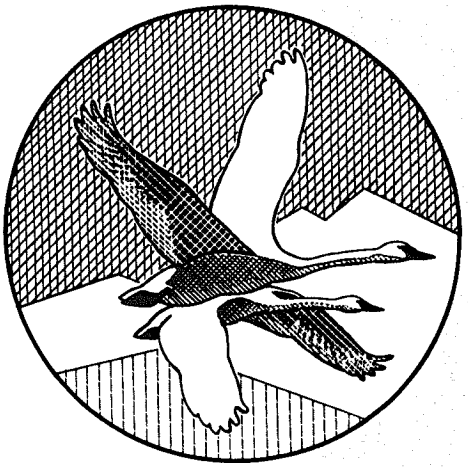
PROCEEDINGS AND PAPERS OF THE

THIRTEENTH TRUMPETER SWAN SOCIETY

CONFERENCE



13 - 16 February 1991
Salt Lake City, Utah

Carl D. Mitchell
Janissa R. Balcomb
and
John E. Cornely
Editors

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PROGRAM CHAIR
David Lockman

CONFERENCE SPONSORS

The Trumpeter Swan Society
Utah Division of Wildlife Resources
U. S. Fish and Wildlife Service, Region 6

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PREFACE

The Thirteenth Trumpeter Swan Society Conference was the first such conference held outside of Trumpeter Swan breeding range. The issue of range expansion in the Rocky Mountain Population is a major one, and the Society's directors believed that discussions would be more thorough and solutions more acceptable if they involved all of the agencies and publics involved. The best way to accomplish this was to hold the conference in the heart of what may prove to be a major area of future Rocky Mountain Population range expansion. Some initial steps have already been taken by the swans and by early, experimental programs. Much of the background, rationale, management actions and recommendations for the future are detailed in these proceedings.

Of course, Trumpeter Swan management is multifaceted, and papers on range expansion efforts in other regions, harvest management of Tundra Swans, marking protocols, basic biological investigations and other management programs are also included.

We trust the presentations at Salt Lake City and the papers in this volume will assist all those individuals endeavoring to help Trumpeter (and Tundra) Swans succeed in a complex and changing world.


MARK BECKEL
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ACKNOWLEDGEMENTS

A number of individuals contributed a great deal of time and energy to making the Thirteenth Trumpeter Swan Society Conference a success.

Dave Lockman and Martha Jordan made the arrangements for the conference site. They, in cooperation with Tom Aldrich, Donna Compton, Larry Gillette, Mary Maj, Len Shandruk and Ruth Shea, developed the program agenda and workshop and assigned some papers. Dave Lockman also served as Program Chair.

All of the hosts, moderators, authors and presenters, the folks who attended and participated in the banding protocol discussion the night of the 14th, and the workshop participants on the 16th had a hand in making the Conference more productive and relevant to swan management issues.

Several anonymous individuals and businesses made very generous donations to the Society to assist with the Conference.

Mark Beckel and Judy Voigt Englund created the artwork found in these proceedings.

Finally, Donna Compton deserves special recognition for helping the editors get through the process and assisting with the final production of these proceedings.

Our sincere thanks to all of you.

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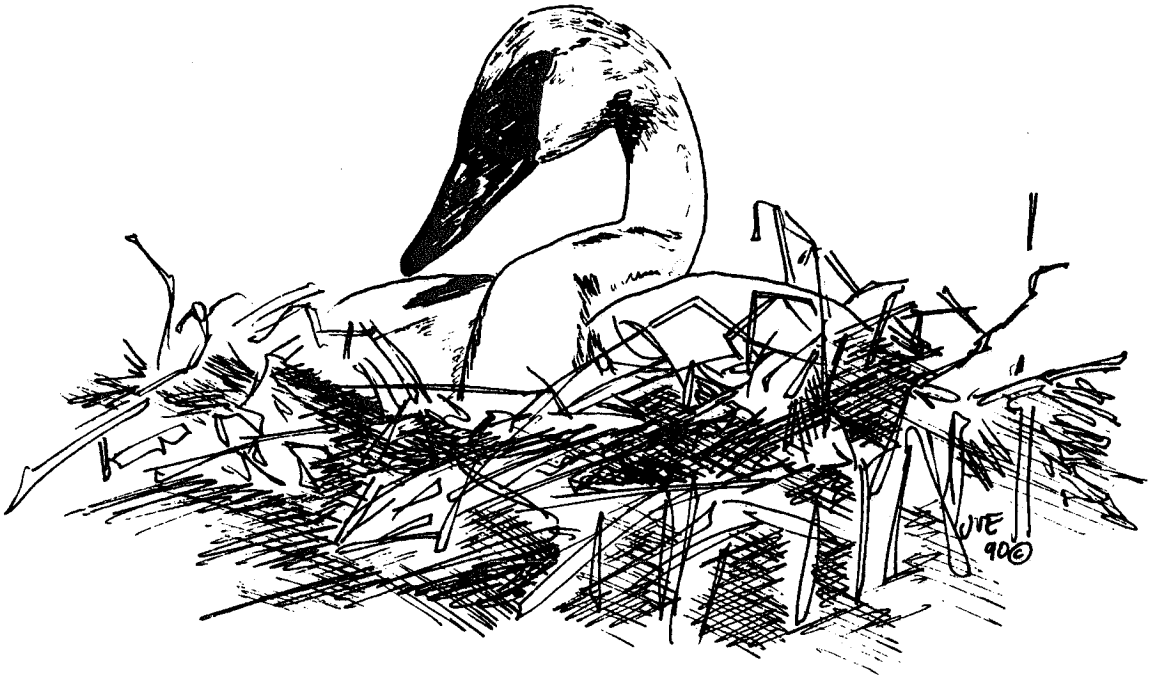
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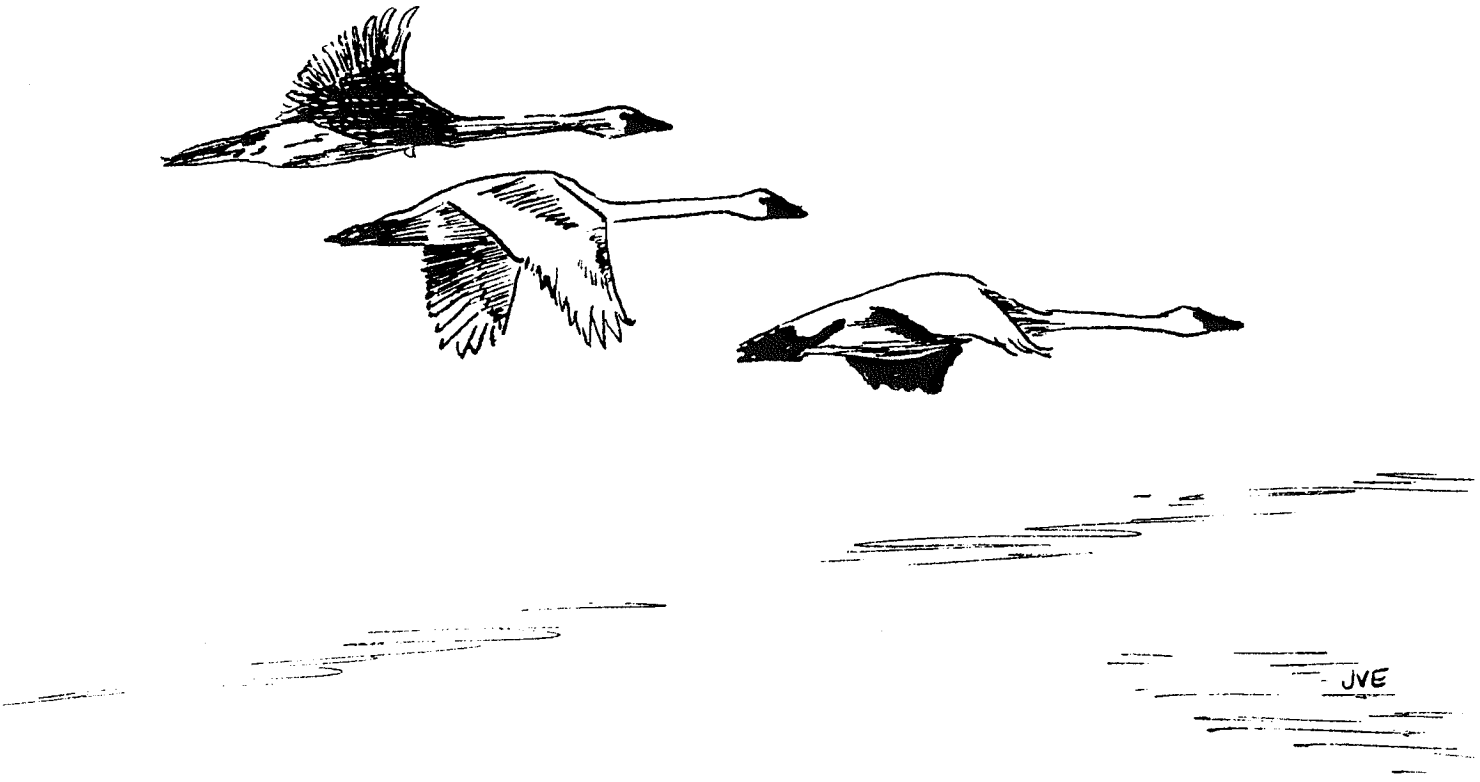
INTERIOR POPULATION

PACIFIC COAST POPULATION

NORTH AMERICAN MANAGEMENT PLAN

FACILITATED WORKSHOP ON TRUMPETER/TUNDRA SWAN MANAGEMENT AND RANGE EXPANSION FOR THE RMP

ROCKY MOUNTAIN POPULATION



ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS: STATUS, DISTRIBUTION AND MOVEMENTS

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ABSTRACT

SURVEY DATA, TECHNICAL LITERATURE AND UNPUBLISHED REPORTS WERE REVIEWED TO DESCRIBE THE STATUS, GROWTH AND POPULATION CHARACTERISTICS OF TRUMPETER SWAN FLOCKS IN THE ROCKY MOUNTAIN POPULATION. FLOCK AND POPULATION TRENDS ARE PRESENTED. INFORMATION ON LOCAL MOVEMENTS AND MIGRATION PATTERNS ARE REVIEWED.

INTRODUCTION

North American Trumpeter Swans are divided into various populations, based on geographic distribution and genetic affinity (for restored flocks). The Rocky Mountain Population (RMP) is comprised of Trumpeter flocks found in inland western North America (Figure 1).

The RMP is comprised of two subpopulations. The Interior Canada Subpopulation (ICSP) is composed of flocks in Alberta, Saskatchewan, eastern British Columbia, Yukon and Northwest Territories. The Tristate Subpopulation (TSP) is composed of flocks in Montana, Idaho, Wyoming, Utah, Oregon, Nevada, and eastern Washington. These latter three flocks were restored in those areas, using swans from Red Rock Lakes National Wildlife Refuge (NWR), Montana. Coordination of the management for these three restoration flocks was assigned to the RMP Technical Subcommittee on Trumpeter Swans in May 1990. They had been assigned to the Pacific Coast Population (PCP) Subcommittee since 1984.

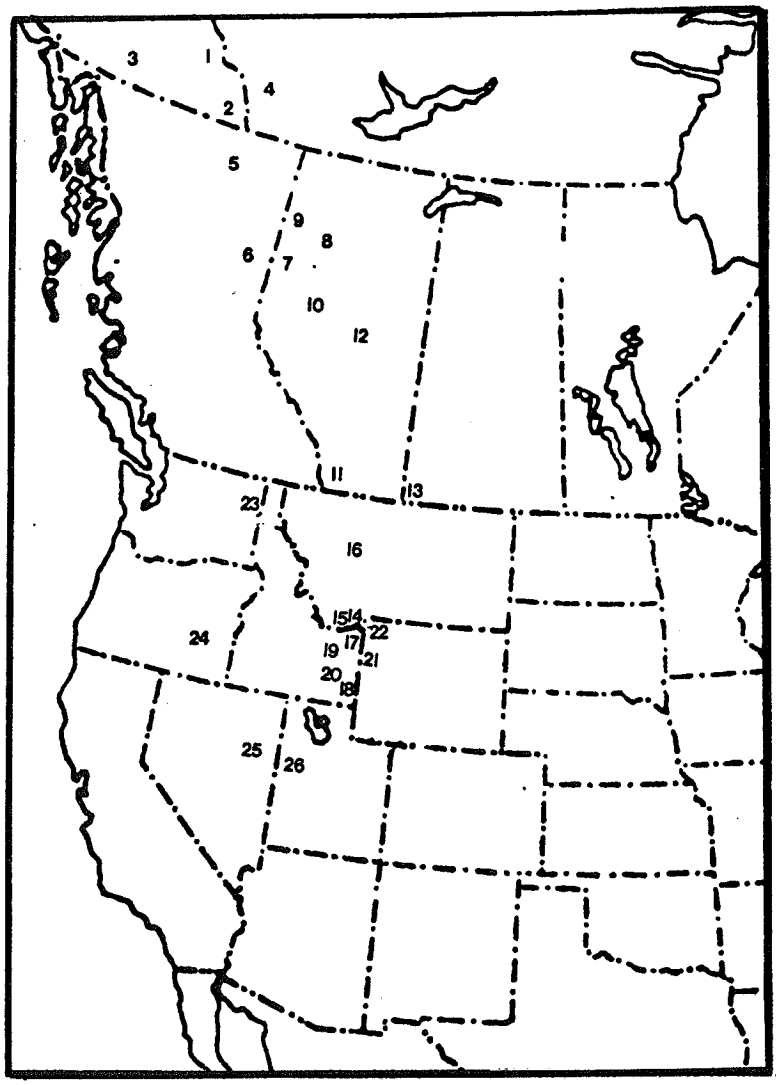
Management responsibilities are divided among state and provincial wildlife agencies, the U. S. Fish and Wildlife Service (USFWS) and the Canadian Wildlife Service (CWS). While various agencies have their own Trumpeter Swan management goals, objectives and programs, all are generally coordinated under the North American Trumpeter Swan Management Plan (Anon. 1984), through the Pacific Flyway Council, and its several technical and study subcommittees.

In this paper, we provide a review of various RMP flock trends and describe distribution, local movements, and migration patterns.

METHODS

Data on flock size, production, wintering numbers, age ratios and distribution were obtained from published accounts (Banko 1960, Gale et al. 1987) agency files (e.g. Mitchell 1990a, 1990b.), and interviews with other biologists about flocks in their areas.

Information on movements was also obtained from Banko (1960), Gale et al. (1987), Lockman et al. (1987, 1989), McEneaney and Sjostrom (1983, 1986), McEneaney (1986), and personal observations. Data on collared or other marked Trumpeter Swans is regularly recorded by personnel with Wyoming Game and Fish Department, Idaho Parks Department, USFWS (Red Rock Lakes NWR, Southeast Idaho Refuge Complex, National Elk Refuge, Wyoming Cooperative Wildlife Research Unit), National Park Service (Yellowstone and Grand Teton National Parks), U. S. Forest Service (Targhee, Gallatin, and Beaverhead National Forests), Shoshone-Bannock Tribes, and a variety of interested private individuals.



1. Itsi/Ross River
2. Toobally Lakes
3. Teslin
4. South McKenzie District
5. Fort Nelson
6. Ft. St. John/Dawson Cr.
7. Grand Prairie
8. Otter Lakes
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10. Edson/Whitecourt
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23. Turnbull NWR
24. Malheur NWR
25. Ruby Lakes NWR
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Figure 1. Location of Trumpeter Swan flocks mentioned in text

RESULTS AND DISCUSSION

Status

In this section we report on the size, mean production to fledging (or percent of cygnets in flocks) and numerical trends of the component flocks over time. Flock numbers in the text refer to locations in Figure 1.

Interior Canada Subpopulation

During the last 90 years Trumpeter Swans breeding in western Canada have made a dramatic comeback. From a small remnant flock of less than 100 swans, there are now believed to be about 1800 Trumpeters summering in Canada. Because the proportion of Trumpeter Swans breeding in Canada is still small relative to the total North American population, and breeding flocks are limited to a small portion of western Canada, it was classified as a vulnerable migratory bird by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1990. Major management concerns are related to the concentration of breeding and wintering habitats in western North America. In order to determine population status and breeding habitat use, surveys of over 15 separate flocks in western Canada have been conducted every five years in five provincial jurisdictions.

Yukon flocks

1. Itsi (Ross River)

This flock increased from 29 swans in 1985 to 83 in 1990 (McKelvey et al. 1988, McKelvey and Hawkings 1990).

Seven pairs were tallied in 1985, compared to 19 pairs in 1990. However, only three broods (seven cygnets) were observed during the first survey, and only six broods (14 cygnets) were documented on the second. While production has increased, it has not kept pace with the flocks overall growth.

2. Toobally Lakes

Overall flock size in this area has varied considerably. There were 85 swans counted in 1980 and 94 in 1981 (McKelvey et al. 1983). This declined to 56 swans in 1985 (McKelvey et al. 1988) but then increased to 113 in 1990 (McKelvey and Hawkings 1990).

The number of paired and breeding swans has been more stable. Between four and 10 broods containing 10 to 30 cygnets were recorded for any given year (McKelvey et al. 1983, McKelvey et al. 1988, McKelvey and Hawkings 1990). Mean annual production is 21.2 cygnets per year for four years (1980, 1981, 1985 and 1990).

The decline in overall numbers and productivity in 1985 was believed to be the result of local summer wildfires or higher than normal mortality in the Tristate area during the preceding winter (McKelvey et al. 1988).

3. Teslin Lake area

In 1978, a single pair of Trumpeter Swans was observed on Big Salmon Lake. Five adults were observed in 1985 (McKelvey et al. 1988) and four adults in 1990 (McKelvey and Hawkings 1990). No cygnets are known to have been produced in this area.

Other areas, Yukon

Trumpeter Swans have been documented summering in southwestern Yukon since 1945, and 66 swans were counted at scattered sites on several surveys between 1970 and 1977 (McKelvey et al. 1983). Between 1978 and 1990, various surveys have tallied between 13 and 79 swans, with the high count in 1978. The number of swans observed dropped in 1979 but increased through 1990 (McKelvey et al. 1983, McKelvey et al. 1988, McKelvey and Hawkings 1990).

Production has ranged from one cygnet in 1979 to 30 in 1990 (McKelvey et al. 1983, McKelvey et al. 1988, McKelvey and Hawkings 1990).

Yukon summary

In general, Yukon Trumpeter Swan flocks are stable or increasing. In 1983, McKelvey et al. (1983) estimated about 50 pairs present in this area. In 1990, a total of 55 pairs (214 total swans) was documented (McKelvey and

Hawkings 1990). In addition, another flock of Trumpeters located in the Kluane-Beaver Creek area was surveyed for the first time in 1990. This flock was made up of a total of 71 swans (48 adults and 23 cygnets). Since this flock is adjacent to a substantial population of Alaskan Trumpeters on the Tanana River, it is probably the result of expansion of the Alaska flock and part of the PCP and not the ICSP (McKelvey and Hawkings 1990).

Northwest Territory flocks

4. Southern Mackenzie District (including Nahanni National Park)

Trumpeter Swans were first observed in this area in 1970, but breeding was not confirmed until 1977 (McCormick 1986). Most of the swans in this area are found on the South Nahanni, Liard and Mckenzie River basins (Shandruk and McCormick 1990). Total swans counted in recent years have ranged from 18 in 1984 to 182 in 1990 (McCormick 1986, Shandruk 1988a, 1990, Shandruk and McCormick 1990, 1991).

Between seven and 23 broods have been observed annually. The number of broods observed increased from three in 1984 to 19 in 1987 (McCormick 1986, Shandruk 1988a). Ten broods were counted in 1988 (Shandruk and McCormick 1991). This increased to 23 broods in 1990 (Shandruk 1990). From 1984 to 1990 the number of cygnets counted ranged from zero to 69 (mean = 43.4).

Northwest Territory summary

Northwest Territory flocks have shown relatively consistent increases and have shown the second highest growth rate (143%) of all Canadian flocks between 1985 and 1990 (Shandruk 1990).

British Columbia flocks

5. Fort Nelson area

Thirty-four adult Trumpeter Swans were observed in this area in 1981 (Gale et al. 1987), 20 swans in 1985 (McKelvey et al. 1988) and 84 in 1990 (McKelvey and Hawkings 1990).

In 1985, four cygnets were found in three broods (McKelvey et al. 1988). In 1990, surveyors found 27 cygnets in 10 broods (McKelvey and Hawkings 1990).

6. Fort St. John and Dawson Creek

A total of 10 adults was found in the area near Ft. St. John in 1981. Dawson Creek was included in the 1985 survey, and 50 swans were counted (McKelvey et al. 1988). In 1990, the flock totalled 159 swans (McKelvey and Hawkings 1990).

Production steadily increased from zero in 1981 to 23 in 1985 to 52 cygnets in 1990.

Other areas, British Columbia

Trumpeter Swans are found in small numbers in the Alsek River, Old Man Lake/Smithers area, and several other sites (McKelvey et al. 1988, McKelvey and Hawkings 1990). All of these areas have shown numerical increases between 1985 and 1990. Swans near the Alsek River increased from three adults and four cygnets to 10 adults and 11 cygnets. The flock inhabiting the Old Man Lake/Smithers area grew from two adults in 1985 to six adults and three cygnets in 1990. In all other British Columbia waters surveyed, 16 adults and six cygnets were counted in 1985, while 16 adults and 14 cygnets were found in 1990 (McKelvey et al. 1988, McKelvey and Hawkings 1990).

British Columbia summary

Between 1985 and 1990, British Columbia stocks increased by 172%, or 22% per annum. This is the largest increase shown by any of the Canadian flocks and is very close to the biological maximum for the species. The extraordinary increase in these flocks may be due to under counting in 1985, consistently excellent production and survival of cygnets, immigration from other flocks (e.g. Grand Prairie), or some combination of these.

Alberta flocks

7. Grand Prairie

Early records on this flock go back to 1894 (Mackay 1988). In 1944, 72 swans were

counted. This increased to 100 in 1946 and 106+ in 1948 (Mackay 1988, Sheehan 1988). In 1959, 127 swans were found (Gale et al. 1987). A general decline in flock size occurred then and lasted through the late 1960's. Only 68 Trumpeter Swans were counted in 1967. From that point through 1986 there was an increase in flock size, with 347 swans tallied in 1986. Since that point, the flock has fluctuated between 321 and 361. The mean flock size from 1983 to 1990 is 334.2. (This included swans removed to Elk Island National Park. If those swans are not counted, the 1983-90 mean flock size is 321.7). Significant winter mortality in the Tristate region is believed to have occurred in 1978-79, 1984-85 (Holton 1988) and 1988-89.

The number of cygnets produced has ranged from 14 in 1944 (Mackay 1988) to 124 in 1986 (Shandruk and Winkler 1990). The mean number of cygnets produced per year in the eight years from 1983 to 1990 is 89.6 (range 61-124).

8. Otter Lakes

This small flock has been relatively stable, with 11 total swans in 1985 (Shandruk 1988b), seven in 1986 (Holton 1988), and 13 in 1990 (Shandruk 1990).

Production has ranged from three to four cygnets per year over the same time frame. Insufficient quality breeding wetlands may be limiting growth of this flock.

9. Chinchaga River

Since 1985, this flock has increased in size from five to 58 (Shandruk 1988b, 1990).

Annual production varied from three cygnets in 1985 to 25 in 1990, with a four year mean of 14.2.

10. Edson/Whitecourt area

Eight adults were present in 1983 (Gale et al. 1987), 18 total swans in 1984 (Shandruk 1988b), 24 total in 1985 (McKelvey et al. 1988) and 26 total in 1990 (Shandruk 1990).

Annual production ranged from zero in 1983 to 12 in 1990. Mean production was 6.5 per annum for four surveys during the eight years from 1983 to 1990.

11. Pincher Creek/Cardston

Six adults were counted in 1985 (Shandruk 1988b). Eleven adults and nine cygnets were observed in 1990 (Shandruk 1990). This area is a very important staging area for Trumpeter Swans during both spring and fall migration. Field feeding on waste cereal grain during spring migration allows ICSP birds to quickly regain body reserves lost during the winter.

12. Elk Island National Park (EINP)

This area was chosen for an experimental program designed to reintroduce an additional breeding flock within historic range, diversify migration patterns, and possibly expand winter range.

In 1987, eight adults and 18 cygnets were relocated from Grand Prairie (Shandruk and Winkler 1990). Eight adults and 20 cygnets were moved in 1988, followed by 10 adults and 20 cygnets in 1989 (Shandruk and Kaye 1991). In 1990, two adults and 14 cygnets were relocated (Shandruk 1990).

Winter mortality of relocated Trumpeter cygnets was high (Shandruk and Winkler 1990, Shandruk and Kaye 1991). Several of the swans transplanted to EINP were observed wintering at traditional sites in the Tristate Region. At present, five adults are summering at or in the vicinity of the Park. One pair bred in 1990 and produced two cygnets which did not fledge. The cob of this breeding pair was an original 1987 transplant cygnet, while the female was of unknown origin.

Alberta summary

In general, Alberta flocks increased through the mid-1980's. Grand Prairie has remained relatively stable since then, due in part to winter mortality, spring flooding with consequent poor production, removal of swans to EINP, and possibly immigration to other areas. Several of the smaller flocks have grown significantly since 1985, leading to an

overall increase in Alberta's total flock size from 285 observed in 1985 to 477 in 1990. This is a 43% increase in the total population over the five year period.

Saskatchewan flocks

13. Cypress Hills

This flock is the only documented concentration of Trumpeter Swans in the Province (Nieman 1972). A single pair was reported here in 1914, but breeding was not confirmed until 1953. The flock fluctuated between two and nine swans until 1971 and 1972, when 16 swans, including three pairs, were counted (Nieman 1972, Nieman and Ibister 1974). By 1974, only two pairs were counted. Two adults and two cygnets were found in 1985 (Shandruk 1988b). Two adults with one cygnet were found in 1990 (Shandruk 1990). Limited habitat and high cygnet mortality are believed to be preventing flock increase. Without transplanting additional swans in this area, this flock will likely disappear by 1995.

Interior Canada Subpopulation trends

Overall, the ICSP exhibited a mean annual growth rate of 12.4% between 1985 and 1990. The number of "white birds" increased from 462 to 791, while cygnet numbers increased from 191 to 380. Overall flock size increased from 653 to 1171.

Tristate Subpopulation

Montana flocks

14. Red Rock Lakes NWR

This flock grew from an estimated 26 Trumpeter Swans in 1932 to 258 in 1990. A peak of 382 Trumpeter Swans was counted in 1954.

Nesting pairs increased from four in 1935 to 79 in 1954 then declined to between 24 and 41 per year in the 1980's.

Cygnet production is highly variable in this flock, due to constraints from weather and the refuge's winter feeding program (Gale et al. 1987). Annual production of cygnets to fledging range from zero to 122, with a mean of 39.0 for the 59 year period from 1932-90.

15. Centennial Valley

This flock is integral with the Red Rock Lakes NWR flock. Both share molting and wintering areas. We separate them on the basis of different nesting and brood rearing habitat used and different threats to nest sites. Breeding habitat is very different off of the refuge, with most nesting occurring on small potholes or in oxbows along the Red Rock River. This flock has ranged in size from two to 221 swans. Most of the variability in flock counts is probably due to habitat use by molting nonbreeders and whether they molt on Lima Reservoir or on Red Rock Lakes NWR.

In recent years this flock has had between seven and 18 nests and fledged between zero and 34 cygnets annually (mean = 9.2 for 54 years, 1932-90).

16. East Front

A small group of Trumpeters breeds and summers on Nilan Reservoir and nearby stock ponds, about 10 miles west of Augusta. The Montana Department of Fish, Wildlife and Parks monitors these swans. Flock size has ranged from four to 12 recently. Production from the one breeding pair is two to five per annum.

Montana summary

In general, Montana flocks have increased since the 1930's and then stabilized at, or slightly below, peak numbers. Nesting habitat may be saturated in currently occupied areas. Little natural pioneering has occurred.

Idaho flocks

17. Island Park area

Most nesting in Idaho to date has occurred in the Island Park area of eastern Idaho. Since 1979, the number of nesting pairs has varied from six to 15. The number of swans in the flock has grown from four (1933) to 120 (1990). Cygnet production has ranged from

zero in the 1930's and 1940's to 28 in 1988 and 1990 (mean = 10.1 for 47 years, 1931-90). The flock is still increasing slightly (Mitchell et al. 1990).

18. Grays Lake NWR

Trumpeter Swans also nested at Grays Lake NWR in 1990. This was the first attempt in over 20 years. Five eggs were laid, four eggs hatched, and three cygnets were fledged (Mike Fisher, pers. comm.). The breeding pair were birds released during the range expansion program in 1988 and 1989 (Shea et al. 1991). In 1990, 16 adults were tallied. The flock is increasing due to relocation of Trumpeter Swans from Red Rock Lakes NWR.

19. Camas NWR

Nesting also occurs at Camas NWR. Generally zero to four cygnets are fledged. Adults number between three and six. The flock is stable.

20. Fort Hall Indian Reservation

Swans have been relocated at Ft. Hall since 1988 (27 during summer molt, 88 from November 1990 through 8 January 1991). No breeding has occurred to date.

Idaho summary

Trumpeter Swan numbers have also increased in this area of the Tristate Region. Part of the increase is due to natural reproduction and possibly some pioneering from adjacent areas, but most is due to active range expansion programs (Shea et al. 1991).

Wyoming flocks

21. Teton and Lincoln Counties (including Grand Teton National Park)

Trumpeter Swans in Wyoming nest in the northwestern area of the state. In 1931, six adults and three cygnets were counted. The flock fluctuated, generally increasing, through 1960. It then declined until the mid- to late 1970's, when it began to increase again. This flock peaked at 85 adults and 16 cygnets in 1989. The number of nesting pairs in the mid-1980's ranged from four to 10 (Lockman et al. 1987). The number of cygnets fledged in this flock varied between zero and 25 and averaged 5.7 for 38 years between 1931 and 1990.

22. Yellowstone National Park

This flock is considered somewhat different from other adjacent flocks because of the higher elevations in which they live. They were documented nesting here in 1919 (Banko 1960). Like other flocks in the Tristate Region, Yellowstone swans increased from a low of less than 10 from 1915-21 (Banko 1960) to 87 in 1954 then decreased and are still decreasing. Nesting pairs have averaged eight to nine per year for the last five years (Terry McEneaney, pers. comm.). Production is variable but generally low, ranging from one to 26 cygnets (one to 12 since 1959) with a 51-year mean of 8.9.

Wyoming summary

Trumpeters in lower elevation areas of Wyoming were reestablished due to an early range expansion effort (Banko 1960), and since that time have increased and more or less stabilized at their current level. Swan production in Yellowstone National Park increased in parallel with the rest of the Tristate flocks until the mid-1950's and began to slowly decrease. It continues at a low level at this time.

Restoration flocks

In 1990, the Pacific Flyway Council elected to move the oversight of management of restored Trumpeter Swan flocks at Turnbull NWR, Washington, Malheur NWR, Oregon, and Ruby Lakes NWR, Nevada, to the RMP Subcommittee. The rationale was based in part on genetic considerations (the swans at these refuges originated from Red Rock Lakes NWR stock) and partially due to the different management guidelines for the RMP versus the PCP.

23. Turnbull NWR

Turnbull NWR is located in eastern Washington, near Spokane. Thirty-six

Trumpeter Swans were moved from Red Rock Lakes NWR between 1962 and 1966 (Anon. 1984). Swans were provided with supplemental food, and water was kept open in winter by an aerator.

The flock grew to 47 individuals by 1976 but declined precipitously when feeding and aeration ceased. In 1982 there were five swans, and in 1991 only one adult male remained (Kathleen Fulmer, pers. comm.).

First nesting occurred in 1967 and reached a maximum of eight nests in 1975 (Anon. 1984). The last nesting attempt occurred in 1988, and the pen was killed by a predator (Kathleen Fulmer, pers. comm.). Some nesting occurred off of the refuge.

The most cygnets fledged was 14 (1975). The last cygnets fledged in 1981.

This flock is functionally extinct.

24. Malheur NWR

The area in eastern Oregon that is now Malheur NWR has several records of Trumpeter Swans present, but not nesting, in the 1800's (Cornely et al. 1985). The refuge received a total of 137 swans, mostly cygnets, from Red Rock Lakes NWR between 1939 and 1958 (Anon. 1984). These swans were pinioned and confined near refuge headquarters. Cornely et al. (1985) considered the flock to be stable in 1985. Since that time, the flock has declined precipitously. In Winter 1991, only 26 swans were present. Fluctuations are due to mortality, low recruitment, a significant reduction in suitable wintering habitat due to the flooding of Malheur Lake with the subsequent spread of carp and loss of aquatic vegetation, and possibly birds moving out of the area.

The first young were produced in 1958. The peak nesting and production was in 1979, with 10 nests producing 33 cygnets (Ivey 1990a). Some nesting also occurred off the refuge. Since 1958, 348 young were produced from 123 successful broods (mean = 2.8, range = 0-6). The mean number of nesting pairs in the last 10 years is 8.4 (range = 2-15). The mean number of cygnets fledged per year for the same period is 10.7. Production has fluctuated considerably (Ivey 1990b).

While there appears to be some natural fluctuation in this flock, the current low numbers of adults, nesting pairs and fledging cygnets, in conjunction with their sedentary habits and the recent destruction of nesting areas, and winter foraging sites due to high water are cause for concern (Ivey and Carey 1991).

25. Ruby Lakes NWR

Between 1947 and 1949, 22 swans from Red Rock Lakes NWR were released at Ruby Lake NWR in northeastern Nevada. An additional 72 swans were transplanted from Red Rock Lakes NWR between 1954 and 1958 (Anon. 1984).

Since the later releases, the flock has fluctuated between 14 and 50+ individuals, with initially high numbers, a relatively sharp decline and slower recovery until about 1980. Since then the flock has declined again, with only 16 swans counted in October 1990 (Sara Brown, pers. comm.).

The first nesting occurred in 1953, off-refuge. Nesting continues both on and off-refuge. Since 1980, the mean number of nesting pairs per year on the refuge is 6.4 (range = 3-9). A mean of 3.81 cygnets fledge per year (range = 0-11). There has been a general decline in the number of breeding pairs and cygnets produced.

Some Trumpeters from this flock are suspected of wintering 120 miles east at Fish Springs NWR in western Utah (Engler 1990), but this has not been confirmed.

26. Fish Springs NWR

Trumpeter Swans have been recorded at Fish Springs NWR in western Utah since 1968 (Engler 1990). Most sightings have been between December and March, with a few sightings in April and May. While it does not host a restoration flock per se, it is used by Trumpeters.

A single swan was seen in 1968. Up to 25 swans were observed in January 1979. In most years, between two and nine individuals are seen (Engler 1990).

In December 1990, 25 swans captured at Harriman State Park, Idaho, were transported to and released at this refuge. Most stayed until a severe cold front drastically reduced open water in early January 1991 (Joe Engler, pers. comm.).

This area appears to have the biological attributes necessary to successfully winter swans, as well as to support at least a few breeding pairs.

Restoration flocks summary

Although initial results were promising for all the restoration flocks, they all stabilized at fairly low levels, and all but Fish Springs NWR have decreased markedly in recent years. Problems at Turnbull NWR and Malheur NWR are well defined. The birds at Ruby Lake NWR and vicinity may be limited by sufficient high quality winter habitat. The recent increase in Trumpeter Swan use at Fish Springs NWR by Ruby Lakes NWR swans is encouraging, and hopefully the Trumpeters relocated from Tristate wintering sites will return in future years.

Winter numbers and age ratios

The RMP is censused in February (Mitchell et al. 1990). By subtracting the number of swans found during the September TSP count from the total number found during the February census, we can closely estimate the number of Trumpeter Swans, and the age ratios of the ICSP.

Coordinated aerial Midwinter Surveys began in 1972 (Gale et al. 1987). The first survey tallied 447 Trumpeter Swans. There has been a relatively steady increase since then, with a short span in the late 1970's when the counts declined. The 1990 Midwinter Survey counted 2007 Trumpeter Swans (Mitchell 1990a).

Nearly all of the growth in the RMP since 1954 has come from the ICSP. It has increased at a mean rate of 80 swans per year (Mitchell et al. 1990). The TSP has not significantly increased, or declined, since 1954 (Mitchell et al. 1990).

Since 1972, the RMP has averaged 18.1% cygnets per year (range = 6.2-23.5%). The tremendous increase in the RMP, with no concurrent increase in available winter habitat, has grave consequences for the swans. Many of the problems involving water flows, forage abundance, and disease potentials are discussed elsewhere in this volume.

Distribution

Winter distribution of Trumpeter Swans in the Tristate Region has changed considerably with the increase in population. In Montana, numbers have increased, but the percentage of the RMP wintering there has declined. Typically, numbers at Red Rock Lakes NWR peak at 450 (ignoring the 1991 anomaly, when 800-900 swans were present due to forage depletion on the Henrys Fork). Use of Hebgen Lake and the Madison River have generally increased (Mitchell et al. 1990).

All Idaho wintering sites have shown increasing levels of use, and an increasing percentage of the total RMP uses these areas. This is due in part to an increasing resident flock, but primarily because a majority of the ICSP winters at Idaho sites.

Wyoming has shown a steady increase in numbers but a stable percentage of the RMP wintering there (Mitchell et al. 1990).

We presume that changes in habitat use can be explained by conditions of crowding, changes in available forage and traditional site use by specific flocks (Lockman et al. 1989). Thus, families with cygnets might be inclined to leave Red Rock Lakes NWR as numbers reach a certain threshold. Since Canadian flocks tend to have a higher proportion of cygnets, and since those flocks tend to winter in Idaho, a concomitant reduction in the overall percentage of cygnets found in Montana is to be expected.

Increasing use of the Teton River, Ashton Reservoir, and other Idaho sites (Mitchell et al. 1990) may also be due to forage depletion and

crowding at more traditional Idaho sites, such as at Harriman State Park.

A stable percentage of RMP use with an increase in actual numbers counted suggests that Wyoming is providing stable habitat for both local swans and Canadian migrants. Some temporary increase in use of Wyoming habitat occurs when extremely cold weather or drought reduces water availability at other sites.

Movements

In this section we review movement patterns of TSP swans to and from winter sites, routes and migratory stopover sites of the ICSP from breeding areas to the Tristate Region, and extralimital movements of RMP swans to areas outside of traditionally used areas. Naturally, data discussed are from marked swans. Sightings are undoubtedly biased towards the more regularly observed sites, such as the Red Rock Lakes NWR wintering ponds.

Tristate Subpopulation movements within the Tristate Region

Most of the marked swans from Montana (all collared at Red Rock Lakes NWR) use Red Rock Lakes NWR. Most sightings (82.5%, N = 557) have been on the wintering ponds. Of 18 off-refuge sightings, three have been in the very near vicinity during summer months. During winter, one was seen in Yellowstone National Park, two were in the Teton Basin of Idaho, nine were at Harriman State Park, Idaho, and one at Hebgen Lake, Montana.

These patterns are very similar to those described by McEneaney and Sjostrom (1983, 1986) for a different group of marked birds. Very few marked swans from Red Rock Lakes NWR were seen outside the area bounded by Lima Reservoir, Ennis Lake, Hebgen Lake, (all Montana), and Island Park and Sheridan Reservoir (both Idaho). Movements outside this area are discussed below.

Similarly, most of the swans marked in Wyoming (primarily on Upper Snake River drainage), tend to winter on the Snake River near Jackson (Lockman et al. 1987). A few marked Wyoming swans have been seen wintering at Harriman State Park, Idaho, and the Teton Basin, Idaho. One was observed on the Yellowstone River, Montana. Limited spring and summer use by swans marked in Wyoming occurs in the Teton Basin, Sheridan Reservoir and Henrys Fork, Idaho. Lockman et al. (1987) stated that Trumpeter Swan movements are motivated by the need for open water, food and reproduction and that seasonal movements tend to be traditional. Specific site use and patterns for Wyoming swans are detailed in Lockman et al. (1987, 1989).

Swans moved to the Salt River, Wyoming, during Winter 1990 relocation efforts have largely dispersed from that site (Dave Moody, pers. comm.). As of this writing, they have not been located.

Other than these birds used in recent range expansion projects, few, if any, Trumpeters have been marked in Idaho. Swans released at Grays Lake NWR are generally observed on the refuge and to the east on the Salt River, Wyoming. There have been a few sightings on Little Crane Reservoir, Blackfoot Reservoir, Chester Reservoir, Soda Springs and Soda Creek, and on ponds near the Blackfoot River (all Idaho), the Salt River and Palisades Reservoir (Wyoming). Long range movements by four swans are described below. Only 38 marked swans have been released at Grays Lake NWR to date, and several of the 1988 release birds died, while others lost their wrap-around patagial markers. Thus, the sample is not large.

To date, 27 marked swans have been moved to the Fort Hall Indian Reservation during summer range expansion projects. At least six are known dead, while others have lost their markers. Nearly all of the sightings of these swans has been on sloughs and creeks in the immediate area, the adjacent American Falls Reservoir, and nearby Springfield Bird Haven. Two swans released in 1988 dispersed and were found dead at Springfield and Rockford (Idaho). Others were seen on Chesterfield Reservoir (Steve Bouffard, pers. comm., Dan Christopherson, pers. comm.).

Data are not complete on the number of swans moved to or present at Ft. Hall during winter

1990, but the vast majority seem to have remained there.

Sixteen swans moved from Harriman State Park to Minidoka NWR, Idaho, during November and December 1990 dispersed when the reservoir froze.

Most of the 152 Trumpeters moved from Red Rock Lakes NWR and Harriman State Park to Bruneau Dunes State Park during Winter 1990-91 remained there. One returned to Red Rock Lakes NWR; two were seen at Silver Creek in central Idaho. As of 29 January 1991, 134 (88%) remained in the general area (Mike Fisher, pers. comm.).

Extralimital movements of Tristate Subpopulation swans

There has been a small percentage of marked swan sightings outside of normally used areas. These sightings usually consist of one to five swans, generally nonbreeding birds in adult plumage.

In December 1968, a Red Rock Lakes NWR banded Trumpeter was found dead near Ryegate, Montana, approximately 200 km northeast of the capture site (Papike 1971).

A recovery of a swan banded at Red Rock Lakes NWR was made 10 September 1975 near Calgary, Alberta.

A male hatched in 1971, and banded in 1972 at Red Rock Lakes NWR was recaptured on the Snake River near Moran, Wyoming, in 1983. In November 1984 it was seen near Cody, Wyoming, near a captive flock of swans. In 1985-86 it wintered on the Snake River near Jackson (Lockman et al. 1987).

A collared swan was observed on the Madison River in Yellowstone National Park on 23-26 September 1984, at Red Rock Lakes NWR on 28 November 1984, and on the Colorado River near Loma, Colorado, on 30 November 1984. It wintered there in company with an unmarked swan. Subsequent sightings were made at Vernal, Utah, (11 April 1985) and Red Rock Lakes NWR (Summer 1985). An intermediate sighting (19 April 1985) of a marked swan near Big Piney, Wyoming, was probably this same individual, but this was not confirmed (McEneaney 1986).

In 1986, a presumed sibling group of five Trumpeters molted on the Green River near Farson, Wyoming (Lockman et al. 1987). This is approximately 120 km south of normal range.

In 1986, two Trumpeters were marked in Wyoming and moved to Grays Lake NWR, Idaho, in July as part of an initial range expansion experiment. They moved back to Wyoming in September and stayed in the general area of the Salt River, Wyoming, Palisades Reservoir and Swan Valley, Idaho. One apparently hit a fence in November and was not seen after 22 November. The other was not seen after 20 November. In mid-February, Dave Lockman was informed that the missing collared Trumpeter Swan had been on Lake Powell, Arizona, from 18 December 1986 through 15 February 1987. On 3 April 1987, this swan was observed back in the Salt River area and observed back in vicinity of natal site in June. It apparently lost its collar soon after (Lockman et al. 1987).

In July 1989, 15 collared Trumpeter Swans were released at Grays Lake NWR, Idaho. Most or all of these moved to the Salt River, Wyoming, in November. On 25 December 1989, four collared swans from this release were observed at Fish Springs NWR, Utah. At least one of these had been identified on the Salt River in November. They were last observed at Fish Springs NWR on 14 March (Engler 1990). Two of these swans were subsequently observed at Red Rock Lakes NWR in May and again in November 1990. One was still at Red Rock Lakes NWR as of February 1991. A third swan from the group that went to Fish Springs NWR returned to Grays Lake NWR and nested there.

Other sightings of Trumpeters in Utah include records of one to 25 wintering at Fish Springs NWR 12 of 22 years since 1968 (Engler 1990). It is probable that most or all of those swans were from the Ruby Lakes NWR flock. A Trumpeter Swan was reported by Bartonek (1966) at Bear River Migratory Bird Refuge. A Trumpeter Swan was shot near Great Salt Lake in Utah in December 1989 (Engler 1990).

Three Trumpeter Swans from the Turnbull NWR flock were observed 430 km south on Crooked River Prineville, Oregon (Anon. 1984). Paullin (1987) lists an additional 38 records of Trumpeter Swans outside of Malheur NWR. However, 31 of these are coastal or near coastal records, and, therefore, were probably swans from the PCP. An additional record from Deshutes County was a marked swan from Alaska. Only six are likely records of swans dispersing from Malheur NWR. Those were in Wallowa County (four swans in 1977 and an unknown number in 1981), Summer Lake, Lake County (one swan in 1983 and another in 1985), Rome, Malheur County (one swan in 1985) and Catlow Valley, Harney County (four swans in 1986).

Trumpeter Swans have also been sighted in New Mexico, at several locations, on different occasions (Gale et al. 1987).

Interior Canada Subpopulation migration

Most of what is known about migrating Canadian Trumpeter Swans comes from observations of birds marked in summer range in the Northwest Territories and Alberta or on winter range in the Tristate Region (Drewien et al. 1992).

Swans begin to leave northern breeding range in October. Most arrive at various Tristate wintering sites in late October or early November. Gale et al. (1987) provides a comprehensive review on arrival dates and movements of ICSP swans in the Tristate Region.

Sightings of collared Trumpeters during fall migration are somewhat limited. A red collared swan was observed near Cour d'Alene, Idaho, on 27 November 1987.

Most of the swans collared in Alberta winter on or near Henrys Fork of the Snake River, Idaho. The use of this area, with crowded conditions, uncertain access to forage, and extreme winter weather, may be impacting flock growth.

Swans migrating from EINP have been seen at numerous winter sites. There are November sightings from Hebgen Lake, Montana, and Teton River, Idaho, and January sightings from Grand Teton National Park, Wyoming (Shandruk and Winkler 1990). Marked EINP swans have been seen every month from November through April at Red Rock Lakes NWR.

Most swans collared in the Northwest Territories appear to winter in the Teton Basin of Idaho. Northwest Territory swans have also been sighted at Wells and Ash Meadows, Nevada, and Chico, California.

Early collaring efforts of Grande Prairie Trumpeter Swans was carried out by R. McKay of CWS during the summers of 1954-56. Results of this work indicated that most Grande Prairie Trumpeters winter with the TSP. Key wintering locations for these swans were Harriman State Park, Yellowstone Lake and Yellowstone River. One family group from Lowe Lake, Alberta, were recovered after being shot in the Fall of 1957 near Cody, Wyoming, and in Nebraska (McKay 1957).

Trumpeters marked during the winter of 1990-91 have provided considerable information on spring staging and migration. Swans stage at Red Rock Lakes NWR and Ennis Lake, Montana, in February and March. Swans en route to Canada have been observed in Montana at Red Rock Lakes NWR, Ennis Lake, Lake Helena and Freezeout Lake. Another smaller migratory route apparently runs from the Tristate Region up the Clark Fork, Bitterroot and Flathead Valleys, with marked swans observed at Warm Springs WMA, Lee Metcalf NWR, and near Fortine, Montana. In Canada a majority of green collars were observed in the Cardston, Mountain View area and along the east slopes of the Rockies in Alberta and British Columbia. Scattered sightings also occurred in the Columbia trench on the west side of the Rockies in Kootenay National Park, British Columbia, and the Yukon Territory. Summering green collared Trumpeters were observed at Mountain View, Alberta; Rocky Mountain House, Alberta; Elk Island National Park, Alberta; Edson, Alberta; Grande Prairie, Alberta; Peace River, Alberta; Stoney Lake, British Columbia; and in the Nahanni National Park Reserve, Northwest Territories.

Clearly, some dispersal from traditional swan range is occurring. These movements have been documented in all swan flocks. The limitation seems to be in the low number of swans that do disperse, manage to survive, and continue to use these new routes and sites. If significant range expansion is to occur, it must be with human intervention. Recent work (Shea et al. 1991, Drewien et al. 1992) has shown that we understand enough about habitat needs and characteristics, capture and transport techniques, and numerical requirements for establishing new flocks in new areas. This continued work should receive the highest priority.

Information needs and future plans

It is clear from recent winters observations and actions in the Tristate Region that the RMP needs to be redistributed. The population has reached and passed the carrying capacity of existing habitat there. We think it somewhat silly to speak of too many Trumpeter Swans, when the world population is only about 17,000-18,000. Rather, we feel that we have a problem of distribution. The concept of "too many Trumpeter Swans" must be tied with the concept of limited available wintering habitat to make any sense. The needs and recommended plans delineated below are presented with the idea that RMP Trumpeter Swans must be redistributed foremost in mind.

Information needs

1. Identify specific migratory routes currently used, along with stopover sites, to assure their future protection.

2. Identify potential new migratory stopover sites and routes south of current Tristate wintering areas.

3. Quantify migratory patterns for emulation in future range expansion experiments. For example, are birds moving before weather fronts? How far do they fly per day (maximum, minimum, mean distances)? Do family groups have different travel and habitat use patterns than nonbreeders? How long do layovers last?

4. Determine factors which effect winter site choice and within-winter movements from one site to another. Determine the importance of tradition, food quantity and quality, overcrowding, and human disturbance. Again, do nonbreeders patterns differ from adults with cygnets? This information will allow us to better understand and manage for the existing Trumpeter Swans in the Tristate, as well as predicting needs and patterns of new flocks.

5. How do we best teach, or otherwise encourage, swans to migrate? Is some degree of disturbance enough at some sites? Will the same methods work at sites with longer traditions of use? Should we be testing the imprinting and guiding of cygnets?

6. Better information on how flocks function in terms of recruitment, turnover in the breeding segment of the population, etc. are needed to allow better and more efficient management of existing flocks while we work out the difficulties of preliminary range expansion projects and stop-gap measures to avoid disaster. Guessing at how many birds of what ages can be removed from a given flock, and waiting to see what happens, is no longer adequate.

Future plans

There will be future efforts to redistribute RMP Trumpeters. It is very likely that winter trapping and relocation will continue until other methods are implemented, and swan numbers on existing Tristate winter range are reduced.

We suggest that there are three major approaches to accomplishing this task that are likely to provide long-term solutions.

(a) Teach TSP cygnets to migrate to new areas. This would likely be accomplished through programs similar to that proposed by W. Carrick and W. J. L. Sladen or being conducted by the University of Wisconsin and the Wisconsin Department of Natural Resources.

(b) Teach ICSP cygnets to migrate to new areas.

(c) Actively relocate, using existing techniques or modifications of them, large numbers of nonbreeding ICSP and TSP swans to other areas (e.g. Ontario, Minnesota, Wisconsin, Michigan, Missouri, etc). This will reduce population growth in the RMP and consequent crowding at Tristate wintering sites. It will provide other projects with much needed swans, will ensure that sufficient numbers of swans are placed to achieve restoration flock size objectives, and will reduce the need for somewhat risky techniques such as obtaining eggs from wild nests for artificial incubation, cross-fostering, etc.

In order to move large numbers (hundreds?) from ICSP or TSP flocks, we will need to address likely consequences to existing flocks, possibly revise objectives, etc.

CONCLUSIONS

While a few flocks have declined since monitoring began, most of them have grown, and the RMP has increased significantly in recent years.

The increase in collaring and marking swans by managers has also led to a greatly increased understanding of the affinity of breeding flocks to wintering sites, migratory routes, and extralimital movements. Again, there is much to learn, but there is every reason to believe that important questions will be answered as these programs continue, and hopefully more work is directed at this aspect of swan ecology.

We know a fair amount about the biology of RMP Trumpeter Swans. Our knowledge far exceeds that of earlier managers. However, obtaining biological information has a low priority, and the integration of new information into management programs takes much too long. It wasn't until 1987 that Gale et al. quantified the relationship between winter feeding at Red Rock Lakes NWR and subsequent reproduction there. Intuition is no way to manage rare wildlife species.

While there is much to learn, we do know enough about techniques (Shea et al. 1991, Drewien et al. 1992), and the consequences of *not* doing anything (Shea 1992), to begin large scale range expansion. Without a commitment to some long-range programs of this nature, we are consigning ourselves, and more importantly the Trumpeter Swans, to endless repetitions of recent disastrous winters. We can, and should, do better.

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ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS - A PACIFIC FLYWAY STUDY COMMITTEE PERSPECTIVE

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ABSTRACT

THE ROCKY MOUNTAIN POPULATION (RMP) OF TRUMPETER SWANS IS COMPRISED OF AN EXPANDING INTERIOR CANADA SUBPOPULATION AND A TRISTATE SUBPOPULATION WHICH IS RELATIVELY STABLE. THE DEPENDENCE OF BOTH SUBPOPULATIONS ON A SMALL, HIGH ELEVATION WINTERING AREA IS THE SINGLE GREATEST THREAT TO THE POPULATION. MANAGEMENT EFFORTS DESIGNED TO RESOLVE THIS ISSUE AND OTHERS HAVE BEEN COORDINATED THROUGH THE PACIFIC FLYWAY COUNCIL. STATE WATERFOWL TECHNICIANS, COUNCIL MEMBERS, U. S. FISH AND WILDLIFE SERVICE PERSONNEL, TRUMPETER SWAN SOCIETY MEMBERS AND MANY OTHER INTERESTED INDIVIDUALS HAVE BEEN INVOLVED IN THESE EFFORTS. UPDATING THE RMP TRUMPETER SWAN MANAGEMENT PLAN, DEVELOPING A RANGE EXPANSION PROGRAM, AND IMPLEMENTING THE HARRIMAN STATE PARK CONTINGENCY PLAN HAVE BEEN THE FOCUS OF THIS WORK.

INTRODUCTION

Distribution, population status and management concerns for the Rocky Mountain Population (RMP) of Trumpeter Swans are well documented in the North American Management Plan for Trumpeter Swans (NAMPTS). Recent events centered primarily on the winter range of this population in the Tristate Region have highlighted issues raised in the management plan. The Interior Canada Subpopulation of the RMP has expanded significantly over the last seven years and represents a success story. The Tristate portion of the population continues to experience problems associated with its nonmigratory nature and habitat related issues but is relatively stable. The dependence of both subpopulations on an unacceptably small, high elevation wintering area is the single greatest threat to the continued expansion and health of this population.

Management efforts coordinated at the flyway level to address these issues have included Pacific Flyway waterfowl technicians, Council members, U. S. Fish and Wildlife Service personnel, Trumpeter Swan Society members and many others interested in the management of these swans. Certain activities have been progressing concurrently and the intent of this paper is to summarize those actions. Numerous speakers throughout this symposium will provide much more detail about each of these management activities.

REVISION OF THE RMP MANAGEMENT PLAN

The plan has provided overall management direction but was due for review in 1989. After an initial review, the revision process was temporarily put on hold because of the severe icing problems that threatened swans on the Harriman State Park (HSP) winter range in Idaho. During the interim, two additional documents were developed by working groups to deal with winter range issues. Before discussing these efforts, certain points need to be clarified concerning the plan's revision.

The plan needs to be updated to more accurately reflect current population status and trends. Objectives for breeding and wintering numbers need to be reassessed, especially in light of ongoing programs and new management strategies. As was stated earlier, the Interior Canada Subpopulation continues to grow and the Tristate Subpopulation exhibits

a stable adult and subadult segment with production fluctuating from year to year.

The Recommended Management Procedures section of the plan should be reviewed in terms of the major problems affecting RMP Trumpeter Swans and the progress being made towards resolving those issues. This has been done in an abbreviated format and the reports were presented at the 1989 and 1990 July Pacific Flyway Subcommittee meetings. Important unresolved items include the establishment of new wintering sites, redistribution programs and restoration flocks, hunting restrictions, habitat identification and protection, the interpretive program (expanded I&E efforts), and specific action items at Red Rock Lakes National Wildlife Refuge (RRLNWR) and HSP. New items should include clear delineation of agency responsibilities and roles in the various tasks and funding sources available to cover action items.

