very proudly showed off the progress of the project. The officers returned a week later and seized the swans, presumably because they were hybrids not on his property and because they had been imported illegally. We were also supposedly conducting research without a scientific permit; however, according to the legislation, scientific permits are only given to capture or collect birds or eggs from the wild.

The CWS forbade Lishman from doing any further flying with the birds and cancelled, or failed to renew, our avicultural permits. As well, the CWS withdrew permission for Lumsden to release any further Trumpeter Swans in southern Ontario and suggested, instead, that he move his operation to the Hudson Bay Lowlands. When Lumsden prepared a cost estimate for a northern venture and organized support for the original plan, it was reinstated.

In the meantime, Lishman and I parted company as far as flying birds was concerned. I suggested he continue with the plan to migrate geese to Virginia with Sladen, but I wanted to continue to work with the Trumpeter Swans.

Lishman has made three fall migration flights to the U. S. with flocks of Canada Geese. He decided to try a return flight leading the geese north in the spring, but I disagreed with this, maintaining that, in the wild, young birds return whether the family group has remained intact or not. As it turned out, the first group of geese left for the north before he arrived to lead them back.

The following year, Lishman took birds as far as South Carolina. He was planning to fly the return trip with the birds but could not locate them. The birds returned on their own, with a remarkable survival rate of 38 out of 40 birds.

Lishman sold the rights to the migration flight to ABC Television for US$35,000. He then made a deal with Columbia Pictures for $500,000 for the rights to his life story. He also received $1.2 million for re-creating the migration story for the movie *Fly Away Home*.

I was paid $50,000 to advise on the film and to raise geese for it, as well as for providing a late hatch of 20 Canada Geese, acquired, with permission, as eggs from Baffin Island in the arctic.

While Lishman was busy with his adventures, we continued to raise and release Trumpeter Swans and started to work with an ultralite aircraft on floats, as well as with a bass boat.

In 1993, Lumsden obtained 50 Trumpeter Swan eggs from Alaska, and we hatched and raised 42 birds. Half of the cygnets were imprinted on humans, and the remainder were raised in isolation. Behavioral observations compared the activities of each group (Eadie *et al.* 1995).

At fledging, the behavioral study was terminated, and the flock of imprinted birds as well as five of the unimprinted birds were taken to Lake Scugog to fly following a boat for photography. While conditioning the imprinted birds, the unimprinted birds were let out of their pen to feed and exercise on their own. These unimprinted birds, without any inducement, began to follow the boat and the other birds.

The unimprinted birds were soon flying with the boat more consistently than the imprinted birds. We had noticed similar behavior occasionally in the past with several Canada Geese. This following response appears to intensify at fledging. Similar behavior in Greylag Geese (*Anser anser*) was noted by Lorenz (1978).

We have obtained major support from Falconbridge Limited, a large nickel-producing company, to design and build an aircraft suitable for leading swans in an attempt at a major cross-country flight. The pilot of this endeavor is Wayne Bezner-Kerr, who formerly flew Sandhill Cranes (*Grus canadensis*) for Lishman. He is now working on his master's degree on induced migration.

We are open to suggestions or candidates for a suitable starting point and wintering destination.

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PAIR FORMATION IN CAPTIVE TRUMPETER SWANS

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ABSTRACT

Pair formation in captive adult Trumpeter Swans (*Cygnus buccinator*) was recorded from 1993 to 1996. Pairs formed in every month except May, September and December. Copulations were seen in every month except May, July, and September to December. A male homosexual pair was recorded.

INTRODUCTION

Ontario's Trumpeter Swan (*Cygnus buccinator*) restoration program is based on placing captive, mated pairs of swans in the hands of cooperators for care and breeding. Offspring are released into the wild at 2-years of age. In recent years, we have had 22-25 mated pairs and 10-16 breeding age but unmated birds in the program.

Occasionally, we lose one bird from a pair due to accident or disease. Our practice has been to bring the bereaved bird to Aurora, Ontario, and confine it in a pen separated from the resident birds only by wire mesh. This prevents aggression toward the stranger which might cause injury or death to the bird. After about a week, the newcomer is released with the residents with the expectation that it will eventually form a new pair bond.

There are few places where studies of marked Trumpeters of known age and sex can be carried out. Consequently, the literature on pair formation is often generalized. Delacour and Mayr (1945) wrote that, "Pair formation, which occurs in the fall in all temperate zone swans, takes place without elaborate displays".

Scott (1972) in his account of pair formation in swans stated that, "It is uncertain to what extent the slow process of pair formation begins on the wintering grounds. On several occasions the wild Bewick's Swans [*C. bewickii*] at Slimbridge [Wildfowl and Wetlands Trust, UK] have seemingly established bonds during their second winter but only one of these liaisons was still intact the following year. The Mute Swan *Cygnus olor* certainly enters into courtship in autumn and winter, but here again the majority of permanent pairs are formed in the herds of young birds after the adults have left to nest. In all probability most of the migratory species do likewise."

Palmer (1976) wrote that, "It is probable that Trumpeters engage in pair formation activity in their second winter. Probably all of them the following winter, regardless of the length of interval thereafter before they first nest. Since younger cohorts contain more birds than older ones (there is less time for attrition) it follows that nonproductive mated pairs i.e. mated pre-breeders can be numerous on summer range. Captive pre-breeders form temporary attachments culminating in a stable bond."

