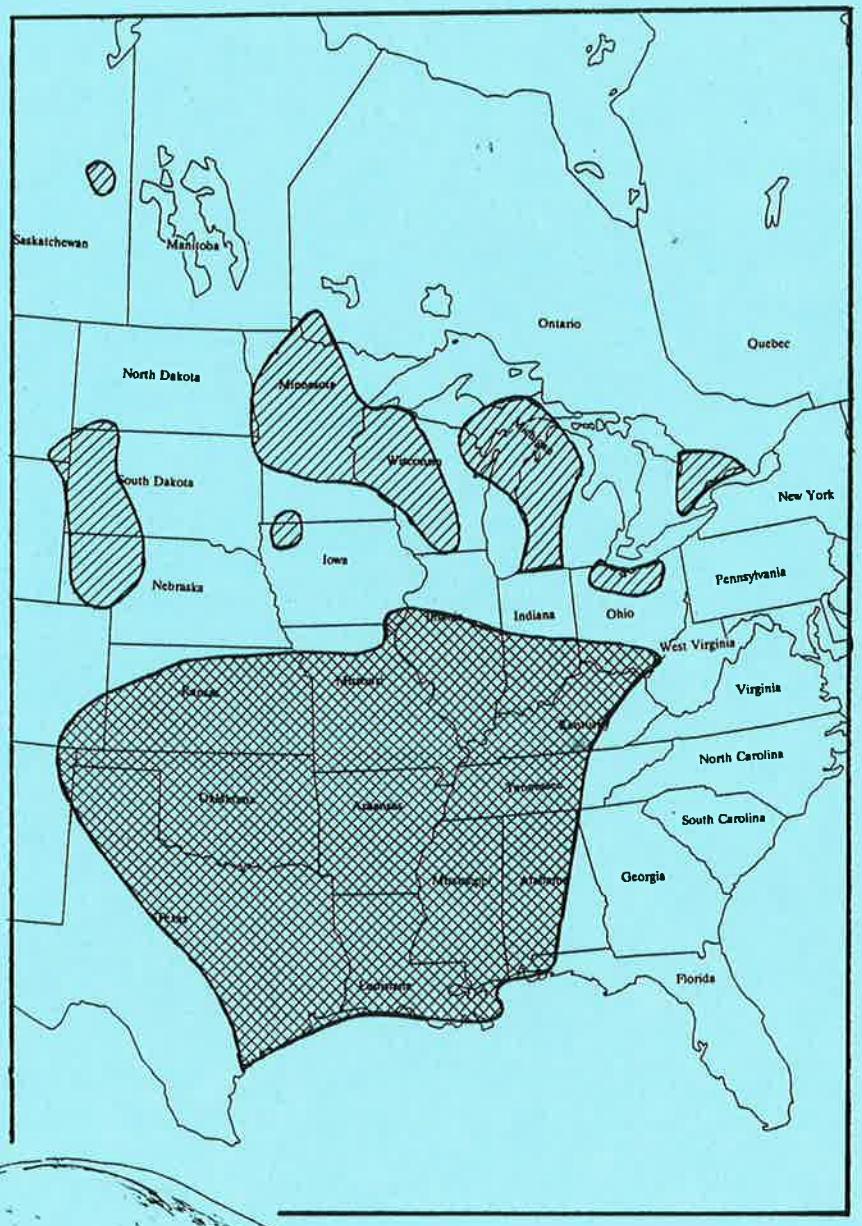
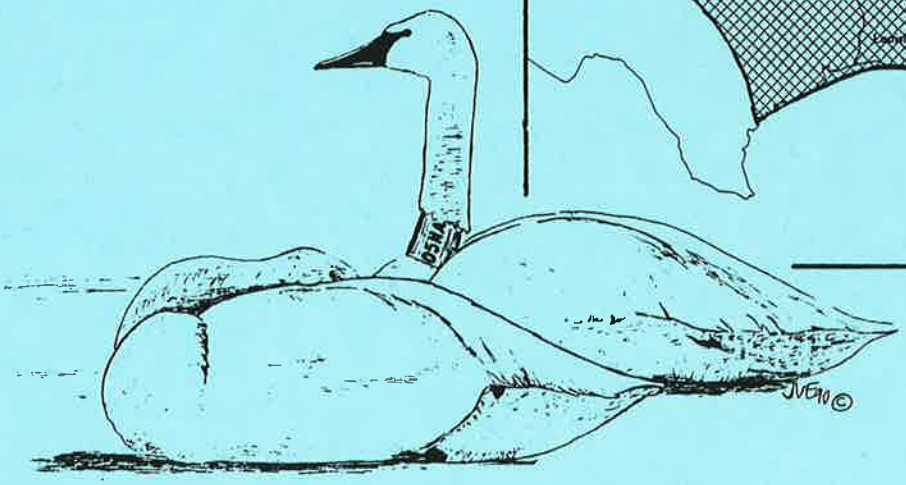
Mississippi and Central Flyway Management Plan for the

Interior Population of Trumpeter Swans





MISSISSIPPI AND CENTRAL FLYWAY MANAGEMENT PLAN

FOR THE

INTERIOR POPULATION OF TRUMPETER SWANS

Prepared for the:

Mississippi and Central Flyway Councils
U. S. Fish and Wildlife Service
Canadian Wildlife Service

Prepared by:

The ad hoc Drafting Committee for the Interior Population of Trumpeter Swans
Mississippi and Central Flyways

January, 1998

Approved by:

_____ 20 March 1998
Chair, Mississippi Flyway Council **Date**

_____ May 1, 1998
Chair, Central Flyway Council **Date**

Suggested Citation:

Ad hoc Drafting Committee for the Interior Population of Trumpeter Swans, 1998. Mississippi and Central Flyway Management Plan for the Interior Population of Trumpeter Swans. Mississippi and Central Flyway Councils. [c/o USFWS, Migratory Bird Coordinator] Twin Cities, MN. Unpub. rpt.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. EXECUTIVE SUMMARY

The preparation of this management plan for the Interior Population of trumpeter swans began in 1995 as a joint effort by the Mississippi and Central Flyway Technical Committees. The purpose of the Interior Population Management Plan (IPMP) is to coordinate present and future efforts to restore a self-sustaining migratory population of trumpeter swans in the Central and Mississippi Flyways. The Plan focuses on population size, distribution, continuing restoration efforts, present and anticipated management issues, strategies and recommended actions. At this stage, the Plan is more conceptual than strategic.

The Plan goal is to restore a self-sustaining, migratory population of trumpeter swans in the Central and Mississippi Flyways. The principal objectives are to: (1) Develop a dispersed breeding population consisting of at least 2,000 birds and 180 successful breeding pairs by 2001. (2) Implement a program that will encourage 50 percent of the population to migrate to suitable wintering areas by 2001. (3) Identify and manage seasonal habitats required to meet population and distribution objectives. (4) Strive for compatibility with other waterfowl management programs. (5) Provide for optimal recreational benefits. (6) Develop protocols for banding, marking and reporting swan observations. (7) Implement an effective information and education program to enhance restoration efforts.

The primary issues of concern and recommended management strategies are discussed in detail in Section VI of the Plan. A brief synopsis of management strategies is included below.

- Strengthen coordination among federal, state and provincial agencies, tribal councils, and private organizations involved through closer liaison with flyway technical sections and councils.

- Develop a dispersed breeding population of at least 2000 birds and 180 successful breeding pairs by 2001. Present and planned restoration programs appear to be adequate to attain the desired population and distribution objectives.

- Develop state management plans designating potential wintering sites and determining the adequacy of natural food resources. Areas should be relatively free of lead shot.

- Experiment with known and new techniques to induce trumpeters to migrate, find and use suitable wintering sites. Special consideration should be given to protection and accommodation of pioneering birds.

- Resolve potential conflicts between restoration of trumpeter swans and other waterfowl management programs.

- Establish an information and education program for waterfowl hunters stressing positive identification of both species of swans to reduce the chance of illegal taking of swans during other waterfowl hunting seasons.

- Manage known lead-free sites more intensively to attract and hold trumpeters. Enhance law enforcement and information programs to ensure strict compliance with non-toxic shot regulations.

Successful implementation of the IPMP will depend on meeting a variety of information needs. Management, research, habitat requirements, restoration techniques, monitoring, program evaluation, communications and other educational activities are addressed under 19 categories of information needs in Section VII.