As a result of action taken during the July 1990 Pacific Flyway subcommittee meeting, the introduced flocks at Ruby Lake NWR and Malheur NWR will now be addressed under the RMP plan. Previously these flocks and the Turnbull NWR flock had been considered part of the Pacific Coast Population (PCP). This action was taken because these flocks were derived from RRLNWR stock, have been less than successful and, in many ways, reflect the same management problems associated with the Tristate Subpopulation. Furthermore, the PCP Management Plan specifies that natural pioneering will serve as the basis for any range expansion that occurs and thus limits management options. Guidelines used to evaluate any proposed expansion activities in these areas will be similar to those employed for RMP work.

The revision of the plan will proceed in 1991. Revised management strategies developed as a result of deteriorating conditions at HSP and the stepped up range expansion efforts will be incorporated into the document. Comments will be solicited on a draft version.

RANGE EXPANSION AND RESTORATION OF MIGRATORY TRADITIONS

In 1987, the RMP Trumpeter Swan Subcommittee prioritized the range expansion efforts for the 1989-93 period. Range expansion was designed to help achieve two population objectives outlined in the NAMPTS. These were to maintain a wintering population of at least 1,100 swans within the Tristate region and to expand the distribution of wintering and nesting swans in the Tristate region by establishing at least four new wintering sites in Montana, Wyoming, and eastern Idaho.

In order to meet these objectives, range expansion efforts were to focus on the following action items: reducing the number of swans that short-stop and winter at RRLNWR and HSP, initiating a coordinated public information program, releasing salvaged cygnets onto target winter ranges and onto nearby summer range sites, relocating yearling swans during their first molt to target winter ranges and nearby summer habitats, using any available salvaged yearlings or adults that could be rehabilitated for release onto target areas as decoy birds, and developing a marking and monitoring protocol for relocated swans.

Proceeding with range expansion required that several target sites had to be evaluated for habitat suitability. The Fort Hall Indian Reservation and Grays Lake NWR were identified as potential release sites. Habitat mapping was to be initiated on a much broader scale as time permitted. Techniques developed on the Salt River of Wyoming for acclimating swans to a specific release area were to be used on the Idaho release sites. Trapping and transplanting efforts were initiated in July 1988 and 28 yearling Trumpeters were relocated to the Idaho sites.

HARRIMAN PARK CONTINGENCY PLAN

The potential for serious problems on the HSP wintering area resulted in the development of a contingency plan. This plan was brought to the RMP Subcommittee and approved in March 1988. The plan contained the following

provisions that would chart a course of action for managers involved with this segment of the RMP. The first priority was to work with the Bureau of Reclamation to maintain release flows from Island Park Dam in order to maintain ice free stretches of the river for feeding swans. Managers were to haze the birds in an attempt to discourage swans from settling in at HSP. If conditions deteriorated, an attempt would be made to trap and relocate swans to lower elevation wintering sites. As a last resort, supplemental feeding would be initiated.

If mild winter conditions prevailed, managers would proceed with efforts to develop reliable trapping techniques, secure the necessary permits and cooperative agreements, and identify funding and manpower needs in order to implement a more intensive trapping and relocation program in the future.

Mild conditions did not prevail as a record setting arctic cold front dropped into this region in February 1989. The severity of the conditions limited the management options and threatened a large segment of the Tristate flock. Moderating temperatures along with negotiated water releases reduced the mortality of wintering swans to approximately 100 birds.

Low stream flows were again predicted for the 1989-90 winter period. The water issue had not been resolved and the habitat conditions were potentially similar to February 1989, when approximately 95 to 100 percent of the feeding areas were frozen. However, winter conditions were mild, and by late February 1990 an unusually high number of swans (750) had eaten virtually all available aquatic vegetation. About 400 swans then moved from HSP to RRLNWR and, combined with the 400-450 swans already present, exhausted the supply of supplemental grain. Inventory efforts conducted the following spring and summer indicated that aquatic forage production was almost nonexistent on the HSP wintering area, and the capacity to winter swans had been greatly reduced.

Because of these developments a working group that convened in Boise, Idaho, in May 1990 recommended an accelerated implementation of the range expansion activities and some revisions in the contingency plan for 1990-91. These activities would include increasing the intensity of early hazing operations at HSP, initiation of a trapping operation at both HSP and RRLNWR, coordination of an expanded relocation effort in conjunction with the trapping to new wintering sites, and the monitoring of the distribution and movements of relocated swans. Obtaining a formal agreement with the Bureau of Reclamation and the water users to insure adequate flows was still a priority. However, allowing the river to freeze would tend to force swans from the area where the vegetation had not recovered. Furthermore, assignment of responsibilities and budgetary needs were detailed. The revised contingency plan was endorsed by the Pacific Flyway Council at the July 1990 meeting.

SUMMARY

In closing, we feel it is important to emphasize that the Flyway Councils, the U. S. Fish and Wildlife Service, and the various states have broad responsibilities towards migratory birds, including both game and nongame species. Prior to the completion of the North American Management Plan for Trumpeter Swans, the Pacific Flyway Council endorsed the initiation of actions designed to help identify and resolve RMP management issues. The impetus of these decisions set in motion the evolution of the current management strategies. The increasing number of Trumpeter Swans wintering in the Tristate Region, in combination with the environmental events that have occurred, have accelerated efforts to overcome both the winter range problems and to expand the distribution of breeding swans.

Progress has been made as a result of cooperation and hard work involving both the private and public sectors. Obstacles do remain that will require additional compromise and cooperation from all parties. The success of the winter range expansion efforts and the establishment of new migration traditions will have to be evaluated next winter. Positive steps have been taken that will benefit the RMP Trumpeter Swans without compromising existing management programs for other species. More positive steps must be taken.

ELK ISLAND NATIONAL PARK TRUMPETER SWAN REINTRODUCTION - 1990

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INTRODUCTION

The Elk Island National Park Trumpeter Swan reintroduction project was developed in 1987 to restore the Trumpeter Swan (Cygnus buccinator) as a free-flying migratory breeding bird in Elk Island National Park (EINP) (Figure 1).

The objectives of this project are to increase summering and breeding range of Trumpeter Swans in Alberta, diversify migration patterns and, in cooperation with U. S. wildlife agencies attempt to expand wintering traditions. Project goals are:

1. To transplant family groups of Trumpeter Swans from the Grande Prairie flock in west-central Alberta to suitable wetlands inside EINP.

2. To refine capture and transplant techniques and procedures for marking and tracking swans.

3. To determine if cygnets released at EINP will consistently home to the park.

4. To assess the impact of the relocation on both cygnets and adult guide birds.

5. To assess the impact of the transplant on the Grande Prairie Trumpeter Swan populations.

6. To establish a free-flying, breeding flock of 10 pairs of Trumpeter Swans in EINP.

7. To evaluate the impact the swans will have on existing waterfowl and other resources in the park, should they become seasonal residents.

METHODOLOGY

Project funding and guidelines

The Canadian Wildlife Service (CWS), Canadian Parks Service (CPS), and Friends of Elk Island Society obtained funding, as a Wildlife-87 initiative, through a Trumpeter Swan reintroduction project proposal submitted to World Wildlife Fund (WWF) and Alberta Recreation Parks and Wildlife Foundation (RPWF). This project has been sanctioned by the Pacific Flyway Council, The Trumpeter Swan Society, Alberta Fish and Wildlife Division, CPS and CWS.

During the first three years of the project, Alberta RPWF contributed $17,000, CWS $9,000, CPS $6,000 and WWF $14,000. Funding from outside sources not actively involved in the Trumpeter Swan reintroduction program was not extended to the 1990 season. For this reason, the Friends of Elk Island Society assumed control over and administration of the project's budget, and initiated a fund raising campaign to finance the continuation of this project.

A core committee (Trumpeter Swan Conservation Project Committee - EINP) was set up, consisting of chairman John Hill from Edmonton, and committee representatives from the Friends of Elk Island, CWS, and from the Interpretive and Resource Conservation sections of the CPS - EINP.

To solicit donations for 1990, the committee produced and mailed Trumpeter Swan brochures to 25,000 homes in nearby Strathcona County; sent letters to corporations; placed advertisements in newspapers, magazines and on television; set up radio and television interviews; applied for several grants; and invited the participation of wildlife

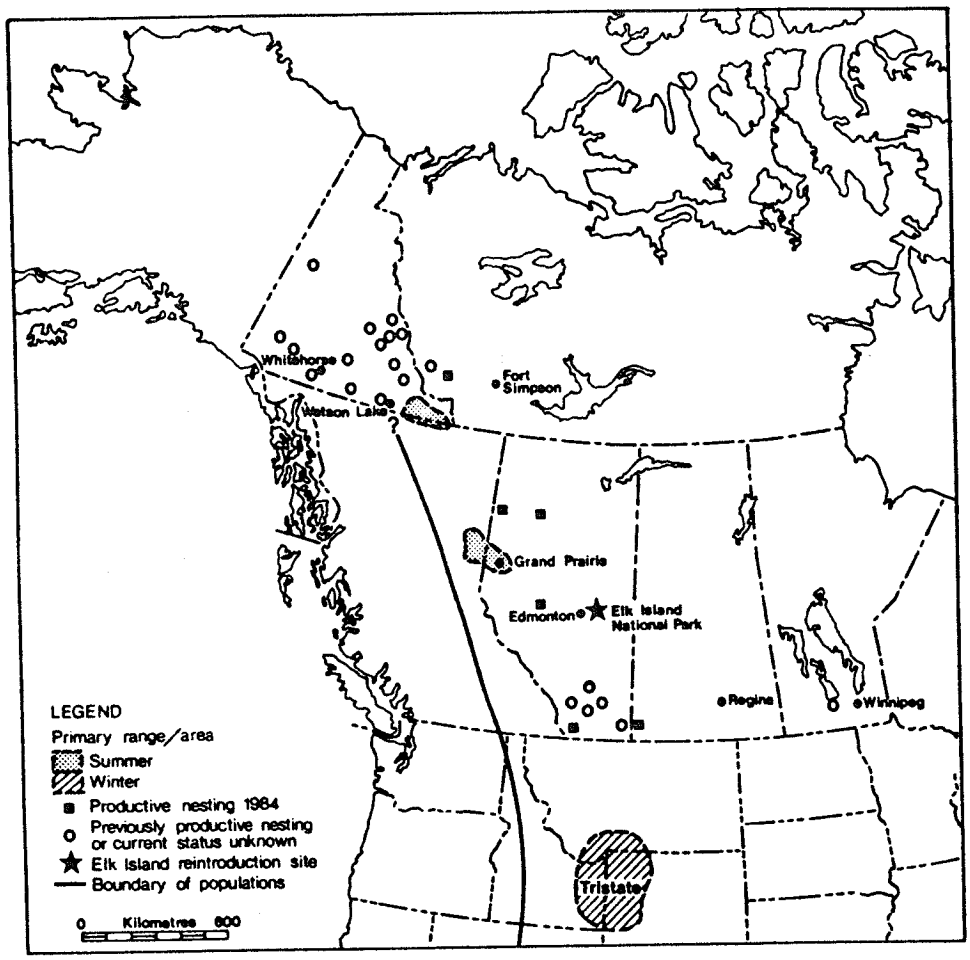

Figure 1. Key locations: Elk Island National Park Trumpeter Swan Transplant Project.

artist Robert Bateman and Mill Pond Press.

Donations and funding commitments to the end of June 1990 totalled approximately $10,000 from mailings and $18,000 from the Environmental Partners Fund. A commitment in writing has been received from Mr. Bateman to produce a special mylar lithograph print of a Trumpeter Swan. Mill Pond Press and Robert Bateman guaranteed the Friends of Elk Island Society will receive the sum of $25,000 per year for five years, for a total of $125,000, with the first donation made before the end of 1990.

Public relations

The CPS and CWS developed a public relations plan to target the media, naturalists, hunters, landowners and biologists both locally and along the migration and wintering areas. News releases were concentrated at pre-capture, capture, transplant and at pre- and post-migration sites to explain the project and to solicit observations in the field. An information poster and a swan identification brochure were also developed to meet this end.

In 1990, more than 50 media releases were made through television, radio and newspapers to inform the public of the project status and the need for public support and funding. An interpretive program, slide tape and series of displays explaining the project and Trumpeter Swans has been developed by EINP and CWS.

In 1989, the Friends of Elk Island Society, Trumpeter Swan Conservation Project committee, initiated planning for the construction of an interpretive kiosk near the Astotin Interpretive Center. Information on

the Trumpeter Swan and the reintroduction project at EINP will be displayed on this kiosk.

Future public relations and project funding plans include a television documentary based on the Trumpeter Swan reintroduction program and on-going media campaigns to provide program awareness.

Field methods

As in previous years, an aerial survey of EINP and surrounding wetlands (including Beaverhill Lake) was flown during May to determine whether any of the 1987, 1988 or 1989 transplanted cygnets migrated back to the park.

Aerial surveys were also flown on 14 June 1990 to assess the spring breeding status of Trumpeter Swans of the Grande Prairie flock and to select candidates for transplant.

As a first step in the transplant, a short reconnaissance helicopter flight was flown the first week in September 1990 to determine the molt status of candidate family groups.

The following criteria are used in selecting candidate swan families:

1. The family should be found on the periphery of the Grande Prairie nesting population.

2. They must have a minimum of three young.

3. High priority is given to previously captured adults since they have already experienced the capture/release process.

Family groups were captured with the aid of an A-Star helicopter from which a salmon net was used to capture the birds. Once the swans were captured, they were flown to a central staging area. Here they were sexed, weighed, measured, leg banded, radio collared (adults only), and blood sampled for parasites and profile analysis. The birds were also treated with Ivermectin and Dronsit to control internal parasites. Finally, they were placed in plastic kennels and transported to EINP by truck and trailer. Just before release on specific wetlands in the southern portion of the park the swans were given dextrose and electrolytes to reduce the stress of the capture and transplant.

Several aerial surveys of the south side of the park and surrounding area were flown during late September and October 1990. Adult and cygnet status, locations, radio frequencies and numbers of swans were documented during these surveys.

As in previous surveys, a fall Trumpeter Swan production survey was flown on 5 September to aid in assessing the impact of the transplant on the Grande Prairie cygnet population and to determine fall flock status. Results of this survey help determine whether subsequent cygnet transplants will be undertaken. Detailed aerial survey techniques are also outlined in Shandruk and Winkler (1988).

Monitoring

Ground and aerial monitoring of 1990 transplanted family groups were conducted weekly by the EINP Warden Service from 9 September to the end of October (just prior to freeze-up). Aerial and ground surveys of the park and surrounding area for returned transplanted cygnets were conducted from April to October 1990.

During the winter months of 1990-91, the U. S. Fish and Wildlife Service will be conducting cooperative aerial surveys for wintering transplanted Trumpeter Swans to determine habitat use, distribution and survival of transplants.

All Trumpeter Swan collar numbers and radio frequencies (Table 1) were forwarded to state and federal personnel conducting swan and/or waterfowl surveys throughout the Tristate Region and adjoining areas (Figure 2).

RESULTS AND DISCUSSION

Capture and transplant

The 1990 capture and transplant was conducted on the morning of 8 September, from lakes in the Saddle Hills northwest of Grande Prairie. The goal was to capture three

Table 1. Age, sex, identification and release site of Trumpeter Swans transplanted to Elk Island National Park, September 1990.

AGE	SEX	COLLAR	LEG BAND	RADIO FREQ	LAKE
Adult	M	85AC	193900230	151.340	Walter
Cygnet	F		193900231	-	Walter
Cygnet	F		193900232	-	Walter
Cygnet	M		193900233	-	Walter
Cygnet	F		193900234	-	Walter
Cygnet	M		193900235	-	Walter
Cygnet	F		193900236	-	Walter
Cygnet	M		193900237	-	Walter
Adult	M	78AC	193900238	151.400	Bailey
Cygnet	-		193900239	-	Bailey
Cygnet	-		193900240	-	Bailey
Cygnet	-		193900241	-	Bailey
Cygnet	M		193900242	-	Bailey
Cygnet	F		193900243	-	Bailey
Cygnet	M		193900244	-	Bailey
Cygnet	F		193900245	-	Bailey

family groups of swans with a maximum combined total of 15 cygnets.

During the first and second family group captures, seven cygnets were netted along with only one adult parent. Later at the staging area the single parents from each group were identified as males. Initial efforts to capture the other parent from each of the two family groups were unsuccessful, as the birds were unexpectedly able to gain partial flight because they were further along the molt than anticipated.

A helicopter accident thwarted plans to capture the third family group and a possible attempt at capturing the remaining parent of each of the first and second groups. Shortly after the helicopter accident, the two groups of swans captured were taken to EINP by truck and trailer and released without incident.

EINP monitoring

Two 1987 transplant cygnets (yellow collars 20AC and 25AC) again returned to the EINP area in April 1990. This was the third consecutive year these birds returned to the area from which they fledged. Three other Trumpeter Swans also returned to the park area this spring. These birds were the first confirmed sightings of transplanted Trumpeter Swans other than the 1987 transplanted cygnets (Table 2).

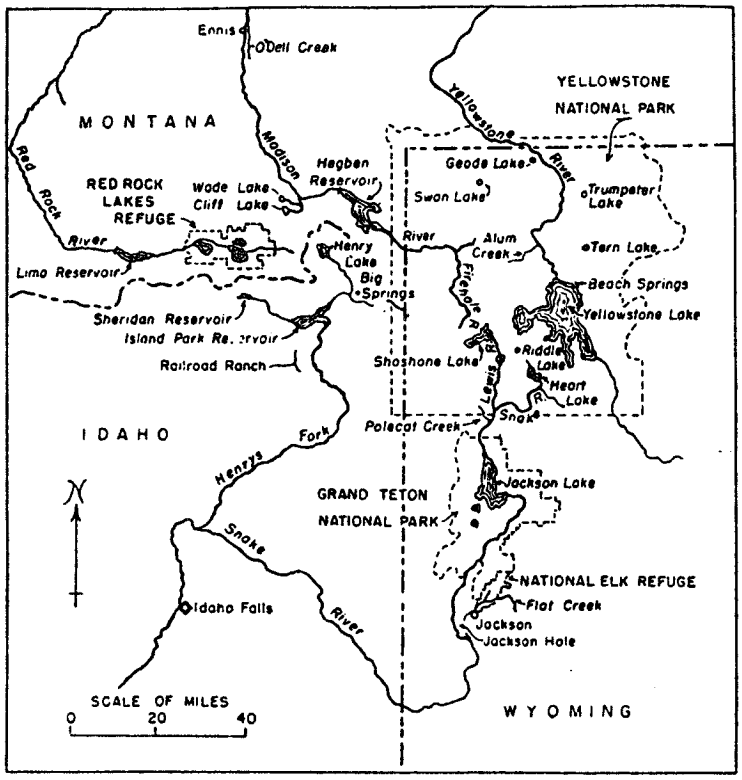

Figure 2. Geographical features of Trumpeter Swan breeding and wintering areas in the Tristate Region of the United States.

Yellow collared 20AC was first sighted 11 April on Goose Lake at the eastern end of the park, paired with one of the new birds, an unmarked female adult. On 4 May, these swans were sighted on Running Dog Lake, 1 km south of the southeast boundary of the park in the Cooking Lake-Blackfoot Provincial Recreation Area. They were again observed on the same lake on 30 May, at which time mating behavior was noted. The two swans were observed on Running Dog Lake throughout the month of June. They appeared to be nesting on a beaver lodge, and during July 1990 this pair produced two cygnets, becoming the first breeding pair of Trumpeter Swans in EINP in over 100 years. During collaring in July the female from this pair was captured, collared and leg banded. However, her origin is unknown.

By the end of July the Running Dog Lake pair had lost one of their cygnets. Monitoring confirmed that the remaining cygnet had also been lost sometime around the middle of August. The causes of the mortality of these cygnets is unknown as their bodies were not found.

Yellow collared 25AC was first observed on Astotin Lake in the park on 22 April. On 21 May this bird was sighted on Paul Lake in the northwest corner of the park. It was again sighted on Paul Lake on 26 May and on several other occasions throughout the summer months on Paul Lake and other nearby lakes in the north end of EINP.

Two subadult Trumpeter Swans were observed on Walter Lake in the southwest corner of the park on 17 May, by a U. S. Fish and Wildlife Service biologist flying waterfowl breeding population surveys. These birds were then monitored frequently throughout the summer and fall on the same lake. After the July 1990 capture we found these subadults were a female (leg band 1939-00219) and a male (leg band 1939-00220) transplanted to the same lake in EINP in September 1989. These birds

Table 2. Age, sex, identification and location of Trumpeter Swans returned to Elk Island National Park, September 1990.

AGE	SEX	COLLAR	LEG BAND	LAKE
Adult	M	Yellow 25AC	193900024	Paul
Adult	M	Yellow 20AC	193900019	Running Dog
Adult*	F	Yellow 03AC	193900224	Running Dog
Subadult	F	Yellow 04AC	193900219	Walter
Subadult	M	Yellow 11AC	193900220	Walter

* Collared and banded July 1990 - origin unknown. Mated with 20AC.

were fitted with yellow collars 04AC and 11AC respectively.

Other sightings of Trumpeter Swans in the EINP area were reported between the months of April and July. It has not been confirmed whether these sightings were of different individual birds than the five confirmed swans that resided in the EINP area over the 1990 season.

Initial monitoring of the two family groups released on 8 September 1990 was implemented on 9 September. The entire family group (one adult male and seven cygnets) released on Walter Lake was observed together and in apparent good health, as were the seven cygnets on Bailey Lake.

The adult male from the Bailey Lake family group was not observed on 9 September or during later fall monitoring. After a thorough air and ground search failed to locate a radio signal or carcass, it was assumed this male flew back to Grande Prairie.

After it became apparent that the male from the Bailey Lake family group left the area, a decision was made to attempt to recapture the seven cygnets. Plans were to move four cygnets to Walter Lake in hopes the family group there would foster them or that they would at least migrate together. The other three cygnets would be taken to a swan facility at Camrose (70 km south of EINP). Here they would be wing clipped with plans to foster them to returned transplanted EINP swans in 1991. On 18 September an attempt to recapture the cygnets by helicopter and boat failed as it was found they had already attained flight.

On 26 September the adult male at Walter Lake was observed with eight cygnets. It seemed apparent that one of the Bailey Lake cygnets had found this family group. The same day only four of the remaining six cygnets from Bailey Lake were observed on that lake. It was assumed the other two cygnets were somewhere in the area.

Monitoring efforts in early October failed to locate any of the 1990 transplanted swans. We assumed all the swans had migrated (including the Bailey Lake cygnets) from the park, as we had no sightings of dead birds or sightings or reports of stray swans.

Transplant results and impact

During the last four years the project has transplanted 30 adults (20 family groups) and 82 cygnets (Table 3) to EINP. Of these, 26 adults and 32 cygnets migrated from the park to the wintering grounds. Due to high winter mortality we have had only four known cygnets return to EINP over the last three years. During 1990 one of the 1987 transplants, yellow 20AC, returned with an unknown mate which nested and produced two cygnets. In all, five adult Trumpeters were summer residents of EINP in 1990. We have

Table 3. Summary of Trumpeter Swan transplant results 1987-90, Elk Island National Park.

YEAR	NUMBERS TRANSPLANTED	NUMBERS MIGRATED	% CYGNETS FLEDGED
1987	8 Adults + 18 Cygnets	8 Adults + 5 Cygnets	28
1988	10 Adults + 30 Cygnets	8 Adults + 9 Cygnets	30
1989	10 Adults + 20 Cygnets	8 Adults + 4 Cygnets	20
1990	2 Adults + 14 Cygnets	2 Adults + 14 Cygnets	100
TOTAL	30 Adults + 82 Cygnets	26 Adults + 32 Cygnets	39

also observed that five to seven adults of the eight to 10 that were transplanted annually to EINP have returned to the original breeding lakes we removed them from. Thus, the transplant has had limited impact on the breeding component of the Grande Prairie flock.

In order to determine the theoretical long-term impact of cygnet removals on the Grande Prairie flock, we used a population model developed by Leslie (1945) and constructed a swan population model which attempts to duplicate what we have observed for the Grande Prairie flock starting in 1987. This population model starts at 1987 with 103 cygnets and 274 adults and subadults in various age classes. The growth rate for the population in this model was determined to be 7.9% per year over three years. From the model it was determined that the removal of 70 cygnets and eight adults and the high 1988-89 winter mortality reduced this growth rate by 4.6% to 3.2% per year over three years. Three years after the removal of 70 cygnets, the number of cygnets produced was reduced by seven and the total population was reduced by 61 birds. Over 100 swans apparently died on the Henrys Fork. If we assume a minimum winter mortality of 50 swans during 1988-89, then the transplants had an actual impact of removing 11 birds from this population. Thus, we postulate that the growth and performance of this flock is regulated more by positive or negative changes in environmental conditions on the wintering and breeding grounds than by the removal of 20 to 30 cygnets and one to three adults per year as part of the EINP transplant.

CONCLUSIONS AND RECOMMENDATIONS

The return of two 1987 transplant cygnets to EINP in 1988, 1989 and again in 1990 provided unquestionable evidence that the transplant effort will result in establishing summering Trumpeter Swans at EINP. The return of two additional cygnets to Walter Lake in 1990 provides additional evidence that transplanted cygnets will home to the area they migrate from. Techniques and methods must continue to be refined so that an adequate number of cygnets are moved, fledged and survive their first winter in order to ensure an eventual breeding flock of 10 pairs in the EINP area.

From the results of the 1988 reintroduction, it was determined that a mid-July capture and transplant of family groups would not be continued because of the extremely high cygnet mortality. Of the 20 cygnets transplanted in July of 1988, 18 did not make it through the summer season. On the other hand, nine of 10 cygnets fostered to adults already in the park during late fall survived and migrated. Unfortunately, these birds did not survive the unusually harsh 1988-89 winter conditions experienced in the Tristate Region.

The 1989 family groups totalling four adult pairs and 17 cygnets were captured in Grande

Prairie and transplanted in the park on 15 August. Only two cygnets from this transplant survived to migration. Four cygnets which were found dead were necropsied and determined to be in poor physical condition (D. K. Onderka D.V.M., pers. comm.). The birds were extremely emaciated with loss of all internal body fat reserves and much loss of muscle mass. Evidence indicated that this condition had occurred prior to capture and transport of the swans. The birds also had significant parasite infestations which were severely impacting the intestinal tract and interfering with nutrition. It was later felt that the young age of the birds also lowered their ability to survive the stress of transplant.

With this in mind, another family group consisting of an adult pair and three cygnets were transplanted on 15 September. These birds were given a broad spectrum antibiotic and deworming medication (Ivermectin and Dronsit) to help reduce infection and parasite infestations. An electrolyte and dextrose solution was also administered to restore chemical balance and fluids lost through dehydration during capture and transport. The adults and two of the three cygnets survived to migration. Both cygnets returned to EINP in 1990.

From the success of the September 1989 transplant it was determined that cygnets over 60 days old were much more able to withstand and survive the stress of relocation than younger birds. We also felt that the antibiotics and electrolyte/dextrose solution administered to the swans assisted in their survival.

For these reasons, we held off the 1990 transplant until 8 September, at which time the cygnets were 75-80 days old, and again administered medication before release. The survival of all 14 of the cygnets transplanted to EINP in 1990 to migration demonstrated the success of the transplant procedures.

If further capture and transplant is undertaken in 1991, procedures will closely follow those of 1990. The one aspect of the capture process we must be more aware of is the adult molt period. Capture date must be closely evaluated, between the time cygnets are 60+ days old and before the adults regain flight. This may only give a narrow margin of a one to two week period. The anticipated yearly return of the Running Dog Lake nesting swan pair, and the possibility of other EINP swans pairing within the next few years, will increase the management options we will have available in the future.

One option may be to foster cygnets from Grande Prairie to swans residing in EINP. This would not only increase cygnet production, especially if brood size is small, but increase the genetic diversity of EINP swans as well.

Another option available to us is to foster cygnets from the nesting pair at the Camrose swan facility to swans in EINP. This will reduce the number of cygnets required from the wild flock in Grande Prairie. Cygnets from Camrose would also be healthier as they could be cared for by the provision of a supplement diet and appropriate medication as required. These cygnets would handle the stress of capture/transplant much better than Grande Prairie cygnets because of better health, partial conditioning to humans, and a short transit time from Camrose to EINP.

With the hopeful return in 1991 of the Running Dog Lake nesting pair, the three other swans which resided in the park in 1990, and some of the 1990 EINP fledged cygnets, our project will be showing some encouraging results. The return of fledged cygnets is strongly related to winter severity and condition of wintering habitats in the Tristate Region. Thus, success of the EINP transplant will depend partially upon current management efforts to enhance and diversify these areas. The CWS and CPS will continue to support and encourage all efforts to improve and diversify the wintering areas for Trumpeters in the United States through liaison with the U. S. federal and state wildlife agencies.

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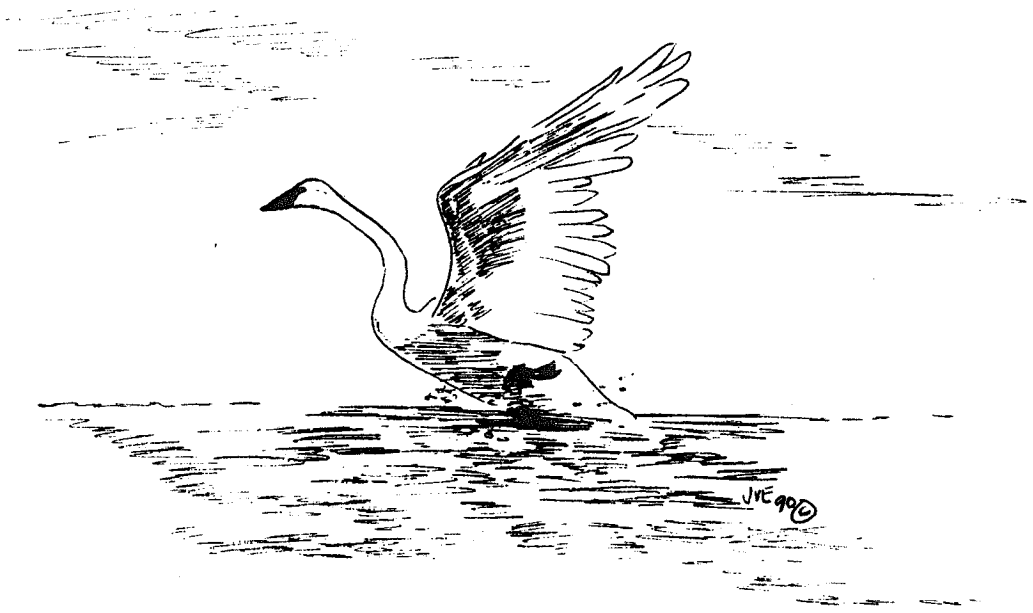

RESPONSE OF TRUMPETER SWANS TO TRAPPING AT RED ROCK LAKES NATIONAL WILDLIFE REFUGE, MONTANA, AND HARRIMAN STATE PARK, IDAHO, WINTER 1990-91

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ABSTRACT

THE ROCKY MOUNTAIN POPULATION (RMP) OF TRUMPETER SWANS (CYGNUS BUCCINATOR) WINTERS IN THE TRISTATE AREA OF IDAHO, MONTANA AND WYOMING AND HAS INCREASED FROM 600+ IN 1972-73 TO 2000+ IN 1989-90. IN 1989-90, 60% OF THE RMP WINTERED IN THE VICINITY OF RED ROCK LAKES NATIONAL WILDLIFE REFUGE (RRLNWR), MONTANA, AND HARRIMAN STATE PARK (HSP), IDAHO. DECLINING AQUATIC VEGETATION AT HSP AND INCREASING CONCENTRATIONS OF SWANS DEPENDING ON AN ARTIFICIAL FEEDING PROGRAM AT RRLNWR LED TO EFFORTS TO CAPTURE AND DISPERSE SWANS FROM THE RRLNWR/HSP AREA DURING WINTER 1990-91. ABOUT 1,500 SWANS RETURNED TO THE AREA IN AUTUMN 1990, A 25% INCREASE FROM FEBRUARY 1990. TRAPPING REMOVED 353 SWANS WHICH WERE TRANSLOCATED TO MORE SOUTHERLY WINTERING SITES WHILE AN ESTIMATED 400 SWANS DISPERSED IN RESPONSE TO DISTURBANCE. SWANS DISPERSED FROM BOTH RRLNWR AND HSP DURING HIGH DISTURBANCE PERIODS OF NIGHT LIGHTING. LOWER DISTURBANCE ASSOCIATED WITH BAIT TRAPPING WAS NOT ADEQUATE TO DISPERSE SWANS FROM RRLNWR WHILE HIGH DISTURBANCE NIGHT LIGHTING OCCURRED AT HSP. SWANS SHIFTED FROM HSP TO THE FEEDING PONDS AT RRLNWR IN MID-FEBRUARY, TWO TO THREE WEEKS EARLIER THAN IN THE PREVIOUS WINTER. COMPARED TO THE PREVIOUS WINTER, NUMBERS DECREASED BY 71% AT HSP AND INCREASED BY 75% AT RRLNWR BY 22 FEBRUARY 1991. LONG-TERM REDUCTION OF SWAN USE IN THE RRLNWR/HSP VICINITY IS UNLIKELY UNLESS HIGH LEVELS OF DISTURBANCE OCCUR ANNUALLY AT BOTH LOCATIONS AND CANADIAN TRUMPETERS ARE AGGRESSIVELY EXCLUDED FROM THE ARTIFICIAL FEEDING PROGRAM AT RRLNWR.

INTRODUCTION

The RMP is comprised of the relatively sedentary Tristate Subpopulation (TSP) which summers in Idaho, Montana and Wyoming, and the migratory Interior Canada Subpopulation (ICSP) which summers in Alberta, British Columbia, Northwest Territories, Saskatchewan and Yukon Territory. Both subpopulations winter together in the Tristate Region, in and near Yellowstone National Park.

Trumpeter Swans from both subpopulations have been collared in various studies since 1956 (Mackay 1957, Gale et al. 1987). A few RMP swans have been observed wintering in Colorado, Utah, Nevada, Oregon and California, and unmarked Trumpeters were reported in the Rio Grande Valley, New Mexico. These sightings confirm winter dispersal by a few RMP swans. Since 1956, however, over 99% of winter sightings of marked RMP Trumpeters have occurred within the Tristate area. No recurring use of winter sites outside of this area has been documented (Gale et al. 1987).

U. S. Fish and Wildlife Service (USFWS) Midwinter Trumpeter Swan Surveys show that due to growth of the ICSP, Trumpeters wintering in the Tristate area increased from 600+ in 1972-73 to 2000+ in 1989-90, while the TSP remained relatively static (537 in 1973 vs. 579 in 1990). Growth of Canadian flocks resulted in record concentrations of swans in the vicinity of Harriman State Park (HSP) and Red Rock Lakes National Wildlife Refuge

(RRLNWR), with 60% of the RMP (1,202) wintering there in 1989-90. The single most important wintering site is HSP on the Henrys Fork of the Snake River, Idaho, where swans have increased from 250± in 1972-73 to 750± in 1989-90.

RRLNWR, 30 km northwest of HSP, has virtually no natural winter swan habitat and wintering birds are fed stored grain at two man-made ponds. From 1935-85, collar sightings revealed that swans wintering at RRLNWR were primarily local residents, and winter numbers usually remained below 300 (Gale et al. 1987).

Although some Canadian Trumpeters have wintered at RRLNWR since at least 1956, (Mackay 1957), increases in both neck band sightings and total swan numbers indicate that growing numbers of Canadian Trumpeters have used the RRLNWR feeding ponds since 1986-87. These migrants are present from November through March, with numbers increasing throughout the winter. Swans move between the refuge feeding ponds and ice free river sites in and near HSP.

The *1990-91 Contingency Plan to Reduce Potential for Mortality of Wintering RMP Trumpeters at Harriman State Park and Red Rock Lakes NWR* was adopted by the Pacific Flyway Council in July 1990. This Plan recognized the extreme vulnerability of these swans due to increasing numbers and their dependency either upon the artificial feeding program at RRLNWR or the aquatic vegetation of the Henrys Fork River.

During winter 1989-90, record numbers of swans gathered at HSP and aquatic plants in the river suffered a major decline (estimated 78% reduction) from which they have not recovered (Vinson 1991). As vegetation became depleted at HSP by March 1990, over 800 Trumpeters gathered at the RRLNWR feeding ponds and consumed all remaining grain supplies. This late winter concentration of 800+ swans and other waterfowl created serious concerns regarding disease potential and the increasing dependency of Canadian Trumpeter Swans on the artificial feeding program.

The goal of the 1990-91 Contingency Plan was to reduce the potential for high mortality of Trumpeter Swans due to inadequate food resources, inadequate water flows and/or disease at HSP and RRLNWR. Accomplishment of this goal requires long-term, continuous reduction of winter waterfowl use at these sites. Efforts began in 1990-91 when 353 Trumpeters were trapped, collared and moved from RRLNWR/HSP to more southerly wintering sites (Drewien et al. 1992). This paper discusses the effectiveness of efforts to reduce the number of swans and other waterfowl wintering at HSP and to prevent a major influx of Canadian Trumpeters into the RRLNWR feed ponds (remove swans >250 in November and December).

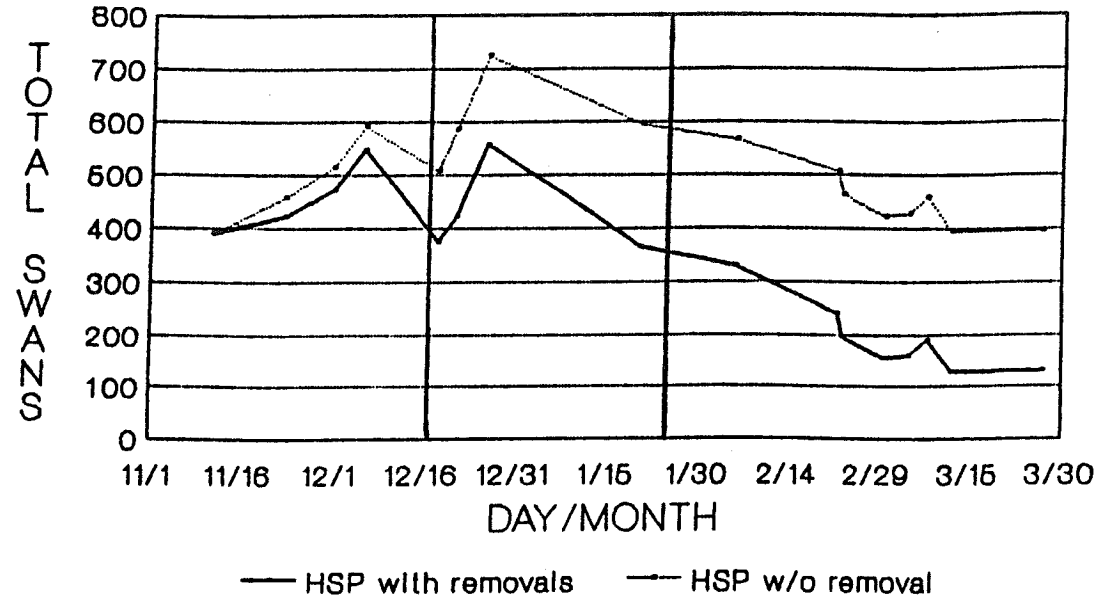
METHODS

I coordinated monitoring which involved gathering collar sightings through the help of a network of observers from the USFWS, The Wildlife Research Institute (University of Idaho), Idaho Department of Parks and Recreation, Idaho Department of Fish and Game, Wyoming Department of Game and Fish, the U. S. Forest Service, the National Park Service, and several private citizens. Swan numbers, distribution and location of collared swans were assessed by aerial fixed wing and ground surveys. Surveys occurred at most traditional winter use sites in the Tristate Region.

RESULTS AND DISCUSSION

Waterfowl numbers and distribution in the RRLNWR/HSP vicinity

Survey data (Figure 1a) for the HSP area (Pinehaven to Box Canyon) are from aerial surveys flown between 11 November 1990 to 22 February 1991 and from ground surveys thereafter. Data from RRLNWR (Figure 1b) are maximum weekly ground counts at the feeding ponds, except for one aerial survey of the entire refuge and adjacent Elk Lake on 11 Novembér 1990. The number of swans that would have wintered at each site if no trapping had occurred was estimated by adding the number of swans previously removed to the number counted.



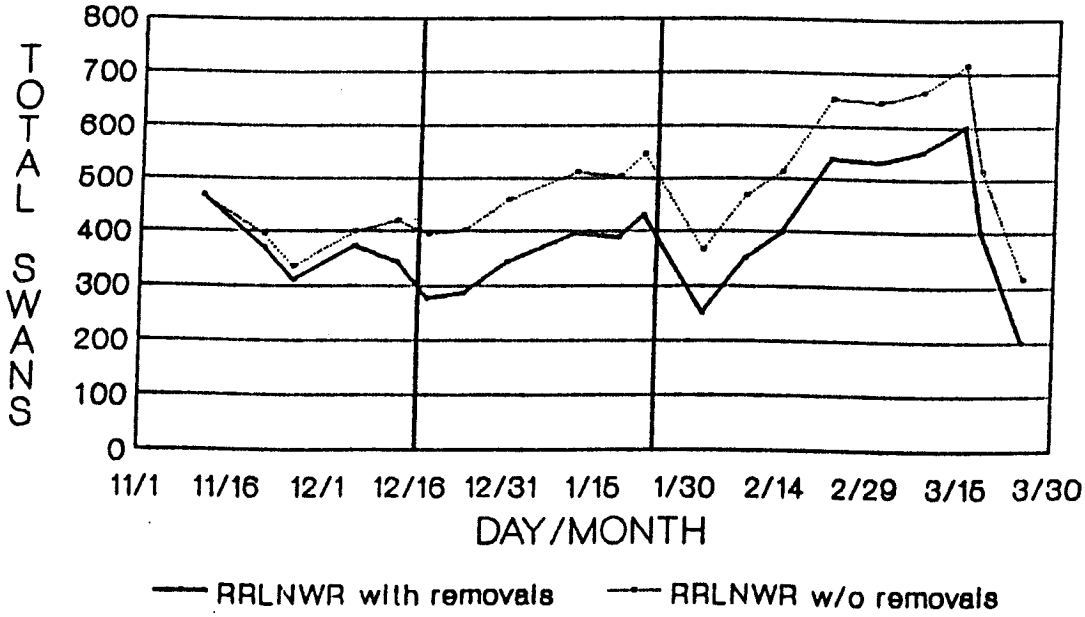


Figure 1a. Abundance of Trumpeter Swans, Winter 1990-91, at Harriman State Park, Idaho. (top)
Figure 1b. Abundance of Trumpeter Swans, Winter 1990-91, at Red Rock Lakes National Wildlife Refuge, Montana. (bottom)

To analyze the response of swans to disturbance, I divided the winter into three survey periods which encompassed three very different scenarios of human disturbance at RRLNWR and HSP. The segments are:

A. High Disturbance RRLNWR - High Disturbance HSP
B. Low Disturbance RRLNWR - High Disturbance HSP
C. Low Disturbance RRLNWR - Low Disturbance HSP

Period A (11 November - 16 December 1990)

The aerial survey on 11 November showed unusually high numbers of Trumpeters had congregated at both at HSP (390) and RRLNWR (467). Canadian Trumpeters began arriving at RRLNWR at least by 7 November, when a collared swan was identified (Carl Mitchell, pers. comm.). This early influx of nonresident swans into RRLNWR continued the trend of increasing use that has become apparent since 1986-87 (Table 1) and demonstrated that many of the 800+ Trumpeters that utilized the refuge grain in March 1990 had returned.

During Period A, when both RRLNWR and HSP experienced unprecedented levels of disturbance, surveys (Figure 1b) showed movement of about 130 swans out of RRLNWR during and immediately after night lighting occurred in mid-November. This was followed by movement of about 80 swans into RRLNWR as disturbance lessened and grain was available at bait traps. Despite high disturbance, swan numbers increased at HSP throughout November and early December as new migrants arrived. Numbers then decreased during the night lighting "blitz" of 8-18 December 1990, when a net dispersal of about 90 swans occurred.

Period B (17 December 1990 - 23 January 1991)

Trapping ended at RRLNWR on 16 December and in subsequent weeks abundant grain was available and disturbance levels were low. An intense blizzard struck the region on 19-21 December. Intermittent high disturbance from trapping attempts continued at HSP whenever weather permitted.

With the cessation of trapping at the feeding ponds, swans moved into the refuge as disturbance was maintained at HSP. Numbers at the ponds rose from 277 on 18 December to 430 by 22 January. This second influx brought a net gain of about 150 swans (54% increase) into RRLNWR during Period B, continuing the trend that began around 26 November after night lighting terminated.

At HSP, numbers peaked at 558 on 26 December after the blizzard subsided and swans arrived from Yellowstone Lake and other ice-locked areas (Table 2). Most habitat at HSP and elsewhere in Island Park was frozen but gradually reopened in early January. Subsequent trapping removed 103 swans and disturbance was very high; about 90 other swans dispersed by 20 January when 367 were counted.

Period C (24 January - 31 March 1991)

Approximately 180 swans left RRLNWR within a week after disturbance ended at HSP (Figure 1b). Numbers at the refuge then increased throughout February to peak at 600+ on 15 March.

Maximum daily temperatures in January and February were unusually mild. During this period swans steadily declined at HSP (Figure 1a). After mid-February most use at HSP was concentrated on Silver Lake which thawed unusually early and provided a new food source. Less than 50 swans remained on the river at HSP after 22 February, except for a few days when Silver Lake refroze in early March.

Dispersal of swans from the HSP/RRLNWR vicinity

Collared swans continued to arrive at HSP until at least the first week of January. However, of 56 collared Canadian swans observed in the Tristate area during the winter, eight dispersed from the HSP/RRLNWR area during November and December. Assuming that the Interior Canadian Subpopulation contains 1800+ swans

Table 1. September counts of Centennial Valley (CV), Montana, Trumpeter Swan flock and maximum monthly counts at the Red Rock Lakes NWR (RRLNWR) feeding ponds, winters 1981-82 through 1990-91[a].

	September CV Flock	Maximum monthly counts at RRLNWR feeding ponds				
Year	Total	Nov	Dec	Jan	Feb	Mar
1981-82	337	396	329	294	321	282
1982-83	no count	191	187	188	244	252
1983-84	249	229	188	265	214	271
1984-85	262	221	234	244	267	272
1985-86	280	232	222	241	263	269
5 year $\bar{X}$	282	254	232	246	262	269
1986-87	195	255	366	325	318	267
1987-88	335	156	355	508	466	300[b]
1988-89	328	no count	369	400	426	400
1989-90	308	288	390	396	510	800±
1990-91	345	467	373	430	537	600
5 year $\bar{X}$	302	292	371	412	451	473

[a] Data are from USFWS Tristate September Trumpeter Swan Surveys, Gale et al. (1987), and RRLNWR files.

[b] Counts of 490 on 4 March 1988 and 595 on 14 March 1988 were not included due to presence of Tundra Swans.

(Len Shandruk, pers. comm.) these eight marked swans represent about 250 unmarked Trumpeters that dispersed from RRLNWR/HSP during these months. By 22 February, aerial surveys showed that an additional 150 swans had dispersed from the area since 26 December. In total, some 400 Trumpeter Swans left the RRLNWR/HSP area.

Approximately 1,000 swans remained in the area on 26 December despite high levels of disturbance. Including 287 swans that had been trapped before 26 December, and some 250 that had dispersed, I estimated 540+ swans were displaced from the HSP/RRLNWR vicinity by that date. Thus, approximately 1,500 Trumpeter Swans would likely have occupied the HSP/RRLNWR vicinity by year's end if contingency actions had not occurred. This represents an increase of 25% from the 1,197 swans in the area in February 1990, and coincides with an estimated 20% cygnets (1,200 adults and 300 cygnets) observed during autumn.

Net impacts of trapping and hazing on swan abundance at HSP/RRLNWR

A total of 844 swans was found in the area on 22 February 1991 after contingency actions ceased and swans began returning from downstream sites on the Snake River. This total represents a reduction of 44% from the 1,500 swans that returned to RRLNWR/HSP in autumn 1990, and a 30% reduction in swans compared to 20 February 1990 (Table 3).

Overall, efforts to disperse swans from HSP were highly effective, resulting in a 71% decrease by 22 February, compared to the

Table 2. Swan surveys in Island Park, Idaho, and Red Rock Lakes NWR, Montana, 11 November 1990 - 22 February 1991.

Date	Harriman State Park Pinehaven to Dam	Other Island Park	RRLNWR	Total
11 November	390	109	467	966
23 November	422	103	371	896
06 December	548	162	373	1083
18 December	375	191	277	843
21 December	420	363	238	1021
26 December	558	158[a]	256	972+
20 January	367	164	430	961
05 February	330	134	322	786
22 February	240	67	537	844

[a] Sheridan and Island Park Reservoirs not surveyed due to high winds

Table 3. Comparison of Trumpeter Swan abundance at and near Harriman State Park, Idaho, and Red Rock Lakes NWR, Montana, on 20 February 1990 and 22 February 1991.

Location	20 Feb. 1990	22 Feb. 1991	Change Swans	Change %
Harriman State Park (Henrys Fork and lakes)	679	195	-484	-71%
Henrys Fork River from dam to Pinehaven	666	240	-426	-64%
All of Island Park	895	307	-588	-66%
Red Rock Lakes NWR	307	537	+230	+75%
Total Island Park/ Red Rock Lakes NWR	1202	844	-358	-30%

previous winter. Efforts to disperse swans from the entire RRLNWR/HSP vicinity were considerably less effective, however, due to a 25% increase in swans returning to the area and earlier and increasing use of the refuge feeding ponds by Canadian swans. Compared to the previous winter, the net reduction in swans wintering in the entire area (358) in 1991 was equivalent to the number removed by trapping (353). Even though several hundred additional swans dispersed from the area in response to disturbance, net reductions due to this dispersal were effectively negated by the annual population increase.

A major reduction of use by other waterfowl at HSP also resulted. A survey on 13 February 1991 found 83 geese and 1,593 ducks, compared to 1,200 geese and 3,600 ducks counted on 5 January 1990. This reduction in swan and other waterfowl use at HSP was accompanied, however, by movement of swans to the artificial feeding program at RRLNWR. After removal of 353 swans from the RRLNWR/HSP vicinity, peak numbers at RRLNWR were approximately 200 less in March 1991 compared to March 1990. In 1991, however, the late winter influx of swans occurred several weeks earlier than in 1990, and by 22 February there was a 75% increase at the feed ponds compared to the previous year. The availability of grain at RRLNWR decreased the effectiveness of the efforts to disperse swans, resulting in a 30% decline of swans in the total area as compared to a 71% decline at HSP.

Monitoring showed that trapping and hazing effectively dispersed waterfowl from HSP, but increasing numbers moved to RRLNWR because grain was provided. It was not possible to provide grain to local resident swans without attracting migrants. Record numbers of swans appeared at the feeding ponds in November and gathered again by late February despite unprecedented trapping and disturbance. A long-term reduction in waterfowl use at HSP is unlikely unless high levels of disturbance are maintained annually. Long-term reduction of wintering swans in the RRLNWR/HSP vicinity is unlikely unless Canadian Trumpeters are aggressively excluded from the artificial feeding program at RRLNWR.

ACKNOWLEDGEMENTS

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WINTER CAPTURE OF TRUMPETER SWANS AT HARRIMAN STATE PARK, IDAHO, AND RED ROCK LAKES NATIONAL WILDLIFE REFUGE, MONTANA

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ABSTRACT

TRUMPETER SWANS (CYGNUS BUCCINATOR) OF THE ROCKY MOUNTAIN POPULATION WERE CAPTURED AT HARRIMAN STATE PARK (HSP), IDAHO, AND AT RED ROCK LAKES NATIONAL WILDLIFE REFUGE (RRLNWR), MONTANA, DURING WINTER 1990-91 AND TRANSLOCATED TO NEW WINTER AREAS. THE U. S. FISH AND WILDLIFE SERVICE AND CONCERNED STATE FISH AND GAME AGENCIES IN THE PACIFIC FLYWAY RECOMMENDED A TRAPPING AND TRANSLOCATION PROGRAM TO MINIMIZE POTENTIAL MORTALITY. THESE ACTIONS WERE PROMPTED BY (1) EXCESSIVE CONCENTRATIONS OF WINTERING SWANS, (2) GREATLY REDUCED AQUATIC VEGETATION FOR FEED IN THE HENRYS FORK OF THE SNAKE RIVER, IDAHO, AND (3) A DIE-OFF OF SWANS ON THE HENRYS FORK IN FEBRUARY 1989. A TOTAL OF 353 TRUMPETER SWANS, INCLUDING 237 AT HSP AND 116 AT RRLNWR, WAS CAPTURED, BANDED, COLOR MARKED, AND TRANSLOCATED TO NEW WINTER SITES IN SOUTHERN IDAHO (298), SALT RIVER, WYOMING (30), AND FISH SPRINGS NATIONAL WILDLIFE REFUGE, UTAH (25). CAPTURE METHODS INCLUDED NIGHT LIGHTING (65.4%), BAIT TRAPPING (26.1%), AND BY SNOWMOBILE (8.5%). TWENTY-ONE TRUMPETER SWANS, PREVIOUSLY BANDED IN WESTERN CANADA (12) AND CENTENNIAL VALLEY, MONTANA (9), WERE TRAPPED AND TRANSLOCATED. ANALYSIS IS MADE OF THE EFFECTIVENESS OF THE VARIOUS CAPTURE TECHNIQUES.

INTRODUCTION

Trumpeter Swans of the Rocky Mountain Population (RMP) have recently increased beyond the carrying capacity of some portions of their winter range in the Greater Yellowstone region. The February 1990 mid-winter count showed 2,007 swans in the Tristate Region (Mitchell 1990). The large population segment that traditionally winters at Harriman State Park (HSP) and vicinity on the Henrys Fork of the Snake River in Island Park, Idaho, is vulnerable to starvation due to deteriorated winter habitat conditions. Reduced water flows in the river from prolonged drought (Gale 1990) and a major decline in aquatic vegetation have contributed to the current adverse habitat conditions (Snyder 1991a, 1991b; Vinson 1991; Mitchell 1990).

During an extreme cold period in February 1989, all feeding areas at HSP froze over (Snyder 1991a, 1991b) and an estimated 100 swans died from starvation and hypothermia (Ruth Shea, pers. comm.). In the 1989-90 winter, a record number of swans (750+) wintered at HSP and consumed all aquatic vegetation by early March; 400-500 then moved to nearby Red Rock Lakes National Wildlife Refuge (RRLNWR) (Mitchell 1990). By mid-March, there were over 800 Trumpeters at RRLNWR where they exhausted the supply of stored wheat used to feed the local wintering population.

Surveys on Henrys Fork during Summer and Fall 1990 by the U. S. Fish and Wildlife Service (USFWS) revealed that aquatic vegetation growth was reduced by 78% compared to Fall 1989 (Vinson 1991). The poor habitat conditions combined with low water flows partly due to continued drought suggested that if large numbers of swans returned to Henrys Fork during the 1990-91 winter, starvation and further deterioration of aquatic vegetation could occur.

A contingency plan was prepared by the RMP Trumpeter Swan Subcommittee of the Pacific Flyway Study Committee in June 1990. The plan addressed the vulnerability of Trumpeter Swans wintering at HSP and outlined strategies for water flow releases from Island Park Dam, for capturing and translocating swans to other preselected winter sites, and for hazing swans at HSP if capture efforts were unproductive.

The USFWS, Regions One (Portland) and Six (Denver), accepted responsibility for implementing the contingency plan. Charles Peck, Manager of the Southeast Idaho Refuge Complex, coordinated the program. The Wildlife Research Institute, University of Idaho, was contracted to organize and undertake a capture program at HSP and at RRLNWR if the winter population at the Refuge exceeded 250 swans. Captured swans were to be translocated to preselected winter sites in (1) Star Valley, Wyoming, (2) Fish Springs NWR, Utah, and (3) to lower elevation areas along the Snake River in southern Idaho. The objective of this paper is to summarize Trumpeter Swan capture activities during Winter 1990-91.