Mackay (1978) stated that, "young Trumpeters form pairs while in nonbreeding groups on the breeding grounds during the summer months."

Two studies of marked Trumpeters gave winter and fall as the periods during which pair bonds were formed. Monnie (1966) recorded pairing in 1964 among collared Trumpeters received as cygnets in 1962 at Lacreek National Wildlife Refuge (NWR). He wrote, "Courtship displays began in mid-January and continued intermittently until about mid-March ... Beginning in mid-January and continuing for a week the birds generally mixed freely and all sorts of combinations were recorded. However, beginning 23 January, the 20-month-old swans apparently were paired."

Turner (1988) at Grande Prairie also had collared swans for observation, and he reported, "Circumstantial evidence strongly suggests that pair formation occurs in the fall before the birds reach their wintering area." He reached this conclusion because none of his marked migrant Grande Prairie Trumpeters remained in the Tristate Region to breed among that resident stock, presumably because they had not formed pair bonds during the winter when

the two stocks mixed. Contrary to this conclusion, Gale *et al.* (1987) stated, "In Wyoming, pair bond initiation occurred in mid- to late winter and through the spring. Pairing followed soon after the late winter dissolution of sibling group bonds, during a swan's second or third winter." Lockman *et al.* (1987), writing of the same area, reported that, "a peak of courtship activity was observed in April and early May."

The closely related Whooper Swan (*C. cygnus*) of Eurasia forms pairs in winter quarters (Dementiev *et al.* 1967), and Cramp *et al.* (1977) writes that pair formation is slow; courtship occurs in winter flocks but more often in nonbreeding herds. Black and Rees (1984) also record a higher level of courtship display on the wintering grounds in the spring months. These authors did not report pair formation. However, Rees *et al.* (1996) did record courtship and pair formation as occurring in winter.

METHODS

Pair formation at Aurora was recorded from 1993 to 1996 among the captive Trumpeters. The swans were marked with a numbered aluminum band, on the right leg on males and the left leg on females. All were also marked with coloured darvic bands and/or yellow dye (picric acid) on various parts of the plumage. It was possible to recognize individuals at a distance, and, because all were in full view of the house, it was relatively easy to keep extensive records. The pen in which they were confined was 0.63 ha (1.56 acres). The pond was 0.27 ha (0.67 acres), 85m (94 yards) long, and contained two small islands.

RESULTS

Courtship behaviour

The first indication that a pair bond may be forming normally comes from nearest neighbour records. Over a period of days, the same two birds may be seen standing or swimming close together. Later, mutual head bobbing may be seen, which in time becomes exaggerated and which may include trumpeting. Finally, in a fully developed triumph ceremony, head bobbing becomes extreme, and the wings are partially spread and waved rather than flapped. Accompanied by much trumpeting, this display is used in courtship or as a threat and usually follows a fight, whether the pair wins or loses.

The Mute Swan expresses aggression by raising the humerus, radius, and ulna and by spreading the secondary feathers. In aggression and in courtship, the Trumpeter Swan may raise the humerus, radius, and ulna slightly, but the secondaries are not spread.

The pair may stand or sit in the water with their breasts pressed together or pressed on the partner's flank. If separated, the male may swim toward the female with beak pointed slightly downward, neck feathers slightly fluffed, and turning the head from side to side. Johnsgard (1965) reports mutual head turning in the Mute Swan, but I have not seen mutual head turning in Trumpeters.

Occasionally, the initial contact between potential mates may be almost violent, as in the case of male 728 and female 785.

Normally, when copulation occurs, one can consider that the pair is bonded, although this may not necessarily follow when subadults are concerned.

Pair bonding

Formation of new pair bonds among bereaved birds sometimes occurs remarkably quickly. Male 091 lost his mate on 14 January 1996 and was moved to Aurora. Two days later, he was seen in triumph ceremony with female 123, which was, prior to that time, an unmated 3-year-old. They remained close together thereafter. On 26 January, they were moved back to his original home pond and were later seen to copulate.

Female 785 lost her mate in August 1985. She, along with her two cygnets, was moved to Aurora on 20 September and confined in a holding pen. Male 728 was pinioned at the Veterinary College at Guelph and, on 7 October 1995, was brought to Aurora and confined in a small pen adjacent to that of female 785. On 14 October at 09:15, they were all released on the main pond. Male 728 immediately and aggressively chased female 785 as if to attack her. Finally, he cornered her in the angle of a fence and twice stood with his breast pressed against her body. His wings were closed but raised slightly over his back. Both intermittently bobbed their heads. At 12:45, he was following her closely, occasionally uttering brief, rapid trumpeting notes and holding his wings slightly raised over his back. At 17:25, he left her briefly to chase another male; returning immediately, they were both seen to

perform their first triumph ceremony together. Meanwhile, the cygnets kept their distance. On 16 October, the female was seen to follow the male for the first time, and, by 22 October, her two cygnets were accepted by the male and stayed close to the new pair, behaving like a normal brood. On 7 February 1996, the pair were returned to the female's home pond where they nested that summer.