A procedure will be developed to monitor progress in implementation of the Plan, to measure and report annual accomplishments and to periodically update the Plan as necessary. It is recommended that a joint IP Subcommittee be established within the participating flyways to help implement and oversee the IPMP.

II. INTRODUCTION

There is strong public interest in the well being of trumpeter swans that once were on the brink of extinction. Opportunities to observe, photograph and study trumpeters are important pastimes of people throughout their range. Restoration efforts in the Upper Midwest have increased opportunities for the public to pursue these activities. This Plan provides a framework for state, provincial and federal agencies and private organizations to continue the restoration of trumpeters throughout their former range, which will enhance these public benefits.

During the past 15 years, considerable effort has been devoted to the development of management plans for trumpeter swans both on an international basis and for specific flocks. The final draft of The North American Management Plan for Trumpeter Swans (NAMP) was completed in 1984 and circulated to the Flyway Councils, U.S. Fish and Wildlife Service (USFWS), and Canadian Wildlife Service (CWS) for approval. The plan was signed by the Chairman, Pacific Flyway Council as it pertained to the Pacific Coast Population (PCP) and the Rocky Mountain Population (RMP), but deferred to the other flyways pending further input on the Interior Population (IP). By 1986, an ad-hoc trumpeter swan committee of the Mississippi Flyway Council Technical Section had revised the IP portion of the NAMP (Section V) which was approved by the Mississippi Flyway Council on March 23, 1986 (MFCTS, 1986, App. H). The approval process for the NAMP was never fully completed, but the document provided a framework for

initial program coordination through the Flyway Council System, and served as a basis for revisions of the RMP Management Plan in 1992 and the PCP Management Plan in 1993. The North American Waterfowl Management Plan also recommended population goals for the three populations of trumpeter swans.

Management of the Lacreek flock in South Dakota and adjacent areas proceeded under a separate management plan for Lacreek trumpeter swans which was endorsed by the Central Flyway Council in 1982. Individual state and provincial management plans were prepared to guide restoration efforts in the Mississippi Flyway. These plans were approved by the Mississippi Flyway Council on a state-by-state basis. In September 1994, The Trumpeter Swan Society hosted a meeting for interested parties to develop a consensus for future management of the IP. A Drafting Committee was appointed by the two councils and assigned the task of reviewing goals and objectives, updating management concerns and strategies, and completing a Draft Management Plan (DMP) for the IP by February 1996. The Draft Plan was submitted to the Technical Committees of the two Flyways in February and March 1996 for their review and comment. This Plan reflects those comments.

The IPMP is based on the knowledge gained from restoration efforts, the expansion of local breeding flocks, the beginning of natural migration to wintering sites, and the need to coordinate efforts to restore self-sustaining migratory populations of trumpeter swans in the Central and Mississippi Flyways. The IPMP focuses on current population size, distribution, continuing restoration efforts, present and anticipated management issues, and recommended management actions. The primary goal, supporting objectives and related management strategies establish a framework for addressing the principal issues and provide guidelines for short-term and long-term management of the IP.

Management actions have been designed to restore a self-sustaining migratory population of trumpeter swans with adequate wintering sites, while minimizing conflict with other waterfowl management objectives. The IPMP recommends development of a monitoring and evaluation component, and provides for updating at 5-year intervals to meet changing conditions. It may be desirable to include future management actions related to the Atlantic Flyway in the updating process or consider a separate plan for the eastern segment of this population at that time.

The Management Plan for the Interior Population of Trumpeter Swans (IPMP) would not have been prepared if it were not for a grant to The Trumpeter Swan Society from The World Wildlife Fund to cover most expenses associated with meetings of the Drafting Committee, coordination with the Flyway Councils and completion of the Plan.

III. BACKGROUND

The trumpeter swan is the largest native waterfowl in North America. It was once common throughout the northern United States, Alaska, and Canada (Figure 1, modified from Matteson *et al.*-1995, compiled from the studies of Philip Rogers, Don Hammer, Harold Burgess, Harry Lumsden, Frank Belrose and Ralph Palmer). The trumpeter swan's historic breeding range extended in a wide band from the Bering Sea east to the Atlantic Coast through most of Canada and south to Missouri, Illinois, and Indiana. Currently, there are three recognized populations of trumpeter swans for management purposes: the Pacific Coast Population, the Rocky Mountain Population, and the Interior Population (Figure 2, modified from Gillette and Shea 1995).

The Interior Population was extirpated by 1900 due to market and subsistence hunting (Matteson *et al.* 1995). Historically, the IP may have exceeded 100,000 birds (Gillette and Shea 1995). The present population, which is comprised of small, scattered flocks across the central and eastern portions of their historic range, is the result of restoration efforts by federal, state, provincial, county and private agencies and individuals.

Reintroduction efforts began in 1960 at the Lacreek National Wildlife Refuge (SD) in the Central Flyway, followed by Mississippi Flyway programs in Hennepin Parks (MN) in 1966, Minnesota, Missouri and Ontario in 1982, Michigan in 1986, Wisconsin in 1987, Iowa in 1994, and Ohio in 1995. Two small satellite flocks were discovered in eastern Saskatchewan and western Ontario (Kenora) in 1989. Based on observations of colored markers, they originated from the Lacreek and Minnesota Department of Natural Resources (MNDNR) programs, respectively.

During the course of this 30-year effort, sources of swans and restoration methods have varied extensively. Early on, Lacreek NWR and Hennepin Parks obtained adults and cygnets from Red Rock Lakes NWR (RRL) in Montana. In the early 1980's, the Missouri program focused on translocating birds from Lacreek. Meanwhile, Ontario collected eggs from Alberta and translocated a small number of birds from Comox, British Columbia.

Recently, however, the primary source of eggs has been from Alaska, with critical logistical assistance provided by the USFWS with concurrence of the Pacific Flyway Council. A secondary source of eggs and cygnets has been from captive pairs held by zoological parks and private aviculturists throughout North America. Of the 599 Alaskan eggs collected and transported to the Midwest since 1986, a remarkable 90 percent (537 cygnets) have been hatched in incubators (Joe Johnson, personal communication). Some did not survive captive rearing, a few were retained in captivity for breeding purposes, and approximately 400 of the Alaskan cygnets will have been released by 1997, either through decoy rearing and release as cygnets, or through release as 2-year-olds following hand rearing.