METHODS

Little information was available concerning successful ways to capture Trumpeter Swans during adverse winter weather. We investigated various techniques, including night lighting, bait traps, rocket nets, drive traps, and net guns.

Night lighting

Various night lighting equipment was tested. The primary unit used was a small (11.8" x 8.3" x 11.3"), light-weight (18.7 lbs.) generator (Tanaka model AQB-300) mounted on an aluminum backpack frame, an improved version of that described by Drewien et al. (1967). The generator served as a power source for an aircraft landing light (GE# 4553, 28V, 250W) attached to a football helmet. This portable night lighting unit was used in boats, from a 4X4 Honda ATV, from snowmobiles, and on foot. A Q-Beam spotlight powered by a 12-volt deep-cycle battery was often used as a backup night lighting unit in boats and on snowmobiles. We also tested an airboat for night lighting. We installed twin 12-volt spotlights on the bow and utilized a Q-Beam spotlight as a third light source. Large salmon landing nets were used to capture swans.

Various motorized equipment was tested to approach swans at night. Equipment included aluminum boats powered by electric, outboard and Go-Devil motors, an airboat, a 4X4 Honda ATV, a Hovercraft and snowmobiles.

Bait traps

Two types of swim-in bait traps were tested:

(1) Two traps were constructed by Refuge personnel at winter grain feeding sites in Culver and McDonald Ponds, RRLNWR. Traps were 20' by 20' by 8' and covered with nylon netting. Drop doors were activated by pulling cords from camp trailers serving as blinds.

(2) We also tested swim-in funnel entrance traps (30' by 20'). Adjustable funnel entrances were made with fiberglass rods (2.5' or 3' long) held in place by wood frames. One funnel trap was constructed at RRLNWR and one at HSP.

Drive traps, rocket nets and net guns

A drive trap, complete with lead-in wings, was constructed with nylon netting and metal rods. Rocket nets were obtained from the Southeast Idaho Refuge Complex and Deer Flat NWR, Idaho. Two portable Coda net guns (Telonics, 1038 East Norwood, Mesa, AZ 85203) were obtained from the Idaho Department of Fish and Game.

Banding, marking, handling

All captured swans were banded with 9C USFWS metal leg bands. Swans were individually marked with green plastic collars (4.25" tall, 2.5" dia., 1/8" thick) bearing white alpha-numeric codes (one letter and two numbers) made by Spinner Plastics, Springfield, Illinois.

All but three adults and some juveniles were dyed with yellow-orange picric acid on specific areas of the body to designate release sites and to aid in monitoring winter and spring movements. Dyed body parts and release site locations included: (1) left outer wing - Star Valley, Wyoming, (2) right outer wing - Fish Springs NWR, Utah, (3) tail - Ft. Hall Indian Reservation and Minidoka NWR on the Snake River, Idaho, (4) solid color neck - Bruneau Dunes State Park and vicinity on the Snake River, Idaho, and (5) striped neck - Bear River near Grace, Idaho.

When captured, swans were put in plastic grain sacks and transported to a processing building at HSP. After banding and color marking, swans were transported in 3/8" thick plywood, ventilated boxes (28" x 20.5" x 20.5") with sliding doors. The U. S. Forest Service (USFS) Targhee National Forest arranged for and supervised the construction of 60 boxes by minimum security prisoners at correction facilities in St. Anthony, Idaho. Swans were usually shipped within 24 hours following capture to preselected winter sites in vehicles provided mainly by USFS.

RESULTS

Weather conditions during capture operations

Weather data for HSP area were obtained from the Island Park Bugle (D. Hays, editor, recorded by T. Scarpelli).

Weather at HSP between 15 November and 14 December was relatively mild. Sub-zero temperatures occurred on only two days in late November and on five days in December prior to the 14th. An arctic cold wave arrived in mid-December with -58°F recorded on 22 December. Sub-zero temperatures occurred on 19 of 22 days between 15 December 1990 and 5 January 1991. The mean low daily temperature during this period was -26°F (SD=12.6°F, range -58°F to +03°F). Much of the Henrys Fork froze over during this period. However, aerial surveys revealed that swans increased within the area during these adverse conditions.

Weather moderated between 6-18 January with only one day of sub-zero temperatures and most of the river opened up. Sub-zero temperatures returned between 20-23 January. Trapping was terminated on 24 January.

During the 70 day capture period, 15 November 1990 to 23 January 1991, precipitation (snow) was recorded on 40 days (57%). Periods of deep snow and extreme cold greatly hindered field operations.

Swan numbers

Information on number of swans using Henrys Fork, including HSP, was obtained mainly from aerial surveys conducted by Ruth Shea (pers. comm.). Carl Mitchell (pers. comm.) recorded ground counts at RRLNWR, mainly at Culver and McDonald Ponds where most swans winter. Counts for the trapping periods at HSP (15 November-23 January) and at RRLNWR (19 November-16 December) are listed in Table 1.

Counts on Henrys Fork from Pinehaven to Island Park Dam showed nearly 400 swans by mid-November with numbers increasing to 558 by 26 December, then declining about 200 by 20 January (Table 1). The increase in late December is attributed to swans moving to Henrys Fork from outlying areas that froze over during the extreme cold period after mid-December. We attribute the decline in swans in January in part to harassment from night lighting from snowmobiles. Counts at HSP, where all capture operations on Henrys Fork occurred, accounted for 84% of all swans on Henrys Fork in December and only 41% in January.

A September 1990 count of the Centennial Valley, Montana, including RRLNWR, found 345 swans (Carl Mitchell, pers. comm.). Prior to trapping at RRLNWR, an aerial count on 11 November at RRLNWR and nearby Elk Lake

Table 1. Trumpeter Swans counted on Henrys Fork River, Idaho, and at Red Rock Lakes NWR, Montana, Winter 1990-91. Counts on Henrys Fork were mainly by air and at Red Rock Lakes mainly by ground surveys.

Date	Henrys Fork [1]		Red Rock Lakes NWR [3]
	Harriman State Park [2]	Pinehaven to Island Park Dam (includes HSP)	
11 Nov. 90	--	390	467[4]
23 Nov.	--	422	371
1 Dec.	362	471	--
6 Dec.	508	548	373
10 Dec. [5]	540	542	
18 Dec.	353	375	277
21 Dec.	389	420	
26 Dec.	383	558	
11 Jan. 91[5]	108	314	
20 Jan.	173	367	

[1] Count data provided by R. Shea
[2] Trapping area on Henrys Fork
[3] Count data at refuge feeding ponds provided by C. Mitchell
[4] Aerial survey of entire refuge and adjacent Elk Lake, R. Shea, (pers. comm.)
[5] Ground count

showed 467 swans, obviously representing an influx of birds. About 370 swans were present on 23 November, six days after trapping was initiated. On 18 December, two days after trapping terminated, 277 swans were at the two ponds (Culver and McDonald) where birds are artificially fed (Table 1).

Number of swans captured

At HSP capture operations occurred between 15 November and 23 January, except for one swan caught in February. At RRLNWR we started on 19 November and terminated on 16 December when the number of swans was about 250 (Table 1), the target population level specified by USFWS.

Two Tundra Swans (Cygnus columbianus) and 353 Trumpeter Swans were captured and translocated to new winter sites; 237 Trumpeters were captured at HSP and 116 at RRLNWR (Table 2). Both Tundra Swans were captured at HSP.

Of 353 Trumpeters captured, 212 (60.1%) were adults and 141 (39.9%) were juveniles (Table 3). Capture locations for adults included 152 (71.7%) at HSP and 60 (28.3%) at RRLNWR. Eighty-five (60.3%) juveniles were captured at HSP and 56 (39.7%) at RRLNWR. The proportion of juveniles in the capture sample was higher than the 20-25% noted in the winter population (Ruth Shea, pers. comm.), indicating that juveniles were more susceptible to capture. Sex ratios of 212 adults (49.1 M: 50.9 F) and 141 juveniles (50.4 M:49.6 F) were essentially 50:50 (Table 3), indicating that capture operations were not sex-biased if the population sex ratios for both adults and juveniles were about 50:50.

Table 2. Trumpeter Swans captured at Harriman State Park, Idaho, and Red Rock Lakes NWR, Montana, employing various methods, Winter 1990-91.

Trapping Location	Capture Method			Total Swans Captured
	Night-Light	Bait	Snowmobile	
Harriman State Park, ID	206	1	30	237
Red Rock Lakes NWR, MT	25	91	0	116
Total	231	92	30	353

Table 3. Transplant locations and sex and age of 353 Trumpeter Swans captured at Harriman State Park, Idaho, and Red Rock Lakes NWR, Montana, Winter 1990-91.

Transplant Location	Age & Sex				
	Adult		Juvenile		
	Male	Female	Male	Female	Total
Star Valley, WY	5	6	7	12	30
Fish Spr. NWR, UT	4	9	4	8	25
Ft. Hall, ID	37	47	13	15	112
Minidoka NWR, ID	7	3	3	3	16
Bruneau Dunes State Park, ID	47	43	42	31	163
Bear River, Grace, ID	4	-	2	1	7
Total	104	108	71	70	353

Two swans died during capture operations. One was lost at HSP and one at RRLNWR. Cause of mortality for the swan from HSP was unknown, but the loss at RRLNWR was possibly due to suffocation. When removed from the grain sack, its head was under a wing.

Twenty-one previously banded swans were captured and translocated to new winter sites. All nine swans captured at HSP and three of 12 captured at RRLNWR were originally banded in western Canada (Shandruk and McCormick 1990, 1991; Shandruk and Winkler 1990). Nine others captured at RRLNWR had originally been banded in the Centennial Valley, Montana.

Nine additional Trumpeters originally banded at RRLNWR were recaptured and released at the Refuge. Refuge personnel did not want too many of the local population removed from the valley.

Swans were transplanted to six different sites in southern Idaho, western Wyoming and western Utah. Most swans were sent to Bruneau Dunes State Park (163 Trumpeters and one Tundra Swan) and Ft. Hall Indian Reservation, Ft. Hall, Idaho (112 Trumpeters and one Tundra). Age, sex and numbers shipped to each release site are listed in Table 3.

Effectiveness of capture methods

Night lighting

Night lighting was the most successful method, accounting for 231 Trumpeters captured. We night lighted swans from boats (n=184, 79.7%), snowmobiles (n=43, 18.6%), and 4x4 all terrain vehicle (n=4, 1.7%).

Nocturnal conditions such as moon phase, amount of starlight, and weather all influenced capture success. Repeated night lighting in the same areas on consecutive nights yielded diminishing success. Mean number of swans caught per night of effort in boats varied from a low of 5.1 (SD=5.6, range 1-17) on clear, starlit nights, to 10.3 (SD=4.2, range 7-15) on foggy nights, to a high of 17.4 (SD=7.9, range 5-25) during nights with snowstorms. The highest catches per night from boats (25, 24 and 21) were obtained during snowstorms when swans were reluctant to fly. We made little effort to catch swans during moonlit nights because they normally flushed out of capture range.

Compared to other species of waterfowl and cranes we have captured, swans were relatively easy to night light. The major difficulty was that no type of watercraft functioned satisfactorily in the cold weather and low water flows (450-500 cfs) of Henrys Fork. Boat navigation was greatly hampered by numerous rocks and extensive areas of shallow water. Extremely cold temperatures caused numerous equipment malfunctions. Ice sheets along the shore and large pieces of ice floating in the river also hampered boat operations.

Extensive areas of shallow water and rocks in the river caused outboard and electric motors to perform poorly. However, motors worked successfully in Silver Lake at HSP in mid-November prior to freeze up. We had the best overall success with a Go-Devil motor that could operate in 8-12 inches of water. Hitting submerged rocks was a problem, and on three occasions the person netting swans from the bow of the boat was dumped into the river. Collisions with rocks caused numerous leaks in boats.

In December, we tested an airboat that had the engine modified for cold weather. Swans were easily captured from the airboat (21 in 2.5 hours). However, sub-zero temperatures caused the engine to malfunction. Further inspection revealed that the fiberglass bottom was damaged significantly from running over ice, snow, and rocks. These mechanical problems limited our test of the airboat to one night. Perhaps an airboat with a reinforced hull would perform better in the harsh conditions that prevail on Henrys Fork.

Between 27 December and 23 January, we night lighted swans from snowmobiles on nine nights and caught 43 swans. We traveled along the edge of the river until we located swans, then we pursued them on foot with the backpack night lighting unit.

The mean number of swans captured per night using snowmobiles was 4.8 (SD=5.0, range 0-15). We were most successful during the first two nights when we caught 25 swans. As efforts continued, swans became increasingly wary and usually flushed when snowmobiles approached. As with night lighting from boats, the largest catches occurred during inclement weather.

We night lighted from a 4x4 Honda ATV and captured four swans. The ATV did not function in deep water and after several dunkings in deep holes we discontinued using it after one night.

In December, we tested a Hovercraft at HSP for night lighting. Powder snow, moisture, and low temperatures caused the air intake to freeze up, which in turn eliminated the air foil (bubble) needed to make the craft operational. We believe that the Hovercraft might have performed well if used on Silver and Golden Lakes at HSP prior to freeze up.

Bait trapping

Ninety-two swans were captured in swim-in bait traps, all but one at RRLNWR (Table 2); 74 were caught in drop door traps and 18 in funnel entrance traps. Swans quickly became trap shy and were soon reluctant to enter traps in daylight hours. Many were caught after sundown but before it was too dark to see. Consequently, many hours were spent in blinds waiting for swans to enter the drop door traps. The main problem encountered with funnel traps was that some trapped swans forced their way out through the funnel entrances.

We prepared and pre-baited three trap sites at HSP. Large numbers of Mallards (Anas platyrhynchos) and Canada Geese (Branta canadensis) always consumed the bait before many swans found the sites. Swans preferred to forage on aquatic vegetation, as compared to wheat, as long as the river remained open. All three trap sites froze over at HSP during the extremely cold weather in late December. Due to other waterfowl eating the bait and problems with ice, we discontinued bait trapping efforts at HSP.

Snowmobiles

When most of the river froze over in late December, swans concentrated around the few remaining open water areas. While surveying swans from snowmobiles, we found that some would panic and flush when we approached and would land in deep snow where they were unable to fly. Others, flushed from small water areas where takeoff distances to reach flight speed were inadequate, would land in nearby deep snow where they were captured. We captured 30 swans by hand in this manner (Table 2). Swans were not caught in this fashion when weather moderated, more water opened up, and they had ample takeoff distances.

Drive traps, rocket nets, and Coda net guns

In January, we built a drive trap with wings of nylon netting in the river and attempted to herd swans into the trap by boat equipped with lights. About 30 swans swam into the wings and were stopped by the nets. However, they flushed and flew upstream over the boat. Additional experimenting with drive traps at night appears warranted.

Large numbers of Mallards and Canada Geese but few swans were attracted to bait (wheat) on Henrys Fork. Consequently, we had no real opportunity to capture swans with rocket nets. The harsh winter conditions, including very cold temperatures, dense fog along the river, and considerable snowfall, created poor rocket netting conditions. Problems with frozen nets would likely have occurred.

We mounted a Coda Net Gun on the front of a 4x4 Honda ATV. Several attempts were made at night to fire the net at small groups of swans on the river after approaching within 20 ft. The net gun failed to fire because moisture apparently wet the powder in shells used to detonate the gun. We made one other attempt to capture swans at night with a net gun fired from the shoulder but missed with the net. Problems with projectiles freezing in the barrels and with firing pins freezing also contributed to malfunctions. The net guns should be tested further because the potential to catch swans with them at night appears promising.

CONCLUSIONS

Capturing Trumpeter Swans by night lighting during cold winter weather on the Henrys Fork was difficult and accomplished only with much effort. Cold weather, snow and ice, extensive shallow areas, and numerous rocks in the river greatly reduced operational capabilities of conventional watercraft. None of the watercraft we tested operated satisfactorily over time under the existing harsh working conditions. A small or medium airboat with a flat, strong, reinforced hull and an engine modified to operate in cold weather would probably provide the greatest potential to navigate in shallow water to capture large numbers of swans at night.

Capturing swans at RRLNWR is an easy task compared to operations on Henrys Fork. Winter sites at the Refuge are confined to two small, spring-fed ponds, and swans are conditioned to eating wheat because of the annual winter feeding program. Swans at RRLNWR are also relatively easy to night light due to the restricted areas of open water and because water levels can be regulated.

Some capture methods need further testing, including net guns and nighttime drive trapping. Drive trapping may be feasible on lakes before they freeze or if little or no ice flows occur in the river.

Our experience in capturing swans provided us with insight into what does and does not work under harsh winter conditions on Henrys Fork and at RRLNWR. A more efficient program requiring less time and staff could be organized in future winters if it is deemed necessary to again capture and translocate Trumpeter Swans.

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Many thanks go to personnel of the USFWS (Regions One and Six), USFS Targhee National Forest, HSP, Idaho Department of Fish and Game, and Wyoming Game and Fish Department who provided much needed assistance and equipment. We are especially indebted to many individuals with the USFWS who contributed to the success of the program, especially Charles Peck and the staff of the Southeast Idaho Refuge Complex; Danny Gomez, Carl Mitchell and staff at RRLNWR; Dick Bauer, John Cornely, John Doble, and Skip Ladd. We thank Charles Peck for helping in all aspects of the program; his efforts insured success of the project. Gene Eyraud and staff, HSP, provided housing for the trapping crew, facilities to process swans and much needed information and assistance, and they were all around great hosts. We thank Dave Moody and Dave Lockman, Wyoming Game and Fish Department, for their assistance and for hiring a temporary employee to help with capture operations. We are indebted to Ruth Shea, Idaho Department of Fish and Game (on temporary assignment to the USFWS), for helping in all aspects of the project and for sharing her data and knowledge about swans. We thank Elwood Bizeau and Ruth Shea for reviewing this manuscript.

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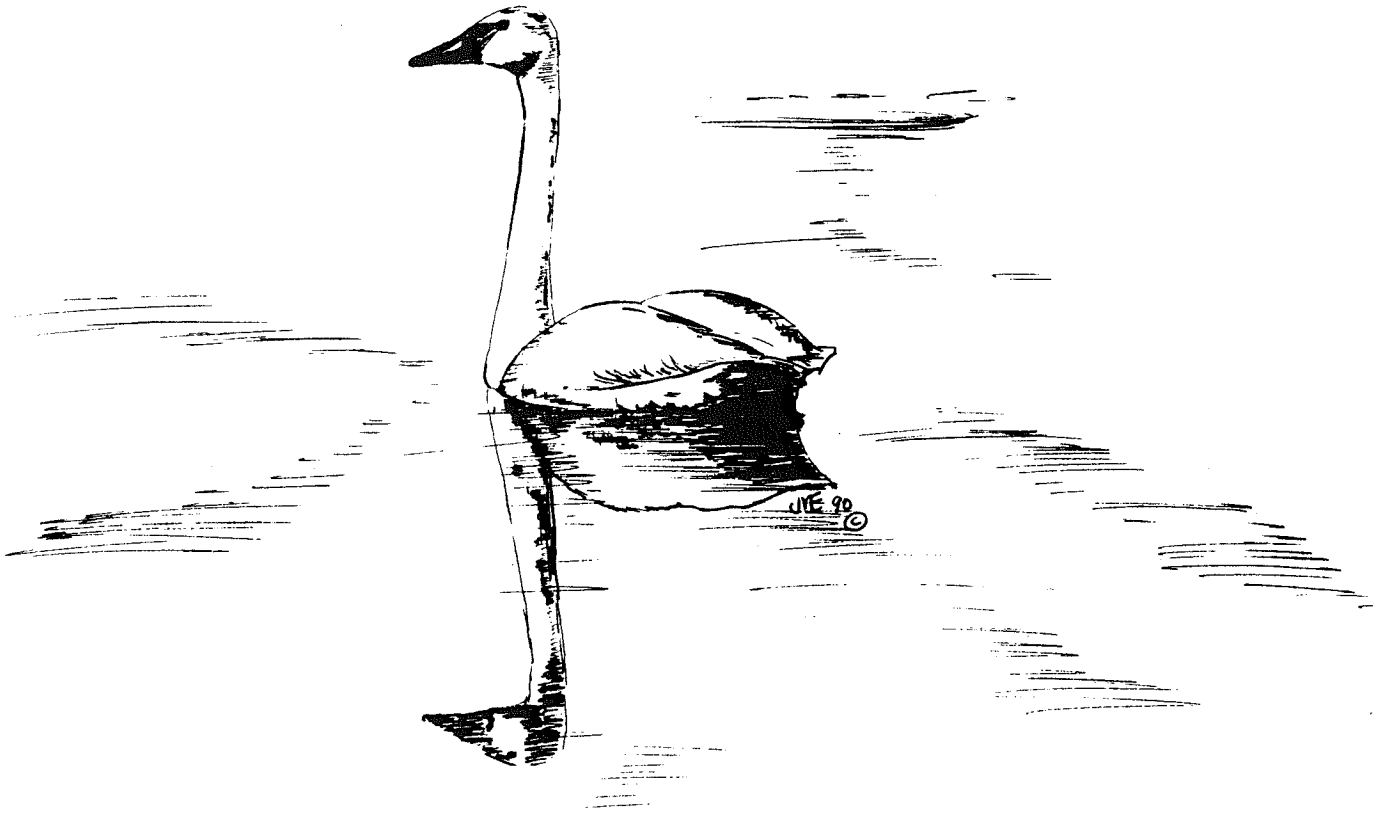
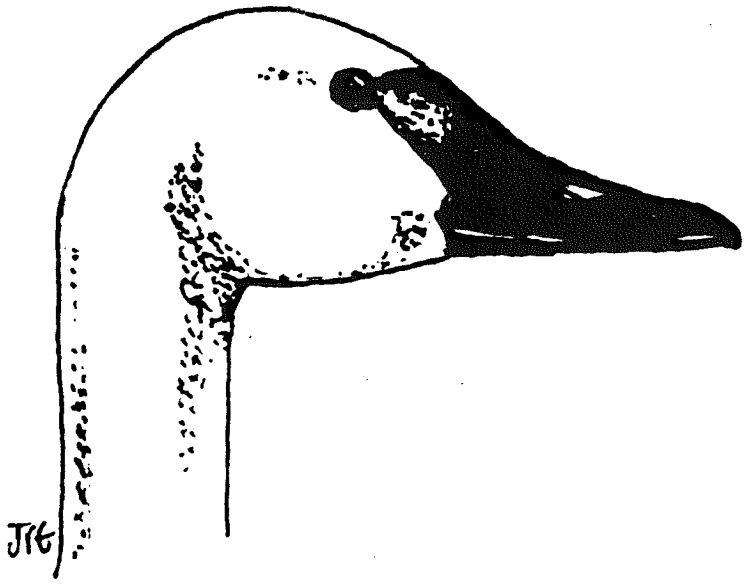


TUNDRA SWAN MANAGEMENT IN NORTH AMERICA



THE HABITAT USE OF TUNDRA SWANS (CYGNUS COLUMBIANUS COLUMBIANUS) ON AN AUTUMN MIGRATORY STOPOVER

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ABSTRACT

THE HABITAT USE OF TUNDRA SWANS ON AN AUTUMN MIGRATORY STOPOVER IN KIDDER COUNTY, NORTH DAKOTA, WAS INVESTIGATED DURING OCTOBER 1988 AND 1989 USING A COMBINATION OF AERIAL SURVEYS, GROUND SURVEYS, AND BEHAVIORAL OBSERVATIONS. TUNDRA SWANS REPORTEDLY FEED ON SAGO PONDWEED (POTAMOGETON PECTINATUS) IN THIS AREA OF THE PRAIRIE POTHOLE REGION, BUT THE RELATIONSHIP BETWEEN SWANS AND SAGO HAD NOT BEEN PREVIOUSLY QUANTIFIED. FIVE HABITAT VARIABLES (PRESENCE OF SAGO PONDWEED, WETLAND SIZE, WATER PERMANENCE, SPECIFIC CONDUCTIVITY, AND EXTENT OF OPEN WATER) WERE USED TO PREDICT THE NUMBER OF TOTAL SWANS, FEEDING SWANS, AND CYGNETS PER WETLAND.

THE PRESENCE OF SAGO PONDWEED WAS NOT A SIGNIFICANT PREDICTOR OF THE TOTAL NUMBER OF SWANS ON A WETLAND, PERHAPS BECAUSE THE MAJORITY OF SWANS ON MOST WETLANDS WERE ROOSTING. THE ONLY THREE SIGNIFICANT PREDICTORS OF THE TOTAL NUMBER OF SWANS WERE WETLAND SIZE, SPECIFIC CONDUCTIVITY, AND EXTENT OF OPEN WATER ($R^2_{ADJ} = 19\%$, $n = 80$, $p < 0.001$). MORE SWANS WERE FOUND ON LARGER LAKES ($p < 0.01$), ON LAKES OF INTERMEDIATE SPECIFIC CONDUCTIVITIES ($p < 0.01$), AND ON LAKES WITH MORE CONTIGUOUS OPEN WATER ($p < 0.05$).

THE PRESENCE OF SAGO PONDWEED WAS THE ONLY SIGNIFICANT PREDICTOR OF THE NUMBER OF FEEDING SWANS ON A WETLAND ($R^2_{ADJ} = 7\%$, $n = 60$). THERE WERE MORE THAN FOUR TIMES AS MANY FEEDING SWANS ON SAGO PONDWEED WETLANDS ($\bar{X} = 19.2 \pm 4.9$) THAN ON NON-SAGO PONDWEED WETLANDS ($\bar{X} = 3.7 \pm 1.5$, $t = 2.68$, $p = 0.009$).

THE PRESENCE OF SAGO PONDWEED WAS ALSO THE ONLY HABITAT VARIABLE WHICH SIGNIFICANTLY PREDICTED THE NUMBER OF CYGNETS ON A WETLAND. IN ADDITION, CYGNETS AND FEEDING SWANS WERE FOUND PROPORTIONATELY MORE OFTEN IN SMALL FLOCKS THAN IN LARGE FLOCKS.

MOVEMENTS OF TUNDRA SWANS ON THE EAST COAST IN WINTER

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ABSTRACT

WE INVESTIGATED WHETHER WINTERING TUNDRA SWANS ON THE EAST COAST FORM A SINGLE, WELL MIXED POPULATION OR CAN BE DIVIDED INTO SEVERAL DISTINCT SUBPOPULATIONS. SWANS COLLARED ON THE COLVILLE DELTA IN NORTHERN ALASKA WERE LATER RESIGHTED THROUGHOUT THE WINTERING RANGE, THOUGH THEY APPEARED TO BE CONCENTRATED IN THE NORTHERN PORTION OF THE RANGE. WE DISTINGUISHED THREE REGIONS WITHIN THE WINTER RANGE AND FOUND THAT SWANS SELDOM MOVED BETWEEN THEM WITHIN A WINTER. APPROXIMATELY 25% OF THE ADULTS, AND 50% OF THE YOUNG, CHANGED WINTERING LOCATIONS EACH YEAR. THE RESULTS SUGGEST THAT THE WINTERING POPULATION IS NOT SUBDIVIDED INTO DISTINCT SUBPOPULATIONS.

POSITION PAPER ON TUNDRA SWAN HUNTING: INTRODUCTORY REMARKS

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For more than a decade, The Trumpeter Swan Society has been concerned about the potential for harvest of Trumpeter Swans during Tundra Swan hunts. This concern culminated in the development of a position paper on Tundra Swan hunting which was approved by the Society in February 1990 and submitted to the Flyway Councils that month. The position paper is reprinted following these remarks so that everyone will have an opportunity to become familiar with it. Opinions may vary on the value of and need for the position statement. That's fine, as long as the opinions are based on facts and not assumptions.

It is stated on page 1 of the position paper that "the Society believes that the plans for Trumpeter Swan restoration and management and the Tundra Swan hunting and management plans . . . can not both be completely implemented without coming into conflict with each other." Conversely, it may be possible to partially implement both plans without serious conflict. It is important to remember the converse when thinking about the impact this position paper could have.

The Trumpeter Swan Society is not an anti-hunting organization. We have not used our organization as a tool to fight recreational hunting. Our comments on hunting are restricted to specific instances where Trumpeters are involved in more than incidental ways. The Society must work with waterfowl hunters across the continent to achieve common goals such as preservation of habitat. The Society has far more in common with waterfowl sportsmen and managers than it has areas of conflict.

Page 2, No. 2, states, "All Tundra Swan hunts should be required to monitor harvest of Trumpeters." The Society's Directors believe that monitoring is necessary to determine where problems exist. Detection of the harvest of Trumpeters will not automatically result in an effort to stop Tundra Swan hunting, but it will provide a better data base upon which decisions can be made. Monitoring may show that some of the Society's concerns are unfounded or that incidental harvest is restricted to one or two isolated areas that would require very little change in hunting regulations to correct. The intensity of monitoring could vary from one hunt to another, based on the suspected probability of incidental harvest.

A standardized technique for monitoring harvest does not exist. However, the Society is in the process of evaluating a technique using feather measurements, and both Utah and Montana are taking bill measurements at check stations. There is a good probability that a monitoring technique will be available next year.

The North American Management Plan for Trumpeter Swans recognizes that occasional harvest of Trumpeter Swans will occur. It states that incidental harvest of Trumpeters will not be grounds for modifying other waterfowl seasons. In evaluating what is incidental, we must consider not only the percentage of Trumpeters in the harvest, but the impact accidental shooting is having on the population of Trumpeters. As a hypothetical example, the loss of a few swans migrating between Alberta and the Tristate Region could be considered inconsequential for such a large and growing population. However, the annual loss of a few birds south of the Tristate Region could have a major impact on the population's ability to pioneer into new winter range. More aggressive range expansion efforts may be sufficient to compensate for the loss of a few Trumpeters.

Finally, I want to emphasize the need for communication and cooperation. Working through the Flyway Committees appears to be an excellent way to work with waterfowl biologists. The Society needs to ensure that it is represented at swan subcommittee meetings,

and the technical committee chairs need to ensure that swan subcommittee meetings are held on an annual basis. The Trumpeter Swan Society has made the commitment to try to work with the Flyway Councils to resolve any problems that may come up regarding Tundra Swan hunting.

POSITION PAPER ON TUNDRA SWAN HUNTING

Issued by The Trumpeter Swan Society

The Trumpeter Swan Society is dedicated to restoring the Trumpeter Swan to as much of its former range as possible. Although the Society remains a single-purpose organization, it has concluded that management of Trumpeter Swans can not be separated entirely from Tundra Swan management. Range overlap and difficulty in distinguishing between the two species in the field necessitate consideration of Tundra Swan harvests.

The future well-being of the Trumpeter Swan depends on our abilities to successfully expand winter distribution of all three populations and to reintroduce the Trumpeter into portions of its former range in the Mississippi and Central Flyways. Specifically, the Society's primary management objectives (one for each swan population) for the next decade will focus around the following issues:

1. Winter range is recognized as being the primary limiting factor for the Rocky Mountain Population of Trumpeter Swans. The Society encourages protection of existing wintering sites and aggressive expansion of winter distribution to encourage additional growth of this population.

2. The Pacific Coast population of Trumpeter Swans, which largely nests in Alaska, is expanding in size and reoccupying former summer habitat. This is putting increased pressure on available winter habitat, forcing some birds to move into agricultural areas of British Columbia, Washington, and Oregon. Some winter habitat acquisition and/or dedication in these areas is essential for the welfare of this population.

3. Successful restoration of the Interior Population of Trumpeter Swans requires establishing new flocks of swans that can expand over time. These flocks need safe nesting, wintering, and migration sites to prosper.

The Trumpeter Swan Society is committed to fulfilling these management objectives. However, the Society believes that the plans for Trumpeter restoration and management and the Tundra Swan hunting and management plans prepared by the U. S. Fish and Wildlife Service can not both be completely implemented without coming into conflict with each other. Hunters can not readily distinguish between the two species, and the Trumpeter's behavior makes it extremely susceptible to shooting. Continued expansion of Tundra Swan hunting in any of the flyways will eventually conflict with the Society's goal to restore the Trumpeter to as much of its former range as possible. Likewise, continued expansion of Trumpeter range will eventually bring Trumpeters into areas open to Tundra Swan hunting. Resolution of potential and actual conflicts must be sought through a cooperative planning process.

Special provisions must be included in Tundra Swan management plans to adequately protect Trumpeter Swans. A much higher level of interstate, interprovince, and federal cooperation will be required to protect Trumpeters as their populations and ranges expand. The Society favors working closely with the four Flyway Councils and their Tundra and Trumpeter Swan population subcommittees as a means to resolve potential or existing conflicts. Areas which must be addressed through cooperative action include:

1. Area- and site-specific measures to minimize the potential for Trumpeter Swan losses during Tundra Swan hunting seasons must be developed and implemented. The Trumpeter Swan Society recognizes recreational and subsistence harvesting of Tundra

Swans within a sound management framework. However, it believes that hunting conflicts with Trumpeters have been poorly identified and resolutions inadequately defined and implemented. The Society expects the Tundra and Trumpeter Swan population subcommittees to coordinate in identifying and resolving conflicts. This should be accomplished in conjunction with implementation of a revised North American Management Plan for Trumpeter Swans by 1991 and through implementation of all ongoing range expansion efforts.

2. All Tundra Swan hunts should be required to monitor harvest of Trumpeters. This monitoring should be required in all Tundra Swan hunting frameworks and be included in respective population plans. Minimum acceptable standards for monitoring methods and for reporting Trumpeter losses should be identified. In addition, efforts must be increased to account for Trumpeter Swans throughout the year in areas open to Tundra Swan hunting.

3. States outside of current Trumpeter Swan range, but within the scope of range expansion efforts, should be encouraged to provide representation and participation in the current flyway subcommittees. Participation should include planning and implementing range expansion programs and evaluation of potential habitats and sites important to expansion efforts.

Careful coordination will be necessary to avoid existing and future conflicts between Trumpeter Swan management and Tundra Swan hunting. More intensive management of Trumpeters may be needed to compensate for opportunities precluded by Tundra Swan hunting. The Trumpeter Swan Society wants to cooperate with the Flyway Councils and their appropriate subcommittees in the development of management plans which will benefit both species.

NEVADA'S TUNDRA SWAN HUNTING PROGRAM

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ABSTRACT

NEVADA'S TUNDRA SWAN HUNT PROGRAM HAS BEEN IN OPERATION FROM 1969 TO PRESENT. PROCEDURES HAVE REMAINED FAIRLY CONSTANT THROUGHOUT THIS PERIOD OTHER THAN SLIGHT ADJUSTMENTS IN HUNT AREAS AND PERMIT NUMBERS. HUNT PROCEDURES, SWAN MIGRATIONS, HARVEST AND HUNTER SUCCESS ARE DISCUSSED FOR THE PERIOD 1969-89.

INTRODUCTION

In 1969, the State of Nevada was allowed its first Tundra Swan hunt after having petitioned the Pacific Flyway Council (PFC) and the U. S. Fish and Wildlife Service (USFWS) the previous five years for such approval. Nevada was only the second state, junior to Utah in 1962, to gain legal status for the hunting of Tundra Swans since enactment of the Migratory Bird Treaty Act of 1918.

HUNT PROCEDURES

Provisions of the hunt in 1969 authorized 500 permits in western Nevada for the taking of Tundra Swans in the Lahontan Valley of Churchill County. These permits were issued by a special application and drawing process held well before the season and allowed the successful permit holder one bird per season. The permit was in tag form and was required to be legally punched and placed on the wing of the harvested bird in addition to the required metal locking seal of corresponding number. Season length varied over the years but was required by the USFWS to be within the duck season opening and closing frameworks. In 1988, a season framework change was approved by the USFWS that allowed Tundra Swan seasons to be concurrent with those as established for dark geese. In 1973, the hunt area was expanded to include all of Churchill County with all other hunt provisions remaining the same. In 1983, the hunt area was again expanded to include all of Churchill, Pershing and Lyon Counties and the number of permits was expanded to 650. All hunt provisions have remained the same from 1983 to present, except that costs of the nonrefundable application fee is now $5.00 and the tag fee is $5.00, which is refundable if the applicant is unsuccessful in the drawing.

MIGRATIONS

Tundra Swan migrations to western Nevada normally begin with the first cold spell in October. Large numbers of Tundra Swans begin to build in western Nevada the third week of November and peak by the first week of December. Numbers remain fairly high throughout December then decline in January (Schroeder et al. 1983). Peak of Tundra Swan abundance by month is shown in Figure 1.

Midwinter inventory data for the period 1969-89 shows an annual average of 2,022 Tundra Swans wintering on Nevada's wetlands as compared to 3,002 for Utah, and 62,744 for the Pacific Flyway's total. The number of Tundra Swans recorded during this period in Nevada ranged from a low of 31 in 1988 to a high of 10,742 in 1987.

HARVEST

Tundra Swan harvest in Nevada is annually dependent on wetland habitat conditions in western Nevada and phenology of the migration. Nevada's harvest generally coincides with the peak of abundance which occurs the first week of December. Long term data shows that approximately 85% of the harvest occurs between the third week of November through the first week of January. The peak of harvest

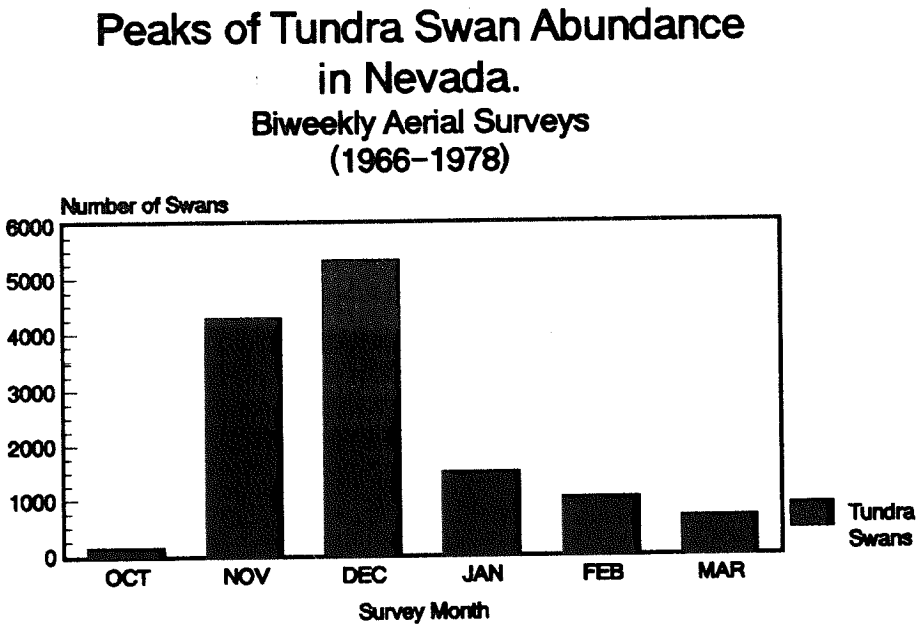

Figure 1. Peak of swan abundance in Nevada as measured by biweekly aerial surveys (1966-78).

(14%) occurs the last week of November through the first week of December. Harvest location by county for the period 1983-89, shows 85% of the birds are taken in Churchill County, 11% in Lyon County and 4% in Pershing County.

Season length, hunter participation and activity, harvest and percent young in the bag for the period 1969-89 are summarized in Table 1.

Average weights from a sample of 50 harvested birds recorded at check stations in 1969, showed average weights of 17 lbs. 2 oz. for adult males, 15 lbs. 15 oz. for adult females, 15 lbs. 4 oz. for immature males, and 13 lbs. 11 oz. for immature females. Maximum wing span recorded from this sample was 87.5 inches, while maximum body length was recorded as 52.5 inches.

DISCUSSION

Tundra Swan hunting in Nevada is only allowed in Churchill, Pershing and Lyon Counties of western Nevada. All other counties in the state are closed to the take of Tundra Swans. In addition, Nevada has closed the season on white geese in Elko, White Pine, Lincoln and Nye Counties of eastern Nevada in a effort to further protect the Trumpeter Swan restoration flock located at Ruby Lake NWR in Elko and White Pine Counties.

Since initiation of Nevada's Tundra Swan hunt in 1969, only two recoveries of Trumpeter Swans have been recorded for the state. During 1987, one bird was picked up dead at the Key Pittman Wildlife Management Area in Lincoln County, southern Nevada. Cause of death is unknown, however, was highly suspected of being a wounding mortality. This bird wore a red neck collar which proved it had been banded in the Northwest Territories of Canada. The second reported recovery was

Table 1. Season length, estimated hunter participation and activity, estimated retrieved and unretrieved harvests, and percentage of young in the bag during Tundra Swan seasons in Nevada.

Year	Season Length in Days	Number of Appls. Received	Number of Permits Issued	Percent of Permittees Hunting	Number of Hunter Days	Retrieved Harvest	Number of Reported Cripples	Percent Young in Bag
1969	58	500	500	-	1410	87	-	63
1970	64	500	500	-	1370	208	-	49
1971	58	510	500	83	1475	102	-	37
1972	65	571	500	80	1635	124	-	34
1973	65	686	500	75	1315	109	10	47
1974	72	534	500	77	1455	190	25	39
1975	65	690	500	78	1123	188	35	38
1976	65	682	500	82	1378	206	21	34
1977	72	638	500	76	1326	84	10	46
1978	65	621	500	74	1407	90	4	47
1979	72	604	500	78	1314	214	42	32
1980	65	767	500	79	1428	103	16	31
1981	62	500	500	89	1115	301	49	32
1982	79	534	500	80	1200	161	22	20
1983	79	650	650	78	1833	169	24	29
1984	79	650	650	76	1618	229	22	31
1985	72	650	650	67	1381	145	12	34
1986	79	608	608	79	1530	196	58	34
1987	79	594	594	68	1694	94	11	38
1988	93	260	260	75	770	78	4	49
1989	93	324	324	81	1076	81	4	37
10 Year $\bar{x}$ (1980-89)	78	554	524	77	1365	156	22	34

Hunting of swans had been in Churchill County only through 1982. Beginning in 1983, swans could be taken in Churchill, Lyon and Pershing Counties.

from a Trumpeter shot during the Tundra Swan season at the Mason Valley Wildlife Management Area in Lyon County during 1987. This collared bird proved to be an immature bird from the restoration flock located at Malhuer NWR of southeastern Oregon.

With the continued efforts to expand the wintering areas of both the Pacific and Rocky Mountain Population of Trumpeter Swans, a concerted effort is needed by the appropriate entities to development Contingency Plans that will address the problems which may arise with existing hunt programs. These plans should be fully developed and in place prior to

the actual movement of Trumpeters to these proposed sites.

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SUMMARY OF MONTANA'S TUNDRA SWAN HUNTING SEASONS, 1970-90

Jeff Herbert, Statewide Waterfowl Coordinator, Montana Department of Fish, Wildlife and Parks, 1420 East 6th Avenue, Helena, MT 59620

ABSTRACT

RESULTS FROM 20 YEARS OF TUNDRA SWAN HARVEST IN THE PACIFIC FLYWAY AND SEVEN YEARS OF HARVEST IN THE CENTRAL FLYWAY PORTIONS OF MONTANA ARE PRESENTED. HUNTING IS PERMITTED IN SIX COUNTIES AND 29 COUNTIES IN THE PACIFIC AND CENTRAL FLYWAY AREAS RESPECTIVELY. HUNTER PARTICIPATION RATES AND HARVEST DATA OBTAINED FROM HUNTER QUESTIONNAIRES WERE AVERAGED FOR THE REPORT PERIOD. FOR THE PACIFIC FLYWAY THIS INCUDES AN AVERAGE OF 750 APPLICATIONS FOR THE 500 PERMITS AVAILABLE, AN AVERAGE PARTICIPATION RATE OF 66 PERCENT, AN AVERAGE OF FOUR DAYS HUNTED PER SWAN BAGGED, AN AVERAGE HARVEST OF 202 SWANS, AND AN AVERAGE OF 34 PERCENT JUVENILE SWANS IN THE HARVEST. FOR THE CENTRAL FLYWAY THIS INCUDES AN AVERAGE OF 135 APPLICATIONS FOR THE 500 PERMITS, AN AVERAGE PARTICIPATION RATE OF 56 PERCENT, AN AVERAGE OF SEVEN AND ONE-HALF DAYS HUNTED PER SWAN BAGGED, AN AVERAGE HARVEST OF 30 SWANS, AND AN AVERAGE OF 32 PERCENT JUVENILE SWANS IN THE HARVEST.

INTRODUCTION

Montana has offered waterfowl hunters the opportunity to hunt Tundra Swans in the Pacific Flyway portion of the state since 1970 and in the Central Flyway portion of the state since 1983 (Figure 1). These hunts are conducted within the frameworks established by the U. S. Fish and Wildlife Service (USFWS) and adopted by the Montana Fish and Game Commission during the annual regulation process. Guidelines are consistent with the management plans that have been developed for both the Western and Eastern Tundra Swan Populations. A total of 500 permits are available for both the Pacific and Central Flyway portions of the state.

The Pacific Flyway hunt in Montana was initiated in Teton County. This county includes the Freezeout Lake Wildlife Management Area and it is the major staging area for migrating swans in western Montana. Cascade County was added in 1980 to provide additional opportunity at the Benton Lake NWR which lies approximately 30 miles east of Freezeout Lake. At the request of waterfowl hunters living along the Hi-Line area of north central Montana four additional counties (Toole, Liberty, Hill and Pondera) were added in 1988. It was anticipated that the addition of these counties would not change the distribution of the harvest significantly. This has been the case as the majority of the harvest continues to occur in Teton and Cascade Counties. The concentration of 3,000 to 10,000 swans at Freezeout Lake and the variety of hunting opportunities associated with the area will continue to serve as the focus of swan hunting in western Montana.

In the Central Flyway portion of the state, all counties (29) were opened. Phillips and Sheridan Counties provide the majority of the hunting opportunity which is primarily associated with Bowdoin and Medicine Lake NWR's in each of those counties respectively.

PERMIT

Interested hunters apply for a permit in early September. Applicants must indicate their choice of flyway. If successful in the computer drawing, hunters are notified by mail when they receive their tag. The permit is printed on Tyvec with an adhesive back and is validated by cutting out the day and month of the kill. It must be attached to the swan

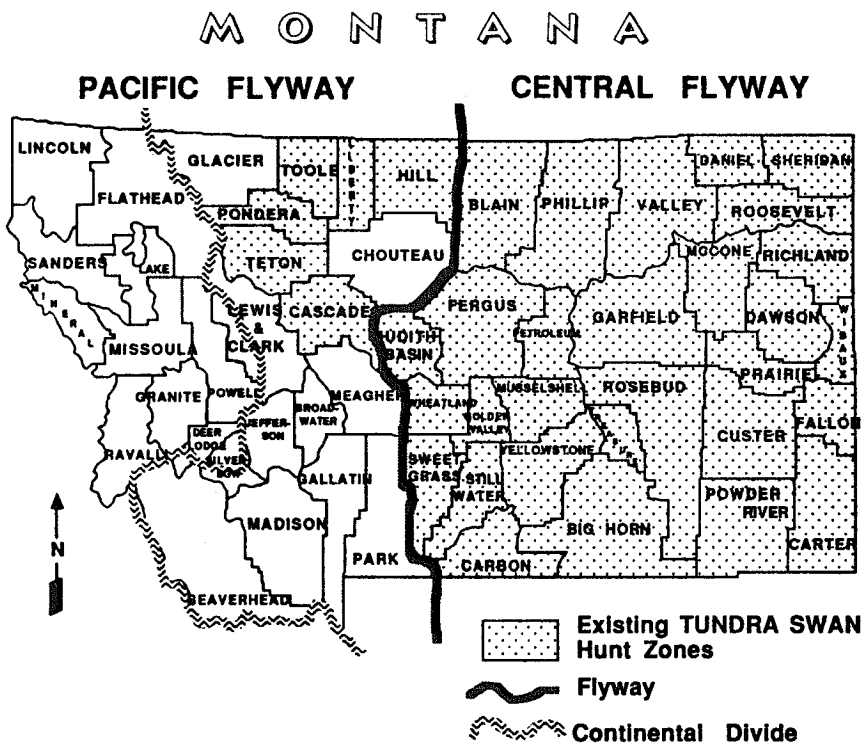

Figure 1. Montana Tundra Swan hunt zones.

immediately. All permit holders are contacted by mail after the season to collect harvest information. Response rates generally exceed 75 percent. Hunter questionnaires for the 1990-91 season are currently being received and the data tabulated.

HARVEST DATA AND TRENDS

For information purposes we have compiled the harvest parameters and averaged these statistics by flyway during the years these hunts have been operational. In the Pacific Flyway portion of Montana this includes the period from 1970-89. In the Central Flyway portion of Montana this includes the period from 1983-89. Also included in Table 1 are the totals for the 1989 season.

SWAN RETRIEVAL

In 1979, department personnel and waterfowl hunters at Freezeout Lake reported an increase of unretrieved swans. As a result, the Commission adopted specific regulations based on the department's recommendation that required a visible means of retrieval for all swan hunters using the dikes. Swan hunters are required to have a watercraft, a dog capable of retrieving, or chest-high waders as an aid in retrieving birds. The opportunity still exists to hunt a number of other locations that do not require water retrieval of downed swans.

CHRONOLOGY OF HARVEST BY WEEKLY TIME PERIOD

Pacific Flyway

Swan migration peaks during the first week of November at Freezeout Lake. Over 90 percent of the harvest occurs between the middle of October and the middle of November (Figure 2). Freeze-up usually occurs sometime around mid-November, but it is not uncommon to have the marsh freeze and open up during this period. Counties to the north generally

Table 1. Tundra Swan harvest data for Pacific and Central Flyway hunts in Montana, 1970-89.

	PACIFIC		CENTRAL	
	1970-89 (Average)	1989	1983-89 (Average)	1989
Number of Applications	750	867	135	167
Percent of Active Hunters	66	80	56	70
Number of Hunter Days	868	779	223	318
Number of Swans Harvested	202	302	30	41
Number Days/Swan Harvested	4.3	2.6	7.4	7.8
Percent Juveniles in Harvest	34	29	32	23
Percent Reported Crippling Rate	12	13	.04	13

experience this same weather pattern while Cascade County offers some later hunting opportunities on the Missouri River.

Central Flyway

Drought conditions during most of the seven year period have adversely affected many wetland basins and have reduced swan habitat and limited harvest opportunities. Migration in the Central Flyway begins earlier. Important harvest periods exhibit more variability during the early October to mid-November period (Figure 3). Freeze-up patterns are generally similar to the Pacific Flyway although wetlands in the Hi-Line area generally remain frozen once cold weather predominates.

THE SWAN HUNTING TRADITION

Comments submitted by hunters on their harvest questionnaires indicate the popularity of the swan hunting tradition. These hunters view it as a very unique opportunity that they wish to see continued. Since 1988 they have also commonly expressed their concern over the use of steel shot and its effectiveness in killing swans. The department is continuing its educational efforts to improve the skill level of waterfowl hunters and to inform them on how to most effectively use non-toxic shot.

INCIDENTAL HARVEST OF TRUMPETER SWANS

Efforts were initiated at Freezeout Lake WMA during the 1990 season to quantify incidental harvest of Trumpeter Swans. Field personnel collected bill length measurements on 34 hunter-killed swans between 26 October and 6 November. This sample included 24 adults and 10 juveniles. The measurements recorded the distance from the nostrils to the tip of the bill. All bills measured ranged from 1 3/8 to 1 3/4 inches. All were classified as Tundra Swan because the bill length was less than two inches. Efforts will be made to expand the sample next year.

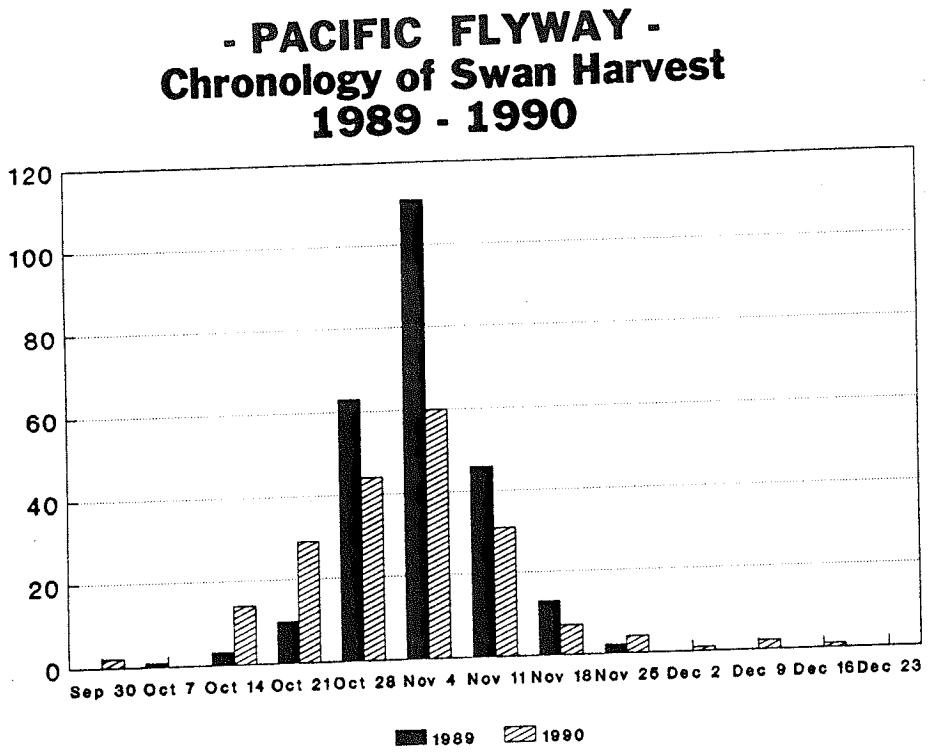

Figure 2. Pacific Flyway swan harvest chronology.

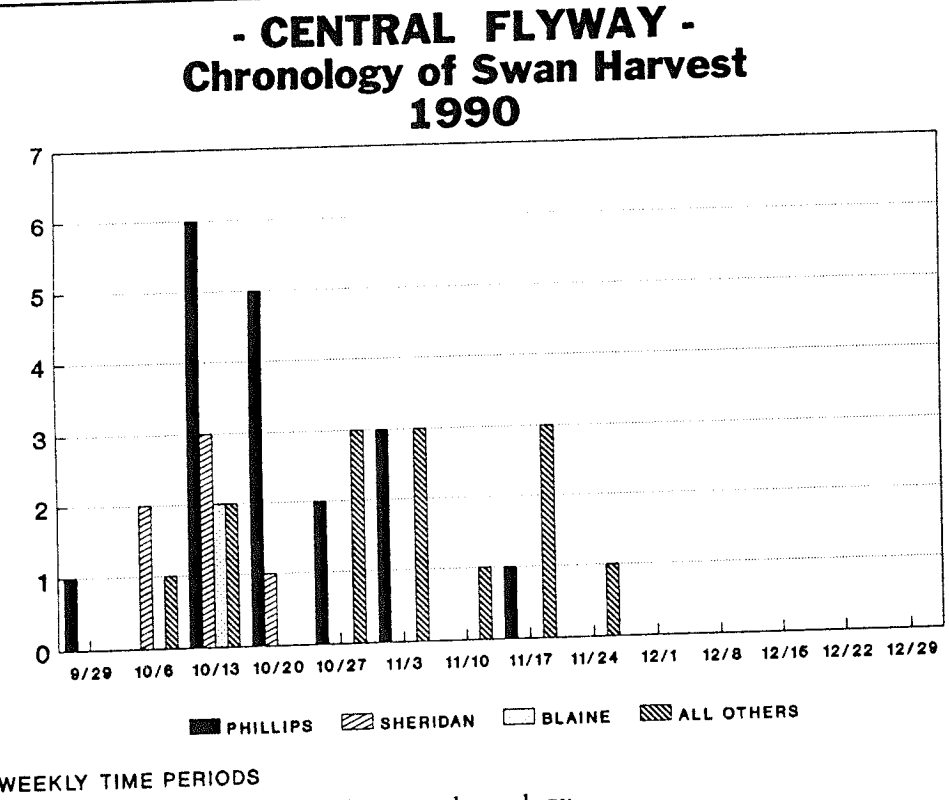

Figure 3. Central Flyway swan harvest chronology.