Male 272 was bereaved on 23 February 1996, moved to Aurora, and released immediately on the main pond. On 24 February, he was seen in triumph ceremony with an unmated 3-year-old female, 131. They then became inseparable and were first seen copulating in March.

Not all bereaved females will accept the first male that courts them. Two previously mated males, 135 and 745, formed a same-sex liaison, behaving like a pair. Frequently they chased other swans, triumphing regularly but deferring to a mated pair. Female 110 had lost her mate on 20 March 1996. On 12 April, I released her from a neighbouring pen onto the main pond. Both males 135 and 745 chased her aggressively and performed frequent triumph ceremonies over her. On 14 April, I returned female 110, along with male 135, to her former pen, excluding male 745 and other swans. Immediately, female 110 attacked male 135 and beat him severely until he fled and sought shelter under a dense rose bush, where she left him alone. I moved her back onto the main pond where male 745 immediately chased her vigorously. On 15 April, the two were staying close together. On 16 April, the two were on the water separated by about 8 m (25 ft). The male swam slowly toward the female with neck erect, beak pointed slightly down, and turning his head from side to side. He moved very close to her, almost touching, when she slowly turned away. On 23 April, 3 May, and 8 May, they were seen copulating but did not nest in 1996.

A pair, male 105 and female 791, nested for 3 years but produced no cygnets. They were brought to Aurora on 30 June 1995 and remained together until July, when another male, 134, hatched in 1993, was seen following her without interference from her former mate. They remained together, occasionally doing triumph ceremonies, and were moved back to her home pond on 1 August. Meanwhile, on 4 August, male 105 was first seen following female 120, hatched in 1993. They occasionally performed triumph ceremonies and were seen copulating on 11 August. They continued to do so almost daily until 17 September. They were moved to a cooperators pond on 20 November where they nested in 1996.

These are a few of the case histories of pair formation among captive Trumpeters at Aurora. We have records of 15 pair bonds formed in January (1), February (3), February-March (1), March-April (2), April (1), June (2), July (1), August (1), October (2), and November (1). Among these pairs, we have seen pairs copulate in January (1), February (2), March (1), April (1), June (1), and August (1).

Subadults

Trumpeters hatched from eggs collected in Alaska were pinioned as yearlings and moved to Aurora in August to November 1994. Some of these birds formed pair bonds with older males during the fall and were moved to cooperators' ponds.

Ten of them remained at Aurora for an average of 10 months. In February and March 1995, many of these 20-month-old swans started courtship. They were frequently seen copulating but switched partners at intervals, as recorded by Monnie (1966) at the Lacreek NWR. Many of these birds were raised as siblings, and none of their sexual activities resulted in stable bonds. However, during the summer of 1995, it was clear that some had mated with older birds. These were moved to cooperators' ponds where two of these pairs bred in 1996.

Homosexual relationships

Male 105 was hatched in 1988 and raised by Ray Nash's captive pair. 105's breeding history is described above. He was returned to Aurora on 20 September 1996 after his mate and remaining cygnet were killed by a coyote. Male 124 was hatched from an Alaskan egg in an incubator. With others, he was raised unexposed to people until 12-weeks of age. He was, therefore, not imprinted on humans and would not follow anyone. He was moved on 30 October 1994 with female 787, with which he seemed to be paired, to a cooperator's pond. They did not breed in 1995 and were returned to Aurora on 25 May 1996, at the request of the cooperator. On 11 October 96, male 105 was released from a holding pen onto the main pond where six unmated mature females were present and available as mates. Almost immediately, he formed a homosexual attachment to male 124, and they were

seen copulating for the first time on 15 November. They copulated repeatedly with much trumpeting, unlike normal pairs, through November and early December. On 22 December 1996 and again on 3 January 1997, the two performed pre-copulatory head dipping, and male 105 made a half-hearted attempt to mount, but gave up.

This is clearly homosexual behaviour and differs from the behaviour of the two males 135 and 745. Both had lost their mates in March 1996. Previously, 745 had bred successfully from 1990 to 1992. They first encountered one another on 14 March 1996 and became inseparable. They harassed other birds on the pond with frequent triumph ceremonies and behaved in every way as a mated pair, except that they did not indulge in sexual behaviour. This association finally broke up when 745 formed a pair bond with the female 110 in April (see above). Male 135 went on to form an alliance with male 108 who had lost his mate in August 1996. 108 had bred in 1995 and 1996 and was an Alaskan cygnet raised unexposed to humans in the same manner as 105. These males remained together but did not have an alliance as intense as that of 135 and 745. They seldom harassed other swans and were never seen to copulate.

These alliances cannot be called homosexual relationships because copulation is not involved. Perhaps they can best be called homomorphic behaviour since the relationship is similar in form to that of a homosexual or heterosexual pair. Of similar form is the behaviour of two siblings or two females which use their alliance to dominate other birds in the flock. This kind of homomorphic behaviour appears to confer competitive advantage on the participants in that they displace other birds from the food hoppers and take over favoured loafing spots.

DISCUSSION

These observations were made on captive, flightless Trumpeter Swans. Flying birds in nature would not have encountered the densities imposed on these penned captives. Nevertheless, these data illustrate the capabilities of the species.

It is not always easy to determine when a pair bond has been consolidated. Generally, when a male and female have not been consorting but suddenly do so and start to perform the triumph ceremony, it is a good indication that a pair may be forming. When such behaviour persists for some time and culminates in copulation, one can be fairly sure that a bond has been consolidated.