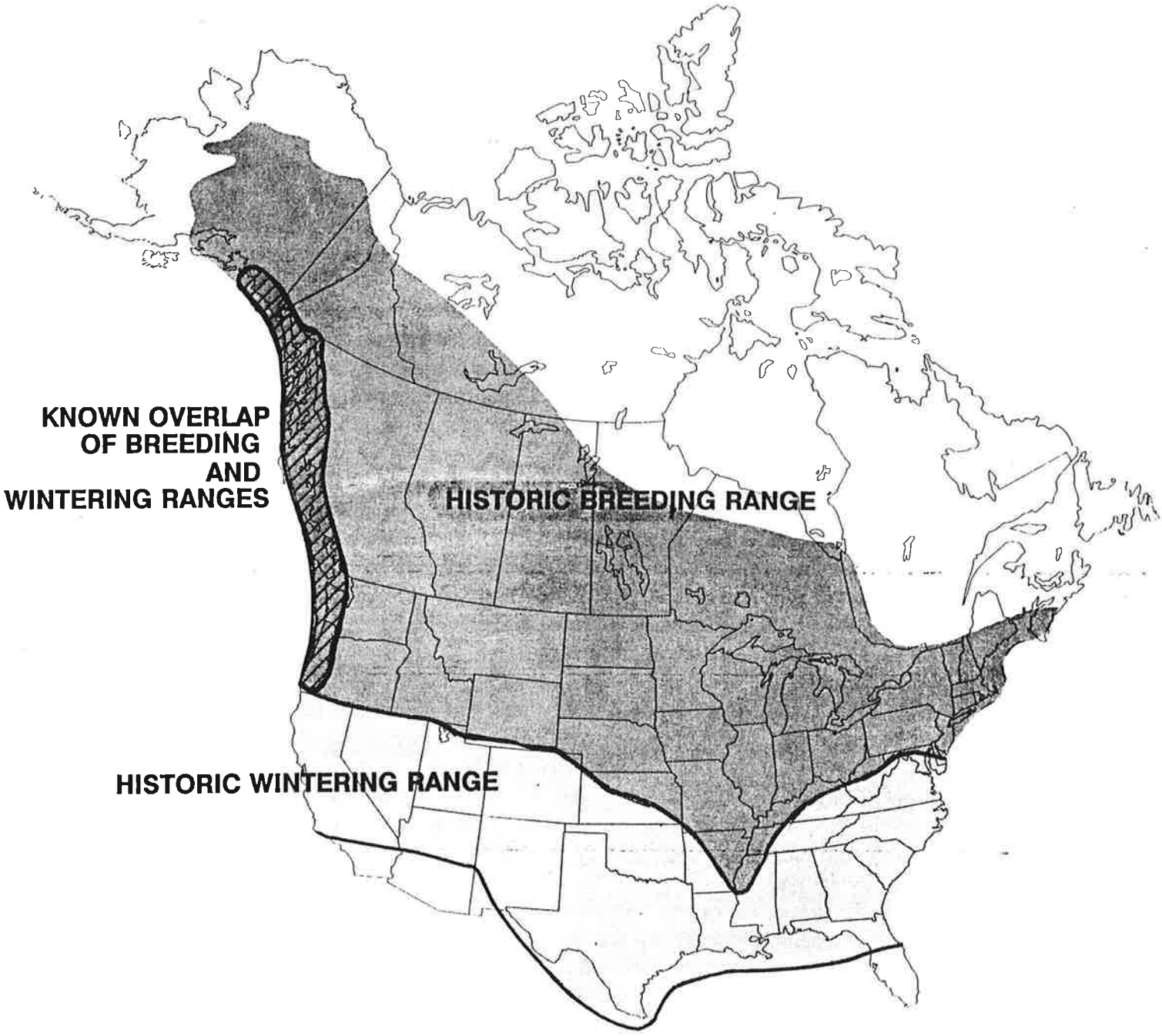


Figure 1. Historic range of the trumpeter swan.

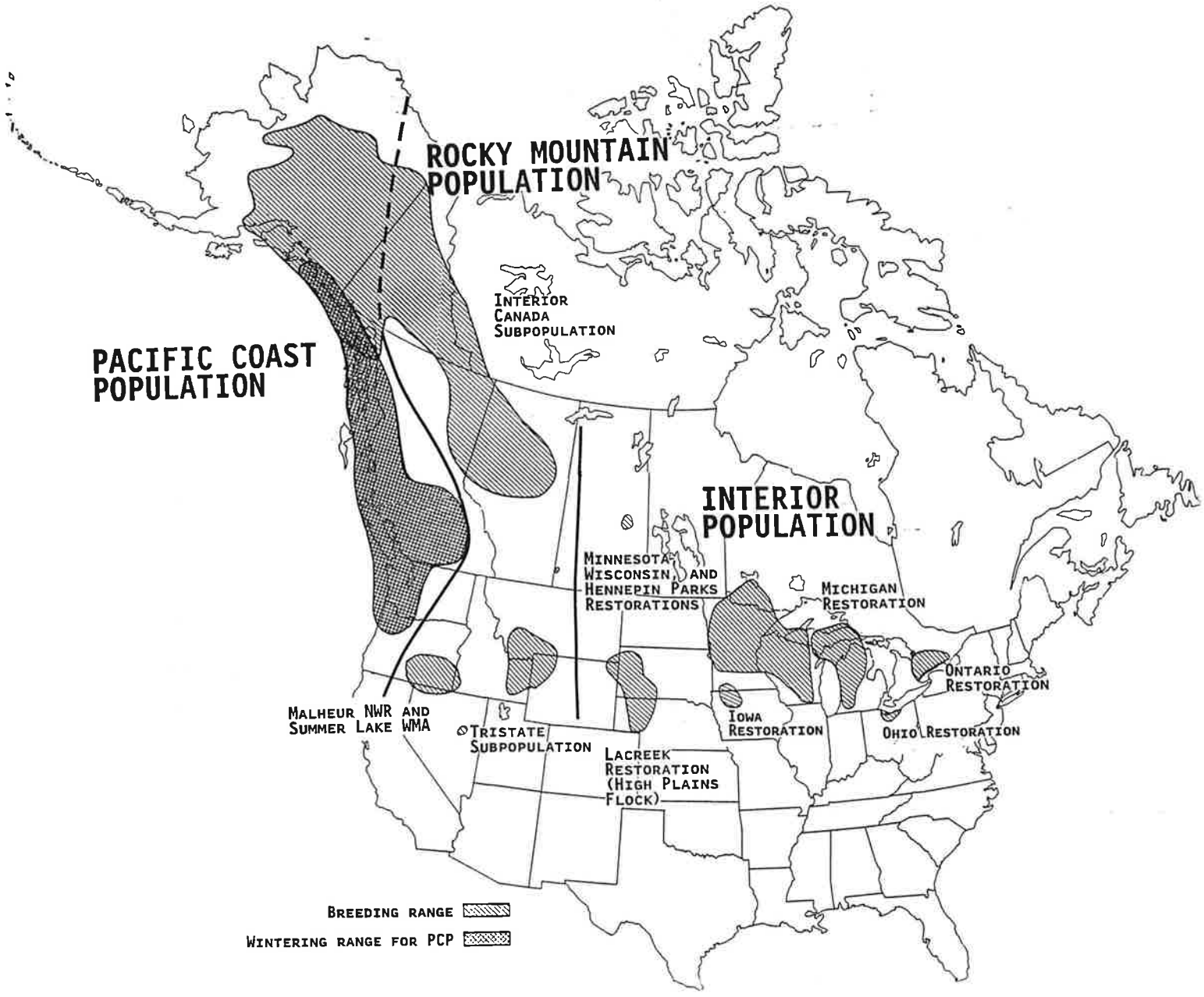


Figure 2. Populations of trumpeter swans (modified from Gillette and Shea 1995).

In summary, approximately 912 trumpeter swans have been released through translocating, cross-fostering, decoy rearing, and captive rearing by eight different agencies between 1962 and 1995 (Compton 1996). These "releases" coupled with natural reproduction resulted in a 1995 fall population of 927 free-flying trumpeter swans (Caithamer 1996), which is still less than one percent of the original population estimate.

All of these restoration efforts occurred within the historic range of trumpeter swans. These restoration programs are the result of collaborative efforts among government agencies, private organizations and private individuals. However, despite these efforts, most of the restoration plans for the IP evolved somewhat independently. For the recovery effort to be more effective and successful throughout the breeding, migration, and wintering range of IP trumpeter swans, an overall management plan for the IP of trumpeter swans is necessary.

A more detailed account of each individual program appears in Appendix A. Additional background information is summarized in Appendixes B and C, and also in the NAMP.

IV. CURRENT POPULATION SIZE AND DISTRIBUTION

SUMMER

Interior Population trumpeter swans currently occur in Saskatchewan, southeastern Montana, eastern Wyoming, South Dakota, Nebraska, Minnesota, Iowa, Wisconsin, Michigan, and southern Ontario during the summer (Fig. 3 prepared by Joe Johnson from records maintained by The Trumpeter Swan Society). Nesting now occurs in all areas mentioned with the exception of Iowa, where releases just began in 1994.

Interior Population trumpeter swans are currently surveyed annually throughout their summer range. Annual population estimates should continue until 2000, a date established in most agency restoration plans and Chapter 5 of the NAMP. These estimates provide an index to population size, distribution and productivity (Appendix C, Tables 1 & 2).