RESULTS OF TUNDRA SWAN HUNTING SEASONS IN NORTH DAKOTA, 1988-90

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Michael A. Johnson, Supervisor, Migratory Game Bird Management, North Dakota Game and Fish Department, Bismarck, ND 58501

ABSTRACT

RESULTS OF THE FIRST THREE MODERN TUNDRA SWAN HUNTING SEASONS IN NORTH DAKOTA ARE PRESENTED. A TOTAL OF 2400 SWAN HUNTING PERMITS WAS ISSUED DURING THE THREE YEARS. RESULTS OF HARVEST QUESTIONNAIRE SURVEYS INDICATED 83 PERCENT OF THE PERMIT RECIPIENTS HUNTED. THEY HUNTED AN AVERAGE OF THREE DAYS EACH. ACTIVE HUNTER SUCCESS WAS 59 PERCENT. ESTIMATED SWAN HARVEST DURING THE THREE YEARS WAS 1182 BIRDS WITH 32 PERCENT OF THE BIRDS TAKEN DURING THE WEEK OF 14-20 OCTOBER. HUNTERS INDICATED THAT IMMATURE BIRDS COMPRISED 11 PERCENT OF THE BAG. HUNTER COMMENTS ON QUESTIONNAIRES INDICATED STRONG SUPPORT FOR CONTINUING THE SEASON.

INTRODUCTION

The Migratory Bird Treaty Act of 1918 declared Tundra Swans (Cygnus columbianus) a migratory game bird and closed swan hunting for 10 years. It also provided for hunting seasons not exceeding 3 1/2 months between 1 September and 10 March. Modern-day hunting of the Eastern Population of Tundra Swans in the Central Flyway began in 1983, when the U. S. Fish and Wildlife Service (USFWS) offered North Dakota 1,000 permits, South Dakota 500 permits, and Montana 500 permits for a limited hunting season. Only Montana took advantage of this first season offering. North Dakota held its first season in 1988 (Johnson and Kohn 1991) and has continued with a season each year since then. This paper summarizes results of the 1988 through 1990 Tundra Swan hunting seasons in North Dakota.

BACKGROUND

The Eastern Population of Tundra Swans has increased at a rate of two to three percent per year over the past 45 years, and the population has more than doubled since 1950. The Management Plan for the Eastern Population of Whistling Swans (Anon. 1982) provides guidelines for the cooperative management of these birds. Objectives in the plan call for maintaining a wintering swan population within a range of 60,000 to 80,000 birds based upon a three year average population index derived from winter surveys in the Atlantic Flyway. The most recent (1988-90) three year average of 85,500 birds is above the upper end of the population objective (Figure 1). It is believed that, left unchecked, the Eastern Population will continue this rate of increase and that the population has reached or exceeded the number which should be wintered and can be tolerated on the East Coast. Numerous efforts are being made to control and reduce depredation problems and to improve wintering habitats.

Hunting of Eastern Population Tundra Swans is guided by the Eastern Population Tundra Swan Sport Hunting Plan (Anon. 1988), appended to the Management Plan. The hunting plan contains guidelines for distribution of permits, allocation of harvest among provinces and flyways, and season evaluations.

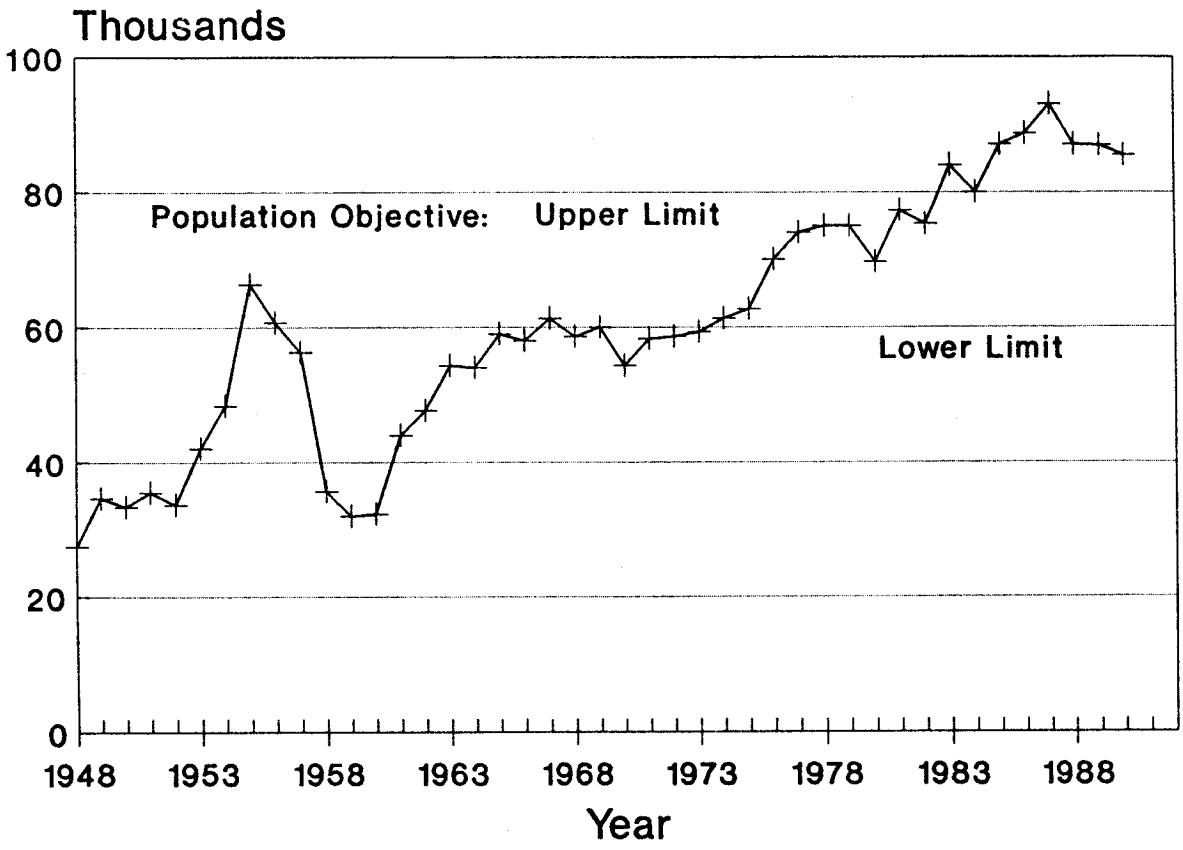

Figure 1. Three-year running averages of indices to the Eastern Population of Tundra Swans, 1948-1990. Data from the Midwinter Waterfowl Inventory.

METHODS

Because demand for the initial season in North Dakota was largely unknown, only 400 of the 1000 permits allowed were offered to hunters in 1988. All 1000 permits were issued in both 1989 and 1990. The permits were free and issued by lottery, with both residents and nonresidents eligible to apply. Applications were accepted on standard U. S. Postal Service post cards during the month of August each year. Successful applicants were sent details of the season by letter (Figure 2). Each hunter was issued a non-reusable tag, which also served as the hunting permit, allowing them to take one swan during the season (Figure 3). A Federal Duck Stamp is required for all swan hunters over the age of 16. Steel shot was required for hunting swans in seven counties and on all state Wildlife Management Areas and federal Waterfowl Production Areas in 1988 and statewide in 1989 and 1990.

The seasons opened the first Saturday in October each year and closed the second Sunday in November in 1988 and 1989. The season was extended an additional week in 1990. Shooting hours began at sunrise in 1988 and 1989; one-half hour before sunrise in 1990; and ended at sunset in all years. Swan hunting was allowed only in the eastern one-third of the state in 1988 (Johnson and Kohn 1991) and in that portion of the state north and east of the Missouri River in the following two

" VARIETY IN HUNTING AND FISHING "

NORTH DAKOTA GAME AND FISH DEPARTMENT

100 NORTH BISMARCK EXPRESSWAY BISMARCK, NORTH DAKOTA 58501-5095 PHONE 701-221-6300 FAX 701-221-6352

September 4, 1990

Dear Waterfowler:

Congratulations, you have received a North Dakota Tundra Swan Hunting Permit for the fall of 1990. Because this is the third Tundra Swan Season in our state in over 70 years, I am making this special effort to inform you about details of the season as well as some rules, regulations and suggestions for hunting.

Season Dates: October 6 through November 18, 1990

Shooting Hours: 1/2 Hour before Sunrise to Sunset

Open Area: All of North Dakota north and east of the Missouri River

Bag Limit: 1 swan per hunter per season

License Requirements: In addition to a valid 1990 North Dakota Swan Tag all swan hunters are required to have in their possession the following valid licenses while hunting. Residents: General Game and Habitat Stamp, and Small Game Stamp; Nonresidents: Small Game License, General Game and Habitat License, Non-resident Waterfowl Stamp. Both resident and non-residents, 16 years of age and older, must also have a Federal Migratory Bird Hunting and Conservation Stamp (Duck Stamp).

Tagging Requirements: Immediately upon retrieving your bird cut out the appropriate month and day on the tag and attach it to the leg as instructed on the back of the tag.

Identification: Tundra Swans are a large bird with adults weighing from 10 to 21 pounds. Adults are all white except for the black feet and bill. Young of the year (immatures) are grayer and have distinctive gray coloration of the head and neck. A pamphlet is enclosed which will aid you in distinguishing swans from other similar looking birds. Please study it carefully, before you hunt.

Lloyd A. Jones
COMMISSIONER

Keith A. Trego
DEPUTY COMMISSIONER

Questionnaire: All swan hunters will be sent a questionnaire to provide us with information on hunting success. The questionnaire will ask the number of days you hunted swans, if you shot a swan, whether the bird was all white (adult) or had gray head and neck feathers (immature), the location that you killed a bird, the date you killed a bird and how many swans were knocked down but not retrieved. Please record this information, after you hunt, so you can complete your questionnaire accurately.

Steel Shot: Steel shot is required for swan hunting (consult the Waterfowl or Small Game Hunting Guide for details). Recommended steel pellet sizes are BB, BBB or T in 12 or 10 gauge.

Suggestions: Swan can be hunted over decoys or by pass-shooting. All laws and regulations for waterfowl also apply to swans (consult the Waterfowl Hunting Guide). Swans are a large and powerful bird. Ranges can be deceiving and they will frequently appear to be closer than they actually are. If in doubt of the range, don't shoot. We strongly recommend that all swan hunters have a means of retrieval available (boat, chest waders, or dog capable of retrieving a 20 lb. bird).

While some hunters believe the flesh of younger birds is more tender than that of adults, young birds are mostly bone and have little meat. Some adult birds can be very tough but most are comparable to a very good Canada goose.

Good luck and have a good hunt,

Michael A. Johnson, Supervisor
Migratory Game Bird Management

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mike#2\swanwtfl.ltr

Figure 2. Season information sent to all Tundra Swan hunters in North Dakota, 1990.

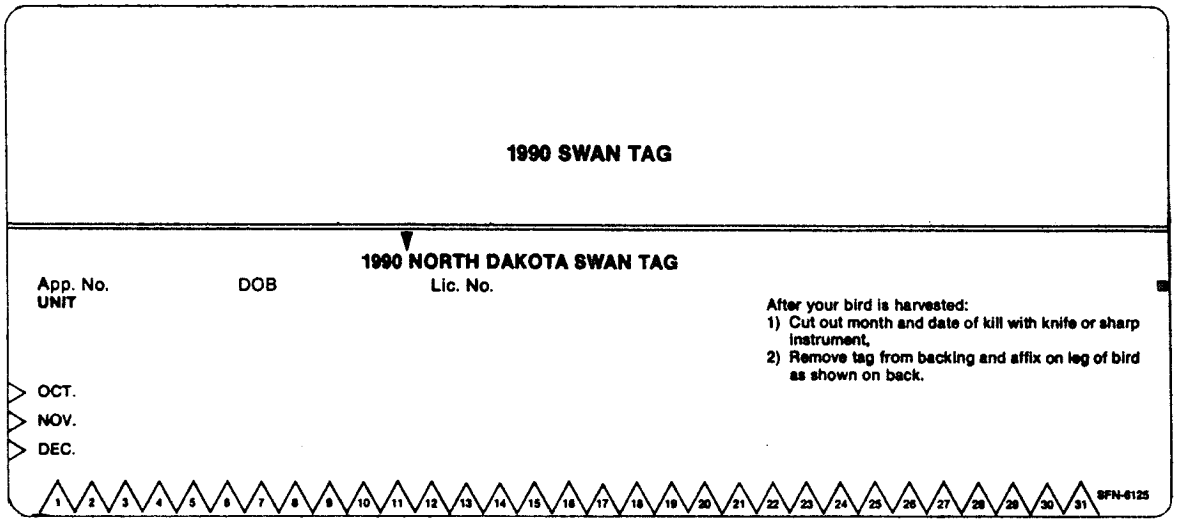


Figure 3. Leg tag and hunting permit issued to Tundra Swan hunters in North Dakota, 1990.

years (Figure 4). All swan hunters were sent a questionnaire after the season (Figure 5). Follow-up questionnaires were sent after 30 days to all those not responding to the initial questionnaire. Harvest estimates assume non-respondents experienced the same hunting activity and success as those responding to questionnaires.

RESULTS AND DISCUSSION

The number of applications received increased from 2,004 in 1988 (400 permits issued) to 2,733 in 1990 (1000 permits issued) (Figure 6). Most permits (78 percent) were issued to North Dakota residents. Most nonresident permits were issued to residents of Minnesota (54 percent), followed by Wisconsin (14 percent), and California (2 percent).

Harvest questionnaires were returned by over 90 percent of the permittees in all three years. More than 80 percent of the permittees actively hunted swans and active hunters hunted an average of three days (Table 1). Approximately 60 percent of the active swan hunters were successful in bagging a swan. The estimated swan harvest for the three years was 1182 birds (Figure 7). Reported crippling losses (birds downed but not retrieved) were less than 18 percent of the estimated harvest. The reported age composition of the harvest averaged 11 percent juveniles and 89 percent adults.

Swans were taken in 24 counties in 1988, 33 counties in 1989 and 37 counties in 1990. Forty-three percent of the swans have been harvested in 5 counties: Kidder, Stutsman, Ramsey, Barnes and Logan (Table 2). Thirty-two percent have been harvested during the week of 14-20 October (Figure 8), which likely coincides with the peak of the Tundra Swan population within the state.

Comments received from questionnaire respondents are summarized in Table 3. By far the most frequent comment indicated some type of favorable support for the swan season (176 respondents). Forty-four respondents wanted to use lead shot for swans and 29 wanted to expand the hunt area or have additional permits available.

North Dakota's modern-day swan hunting season is considered a success. Hunter demand remains high and many additional hours of recreational opportunity have been provided. No significant problems have been encountered and the season is well received by

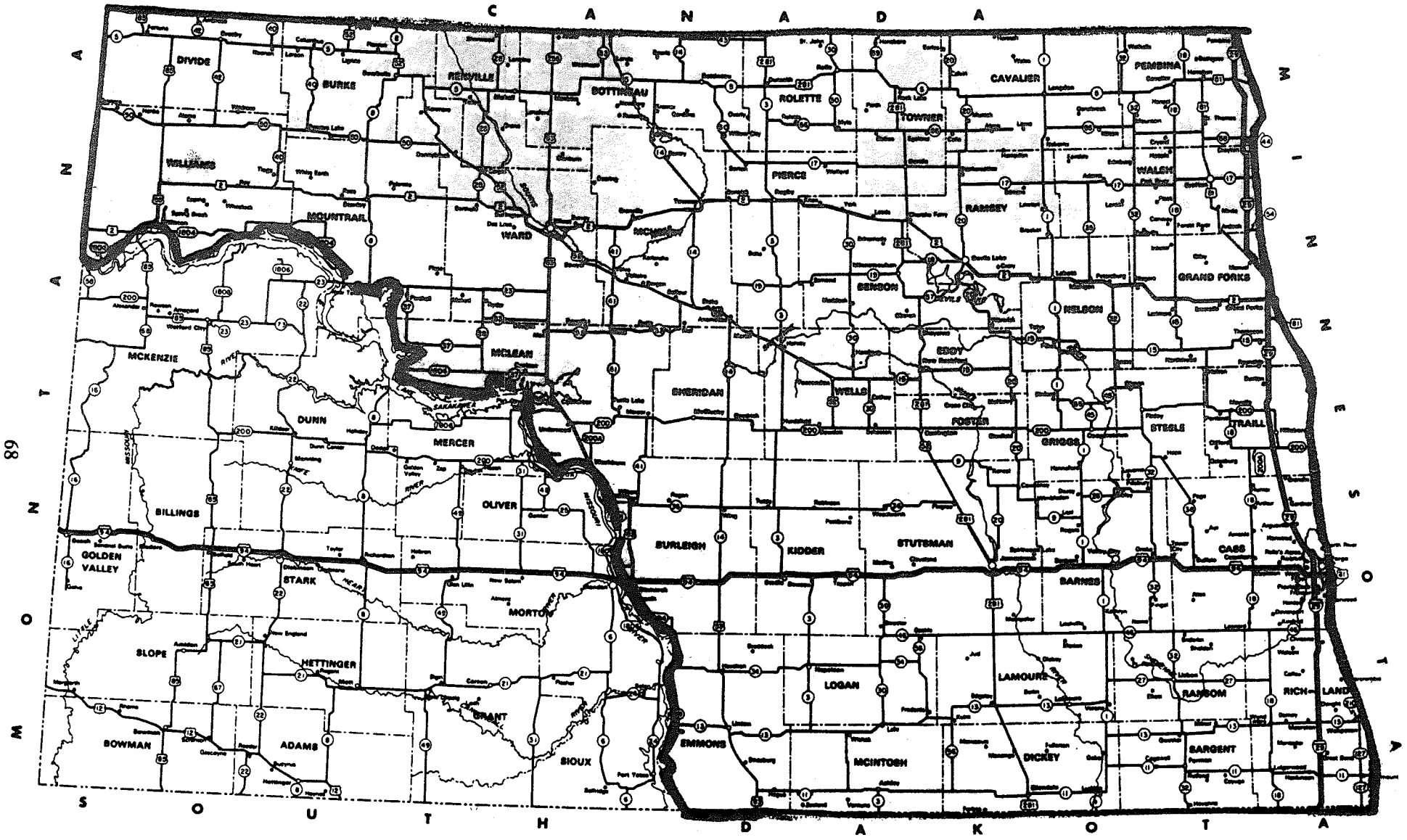
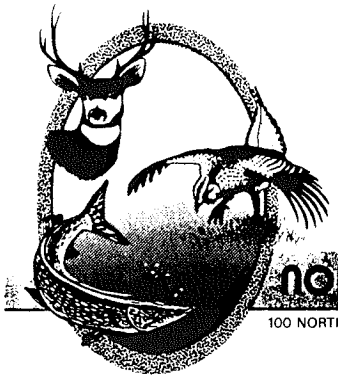


Figure 4. Tundra swan hunt area (shaded portion), 1989–90.



"VARIETY IN HUNTING AND FISHING"

NORTH DAKOTA GAME AND FISH DEPARTMENT

100 NORTH BISMARCK EXPRESSWAY BISMARCK, NORTH DAKOTA 58501-5095 PHONE 701-221-6300 FAX 701-221-6352

November 18, 1990

Dear Swan Hunter:

We need your help in determining the results of the 1990 Tundra Swan Hunting Season in North Dakota. Please take a few minutes to complete the following questions and return the completed form to us in the enclosed postage paid envelope as soon as possible.

Thanks for your cooperation,

Michael A. Johnson, Supervisor
Migratory Game Bird Management

* *

1. Did you hunt swans? Yes _____ No _____
2. How many days did you hunt swans? _____
3. What county did you hunt most often for swans? _____
4. Did you get a swan? Yes _____ No _____

   If yes, please answer the following:

   Date shot: |____|____|
   Month Day

   Location Shot: _____ _____
   Nearest Town County

   Color of head and neck feathers:
   Gray Colored _____ Nearly All White _____

5. Did you knock down any swans which you could not retrieve? Yes __ No __
6. If yes, how many unretrieved swans? _____
7. What steel shot loads have you been using?

   Gauge _____ Shell Length _____ Shot Size _____

8. Please provide any additional comments you desire on the back.

Lloyd A. Jones
COMMISSIONER

Keith A. Trego
DEPUTY COMMISSIONER

Figure 5. Harvest questionnaire sent to all Tundra Swan hunters in North Dakota, 1990.

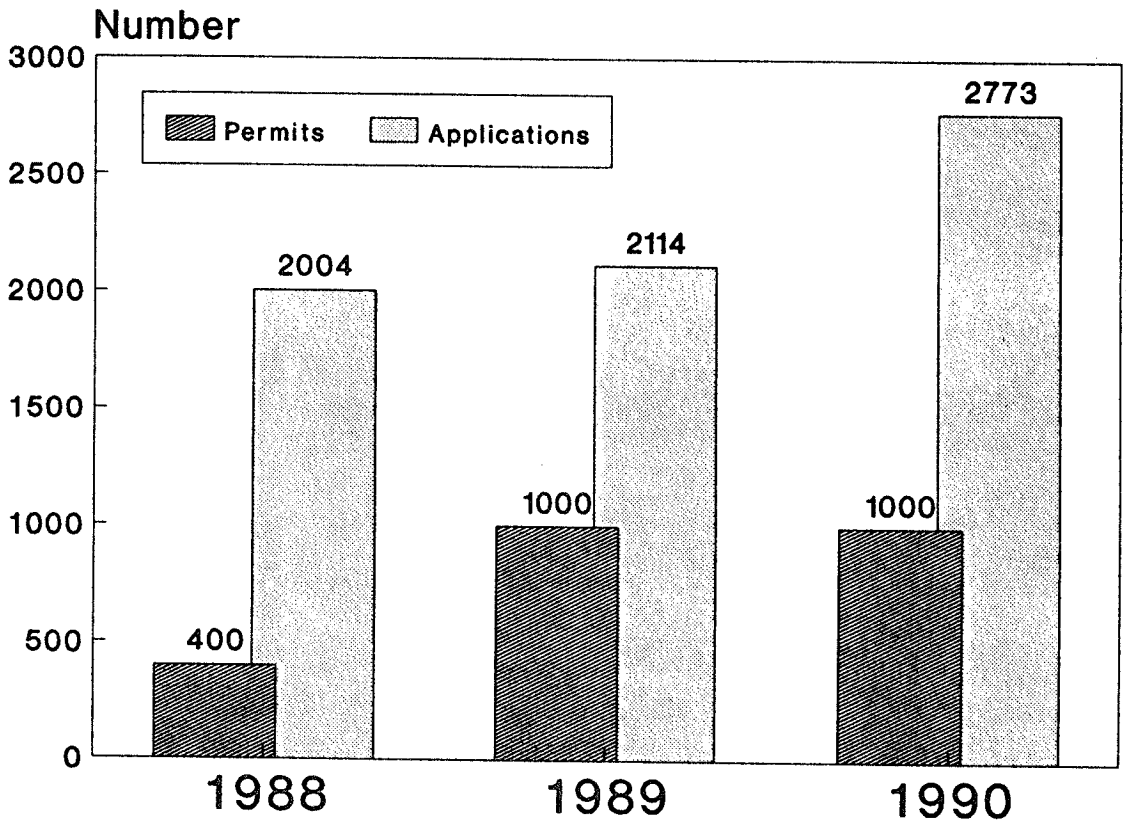


Figure 6. Number of applications received and permits issued for Tundra Swan hunting in North Dakota, 1988-90.

Table 1. Tundra Swan hunter activity and success in North Dakota, 1988-90.

Year	Percent Active Hunters	Average Days Hunted	Percent Hunter Success
1988	78	3.6	61
1989	86	2.6	60
1990	81	3.2	58
Mean	83	3.0	59

both the public and hunters. Two frequent complaints heard from unsuccessful permit applicants relates to multi-year successful applications by some swan hunters and the proportion of permits issued to non-residents. Two efforts are currently underway to address

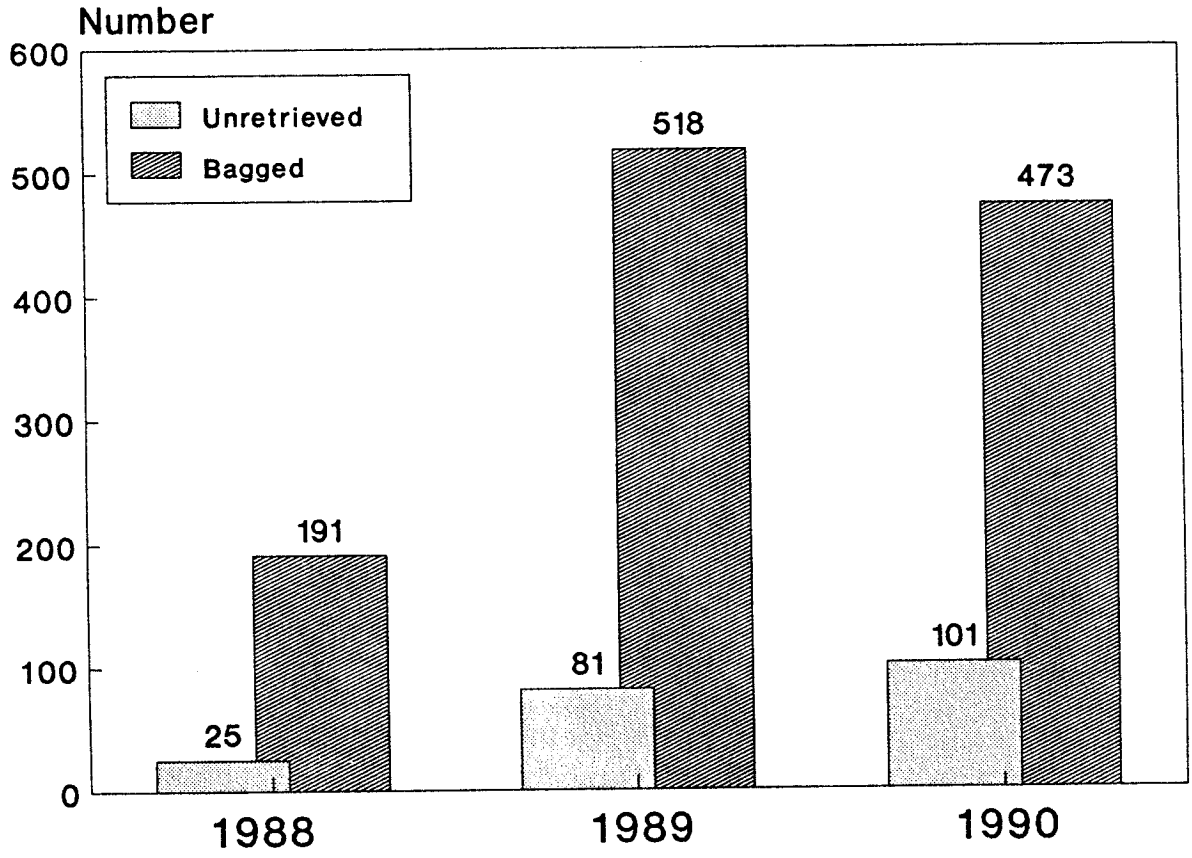


Figure 7. Estimated number of Tundra Swans bagged and downed and unretrieved in North Dakota, 1988-90.

this problem. First, legislation currently before the North Dakota State Legislature calls for a fee to be charged for Tundra Swan hunting permits. Second, we are attempting to secure additional permits which are allocated, but not currently used, throughout the range of the Eastern Population of Tundra Swans. We expect to continue this popular trophy waterfowl season for many years to come.

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Table 2. Reported county of harvest of Tundra Swans in North Dakota, 1988-90.

County	1988	1989	1990
Unknown	0	4	0
Barnes	15	26	17
Benson	13	17	12
Bottineau	2	8	4
Burke	0	6	4
Burleigh	0	17	23
Cass	1	0	1
Cavalier	0	4	6
Dickey	5	5	3
Divide	0	2	3
Eddy	8	8	3
Emmons	0	0	2
Foster	2	4	3
Grand Forks	1	0	3
Griggs	0	6	2
Kidder	36	55	66
LaMoure	4	7	1
Logan	9	26	20
McHenry	0	16	18
McIntosh	8	17	7
McLean	0	17	14
Mountrail	0	4	2
Nelson	12	21	20
Pembina	1	0	0
Pierce	7	15	16
Ramsey	10	26	37
Ramsom	6	4	4
Richland	6	12	18
Rolette	3	8	8
Sargent	5	17	14
Sheridan	0	29	14
Steele	0	1	1
Stutsman	23	49	50
Towner	2	12	22
Walsh	2	1	2
Ward	0	16	5
Wells	6	5	3
Williams	0	2	0
TOTAL	187	467	428

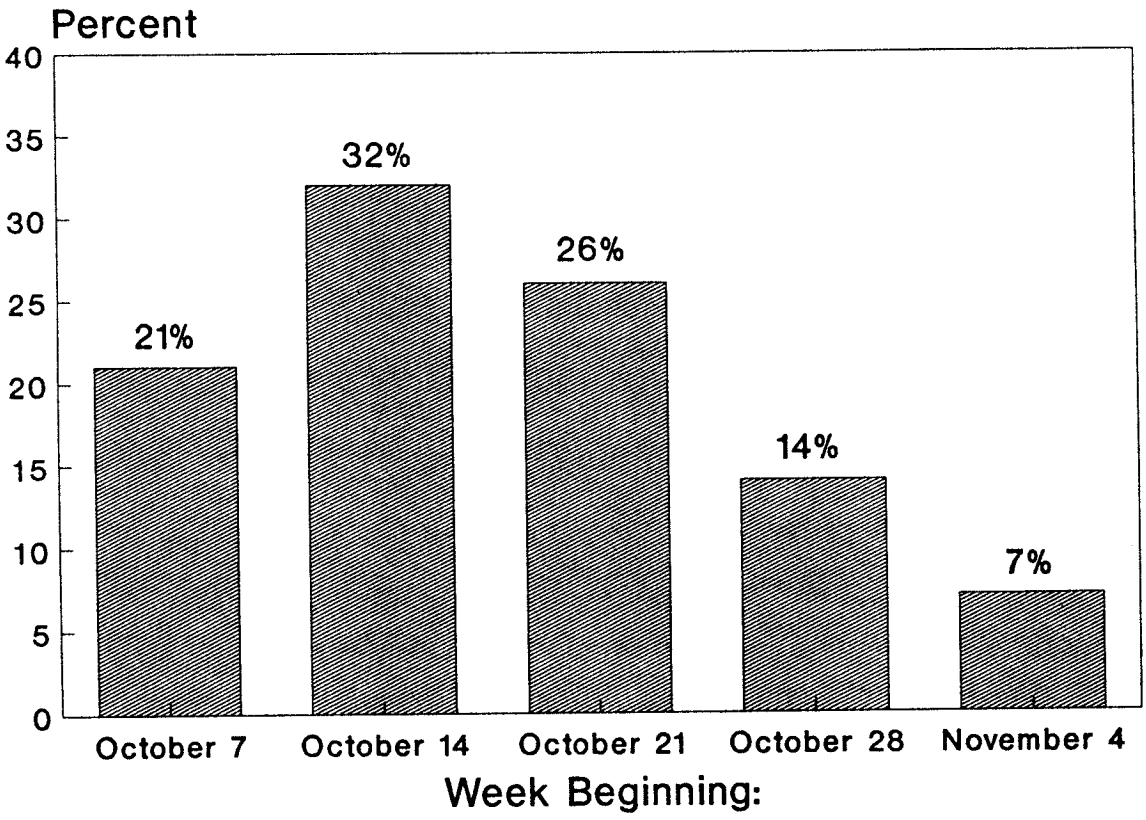

Figure 8. Temporal distribution of Tundra Swan harvest in North Dakota, 1988-90.

Table 3. Comments received on North Dakota Tundra Swan harvest questionnaires, 1988-90.

COMMENT	NUMBER
Support for continuing the season	176
Opposed to steel shot requirements	44
Request expansion of open hunt area	15
Make additional permits available	14
Allow shooting 1/2 hour before sunrise	5
Require a 12 gauge shotgun minimum	5
Concerned about excessive crippling	2
Opposed to season	2
Other comments	16
Total	279

SOUTH DAKOTA TUNDRA SWAN SEASON - 1990

Spenser Vaa, Waterfowl Biologist, South Dakota Department of Game and Fish, Brookings, SD 57006

This was South Dakota's first Tundra Swan season. Large numbers of Tundra Swans migrated through northeast South Dakota and the hunting was excellent. Many of these birds were harvested on public land. The Department and waterfowl hunters were very pleased with the season, and it is expected that there will be a big demand for permits in the future.

Tables 1 and 2 present summaries of license sales, harvest, and effort. Figure 1 shows 11 northeastern counties open to Tundra Swan hunting.

Table 1. 1990 South Dakota Tundra Swan licenses, harvest and effort. (There were 635 applicants for the 500 permits. 250 Licensees were sampled and 236 responded for a response rate of 94%.)

Licenses Available	Licenses Sold	Swan Harvest Projections					Total Days Hunted
		Adult	Juvenile	Total	Success	Cripples	
500	500	301	38	339	68%	68	1625

Table 2. 1990 South Dakota Tundra Swan harvest by county and date.

Reported Harvested by County

Day	- 66	Clark	- 5
Marshall	- 53	McPherson	- 3
Roberts	- 11	Edmunds	- 3
Codington	- 11	Hamlin	- 2
Brown	- 10	Grant	- 1

Reported Harvest by Date

1st week (6-12 Oct)	- 13
2nd week (13-19 Oct)	- 27
3rd week (20-26 Oct)	- 44
4th week (27 Oct- 2 Nov)	- 44
5th week (3- 9 Nov)	- 30
Last 4 days (10-13 Nov)	- 7

SOUTH DAKOTA

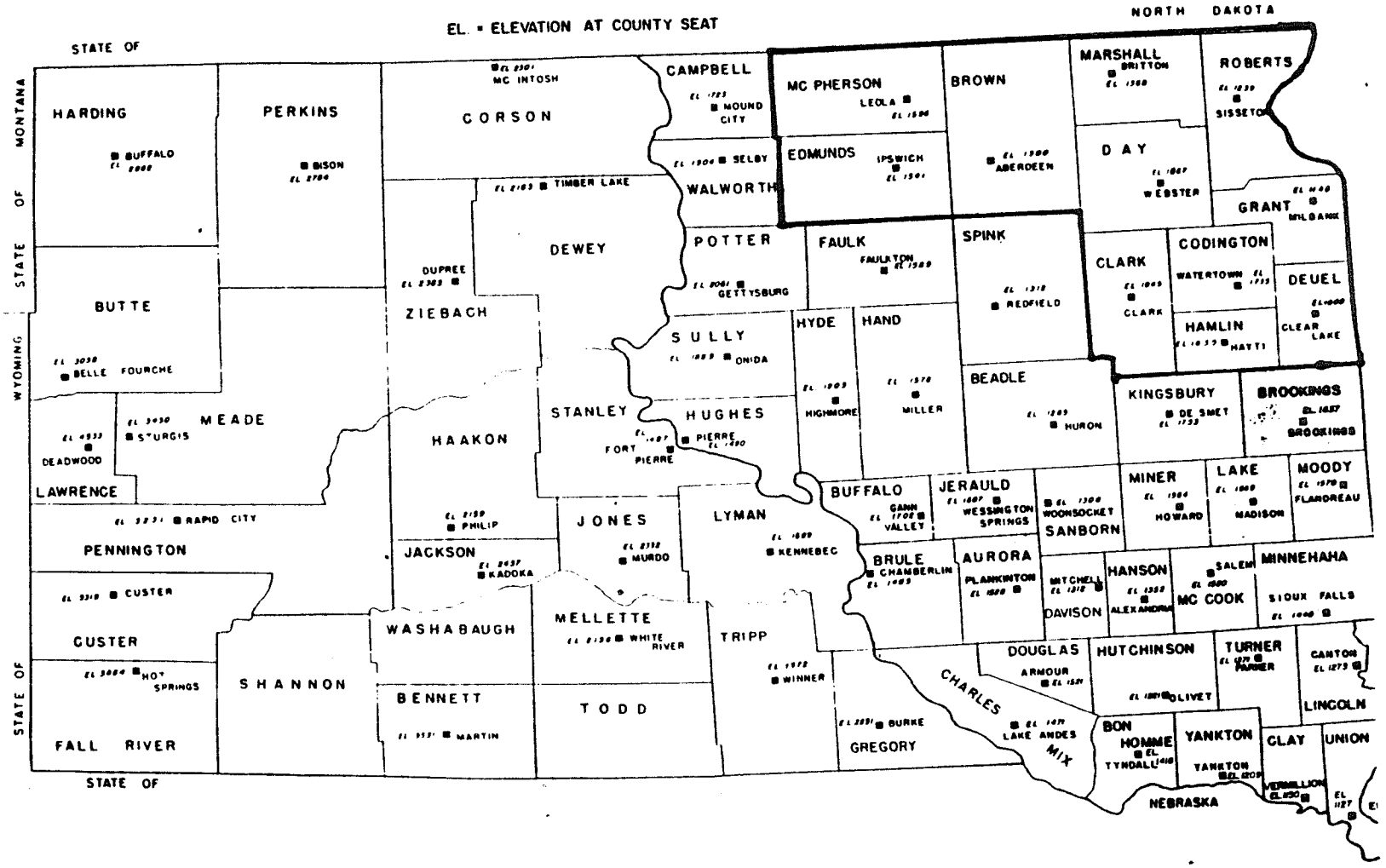

Figure 1. Areas open for Tundra Swan hunting in 1990 in South Dakota (outlined in bold).

TUNDRA SWAN HUNTING IN UTAH

Joel D. Huener, Statewide Waterfowl Biologist, Utah Division of Wildlife Resources, 1596 West North Temple, Salt Lake City, UT 84116

ABSTRACT

UTAH HAS THE LONGEST MODERN HISTORY OF ANY STATE IN THE SPORT HUNTING OF TUNDRA SWANS (CYGNUS COLUMBIANUS). THE CURRENT HUNT WAS INITIATED IN 1962 AND PERMIT ALLOCATION HAS BEEN FIXED AT 2,500 SINCE 1969. INTEREST AND SUPPORT FOR THE PROGRAM IS HIGH, AND THE AVERAGE ANNUAL HARVEST IS 670 BIRDS. SWAN MIGRATION AND HARVEST ARE CONCENTRATED IN THE MARSH COMPLEX AROUND THE GREAT SALT LAKE. THE FLOODING OF THE GREAT SALT LAKE IN THE MID 1980'S HAD PROFOUND IMPACTS ON SWAN AND HUNTER USE OF THE AREA, WITH EFFECTS ON MIGRATION CHRONOLOGY, PEAK NUMBERS AND LOCATION OF SWANS, HARVEST LOCATION AND CHRONOLOGY AND HUNTER INTEREST.

HISTORY

Utah was the first state to reinstate the sport hunting of Tundra Swans after it was closed by treaty in 1918. Utah has always been a major migration stopover for swans, and the state first began requesting consideration for a limited hunt from the Pacific Flyway Council in 1956. Authorization came in 1962, when Utah was granted its first hunt. In that year, the state was authorized 1,000 permits to be issued free of charge, each allowing the harvest of one swan. Interest in swan hunting was and is high enough that Utah's permit allocation was increased to 2,500 in 1969. Permit numbers have remained stable ever since although the hunt plan (Anon. 1989) currently allows for more permits, and all Utah's permits have been issued every year.

In 1962, the first year of the hunt, swan permits were issued on a first come, first serve basis. Long lines of hopeful waterfowl hunters waited for a chance at one of the available permits. It quickly became apparent that interest exceeded the supply of permits, and that a more equitable system for permit distribution was needed. As a result, we have annually held random drawings for permits since 1963. The number of applicants has always exceeded the number of available permits (with as many as 9,574 applications received during the 12 day application window) until 1987. In 1987, the number of applicants received prior to the drawing was less than the number of available permits, and remains so today. Remaining permits have always been quickly issued prior to the season on a first come, first serve basis. The decline in interest in swan hunting came about as a result of the flooding of the Great Salt Lake (GSL) and was commensurate with declines in waterfowl hunter numbers.

Beginning in September of 1982, the basin of the GSL experienced two consecutive years of 100-year flood events (Figure 1). Because the GSL lies at the bottom of the basin this resulted in the rise in water level of the GSL of nearly twelve vertical feet by 1987. In spite of this influx of fresh water the GSL remained nearly twice as saline as the oceans. The combination of up to 10-12 feet of highly saline water resulted in the destruction of 85% of the wetlands along the eastern periphery of the GSL. This wetland complex comprises 78% of Utah's total wetland acreage (Jensen 1974) and is a focal point for Tundra Swan and other waterfowl migration throughout the western United States (Bellrose 1976). The result was profound impacts on habitat availability, bird utilization and migration, and on hunter activity. It should be noted, however, that four consecutive years of drought have brought the lake back down (almost 10 vertical feet from peak at present) much more quickly than anticipated, and habitat recovery of most marshes is occurring

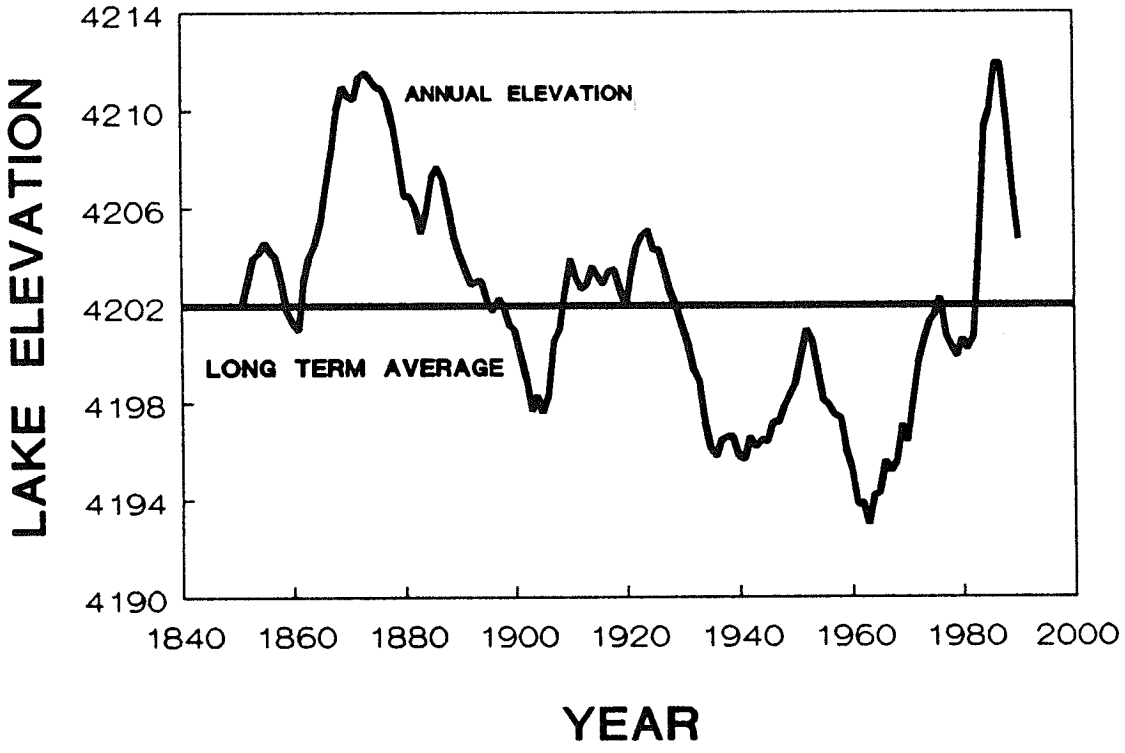

Figure 1. Hydrograph of Great Salt Lake annual peak elevations.

within one to two years of emergence from flood waters with appropriate freshwater management.

HARVEST AND MIGRATION

Hunt mechanics

Tundra Swan permits are issued in mid-September following a random drawing from interested applicants. Permits are issued free of charge, and authorize the taking of only one swan, as stipulated in the original hunt authorization. All applicants are charged a non-refundable $2.00 application fee, which is consistent with all Utah hunt drawings.

Historically, swan season frameworks were tied to duck season frameworks. With increasingly restrictive waterfowl regulations in the mid-1980's, the Pacific Flyway switched Tundra Swan season frameworks to be concurrent with more liberal Rocky Mountain Population (RMP) Canada goose season frameworks. Swan seasons in Utah have been statewide, with local closures at Fish Springs National Wildlife Refuge (NWR) in west central Utah and Ouray NWR in the eastern part of the state.

Figure 2 shows both the total permits issued each year and the total harvest on an annual basis. Participation is high, averaging 85-90%, and an average of 28% of all permittees harvest a swan. Swan harvest varies widely from year to year, and flooding has had dramatic effects on harvest. The highest annual retrieved harvest was 1,290 swans in 1969. The lowest annual harvest (226 swans) occurred not under a 1,000 permit allocation, but during a year of 2,500 permit allocation at the peak of GSL flooding (1987). Swan harvest has increased again as lake levels have declined and as habitat has recovered.

Swan migration

Utah's marshes, particularly the marsh complex along the eastern shore of the GSL, are an important staging and migration area for Western Population (WP) Tundra Swans (Schroeder et al. 1983). Utah is located along

were left on our marshes by Thanksgiving time. Peak harvest was shifted forward by two weeks, and harvest was reduced.

Harvest locations

In addition to being the focus for swan staging in Utah, the marshes of the GSL are the focus for the vast majority of swan harvest in the state, with 95-97% of the harvest occurring in this area. Within this complex, however, there have been some pronounced shifts in swan harvest location as a result of flooding. To demonstrate the change in harvest location I selected two years - one pre-flood (1980) and one post-flood (1990) and categorized all swan harvest locations for each. Prior to flooding, 62% of the swans harvested were taken at Ogden Bay Waterfowl Management Area (WMA). Ogden Bay is an area of high swan use along the east shore of the GSL (Figure 3) in close proximity to human population centers in Ogden and Salt Lake City. This combination of high hunter activity and heavy swan use resulted in high harvests at Ogden Bay. During the high water years, however, this area was almost completely inundated, and use by both hunters and swans was sharply curtailed.

In the years following flooding, harvest shifted to Public Shooting Grounds WMA on the northeastern portion of the lake (with 71% of the harvest in 1990). Public Shooting Grounds is further from both Ogden and Salt Lake City, and as a result received less hunting pressure prior to flooding. During the high water years Public Shooting Grounds and the adjacent north end of unit 1 of Bear River Migratory Bird Refuge were the biggest block of relatively undamaged swan habitat, and as a result swan use shifted to this area. Unit 1 of Bear River is a closed area, and so hunter activity was focused on Public Shooting Grounds WMA.

The last year has seen significant recovery of many of our GSL marshes, and shifts in swan activity patterns are already occurring. More suitable habitat and public hunting areas are becoming available, and both swan use and hunter activity will probably be more evenly distributed in coming years.

SUCCESS OF PROGRAM

In order to assess the success of the hunt in meeting the original objectives, we need to look at the objectives in the management plan for WP swans (Schroeder et al. 1983). The original objectives of the hunt were to provide recreational hunting opportunities within the framework of an expanding population, which are reflected in objectives A and D in the population management plan.

Objective A sets a minimum goal of 38,000 WP swans as measured by the midwinter survey. While there have been some fluctuations the long-term trend in this population is increasing, and the current population is well above the 38,000 bird threshold.

Objective D states "Provide for aesthetic, educational, scientific and hunting uses of these swans." We currently average 10,000 hunter days in pursuit of swan while maintaining viewing, photographic and scientific opportunities. As a result, I think we can classify Utah's hunt as successful in meeting the stated objectives.

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POTENTIAL TECHNIQUES FOR MONITORING THE HARVEST IN TUNDRA SWAN HUNTS

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ABSTRACT

SEVERAL TECHNIQUES HAVE BEEN SUGGESTED AS A MEANS OF DETECTING THE HARVEST OF TRUMPETER SWANS DURING TUNDRA SWAN HUNTING SEASONS. INVESTIGATIONS ARE UNDERWAY TO DETERMINE THE VIABILITY OF USING BILL MEASUREMENTS OR THE LENGTH OF OUTER PRIMARIES AS A MEANS OF DIFFERENTIATION. PRELIMINARY DATA INDICATES THAT THERE IS SOME OVERLAP BETWEEN THE LARGEST TUNDRA SWANS AND THE SMALLER TRUMPETERS. FURTHER EVALUATION WILL BE CONDUCTED IN 1991 TO DETERMINE THE EXTENT OF OVERLAP IN THE HOPE OF DEVELOPING A USEFUL MONITORING SYSTEM.

INTRODUCTION

Tundra and Trumpeter Swans are very similar in appearance. Hunters can not be expected to differentiate between the two under field conditions. The only way to avoid the accidental harvest of Trumpeters is to conduct Tundra Swan seasons in a manner that keeps the probability of hunters encountering Trumpeter Swans at a minimum. Therefore, The Trumpeter Swan Society believes that monitoring harvests in Tundra Swan hunts is a necessary step in swan management.

Before harvests can be monitored, a reliable monitoring technique must be developed. Considering the size difference between the two species, it would appear that a technique involving measurements could be used.

A monitoring system must be able to reliably differentiate between species. It needs to ensure that all measurements can be made accurately and in an economical way that will not place an additional burden on waterfowl managers or conservation officers during the hunting season when they are already overworked. Traditional check stations appear to have limited application for Tundra Swan hunts, but there are specific locations where they can be practical.

Having samples sent to a central processing location appears to be the only way to ensure accuracy at a reasonable cost. A monitoring system should not rely on hunters to take measurements. Likewise, sending samples through the mail is the easiest way to collect them over a wide geographic area. These requirements rule out perishable parts such as bills or feet for a statewide survey.

Bill measurements can be useful at locations where hunters are sufficiently concentrated to make operation of a check station practical. Indeed, Montana is employing this technique at Freezeout Lake, and Utah takes bill measurements near Great Salt Lake. Both state agencies will continue to evaluate this technique which could prove viable for monitoring these specific areas.

METHODS

After considering several options, The Trumpeter Swan Society decided to try to develop a monitoring technique based on feather length of the first and second primaries. Feathers can be taken from a carcass easily, sent through the mail, and kept indefinitely.

The length of the shaft from the tip down to the point of eruption from the skin was taken for the outer two primaries. The eruption line is obvious on pulled feathers and does not fade with time. The tape or flexible ruler was held in contact with the shaft.

Measurements for Trumpeters were for captive swans being raised for restoration programs, primarily in Minnesota. Stock originated from Alaska, Montana, and several zoos. Only white birds were measured. No effort was made to correlate feather length with the age of the bird. Cygnets were not measured because the available sample size was very small, and most young birds were not scheduled for handling during the time measurements were being taken.

RESULTS AND DISCUSSION

As expected, there is a range of feather lengths for both the first and second primaries. Although most of the largest feathers came from males, there was no obvious separation based on sex. The preliminary data suggest a nice bell graph will be developed for the distribution of feathers as the sample size increases (Figures 1 and 2).

Only a few Tundra Swans were available to measure in Minnesota. Most of these came from the Raptor Center or the Student Wildlife Rehabilitation Clinic where birds were sent after being shot or injured. Additional measurements were obtained from a captive Tundra Swan flock at the Kellogg Bird Sanctuary in Michigan, courtesy of Joe Johnson. Comparisons with this limited number of swans showed that as many as 30 percent of the Trumpeter Swans had feather measurements less than or equal to the largest Tundra Swan. Thus, this technique using primary measurements may fail to detect the harvest of the smaller Trumpeters.

A much larger sample size is needed for Tundra Swans before an upper limit can be established. The Trumpeter Swan Society intends to collect samples during the coming year to refine this technique. We hope to get feathers from Tundra Swans processed through check stations in Montana and Utah where the birds are identified by a biologist at the time the feathers are removed. Additional Trumpeter Swan feather measurements will be obtained from Michigan and Wisconsin. Both states have collected eggs from Alaska, so some of their birds are of Alaskan origin. An attempt will be made to get feathers from Trumpeters raised in the wild to make sure that feather growth is not affected by nutrition.

Adequate sample sizes should be collected by the end of 1991 to determine the validity of this technique or to determine if some other feather measurement such as shaft diameter can be substituted. If a valid technique is developed, it would be presented to the flyway technical committees in March 1992 for discussion. The Society would likely submit a list of locations where it would like to see monitoring implemented on a trial basis.

Verification of incidental harvest of Trumpeters would not automatically result in the closure of a Tundra Swan hunting season. It would provide biologists with a good idea of areas where additional data is needed to determine the origin of the Trumpeters and the impact of their loss from the population.

How would a monitoring system work? Since Tundra Swan hunters are selected by lottery, each hunter is sent a permit and hunting instructions. Survey forms sent to hunters need to be standardized so that the same data is collected for each state, including the location where the bird was shot and the date. Hunters who shoot birds in areas selected for monitoring would be required to submit the outer two primaries from one wing, or take the bird to a specified area, such as an agency office, to have them measured for birds that may be used for mounts. This requirement would appear in the instructions sent to hunters prior to the hunt. The collected feathers could be measured by state biologists. Only those feathers larger than the maximum determined for Tundras would be recorded as to date and location. The data should be reviewed by flyway biologists and The Trumpeter Swan Society at the flyway meetings to determine the significance of the results and an appropriate course of action.

One question still needs to be resolved. What happens if a hunter submits feathers that are determined to come from a Trumpeter Swan? It is a protected species. The U. S. Fish and Wildlife Service does not have provisions for incidental harvest, and, at least at present, they don't feel they can issue any variances or exemptions. The intent of monitoring hunts is

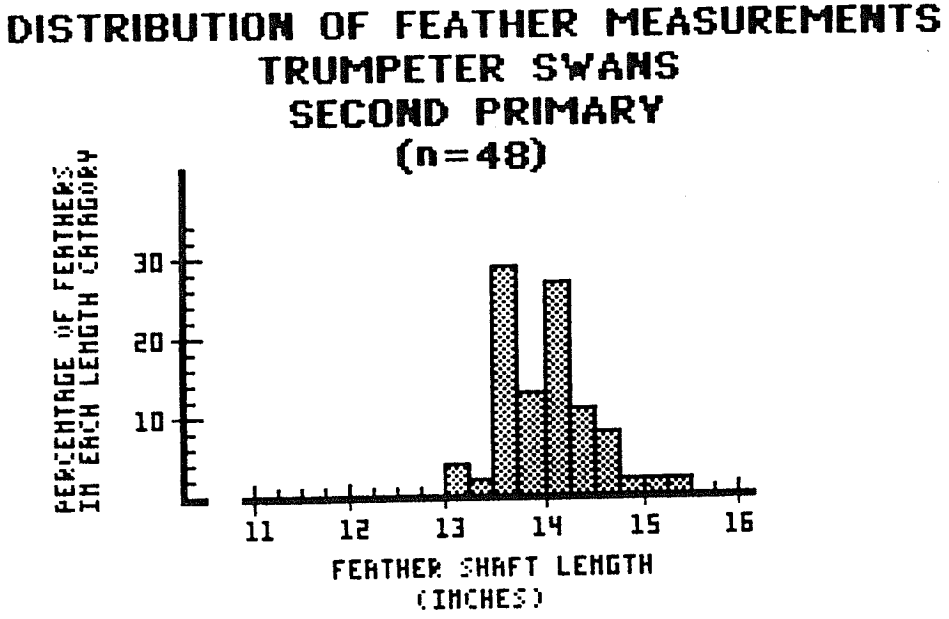


Figure 1. Trumpeter Swan second primary shaft length.