Trumpeter Swans are long-lived birds and often form pairs away from a nesting territory and a year before they actually breed (Palmer 1976). Two birds in alliance are more likely to succeed in competition for nesting space than a single bird.

These captive data, and those of other studies, show a wide range of dates when pair bonds can be formed. At Aurora, there were only 3 months when none were seen, May, September and December. In is clear that many of the copulations seen had nothing to do with procreation. Presumably, the pleasure derived therefrom served as a bonding mechanism.

Increasing day length, which activates the reproductive system in most birds and stimulates courtship, song, and territorial behaviour, presumably operates on Trumpeter Swans. Thus, the hormone balance is activated which controls the production of testosterone and estrogens and stimulates the development of sperm and eggs. It is not surprising that half the pair formation recorded at Aurora occurred from January to April. More difficult to explain is the hormonal background to pair formation seen in June, July, August, October, and November. At a time of decreasing day length, one might expect regression of gonads and a decline in the hormone pattern which stimulates and controls courtship and pair formation. Nevertheless, copulations were seen in June and August, and the homosexual pair copulated in November and December.

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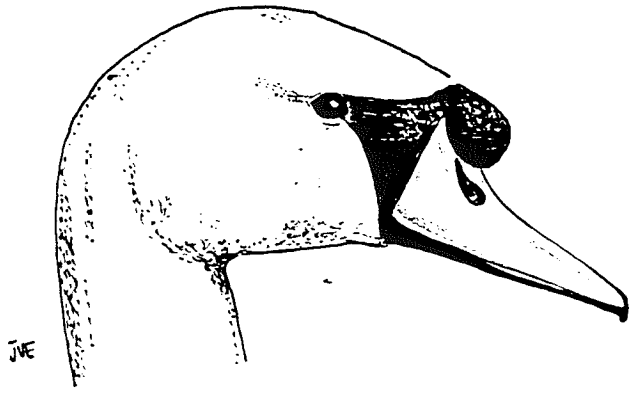

MUTE SWAN POPULATIONS, DISTRIBUTION AND MANAGEMENT ISSUES IN THE UNITED STATES AND CANADA

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BACKGROUND

The Mute Swan (*Cygnus olor*) was introduced to North America from Europe during the late 1800s, when private individuals brought them to their estates in the lower Hudson Valley and on Long Island, New York. About 1910, it was reported that some of these birds had escaped or were released, resulting in the initial wild breeding swans becoming established in New York. Other records indicate that the first wild breeding in 1919 resulted from a pair of Mute Swans that escaped from an estate (Williams 1997).

Mute Swans are essentially nonmigratory, but there are seasonal movements, and some more lengthy migrations are beginning to occur. By the 1950s, they had expanded their range into other Atlantic Coastal states. During the early 1970s, they were reported in all four flyways, with the largest number, over 9500, reported in the Atlantic Flyway during the 1993 summer survey. Other significant numbers occurred in Michigan, Wisconsin, Washington, Ontario, and British Columbia. Surveys conducted during 1996 indicated that wild populations of Mute Swans were present in at least 24 states and six provinces, with annual reproduction reported in nine states and one province. Established breeding populations are increasing at the rate of 6-25% annually. During the past 10 years, the overall wild population increased by more than 50%, including a 65% increase in the Atlantic Flyway (Allin 1981, 1996).

As their name implies, Mute Swans are silent most of the time, although they do hiss and grunt when alarmed. They are intermediate in size between the Trumpeter Swan and the Tundra Swan, with adult males averaging 25 pounds, 4½-5 feet in length, and a wing span of up to 7 feet. Mute Swans are distinguished by their orange bill with a black fleshy knob (cere) and by their resting pose with the neck in an s-curve and the bill pointed down. There are two color phases, Royal, or gray, and Polish, or white, phase (Gelston and Wood 1982).

Mute Swans use a variety of small ponds, bays of larger marshes and lakes, river systems, and estuaries in the coastal zone. They utilize aquatic vegetation, especially submergents, and aquatic invertebrates in great volume, with eat-outs reported where larger concentrations of swans occur. In areas where supplemental winter feeding is conducted, they readily accept corn, small grain, and vegetables.

Preferred nesting sites are small ponds or protected bays, where they select islands or construct mounds of emergent vegetation, usually cattail or bulrush. In the northern latitudes, they begin nesting during March and April, depending on the location. Studies conducted in Michigan (Wood and Gelston 1972) report clutch sizes ranging from one to eight eggs, average four, with an incubation period of about 35-41 days. Nesting success is generally good, with cygnet survival to fledging averaging about 50%. As a result, recruitment rates are relatively high.