Currently, annual population estimates are taken from late summer aerial surveys in the Lacreek region and are evolving toward cumulative surveys in the remainder of the Great Lakes area. On or about September 1st of each year, biologists compile swan sightings from federal, state, county, and provincial employees and a large network of private citizens. Data gathering continues through the fall until freeze up, when migration significantly increases the likelihood of double counting. In the past, most sightings have been verifiable by at least one member of a group being marked. However, as the population increases and a smaller proportion is

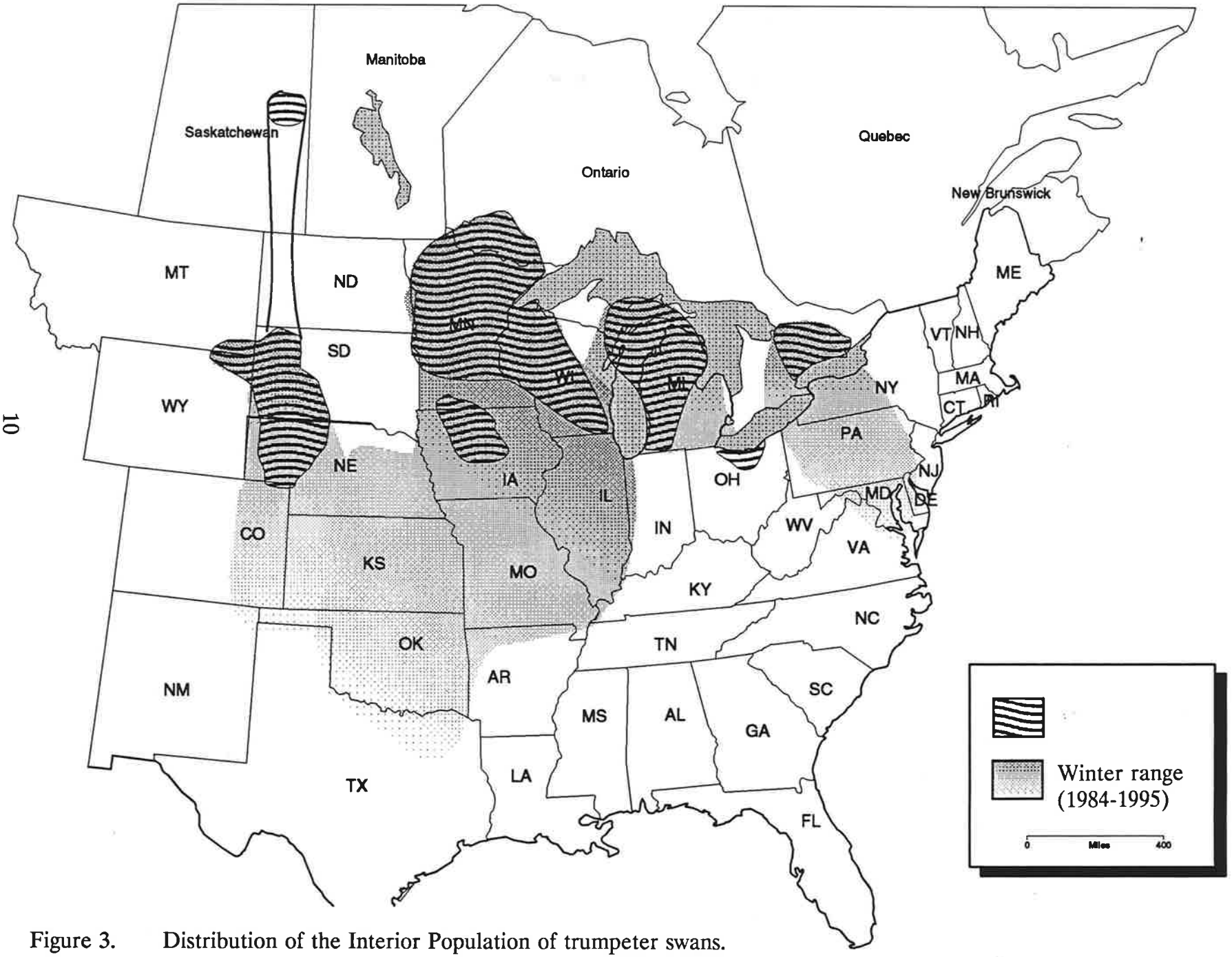


Figure 3. Distribution of the Interior Population of trumpeter swans.

marked, the ability to detect double counting diminishes.

While cumulative surveys may be less accurate than other annual survey methods, and probably underestimate subadults, it is clear that coordinated flyway-wide breeding, summer productivity, and January waterfowl surveys do not index trumpeter swans well. Because of the wide distribution of breeding pairs, systematic aerial surveys are cost-prohibitive and transect sampling techniques are not applicable. As various subpopulations reach established goals, it will be difficult to justify annual population surveys. However, managers should plan for and support the quinquennial North American surveys of trumpeters in 2000 and 2005.

WINTER

Most IP trumpeter swans winter in significant numbers in the states or province where they have been restored (South Dakota, Minnesota, Wisconsin, Michigan and Ontario). Trumpeter swans, some marked, but the majority unmarked, have been observed from Nebraska south to the Texas panhandle, and east through Kansas and Oklahoma to Missouri, Iowa, Illinois, northern Arkansas, and extreme western Indiana (Figure 3). During the past 10 years, fewer than 20 individual trumpeter swans have been reported from southern Texas, Colorado, New Mexico, Ohio, New Jersey and Mississippi. These birds are not included in Figure 3.

The degree to which feeding affects the winter distribution of the Interior Population is known for some flocks, yet unknown for others. Substantial numbers of wintering swans are artificially fed in South Dakota at open water sites at Lacreek; in Minnesota at Fergus Falls, Monticello and Hennepin Parks; and in Ontario at the Metro Zoo and along the north shore of Lake Ontario. In Michigan, some pairs and family groups are fed by private citizens, others appear not to be fed. Supplemental feeding of swans has not been detected for swans at the St. Croix River or Mississippi River wintering sites along the MN/WI border or other sites in Wisconsin. Although the degree to which supplemental food is provided in the southern portion of the winter range is not known completely, it does occur.

Based on reports and observations, it appears that at least 80 percent of the 900+ birds in the IP are receiving supplemental food at some time during the winter (Trumpeter Swan Society files). It ranges from incidental feeding by the public to season-long feeding encouraged by program managers. Proponents of feeding argue that it increases survival by reducing movements of swans through the winter which reduces lead poisoning and the potential for fatal accidents. Increased survival of adults should increase recruitment of cygnets. Opponents argue that feeding prevents the birds from migrating and creates unnatural interactions with people, which could cause behavior or management problems.

If the population growth rate continues at the level of the last 5 years, the IP may

become large enough to allow a sufficient degree of comfort for program managers to decrease or completely suspend winter feeding programs. This would conform to the NAMP (1986, Objective 3) which states, "Except as determined to be necessary for the winter maintenance of swans at Red Rock Lakes and Lacreek NWRs, phase out supplemental feeding programs and the artificial maintenance of ice-free water areas for all US wintering swan flocks by the year 2000." All agree that the goal is to achieve a free-flying, self-sustaining migratory population.

MIGRATION

If we define migration as "an annual movement between a specific breeding ground and a specific wintering ground" (Lumsden *et al.* 1994), it is clear that very few of the restored subpopulations of trumpeters are migrating to locations that are significantly south of their breeding areas.

Trumpeter swans, like giant Canada geese, leave only when freeze up and or lack of suitable food occurs, and often return before spring thaw begins. Like giant Canadas, trumpeter swans appear to move on a north-south axis, with some exceptions in subadults. If it is as true for swans as it appears to be for giant Canadas, that parental guidance is required to establish migratory traditions, and if they migrate as family units rather than in flocks like other waterfowl, then the management challenge of establishing migratory behavior in restored populations is monumental. No Flyway Council-approved restoration plan has advocated the mass translocation of family groups to southern areas in an effort to establish migration. Our experience with Canada geese would indicate that such a plan would not succeed. In fact, a large proportion of the restored giant Canadas move only as far south as the freeze line dictates; a behavior that likely enhances survival. The key will be protection of wintering sites that the swans choose themselves.

Evidence has accumulated over the past 10 years indicating an increase in migratory behavior and some establishment of traditions in at least a small portion of the restored population (Compton 1996). The very small flock of swans nesting in Saskatchewan is migrating to Lacreek NWR. The moderate number of unmarked swans that has been observed in the western parts of Kansas, Oklahoma and Texas during the past 20 years was likely comprised of migrants from the Lacreek flock. A small number of marked groups from both Minnesota flocks has begun to establish traditional migration patterns to or through Iowa, Nebraska, Kansas, Missouri, Arkansas and Oklahoma. Several marked groups from Wisconsin have begun traditional migrations into central Illinois, Missouri and western Indiana (Matteson, personal communication). The majority of sightings has occurred between the 36th and 41st parallels, and may indicate a relatively ice-free zone during most winters. Much shorter intrastate and intraprovincial migrations are occurring in Michigan and Ontario.

POPULATION DYNAMICS

The sixth quinquennial North American Trumpeter Swan Survey was completed during

the late summer and fall of 1995. A total continental population of 19,756 swans was recorded with 16,312 in Alaska (Pacific Coast Population); 2,076 in the Canadian Subpopulation of the Rocky Mountain Population; 441 in the Tristate (US) Subpopulation of the Rocky Mountain Population; and 927 in the IP (Caithamer 1996).