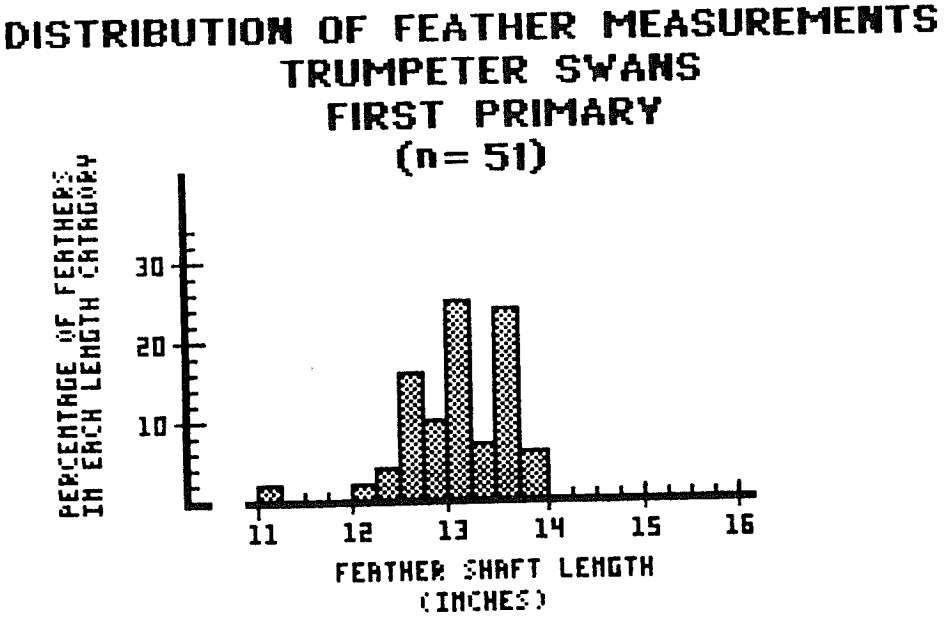
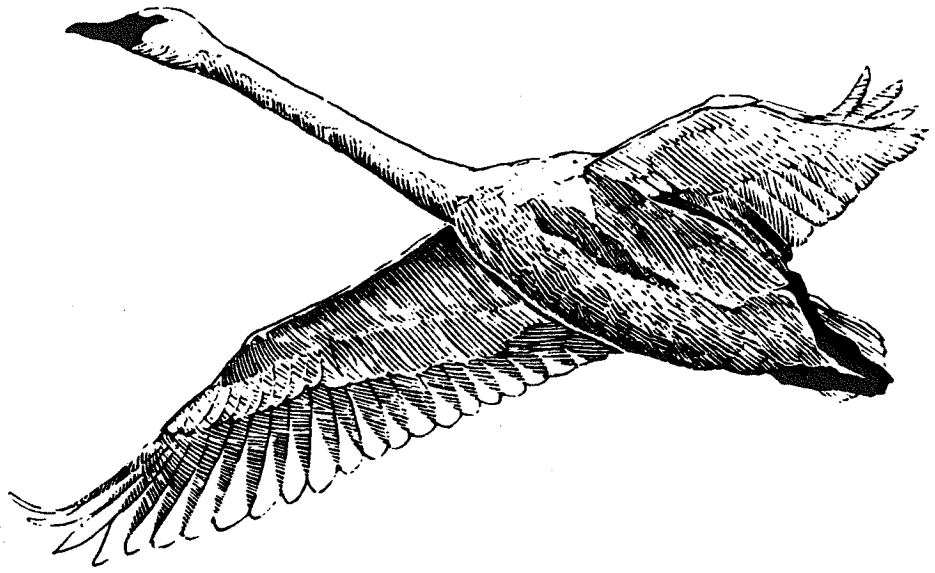


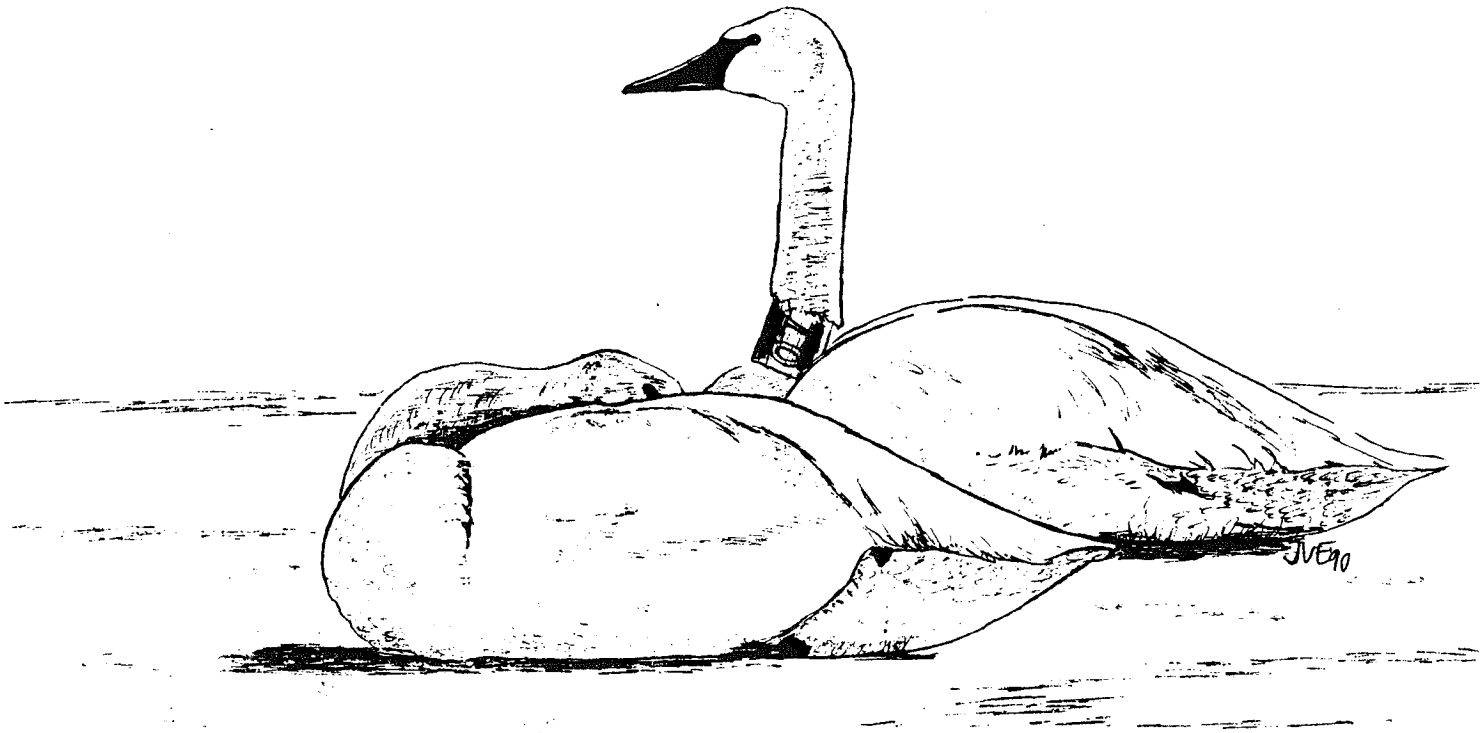
Figure 2. Trumpeter Swan first primary shaft length.

not to prosecute hunters who accidentally shot Trumpeters during Tundra hunts. It is to collect data that can be used to reduce the harvest of Trumpeters in the future. Obviously, this question needs to be resolved before proceeding with monitoring.

While monitoring is supported by the Society as the best way to protect Trumpeters, the need to monitor harvest is not universally accepted by state waterfowl biologists, particularly if it is time consuming and expensive. However, monitoring harvest in Tundra Swan hunts may actually help state agencies ensure their Tundra Swan hunts in the future. Public concern regarding potential shootings of Trumpeter Swans is almost certain to grow. Solid data on what is actually harvested is the best way to defend a season. Data on when and where swans are harvested may enable wildlife managers to make adjustments in seasons to minimize more than incidental harvest of Trumpeters, yet retain seasons on Tundra Swans.



SWAN MARKING PROTOCOL



THE SWAN NECK BAND PROTOCOL - TIME FOR REVISION

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ABSTRACT

NECK BANDS GENERALLY ARE SUPERIOR TO STANDARD LEG BANDS FOR GATHERING DATA ON SWANS, BUT THEIR USE MUST BE GOVERNED BY PROTOCOLS THAT PRESCRIBE COLORS AND ALPHA/NUMERIC CHARACTERS TO BE USED BY BANDERS. SINCE 1973 USE OF NECK BANDS ON SWANS IN NORTH AMERICA HAS BEEN GUIDED BY THE "SLADEN" PROTOCOL. THIS PROTOCOL FUNCTIONED REASONABLY WELL, BUT GRADUAL DEPARTURES FROM IT HAVE REDUCED ITS EFFECTIVENESS. THE PROTOCOL SHOULD BE REVISED TO ACCOMMODATE AN EXPECTED INCREASE IN SWAN RESEARCH DURING THE 1990'S. A WORKSHOP DEDICATED TO THAT PURPOSE WAS HELD IN CONJUNCTION WITH THE THIRTEENTH TRUMPETER SWAN SOCIETY CONFERENCE.

INTRODUCTION

Bird banding is a universal and indispensable technique for studying birds. Few other techniques have provided as much information on birds. Most birds are banded with standard metal leg bands, but increasing numbers of banders are using auxiliary markers such as plumage dyes, radio transmitters and neck bands (also called neck collars). In the case of large, conspicuous birds such as swans, auxiliary markers, particularly neck bands, have proven more valuable to researchers than metal leg bands. Auxiliary markers enable identification of individual birds at a distance, and multiple observations are possible.

Auxiliary markers can provide a wealth of data, but compared to standard leg bands, they have one significant drawback. That is, although millions of birds can be identified individually with standard leg bands, relatively few can be identified with auxiliary markers. This is because suitable types of markers, colors, and, combinations of alpha/numeric characters are limited. Thus, to maximize benefits, the use of auxiliary markers must be managed.

THE CURRENT PROTOCOL FOR SWAN NECK BANDS

The need to manage use of neck bands on swans was recognized almost 20 years ago when Dr. William Sladen developed a protocol for that purpose (Sladen 1973). Sladen's protocol was adopted by the U. S. Bird Banding Laboratory (BBL) and the Canadian Banding Office, and to this day it has served as the basis for allocating swan neck band authorizations.

The protocol was applied to Tundra, Trumpeter and Mute Swans because of their similarities in appearance. The protocol assigned colors for various parts of the continent: blue for swans neck banded in Alaska; red for the Northwest Territories and Yukon; green for British Colombia and the western states; yellow for interior parts of the continent east of the Rockies; black for coastal provinces and states from Newfoundland to Louisiana. The protocol also prescribed alpha/numeric characters to be used for identification of individual birds.

We now have almost two decades of experience with the swan protocol. Approximately 9,000 swans have been neck banded, most of them Tundra Swans banded according to the protocol. Useful knowledge has been gained, (e.g. Limpert et al. 1991), particularly in the delineation of eastern and western populations of Tundra Swans.

PROBLEMS WITH THE CURRENT PROTOCOL

The protocol represented a rational attempt to manage the limited possibilities for using neck

bands on swans. In principle and practice it has functioned reasonably well, but in recent years an increasing number of departures from the protocol have begun to reduce its effectiveness. Compton (1991) reported problems that Trumpeter Swan workers had with the protocol.

The problems relate to two contrary philosophies common to the management of auxiliary marking protocols for any species or group of birds. The first philosophy endorses the broad, holistic view that auxiliary marking should be governed by protocols, and that individual banders should forego individual desires and conform to protocols for the greater benefit of all. This broad, collective approach to protocol management tends to best serve long-term effectiveness. On the other hand, there is the philosophy that auxiliary marking should not be governed strictly, but should be liberal and conform to the needs of individual banders or projects. This narrow, individualistic approach tends to serve short-term efficiency, giving banders exactly what they want, provided that they got there first with their requests.

In principal, most banders subscribe to the first philosophy that protocols are desirable. The swan neck band protocol was developed with this in mind. In practice, however, there has been a tendency for banders to see that their particular needs are met. Banders desire unique colors for their study, special characters to enable recognition of their birds from the air, species specific and population specific colors, etc. The banding offices, anxious to please, sometimes tried to accommodate these desires. Consequently, over the years some exceptions to the color protocol have been made, and there has been little uniformity in how alpha/numeric characters have been used. Some of the exceptions were officially approved by the banding offices. Others were tacitly approved, i.e., the offices were aware of departures from the protocol, did not really approve of them, but elected not to force the bander to conform to protocol.

Regardless of how exceptions came about, enough departures from the protocol have occurred that today considerable confusion about swan neck bands exists. Some observers are having difficulty reading the alpha/numeric characters on neck bands placed by others. In extreme cases, the banding offices have been unable to determine which bander used the observed characters. Swan banders continue to request exceptions. During the last half of 1990, the BBL received three requests, all for significant departures from the protocol.

THE NEED FOR A REVISED PROTOCOL

In the 1990's swan workers will rely heavily on the use of neck bands to provide the information needed in their research and management endeavors. Restoring Trumpeter Swans to historic ranges, relocating Trumpeters from the Henrys Fork of the Snake River in Idaho to new wintering habitat, and the Atlantic Flyway Council's plan for large-scale study of Tundra Swans all portend increased use of neck bands.

It is unlikely that these projects could succeed under the present protocol, given the problems discussed above. Thus, we believe that the protocol for swan neck bands must be evaluated and revised to meet current needs. A workshop for this purpose was held at this symposium. The BBL did not have a new protocol to present at this workshop. Rather our intention was to hold an open forum and solicit the ideas and views of swan workers. We view ourselves as a service and administrative center. We believe that protocols work best when they are developed cooperatively by banders and the banding offices and then are implemented by the offices. Sladen and Limpert's (1992) proposal for a new protocol will serve as a starting point for discussion at the workshop.

Although the banding offices do not have a specific new protocol to propose, we do have several general recommendations for your consideration. We would recommend:

- a major revision of the swan neck band protocol, perhaps abandoning the old for a new one to be jointly developed by swan workers and the banding offices. It will be easier to start anew than to fix the existing protocol.

- a return to more uniformity and tighter control in managing the new protocol, including strict adherence to color schemes and careful accounting of alpha/numeric codes used.

- a separate protocol for Trumpeter Swans. Work on Trumpeters is evolving rapidly, and many workers desire a convenient way of distinguishing them from Tundras in the field.

- required use of standardized alpha/numeric characters. This would enable any swan worker to identify any individual swan, regardless of who banded it.

- more emphasis on reading neck bands in the field, with less reliance on colors to provide information.

- more emphasis on organized, cooperative efforts to read collars. Highly successful studies of neck banded Canada Geese demonstrate the value of this approach to collecting data (Hestbeck and Malecki 1989).

- a special class of neck bands for small scale projects. This would accommodate banders who need only to mark a few birds in localized studies. Such neck bands could be bi-colored, use symbols in lieu of alpha/numeric characters, etc.

We are anxious to hear the ideas and views of swan workers, so we urge all interested persons to attend the workshop. The BBL and the Canadian Banding Office look forward to cooperating with swan workers to revise the swan neck band protocol. We trust that our collective efforts will benefit all parties, and ultimately the swans that we all strive to conserve.

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A NEW LOOK AT THE CODED COLOR NECK AND TARSUS BAND PROTOCOL FOR NORTH AMERICAN SWANS

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ABSTRACT

THE SWAN RESEARCH PROGRAM HAS BANDED SWANS IN NORTH AMERICAN SINCE 1967. THROUGH THE INTERNATIONAL WATERFOWL AND WETLANDS RESEARCH BUREAU'S (IWRB) SWAN RESEARCH GROUP, IT DEVELOPED THE FIRST CIRCUMPOLAR PROTOCOL FOR CODED COLOR NECK AND TARSUS BANDS FOR ALL FIVE SWANS IN THE EARLY 1970's. THE NORTH AMERICAN PROTOCOL HAS BEEN FAIRLY WELL FOLLOWED OVER THE YEARS BUT THERE IS NEED FOR REVISION.

THE OLD PROTOCOL IS BRIEFLY DESCRIBED AND A NEW ONE INVOLVING THREE-DIGIT CODES FOR TUNDRA AND TRUMPETER SWANS SUGGESTED. CONTINUING TO USE THE ORIGINAL FOUR-DIGIT CODE FOR THE MUTE SWAN ALLOWS MORE COMBINATIONS FOR OUR NATIVE SWANS. OTHER METHODS OF MARKING (e.g. COHORTS, REGIONS, SEX/AGE, DYE) ARE DISCUSSED. WE RECOMMEND AN AD HOC ADVISORY GROUP OF SWAN EXPERTS BE FORMED, WITH PROPER REPRESENTATION OF NONGOVERNMENTAL ORGANIZATIONS, TO FURTHER DISCUSS THE NEW PROTOCOL AND ADVISE THE BIRD BANDING LAB AND PROGRAM ORGANIZERS, FINALLY REVISING THE CIRCUMPOLAR PROTOCOL THROUGH IWRB.

INTRODUCTION

Protocols for neck banding swans in North America (Sladen 1973a) and for the Northern Hemisphere (Sladen 1973b, Sladen 1976, Sladen and Kistchinski 1977) were developed in the early 1970's in support of the Swan Research Program's (SRP) studies on Tundra, Cygnus columbianus columbianus, Trumpeter, Cygnus c. buccinator, and Mute, C. olor, Swans, as well as for Whooper, C. cygnus cygnus, Bewick's, C. columbianus bewickii, and Mute Swans through the Swan Research Group of the International Waterfowl and Wetlands Research Bureau (IWRB). Like the white goose protocol (Sladen and Kistchinski 1977) the swan protocol was never officially accepted by the U. S. Fish and Wildlife Service (USFWS) Bird Banding Laboratory (BBL) but was used as a guideline when issuing color marking permits to workers. In the 1970's and early 1980's there were, however, fewer biologists working on swans so it was fairly easy keeping track of them, especially as we at Johns Hopkins University were making most of the neck bands and distributing them with approval of the BBL.

At its inception, the protocol was a good compromise, especially as at that time BBL authorized only colors and no codes for bander's permits. Our protocol for swans allocated *in advance* for each state or province the colors as well as a series of non-duplicating four-digit letter and number neck band and matching tarsus band codes for the entire continent. The protocol was consulted when a new worker requested neck bands. BBL would then enter the code/color series to their permit. The protocol was flexible in its allocation philosophy, but rigid in following the four-digit code and color scheme for large political areas of the continent. If one worker wanted extra codes, as was the case with SRP which has banded over 8,000 swans since 1967, they were transferred from another area not using them. A similar arrangement worked well in Eurasia with the Zoological Museum of the

University in Copenhagen, Denmark making and allocating the neck bands to many countries, including Denmark, Iceland, Finland, Japan, Latvia, Norway, Poland, Sweden and USSR.

In recent years, especially as a result of increased neck banding of Trumpeters involved in restoration programs together with a justified demand for special projects, BBL has allowed exceptions from the original protocol. Moreover, times have changed. The 1970 protocol was designed mainly to: 1) help define migration routes and stop-over locations; 2) encourage swan biologists to work together in North America, 3) excite and mobilize volunteers from the general public (Hansen 1981, Parks et al. 1981), 4) expand swan research, through IWRB, to a circumpolar level (Sladen 1976); and 5) through the US/USSR Environmental Protection Agreement, to encourage Soviet involvement (Sladen and Kistchinski 1977).

We are grateful to be given this opportunity to offer our suggestions for changes. These ideas incorporate those made at the Twelfth Trumpeter Swan Society Conference in Minneapolis (Gillette 1991) as well as our comments to discussions at the Thirteenth Conference.

GENERAL REMARKS

Terminology

Though *collar* was originally used, we now recommend using the words *coded color neck band* instead of *coded color collar*. Since we always place a color plastic taurus band with matching codes on swans and geese as well as the neck band, we find *neck and tarsus band*, a more convenient terminology. It also appears more acceptable to the public, collars sounding more constrictive and choking.

The 1970 coded color neck and tarsus band protocol

Briefly, for North America (Sladen 1973a and 1973b, Compton 1991) this consisted of using five easily recognized colors for large political areas covering the entire range of the four swan species known at that time to occur on the continent. All swans neck and tarsus banded in Alaska had blue with white codes (BL/w). Those banded in the Canadian arctic had red with white codes. Later this color was changed to orange with black codes (0/bk) because the white codes stained orange-brown becoming very difficult to read (see section on selection of colors below). Green with white codes (G/w) were used for provinces and states of the Rockies and west, black with white codes (Bk/w) were used for the Atlantic provinces and states, and yellow with black codes (Y/bk) were used for inland east of the Rockies.

The main objectives of the system were simplicity, instant identification of banding region and easily read codes from more than 500 meters without the need for the bird or observer to move. The code was a simple four-digit letter/number combination (no characters) engraved vertically on laminated plastic in such a way as to be clearly visible at any angle the swan was viewed from (Figure 1a).

All numbers, 0 through 9, were used in combination with 12 letters: A, C, E, F, J, K, M, P, R, T, V, Y. All reversible letters, e.g. H, W, M, X, and letters which could be confused with other letters or numbers, e.g. B like 8, D like O, G like C, were excluded.

The letter/number (L/#) code varied with the species. Thus, all Tundra Swan had codes of 1L/3# (e.g. A123), Trumpeters 2#/2L (e.g. 12VY), Mutes 2L/2# (e.g. AC12), and Whooper Swans 1#/1L/2# (e.g. 1E23).

All bands were placed on neck or tarsus so that the code would read *upwards*.

The four-digit code provided so many combinations it was possible to mark every northern swan banded in North America and Eurasia, like metal bands for North America, with its own unique code number duplicated nowhere else in the northern hemisphere. Exceptions were made for the largely resident Mute Swan, the codes being duplicated on both sides of the Atlantic. Thus, all Mutes in North America had their own unique code; all in Eurasia had theirs.

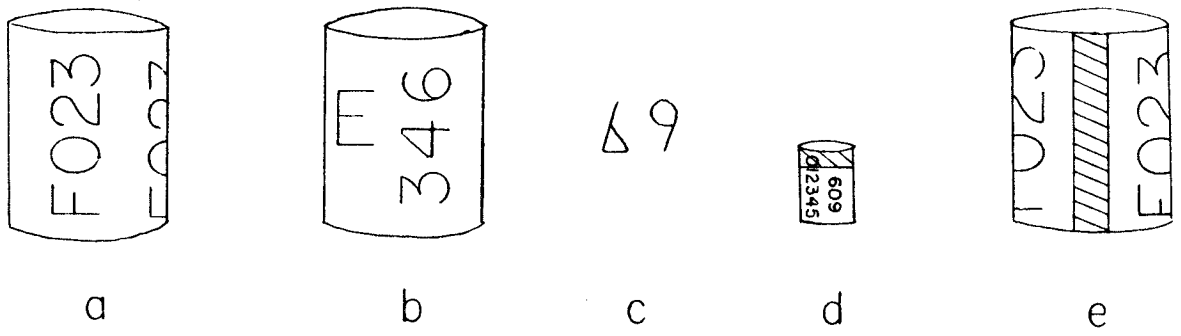

Figure 1. Neck and tarsus band designs to identify individuals and/or cohorts: a) conventional code arrangement, b) recent variation on code arrangement, c) stylized numbers, d) placement of colored tape around the top of the metal tarsus band, e) color tape placed between the codes on a neck band.

Neck banding is a specialized technique and should be used sparingly

The neck band technique serves an important function in allowing investigators to recognize an individual swan through a telescope, even when swimming, from a great distance without the need to recapture. However, SRP has always put these markers on swans with reluctance, knowing that some of the public object to any form of visible marker and being concerned about other problems such as ice build up. Our experience with icing has been negligible; only one or two observations in over 8,000 Tundras neck banded. The two fatalities of swans with iced neck bands could have been secondary to other causes such as lead poisoning, old age, etc. Our policy, therefore, has been not to exceed neck banding one or less percent of the total population in any one year. We have never even attained a one percent catch. We are thus concerned about the increasing number of neck bands being placed on Trumpeter Swans in restoration programs. Some researchers are banding every bird. This is surely too many and unnecessary.

RECOMMENDATIONS FOR CHANGING THE 1970 PROTOCOL

Keep it simple and plan for public involvement

Whatever new system is developed, the most important keys to success are *simplicity* and *longevity*. The system should be able to endure for at least 10 years without the upheavals and confusion of change. We also believe strongly that involvement of nongovernment biologists, volunteers and nonprofessionals should be encouraged and that banding schemes should continue to benefit from the many years of knowledge these people can so often impart (Parks et al. 1981, Hansen 1981). Banding projects should, of course, have definite objectives and additional guidance in this matter from BBL.

One protocol should be prepared for all five kinds of swan

We should remind ourselves that we are not isolated in North America. In fact, the Whooper Swan is a regular winter visitor from northeastern Siberia to the Aleutian Islands, has been reported breeding or molting in western Alaska and is a rare vagrant along the East Coast (Palmer 1976). Moreover, the Bewick's Swan and intergrades between Tundra and Bewick's have been reported in California as well as Bewick's in Maryland (Evans and Sladen 1980). The Tundra Swan now breeds in northeastern Siberia (Kistchinski et al. 1975) and winters regularly in Japan.

Trumpeter, Tundra and Mute Swans should be included in the North American protocol; the Whooper in the Eurasian protocol. All swan workers should be asked for opinions. We were successful in dovetailing the North American protocol into a circumpolar one in the early 1970's (Sladen 1976). This should be more plausible now after three International Swan Symposiums (see Matthews and Smart 1981, Sears and Bacon 1992). The Swan Research Group of IWRB should continue to be a uniting force in securing a circumpolar protocol.

Continue neck banding Mute Swans with the original four-digit code system

In North America Mute Swans are mostly sedentary and can be viewed at closer quarters than our native swans. We recommend the same four-digit code system (2 letters/2 numbers) be continued for this species in North America. This would free up three-digit codes suggested below for Tundras and Trumpeters.

Change from four- to three-digit code for Tundra and Trumpeters

Using the standard 12 letters and 130 numerals, the present four-digit code system allowed for 12,000 non-repeatable combinations for Tundra and 14,400 each for Trumpeters and Mute Swans. The first coded neck bands were placed on Tundras in January 1970, Mute Swans in 1971 and Trumpeters in Alaska, August 1972 (Sladen 1973a). We realized we would have more than enough codes even for Tundras, so chose the code easiest to cut in large batches (e.g. 1,000 each of C001 through C000 for Maryland, Virginia and North Carolina; A001 through A000 for Alaska). Over 8,000 of the 12,000 possible codes have been used during the past 20 years for Tundras and probably not more than 1,500 for Trumpeters. It seems reasonable to believe that with carefully planned marking programs this number will not be exceed in he next 10 years for the combined two species. We thus recommend changing to a three-digit code. This will allow large digits to be visible from greater distances.

Table 1 summarizes our suggestions following the protocol SRP has been using since 1977 on Great Blue Herons, Ardea herodias and was suggested and partly activated in July 1979 in a circumpolar protocol for Brant Geese, Branta bernicla, (Sladen et al. 1980). The same code system has also been used for the Black-necked Swan, Cygnus melanocoryphus, in South America through SRP and IWRB (Schlatter et al. 1991).

First, it needs to be established that, like the original protocol, each species of swan will have its own characteristic code combination. We kept to one per species in the original protocol (1L/3# for Tundra, 2#/2L for Trumpeter), but with the three-digit code several combinations will be needed per species. Therefore, we suggest the combinations 1L/2#, 3L, 2L/1#, 1#/2L, allowing 5,808 to 11,681 combinations for Tundra Swans; combinations 3#/1L and L/#/L, allowing 2,640 to 4,278 for Trumpeter Swans; and #/L/# (1,200 to 1,570) to be kept in reserve (Table 1). Finally 3#, with 890 combinations, could be kept for special studies.

Consistency in the code characters

A completely different design with vertical and horizontal codes mixed and/or stylized letters (Figure 1b and 1c) has recently been used for Tundra Swans banded in Alaska. SRP, still banding far more Tundras than any other group, have been using the same conventional letters for consistency since 1967.

Table 1. Suggested three-digit[1] code system for Tundra and Trumpeter Swan neck and tarsus bands.

FIRST BATCH				SECOND BATCH				Last			Species
1st	2nd	Last	Total	1st	2nd	Last	Total	Code	Min[2]	Max[3]	Series
A01	A02	A00	100	C01	C02	C00	100	Y00	1,200	1,550	Tundra
AAA	AAC	AAY	12	ACA	ACC	ACY	12	YYY	1,728	4,711	Tundra
AA1	AA2	AA0	10	AC1	AC2	AC0	10	YY0	1,440	2,710	Tundra
1AA	1AC	1AY	12	1CA	1CC	1CY	12	0YY	1,440	2,710	Tundra
							Tundra Total		5,808	11,681	
01A	02A	00A	100	01C	02C	00C	100	00Y	1,200	1,550	Trumpeter
A1A	A1C	A1Y	12	A2A	A2C	A2Y	12	Y0Y	1,440	2,728	Trumpeter
							Trumpeter Total		2,640	4,728	
1A1	1A2	1A0	10	1C1	1C2	1C0	10	0Y0	1,200	1,570	Reserve
001	003	000	890	-	-	-	-	000	890	890	Spec. Studies
							Total Non-duplicated Codes		10,538[2]	18,419[3]	

[1] In the text we recommend Mute Swan neck and tarsus bands remain with four-digit codes (2 letters/2 numbers) as in the original protocol (Sladen 1973a and 1973b).

[2] Minimum possible non-duplicated combinations in each series using the standard 12 non-reversible letters: A, C, E, F, J, K, M, P, R, T, V, Y. This would allow a minimum of 5,808 combinations for Tundra, 2,650 for Trumpeters, 1,200 in Reserve, and 890 for Special Studies.

[3] Maximum possible non-duplicated combinations in each series using the 12 letter above plus the reversible letters H, N, S, X, W when not in reversible combinations with themselves or with numbers 0, 1, 6, 8 or 9. This would allow a maximum of 11,681 combinations for Tundra, 4,278 for Trumpeters, 1,570 in Reserve, and 890 for Special Studies.

In winter, we are thus reading two different designs of neck band. This is not only confusing but encourages inaccurate data gathering. The code characters and neck band design should be the same from year to year. *BBL should enforce this after the swan biologists have agreed which design is best.*

Colors need careful discussion before being finalized

We made a mistake in the original protocol by allocating for the Canadian arctic what we thought was the best color combination red with white codes (R/w). The first winter they were excellent, but after two winters most became very difficult to read because the iron in the arctic water stained the white code orange or brown. The same will almost certainly be true for brown with white codes. Even black with white codes (BK/w), which we thought would be an excellent combination, has proved difficult in certain areas. For example, the white codes become brown, almost black, after one or two years due to the peaty water at Pungo National Wildlife Refuge in North Carolina. We have therefore switched to grey with black codes (GY/bk).

Thus the most important variable needing attention in allocating colors *is the ability to read the codes after two or more years of environmental staining*. Trumpeters tend to stain their heads and necks orange more than Tundra Swans, but there is a great deal of individual variation in both species. A switch to fewer color combinations, but with the neck bands consistently easy to spot and read, should be considered. This was discussed at this Conference but needs further discussion before finalizing.

Some tentative suggestions from our experience are:

Trumpeter Swans - Use one color only (e.g. green with white codes [G/w]) and another color for experimental birds.

Tundra Swans - Use either two color (breeding and winter) or, preferably, four colors (Limpert et al. 1991) as follows: blue with white codes (BL/w) for Eastern Population breeding, light blue with black codes (LB/bk) for Western Population breeding, grey with black codes (GY/bk) for Eastern Population winter, and yellow with black codes (Y/bk) for Western Population winter.

In our experience of all these colors have proved satisfactory on swans during the past two years of neck banding. We do not recommend using red, brown or black with white codes.

Material used

SRP makes its own neck bands using 1/8 inch (1.6 mm) thick two-ply flexible engraving stock manufacturing under the trade names of Lynply or Reaplex (Sladen and Limpert 1988). The tarsus bands are made with the same material but 1/16 inch (0.8 mm) thick. Originally our neck and tarsus bands were both cut from 1/16 inch thick material (Sladen 1973a), but following the experience of John Sarvis (pers. comm.) in Alaska and testing the heavier material on our captive swans, we switched in 1988-89 to the 1/8 inch thick neck band to increase band longevity.

More research on materials is needed. SRP has had problems over the years from inconsistencies in the quality and durability of the material received under the same trade name.

OTHER METHODS OF MARKING

Placement of the metal band to indicate age versus sex

Since 1967, SRP has placed the standard USFWS metal bands on the left tarsus for all known-aged birds, i.e. cygnets in the juvenile grey plumage in winter, and on the right tarsus for those of unknown age, i.e. captured for the first time when with all-white plumage (Sladen 1973a). The coded color band (matching the neck band) is placed on the opposite tarsus. This follows the same system used in Antarctica for all species except the penguin (Sladen et al. 1968). Most studies attach no importance to which tarsus is banded. Others place metal bands on one tarsus for males, the opposite for females.

We recommend continuing to use the placement of the metal band to indicate age for several reasons. First, knowing that an individual is of known age is important for behavioral and population studies. We go to extra effort to read the neck band of a known-aged swan. With experience band types can be detected when swimming as well as on land. Second, swans (especially juveniles) are more difficult to sex than ducks or geese. Errors (rarely admitted!) are sometimes made even by the most experienced banders. SRP has proved this by a few recaptures that have "changed sex". Third, if in doubt as to sex, or the swan was not sexed, what tarsus would be banded? Using our system to indicate age, a bird of doubtful age would be banded on the right leg (i.e. age unknown).

Color tape on metal band to indicate cohorts

When large numbers of young birds were being banded in Antarctica each year for population studies (Sladen et al. 1968, Ainley et al. 1983), we found wrapping 3M plastic tape around a part of the band lasted a number of years provided it was applied warm, on clean metal and overlapped twice. A different color was

used each year for every cohort banded. This gave us 14 possible cohort years: seven with a different color on top (Figure 1d), and seven with the colors below. It was a particularly effective method of picking out known-aged Adelie Penguins, Pygoscelis adeliae, and South Polar Skuas, Catharacta maccormicki, in large colonies. This technique could be used when studying age composition of flocks of wintering swans or at staging areas.

Color tape on neck bands to indicate special areas of studies

As with tarsus bands, there is enough room on the neck band for using contrasting vertical strips of color tape in the space between the codes (Figure 1e). In our experience, these strips of tape will last five or more years.

The little used dye

In the early days of SRP patterns of picric acid and nyanzol were used very effectively to help identify populations on migration or at staging places. The advantage of dyes is that a new scheme with different objectives can be worked out each year. Figures 2a through 2e illustrate five different dye patterns used by SRP that are easily recognizable from the air (Sladen 1975). There are many more possible combinations for observations on the ground, especially when your study subject has a long white neck (Figure 2g).

Dye patterns should be as much a part of the swan color marking protocol as the color and coding system for neck and tarsus bands. Thus, authority to use specific patterns should be given through BBL from a plan carefully worked out *ahead of time*. We emphasize that because, for no fault of their own, BBL is often confronted with dye or color marking demands at very short notice.

Maybe special dye patterns could be used in conjunction with color coded tarsus bands, instead of neck bands, for following the first year movements of the majority of Trumpeter Swan restoration releases. For example, a small ring of picric acid halfway down the neck which would be conspicuous only to a trained observer. A beautiful dye pattern which worked well in the 1960's was alternating picric and nyanzol ring patterns on the neck (Figure 2f).

FINAL RECOMMENDATIONS

Recommendations by Sladen (1991) and the following two made at the Third IWRB International Swan Symposium in Oxford, UK, December 1989 (Moser 1991) relate to this paper:

Recommendation III 6 . . . ." Commending the U. S. Fish and Wildlife Service for acknowledging candidly that unless additional banding and marking studies are carried out, 'measurable impacts (from hunting) to the population status of Tundra Swans will be difficult to assess', the Conference urges the USFWS to proceed immediately with this essential research" and,

Recommendation I 3 . . . ." Recognizing the value of color-marking in the study of swans, the Conference recommends the coordination of such activities through protocols. The controlled use of dyes, where appropriate, should be encourage for short-term studies of population movements, while permanent (lifetime) color bands should be used for long-term studies."

Much initial work has been done for Trumpeter Swan color marking by Compton (1991). Moreover, it looks promising that USFWS will encourage long-term research on the Tundra Swan involving coded color neck and tarsus bands as recommended above by the Third Swan Symposium. We suggest a Swan Marking Advisory Group be formed with appropriate government and nongovernment representatives. For example, a member of the Snow Goose, Brant, and Swan (SNOBS) Flyway Committee, Compton (representing TSS), Sladen (for SRP), Limpert (for IWRB) and BBL personnel could revise the old protocol for review by swan researchers, IWRB and finally BBL. This group would recommend appropriate dyes too. No one will ever be satisfied, but compromises are possible. The aim should be to get everyone working together, as was the case in 1968-70, and *sticking to a simple, workable system that will endure for at least 10 years and be compatible*

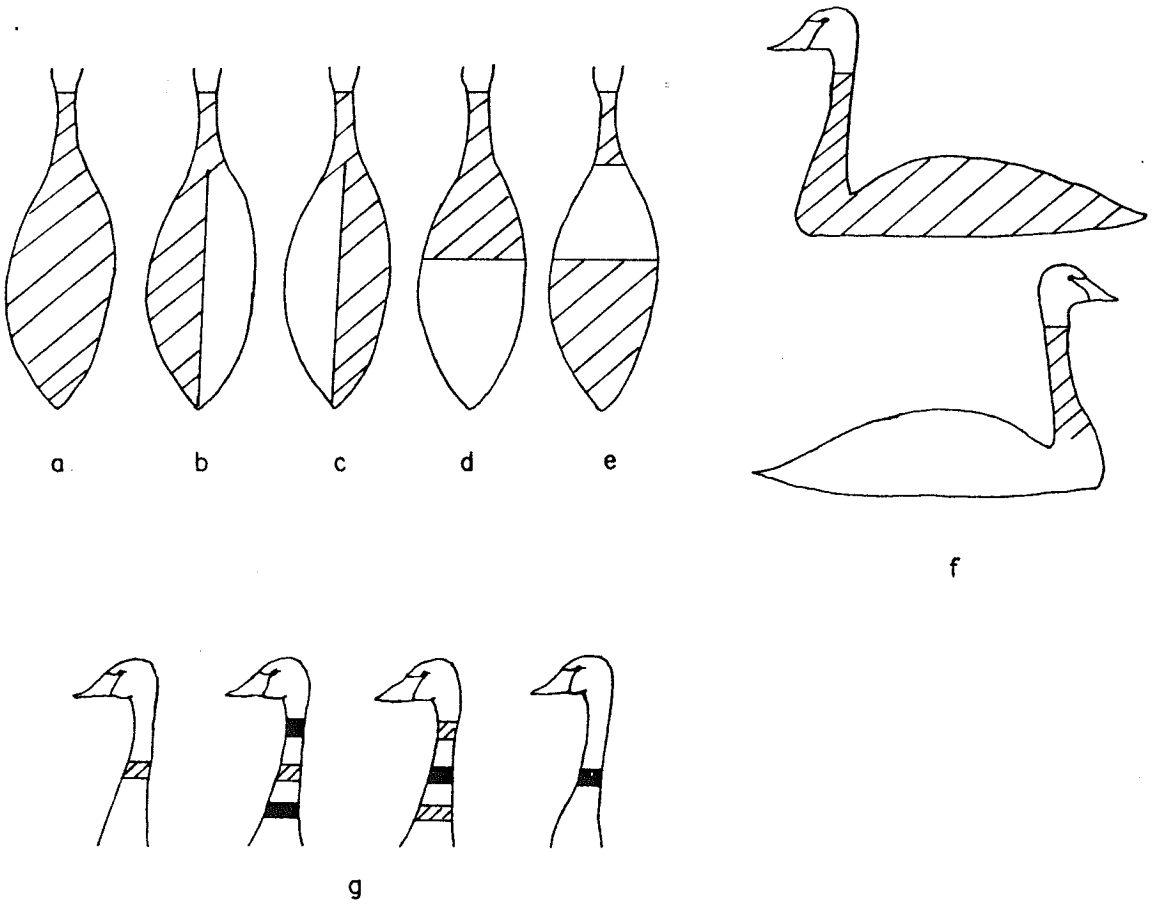

Figure 2. Distinct picric acid (crosshatch) and nyanzol (solid) dye patterns placed on the body (a-e) or neck (g) of swans to mark individuals and/or cohorts to allow identification from the air or ground (f is a ground view of pattern b).

with a revised northern circumpolar protocol through IWRB.

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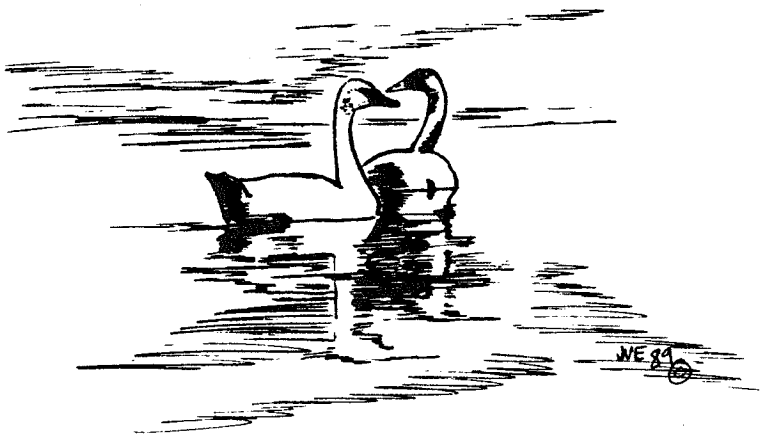
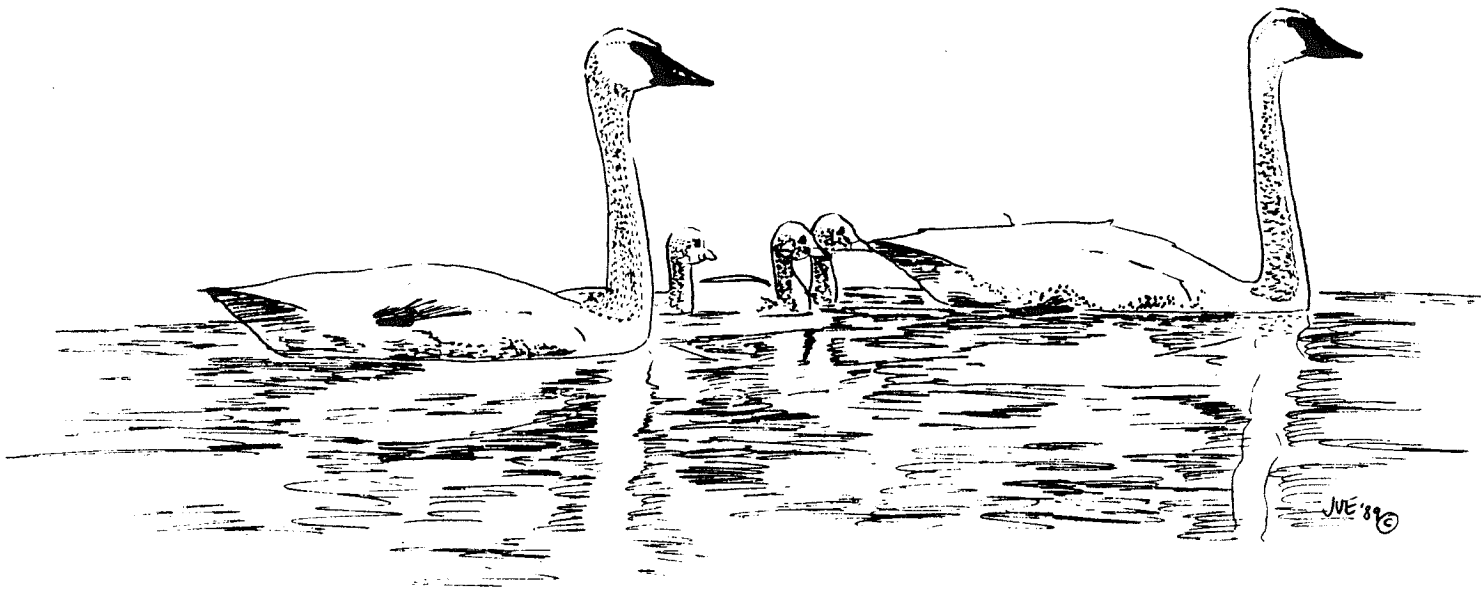


INTERIOR POPULATION



COLLECTION, TRANSPORT, AND HATCHING SUCCESS OF ALASKAN TRUMPETER SWAN EGGS 1989-90, AND STATUS OF WISCONSIN'S TRUMPETER SWAN RECOVERY PROGRAM

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The goal of the Wisconsin Trumpeter Swan recovery effort is to establish a breeding and migratory population of at least 20 pairs by the year 2000 (Matteson et al. 1988). We are utilizing three strategies: captive-rearing cygnets until the age of 23 months followed by release to the wild; decoy-rearing cygnets until fledging age using life-size adult decoys manipulated from a camouflaged float tube; and captive parent-rearing cygnets followed by cygnet releases at age 11 months. The principal source of Wisconsin's restoration birds is from Alaskan flocks. We have collected 40 eggs each of the past two years and plan on collecting eggs through the year 1996. Alaskan eggs are incubated and hatched at the Milwaukee County Zoo. We have also relied on game farm stock to increase the number of birds in our program.

In June 1989 and 1990, Wisconsin Department of Natural Resources (DNR) Nongame Section Chief Jurewicz and Avian Ecologist Matteson journeyed to Alaska to collect Trumpeter Swan eggs for Wisconsin's Trumpeter Swan Recovery Program. They flew both years in a Windway Capital Corporation Citation jet piloted by Terry and Mary Kohler of Sheboygan, Wisconsin. In 1989 they were joined by Michigan State University biologist Joe Johnson.

In 1989 they flew to the Minto Flats, a large wetland complex encompassing about 1900 km^2 west of Fairbanks in east-central Alaska. The Minto Flats area is characterized by a myriad of permanent and semipermanent highly eutrophic lakes surrounded by boreal forest or open meadow. Wetland dominants include a mix of Carex and grasses, water milfoil (Myriophyllum sp.), pondweed (Potamogeton sp.), and duckweed (Lemna sp.) (King 1990).

In 1990 Jurewicz and Matteson flew to the Nelchina Basin in south-central Alaska, about 500 km southeast of the Minto Flats. The Nelchina Basin is a 53,000 ha wetland complex with dystrophic, moderately alkaline brown-water lakes occupying a large plateau with moraines, kettles, and kames (Bird and Shryer 1987).

In 1989, U. S. Fish and Wildlife Service (USFWS) biologist/pilot Rod King flew Matteson in a Cessna 185 float plane to egg collection sites in the Minto Flats. In 1990, USFWS pilot Lee Hotchkiss flew a U. S. Park Service Cessna 206 to collection sites. Both years the exact locations of all Trumpeter Swan nests were placed on quadrangle maps by USFWS personnel prior to our arrival. Nest sites for egg collection were determined on the basis of safe landing and takeoff sites. At each collection nest the plane taxied as close as possible to the nest. Adult swans varied in their behavior as the aircraft approached the nest. Some departed immediately, others stood their ground until the plane was only a few meters away before they departed. On one occasion in 1989 an adult circled behind, attacked the rear of the plane, and clipped a communication wire. This precluded contact with the Fairbanks airport. Rod King had to resort to the use of a ham radio to contact his

wife, who called the airport to relay our expected time of arrival.

At each nest, all eggs were candled with a coffee can sized field candler. Each egg was measured with a metric caliper and the eggs with the largest diameter were collected. In 1989, 57 eggs had a mean girth of 75.73 mm ± 1.36 (range = 71.73 - 79.8). In 1990, 40 eggs had a mean girth of 74.18 mm ± 1.43 (range = 71.5 - 77.6). Each collection nest was assigned an alpha designation and each egg within the nest was assigned a numeric designation. At least two fertile eggs were left in each nest, as per USFWS guidelines. Nest material and down were placed over the remaining eggs to keep them warm and unexposed to potential predators.

Collected eggs were placed in a small grey suitcase with individual styrofoam compartments and transferred to the float plane, where they were transferred to specially designed insulation cases heated by water bottles and ventilated by a battery operated fan. These three cases were on loan from the Minnesota DNR and modified to accommodate 14, 12, and 14 eggs, respectively. After a case was filled with eggs, it was flown to a station (USFWS cabin in 1989; Gulkana Airport in 1990) where hot water was heated to keep the eggs in the low- to mid-90 degree Fahrenheit range. A new case was then placed on board the float plane and the collection trip resumed.

In 1990, the collection team enlisted the services of Al and Jerry Lee after experiencing takeoff problems, due to weight, with the larger Cessna 206. The Lees utilized two Supercub float planes to work in conjunction with the Cessna 206. The Supercubs operated from a lake where the Cessna 206 was parked. These planes flew to small lakes and kettle ponds to collect eggs. After visits to two or three nests, a Supercub returned to the Cessna 206 and eggs were turned over to pilot Hotchkiss who placed the eggs in a suitcase box. Once the box became full, Hotchkiss flew back to the airport station and turned the box over to the care of Mary Kohler and Dair Stewart. Hotchkiss then returned to the rendezvous lake with an empty box to await more eggs.

Egg collection in 1990 occurred on 11 and 12 June. Because of plane problems on the 11th, only 19 eggs had been collected after over 12 hours of effort. While waiting for the Supercubs on the 12th, Matteson decided to attempt to collect eggs from an inland bog lake during the morning. Reaching the edge of a sedge mat and noting that the nest was a moat circa 15 m from the mat edge, he had a decision to make: either to turn back to the waiting float plane or swim out to the nest. While briefly entertaining the notion of heading back, his Danish genes got the best of him and he took the plunge, but not before placing the field candler, caliper, and pencil into a ziplock bag.

Once at the nest he was besieged by horseflies that had a predilection for the back of his feet. The first egg of a four egg clutch he candled was infertile but the rest were viable. He was allowed to take one egg with him. Placing the egg in the ziplock bag (sandwiched between the candler and the bag's side) with the air cell facing up, he swam with the bag in his teeth back to the sedge mat. But he couldn't get out. So he stuffed his clothes into his waders, dropped the waders over his neck, and scratched his way back to dry land. Then he placed the egg in the small collection suitcase for transport back to the float plane. (This story has a happy ending because the egg survived and later hatched in an artificial incubator!)

In 1989, Matteson (1991) examined 134 Trumpeter Swan eggs at 26 nests. In 1990, Matteson and Jurewicz examined 81 eggs at 17 nests The overall mean, both years combined, was 5.00 eggs/nest ± 0.90 (Table 1). The collection team examined a total of 215 eggs at 43 nests and collected 97 eggs during the two year period. Egg collection took 13 hours in 1989 (Matteson 1991) and a total of 17 hours in 1990.

During the 10 hour return flight to Milwaukee in 1989, temperature readings in the 3 suitcase boxes averaged 92.5°F, 90.8°F, and 86.6°F, respectively (Matteson 1991). In 1990, egg case temperature readings were more uniform and averaged 93.2°F, 93.3°F, and 93.5°F, respectively.

Table 1. Mean clutch size for Trumpeter Swan nests in Minto Flats, 6 June 1989 and Nelchina Basin, Alaska, 11-12 June 1990.

YEAR	LOCATION	NO. NESTS	NO. EGGS	MEAN CLUTCH SIZE
1989	Minto Flats	26	134	5.15 ± 0.78 (range = 4 - 6)
1990	Nelchina Basin	17	81	4.76 ± 1.03 (range = 3 - 7)
Total		43	215	5.00 ± 0.90

Table 2. Hatching success of Trumpeter Swan eggs collected in Alaska, 6 June 1989 and 11-12 June 1990.

	INCUBATED	HATCHED		HATCH WEIGHT (g)		
YEAR	Number	Number	Percent	Mean	Range	N
1989	56[a]	54	96	--	--	--
	36[b]	35	97	234.0 ± 32.27	168.9-278.1	34
1990	40	39	97	232.75 ± 17.11	204.7-270.4	39

[a] Includes 20 eggs collected for state of Michigan
[b] Represents Wisconsin data only

In Milwaukee the eggs were transferred to the Milwaukee County Zoo and placed in two incubators: a Humidaire Gooser and a Petersime Model 1. The eggs were maintained at 99.5°F dry bulb and at 85-86°F wet bulb. The Humidaire Gooser automatically rotated the egg trays every two hours for 24 hours a day. Eggs in the Petersime were turned by hand 180 degrees three times a day at 0800 hrs, 1200 hrs, and at 1600 hrs. Eggs were candled daily with an electric candler and the progress of the embryos monitored daily.

As soon as chicks entered the air cell, they were moved to the hatching tray in the lower end of the incubator. At this point the eggs were no longer turned since hatching was imminent. In 1989, 35 cygnets hatched out during 17-27 June. In 1990, 39 cygnets hatched out during 16-26 June. Hatch weights in 1989 averaged 234.0 g, and in 1990 they averaged 232.7 g (Table 2). In total, 74 of 76 (97%) eggs successfully hatched.

A total of 69 Trumpeter Swans was released into the wild in Wisconsin during 1989-90. This total included 23 subadults raised in captivity and 46 decoy-reared cygnets that survived to fledging age. The survival rate after fledging age is about 77%, with 16 of the released swans (eight subadults, five yearlings, and three cygnets) dead or presumed to be dead.

Two pairs originating from Minnesota Trumpeter Swan restoration programs nested

in Wisconsin in 1990 and produced three and two cygnets, respectively. Unfortunately one of the breeding adults and its cygnet were accidentally shot and killed during the fall when they crossed into eastern Minnesota.

In regards to future Wisconsin releases, a total of 22 swans will be released into the wild in spring 1991, including 18 "Alaskan" captive-reared subadults and 4 parent-raised yearlings. This will bring the total of free-flying "released" swans to 75 by the start of the 1991 breeding season. In addition, 35-40 decoy-reared cygnets will be released in the fall of 1991.

ACKNOWLEDGEMENTS

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MINNESOTA DEPARTMENT OF NATURAL RESOURCES TRUMPETER SWAN RESTORATION PROJECT STATUS REPORT

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ABSTRACT

THE MINNESOTA DEPARTMENT OF NATURAL RESOURCES NONGAME WILDLIFE PROGRAM BEGAN ACTIVELY RAISING TRUMPETER SWANS IN 1982. THE PROJECT HAS ACQUIRED SWANS FROM THE WILD IN MONTANA AND SOUTH DAKOTA, AND WAS THE FIRST RESTORATION PROJECT TO RECEIVE A PERMIT AND COLLECT EGGS FROM THE WILD IN ALASKA FROM 1986-88. SWANS HAVE ALSO BEEN ACQUIRED FROM ZOOS, PRIVATE INSTITUTIONS AND PRIVATE PROPAGATORS. APPROXIMATELY 290 TRUMPETER SWANS HAVE BEEN ASSOCIATED WITH THE CAPTIVE REARING PORTION THE PROJECT. THE FIRST RELEASE OF 21 TWO-YEAR-OLD SWANS TOOK PLACE IN APRIL 1987. A TOTAL OF 130 SWANS HAVE BEEN RELEASED AS OF MAY 1990. ANOTHER 70 SWANS ARE PROJECTED TO BE RELEASED BY 1994. WINTERING SITES AND SIGHTINGS FOR THE RELEASED SWANS HAVE INCLUDED LOCATIONS IN MINNESOTA, IOWA, WISCONSIN, MICHIGAN, NEBRASKA, COLORADO, MISSOURI, KANSAS, OKLAHOMA, VIRGINIA, AND NORTH AND SOUTH DAKOTA. AN AVERAGE OF 40% (NEWLY RELEASED SWANS) TO 60% (OLDER PAIRED SWANS) OF THE RELEASED SWANS RETURN TO THE RELEASE AREA FOLLOWING MIGRATION. THE RATE OF KNOWN MORTALITIES FOR EACH RELEASE GROUP ARE 38%, 36%, AND 27% FOR 1987, 1988, AND 1989, RESPECTIVELY. TOTAL KNOWN SURVIVAL RATES ARE 24%, 39%, AND 52%, RESPECTIVELY. THE FIRST NESTING OF RELEASED SWANS OCCURRED IN 1988 WHEN TWO PAIRS NESTED, FLEDGING ONE OF FOUR CYGNETS. IN 1989, FIVE PAIRS ATTEMPTED NESTING, WITH THREE PAIRS FLEDGING THREE OF 10 CYGNETS. IN 1990, EIGHT PAIRS NESTED AND SIX SUCCESSFUL NESTS PRODUCED 17 CYGNETS, WITH 15 OF THE CYGNETS FLEDGING. NINE ADDITIONAL PAIRS WERE ON TERRITORIES AND ARE EXPECTED TO NEST IN 1991. THE GOAL IS TO ESTABLISH A BREEDING POPULATION OF 15 PAIRS FROM THE PROJECT.

The Minnesota Department of Natural Resources (MN DNR) project began to acquire swans in 1982, when eight eggs were collected at Lacreek National Wildlife Refuge (NWR) (Table 1). Twelve eggs were collected at Red Rock Lakes NWR in 1983. Additional swans were obtained in the two year period from Hennepin County Parks, Minnesota.

Swans were reared for 13 weeks to test facilities and procedures and then turned over to Hennepin Parks to supplement that flock. The Minnesota Zoo and the Brookfield Zoo began to supply birds to the program in 1984 and in that year, the first swans were held over winter at our Carlos Avery Wildlife Office in preparation for the first release of swans in 1987. Additional swans were added to this release group in 1985 from the zoo sources and for the first time, a private propagator.