MANAGEMENT ISSUES

The major population increase during the past 10-15 years and the aggressive behavior demonstrated by Mute Swans have created concern about the competition this exotic species may be creating with other waterfowl and waterbirds. In some eastern states, they are reportedly eliminating nesting of Black Skimmers (*Rynchops niger*) and Least Terns (*Sterna antillarum*), an endangered species, and displacing Common Terns (*S. hirundo*), Forster's Terns (*S. fosteri*), and Royal Terns (*S. maxima*) (Williams 1997). There have been documented accounts of competition for nesting sites and other aquatic resources, as well as conflicts with human activities such as swimming, boating, and fishing. Other recreational pursuits are indirectly affected by fouled lawns and waters. Reports of attacks on children and pets are increasing, and Mute Swans have been observed challenging jet skiers that harass them. These incidents have lead to greater concerns about public safety (Jerry Martz, pers. comm.). There is particular concern about potential conflicts with the growing breeding flocks of Trumpeter

Swans and in certain areas where there have been impacts on Common Loons (*Gavia immer*).

Because of these concerns, The Trumpeter Swan Society initiated action in 1996 to begin an assessment of current Mute Swan population levels, distribution, annual recruitment rates, and related management issues across the United States and Canada. There is an apparent need for better coordination of periodic surveys and production studies to monitor population growth. Further consideration should be given to management measures that might be implemented to prevent further growth and expansion of Mute Swan populations. Some states have already developed management policies to deal with growing populations of Mute Swans, while others are confronted with confusing regulatory procedures.

In the United States, Mute Swans are not protected under federal migratory bird regulations while, in Canada, they are included with all swan species protected under the Migratory Birds Convention Act (Mary Wyndham, pers. comm.). The Canadian provinces are thus bound to protect Mute Swans under this Act. In some states, Mute Swans are listed as a protected species while they are not protected in others, and they are listed as a deleterious species in at least one state, Washington.

During July 1996, I discussed these issues with the four flyway representatives of the U. S. Fish and Wildlife Service to determine the current status of management activities underway in the states, provinces, and private organizations in the flyways. In November 1996, I requested their assistance in obtaining current information from the states and provinces through the flyway technical sections. We also discussed future coordination required, resolution of regulatory problems, and a variety of ongoing management issues. The responses received to date are summarized for each flyway in Tables 1-4. As additional information is received, a more comprehensive analysis will be completed .

Summary of responses received

A review of Tables 1-4 indicates that information is incomplete for many states and that there needs to be a more standardized approach used for data collection and analysis. It is evident that, in 1996, there were more than 10,000 wild and captive Mute Swans in the Atlantic Flyway, and there may have been an additional 3000 in captivity. With an annual growth rate of 6-7%, it is believed that this flock may exceed 20,000 swans by the year 2000.

In the Mississippi Flyway, there were more than 3600 Mute Swans in the wild and an additional 1000 in captivity. The greatest number are in Michigan, where an annual increase of 16% was reported. Based on reports received to date, there are relatively few Mute Swans in the Central Flyway, and those present are being raised in captivity under permit. In the Pacific Flyway, there were more than 700 Mute Swans in British Columbia and over 200 in Washington, but annual production in the wild is unknown.

Based on population estimates provided, there must have been 18,000-20,000 Mute Swans present in the wild and in captivity during 1996. These numbers have increased further since then.

It also is obvious that there is great variation in the attention being given to Mute Swans by the respective federal, state and provincial agencies, and private organizations involved. There, likewise, is a varied public interest. In most eastern states, there is increasing public opposition to population control measures being implemented or proposed for Mute Swans. The strongest opposition occurs in Vermont, Massachusetts, Connecticut, Rhode Island, and Maryland. Anti-control sentiments are building in Michigan, where a new organization, "Save Our Swans," has been formed. Control measures are used on a selective basis in Michigan, Ohio, and Wisconsin to address specific problems and on state lands. Capture and transfer programs have been initiated in some states where population reduction is believed necessary. Even these techniques are now considered unacceptable by some opponents (Williams 1997).

It is evident that, where significant populations of Mute Swans are now present in the wild, population control is becoming more difficult, and elimination may be impossible. These experiences should help guide actions in those states contemplating the need for population control. Where the need for control is anticipated, clear policies and guidelines on legal status, regulatory measures, and acceptable control methods should be developed quickly.

Current status

Based on a review of selected literature available on Mute Swans and the information received to date

from the respondents to our recent inquiry, the current status is summarized as follows:

- The continental population of Mute Swans in the wild may exceed 18,000 birds, with strong annual recruitment.
- The coordinated periodic swan surveys are beginning to provide more meaningful information. Better data are required for those states and provinces having significant numbers of Mute Swans to properly monitor the rapid increase of this exotic species.
- There is increasing concern about potential conflicts between Mute Swans and other waterfowl, especially Trumpeter and Tundra Swans on wintering areas.
- There is considerable variation in state regulations pertaining to Mute Swans, ranging from protected status to unprotected, and different interpretations of such laws as related to implementation of population control measures. At least six states now conduct direct control programs under management plans or exotic species guidelines. Five states are considering regulatory changes to permit control when needed. Others apparently remove feral swans in a "silent manner." Public concern over removal of Mute Swans is being voiced in some states, especially in the eastern U. S. This indicates an immediate need to improve public understanding about the danger of expansion of an exotic species. To some, however, all swans are beautiful, big white birds.
- Control measures generally consist of requiring mandatory permits for private rearing, pinioning of all birds held in captivity, prohibiting releases into the wild, sterilizing captive and feral males, shaking or oiling eggs, removing eggs from nests, harassing birds, and eliminating birds by trapping, euthanasia, or shooting. Further attention must be given to developing and using practical and socially acceptable population control methods.
- The rapid growth of populations in the Atlantic Flyway, with large wintering concentrations occurring in Chesapeake Bay, and, more recently, in the Great Lakes Region, is alarming and indicative of what could happen in similar coastal and fresh water habitats in other flyways.
- There is an apparent need for a uniform policy on the prevention of further population growth and range expansion of Mute Swans. Population dynamics of current Mute Swan flocks will need to be considered in this policy statement.
- Wildlife management agencies and private conservation organizations are beginning to devote more attention to all swans and are becoming aware of the potential conflict posed by Mute Swans. Greater emphasis is needed on information, education, and public involvement.
- More definitive information is needed on the potential conflicts between Mute Swans and other swan management programs, particularly the Trumpeter Swan restoration programs.