Figure 4 is derived from the sum of all flocks in the IP at 5-year intervals. Figure 5 shows the contributions of each flock to the total population. Data prior to 1980 were taken from tables in the Lacreek management plan of 1982. Joe Johnson analyzed the population figures and arrived at the following conclusions. From 1965 to 1985 (20 years), the IP doubled to 214 swans. From 1986 to 1990, the population doubled again to 432, and from 1991 to 1995 the population again doubled to 927. The calculated mean annual growth rate was 15 percent between 1986 and 1990, and 17 percent between 1991 and 1995. With the possible exception of the Canadian Subpopulation of the RMP, no other population of trumpeter swans has increased numerically at such a rapid rate. Prior to 1985, the population curve primarily represents the Lacreek and Hennepin Parks flocks. Since 1985, the curve has been driven upward by the relatively large releases of swans by Minnesota, Wisconsin, Michigan and Ontario (Appendix C, Table 1). During 4 of the last 8 years (1988-1995), the annual-growth increment included at least 50 percent released swans. While the curve in Figure 4 represents free-flying swans, the reader is cautioned that, because of the large input to the population by releases of captive swans, the total does not represent a viable, self-sustaining population of trumpeters at this time.

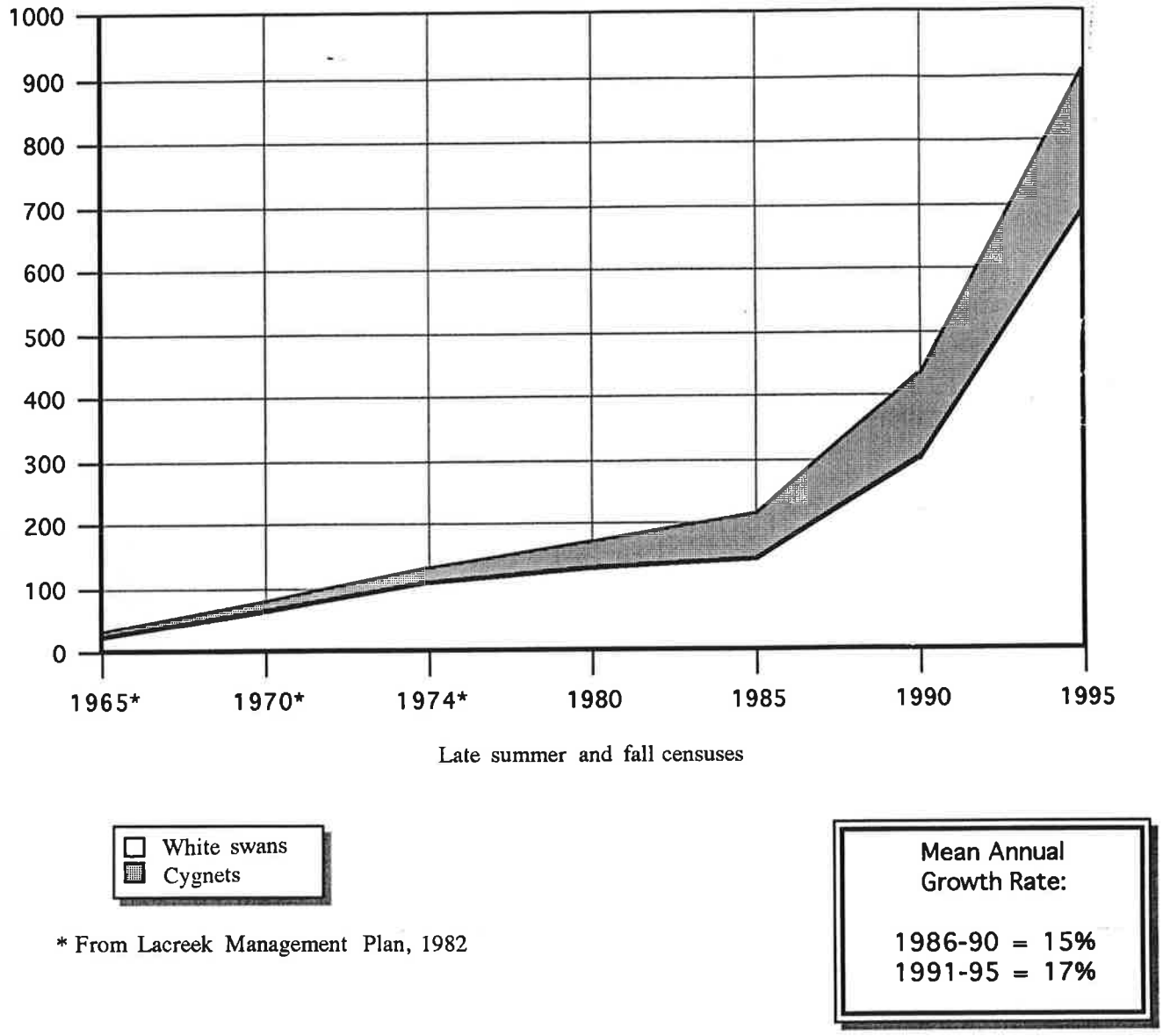


Figure 4. Growth of the Interior Population of trumpeter swans.

VI. ISSUES OF CONCERN AND MANAGEMENT STRATEGIES

1. Coordinating Restoration Efforts

Issue of Concern

State initiatives have funded most trumpeter swan restoration programs throughout the Upper Midwest, mostly through nongame programs. In Ontario, the Provincial government started the restoration that has been carried out by the private sector since 1988. The USFWS was responsible for restoring the Lacreek flock. With the exception of a brief experiment in Missouri, all formal restoration efforts have focused on restoring breeding flocks, with specific objectives for each program. Thus far, there isn't any consensus on what management actions should be taken once the swans migrate to winter habitat, although most southern states do report on swan observations and publicize the restoration efforts. While support has been enthusiastic from states participating in trumpeter restorations on the breeding range within the Mississippi Flyway, concern has been expressed in states where birds may migrate or winter regarding the program's impact on waterfowl hunting and other wintering waterfowl. Biologists in some states question whether they have adequate aquatic habitat to support the swans. Atlantic Flyway waterfowl biologists have expressed concern over the restoration effort in Ontario, especially as it may relate to tundra swan hunting within that flyway.

Most restorations are in the Mississippi Flyway, while the states of Kansas, Oklahoma and Texas (in the Central Flyway) are becoming important as winter locations. While the Central and Mississippi Flyways each have a swan subcommittee, they meet independently. "A Management Plan for Trumpeter Swans" that was adopted in 1986 as part of the NAMP recommended the formation of an IP Subcommittee to coordinate management issues. However, the Subcommittee was never created, and issues like coordinating all the plans into one program or determining if adequate winter habitat exists to support the restored breeding populations were not resolved.

The Mississippi Flyway Council has reviewed and approved individual state restoration proposals, but this review considered primarily the feasibility of the project and the distribution of swan eggs from Alaska. Coordination between game and nongame programs remains primarily at the state level.

Management Strategy

There is a need for greater coordination between flyways and among states and provinces. This management plan, along with the suggested process for review or revision by a joint IP swan subcommittee, could provide this coordination. It is equally important that individual states and provinces prepare their own trumpeter swan management plans and policies that contribute to the overall objectives of the IP plan. This is especially important for states that may serve as wintering sites, since management activity within these states has been lacking to date. Individual state or provincial restoration or winter site management plans should be appended to this management plan. States are encouraged to update their current plans if needed. The individual state restoration or winter site management plans should be reviewed by a joint IP swan subcommittee to determine if they are adequate to meet the needs of the restored population and if they address the concerns of states that may be impacted by implementation of the plan.

2. Setting Population Objectives

Issue of Concern

The 1986 IP Management Plan established an objective of up to 10 separate breeding flocks with a minimum of 15 nesting pairs in each by the year 2000. Restoration efforts to date have concentrated on establishing small flocks as part of the overall Interior Population. Each effort had its own flock population objective and restoration goal, and each program tried to establish a breeding flock within a limited geographic boundary. The Drafting Committee considered the 1986 population objective to be too low for the IP to provide a self-sustaining population that could withstand environmental assaults such as disease or lead poisoning, as well as accidental shooting.

Management Strategy

The first objective of this new IP plan is to "develop a dispersed breeding population consisting of at least 2000 birds and 180 successful breeding pairs by the year 2001".