The first of three egg collections in the Minto Flats area of Alaska took place in 1986. Fifty eggs were collected and transported to Minnesota for hatching and inclusion in the release program. One hundred more eggs were collected in 1987 and 1988 to add to the other sources of swans. Under a cooperative agreement, seven of the Alaska swans reared in 1987 and 1988 were transferred to the

Table 1. Summary of Trumpeter Swans acquired and reared in the MN DNR restoration project.

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
Eggs	8	12	0	4	52	50	50	0	0	176
Hatched	5	8	0	3	45	43	37	0	0	141
Cygnets Acquired	0	6	18	16	7	31	28	25	18	149
Total Swans	5	14	18	19	52	74	65	25	18	290

Wisconsin Department of Natural Resources for their newly established restoration project. Also in 1987, we began purchasing swans from the Delta Waterfowl Station in Manitoba.

In 1989, no eggs were collected as the project moved into the next phase of supplementing the flock with birds hatched at the other facilities and a new location, the Alaska Zoo. In 1990, the three zoos and the Kellogg Bird Sanctuary raised 18 cygnets for release in 1992. In 1991 and 1992, it is hoped that a minimum of 30 swans will be produced by the captive sources to add to the flock.

A total of 141 (80.1%) hatched of the 176 eggs acquired from 1982-88 (Table 1). Another 149 swans have been hatched at other facilities to date bringing the total number of swans having been through the project to 290. This includes swans that have been exchanged with or taken in, reared, and then returned to other programs.

Veterinary care for the project is obtained through the Raptor Center at the University of Minnesota. This involves routine health checks of captive swans and treatment of all birds as required. Several swans have been released following treatment. Necropsies are conducted through the Raptor Center to determine the cause of death where possible.

Mortalities in the captive flock have totalled 87 since the project began acquiring birds in 1982. The greatest number, 32 (36.8%), is due to predation, with 31 of those occurring in one incident in 1987 when a mink entered the brooder building. Other factors of mortality are; infection 14 (16.1%), accidental injury 10 (11.4%), lead poisoning 9 (10.3%), aspergillosis 8 (9.2%), physical defects 4 (4.6%), transport stress 1 (1.1 %), and undetermined 9 (10.3%).

The swans are held in captivity until they are released at the age of 23 months on selected lakes and marshes in northwestern Minnesota. At that time, the swans are matched with unrelated birds and released, usually one pair at each release site. They are marked with orange patagial tags with a black numeric code and U. S. Fish and Wildlife Service aluminum leg bands. The program has released 130 swans through 1990 with another 70 projected to be released by 1994 (Table 2).

The first swans were released in April 1987, soon after ice out to allow the swans time to imprint on the release site and their mate before molting their clipped wing feathers. However, during the second year conflicts began to occur when several returning swans attempted to establish territories and chase newly released swans from the release sites. In 1989, the release of new swans was delayed until early May to allow returning swans to set up territories. Adjustments in the release sites were made to avoid conflicts between the returning swans and the newly released birds.

Aerial surveys are done every 10-14 days from mid-April to mid-December in the release

Table 2. Summary of Trumpeter Swans releases in the MN DNR restoration project from 1987-94[a].

	1987	1988	1989	1990	1991[a]	1992[a]	1993[a]	1994[a]	TOTAL[a]
Swans Released	21	44	27	40	22	18	15	15	202
Wild Fledged	0	1	3	15	-	-	-	-	-

[a] 1991-94 projected

area. Ground checks are made to collect wing tag data. Released swans usually remain on their release lake until late September or early October.

The swans begin to explore a larger area as the smaller marshes begin to freeze. By early December, most of the swans are arriving at their wintering sites. Two aerated sites were provided in the release area during the fall in the first year of release. One site had a pair of wing-clipped swans as decoys. The released swans chose to migrate, and 11 of the 13 that migrated returned to the release area the following spring. It was determined that aeration was not necessary for the project.

Wintering sites and sightings have ranged from open river flowage just south of the release area to locations in Oklahoma, Missouri, Nebraska, Colorado, Iowa, Kansas, eastern Wisconsin, and the eastern Dakotas. Two swans may have followed Tundra Swans in an easterly migration. One wintered in Alexandria, Virginia, and migrated back to Minnesota last spring. It was last reported in central Iowa in mid-December. Another swan was reported in a flock of Tundra Swans at Saginaw Bay, Michigan, last spring. This bird had not been reported for 24 months after being released in the spring of 1987.

For the past three years, an average of 40% of the swans have returned to the release area after their first migration. As the swans establish pair bonds and migratory traditions, the return rate increases. Last year, 60% of the birds that migrated in 1989 returned to the release area. They usually do not return to their specific release site, but rather to the general area.

Tables 3 and 4 represent the status of released swans in the MN DNR project as of mid-November 1990. The data do not include the 1990 release group because they had not migrated at the time this was written.

Table 3 shows the survival status of the 1987-89 release groups. The number of swans released are in parentheses. The release group that has been in the wild the longest has the highest percentage of deaths and missing swans and the lowest percentage of birds known to be alive. The rate of known swan deaths decreased from 38% for the 1987 release group to 26% for the 1989 release group. The mean for all three groups is 34%.

Approximately one-third of the mortalities have been caused by unknown factors; one-third from lead poisoning; and one-third from causes such as power line and vehicle collisions, disease, and shootings. Five of the 130 swans that have been released are known to have been shot.

The rate of missing swans decreased from 38% for swans released in 1987 to 22% for the 1989 release group. The mean for all three groups is 27%. The project staff is somewhat encouraged by a few sightings of birds from this group after a considerable length of time. A Saginaw, Michigan sighting occurred after a 24 month period with no reports of the bird, and a March 1990 sighting in central Nebraska was reported where the bird not been seen for 17 months. A few sightings of swans have

Table 3. Summary of the status of MN DNR swans released 1987-89 as of November 1990.

Release Group Year	N	Dead %	Dead N	Missing %	Missing N	Total Known Survival %	Total Known Survival N
1987	21	38%	8	38%	8	24%	5
1988	44	36%	16	25%	11	39%	17
1989	27	26%	7	22%	6	52%	14
1987-89 Combined	92	34%	31	27%	25	39%	36

been reported that had not been seen for approximately 12 months. However, even though these individuals have been sighted, they may not be participating in the functions of the released populations. This is the case for birds like the Saginaw, Michigan sighting.

The percentage of swans that have been sighted in the last month increased from 24% for the birds 1987 group to 52% for the 1989 release group. The mean rate for all released swans is 39% or 36 of the 92 swans that were released from 1987-89.

This group of 36 is described in Table 4 showing activity status of known surviving swans. The second column is the number of swans known to be alive as of mid-November 1990. These individuals may be breeding, and may have surviving young; or they may be paired and on a territory, but not nesting; or they may be unpaired.

The totals include the swans from the release group plus any surviving offspring. There are 16 surviving young from pairs that have involved 11 different swans. Fifteen of the 16 were produced in 1990. There are 13 additional swans that are paired with other DNR released or Hennepin Park swans or with swans of unknown origin. Eleven swans may be unpaired in a flock or lone birds.

A total of 52 swans from these groups and 35 surviving of 38 released in 1990 bring the total number of known swans being monitored in the release area to 87 prior to the fall migration. Some individuals nest and successfully raise young at three years of age. In 1988, two pairs nested with only one of four cygnets fledging. In 1989, five pairs nested, three of the nests were successful and hatched 10 cygnets, but only three of the cygnets fledged. In 1990, eight pairs nested, and six

Table 4. Status summary of total known survival group of MN DNR released swans.

Release Group Year	N	Unpaired	On Territory	Nesting	Cygnets Produced	Total
1987	5	0	2	3	7	12
1988	17	5	5	7	6	23
1989	14	6	6	2	3	17
Totals	36	11	13	12	16	52

nests were successful and known to produce 17 cygnets. Fifteen (88.2%) of the 17 cygnets that hatched, fledged.

Nine additional pairs that appeared to be bonded but did not nest were observed in the release area during the summer and fall. The 11 unpaired swans from the 1987-89 releases and the possibility of some breeding birds coming from the 35 swans from the 1990 release gives us the potential of reaching our goal of 15 pairs in 1991.

The population will continue to be monitored to track the progress of the released swans and determine future project needs. It is hoped that the production of the wild pairs will continue to increase and the need for releasing captive reared swans will not be necessary beyond 1994.

SURVIVAL OF HAND-REARED AND PARENT-REARED TRUMPETER SWANS, CYGNUS BUCCINATOR, IN THE MINNESOTA DEPARTMENT OF NATURAL RESOURCES RESTORATION PROJECT

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The goal of the Minnesota Department of Natural Resources (MN DNR) Trumpeter Swan Reintroduction Program is to establish a free-flying, migratory, breeding population of Trumpeter Swans in Minnesota.

Trumpeter Swan cygnets are hatched and reared in captivity. The primary sources are as follows: eggs collected from Alaska by the MN DNR which are hatched and reared at their facility at Carlos Avery Refuge; swans hatched and reared at the Minnesota Zoo; swans hatched and reared from the Hennepin Parks flock; cygnets hatched and reared at the Brookfield Zoo, Chicago; Delta Waterfowl Station, Manitoba; and by Mr. Vance Grannis, Minnesota. Brookfield, Delta and Grannis birds are maintained at Carlos Avery until release. See Table 1 for a detailed list.

Table 1. Sources of Trumpeter Swans released by the Minnesota Dept. of Natural Resources restoration program (1986-90).

SOURCE	# SWANS RELEASED
Alaska/MN DNR	48
Minnesota Zoo	44
Hennepin Parks	15
Brookfield Zoo	16
Delta Waterfowl Station	5
Private/Grannis	2
TOTAL	130

The swans are released in pairs at 22 to 23 months of age into marshes on and near the Tamarac National Wildlife Refuge in northwestern Minnesota in Becker County near the town of Detroit Lakes.

The released birds are marked with U. S. Fish and Wildlife Service bands and orange patagial tags so they can be identified from a distance. The birds are monitored by MN DNR staff and through sightings by private individuals.

One of the major concerns in any restoration project is how well the individuals being released will adapt to their new surroundings. There has been considerable debate on the ability of captive reared birds, especially hand-reared birds, to adapt and survive in the wild, and, therefore, the appropriateness of using these birds in a restoration program. There is very little data available on this subject to date. All of the Trumpeter Swans in the MN DNR project are captive reared in close proximity to humans, therefore their survival may indicate how well birds reared under similar conditions will do.

The MN DNR has released 130 swans into the wild since 1987. The number of parent- and hand-reared and their fate is listed in Table 2.

A Chi-square test on the known parent- and hand-reared birds (N=126) found no significant statistical difference (P=.4975) between their rates of survival. Since there was no significant difference, data for these two groups were pooled to examine the overall survival of the released birds.

Table 2. Survival of parent- and hand-reared birds 1987 to 1990, Minnesota Dept. of Natural Resources Trumpeter Swan restoration program.

REARING METHOD	DEAD		MISSING		PERMANENT CAPTIVE		STAY ALIVE FREE-FLIGHT		TOTAL	
	N	%	N	%	N	%	N	%	N	%
Parent	13	20	13	20	2	3	38	57	66	51
Hand	15	25	11	18	0	0	34	57	60	46
Unknown	2	50	0	0	1	25	1	25	4	3
TOTAL	30	23	24	19	3	2	73	56	130	100

We were unable to locate any published survival curves, using known age birds, for comparison with the survival rate of the MN DNR Trumpeter Swans. Therefore, for comparison, we extrapolated information on annual swan mortality in Wyoming from Table 7 in Lockman et al. (1987). This is a very rough approximation of a survival curve and is only being used to provide some idea how the MN DNR birds are doing in comparison to wild free-flying swans. The comparison is presented in Table 3 and Figure 1.

At 66 months of age the survival of the MN DNR restoration swans (23.8%) is very similar to the survival of the Wyoming swans (24.4%). The Trumpeter Swan population in Wyoming remained stable during the period the data were collected.

Although the annual rate of survival is different, the long term survival of the MN DNR swans is similar to that of Wyoming swans. The mortality levels of the MN DNR swans also compare well with mortality levels for wild birds. First year mortality in wild birds is 80 to 90% for some species, and annual mortality of adult Canada geese has been estimated at 16% (Welty 1982).

An examination of swan survival in relation to the institution where they were reared (Table 4), seems to indicate there may be some differences in survival. A closer examination reveals the differences are related to the year of release (Grannis and Delta birds were more recently released [1990]) and the area of release. Heavy lead levels at specific release sites caused heavy mortality on the birds released there (Brookfield birds).

When these factors are taken into account, no difference in survival was detected between institutions. This is not surprising as the birds were all maintained under similar conditions at the Minnesota Zoo or by the MN DNR for all but the first three months of their life prior to release.

The behavior of the swans after release is difficult to evaluate, especially with the small sample size available. A few subjective comments can be made based on the observations of the birds by Peggy Hines. They are presented to generate further discussion and to provide others releasing birds with information about possible patterns that are emerging.

1. There is no observable behavioral difference between the captive, hand- and parent-reared swans.

2. The swans appear to be very adaptable and their behavior is constantly being adjusted to deal with the problems they encounter.

3. There is annual and seasonal variation in the swans' behavior toward humans. Swans seem to become more wary with age and are more tame in the winter than during the breeding season.

Table 3. MN DNR restoration / Wyoming Trumpeter Swan survival comparisons.

MN DNR Restoration Project 1987-90		AGE IN MONTHS	Wyoming 1982-86	
N	% SURVIVAL		% SURVIVAL	N
		Hatch	100.0	
		12	44.0	72
130	100.0	22		
		24	29.5	12
38	94.7	30		
		36		
27	51.8	42		
		48	27.4	43
44	40.9	54		
		60		
21	23.8	66		
		72	24.4	30

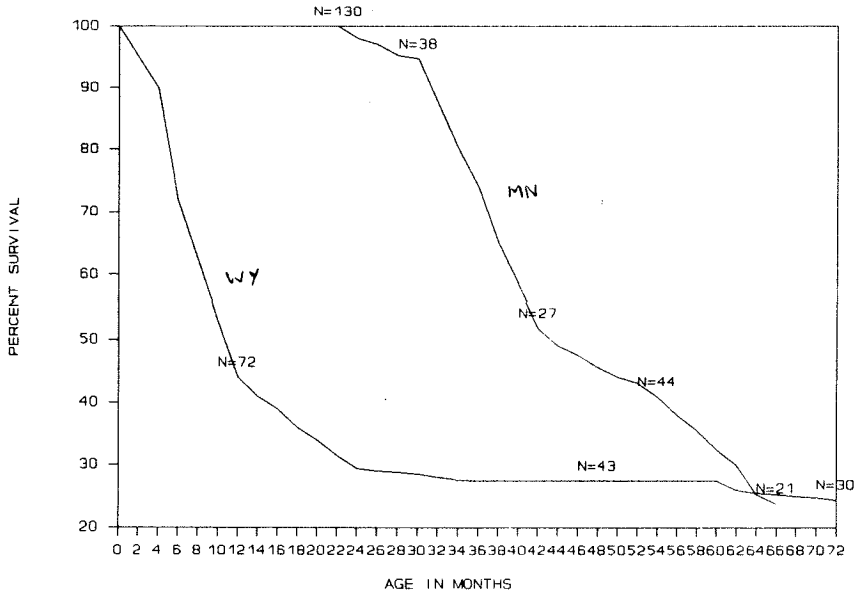

Figure 1. MN DNR restoration/Wyoming Trumpeter Swan survival comparison.

4. The pairing of tame swans with wary swans in the hope of increasing the wariness of the tame swan often may be ineffective. Tame swans have been

Table 4. Survival by institution, Spring 1987 to Fall 1990, MN DNR Trumpeter Swan restoration program.

INSTITUTION	ALIVE N	ALIVE %	DEAD/MISSING/ PERMANENT CAPTIVE N	DEAD/MISSING/ PERMANENT CAPTIVE %	TOTAL N
Minnesota Zoo	26	59	18	41	44
Brookfield Zoo	6	38	10	62	16
Hennepin Parks	6	40	9	60	15
Alaska/MN DNR	29	60	19	40	48
Delta Waterfowl Station	4	80	1	20	5
Private/Grannis	2	100	0	0	2
Total	73	56	57	44	130

observed approaching humans with the wary swan following close behind.

5. Release site can play a major role in the behavior of the swan. The sites that are more isolated from humans may help captive reared swans become less tame. Sites close to human activity may encourage tameness as humans attempt to coerce the birds to get them closer.

An evaluation of the reproductive success of the restoration swans provides us with an indication of how the release birds are doing in the wild. Only the birds released from 1987-89 (N=92) were considered in this analysis as they were the only birds of breeding age in 1990. Twenty-two of the 39 known surviving, breeding age birds attempted to hatch eggs (Table 5).

Hand-reared birds breed at a slightly higher rate than expected, but the Chi-square test is not significant (P=0.4173).

Seven of 13 hand-reared swans (54%) began breeding at three years of age as compared to one of nine parent-reared swans (11%). At four years of age, four of 13 hand-reared swans (31%) bred for the first time as compared to five of nine (56%) parent-reared swans. Success rate for the first nesting attempt appears to increase with age (Table 6).

What can we conclude from the above information?

1. There is no difference in survival rates of the hand- and parent-reared swans.

2. Survival of the captive reared restoration swans appears to be similar to that of wild free-flying swans.

3. Behavior of captive, parent- and hand-reared birds does not appear to be different.

4. Swans are adaptable and their behavior varies seasonally and individually.

5. Release site may have an effect on a swan's potential ability to survive and adapt.

6. Hand-reared birds are equally as successful reproductively as parent-reared birds and may begin breeding a year earlier than parent-reared swans.

The above conclusions are based on a small sample size. They are presented here to provide those involved in swan restorations with a base of information to build on and, above all, to stimulate further discussion.

Table 5. MN DNR Restoration Swans reaching breeding age.

REARING METHOD	REPRODUCTIVE N	%	NON-REPRODUCTIVE N	%	TOTAL N	%
Hand	13	62	8	38	21	54
Parent	9	56	7	44	16	41
Unknown	0	0	2	100	2	5
Total	22	56	17	44	39	100

Table 6. Breeding age and first time breeding success of MN DNR restoration swans.

AGE (yrs)	REARING METHOD (No. of birds) Hand	Parent	SUCCESSFUL FIRST TIME BREEDERS N (%)
3	7	1	5 (62.5)
4	4	5	6 (66.6)
5	2	2	4 (100.0)
6	0	1	1 (100.0)
TOTAL	13	9	

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ONTARIO TRUMPETER SWAN RESTORATION PROGRAM PROGRESS REPORT - 1990

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ABSTRACT

THE TRUMPETER SWAN RESTORATION PROGRAM, UNDER THE SPONSORSHIP OF THE ONTARIO FEDERATION OF ANGLERS AND HUNTERS, HAD A VERY SUCCESSFUL YEAR IN 1990. A TOTAL OF 10 TRUMPETER CYGNETS WAS RAISED BY COOPERATORS AND THREE BY WILD MUTE SWANS ACTING AS FOSTER PARENTS. IN THE PREVIOUS EIGHT YEARS ONLY SEVEN CAPTIVE RAISED CYGNETS WERE RELEASED, ALL IN 1988. THE PREVIOUS BEST YEAR FOR FOSTER RAISED CYGNETS WAS 1986, WHEN FOUR REACHED FLYING STAGE. ONLY 11 HAD FLEDGED SINCE 1982 WHEN THE PROJECT STARTED. FOR THE FIRST TIME CAPTIVE TRUMPETER SWAN EGG PRODUCTION EXCEEDED THE 50 CALLED FOR IN THE PLAN. THE AVERAGE NUMBER OF EGGS USED IN ALL PREVIOUS YEARS WAS 14, AND THE BEST YEAR WAS 1987 WHEN 31 WERE USED. IN 1990 WE HAD 70 EGGS, 30 OF WHICH WERE FOSTERED UNDER MUTE SWANS AND 40 WERE LEFT TO BE INCUBATED BY THE PARENT TRUMPETERS. THIS RESTORATION PROJECT HAS RESULTED IN A COUNT OF EIGHT TRUMPETER SWANS FOUND BY THE TORONTO ORNITHOLOGICAL CLUB ON THE WINTER WATERFOWL INVENTORY ON 6 JANUARY 1991. AN ADDITIONAL FOUR TRUMPETERS WERE REPORTED BY VARIOUS COOPERATORS AT LOCATIONS INLAND FROM LAKE ONTARIO. THERE ARE NOW 12 WILD TRUMPETERS IN SOUTHERN ONTARIO, AND FOUR MORE AWAIT RELEASE AFTER ICE BREAKUP.

INTRODUCTION

The Trumpeter Swan restoration program has been operating now for nine years, and it is time for an assessment. This period has been divided into two phases. Phase I ran from 1982 to 1984 and used three-quarter incubated eggs shipped from Grand Prairie, Alberta. All were incubated under feral Mute Swans. An average of seven eggs per year were available. Phase II ran from 1985 to 1990, and used only fresh eggs laid by captive Trumpeter pairs for foster raising under Mute Swans. An average of 14 eggs per year were available.

RESULTS AND DISCUSSION

Hatchability

It is well known that three-quarter incubated waterfowl eggs travel well. Since only eggs with developing embryos were shipped from Grand Prairie, it is not surprising that 17 of 20 (85%) hatched in Phase I.

In Phase II, fresh eggs were stored and transported to Mute Swan nests. Of 109 eggs set, 94 (86%) reached full term. The missing 15 eggs were stolen or taken by predators. These 94 eggs produced 35 cygnets, for a 37% hatch rate. This is lower than the normal 45 to 90% performance for wild Trumpeters. We have tried to simulate natural conditions in storage of eggs. Pairs lay their eggs early in the spring in damp nests, and they seldom experience temperatures more than one or two degrees above freezing. The poultry industry follows the practice of storing eggs in a cool place point down, or on their sides, in which case they are turned daily. We stored eggs in a refrigerator using the same procedures.

For shipment, the industry packs eggs point down in flats. We have made suitable compartments to hold Trumpeter Swan eggs point down in a large cooler or box. The very large swan eggs may need handling that differs from that which is successful for domestic geese or ducks. Techniques will be changed to see if we can improve hatchability in 1991.

Cygnet survival to flight stage

Of all the eggs incubated by Mute Swans in Phases I and II, 53 (49%) hatched and 14 (26%) survived to fly. Fledging rates for wild Trumpeters vary widely from 24% in Yellowstone National Park, Wyoming, in 1977 and 1978, to 49-87% (mean = 70% for 22 years) on Kenai National Moose Range, Alaska, to 17-70% (mean = 45% for six years) on the Targhee National Forest, Idaho. While the survival rate in Ontario is not good, it is adequate.

Ontario cygnets are preyed upon by Snapping Turtles which are not present in the locations mentioned above. Lacreek National Wildlife Refuge, South Dakota, has Snapping Turtles, and fledging rates there averaged 63%, and ranged from 36 to 100% (14 years). These cygnets are raised by their own parents which may have adaptations for coping with Snapping Turtles which are lacking in non-native Mute Swan foster parents.

Much may depend on the marsh chosen for foster raising Trumpeters. Cranberry Marsh was originally chosen because of the abundance of submerged aquatic weeds, the absence of Carp, and its obvious superior quality. This marsh deteriorated so much in quality by 1987 that it could not be used in subsequent years, and fostering was switched to seven other marshes. In only one of these, Frenchmens Bay, did cygnets fledge successfully. In 1990, three out of the four cygnets hatched there were raised. In that marsh, and others not yet used for fostering Trumpeters, Mute Swans have successfully raised their own cygnets in recent years.

The number of eggs used per year, and the fate of eggs and cygnets are presented in Table 1.

Survival of cygnets after fledging

The survival of Trumpeter Swans in the Grand Prairie, Alberta flock was estimated from observations of marked birds and through trapping. By following Ontario Trumpeters marked with patagial tags it has been possible to estimate survival and make comparisons.

All Grand Prairie Trumpeters must migrate approximately 1400 km to reach the Tristate wintering grounds on Henrys Fork of the Snake River. Most of the Ontario Trumpeters remain year round on Lake Ontario. One consequence of this is the apparent higher survival over their first year of life (Table 2). Sample sizes are extremely small, however the rest of the data suggest that Ontario Trumpeters survive as well as those at Grand Prairie.

Experience with patagial tags on Mute Swans suggests that they do not last much longer than four years. Trumpeter number 27, seen on 1 May 1990, (in his fifth year), had lost one of his tags. He had lost both of his patagial tags by January 1991. This factor must be taken into account when estimating survival.

Trumpeter Swan cygnets raised by their own parents

From 1984 to 1986 there was only one pair of mature Trumpeters in the program. In 1987 two captive pairs bred. In 1988, although three pairs were available, only one pair bred. In 1989, of four pairs, just one produced eggs. In 1990 three of the five pairs possessed by the project nested. Their performance is summarized in Table 3. Results of eggs hatched in incubators is presented in Table 4.

Failure to breed has been due to moving pairs into new homes or loss of a mate and failure to form a bond with a new mate in time to breed.

In addition to the pairs possessed by the restoration program, avicultural cooperators have contributed cygnets for release. In 1988 one cooperator gave five cygnets, and in 1990 five owners of breeding pairs gave 11 cygnets which they had raised.

Overall success was 42 eggs incubated to full term of which 24 (57%) hatched. Of these 18 (75%) reached flight stage.

Incubator hatched and brooder raised cygnets

In 1982 and 1990 Trumpeter eggs were hatched in incubators and raised in brooders as breeding stock. Of 25 eggs, 18 (72%) hatched and of these cygnets 12 (67%) fledged. These

Table 1. Fate of eggs and cygnets from Trumpeter Swans fostered by Mute Swans in Ontario from 1982 through 1990.

	PHASE I			PHASE II					
	1982	1983	1984	1985	1986	1987	1988	1989	1990
EGGS									
No. used	2	6	12	7	17	31	12	12	30
No. stolen	0	0	0	0	0	4	4	0	0
No. predated	0	0	0	3	0	0	4	0	0
No. to full term	2	6	12	4	17	27	4	12	30
No. failed to hatch	1	0	2	1	5	16	1	12	21
No. hatched	1	6	10	3	12[a]	11	3	0	9
% full term eggs hatched	50	100	83	75	71	41	75	0	30
Mean percent hatched		-- 85 --				-- 40 --			
CYGNETS									
Died on nest	0	0	2	0	5[b]	0	0	0	4
Disappeared/accidents	0	4	6	3	3	9	3	-	2
Retrapped	0	0	0	0	0	1	0	-	0
Fledged	2[b]	2	2	0	5	1	0	-	3
Percent fledged	100	33	20	0	42	9	0	-	33
Mean percent fledged		-- 33 --				-- 23 --			

[a] Two with deformed feet
[b] One incubator-hatched cygnet placed in nest

Table 2. Survival rate of Trumpeter Swan cygnets fostered under Mute Swans in Ontario compared with that of cygnets raised by their own parents at Grand Prairie, Alberta. Anniversary date is 1 September.

Age	Number Entering Period	Number Surviving Period	Percent Ontario Survival	Percent Grand Prairie survival
Year 1 1/4	11	7	64	43
Year 2	7	5	71	71
Year 3	5	4	80	80
Year 4	4	3	75	50

Table 3. Reproductive performance of captive Trumpeter Swan pairs in Ontario's restoration project.

	1987	1988	1989	1990	MEAN
EGGS					
No. used	3	7	0	42	
No. flooded/destroyed	0	0	-	7	
No. failed to hatch	1	1	-	19	
No. hatched	2	6	-	16	
Percent hatched	67	86	-	38	46
CYGNETS					
No. disappeared	0	1	-	3	
No. dead on nest	0	0	-	2	
No. fledged	2	5	-	11	
Percent fledged	100	83	-	69	75

Table 4. Fate of eggs and cygnets hatched from incubators and raised in brooders for Ontario's Trumpeter Swan restoration project.

	1982	1990	MEAN
EGGS			
No. used	14	11	12.5
No. failed to hatch	4	3	3.5
No. hatched	10	8	9.0
Percent hatched	71	73	72
CYGNETS			
No. disappeared	1	4	2.5
No. dead on nest	1	0	0.5
No. fledged	8	4	6.0
Percent fledged	80	50	67

data are summarized in Table 4.

ACKNOWLEDGEMENTS

Many have helped with the Trumpeter Swan program in 1990. Harold Boyer in his Cessna flew a survey of Mute Swan nests on 1 May. Judy Griffiths, Bob Sharp and Daviel Medeiros fed and kept an eye on cygnets hatched by Mute Swans. Bill Carrick, Ted Boote and John Brouwer joined the project in 1990 and gave eggs and cygnets for release. Bob Whittam, Don Foxall and Mary Cameron at the Wye Marsh Wildlife Center hatched the first brood of Trumpeters in perhaps 300 years in Wye Marsh and cared for cygnets for release. Harold Hadley, Peter Calverly, Gerald Donnelly, John Gartshore, Gill Henderson and Harry Lumsden cared for breeding pairs, three of which laid 30 eggs for fostering and produced cygnets for release. Mr. H. A. Hornung, the Central Lake Ontario, Metro and Region, and Credit Valley Conservation Authorities, the Royal Botanical Gardens at Hamilton, the town of Oakville and Metro Toronto Parks Department gave permission to operate in their marshes.

STATUS REPORT OF THE LACREEK TRUMPETER SWAN FLOCK FOR 1990

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ABSTRACT

A TOTAL OF 225 TRUMPETER SWANS, INCLUDING 61 CYGNETS, RETURNED TO LACREEK NATIONAL WILDLIFE REFUGE (NWR) FOLLOWING THE 1990 BREEDING SEASON. THE 1989 AND 1990 PRODUCTION FIGURES ARE DOWN 29 PER CENT FROM 1987, BUT MORE IN LINE WITH RECENT PRODUCTION, WHILE THE 1989 PEAK POPULATION OF 282 WAS AN ALL TIME HIGH. A HARD FREEZE WITH TEMPERATURES DOWN TO -35°F FOR SEVERAL DAYS FROZE OPEN WATER ON THE REFUGE ON 29-30 DECEMBER 1990. TEN SWANS DIED OF EXPOSURE. EMERGENCY RELEASES OF WATER WERE PROVIDED TO OPEN SOME WATER.

THE 1990 AERIAL PRODUCTION SURVEY WAS CONDUCTED DURING AUGUST AND SEPTEMBER. A TOTAL OF 195 TRUMPETER SWANS WAS OBSERVED INCLUDING 41 NESTING PAIRS, 22 BROODS WITH 68 CYGNETS, AND 45 NON-BREEDERS IN SEVEN FLOCKS. FIVE SWAN PAIRS NESTED ON THE REFUGE, WITH FOUR PAIRS HATCHING EGGS. OUT OF 18 CYGNETS HATCHED ON THE REFUGE, ONLY EIGHT SURVIVED TO FLIGHT. IN 1990, ONE REFUGE PAIR HATCHED FOUR CYGNETS ON 14 JUNE AND FLEDGED THEM ON 21 SEPTEMBER, 99 DAYS LATER. THE 100 DAY HATCH/FLEDGE TIME SCHEDULE REMAINS CONSISTENT. TRUMPETER SWAN 43RA (AHY M)[1], OBSERVED NEAR RUSSELLVILLE, ARKANSAS, IN JANUARY 1988, WAS OBSERVED BACK AT LACREEK NWR IN DECEMBER 1989. ANOTHER TRUMPETER, 36FA (AHY M)[1] BANDED ON LACREEK NWR IN 1988, WAS OBSERVED ON THE UPPER PENINSULA OF MICHIGAN DURING THE SUMMER OF 1990 AND IN MINNESOTA IN JANUARY 1991.

POPULATION REPORT

A total of 225 Trumpeter Swans, including 61 cygnets, returned to Lacreek National Wildlife Refuge (NWR) following the 1990 breeding season. This compares to 282 Trumpeters (61 cygnets) in 1989, 268 Trumpeters (86 cygnets) in 1987, and 229 Trumpeters (63 cygnets) in 1986 (Table 1). The 1990 production is the same as 1989, but 1990 showed a 20 per cent decrease in total swans. The 1989 and 1990 production figures are down 29 per cent from 1987, but more in line with recent production, while the 1989 peak population of 282 was an all time high. The majority of the 1989/90 wintering Trumpeter Swan flock dispersed in February with only about 15 birds remaining on the refuge for the summer.

Fall Trumpeter Swan numbers began building on 7 November 1990 with the onset of cold weather when 34 Trumpeter Swans moved into the refuge. The weather warmed up again and the swans left the refuge for open ponds in the Sandhills. On 26 and 27 November, we experienced another cold snap and 60 swans were counted on the 26th, 79 (55 adults/24 cygnets) on the 27th, and 127 on the 28th. The 1990 peak population was 225 on 4 December. An aerial survey on 9 December revealed 215 swans (39 cygnets) on the refuge, 216 on 24 December and 157 on 30 December.

One swan (collar # 43FA, banded at Lacreek in 1990) was found dead in Pool 5 on 22 December. A hard freeze with temperatures down to -35°F for several days froze the open water in Pool 5 below the Pool 8 water control

[1] USFWS Bird Banding Manual code for a bird banded "After Hatching Year, Male." The Editors

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

Breeding Season	Adults	Cygnets	Total
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
1980	140	56	196
1979	119	65	184
1978	138	36	174
1977	126	65	191
1976	146	41	187

structure on 29-30 December, and ten more swans died of exposure. Nine carcasses were frozen into the ice and later scavenged by coyotes and eagles, and one died with large ice balls frozen on the wings, tail, and collar. Three of the ten dead swans were banded and had collars (71RA banded 1987, 74RA banded 1989, and 77RA banded 1990; all at Clubhouse Lake, Nebraska). Two severely iced up swans (45FA & 60RA) were caught by hand and placed in a heated building for two days. One swan had an ice ball close to ten lbs frozen on its tail, and the other had at least five lbs of ice frozen onto the collar plus significant ice on the wings and tail. Breaking the ice ball off the collar with an ax provided some tense moments for us as well as the swan. Both swans recovered with significant vigor and were released.

Emergency releases of water from Pool 7 provided some open water on the south end of Pool 5 and the swans were flying up to the feeders in Pool 5 during the middle of the day to feed. The fate of a few weakened swans is still in doubt.

A few swans were observed feeding in winter wheat fields in January 1991. This is unusual behavior and has only been observed a few times over the last 12 years. One cygnet flying east of the wheat fields over the refuge was apparently taken out of the air by several Bald Eagles on 10 January 1991 and consumed. The attack was not observed, but swans have never been seen on the ground in the vicinity of the carcass, and no swan tracks were found in the snow, only eagle tracks and numerous wing marks. If the swan had spent any time on the ground prior to the attack, foot prints would have been visible in the snow. The swan was attacked and consumed so quickly that rigor mortis had not yet stiffened the remaining foot and wing joints, and the eyes were still bright and clear, even though virtually all the flesh was gone.

PRODUCTION REPORT

The 1990 aerial production survey was conducted 12, 21, 22, 23 August, and 1 and 2 September. The survey included Bennett, Todd, Shannon, Pennington, Jackson, Mellette, and Perkins Counties in South Dakota; Cherry, Sheridan, Garden, Grant, McPherson, and Arthur Counties in Nebraska; and Crook County in Wyoming. Report cards were received advising of pairs with broods on Dog Ear Lake, Tripp County, South Dakota, and Long Lake, Rock County, Nebraska. A total

of 195 Trumpeter Swans was observed including 41 nesting pairs, 22 broods with 68 cygnets, and 45 non-breeders in seven flocks. The total number of adults, including flocked subadults and young unproductive pairs, decreased 16% from 1989, but remains 2% above the previous high in 1987. Flocked bird numbers remained about the same while nesting pairs without broods (primarily first time or inexperienced nesters) declined 10%, pairs with broods declined 27%, and production declined 14% (Table 2). The breeding season data revealed 164 adults with 61 cygnets on the refuge in December 1990. The decrease in breeding pairs and production can not be explained since unpaired swans numbers remained constant. Perhaps pairs have a greater inclination to pioneer than single birds in flocks and these losses are the result of migration attempts. Nevertheless, the declines are considered normal population fluctuations, as the high plains Trumpeter Swan flock continues to expand. Increased sightings over the past several years indicate that some pioneering is occurring and places a greater demand on the wildlife profession to find suitable wintering areas.

John Smith, Missouri Department of Natural Resources, reported that the original pair of Trumpeter Swans (82TY & 98TY) transplanted to Mingo NWR in 1982, successfully raised one cygnet to flight stage in 1988 and 1989, respectively, but no cygnets were observed in 1990. Dense vegetation on Mingo interferes with observations during the summer; however, four adults were observed on Mingo NWR in 1990. Another adult Trumpeter was observed on Lake Wappapello near Poplar Bluff, Missouri. It was believed to be a release from the Kansas City Zoo. Smith also reported that two adult Trumpeters were killed on the Duck Creek Wildlife Area in November 1990.

REFUGE PRODUCTION

Five pairs of swans nested on the refuge in 1990 on Pools 2, 6, 7, and 11. The first Trumpeter Swan brood was observed in Pool 2 on 7 June with seven cygnets, but lost two by the end of June. The swan pair in Pool 7 hatched five cygnets out of a clutch of seven eggs on 11 June, but lost all but one by the end of the month. The swan pair nesting in the north end of Pool 6 was first observed with two cygnets and one gosling on 11 June, but lost one cygnet and the gosling after one week. The swan pair in Pool 11 hatched four cygnets approximately 14 June. The pair nesting on the south end of Pool 6 failed to hatch their eggs. In summary, five swan pairs nested on the refuge, with four pairs hatching eggs. By the end of the summer the Pool 2 pair moved to Pool 7 and fledged three cygnets, the Pool 7 pair lost all their cygnets, the north Pool 6 pair fledged one, and the Pool 11 pair moved to

Table 2. Breeding performance of Nebraska and South Dakota Trumpeter Swans.

Year	# Adults	# Pairs	# Broods	# Cygnets	Total
1990	127	41	22	68	195
1989	152	51	30	79	231
1988		----------	No Data	----------	
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		----------	No Data	----------	
1982		----------	No Data	----------	
1981	104	30	16	54	158
1980	120	28	18	44	164

Pool 9A and fledged all of their four cygnets. Experience counts! In total, out of 18 cygnets hatched in spring 1990, only eight survived to flight (Table 3).

First flights normally occur the last two weeks in September. With hatching occurring between 1-15 June, the hatch/fledge time is estimated at 100 days. A review of our old records produced only one instance where a recorded hatch date could be directly tied to a recorded first flight date for a specific brood. That brood hatched 2 June, and fledged 9 September, 99 days later. In 1990, the Pool 11 pair hatched four cygnets on 14 June and fledged them on 21 September, 99 days later. In 1989, the pair on north end of Pool 6 hatched three cygnets on 23 May and they fledged on 31 August, 101 days after hatching. The 100 day hatch to fledge time schedule remains consistent.

MIGRATION ATTEMPTS

One of the earliest indications of winter migration of the Lacreek flock was a rapid decline by ten birds in December 1976. The season peak of 159 Trumpeters occurred 12 November 1976, but the population dropped to 149 by mid-December with no obvious mortality. The first conclusive evidence of a winter migration was the discovery of a banded adult pen with two cygnets found dead at the Thomas Hill Reservoir near Macon, Missouri, in December 1978.

The Missouri transplant program began in 1982 and ended in 1987. Thirty-five swans were transferred to Missouri during that time in an attempt to establish a winter migration. Of the thirty-five swans transferred to Missouri between 1982 and 1987, only four adults were observed in 1990, and only one swan (20RA, AHY F[1]) returned to Lacreek NWR.

Severe cold in 1983 forced over 100 Trumpeters to leave Lacreek NWR in December. No evidence of major mortality was found, indicating that most of these birds migrated somewhere. Further evidence of winter pioneering, probably resulting from the severe cold, is demonstrated by the following observations: On 20 and 28 December 1983, six unmarked adults and five cygnets, and eight unmarked adults and five cygnets, were observed near Dumas, Arkansas, and Ada, Oklahoma, respectively. Other unmarked Trumpeters were reported near Perry, Oklahoma, on 6 January 1984; Cedar Bluff, Kansas, on 26 November 1985; Emporia, Kansas, on 12 December 1985; and one cygnet with five adults near Mangum, Oklahoma, on 8 February 1986. The 1986 Status Report speculated that the reduced 1985 winter peak of 187 may have been the result of the small southern migration that began in 1983 when severe cold forced some birds south. Even though the 1986 winter peak of 229 brought the Lacreek winter population back to normal, the minor migration may indeed have continued. Following the mid-winter peak of 268 for the 1987 breeding season that occurred on 4 January 1988, the Lacreek population declined sharply to 192 on 20 January 1988. This rapid loss of an estimated 76 birds indicates that some migration must have occurred. That number of birds could not have died without some evidence. An aerial survey of the surrounding swan wintering habitat failed to find any of the missing birds. Four collared swans were among the missing (15FA, 25FA, 26FA, 27FA). Swan 15FA (originally banded 53TY in 1973) and 27FA have not been seen since December 1987. Swan 25FA was seen again January 1988 and 26FA was observed December 1988 and February 1990 on Lacreek NWR; however, on the last sighting of 26FA, the collar had been lost and only the yellow leg band remains. The Arkansas Audubon Society reported additional unmarked Trumpeters in January 1991. These may be Lacreek birds, because most Minnesota swans are marked. Three cygnets were observed near Heber Springs, Cleburne County, Arkansas, on 8 January 1991, and one adult and three cygnets were observed near Conway, Faulkner County, Arkansas.

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[1] USFWS Bird Banding Manual code for a bird banded "After Hatching Year, Female." The Editors

Table 3. Production data for Trumpeter Swans on Lacreek NWR.

Year	Nesting Pairs	Broods	Hatched	Fledged
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
1982[a]	7	3	9	4
1981	5	3	12	6
1980	6	4	11	6
1979	5	5	14	5
1978	6	5	17	12
1977	5	4	15	14
1976	5	5	11	6

[a] Includes one pair with three fledged cygnets transferred to Missouri and the removal of 8 eggs for Minnesota.

Additional confirmed evidence of southern winter migration attempts from Lacreek was obtained when Trumpeter Swan 43RA (banded on Clubhouse Lake, Cherry County, Nebraska, 12 miles south of the refuge during the summer of 1987) was observed 18-24 January 1988 on Lake Dardanelle, near Russellville, Arkansas, and another Trumpeter, 20RA transferred via aircraft to Mingo NWR in 1986, returned to the vicinity of Lacreek in July 1986, and has been seen several times on Lacreek NWR with the last observation at the close of 1990. Another Trumpeter, 36FA (AHY M) banded on Lacreek NWR in 1988, spent the summer of 1990 on the upper peninsula of Michigan at Tee Lake near Blaney Park and was observed again during the first part of January 1991 at the confluence of the Chippewa and Mississippi rivers near Wabasha, Minnesota.

Banding and collaring of subadults and adults will continue in the vicinity of the refuge to provide an increasing pool of marked birds to aide in positive observations. Nine Trumpeters were banded in South Dakota and five in Nebraska in 1990, but more needs to be done. There is no doubt that considerable winter pioneering and some migration is taking place, but the loss of birds, though undocumented, must be significant. We restored these magnificent birds to their former breeding ranges without adequate consideration for their winter survival. It is now incumbent upon us to find suitable wintering habitat and assist this species to find it.


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UPDATE ON THE PACIFIC COAST POPULATION SWAN MANAGEMENT PLAN

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In the spring of 1990 the Pacific Coast and Rocky Mountain Trumpeter Swan Technical Subcommittees met in Boise, Idaho, to discuss revisions of the current North American Plan. The following is a brief summary of the significant management decisions and directions that came out of that meeting and were later endorsed by the full technical committee.

One of the major discussion items focused on placing a greater emphasis on evaluating objectives for the Pacific Coast Population (PCP). The potential for expansion appears to be increasing for Trumpeters on Alaskan breeding grounds. In 1990, observation counts show total Trumpeter Swans on Alaskan breeding grounds at more than 13,000 birds. Counts in 1980 showed a total of about 7,700 birds. Also, it is the general consensus that the population will continue to expand its winter range. For example, in Oregon and Washington the number of wintering swans has increased over the past decade and is best documented in Washington. Over the last decade, wintering Trumpeters in Washington have nearly doubled with over 1,300 birds recorded this winter.

Therefore, the current population goal of 8,000 swans (summer index) is no longer valid but it is still uncertain how high population goals should be set. More importantly, however, while revising population goals, it is felt that there needs to be an update on the status of birds in particular areas, with an emphasis on identifying critical wintering areas. There are problems with the loss of wintering habitat in some areas and I'll discuss that in more detail in a later paper. Also, crop damage in these wintering areas may need to be addressed eventually. Significant damage is currently being recorded in British Columbia and the damage issue needs to be considered when setting increased population goals. There are also increased chances for conflicts as wintering populations build in the lower coastal states.

One of the major revision needs in the North American Plan relates to the status of restoration flocks. There are conflicting statements about these flocks in the plans. Specifically, goals for the PCP call for an emphasis on natural range expansion rather than transplants, but goals for the Malheur National Wildlife Refuge (NWR) restoration flock specify development of a migrating tradition in those Trumpeters.

It is now felt that the Malheur, Ruby Lake, and Turnbull NWR flocks in the PCP belong more appropriately in the Rocky Mountain Population (RMP). The rationale for this change was that management issues, especially those related to wintering areas for these flocks, are more similar to the RMP; genetics of the flocks are more similar to the RMP; and the flocks may be useful for RMP range expansion efforts by serving as decoys for migrant RMP flocks. As part of the RMP, the restoration flocks would fall under range expansion criteria being developed by the RMP committee.

The U. S. Fish and Wildlife Service and the Oregon Department of Fish and Wildlife, in conjunction with the Trumpeter Swan Subcommittee, are currently working together on a plan to enhance the Malheur flock by restoring habitat conditions on the Refuge for breeding and wintering Trumpeters. Plans are to also try to instill a migratory tradition in the flock so they will move to more secure wintering habitats in the Summer Lake Basin, which is approximately 100 miles to the southwest. Other goals would be to establish new breeding flocks at Summer Lake and Klamath Forest NWR with a tradition for these birds to winter in suitable sites in Oregon.

However, there is concern regarding potential impacts of migrating Trumpeter Swans on

Tundra Swan hunting programs in other states. If Malheur NWR continues to enhance the Malheur flock without taking actions to guide their migrations, it is likely that migration of Malheur Trumpeters into Nevada will increase, and thus magnify chances for conflicts between Trumpeter expansion and Tundra Swan hunting programs.

The smaller the Oregon Trumpeter Swan population is, the greater the concern would be about chance killings of these birds. A larger flock would better withstand a limited amount of hunting related mortality. By encouraging Malheur Trumpeters to move west to Summer Lake and other areas in Oregon, the chances of migration into Nevada should be greatly reduced. The State of Oregon also has concerns about potential conflicts in traditional Snow Goose hunting areas. But we believe that both hunting programs and Trumpeter restoration efforts can coexist.

The North American Management Plan for Trumpeter Swans addresses the hunting issue by stating that hunting of other waterfowl will not be precluded because of the chance killing of Trumpeter Swans. Increased educational and enforcement efforts should also be employed where swans are being hunted.

I think it is important to stress that the states need to work cooperatively to settle disputes between Trumpeter enhancement efforts and Tundra Swan hunts. In the State of Oregon's opinion, it is critical for all parties, whether federal, state, or private, to acknowledge that some hunting mortality will occur in Trumpeter populations and that this is acceptable under enhancement plans. I think most management agencies can agree that in today's world, we cannot ignore the management of a species because of perceived impacts on a hunting season.

In summary, more emphasis is currently being put on the PCP Trumpeter plan to update information on summer and wintering populations and their habitats. There is also great potential for restoration flocks, such as the Malheur flock, to expand breeding populations and provide suitable wintering habitats for various flocks. Again, work is currently underway to revise population goals for the entire flyway, identify critical wintering areas, and to increase management options for restoration flocks.

THE 1990 CENSUS OF TRUMPETER SWANS ON ALASKAN NESTING HABITATS

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ABSTRACT

THE FIFTH COMPLETE CENSUS OF TRUMPETER SWANS (CYGNUS BUCCINATOR) ON THEIR ALASKA SUMMERING GROUNDS WAS COMPLETED IN 1990. THIS YEAR OVER 500 HOURS OF FLIGHT TIME WERE EXPENDED BY MANY SURVEY CREWS TO FLY 82,660 KM OF SURVEY TRACKS (51,990 KM IN 1985) OVER ALL THE POTENTIAL SWAN HABITAT DEPICTED ON 625 (425 IN 1985) USGS, 1:63,360 SCALE MAPS. COMPARED TO 1985 THE POPULATION WAS COMPRISED OF 7,056 PAIRED BIRDS (+38%), 647 SINGLES (+44%), 2,039 FLOCKED BIRDS (-7%), 9,742 TOTAL WHITE SWANS (+25%), 3,595 CYGNETS (+113%), AND 13,337 TOTAL SWANS (+41%). CYGNETS ACCOUNTED FOR 27% OF THE POPULATION (18% IN 1985) AND 1125 BROODS (+91%) WERE FOUND WITH AN AVERAGE BROOD SIZE OF 3.2 (2.9 IN 1985). 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 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 FIVE YEARS AND RANDOM SAMPLING FOR INTERIM YEARS IS RECOMMENDED TO PROVIDE THE HIGH QUALITY DATA NEEDED FOR THE BEST MANAGEMENT OF THIS MAGNIFICENT INTERNATIONAL 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, and 1985 (Hansen et al. 1971, King and Conant 1981, Conant et al. 1988). Because of the projected increase in the summer population (Groves et al. 1990), many survey crews and aircraft were needed to ensure completion of the 1990 census. A total of over 500 hours of flight time was expended to fly 82,660 km of survey tracks over all the potential Trumpeter Swan habitat. The survey was initiated on 1 August and terminated on 9 September. The primary survey aircraft used were a specially modified, turbine powered de Havilland Beaver, a Cessna 185, a Cessna 206 (all on amphibious floats), 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. The Alaska swan data base is in the midst of conversion to a standard PC ARC/INFO Geographic Information System (GIS). Various map overlays and summaries of all Trumpeter survey data are available upon request from the Alaska Regional Office of the USFWS in Anchorage, Alaska.

ACKNOWLEDGEMENTS

The bulk of the strenuous flying was provided by wildlife pilots Bruce Conant, William I. Butler, and Rodney J. King of the Migratory Bird Management (MBM) division of the USFWS. Numerous dedicated pilots and observers in the following organizations made completion of this census possible. These include: USFWS - MBM/Anchorage, MBM/Fairbanks, MBM/Juneau, Koyukuk National Wildlife Refuge (NWR), Tetlin NWR, Kanuti NWR, Yukon Flats NWR, Alaska Fish and Wildlife Research Center; U. S. Army - Department of Natural Resources/Fairbanks. Logistic support was provided by the Innoko NWR of the USFWS and the U. S. Forest Service - Cordova Ranger District. Deborah Groves served as a primary observer on one

survey crew and digitized all of the map data. Barry Dearborn of the Information Resources Management division of USFWS has invested many hours of programming in converting the swan data base into a custom PC ARC/INFO GIS format. John I. Hodges MBM/Juneau 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: Walter O. Stieglitz, Regional Director; John P. Rogers, Assistant Regional Director/Refuges and Wildlife; Robert Leedy, Chief/MBM and George Constantino, Associate Manager/Refuges.

SURVEY AREAS

A total of 625 U. S. Geological Survey (USGS) quadrangle maps were censused in 11 delineated Trumpeter Swan nesting areas in Alaska (Figure 1). Most of these 11 units were separated 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 (2.54 cm = 1.61 km) 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, ensuring that all habitat was adequately searched, and finding all swans. Consideration was given to factors such as 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. Secondary observers, when available, were used to increase the "eye power" from the moving platform.

Swan attribute data from completed maps were entered into an IBM compatible PC computer (a format designed for eventual use with field computers). The exact latitude and longitude of each sighting was determined from the original survey maps with a IBM compatible/Tektronix 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 and also a Data General MV 8000 computer in Anchorage, 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 (Figure 1), tabular summaries, and computer drawn graphs are examples of products that can be easily produced.

RESULTS

The five complete, statewide Trumpeter censuses show how the population has increased (Figure 2, Table 1). The subtotal for white swans (birds more than 1 year old) and singles plus paired birds best show this growth.

Continued expansion of Trumpeters into the peripheral habitat (units 6 through 11) is shown in Table 1.

Trumpeter Swan production is summarized for the five census years, as measured in late summer (Table 2). A return to average production in 1990 is indicated by the values for average brood size, percent juvenile, and percent of pairs with broods. The number of cygnets (Table 1) and broods (Table 2) both increased from 1985.

The trend in numbers of white swans recorded for the five statewide counts varies by unit (Figure 3). Generally, expansion of swan range into peripheral habitat is shown by the increase in maps surveyed for units 3 and 5-9. Increases in swan density since 1975 is demonstrated by the increase in white swans recorded in units 1, 3, 5, and 6.

DISCUSSION

The summering population of Trumpeter Swans continues to increase in Alaska, but below the exponential rate experienced in recent years. This continued growth is best reflected by the increase in white swans recorded since 1968 (Figures 4 and 5). This was anticipated from the results of a random sample survey flown in 1986 (Hodges et al.

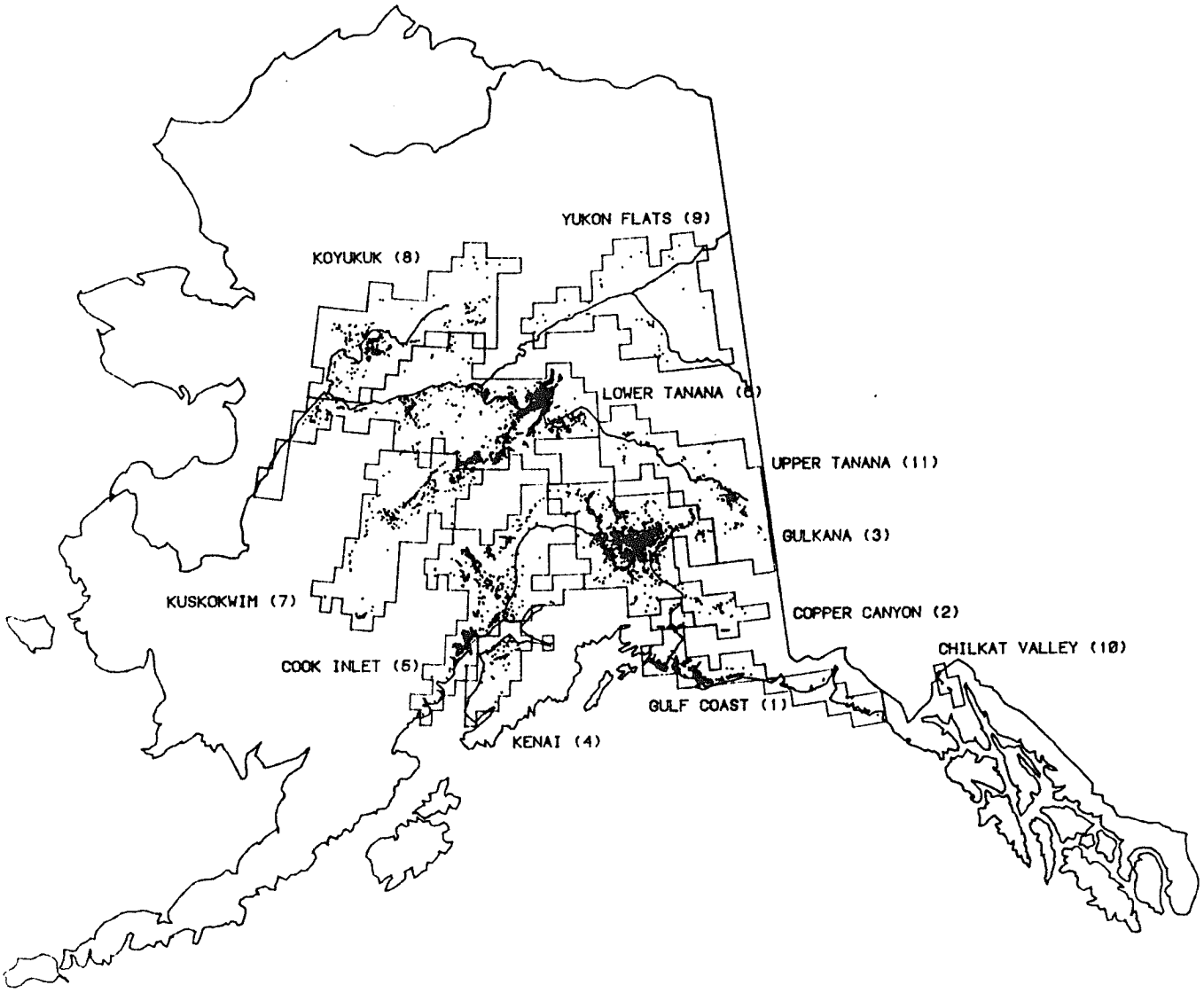


Figure 1. Trumpeter Swan summering areas in Alaska within 625 USGS maps censused in 1990 (each one of the 4503 points represents an actual swan observation).