RECOMMENDATIONS

At this stage of the assessment process, I believe the following recommendations are in order:

- Develop better policy guidelines and administrative procedures to fully address the biological, ecological, and sociological relationships involved in the management of the Mute Swan as an exotic species.
- The flyway councils and technical sections should take the lead in each flyway to develop the necessary policies, regulatory changes required, and management guidelines to address the growth of this exotic species in North America. The Atlantic Flyway has indeed already taken action.
- The U. S. Fish and Wildlife Service and the Canadian Wildlife Service should reassess their role and responsibility in the management of Mute Swan populations as related to potential adverse impacts on other migratory birds and their shared habitats.
- Proceed with completion of this assessment under the auspices of The Trumpeter Swan Society and prepare a more comprehensive status report during 1998 to support any flyway council actions as recommended above. This will require continued cooperation with the federal, state, and provincial agencies involved, the flyway technical sections, other

conservation organizations, and private interest groups.

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Table 1. Status of Mute Swans in the Atlantic Flyway, 1996.

State/Province	Total Swans	Number in Captivity *	Annual Production	Seasonal Movements	Legal Status	Management Problems	Control Measures
Connecticut	1700	-	-	-	Protected	Other birds & public safety	Proposed
Delaware	50	-	1 pr.- 4 cygs.	-	Non-protected exotic	-	Yes
Florida	1000	1000	40 cygnets	-	Non-protected	-	None
Georgia	50	-	-	-	-	-	-
Maine	15	-	2 pr. - 4 cygs.	None	Protected - permits	None	None
Maryland	2260	-	340	Yes	Non-protected	Other birds & public safety	Yes
Massachusetts	900	-	180	To coast	Protected - permits	None	None
New Hampshire	50	-	2 pr. - 6 cygs.	Unknown	Non-protected	Other birds & public safety	Yes
New Jersey	900	-	-	-	-	-	-
New York	2000	-	Unknown	To coast	Protected - permits	Other birds & public safety	Yes
North Carolina	30	-	-	-	-	-	-
Ontario	2500	600	-	Great Lakes	Protected	Competition w/ Trumpeters	-
Pennsylvania	250	190	13 prs - 24 cygs.	Unknown	Non-protected	Habitat degradation	Yes, on state land
Rhode Island	1300	-	-	To coast	Protected - state	Other birds & public safety	Yes
South Carolina	10	-	-	-	-	-	-
Vermont	5	-	2 pr. - 2 cygs.	-	Preparing policy	-	-
Virginia	250	100	2 pr. - 4 cygs.	-	Preparing policy	-	-
West Virginia	10	-	1 pr. - 2 cygs.	None	Protected	-	None

NOTE: Information is incomplete. Current information will be requested. Information from Atlantic Flyway Provinces has been requested but not received.

* Most state/province surveys did not include Mute Swans in captivity.

Table 2. Status of Mute Swans in the Mississippi Flyway, 1996.

State/Province	Total Swans	Number in Captivity *	Annual Production	Seasonal Movements	Legal Status	Management Problems	Control Measures
Arkansas	0	-	0	-	Non-protected, no releases allowed	Reexamine regulations	None
Iowa	75	50	Unknown	Unknown	Being reviewed	Reexamine regulations	None
Illinois	200	-	25 pr., 100 cygnets	Yes	Protected by IL law	Other wetland birds	None
Michigan	4000	1000	Unknown est. 17-20% annual increase	Yes	Exotic by MI law, permits required	Conflicts w/ Trumpeter Swans and loons, habitat degradation, public safety	None
Minnesota	60	50	None	None	Non-protected, exotic permit required	Conflicts w/ Trumpeter Swans, loons and other birds, public interpretation	Yes
Missouri	12 **	-	-	-	-	-	None
Ohio	Unknown	-	Yes	Yes	Nongame	Conflicts w/ Trumpeter Swans, habitat degradation	Yes, on State lands
Wisconsin	340	-	50+ cygnets, 17% annual increase	Yes	Non-protected, policy to remove from wild by 2005	Conflicts w/ Trumpeters, Tundras Swans and other birds, public safety	Yes, prevent growth

Data is incomplete; current information will be requested.

* Most state/province surveys did not include Mute Swans in captivity.

** Reported in CBC count from Springfield, MO.

Table 3. Status of Mute Swans in the Central Flyway, 1997.