The IP of trumpeter swans consisted of just over 900 swans as of September 1995. The population had been growing at a rate of roughly 17 percent per year as a result of reproduction in the wild and the release of captive-reared swans from several programs (Joe Johnson, personal communication). Suitable nesting habitat remains abundant and under utilized across the northern US and southern Canada, so the breeding population is expected to continue to grow in the near future.

Existing restoration programs (1995) appear to be adequate to reach the population objective of 2,000 trumpeters by 2001 called for in this plan. Table 1 presents suggested minimum population levels by state or province to reach this objective. The actual distribution of swans by individual state is less important than the cumulative minimum population objective of 2,000 swans for the IP as long as it does not result in scattered non-viable flocks. Absence from this list does not preclude other states from starting restoration programs.

Growth of the Lacreek flock is predicated on a significant increase in the number of trumpeters nesting in eastern Saskatchewan. The two Minnesota flocks together could reach the suggested population objective of 500 birds by 1998 through natural recruitment alone. Michigan and Wisconsin will take longer and additional releases may be necessary. Continued releases of swans are necessary in Ontario, Iowa and Ohio to meet the population objectives suggested in this plan.

3. Wintering Sites and Preparation of Management Plans for Winter Habitat

Issue of Concern

Wetland habitat loss is a major problem for trumpeter swans and all waterfowl. The landscape features of North America have changed from presettlement times. Historically, trumpeter swans were thought to spend the winter on coastal wetlands or along inland rivers and wetlands with aquatic vegetation. Wetlands have been lost at a high rate, while new open water areas, potential migration and winter sites have been created by dams, power plants, stock ponds, reservoirs, or other water development projects. Unfortunately, many of these new sites do not provide suitable food for trumpeters or other species of waterfowl. Most trumpeters that use farm ponds as winter habitat have chosen sites where they are fed by the landowners. Geese and mallards, however, have adapted to field feeding which enables them to winter at more northern locations.

The IP is being restored through releases of swans to portions of the trumpeter's historic breeding range. At present, most of the restored swans do not migrate south of 40°N latitude and many swans do not leave the state in which they were released. Many of the trumpeters that have been wintering north of the 40°N latitude are able to do so because they are provided with supplemental food at sites where water is kept open by manmade alterations to the landscape, such as dams or power plant discharges.

Wintering sites, including open water and artificial feed, are provided at Lacreek NWR, at several private sites in Minnesota, and on the Lake Ontario waterfront. Some of the swans in other northern states have found sites to spend the winter in small numbers. Several of these restored populations have flourished because this

Table 1. Suggested minimum trumpeter swan flock objectives.*

Location	Number of swans
Lacreek (includes Saskatchewan, South Dakota, eastern Wyoming and Nebraska)	500
Minnesota (includes Hennepin Parks)	500
Wisconsin	300
Michigan	300
Ontario	500
Iowa	100
Ohio	50
Other states (due primarily to natural pioneering)	50
Total Interior Population objective	2,300

*Not all program managers have agreed to the individual population objectives listed here. For example, Wisconsin will be developing a population model after the 1996 field season which will help determine their population objective. The total exceeds the minimum objective of 2,000 swans.

strategy results in increased survival of sedentary swans over those that attempt to migrate. (Winter survival at Monticello, MN, has been approximately 95 percent between 1993 and 1996 based on records kept by Sheila Lawrence, personal communication 1996.) However, these wintering sites do not meet the objectives of this plan for a migratory population.

What comprises adequate winter habitat for trumpeter swans in the Midwest has not been adequately determined. Waterfowl managers are concerned that there is not sufficient aquatic habitat with submergent vegetation to provide for the IP swans, at least from Missouri and Arkansas west through north Texas. According to reports received from state waterfowl managers, almost all swans that winter in this region are dependent upon or at least receive some supplemental feed. Aquatic habitat quality may be better farther south, but to date, only a few trumpeters have migrated to the Gulf Coast region (Harold Burgess, personal communication), and no data has been collected on these birds or the sites they use.

Trumpeters have adapted to field feeding on the West Coast (Wareham et al. 1994).* Field feeding by trumpeters has been observed rarely in the Midwest, but this behavior may be necessary for the development of migration traditions to the south. In addition, criteria have not been established on a regional basis regarding management of trumpeter swans on wintering sites. Very little has been done to assess the survival of migrants under various management practices. While there are restoration plans for each breeding flock, there are no specific plans for management on wintering sites for the IP.

Management Strategy

Waterfowl, including trumpeter swans, must adapt to these new habitats to survive. Waterfowl managers need to recognize these changes and develop plans that utilize these new habitats and behavioral changes. Each state in the wintering region is encouraged to develop an individual management plan which fulfills its specific needs for waterfowl management and is consistent with the overall objectives of the IP plan.

Based on sightings of trumpeter swans that have migrated during the past decade (Figure 6, which includes temporary migration stops as well), the key wintering region where swans have tried to spend the winter appears to encompass the following: Oklahoma, the northern third of Texas (especially the panhandle), the southern half of Kansas, the southern half of Missouri, the northern half of Arkansas, and the southern half of Illinois. Kentucky, Tennessee, southern Indiana and southern Ohio may become important wintering areas as restoration continues in Michigan, Ohio, and Ontario, but there is insufficient data from which to draw conclusions at the present time.

The area considered by the Ad hoc Drafting Committee to have the most potential as trumpeter winter habitat is delineated in Figure 7. Some more northern areas serve as temporary stopover points during migration, and a few locations may be able to support limited numbers of swans without supplemental food. Areas along the Gulf Coast need to be investigated further to determine their suitability for trumpeters.

The states mentioned above as wintering locations should determine how actively they want to manage for trumpeter swans and if they have adequate aquatic sites. Waterfowl managers need to determine the significance of supplemental food at each site, and they should try to identify the natural foods that are being consumed, and in what abundance. Plans should be developed to manage swans on sites which they presently use or to attract swans to sites deemed desirable for trumpeters. Migration and wintering habitats that are relatively free of lead and that are not in the center of prime waterfowl hunting areas are in short supply. These sites must be identified and preserved. Considered together, if they are inadequate to serve a migratory population of 1,000 trumpeters, additional wintering sites will need to be restored or created through joint ventures or other cooperative programs. Swans may adapt to new food sources such as agricultural crops, but encouragement may be necessary to make this transition.

The general public is very interested in trumpeter swans. They want to participate in management efforts. It will be important to determine how the public can participate in state programs with active management, or if the public will be allowed to initiate management activities in the absence of state participation.

Locating sites near, but not in, centers of human population may be advisable to provide viewing and educational opportunities for the public, and to avoid conflicts with hunting or the potential for lead poisoning. The trumpeter swan is a protected species. There is no reason why trumpeters cannot adapt to living in close proximity to man.