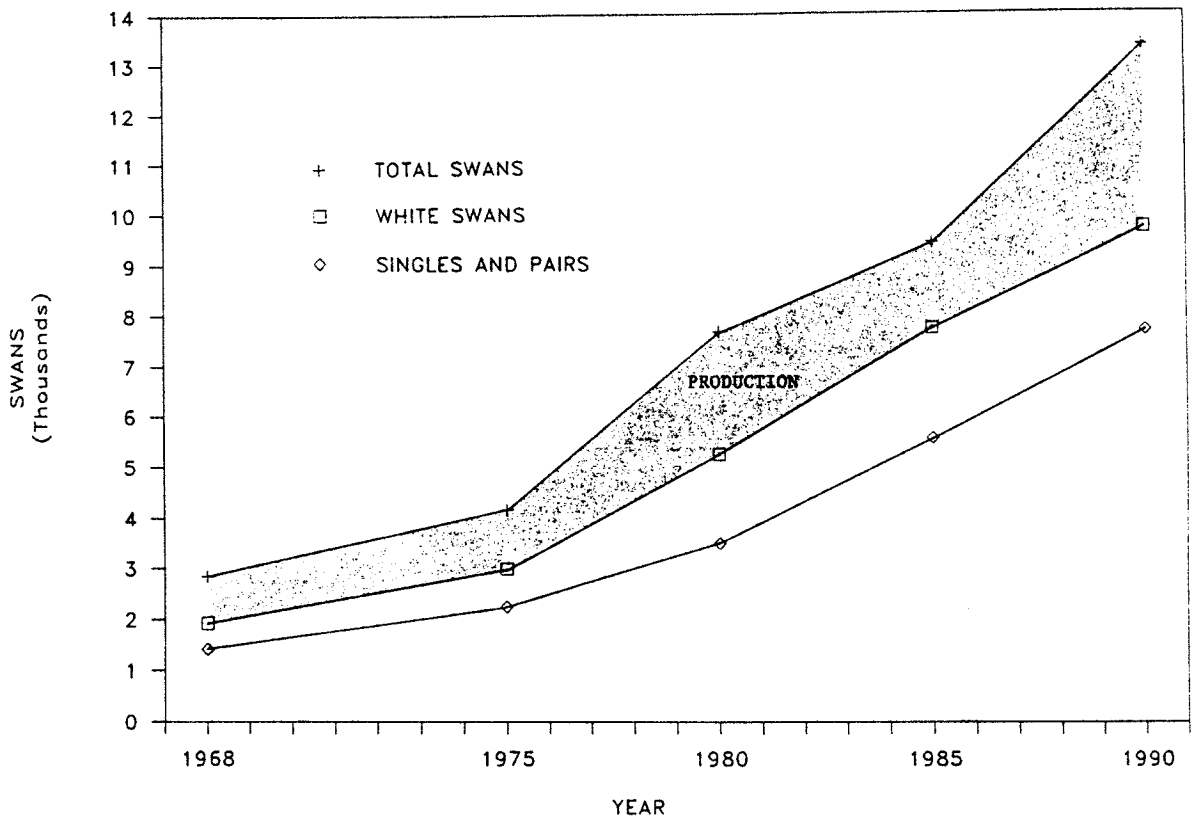


Figure 2. Trumpeter Swans recorded in Alaska during state-wide summer censuses for 1968, 1975, 1980, 1985, and 1990.

1986) and nonrandom sampling 1987-89 (Groves et al. 1990). Production increased significantly in 1990, primarily because of the early spring and advanced phenology (Conant and Dau 1990).

Obviously, this rate of increase can not be sustained indefinitely, but it is still not apparent when the total summering population in Alaska will stabilize or even reverse. 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 others, various rates of increase have occurred (Figure 3). There appears to be a large (approximately 20,000 km^2) amount of summer habitat available on the Yukon Flats (unit 9) which is just beginning to fill with swans. The density of swan use in some of the apparent 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 (and particularly Alaska) 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 modeling for survival rates may increase our understanding.

A factor which could slow or ultimately reverse the present trend is the exclusion of swans from good habitat by human appropriation and disturbance, especially on

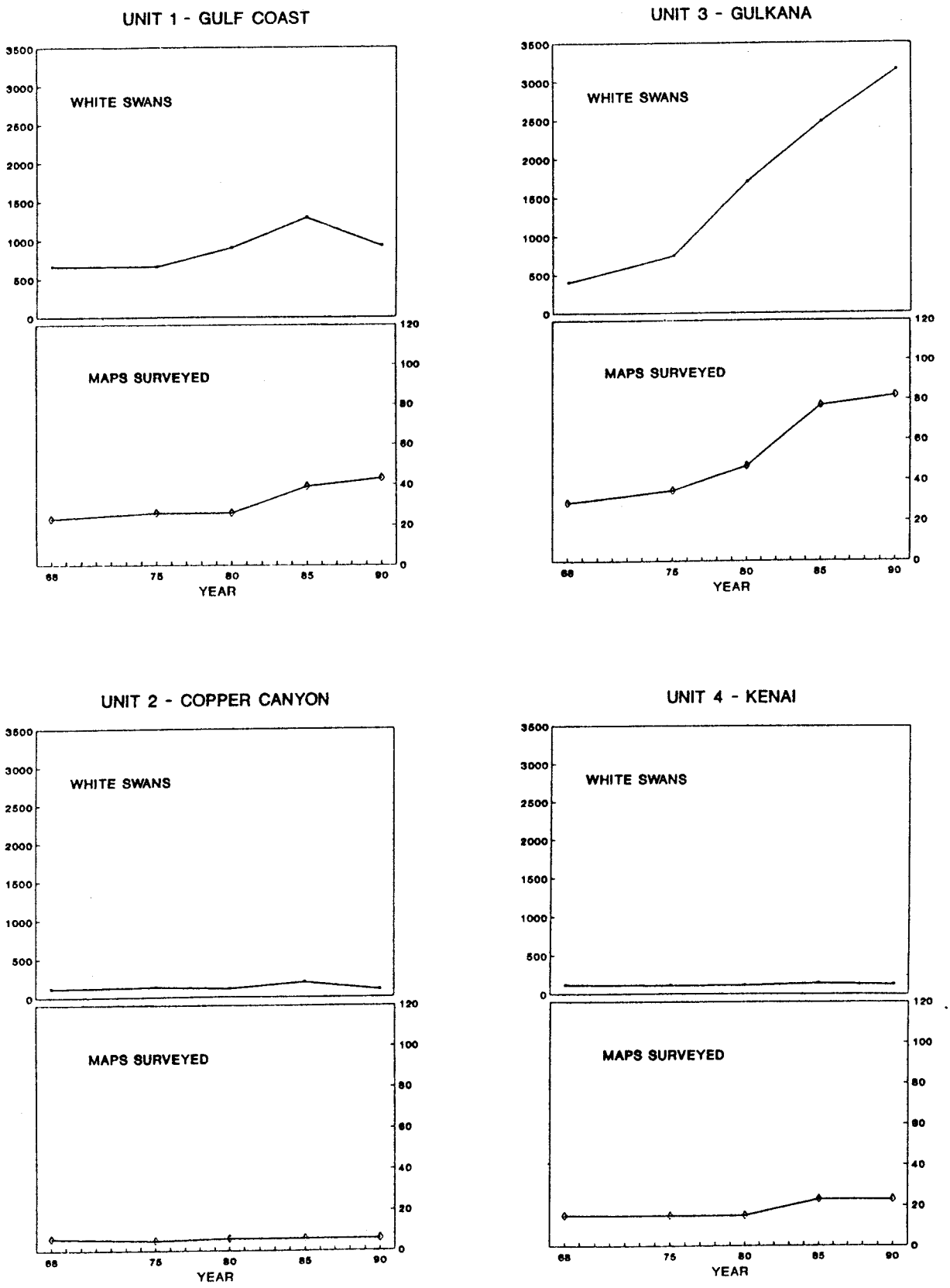
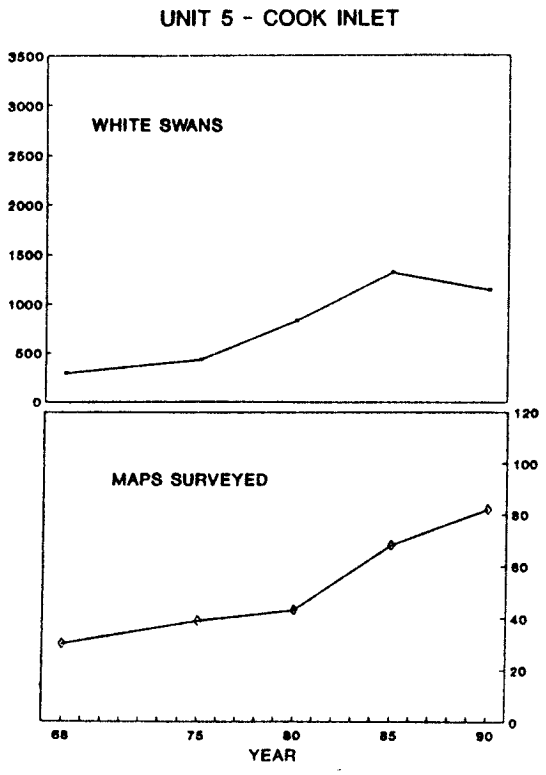
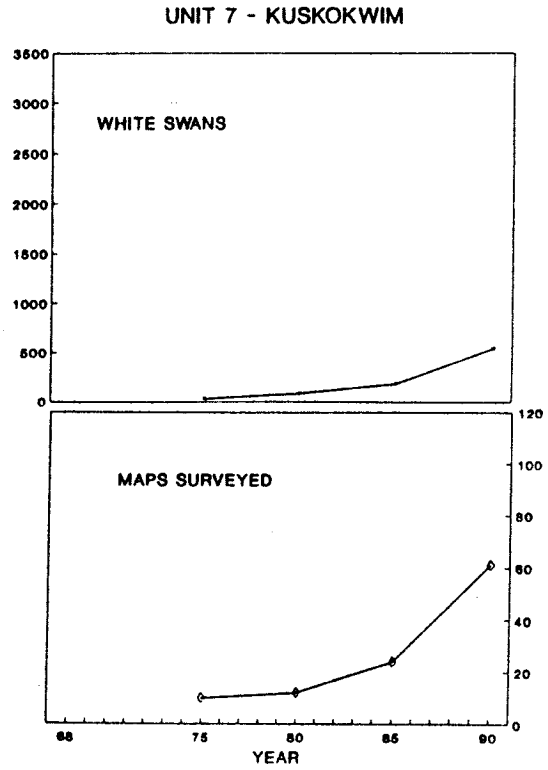
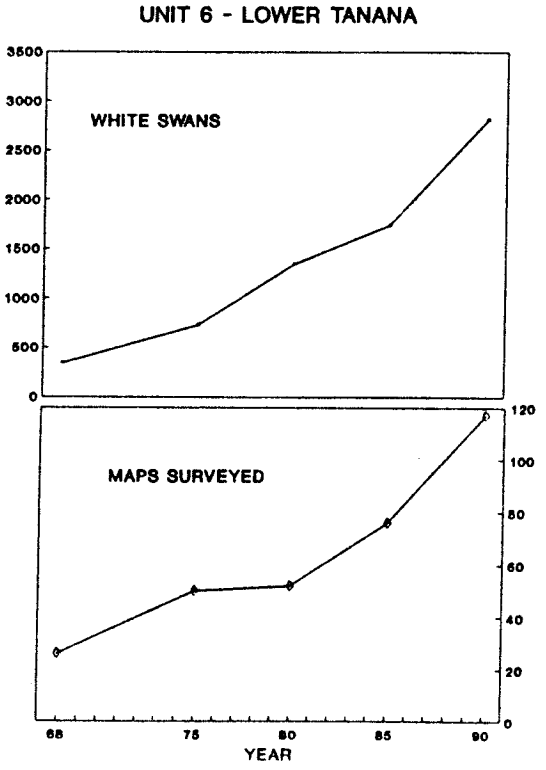
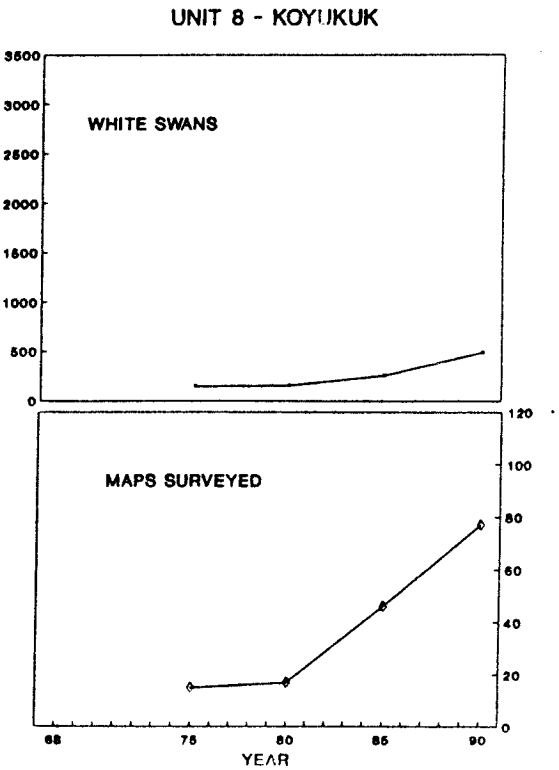


Figure 3. Numbers of white swans recorded compared to the number of maps surveyed by unit for 1968, 1975, 1980, 1985, and 1990.









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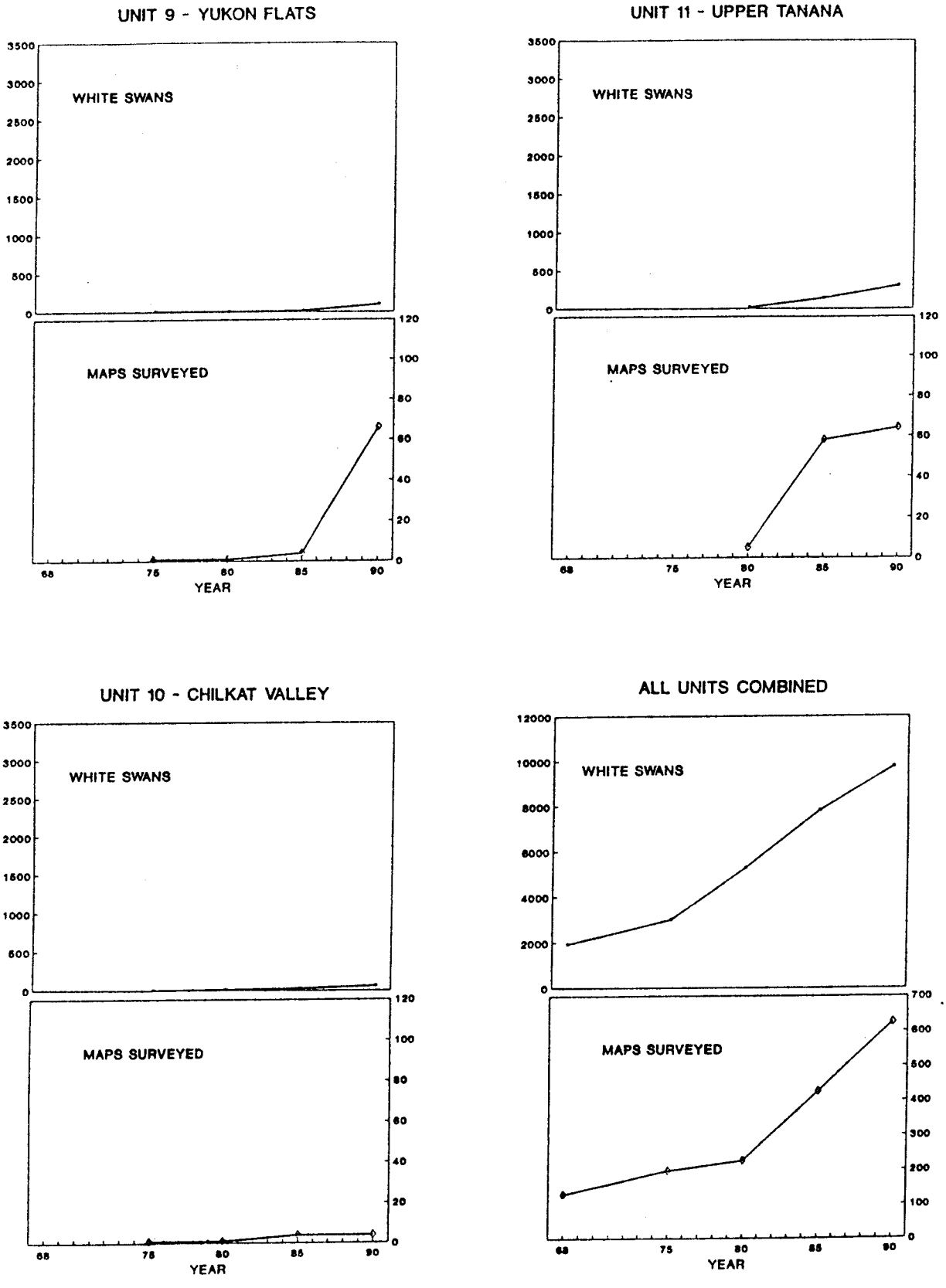

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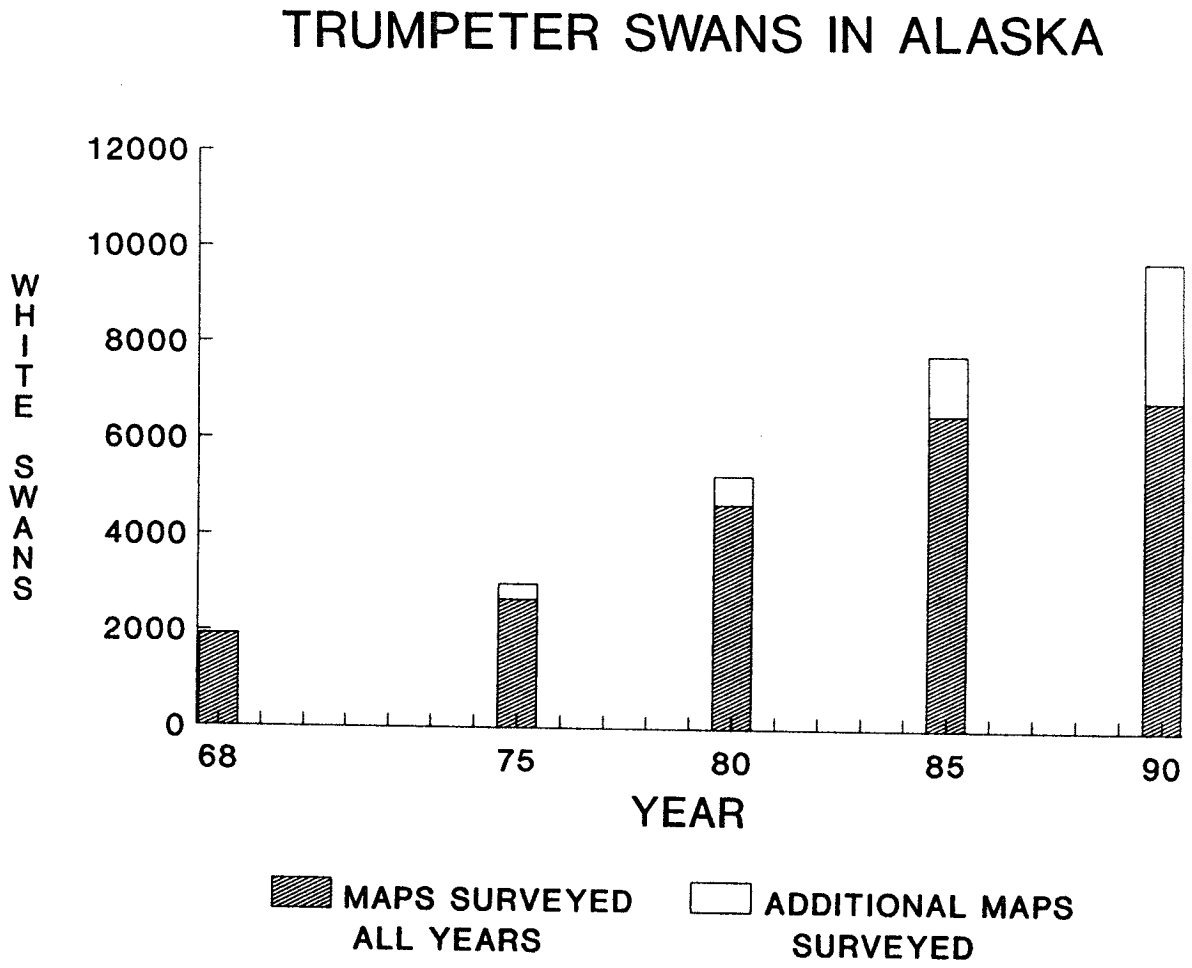

Figure 4. Growth of the number of white phase Trumpeter Swans in the high density and peripheral habitat of Alaska.

the rapidly urbanizing wintering grounds in the Pacific Northwest. This obviously has happened on the breeding grounds to some of the swan habitat in the Cook Inlet (unit 5) area. There, swans are being displaced from good lake and pond habitat because of recreational use (Timm and Wojeck 1978). However, the population has increased due to the ability of Trumpeters to utilize beaver ponds and marshy areas not yet selected by people. As the human population in Alaska also increases and becomes more mobile, the loss of swan habitat will accelerate. 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 of their present distribution throughout their range.

Although the amount of area censused within the Trumpeter summer range in Alaska continues to increase (number of maps surveyed: 1968 - 177; 1975 - 278; 1980 - 306; 1985 - 425; 1990 - 625), that factor is not the primary reason for the increase in the numbers of swans recorded. Personnel conducting statewide swan surveys over the years have been involved with other detailed waterfowl surveys and hence knew where any significant expansion of the summer swan population was

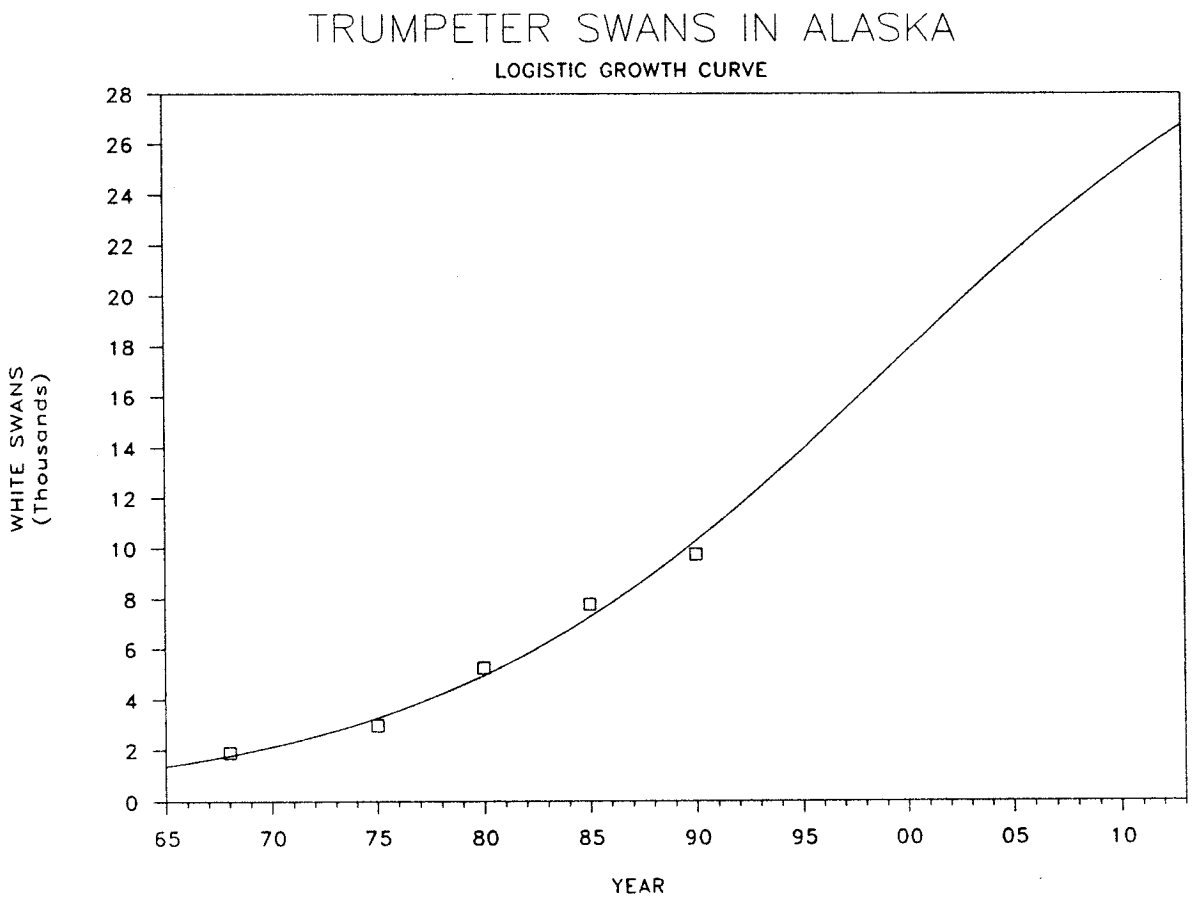

Figure 5. Logistic growth curve of the number of white phase Trumpeter Swans recorded on state-wide summer censuses for 1968, 1975, 1980, 1985, and 1990.

occurring. The main factors responsible for the increase were the increase in density on the previously censused high quality habitat as well as the expansion of swan range into peripheral habitat. Although the rate of increase was surprising, the pattern of expansion of habitat use was expected. It resulted from a rapidly increasing population (Figures 2, 4 and 5), the consequence of a number of recent years of good production.

Alaska hosts nesting populations of both Trumpeter and Tundra Swans (Cygnus columbianus) during the summer. The Trumpeter Swan census is 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 survey area

Table 1. Summary of the numbers of Trumpeter Swans from censuses during August-early September, by census unit in Alaska for 1968, 1975, 1980, 1985 and 1990.

Unit	Year	White Swans in Pairs	White Swans as Singles	White Swans in Flocks	Cygnets	Total Swans
1 Gulf Coast	1968	442	29	191	363	1025
	1975	442	32	190	193	857
	1980	586	52	266	351	1255
	1985	778	76	440	164	1458
	1990	666	59	205	434	1364
2 Copper River	1968	56	5	53	44	158
	1975	56	2	72	49	179
	1980	70	4	33	33	140
	1985	74	8	108	11	201
	1990	88	7	0	21	116
3 Gulkana	1968	288	31	81	190	590
	1975	556	43	155	284	1038
	1980	1026	42	632	660	2360
	1985	1736	143	595	533	3007
	1990	2142	225	776	778	3921
4 Kenai	1968	86	3	27	65	181
	1975	72	5	29	39	145
	1980	90	12	8	65	175
	1985	92	5	40	51	188
	1990	114	5	7	78	204
5 Cook Inlet	1968	224	19	50	124	417
	1975	340	36	60	181	617
	1980	608	38	186	369	1201
	1985	800	66	454	241	1561
	1990	904	79	162	516	1661
6 Lower Tanana (Fairbanks)	1968	224	21	94	137	476
	1975	518	21	185	388	1112
	1980	746	16	585	773	2120
	1985	1202	113	426	503	2244
	1990	2070	179	559	1072	3880
7 Kuskokwim (McGrath)	1968	-	-	-	-	-
	1975	20	6	4	7	37
	1980	60	0	22	63	145
	1985	122	0	62	55	239
	1990	386	21	141	233	781

Unit	Year	White Swans in Pairs	White Swans as Singles	White Swans in Flocks	Cygnets	Total Swans
8 Koyukuk	1968	-	-	-	-	-
	1975	94	6	45	35	180
	1980	124	4	27	104	259
	1985	206	23	29	45	303
	1990	366	40	86	133	625
9 Yukon Flats	1968	-	-	-	-	-
(Ft. Yukon)	1975	2	0	0	1	3
	1980	2	0	0	4	6
	1985	10	0	0	3	13
	1990	66	8	22	56	152
10 Chilkat Valley	1968	-	-	-	-	-
(Haines)	1975	2	0	0	0	2
	1980	6	0	3	11	20
	1985	16	1	7	16	40
	1990	34	1	23	50	108
11 Upper Tanana	1968	-	-	-	-	-
(Fairbanks)	1975	-	-	-	-	-
	1980	6	1	4	4	15
	1985	84	14	43	64	205
	1990	220	23	58	224	525
TOTAL	1968	1320	108	496	923	2847
	1975	2102	151	740	1177	4170
	1980	3324	169	1766	2437	7696
	1985	5120	449	2204	1686	9459
	1990	7056	647	2039	3595	13337

and some Tundra Swans within it. With both populations growing, the amount of overlap is probably increasing. The habitat covered during this census probably does not miss many Trumpeters but contains 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 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 shed more light on 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

Table 2. Summary of Trumpeter Swan production from censuses during August-early September, by census unit in Alaska for 1968, 1975, 1980, 1985 and 1990.

Unit	Year	Number of Broods	Average Brood Size	Percent Juvenile	Percent Pairs with Broods
1 Gulf Coast	1968	93	3.9	35	41
	1975	61	3.2	23	27
	1980	99	3.6	28	33
	1985	57	2.9	11	14
	1990	125	3.5	32	37
2 Copper River	1968	13	3.4	28	39
	1975	16	3.1	27	57
	1980	10	3.3	24	29
	1985	3	3.7	5	8
	1990	9	2.3	18	20
3 Gulkana	1968	52	3.7	32	36
	1975	93	3.1	27	33
	1980	194	3.4	28	36
	1985	191	2.8	18	22
	1990	276	2.8	20	25
4 Kenai	1968	21	3.1	36	49
	1975	15	2.6	27	42
	1980	19	3.4	37	42
	1985	16	3.2	27	35
	1990	23	3.4	38	40
5 Cook Inlet	1968	36	3.4	30	29
	1975	61	3.0	29	36
	1980	103	3.6	31	34
	1985	85	2.8	15	21
	1990	157	3.3	31	34
6 Lower Tanana (Fairbanks)	1968	42	3.3	29	33
	1975	112	3.5	35	42
	1980	202	3.8	36	54
	1985	179	2.8	22	29
	1990	336	3.2	28	32
7 Kuskokwim (McGrath)	1968	-	-	-	-
	1975	3	2.3	19	30
	1980	16	3.9	43	53
	1985	18	3.1	23	30
	1990	68	3.4	30	34

Unit	Year	Number of Broods	Average Brood Size	Percent Juvenile	Percent Pairs with Broods
8 Koyukuk	1968	-	-	-	-
	1975	16	2.2	19	34
	1980	36	2.9	40	55
	1985	16	2.8	15	13
	1990	50	2.7	21	26
9 Yukon Flats	1968	-	-	-	-
(Ft. Yukon)	1975	1	1.0	33	100
	1980	1	4.0	67	100
	1985	1	3.0	23	20
	1990	18	3.1	37	55
10 Chilkat Valley	1968	-	-	-	-
(Haines)	1975	0	-	-	-
	1980	2	5.5	55	67
	1985	3	5.3	40	38
	1990	10	5.0	46	59
11 Upper Tanana	1968	-	-	-	-
(Fairbanks)	1975	-	-	-	-
	1980	1	4.0	27	33
	1985	19	3.4	31	45
	1990	53	4.2	43	48
TOTAL	1968	257	3.6	32	37
	1975	378	3.1	28	35
	1980	683	3.6	32	40
	1985	588	2.9	18	23
	1990	1125	3.2	27	31
5 Year Average		-	3.3	27	33

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 is greatly facilitated with this system. Conversion to the ARC/INFO format will enhance standardization. Merging this new swan data base with others such as land ownership, will add a new dimension to the utility of the data.

A stratified random sampling scheme was developed and used in 1986 to better monitor the total Trumpeter population on Alaskan breeding grounds between the census years. Unfortunately, this survey was not repeated and nonrandom sampling was used again from 1987 through 1989. A random sample should be reemployed 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 data collecting protocol has been developed and is available upon request. A continued complete census every five years is recommended to maintain the continuity of this impressive data set for better management of this magnificent international resource.

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PACIFIC COAST JOINT VENTURE: AN UPDATE

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ABSTRACT

A BRIEF DESCRIPTION OF THE NEW PACIFIC COAST JOINT VENTURE IS GIVEN. THE JOINT VENTURE WAS APPROVED BY THE NORTH AMERICAN WATERFOWL MANAGEMENT PLAN COMMITTEE IN OCTOBER 1990. IT IS INTENDED TO PROTECT UP TO 119,000 HA OF HABITAT ALONG THE MIDDLE UPPER PACIFIC COAST, AT A COST OF $530 MILLION (US). FIRST STEP PROJECTS ARE PROPOSED FOR THE COMOX AREA OF VANCOUVER ISLAND AND THE FRASER RIVER DELTA IN BRITISH COLUMBIA AND THE SKAGIT RIVER DELTA, WASHINGTON, TO BE COMPLETED WITHIN THE NEXT FIVE YEARS.

INTRODUCTION

In 1986 Canada and the United States jointly adopted a strategy for the long term management of the continent's waterfowl. This strategy was called the North American Waterfowl Management Plan, and it was intended to chart a course that would return waterfowl populations to the abundance of the early 1970's.

The North American Waterfowl Management Plan (the Plan), recognizing that the problems to overcome were very large, and suggested that joint ventures be established to facilitate its execution. The Plan provided numeric goals for populations and habitats, and recognized that, in order to achieve those goals, many different groups would have to work together through these joint ventures.

Several joint ventures were created with the signing of the Plan in areas deemed to be of the highest priority continentally, and since then several more have been added. In Canada these included the Prairie Habitat Joint Venture, the Eastern Habitat Joint Venture, the Black Duck Joint Venture and the Arctic Goose Joint Venture. In the United States the following Joint Ventures are operational: Central Valley, Lower Mississippi Valley, Atlantic Coast, Gulf Coast, Lower Great Lakes/St. Lawrence River, Playa Lakes, and the Prairie Pothole Joint Ventures. As progress is made in the high priority areas more Joint Ventures are being and will be established. The most recently ratified Joint Venture is the subject of this short note, the Pacific Coast Joint Venture.

PACIFIC COAST JOINT VENTURE

The Pacific Coast Joint Venture (PCJV) was designed to protect migration and wintering habitat in the area identified as the Middle Upper Pacific Coast in the Plan. It encompasses the coastal plain west of the Coast Mountain Range in British Columbia and the Cascade Mountains in the northwestern United States, from the mouth of the Skeena River, British Columbia, to just north of San Francisco Bay, California.

The PCJV will focus on estuarine and adjacent lowland habitat throughout it's length. Protection of those habitats will in turn help protect upwards of 9,000 Trumpeter Swans, 40,000 Snow Geese, the entire population of Pacific Brant (127,000, at least in migration), 250,000 dabbling ducks, 125,000 diving ducks and 125,000 sea ducks. Many other species will also benefit, such as coastal dwelling large mammals including deer, elk, brown and black bears, many other species of birds, and anadromous fish.

Goals

The goals of the Joint Venture are ambitious, as Table 1 indicates. There is much to do and time is short. Most of the areas within the PCJV's interest overlap areas heavily used by the human species. People have settled on and near estuaries for the same reasons they are so

productive of wildlife. Initially, this wildlife was seen as an abundant food supply, the fertile deltaic soils readily supported agriculture, and the adjacent lowlands were rich in timber. Now, many of the best wetland areas have been converted to other uses. Converting those back to wildlife uses, and securing the remaining wetlands will be a large task.

Costs

Costs of the Joint Venture will be commiserate with the size of the task. Land on the west coast of North America is in short supply and highly sought after. If all the land identified as needing protection is secured by purchase, over $530 million (US) will be required (Table 2).

Programs

Two major program types are envisaged for the Joint Venture. The Direct Program will secure, by several methods, the habitat necessary to meet the population goals set for the Middle Upper Pacific Coast by the Plan. That will involve the acquiring, enhancing, managing and restoring both estuarine and upland habitats. The Indirect Program will be aimed at protecting the rest of the habitat it is not possible to protect through the Direct Program. It will seek to reduce and eliminate wetland degradation, modify impacts of developments, and foster public support. Such activities as conservation incentives, demonstration projects, extension services, and cooperative education programs are planned.

First steps

As with most large and ambitious programs, implementation of the Joint Venture will begin with a First Step. Because this Joint Venture is an international program, and because there are several initial target species, the PCJV First Step will take place in three locations. Programs are planned for the Comox valley area of British Columbia, aimed at Trumpeter Swan wintering habitat. In the Boundary Bay

Table 1. Habitat goals of the Pacific Coast Joint Venture, in hectares.

Area	Secure	Restore	Enhance
British Columbia	55,400	2,800	11,100
Washington	33,300	1,700	6,700
Oregon	17,200	900	3,400
California	13,100	600	2,600
Total	119,000	6,000	23,800

Table 2. Estimated costs of the Pacific Coast Joint Venture over 15 years, in millions US $.

Area	Acquisition	Development	Operation
British Columbia	315	12.6	16.8
Washington	112	7.0	2.0
Oregon	56	3.2	.9
California	46	3.1	.9
Total	529	25.9	20.6

area of the Fraser River delta in British Columbia, the focus will be on Pacific Brant, Lesser Snow Geese and duck habitat. In the Skagit River delta in Washington, the First Step is aimed at Trumpeter Swan, Brant and Snow Geese habitat.

Costs of these First Steps have been estimated, over a 5-year period, at a relatively modest $8.6 million (US). Acquisition will account for $7.5 million, development for $300 thousand and operations $800 thousand.

Timetable

The PCJV was approved by the North American Waterfowl Management Plan Committee in October 1990. Soon after that, actions were taken to create the various levels of management structure needed to begin implementation. Because this is an international Joint Venture, an International Joint Venture Board was created to provide overall direction. That group met in Bellingham, Washington, in January 1991, in Victoria, British Columbia, in May 1991, and will meet at intervals of about six months thereafter. The International Board is co-chaired by Canadian Wildlife Service and the U. S. Fish and Wildlife Service, and includes representatives of provincial and state agencies and non-governmental organizations.

Each country also has a Steering Committee, chaired by the province or states. Steering Committees have met in both countries, with the current schedule being on an "as needed" basis. Reporting to each Steering Committee are Implementation Committees, currently one for British Columbia and one each for Washington, Oregon and California. It is anticipated that, with the rapid pace of creation of the structure of the Joint Venture, implementation will begin perhaps as early as Fall 1991.

Further information on the PCJV can be obtained from the Canadian PCJV Coordinator, c/o Canadian Wildlife Service, Box 340, Delta, British Columbia, Canada, V4K 3Y3; or from the United States PCJV Coordinator, c/o U. S. Fish and Wildlife Service, Eastside Federal Complex, 911 N. E. 11th Avenue, Portland, Oregon, U.S.A., 97232-4181.

CHANGING LAND USE AND TRUMPETER SWANS IN THE SKAGIT VALLEY

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ABSTRACT

WEEKLY SURVEYS OF WINTERING TRUMPETER SWANS (CYGNUS BUCCINATOR) AND TUNDRA SWANS (C. COLUMBIANUS) ARE BEING CONDUCTED IN WASHINGTON STATE'S SKAGIT VALLEY, A HIGHLY PRODUCTIVE AGRICULTURAL AREA. IN 16 SURVEYS BETWEEN 17 NOVEMBER 1990 AND 31 JANUARY 1991, SWANS WERE SIGHTED AT 164 LOCATIONS, COMPRISED OF 11 DIFFERENT HABITAT TYPES. SIGHTINGS PER LOCATION RANGED FROM ONE (70%) TO EIGHT (0.006%). MOST OBSERVATIONS (N = 306) WERE IN CORN (43%), PASTURE (18%) AND POTATOES (13%). THE MAXIMUM NUMBER OF SWANS OBSERVED IN A SINGLE DAY WAS 847 FOR TRUMPETERS (26 JANUARY 1991) AND 1,255 FOR TUNDRAS (15 DECEMBER 1990). THE SKAGIT VALLEY IS AN IMPORTANT WINTERING AREA FOR THE PACIFIC COAST POPULATION.

OBJECTIVES

1. Document the current distribution of, and habitat selected by, wintering Trumpeter Swans in the lower Skagit Valley.

   A. Numbers of swans
   B. Habitat types
   C. Habitat selection

2. Document habitat types and area (km^2) used by individual or family group during the course of the winter.

   A. Tracking via radio telemetry

3. Identify critical Trumpeter Swan habitat, based on data from Objectives 1 and 2 above.

4. Reconstruct historic (1975-90) numbers and distribution of Skagit Valley Trumpeter Swans.

5. Reconstruct historic (1975-90) land-use patterns in documented areas frequented by Trumpeter Swans.

   A. Residential/commercial development
   B. Agricultural crop plantings
   C. Ownership--private/public

INTRODUCTION

Historically Trumpeter Swans (Cygnus buccinator) were seen on western Washington's Puget Sound as occasional winter migrants passing through, but were not common or abundant (Taylor 1923, Banko 1960). Apparently, large numbers of birds did winter in the Columbia River estuary (Yocom 1951, Banko 1960). Over the last twenty years the lower Skagit Valley in Washington State has become an important wintering area for both Trumpeter and Tundra (C. columbianus) Swans (Jordan and Caniff 1981).

The Skagit is the largest river in western Washington, forming a broad delta covering close to 500 km^2, encompassing over 50 km of shoreline on the east side of Puget Sound (Figure 1). Predominate soils are very deep, poorly drained to moderately well drained alluvial sands and silts. Ditching and diking have allowed farming on most soils in the lower valley, one of the most productive agricultural areas in the state.

Agriculture is the primary industry in Skagit County. In 1988 44,467 ha were classified as farmland, producing $120 million in revenue (SCCEO 1990). By acreage, the most important crops were field crops (wheat, barley, oats, corn silage) peas, potatoes, seed crops (cabbage, spinach, beets, mustard),

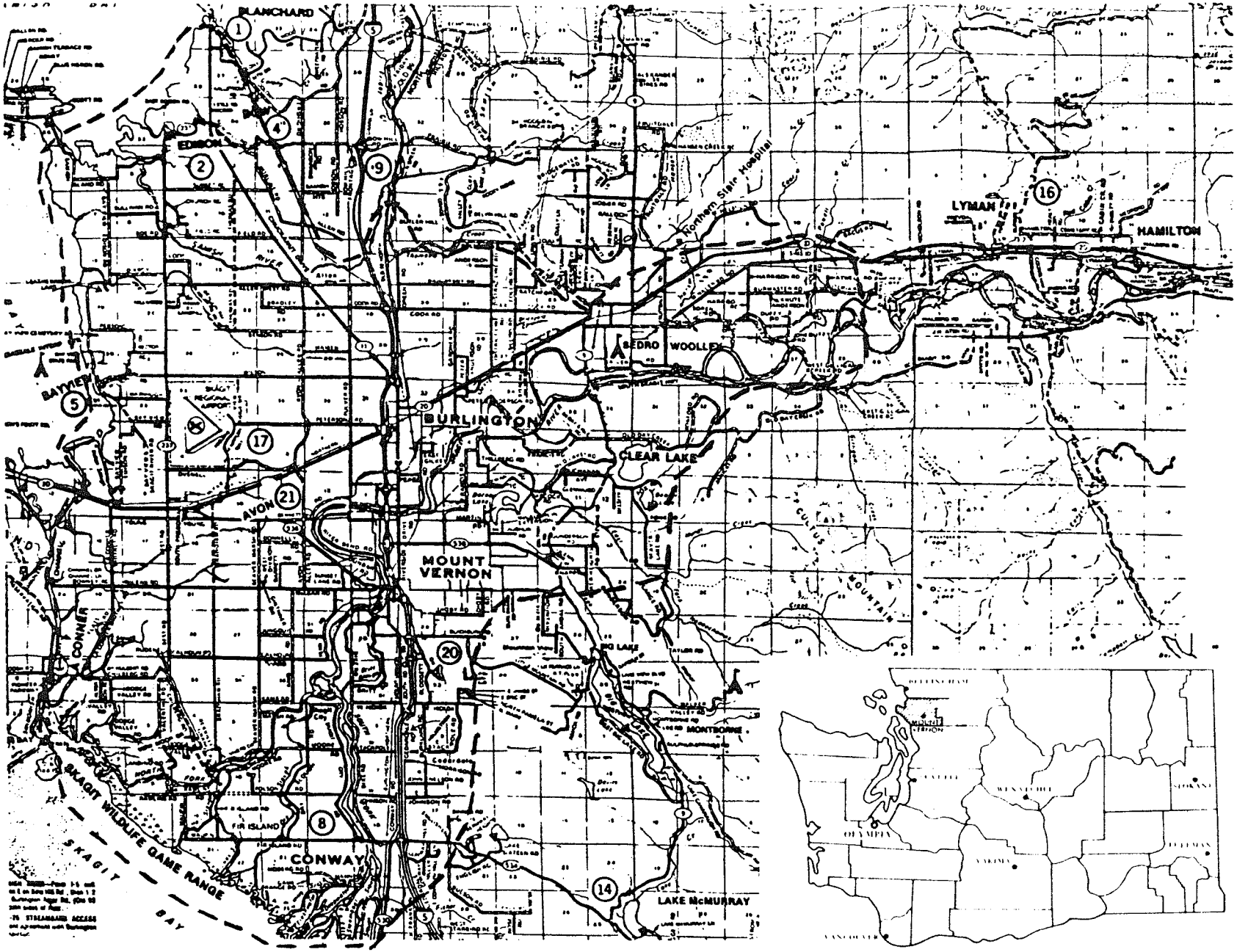

Figure 1. Vicinity map, Skagit Valley, Washington.

— — — Study area boundary

— · — · — Rivers, streams

cauliflower and sweet corn (SCCEO 1990). Since the 1960's there has been a decline in corn and pea production and an increase in acreage planted in potatoes (Figure 2).

Winters are generally mild as a result of the maritime climate. At Mount Vernon, the 20-year average daily minimum temperature for January (typically the coldest month of the year) is 0.3° C. January is also the wettest month of the year with an average of 11.2 cm of precipitation, and 8.4 cm of snow (Soil Conservation Service 1989). The combination of mild winters, fertile croplands, and ample water provide ideal conditions for wintering waterfowl. In many winters, the 4,400 ha Skagit Wildlife Area supports up to 100,000 ducks and geese.

During the winter of 1989-90, up to 800 Trumpeters wintered in the Skagit Valley qualifying this area as one of the most important wintering grounds for the Pacific Coast Population. Typically swans begin arriving in early November and depart by the end of March, with the peak concentrations in late January (Martha Jordan, pers. comm.).

Traditionally, Trumpeter Swans have fed primarily on aquatic vegetation and tubers (Palmer 1976). McKelvey (1981) first documented Trumpeters feeding in agricultural fields in a study on Vancouver Island. Within the last 10 years, Skagit Valley Trumpeters have shifted to a diet of waste grains, particularly corn, and crops such as potatoes and carrots (Mike Davison pers. comm., Martha Jordan pers. comm.). Agricultural lands have become an integral component in the winter ecology of Skagit Valley Trumpeter Swans.

In addition to a growing population of swans in the last 15 years, Skagit County has also

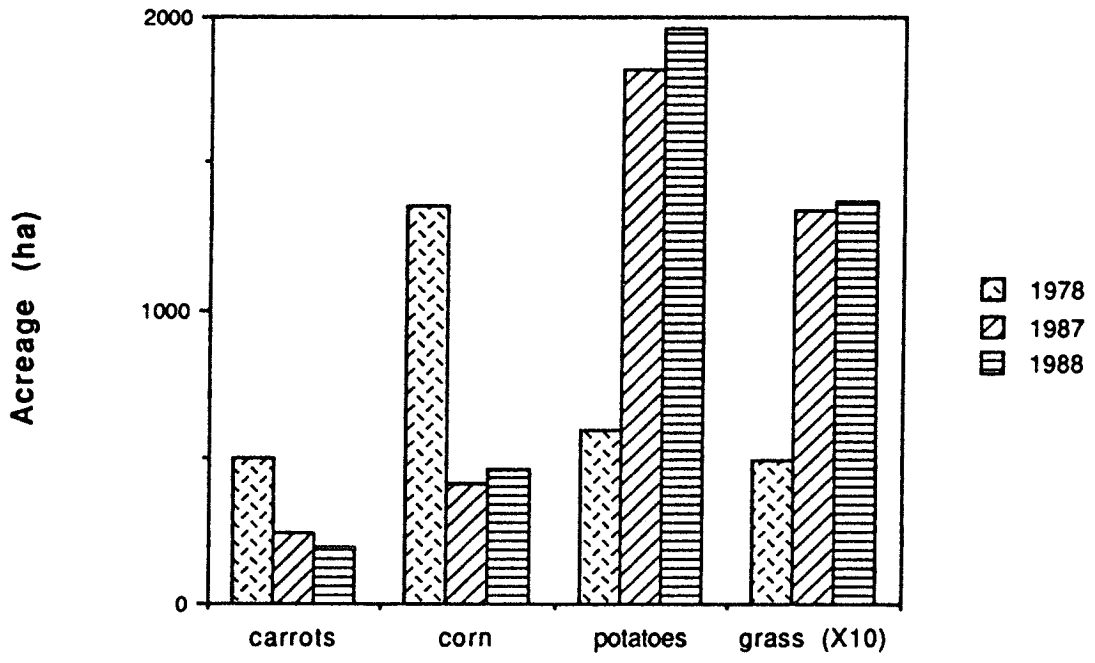

Figure 2. Skagit County agricultural trends.

experienced an increase in the human population and development, especially since the late 1980's. Between 1980 and 1988 the county population increased from 64,138 to 70,800 (10.3%). From 1988 to 1990 the population grew from 70,800 to 76,100, an increase of 7.4%. Roughly one-third of the county's 76,100 inhabitants (1990 census) live in the lower Skagit Valley, including three of the county's four largest towns (SCPC 1990). Two large shopping malls have recently been constructed on former farmland and an amusement park was proposed and rejected for a nearby site.

METHODS

This study was conducted in the lower flood plain of the Skagit River in northwestern Washington State (Figure 1). The general shape of the study area is a broad wedge bounded on the west by saltwater, encompassing roughly 400 km^2. Most of the study area consists of private agricultural lands.

Skagit Valley Trumpeter Swans were censused twice weekly from mid-November (1990, 1991) through March (1991, 1992). The census was conducted by automobile, following roughly the same route for each count. All swans sighted were counted, noting the species, age (adult or juvenile) and number of birds, collar color and number, location, and habitat type. Habitat type classifications follow the protocol developed by the Washington Department of Wildlife. Sighting locations were mapped and data recorded on a field form. Data were entered in a computer data base. Sick, injured or dead swans were noted and, if possible, retrieved and turned over to a rehabilitation center.

RESULTS

Sixteen surveys were conducted between 17 November 1990 and 31 January 1991. Four surveys were canceled due to weather (flooding, snow/ice, fog). Table 1 summarizes the initial data. Trumpeter Swans have been seen within most of the study area. As yet, no clearly discernible pattern to Trumpeter Swan distribution is apparent from mapped sightings.

Most swan observations have been in fields of corn (43%, N = 306), pasture (18%) and potatoes (13%) (Figure 3). Although the greatest number of sightings have been in corn fields, larger flock sizes have been recorded in potato fields (Figure 4).

Of the 164 locations where swans have been seen, swans have been observed just once at 114 (70%) of the sites (Figure 5). The maximum number of sightings per location is eight, on Skagit Bay, an important roosting area for Tundra Swans.

Flock size ranges from one bird to 1,247 (209 confirmed Trumpeters), with two birds the most frequent (28%, N =112). The maximum number of swans observed in a single day was 847 for Trumpeters (26 January 1991) and 1,255 for Tundras (15 December 1990).

DISCUSSION

Severe flooding in November and freezing temperatures in December 1990 have undoubtedly effected the temporal and spatial distribution of Skagit Valley Trumpeter Swans. The ability to census swans was also effected. Floodwater was still present in many fields in mid-January. Swans are strongly attracted to flooded fields. Heavy fall rains prevented the harvest of some potato and carrot fields, where many of the larger flocks have been observed.

The impact of development on the distribution of Trumpeter Swans has not been analyzed. On several occasions, swans have been observed feeding and loafing within 30 m of houses, barns and heavily travelled roads, apparently tolerant of human activities.

This project will be continued next winter and it is hoped that research questions and methods can be further refined to enable the collection of the most pertinent data, and provide a greater insight into the ecology of and conservation strategies for this magnificent bird.

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Table 1. Study summary of Trumpeter Swan observations in the Skagit Valley, November 1990 through January 1991.

	N	Median	Range
Surveys	16	--	--
Habitat	306	7.5	2-10
Locations	164	17	2-44
Swans	20,337	1,325	372-1,987
Flock	112	2 (mode)	1-1,247

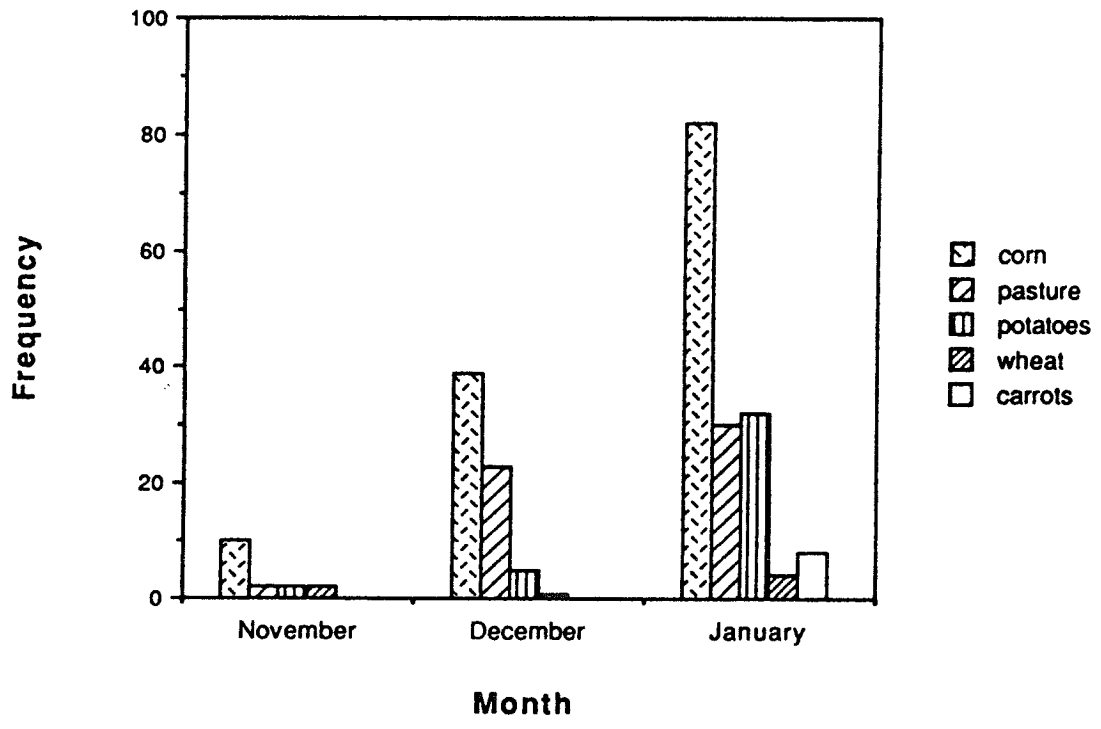

Figure 3. Habitat use by Skagit Valley Trumpeter swans.