State/Province	Total Swans	Number in Captivity *	Annual Production	Seasonal Movements	Legal Status	Management Problems	Control Measures
Alberta	67	67	Unknown	Captive	Protected, permit required	Aggressiveness	None
Colorado	<50	50	Unknown	Sedentary	Protected, permit required	None	None
Kansas	None	-	None	N/A	Protected	None	None
Montana	None	-	None	N/A	Unknown	None	None
Nebraska	<12	-	2-4 Broods	Sedentary	Protected	None	None
New Mexico	Unknown	-	Unknown	Captive	Unknown	None	None
North Dakota	Unknown	-	Unknown	Sedentary	Unknown	None	None
NWT	-	-	Will receive from CWS				
Oklahoma	Unknown	-	None	None	Unknown	None	Unknown
Saskatchewan	-	-	Will receive from CWS				
South Dakota	None	-	None	N/A	Unknown	None	Unknown
Texas	Unknown	-	Unknown	Sedentary	Not protected	Aggressiveness	None
Wyoming	19 **	-	Unknown	Captive	Protected, permit required	Unknown	None

Data incomplete; current information will be requested.

* Most state/province surveys did not include Mute Swans in captivity.

** National Park Service has removed 70+ Mutes over the past few years and replaced with Trumpeters.

Table 4. Status of Mute Swans in the Pacific Flyway, 1996.

State/Province	Total Swans	Number in Captivity *	Annual Production	Seasonal Movements	Legal Status	Management Problems	Control Measures
Alaska	0	-	-	-	Permits required, no release	-	-
Arizona	0	-	-	-	-	-	-
British Columbia	500	-	Unknown	None - coastal habitat year-round	Protected	Conflicts w/ Trumpeters, Tundra, and other birds	-
California	No info	-	-	-	-	-	-
Idaho	No info	-	-	-	-	-	-
Nevada	0	-	-	-	Protected, permit required	-	-
Oregon	No info	-	-	-	-	-	-
Utah	No info	-	-	-	-	-	-
Washington	200	-	-	-	Deleterious species, permits required	Conflicts w/ Trumpeter Swans, habitat degradation	Yes

Note: The information from the states/provinces of Alberta, Colorado, Montana, New Mexico and Wyoming included in Central Flyway report.

Data incomplete; current information will be requested.

* Most state/province surveys did not include Mute Swans in captivity.

FOOD PREFERENCES OF MUTE AND TRUMPETER SWANS

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ABSTRACT

As part of a larger study of herbivory in freshwater systems, the food preferences of Trumpeter Swans (*Cygnus buccinator*) and Mute Swans (*C. olor*) were examined. We performed selective feeding assays with subadult swans at the Kellogg Biological Station Bird Sanctuary in an attempt to determine food preferences, amount of overlap between the two swan species, and plant characteristics which influence feeding preference. Several species of submerged and floating-leaved aquatic vegetation collected from a Michigan lake were tested. Both species of swan showed distinct preferences for and against some plant species. Results showed that there are both similarities and differences in feeding preferences of Mute Swans and Trumpeter Swans. More research is needed to address the extent of overlap between the two species. Theories of plant defense indicate that, while palatability varies among plant species, it can also vary within the same species of plant. To test one of these theories, we collected *Ceratophyllum demersum* from two lakes of differing light availability and trophic status. Trumpeter Swans showed a significant preference for *Ceratophyllum* grown under low light levels over that grown in a high light environment. Thus, preferences for a species of macrophyte may vary depending on the environmental conditions of its habitat.

OBSERVATIONS OF TERRITORIAL CONFLICT BETWEEN TRUMPETER SWANS AND MUTE SWANS IN MICHIGAN

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ABSTRACT

A portion of the restored Trumpeter Swan (*Cygnus buccinator*) population range and that of the established feral population of Mute Swans (*C. olor*) overlap in Michigan. Anecdotal data is presented on conflicts between the two species during the nesting season. Despite the fact that the two species are equivalent in many respects, a body of evidence is accumulating that indicates that Trumpeter Swans will dominate Mute Swans in conflict associated with the acquisition and maintenance of nesting territories.

INTRODUCTION

The first feral Mute Swans (*Cygnus olor*) in Michigan were allowed to fly free in 1919. Additional releases and escapes from captivity have resulted in a population that now nests in 40 of Michigan's 83 counties. The population reached peak numbers of 2900 in 1992 and has declined to approximately 2000 in 1996 (Jerry Martz, pers. comm.). Cessation of winter feeding, starvation, and parasitism have resulted in an altered distribution and apparent population decline in recent years.

From 1986-88, attempts were made to utilize Mute Swans as foster parents for Trumpeter Swans (*C. buccinator*). A total of 44 viable Trumpeter Swan eggs was placed under Mute Swans. Thirty-one hatched, but only six cygnets were reared to fledging. Predation, parental rejection, and abandonment were known causes of cygnet losses. This experimental restoration technique worked, but not well.

Michigan continued its effort to restore Trumpeter Swans utilizing techniques developed by the State of Minnesota. A total of 139 2-year-old swans have been released to date, with major releases occurring in 1991, 1992, and 1993. The Fall 1996 population estimate for Michigan was 141, including 16 successful nesting pairs and 43 cygnets.

Considerable effort was made not to release clipped Trumpeter Swans into habitats occupied by free-flying Mute Swans. If Mute Swans were present, they were selectively removed. It was only a matter of time before interactions between the two species would occur and be documented.