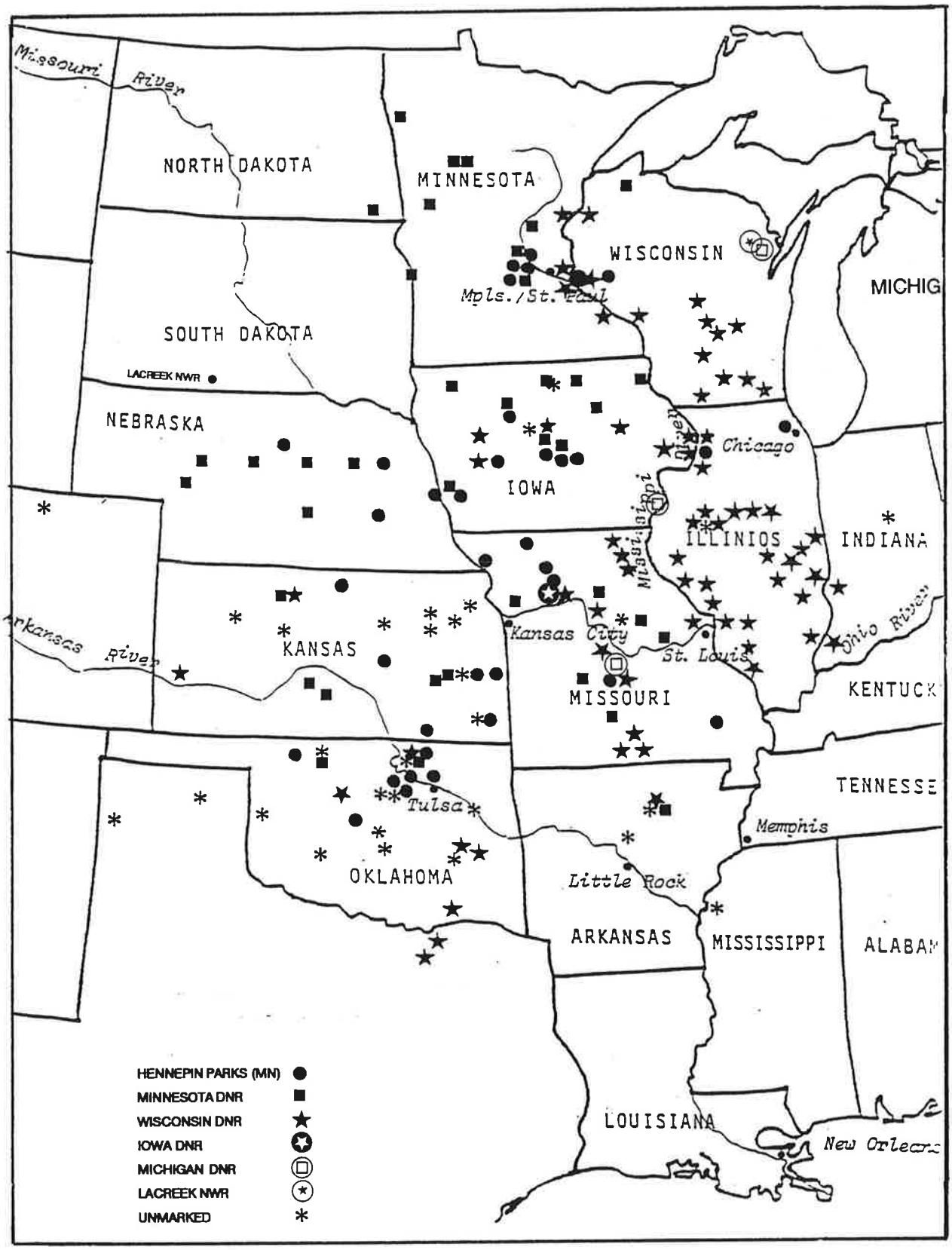


Figure 6. Trumpeter swan winter sightings (1984-1995).

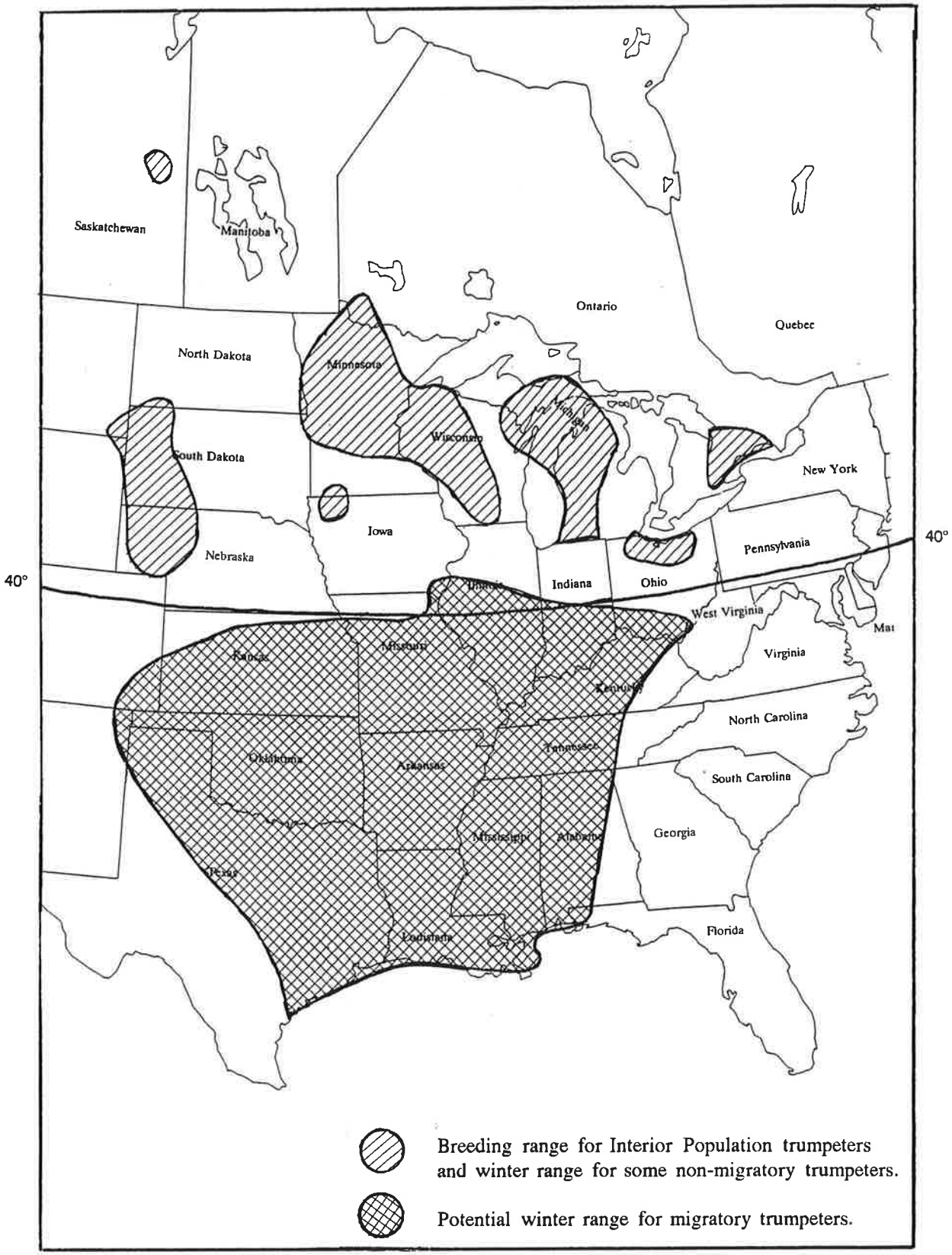


Figure 7. Potential winter range for the migratory portion of the Interior Population of trumpeter swans.

4. Establishing a Migratory Population

Issue of Concern

Trumpeter swans migrate as family units rather than flocks. The cygnets learn the migration route by migrating with their parents under normal conditions. They are very traditional in their use of both nesting territories and winter habitat. They will return to the same sites year after year as long as the habitat is suitable. For this reason, it is very difficult to get trumpeters to reestablish a migratory tradition once it has been broken.

Getting swans to migrate and survive long enough to establish a migratory tradition is the most challenging component of the plan which remains to be done. Less than 20 percent of the IP migrated south of 40°N latitude in the winter of 1994-95 based on reports compiled by The Trumpeter Swan Society. While some swans migrated considerable distances, the majority did not go far enough south to satisfy the migration objectives of this plan. If the goal is to establish self-sustaining flocks, the swans must develop new migratory traditions.

Management Strategy

Identifying potential winter destinations and experimenting with techniques to get trumpeters to find and use them are two of the primary management objectives of this Plan. Providing supplemental feed, using decoy swans, releasing subadult captive-reared swans on wintering sites occupied by migrants, and simply releasing swans on wintering sites and letting them migrate north at random have been suggested as experimental techniques to try to increase the number of swans that migrate. These techniques may be controversial, but they may be necessary to attract swans to sites until they can learn to survive in a new environment. Use of any of these techniques should be left to the discretion of the individual states within the winter range, with appropriate flyway review and approval.

Trumpeters can usually be forced to migrate from northern areas by cutting off the food supply, and it may be necessary to do so to achieve the migration objective in this Plan. However, losses could be extremely high if the birds have to adapt immediately to a totally different feeding behavior at the same time they are exploring to find a new winter home. At the very minimum, it is essential that state agencies in potential wintering areas be prepared to monitor the exploratory movements of these pioneering birds to determine where they go and what habitats they use.

Migration of trumpeters will not be uniform across their range. For example, most all of the swans could migrate from Minnesota while none of the birds migrate from Michigan (where over 3,000 nonmigratory mute swans have been able to overwinter). Once again, the decision on what is acceptable should be left to the discretion of the

individual states, working through the flyway councils and responsible federal agencies.