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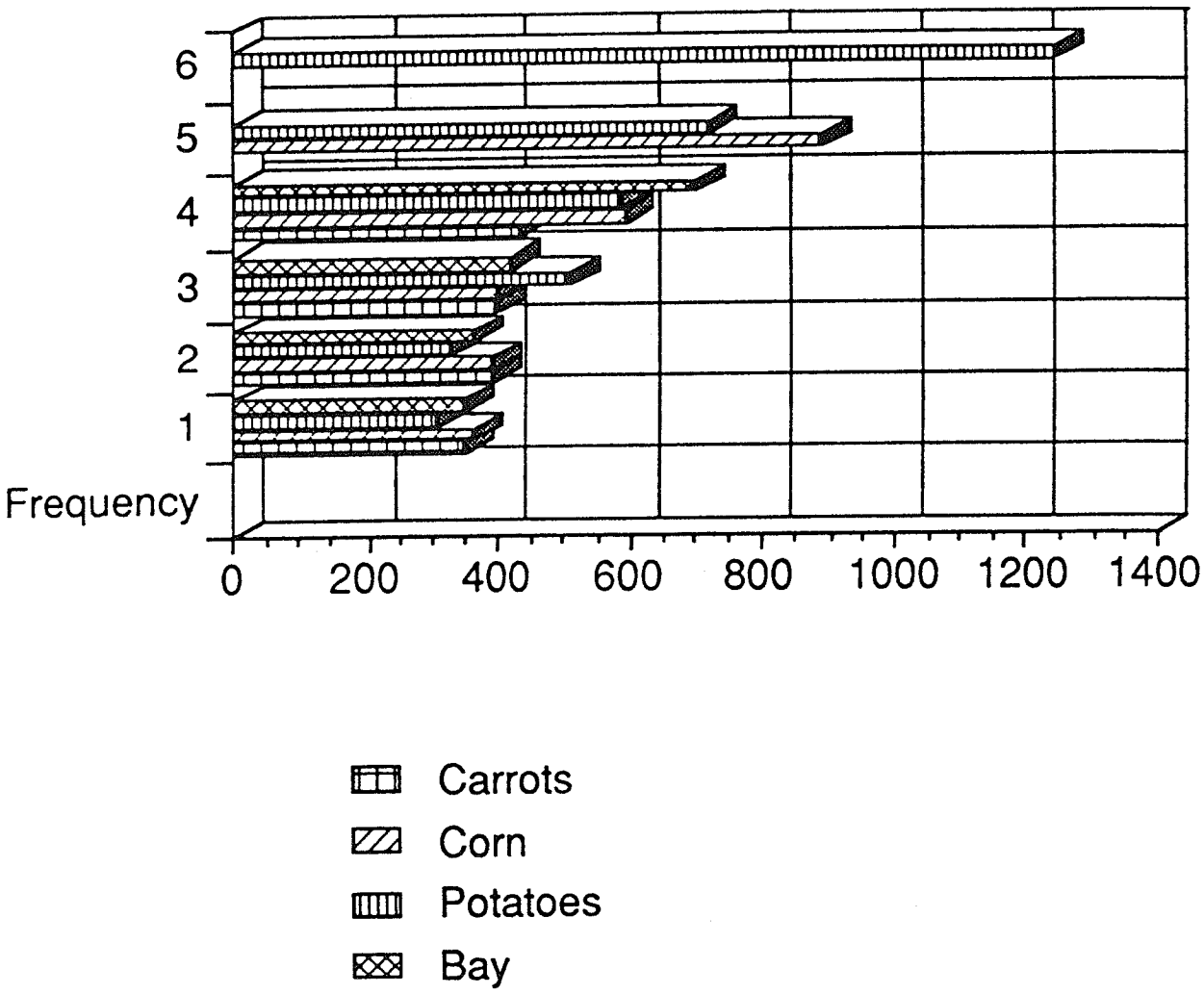

Figure 4. Habitat use by flocks of greater than 300 swans.

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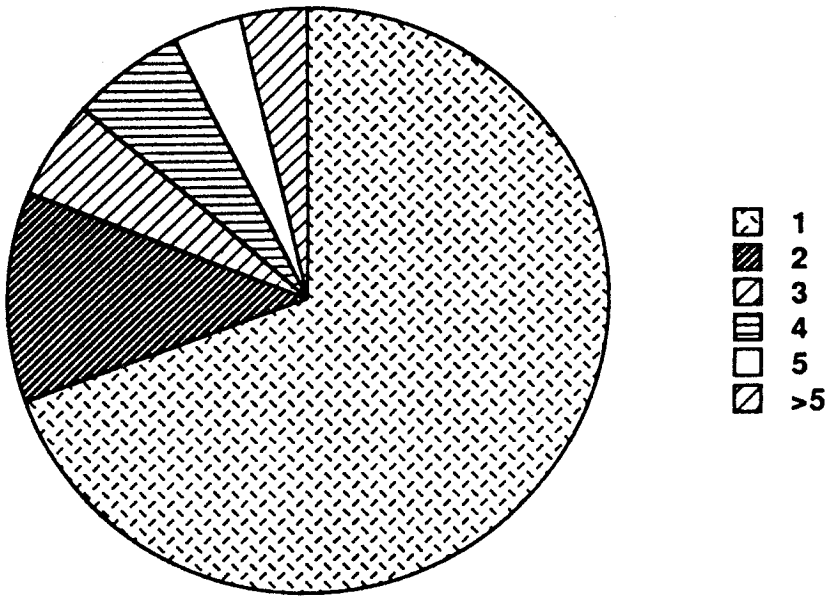

Figure 5. Sightings of Trumpeter Swans per location.

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MANAGEMENT CHALLENGES RELATED TO PACIFIC COAST POPULATION TRUMPETER SWANS IN OREGON AND WASHINGTON

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Numbers of wintering Trumpeter Swans from the Pacific Coast population have been increasing in Oregon and Washington since the 1970's. For example, in Washington winter counts have shown a two-fold increase in wintering Trumpeters over the last decade. In addition, Trumpeters are expanding their range in major wintering areas and pioneering into vacant wintering habitat primarily west of the Cascade Mountains. Small flocks are also being recorded in selected areas east of the Cascades in both states.

Concurrent with the increase in population size and distribution has been an increased emphasis on management of the species by state wildlife agencies. In the past, emphasis of the wildlife programs in Oregon and Washington has been directed toward hunted game species, since almost all agency revenue has been and remains derived from the sale of hunting and fishing licenses. During the 1980's, the Washington Department of Wildlife (WDW) began to receive state tax revenue and in fact shifted management emphasis toward a broader range of wildlife species, which in part has reflected changing public participants in wildlife recreation. Recent changes in Oregon policy, which includes redesigning the state's Wildlife Division, will also be putting more emphasis on total wildlife species management. These changes in agency direction have resulted in higher priorities given to issues and management concerns related to swans in Oregon and Washington.

MANAGEMENT CHALLENGES AND POTENTIAL SOLUTIONS

Habitat

Given the increases in Trumpeters wintering in the Skagit Delta area and elsewhere in Washington, it is apparent that the carrying capacity for swans has not been attained in that state. Birds in the Skagit area have been using new areas and have recently broadened their forage base. Cropping patterns and habitat use are the subject of a current University of Washington research project. This study should add insight on the capacity of the Skagit to accommodate more swans. However, empirical evidence to date has indicated that we will continue to see increased Trumpeter numbers given continuation of recent agricultural trends.

One factor that threatens to limit the potential for increase of the Trumpeter population in Washington, and in the Skagit Delta in particular, is the loss of agricultural land to residential and commercial development. Skagit and Snohomish Counties are two of the fastest growing areas of Washington and are threatened by urban expansion from the Seattle metropolitan area. Agricultural fields (corn, potato, pasture) in several areas have been lost to urban sprawl. In addition, agricultural trends are by no means static. Swan habitat losses due to the advent of "clean" farming and conversion to bulb and vegetable crops are also slowly reducing winter habitat acreage.

In Oregon, less is known about critical wintering sites of Trumpeters. There is a large wintering population of Tundra Swans in Oregon, mainly in the Willamette Valley, lower Columbia River, and various coastal areas. Trumpeters are no doubt mixed in with these Tundras, and have been identified in separate flocks, but there has been very limited work to identify Trumpeters and their preferred habitats.

This past winter, Oregon contracted with Martha Jordan of The Trumpeter Swan

Society, to conduct wintering counts for Trumpeters. These counts are being used to identify areas of use and to get a baseline figure on the number of Trumpeters wintering in the state. While these efforts centered on western Oregon, the state plans to train its field personnel on the identification of Trumpeters to get a better idea on numbers statewide. Trumpeters wintering in the Willamette Valley are probably facing loss of habitat due to urban sprawl as in Washington. Oregon also has some suitable areas for wintering birds that are not currently being utilized.

To counter potential habitat losses for all waterfowl species, Washington, Oregon, California, the U. S. Fish and Wildlife Service (USFWS), and the Canadian Wildlife Service are currently developing the Pacific Coast Joint Venture under the North American Waterfowl Management Plan. The Joint Venture is a plan designed to acquire and enhance waterfowl habitat and establish indirect landowner programs to encourage management practices to benefit waterfowl. One high priority is to acquire 400 acres at DeBays Slough in the Skagit area of Washington. This parcel currently provides roosting and feeding habitat for up to 400 Trumpeters, a number which could be increased with improved management.

Depredation

Depredation by Trumpeters is not an issue in Oregon and Washington. Depredation may be perceived as a problem by landowners in the future as the swan population expands. This is extremely important in Oregon's Willamette Valley where an expanding overall Canada Goose population is causing damage concerns to landowners. But swans have a high public appeal in both states. A proposed Tundra Swan season in Oregon a few years ago caused a major public outcry against the season, which eventually resulted in withdrawal of the proposal.

Mortality factors

Lead poisoning and aspergillosis continue to be a problem in Trumpeter Swan wintering areas of Washington. In spite of the fact that Skagit County has been a steel shot zone since 1987, lead apparently continues to be available to Trumpeters feeding in Skagit County wetlands. Each year the WDW records several lead poisoning and aspergillosis cases in its program that has necropsies done on all swan carcasses. Partly in response to concerns about swan mortalities, all of western Washington was converted to a steel shot zone in 1989, ahead of the USFWS schedule, which will require the use of nontoxic shot for all waterfowl hunting in the U. S. by the Fall of 1991. Many areas of Oregon that have concentrations of swans are currently in steel shot zones, also.

Accidental and malicious shooting continue to be a concern in both states. With Trumpeters expanding in range misidentification problems will probably become more common. Increased educational and enforcement efforts are needed in both states.

Mute Swans

Because of the potential for competition with native waterfowl, the Washington Wildlife Commission voted on 18 January 1991 to place Mute Swans on the list of deleterious exotic wildlife. Washington has removed or ordered removal of Mute Swans found in the wild, and prohibit further importation, propagation, sale, or transfer of Mutes in Washington.

Oregon is just beginning to assess the Mute Swan problem. It is believed Mute Swan numbers are much lower in Oregon than Washington, but the state plans to evaluate the situation.

Population inventory and interchange among wintering areas

Concurrent with the expansion of Trumpeters into new wintering areas has been a greater emphasis on securing accurate population estimates and documenting interchange among wintering areas. Washington has intensified monitoring of habitat use and population levels in the Skagit Valley during the past five years through the establishment of a transect sampling program. In addition, the midwinter waterfowl inventory has been upgraded in conjunction with The Trumpeter Swan Society

to get better estimates of swan numbers throughout the state. A collaring program is also being pursued to provide information on migration movements of Trumpeters wintering in Washington. Efforts are currently underway to capture up to 50 Trumpeters for marking with brown and white collars and up to 50 Tundras with green and white collars.

As mentioned earlier, Oregon has just begun to secure population estimates and plans on working closely with Washington in the future to compliment efforts on Trumpeters in both states.

SUMMARY

Concurrent with the increase of the Trumpeter Swan population and distribution in Washington and Oregon there has been an increased emphasis on management of Trumpeters by both state agencies. Progress is being made toward obtaining better population/production data, securing wintering habitat, and decreasing various mortality factors. Given the current population and habitat status, both states believe that the population of wintering Trumpeters will increase both in size and distribution.

MANAGEMENT PROBLEMS ON THE BREEDING GROUNDS AND STRATEGIES TO RESOLVE THEM

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ABSTRACT

SINCE THE DOCUMENTATION OF A VIABLE POPULATION OF TRUMPETER SWANS IN ALASKA, THE SPECIES NO LONGER APPEARED TO BE THREATENED OR ENDANGERED BY EXTINCTION. THE TRUMPETER SWAN, LARGEST WATERFOWL IN NORTH AMERICA, WAS ENSURED A BIOLOGICAL CHANCE TO INCREASE ITS NUMBERS BY THE ESTABLISHMENT OF SPECIAL REGULATIONS TO PROTECT IT AND ITS HABITAT . THE CONCERN OF AGENCIES AND PUBLIC ALIKE HAS HELPED THE NATION BECOME SENSITIVE TO THE BASIC WELL BEING OF THIS BIRD. NOW RESOURCE MANAGERS, THE PUBLIC, AND ORGANIZATIONS SUCH AS THE TRUMPETER SWAN SOCIETY HAVE AN OPPORTUNITY TO EXPAND THE POPULATION INTO ALL AVAILABLE HABITATS. ENCROACHMENT ON TRUMPETER SWAN BREEDING HABITAT CAUSED BY PEOPLE'S DESIRE TO USE ALL AVAILABLE RESOURCES PRESENTS MANY UNIQUE PROBLEMS. FOR PROPER RESOURCE MANAGEMENT, STRATEGIES INCLUDE COOPERATION BY ALL INVOLVED.

INTRODUCTION

Since the 1968 survey for Trumpeter Swans in Alaska there developed a glimmer of hope for a species that was thought to have disappeared from almost all of its historic habitat. This survey documented more than 2,800 Trumpeter Swans in five separate breeding habitats in coastal and interior Alaska. Other subpopulations may have existed at that time, but manpower, aircraft and funding limited the time and effort for the survey. The Fall 1990 survey saw the Trumpeter Swan population grow to more than 13,000. This survey not only represents a more intense effort throughout virtually all breeding habitat occupied by Trumpeter Swans, but documents the species' ability to capitalize on their migratory behavior. Several years of favorable nesting and brood rearing conditions, biological adaptiveness and the exploratory nature of nonbreeding swans has allowed them to move into previously unoccupied habitat.

To date documentation of this expansion of the breeding range and monitoring of breeding and production has been supported largely by funding of the U. S. Fish and Wildlife Service (USFWS). Other land administrating agencies, the U. S. Forest Service (USFS), Bureau of Land Management (BLM), Department of Defense (DOD) and others, have supported this effort and expended funds to document Trumpeter Swan populations. These funds are acquired as public funds that filter down through the myriad of government programs to find their way for Trumpeter Swan surveys. You, the people, have decided that through the democratic process we, the public servants, can use public funds for the cost of using aircraft and our time to document swan use of the habitat.

The Trumpeter Swan has made "great flights" to expand into habitat recently void of swans. This expansion was documented by the process described above. Now it is up to all concerned about Trumpeter Swans to further promote favorable conditions so the species can continue its upward trend.

PROBLEMS

I shall now discuss what I see as specific problems of the Pacific Coast Population of Trumpeter Swans relative to Alaska.

Funding

The promise of continued funding for Trumpeter Swan work has never been guaranteed. Although we have received hundreds of valuable volunteer hours, some type of funding is necessary to collect and summarize biological data.

The recurrent challenge of the biologist is to secure funding (whether public, private or nonprofit) for the biological work which is important to the species and the public. Without this funding there are definite limitations to what can be accomplished, especially in Alaska. To document Trumpeter Swan use of the habitat, the changes in the habitat, and the preferred use of the habitat from "competitors" (i.e. development of any kind that competes with wildlife) we have relied extensively on aircraft. Flying airplanes is definitely not cheap, especially in Alaska. Therefore, a priority must be established on what data is collected with the available funds. I view biological data gathering and documentation of species status as one of the highest priorities for solving resource management questions and problems.

Nesting

Although excellent data has been collected on the productivity of Trumpeter Swans in the Pacific Coast Population (PCP) we lack consistent population-wide data relative to nesting. We (USFWS) have been fortunate to collect nesting data on swans from the Copper River Delta (eight years data, but not presently funded for 1991), Minto Flats (five years in conjunction with egg collection activities), a small quantity of habitat in the Nelchina Basin surveyed (two years in conjunction with egg collection activities there), and data collected on the Kenai National Wildlife Refuge (NWR) since the late 1970's and early 1980's. There may have been other sporadic and cursory nesting data collected in other habitats.

The importance of collecting nesting data is the documentation and identification of habitat. The very basis of a species success is the ability to reproduce. For waterfowl the nesting period is crucial. In Alaska where spring can be delayed for weeks this time period is critical. For Trumpeter Swans, it is that period before breeding pairs move from their nesting lake to the brood-rearing lakes. Without the documentation of the nest site, we are often unsure of the validity of protecting the lake and its associated habitat.

Part of the nest documentation effort should be the collection of data to substantiate nest site faithfulness of pairs and the natal faithfulness of juvenile females to return to breed in the area where they were fledged. This can readily be done by identification of individual birds through the use of special markers, i.e. neck bands, patagial markers, leg bands, etc., as well as by the use of telemetry. At present the opportunity to band cygnets and follow them through their adult breeding cycle has been very limited because of the low priority for funding such studies and because of the high mortality during the cygnets' first year.

Habitat encroachment

At this time habitat encroachment is tied directly to human activities. Historically, human contact with Trumpeter Swans was in the form of hunting. Hunting techniques were greatly enhanced by the invention of the firearm and thus the swan harvest was greatly increased. Increased human mobility partially explains the outcome from the effects of hunting and other disturbances and the resultant catastrophic decline of Trumpeter Swans in the 48 contiguous states. Since that time recovery has occurred due to changes in laws which protected swans. Now more complicated threats appear significant.

Some of these threats were documented by Timm (1981) where data led to the conclusion that many recreational cabins built on or adjacent to swan nesting lakes subsequently caused Trumpeter Swans abandon nesting and brood rearing areas. This threat continues today. During the 1990 Trumpeter Swan Survey (Conant et al. 1991) we recorded several lakes previously occupied by swans during the 1985 survey, which now were subjected to human disturbance (cabins) and were absent of swans. This desire of humans to "have their own spot" is indeed impacting wildlife habitat.

Resource development

Virtually all land in Alaska is being scrutinized by some private or corporate interest in hopes of monetary gain. Although the Alaska Native Claims Settlement Act established several National Wildlife Refuges and protected some of the most unique habitats in North America, the most productive Trumpeter Swan habitat in the world is left without any special designation. Even those areas under federal jurisdiction are being scrutinized almost daily for the development of petroleum energy.

Some of the more apparent activities include exploration and development of oil and gas resources on the Kenai NWR, Cook Inlet near Anchorage, and the Yukon Flats NWR. The coal industry is actively pursuing the possibilities for development of that industry in the western Cook Inlet and eastern Copper River Delta (the heart of Trumpeter Swan expansion habitat).

These activities also increase the chances of accidental contamination of the habitat. We all know the catastrophic results to wildlife and the environment from the Exxon Valdez oil spill into Prince William Sound. Although, no Trumpeter Swans were known to be directly effected by this oil spill there were approximately 50 Trumpeter Swans wintering in the Prince William Sound area. What would be the outcome if an oil spill occurred at the mouth of the Copper River Delta during spring, summer or fall?

The most recent environmental scare came from the derailment of petroleum carrying tanker cars on the Alaska Railroad. The derailment of several train cars occurred at one of the main tributaries flowing into Minto Flats west of Fairbanks (Goldstream Creek). The incident occurred at a critical time (nesting) and if it had been associated with any substantial increase in precipitation which is common during that time and if a beaver dam downstream from the spill had not temporarily helped contain the oil, this could have been more catastrophic for many wildlife species in the Minto Lakes area, including Trumpeter Swans.

Mining interests continue to grow in the 49th state. Again no habitat seems to be safe without a significant battle over what will be the primary use of its natural resources. When the State of Alaska established the Minto Flats Wildlife Refuge (which is home to one-fourth of the Trumpeter Swans in the Alaska), mining interests petitioned actively for mineral priorities and were successful in reserving access rights.

Again in Minto Flats, Goldstream Creek is downstream from Fairbanks where historically there has been continuous water pollution from mining activities. These activities not only load the stream with silt, but unknown amounts of other contaminants from mining activities flow into the area.

Agricultural development

Although agricultural development in Alaska has slowed somewhat there is still a proportion of the population that believes adamantly that the state should be self-sufficient in its production of food. Agricultural development in the Susitna Valley near Anchorage and the Delta Barley Project east of Fairbanks have caused considerable habitat disturbance. A threat to Trumpeter Swans is from illegal harvest due to the increased numbers of hunters that converge on the area during fall. Not all is bad, however, because waterfowl (including Trumpeter Swans) do use some fields to supplement their diet prior to nesting and again during fall migration.

At present there is an effort to extend the Alaska Railroad west of Nenana to parallel the Tanana and Yukon Rivers and terminate at the town of Tanana. The impetus behind this is not totally understood, but there have been vast lands west of Nenana which have "agricultural development potential" and it is presumed this fuels much of the emphasis. The extension of a railroad west from Nenana would bisect habitat used by Trumpeter Swans. This is one of the areas we now see as expansion habitat for a growing swan population.

Other problems

Problems which face Trumpeter Swans on the breeding area come from:

1. Disturbance and resultant displacement of swan families from airboat activity in the Tanana Valley. Efforts have been made to control access and timing of use, but with little success.

2. Illegal kill of swans continues from uneducated hunters and those with malicious intent. Efforts to educate and control this unlawful take continue.

3. Private inholdings within the boundaries of federally protected land threaten the opportunity to manage large tracts of habitat for wildlife.

4. The proposed development of the Over-The-Horizon radar site antennas in the upper Tanana Valley near Tok and the Nelchina Basin near Glennallen could have catastrophic results on migrating and resident breeding Trumpeter Swans if inclement weather conditions exist at critical times of the year. Fortunately, improved political relationships with Russia has placed the development of these sites on hold.

5. A proposal to use selected agricultural lands in the Delta, Alaska, area for human waste disposal sites is presently in the permit process. The impacts to agriculture soils and vegetation in an arctic environment is unknown. Human waste disposal sites in other areas of the United States have revealed high concentrations of metal contaminants, such as lead. Waste would be used to fertilize hundreds of acres of cropland in the immediate vicinity of the known migration route of Trumpeter Swans.

6. Discussion about problems of the breeding area cannot be made without acknowledging the biological ties to the migration and wintering areas. Trumpeter Swan breeding capabilities are tied to the nutritional status of the birds prior to nesting. Indications from egg collection activities have identified possible contamination of swans somewhere prior to when they arrive on the breeding area. This was discovered when high amounts of boron were found in the tissue of a deformed cygnet which died during hatching. A limited investigation of possible causes indicates areas of high boron levels in the soils of some sections of the Skagit Valley, Washington. Further study of this potential problem is scheduled.

STRATEGIES

Strategies to overcome the above problems are not easy. Many will take the untiring efforts of local organizations dedicated to resolve conflicts while others will take substantial coordinated efforts by all Trumpeter Swan enthusiasts throughout America. All efforts take cooperative attitudes, patience and understanding by everyone involved. These are critical ingredients in educating others about the necessity of protecting habitat.

I believe the greatest challenge to resolution of the problems here is proper land management. All agencies (federal, state, borough and county) will have to be convinced that proper care of the habitat for Trumpeter Swans is the best for all resources. Good, not only for swans, but humans as well.

The Trumpeter Swan Society can remain a influential organization by encouraging proper land management for the swan as well as people.

The first priority in proper habitat management must be a coordinated effort to establish a natural resource priority for the land. Other priorities must protect the land, the resource, and the people. All concerned for the well being of the Trumpeter Swan must be willing to work cooperatively with the bureaucracies, the public and private enterprise. In a time when government budgets are critically scrutinized and diminished, all agencies with Trumpeter Swan

habitat in their jurisdiction must work cooperatively for the collection of biological data which will help understand and protect Trumpeter Swans and their relation to what land management decisions will be made.

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FLYING WITH THE SWANS THROUGH ALASKA'S GREAT MOUNTAINS

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ABSTRACT

A LIGHT PLANE WAS USED FOR OBSERVATIONS OF MIGRATION AND STAGING OF TWO SPECIES OF SWAN, TRUMPETER SWAN (CYGNUS BUCCINATOR) AND TUNDRA SWAN (C. COLUMBIANUS). IT WAS NOT EASY TO STAY WITH MIGRATING BIRDS UNDER ALL CONDITIONS. BIRDS DID NOT MIND THE PLANE JOINING MIGRATION. GEESE, DUCKS AND GULLS ALSO FLEW WITH THE SWANS. GROUND SPEEDS FOR SWANS WERE 25 TO 60 MPH. FLIGHTS OF MIGRANTS WERE ORIENTED STRONGLY TO GEOGRAPHICAL FEATURES. SPRING STAGING DOES NOT SEEM IMPORTANT IN THIS AREA. FALL STAGING/FEEDING IS IMPORTANT FOR TRUMPETER SWAN FAMILIES.

INTRODUCTION

Two of the authors, King and McMahan, spent 110 hours airborne in 1989 watching the arrival, migration and departure of swans in the Gulkana Basin. Some 15,000 Tundra Swans, Cygnus columbianus, migrate through this basin and some 3,000 Trumpeter Swans, C. buccinator, comprise a nesting population within it. We were able to make a number of aerial and staging behavior observations. We managed to fly with seven spring and nine fall flocks long enough to determine their ground speed.

This was part of a four year study by Alaska Biological Research Inc. (ABR) to document bird activity near a huge radar screen proposed by the U. S. Department of Defense near the village of Gakona, 175 miles northeast of Anchorage. (The proposal has been canceled.) Two years of observations by Ritchie, Cooper and others from a tower near the radar site had disclosed a confusing pattern of local movements by Trumpeters and some high elevation flights by Tundra Swans. The aerial surveillance was conceived by Bob Ritchie, owner/manager of ABR, and was coordinated by Brian Cooper, project supervisor. The pilot was Harley McMahan, a second generation, commercial Supercub pilot, guide, and outdoorsman, who is a lifelong resident of the Gulkana Basin. Observations were recorded by King while learning to ride in the cramped back seat of a Piper Supercub.

Our objective was to try to fly with flocks of migrants, determine how they entered and left the Basin, and to document staging and feeding areas. The daily mode was to depart Gakona in the morning and fly easterly in spring and westerly in fall to try to intercept migrating flocks. We would fly about 4 hours, sometimes landing to talk with people on the ground, and finish in the early afternoon. If swans were moving we would go out a second time. We flew 13 days in the spring (18 to 30 April) and 14 days in the fall (30 September to 13 October).

THE GULKANA BASIN

The setting for this effort is absolutely unique. North America's highest mountains ring the area. Recent conservation writers coined the term "Crown Jewels" in reference to national parks and refuges in Alaska. We do not know about the jewels, but these mountains do, in fact, form a crown. The fore peak is Mount McKinley, facing the western weather, reaching 20,000 feet into the atmosphere and backed by the Talkeetna Mountains. The sides, with summits to 12,000 and 13,000 feet, are the Chugach Range rising out of the North Pacific Ocean and the Alaska Range towering above the Yukon River drainage. To the east,

the Wrangell Mountains scrape the sky at more than 16,000 feet. Within this circle is the Gulkana Basin, an area of some 5,000 square miles of undulating hills, lakes and wetlands at elevations averaging 1,500 to 3500 feet.

Intermountain basins at high latitudes, protected from cloud laden coastal weather patterns and bathed by near continuous summer sunlight, can produce a temperate oasis for wildlife. Fish, big game and furbearers, as well as birds, thrive in this one. Life zones of the Gulkana Basin are Boreal Forest to about 2,000 feet, a transition zone of stunted open forest and brush to 3,000 feet with alpine tundra above that. Open bogs and wetlands are scattered throughout. The surrounding mountains are festooned with glaciers and permanent snow cover. Birds can enter this bowl by eight passes at or below 3,500 feet: four on the north, two on the south and one each to the east and west. This is not a small area. From the summit of Mt. McKinley to the summit of Mt. Sanford is nearly 226 miles, thought to be the longest view possible from any two points on earth. It is a suitably impressive crown for North America.

FLYING

Our approach to flying with the swans was cautious because we would not learn anything if the presence of the plane influenced flight patterns. We tried to follow from a mile or so behind. This was tricky because the speed of the plane is some 20-30 mph faster than the swans.

We already knew that swans are not seriously afraid of light planes and, in fact, try to communicate with them. This is obvious because sitting swans do not normally flush when planes go over, as geese almost always do, and because swan pairs often present an airplane the same threat posture they give other swans flying above their nesting territory. As the plane flies on, the displaying swans no doubt have the satisfying impression their message was understood and respected.

We soon noticed some flocks were more timid than others but, within ten or fifteen minutes, they would become accustomed to the plane and we could fly beside, over and even ahead of them without their breaking formation or diverting from their heading. Successful migration no doubt demands that diversions be resisted. In following behind one flock of 240 Tundra Swans for over an hour we were often close to a second flock of 40 going the same way. They maintained their position behind the lead flock even though the plane was often within one hundred yards as it turned and zigzagged.

Migration, it seems, is a great mass movement by dozens of species using the same air space and having a common objective. Other large migratory birds sharing the swan routes in Alaska include geese, raptors, gulls and cranes. ABR ground crews have reported numerous mixed flocks of Trumpeter and Tundra Swans. Other swan flocks have included geese, ducks and even gulls. We tracked a fall flight of nine Trumpeters and one Canada Goose for 59 miles. The goose maintained second place behind the swan leader. We also followed 80 Trumpeters in a "V" behind a single Glaucous-winged Gull, Larus glaucescens, for more than ten minutes until the swans circled and landed with a flock on the water. We saw a swan leading two Northern Pintails, Anas acuta, followed by another swan all in a typical swan line. We wonder if this is a form of "chase" or the spirit of a parade as practiced by dogs, kids and other creatures. What significant aerodynamic advantage could accrue to a swan following a duck or a gull? We were left with the impression that if the plane appeared to be a part of all this it was not unwelcome. Too bad we could not slow down sufficiently to actually join the swan formation.

Our group flying went well if the swans were under 500 feet and over a high contrast background. We soon learned that at higher elevations a flock of swans can vanish in a clear sky while you are looking right at them. The problem was increased by our having to turn regularly and that is when we usually lost them. How could this be? Swans are constantly in motion vertically as well as horizontally and can be cast up or down by gusts. We rose a thousand feet with a flock of 75 Tundras during a couple of minutes in a great thermal but lost them a few minutes later. The ground observers had learned that

you cannot see flocks of swans more than about 5 miles away in good visibility and that glare, mist, snow flurries or a white background can easily reduce this distance. The steady calling of migrating swans suggests they have the same visual limits, especially at night or in poor visibility, and rely on audio signals to stay together. Staying together, of course, is particularly important for the young.

SPECIES

In the air positive identification of swans is impossible, but there are some characteristics that we think indicate species. Perhaps up to 10% of flocks in this area are mixed and even from the ground one cannot always tell unless both are calling. Trumpeter flocks tend to be small, consisting of pairs or family groups of up to about 25. We did identify one Trumpeter flock of 125. Tundra Swans, while sometimes in family groups, are often in aggregations of several hundred to a 1,000 or more. Trumpeters tend to fly lower, under 500 feet, while Tundra Swans are often above 500 feet and up to several thousand feet above the terrain. In the Gulkana in spring, Tundra Swans seemed to land only to rest while Trumpeters landed to feed. The Trumpeter migration, both spring and fall, spans a longer period than the Tundra migration. In the fall early migrants of both species are white (unproductive adults) while the white and grey families come later.

SPEED

We were able to locate the flocks we followed on maps (USGS, 4 miles = 1 inch) and time them between landmarks. The average ground speed for 16 flocks we tracked for a total of 409 miles was 44 mph with a range of 25 to 60 mph. Wind was a factor in every case, favorable or otherwise, so true air speed would be somewhere between these figures. In the mountains, wind often varies within short distances. Thus, maintaining the integrity of migration would demand coping with some unfavorable wind directions and turbulence. We followed one flock of 19 Trumpeters that averaged 25 mph for 20 minutes flying through what we considered uncomfortably rough air. They were unable to hold a nice formation and flew in a bunch much like a flock of ducks. Eventually the air smoothed and the flock resumed a normal formation. We watched one flock of three swans catch up and join a flock of six, gaining several miles in 15 minutes. We also watched a swan turn out of a formation circle and then catch up with no evident trouble. Migration speed is obviously less than maximum speed. We think families flew a little slower than flocks of adults and Trumpeters were slower than Tundra Swans but could not be sure of this.

DIRECTION

It was pretty evident that the flocks we followed knew where they were going and steered on what amounted to a compass heading regardless of turbulence, unfavorable winds and minor topography. We did encounter some local movements of Trumpeters early in the migration period. Most flocks of both species were generally oriented to the great mountain passes through which they travelled. The Trumpeters arrive and depart the Gulkana by two routes, southeast or northeast with a few using a northwest route to and from points beyond this basin. The Tundra Swans used the same northeast route, did not use the southeast route but used western and southwestern routes and were occasionally seen in two of the northern passes. The purposefulness of most of the flocks we followed was obvious. Like airplane pilots orienting to a chart or a radio beam they maintained a true course that could only have been set by an experienced leader. Tundra Swans enter the Basin from the northeast in spring. Near the center of the Basin there is a split with some flocks heading southwest toward Chickaloon Pass and others going west to the Susitna Canyon indicating these may be discreet populations.

RESTING/STAGING

In spring, Trumpeters arrive and disperse very rapidly, however, flocks of 50 or more were seen on several early opening waters. Pairs seem to take up residence on their nesting territories on arrival whether there is any open water or not. We regularly saw swan pairs standing on the solid ice of small ponds. The thaw progresses very rapidly in the high latitudes from winter conditions in mid-April

to nest building in summer conditions of early May. During this migration period we watched Trumpeters on several occasions decoy to flocks on the water. As sitting swans are not as noisy as flying swans perhaps the urge to flock is facilitated by the white color which shows up well for a mile or more. Such camaraderie would not be allowed in nesting territories so some pre-landing communication is required.

Spring migrant Tundras were only known to land on the crumbling ice of the Copper River where we positively identified one flock of 50 and another of 80 that stayed overnight. The Tundra migration only lasted about a week and peaked on 26 April.

By mid-September, with wing molts complete and young fledging, a slight increase in Trumpeter flight activity develops. The territorialism seems to end at this time and families can join each other at favored feeding locations. One might think that, in anticipation of a marathon migration, conditioning and flight training for the young would be important but we did not detect much of this. ABR ground observers reported Trumpeter families did fly once or twice a day and two broods left their territory at least twice for an overnight somewhere, returning next day. From the air we seldom saw what would appear to be a practice flight. Intensive feeding would seem to be a more important pre-migration activity than flight conditioning. Swan muscles and lungs must be very different from those of people.

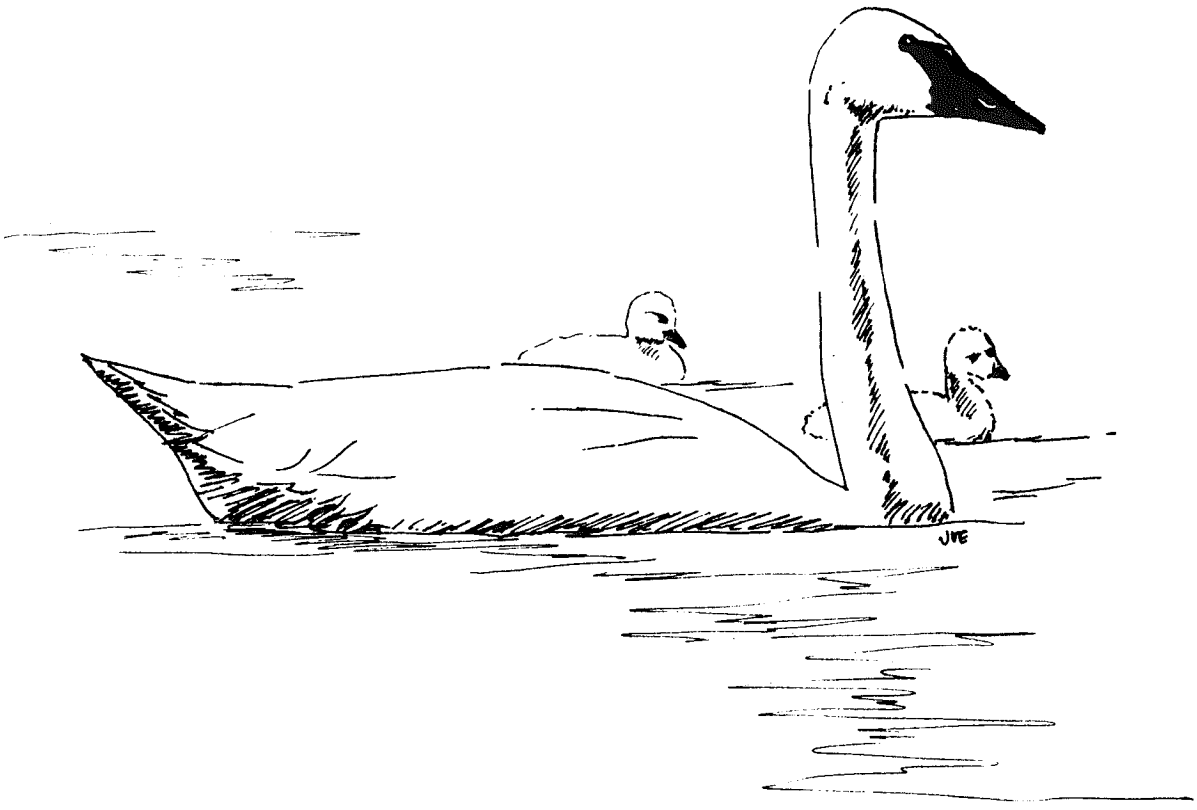
In October we located nine staging areas that peaked with more than 100 Trumpeter Swans, ranging from 145 to 732 birds. Six of these were in shallow lakes where the water was rendered turbid by the root digging of the swans. The swans evidently brought up more food than they ate providing some for Mallards, Anas platyrhynchos, that participated in these feeding binges in numbers equal to the swans. These lakes were frozen on 13 October. The other three staging locations were in shallow, clear rivers loaded with greenery that remained ice free past the middle of October. Ducks did not accompany swans in these streams. From 30 September to 13 October the proportion of young in the staging areas went from 15% to 35% indicating an inflow of families and an outflow of swans without young. On 12 and 13 October, with temperatures near zero and all but the largest lakes covered with black ice, the Trumpeters were moving out. We saw 144 Trumpeters in 11 flocks sitting on the clear ice even though there was open water nearby. Once migrating a little rest is evidently welcome but food and water are already on board for major portions of the trip.

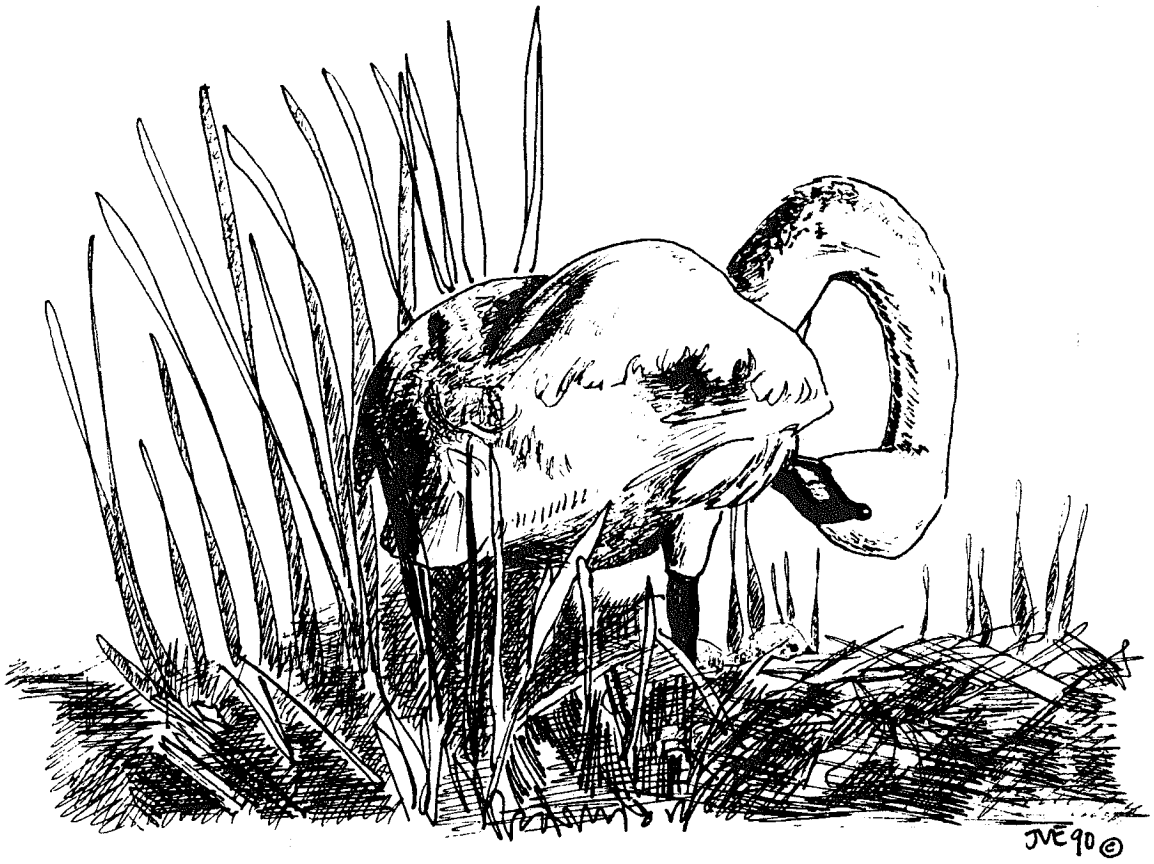
We did not have much luck with following Tundra Swans in the fall. The migration lasted only a few days and peaked on 8 October. Fall Tundras were high, often ducking in and around clouds or snow showers and sometimes flying at night.

CONCLUSIONS

This project demonstrates the value of a light plane as a platform for behavioral studies of birds. Flying with the swans was exciting and rewarding. We did it very carefully so as not to interfere. It provided us with a new perspective of swan activity. Others will no doubt try it. We would hope it would only be done in a most careful and sensitive manner and for an important reason.

Public organizations are wrestling with swan population problems now. In the next few years or decades the North American people will have to decide whether they want to support abundant, wild, free flying, migrating swans or to settle for only a token population of semi-captive park and zoo birds. The swans, of course, work diligently to maintain their traditions and increase their numbers. If we are willing to share with them some of the land and water resources on which we both depend, the swans can thrive. With a little help the glory of the swan migration to and through America's crowning mountain range can continue on and on.

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CANADIAN INVOLVEMENT IN MANAGEMENT OF TRUMPETER SWANS

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ABSTRACT

DETAILS OF THE INVOLVEMENT OF THE CANADIAN WILDLIFE SERVICE IN TRUMPETER SWAN MANAGEMENT ARE GIVEN. RECENT POPULATION SURVEYS INDICATE A SMALL BUT VIGOROUS POPULATION IN CANADA. ALTHOUGH THE SPECIES IS NOT CONSIDERED TO BE OF HIGH PRIORITY, CONCERN FOR AND MANAGEMENT OF TRUMPETER SWANS DATES BACK TO AT LEAST THE 1930'S. CURRENT MANAGEMENT CONCERNS PRIMARILY REFLECT A LACK OF PROTECTED HABITAT DEDICATED SPECIFICALLY TO TRUMPETER SWANS. FUTURE INVOLVEMENT WILL LIKELY ADDRESS THIS PROBLEM, THROUGH SETTLEMENT OF NATIVE LAND CLAIMS IN THE NORTH AND NORTH AMERICAN WATERFOWL MANAGEMENT PLAN JOINT VENTURES IN THE SOUTH.

INTRODUCTION

The purpose of this paper is to present a short synopsis of past and probable future involvement by Canada in the continental management of Trumpeter Swans (Cygnus buccinator). The current status of the species and its standing in management priorities is indicated, past involvement of Canadian Wildlife Service (CWS) and other agencies in management is discussed, current management concerns are presented, and a prognosis for the future is given.

Status

Canada has a relatively small breeding population of Trumpeter Swans, distributed through northern Alberta and British Columbia, the southeastern Northwest Territories and the southern Yukon. In addition, British Columbia is the winter home to a significant portion of the Trumpeter Swans breeding in Alaska. The first more or less range-wide breeding survey of Trumpeter Swans in Canada was conducted in the 1981-82 period. A total of 335 birds (adults and young) was recorded. In 1985, in conjunction with the 5-year periodic survey in Alaska, 647 birds were found in Canada (McKelvey et al. 1988). During a similar survey in 1990, 1236 birds were seen.

Complete surveys of the number of swans wintering in British Columbia have never been undertaken. However, current estimates indicate about 3000 birds winter on Vancouver Island (McKelvey et al. 1991), 1000 in the Fraser River valley (McKelvey 1991), perhaps 1500 in the central interior (unpublished data and D. King, pers. comm.) and probably as many again on the central mainland coast. That totals 7000 birds, or about 54% of the Alaska population.

Species priority

The CWS has responsibility for management and protection of migratory birds under the Migratory Birds Convention Act. Management programs broadly center around game birds, seabirds, shorebirds, forest birds, nongame birds, and rare and endangered species. In the Western and Northern Region of CWS, Trumpeter Swans are managed as part of the endangered species program, while in the Pacific and Yukon Region they are managed as a relatively common (in winter) gamebird for which there is no open season. In both regions they are managed on a relatively low priority, because of more urgent concerns in other programs.

Past involvement

Some of the efforts CWS has undertaken in the past have included:

- annual surveys near Grande Prairie since 1959;

- annual surveys in the Northwest Territories since 1984 (swans were first recorded in Nahanni National Park Reserve in 1975 by Parks Canada);
- collaring of swans at Cypress Hills in 1971-72;
- breeding population and habitat studies in the Yukon Territory, 1978-81;
- studies of the use of early open water spring staging areas in Yukon, 1981-83;
- winter surveys at intervals in south coastal British Columbia since 1971;
- intermittent surveys of birds wintering in the interior of British Columbia from 1981;
- protection of remnant wintering flocks in British Columbia, specifically at Lonesome Lake, since 1935;
- habitat use and feeding ecology studies on coastal British Columbia, 1977-81;
- ongoing input to the North American Management Plan for Trumpeter Swans;
- reintroductions in Alberta, and assistance with such a program in Ontario;
- promotion of aviculture displays and propagation at such locations as the Calgary Zoo, and the cities of Camrose and Grande Prairie.

Current management concerns

Current concerns for the management of Trumpeter Swans include the following:

Yukon Territory

All of the breeding range and the critical early open water spring staging areas remain unprotected.

British Columbia

Breeding range without specific protection; winter concentrations in estuaries without protection; conflicts with agriculture developing in the Comox and Fraser River valley areas.

Northwest Territories

Except for Nahanni National Park Reserve, which contains only 10% of the territorial population, the breeding range is unprotected.

Alberta

Land-use guidelines on Crown land do not provide complete habitat protection and are nonexistent on private lands; large scale forest development in the boreal forest (pulp) is anticipated within the decade.

Ontario

Restoration efforts are proceeding slowly due to setbacks caused by predation and uncertainty about the selection of release sites.

Future involvement of Canadian Wildlife Service

Although programs aimed specifically at management of Trumpeter Swans in Canada are relatively modest, there will be direct benefit to swans from a number of related programs. In addition, many of the existing programs are expected to continue for the foreseeable future. Both types of programs include:

Yukon Territory

Continuation of breeding ground surveys at 5-year intervals; protection of significant portions of habitat through completion of Comprehensive Land Claims.

British Columbia

Continuation of breeding ground surveys at 5-year intervals; continuation of wintering ground surveys opportunistically; protection and management of wintering habitat through the implementation of the Pacific Coast Joint Venture; control and amelioration of crop damage in wintering areas through the same Joint Venture.

Northwest Territories

Continuation of studies within Nahanni National Park Reserve; protection of significant portions of habitat through completion of Comprehensive Land Claims.

Alberta

Continued annual assessment of the Grande Prairie flock, as long as the Elk Island National Park transplant program is being undertaken, and 5-year interval range wide surveys; management of the Elk Island National Park transplant program until 1995; in cooperation with the Province of Alberta; development of provincial management plan.

Ontario

Continued minimal support for restoration efforts.

General

Continued involvement with Pacific Flyway Study Committee and general management planning; support of United States efforts to diversify wintering grounds for the Rocky Mountain Population.

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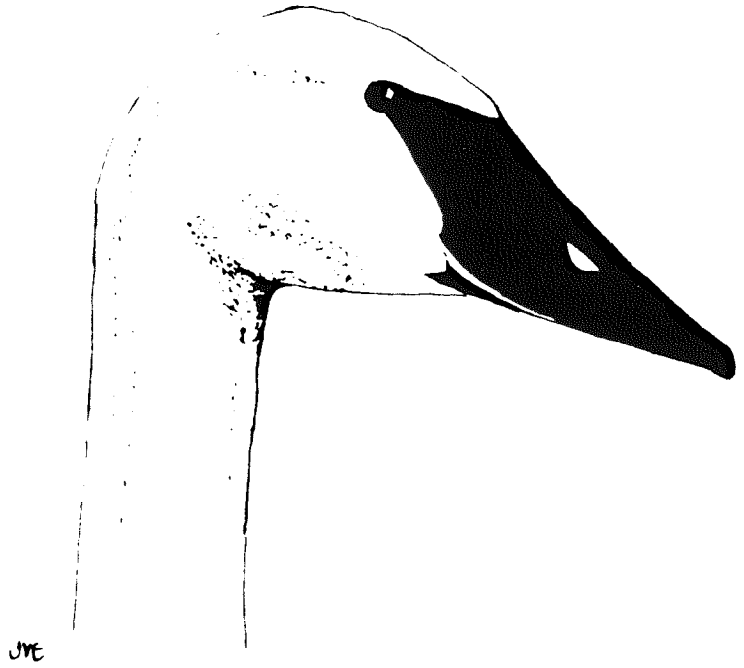
FACILITATED WORKSHOP ON TRUMPETER/TUNDRA SWAN MANAGEMENT AND RANGE EXPANSION FOR THE RMP



FACILITATED WORKSHOP ON TRUMPETER SWAN MANAGEMENT AND RANGE EXPANSION

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INTRODUCTION

At the Twelfth Trumpeter Swan Society Conference in Minneapolis, Minnesota, The Trumpeter Swan Society (TSS) Board of Directors voted to hold the Thirteenth conference in Salt Lake City, Utah. Part of their rationale for locating the conference in Salt Lake was to encourage greater participation by Utah agencies, citizens and wildlife groups in Trumpeter Swan range expansion. In planning the 1991 conference program agenda, it was believed that a workshop on the last day would be a more effective way of involving conference participants, of providing some possible feedback to swan managers and of involving interaction of participants with various levels of swan management expertise and interest.

METHODS

The workshop conduct was developed by Jack Williams, a trained facilitator, with assistance from Dave Lockman, Carl Mitchell and Dave Weaver.

Preworkshop mailings

It was determined that to be most effective and useful for range expansion efforts, citizens and wildlife interest groups from Utah should be solicited to participate with managers in the workshop. With the assistance of the Utah Division of Wildlife and Kayo Robertson of Logan, Utah, Donna Compton mailed out over 250 letters inviting Utah citizens and interest groups to the workshop.

Facilitator's instructions

Presumption

The facilitation model presented here presumes that the participants are at some level aware of the problems concerning the Rocky Mountain Population (RMP) Trumpeter Swan range expansion efforts and associated issues (i.e. population management, habitat, wintering sites, hunting and predator issues). It also presumes that there would be some benefit gained from having the participants define what they believe are the major problems and for them to come up with possible solutions for those problems, rather than work on problems and issues wildlife managers define.

Objective

To solicit input and achieve consensus from workshop participants relative to RMP Trumpeter Swan range expansion efforts. The input gathered from the workshop will be provided to Trumpeter Swan managers for use in management, planning and expansion project activities. This will give representative from affected interests in the region an opportunity to participate in consensus groups of mixed interests for the purpose of contributing input into Trumpeter and Tundra Swan management. It will also promote greater understanding of the difficult decisions that need to be made regarding Trumpeter and Tundra Swan management.

Methodology

The total group of participants is divided into small teams of from six to ten people, depending on the total number of participants. Each will be identified by a color code.

Four distinct activities take place during the workshop:

1. *Funneling*, which requires the groups to "brainstorm", make lists of and report on, issues and problems they identify.
2. *Issue Voting*, which is a process of narrowing lists of issues and problems down to a workable size.
3. *Solutions in the Mail*, a process for determining solutions and prioritizing those which seem most viable.
4. *Judging* is determining which of the potential solutions are most feasible to present to management.

Workshop Agenda

The following agenda was used to conduct the workshop:

1. Introductory Information Session
8:30-10:15

Chuck Peck, U. S. Fish and Wildlife Service (USFWS).
Topic: General overview of the RMP range expansion project. This will be somewhat redundant for those attendees of the entire Conference, but will focus on only the information pertinent to the afternoon workshop.

Jim Bartonek, Pacific Flyway Representative, USFWS.
Topic: The roles of the flyway councils and state/provincial/federal agencies in Tundra and Trumpeter Swan population management.

Ruth Shea, USFWS/Idaho Department of Fish and Game.
Topic: Biological background information which defined the need and desire to expand the Trumpeter Swan's range on the continent.

Ruth Shea and Carl Mitchell, Red Rock Lakes National Wildlife Refuge (NWR), USFWS.
Topic: Review the physical and biological characteristics of Trumpeter Swan winter habitat.

Ruth Shea and Tom Aldrich, Utah Division of Wildlife.
Topic: The RMP management plan and range expansion.
1. The role of western states, south of the current range, in the range expansion effort.
2. Identify Utah's integral role in the range expansion effort.
3. Identify the major conflicts managers have identified to be resolved on potential winter habit, the key to the workshop.
4. Describe the winter habitat evaluation process. Identify the type of wintering sites or areas which will be focused on and the methods that will be used to achieve/promote Trumpeter Swan occupation of these areas.
5. Summarize problems confronted in range expansion efforts nationwide.

Kayo Robertson, Bird Enthusiast.
Topic: How can wildlife managers achieve better support from wildlife advocates in Trumpeter Swan range expansion efforts? What role should wildlife advocates play in range expansion efforts?

Rod Drewien, Wildlife Research Institute.
Topic: The dilemma of shrinking wetland acres in the southwestern U. S., increasing Tundra Swan numbers over the last two decades, competition for space between humans and waterfowl species, and the role of hunting as a management tool.

Len Shandruk, Canadian Wildlife Service.
Topic: Canada's stake in the success or failure of Trumpeter Swan range expansion efforts in the U. S., including recommendations for increased Canadian involvement in the program.

2. Funneling 10:30-11:15

Step 1. Brainstorming

Co-facilitators assist in getting everyone seated into their designated group circles. Objectives are discussed and the first assignment is made.

Small groups discuss issues and problems, and list them.

Step 2. Ranking

Small groups rank issues and problems, and identify three "best".

Step 3. Report Out

Each small group reports on their three "best" and the co-facilitators record their responses on a flip chart.

3. Issue Voting 11:15-12:15

Step 1. Voting on Team Lists

The key facilitator leads a voting process to determine the "best" items presented. Items with highest number of votes are highlighted. Six to ten are chosen from highest ranked items.

Step 2. Break to Make Out Envelopes

Groups take a break while facilitators and volunteers generate issue/problem questions and write those on envelopes.

Step 3. Defining "Criteria"

Co-facilitators pass out envelopes to each small group. "Criteria" development process is explained and the assignment is given.

Step 4. Criteria Identification

Groups identify criteria upon which highest ranking issues and problems will be judged.

Groups adjourn for lunch break.

4. Solutions in the Mail 1:30-4:05

Step 1. Solution Development Process

Facilitator outlines assignment and passes out envelopes to small groups.

Step 2. Solution Brainstorming and Selection

Small groups discuss solutions to issue/problem questions written on envelopes. Every fifteen minutes, small groups pass envelopes on and get new ones until envelopes are returned to the beginning.

5. Judging 4:05-4:55

Step 1. Criteria-based Ranking

Small groups rank and give points by criteria identified earlier to potential solutions written on the 3 x 5 cards found in their envelopes.

Step 2. Report Out

Small groups report on their rankings and facilitator records most favored solutions on flip charts.

6. Wrap-Up

The TSS President takes a few minutes to express his thanks for the group's participation in the exercises, then tells them what actions they can expect from the conference committee on the data and solutions that have been generated.

Program concludes.

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