METHODS

Trumpeter Swan nesting began in 1992, with the number of mature territorial pairs increasing rapidly through 1995 and 1996 to approximately 25. Only about a third of the pairs (nine) occupy ranges that overlap with Mute Swans, primarily in southwestern Michigan. This paper is an anecdotal summary of observations reported to me by a concerned and increasingly interested public. It should be kept in mind that the average person cannot differentiate between the two species of swans.

RESULTS

As second-generation, wild Trumpeter Swans form pair bonds and attempt to occupy new nesting territories, the number of interspecific interactions has increased. Of the five interactions reported in this paper, four occurred in 1996.

On 21 April 1990, a citizen living on Orchard Lake, near Richland, called to report a conflict between Trumpeter Swans and Mute Swans. The caller had observed a fight between the swans. He was quite sure the Mute Swans were gone and that the Trumpeters had a nest with five eggs in it. Considering that this might be the first nesting effort in Michigan by Trumpeter Swans in a century, we were quick to investigate. The Trumpeter Swan pair was in residence, the Mute Swans were indeed absent from the territory, and, to our dismay, the eggs were greenish-blue in color, indicating that they were, in fact, Mute Swan eggs. However, the eggs contained dead embryos. The Trumpeter Swan pair consisted of a male from Ontario, hatched in 1987, and a female from Kellogg, also hatched in 1987.

There was no evidence that this pair of 3-year-olds attempted to nest in 1990. The female was found dead under a power line during the fall of 1990.

On 18 March 1996, a citizen called to report a conflict between a Trumpeter Swan and a Mute Swan on Glasby Lake in Barry County. He reported that, on an upland site in his yard, a Trumpeter Swan, tag number 135, had driven a Mute Swan under a brush pile, had broken at least one of the Mute Swan's legs, and would not allow the Mute Swan out from under the brush pile. The Mute Swan was later removed by Animal Rescue. This male Trumpeter, hatched in 1993, is a first-generation wild swan. He and his unmarked mate occupied the territory and reared one cygnet in 1996.

This next observation was reported on the same day, 18 March 1996, and was only the second nuisance complaint concerning Trumpeter Swans I had ever received. In this case, there was no equity between the species. A single, unmarked, flighted Trumpeter was reportedly driving a pair of pinioned, proven-breeder Mute Swans from a private pond in Van Buren County. It was potentially problematic because private property was involved. The Trumpeter was discouraged from using the pond, and no further interactions were reported.

Another call, on 1 May 1996, involved a pair of Trumpeters, wing numbers 29 and 147, and a breeding pair of Mute Swans in Allegan County. The note received concerning the incident indicated that the Trumpeters were "with his pair of Mutes, and not getting along well." Fortunately, they were free-flying Mutes and not "his." The record is not clear enough to determine which species prevailed. The pond owner indicated that the Mute Swans were dominant until their eggs were lost, then the Trumpeters prevailed and remained until ice-up. This pair of 3-year-old Trumpeters did not attempt to nest in 1996. The male was from Belle Isle Zoo, and the female was from Binder Park Zoo.

The last call of the season relating to territorial conflict occurred on 19 May 1996. A leg-banded Trumpeter was reported chasing a Mute Swan pair from a sizable lake in Barry County. This lake has contained nesting Mutes for a number of years. Unfortunately, the observation is incomplete because drought conditions during the previous summer caused the portion of the lake where the caller lived to become a mud flat and owners on the deeper end of the lake could not add to the story. Circumstantial evidence indicated that the Trumpeters were a pair of 3-year-olds, including wing number 139, and that they reared three cygnets to flight in 1996.

DISCUSSION

Mute Swans and Trumpeter Swans are quite similar in size, weight, color, and diet, and in being northern temperate species (Scott 1972). Scott indicates that many other measures are quite similar between the two species as well; however, it is doubtful some of these, such as incubation time, clutch size, egg weight, egg dimensions, or weight at hatching, are connected to territoriality. Physically, these two species are essentially alike, and our ability to predict which one is likely to dominate is limited.

Two factors that may relate to territoriality and a prediction of dominance are quite different. Nest initiation is 3-4 weeks later for Trumpeter Swans, which could favor Mute Swans. However, both species return to nesting territories prior to ice-out, which may make this difference insignificant.

The second, and perhaps most important, difference is the nesting territory size. According to Banko (1960), Trumpeter Swan nesting territories at Red Rock Lakes National Wildlife Refuge ranged from 30 to 60 hectares. Scott (1972) indicates that Mute Swan nesting territories in the United Kingdom may be as small as 4.5 hectares. Both authors suggest that habitat structure within a wetland system can affect nesting territory size. The nearly tenfold difference in nesting territory size would seem to favor dominance by Trumpeter Swans.

CONCLUSION

The five observations related in this paper indicate that, in most cases to date, Trumpeter Swans have dominated Mute Swans when interspecific competition for nesting territories occurred. The observation of a single Trumpeter Swan dominating a breeding pair of Mute Swans should probably be disregarded because those Mute Swans had been pinioned.

Competition for nesting territories will occur more frequently in the future. Observations in Michigan, Ohio, and Ontario should shed additional light on whether or not the presence of Mute Swans represents a barrier to Trumpeter Swan restoration.

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