5. Conflict with Hunting Programs

Issue of Concern

There are potential conflicts between restoration of the IP of trumpeter swans and other waterfowl management programs, particularly the potential to affect existing tundra swan and snow goose hunting programs. Eastern Montana and portions of North Dakota and South Dakota have tundra swan hunting seasons with 500, 2,000, and 1,500 annual hunting permits, respectively, based on 1995 data. These seasons are very popular with residents in these states and their nonresident visitors (Spencer Vaa, personal communication). Currently, the potential exists for trumpeter swans from adjacent restoration areas (MN, WI, Lacreek and Saskatchewan) and from the RMP (Figure 2) to wander into areas open to tundra swan hunting, and the incidental taking of a few trumpeter swans may occur. There is concern that such chance killing of trumpeter swans may cause changes in the existing tundra swan hunting programs in the Central Flyway. The Federal framework governing tundra swan hunting seasons in the Pacific Flyway was modified in 1995 to accommodate rebuilding migrations of RMP trumpeter swans wintering in the Tristate area of Wyoming, Montana, and Idaho. There is concern that similar changes could be proposed for Central Flyway states. Even if assurances are given by a group or in an approved management plan that the presence of trumpeter swans (which are a Federally-protected species) would not impact current programs or management, there is no way to predict or control what might happen through political or legal avenues as long as trumpeters are protected. This is a major concern.

Nesting trumpeter swans will likely remain on breeding ranges through part or all of the tundra swan hunting season. Thus, breeding birds would be extremely vulnerable to shooting. Therefore, any attempt to restore breeding trumpeters to areas open to tundra swan hunting in North Dakota, South Dakota, and Montana would be in direct conflict with existing tundra swan hunting programs. Decisions regarding restoration efforts need to be made in a way that will enable the people in these states to retain control over their destiny regarding tundra swan hunting and trumpeter restoration.

When considering snow goose hunting seasons, current Federal framework (1996) allows hunting of the Midcontinent population of snow geese for 107 days through March 10 in all areas of the Central and Mississippi Flyways except for the Rainwater Basin area of Nebraska. Kansas, Oklahoma, and Texas in the Central Flyway, as well as all mid-latitude and southern states in the Mississippi Flyway offer potential wintering sites for IP trumpeter swans. Each is allowed a snow goose hunting season that runs to March 10. The potential exists for the illegal killing of small numbers of trumpeter swans during snow goose hunting seasons, which could result in efforts to alter or close the snow goose season to protect trumpeters, even when the losses are not

significant to the overall IP.

Management Strategy

The overall goal of restoring a self-sustaining migratory population of trumpeter swans in the Central and Mississippi Flyways, as well as related Canadian provinces, can be attained without restoration of trumpeters to tundra swan hunting areas, and it can be done without restricting existing tundra swan seasons. In order to minimize the conflict between trumpeter swan restoration and existing hunting programs, several actions are recommended. First, restoration of trumpeter swans should not be undertaken or encouraged in the tundra swan hunting areas in eastern Montana, North Dakota and eastern South Dakota. Second, special effort should not be expended to protect trumpeter swans that migrate or wander into areas in the Central Flyway that are open to tundra swan hunting. It is likely that trumpeters will begin to show up as restorations continue, and that a few will be shot. These losses should not have a significant impact on any restoration program, since trumpeter restoration areas and tundra hunting areas are spatially separated in the Central and Mississippi Flyways. Finally, if tundra swan hunts are to be monitored to species, a way must be found to eliminate the liability to the licensed tundra swan hunter who accidentally takes a trumpeter in an authorized tundra swan hunt. A general swan hunt could be considered for those states in the Central Flyway that are currently holding tundra swan hunting seasons if an effective alternative is not found and implemented to resolve the liability question.

The situation confronting RMP trumpeters is different from the situation in the Midwest. RMP trumpeters must migrate through Utah to expand their winter range. The two species could not be separated spatially, so the tundra season had to be shortened to protect trumpeters that migrate slightly later. Most IP swans do not migrate through areas open to tundra swan hunting. Therefore, there should not be a similar conflict or the need to alter tundra swan seasons in the Central Flyway to protect migrating trumpeters.

The statement, "Hunting of other waterfowl will not be precluded because of the chance killing of trumpeter swans," was adopted in a Position Statement of the Central Flyway Council on July 27, 1989. It is included in this management plan as well. There is little likelihood that knowledgeable hunters will confuse a trumpeter with a snow goose. However, wherever possible, trumpeter swan wintering sites should be selected that have minimal probability of causing conflicts with other waterfowl hunting seasons. This may be very difficult if trumpeters adapt to field feeding as tundra swans have. An information and education program for waterfowl hunters regarding the positive identification of swans, both trumpeter and tundra, should be implemented to reduce the chance of illegal harvest during regular waterfowl seasons.

6. Lead Poisoning

Issue of Concern

Lead poisoning has been identified as the leading cause of mortality for trumpeter swans in Minnesota, exceeding shooting, accidents and predation as a cause of death, and it is a major source of mortality elsewhere in the Midwest* (Degernes and Frank, 1989). Because of their feeding habits, trumpeter swans are very prone to ingesting lead pellets that result in lead poisoning. There is concern about whether there are enough suitable, lead-free wintering sites available to accommodate the increasing numbers of trumpeter swans, and it is uncertain how to get trumpeters to confine their use to "safe" areas or how long the lead poisoning problem will persist.

Management Strategy

Effective law enforcement by the USFWS, CWS and state and provincial wildlife agencies is necessary to ensure strict compliance with nontoxic shot laws. In addition, information and education programs for waterfowl and other game bird hunters are needed to explain the magnitude of the lead poisoning problem for trumpeter swans and other waterfowl.

Wintering sites for trumpeter swans should be as lead-free as possible. This may mean that historical wintering areas may not be suitable due to excessive lead contamination. Flooded fields that are used for hunting may be unsuitable as well. Sites that could be considered include reservoirs, rivers, recreation ponds, or other water areas that either have a history of minimal hunting or that were restored or created after the ban on lead shot. An evaluation for lead should be conducted for any area being considered for swan management.

Managing lead-free sites specifically to make them attractive to trumpeters may be adequate to hold trumpeters on them. Managing for specific aquatic plant species may hold the most promise if artificial feeding is to be avoided. There may be situations, however, where limited supplemental feeding is the most cost-effective way of keeping swans on safe areas. Each state must determine which techniques it will endorse within its borders.

7. Population Surveys

Issue of Concern

The Pacific Coast Population of trumpeter swans is censused every 5 years through an intensive but costly survey of all breeding habitat. The Rocky Mountain Population is censused through an annual summer survey in the U.S. and every 5- years in Canada, and a winter survey is flown annually across the more restricted winter habitat for the RMP in the Tristate area.

Equivalent aerial surveys have never been conducted for the Interior Population. Lacreek NWR conducts a summer aerial breeding survey of all suspected swan habitat within 200 miles of the refuge. Minnesota did aerial searches for nesting trumpeters for several years, but have discontinued that practice. Wisconsin conducts aerial surveys regularly and plans to continue. All other restoration projects rely on ground observations and reports from the public to locate nesting birds.

IP breeding population estimates rely heavily on reports of families of swans (many of them consisting of at least one marked adult) at late summer/fall staging areas and wintering sites. All observations are combined to get a rough estimate of the population. This "continuous" survey technique is possible only because some of the swans are marked for individual identification. The results are becoming less reliable as the percentage of unmarked swans increases.

It is unlikely that funds will become available for complete aerial surveys of either the summer or winter range for the IP, especially considering the size of the area compared to the density of the birds. No existing waterfowl survey indexes trumpeters well.

Management Strategy

Marking additional swans to assist in identification of individual family units and sub-flocks will increase the accuracy of the estimate. Even so, the current census technique will be adequate only if swans continue to concentrate at staging or wintering sites. It will become increasingly difficult if they migrate directly to widely scattered wintering sites.

As flawed as it is, the "continuing" survey process should be used through 2001 to assess the success of the restoration program and to provide data to assist in decisions regarding winter habitat. The census technique should be reviewed for possible modification in 2001. Further consideration should be given to modification of the December goose survey or the midwinter waterfowl survey to obtain better information on trumpeter swans. All swan managers should participate in the 5-year swan survey scheduled for 2000.

8. Marking Swans

Issue of Concern

Almost all swans released as part of restoration programs were marked with collars or patagial-wing tags. Some of these markers have come off. More cygnets are being fledged in the wild now than are being released. With the exception of swans in Wisconsin, very few wild cygnets are being marked before they fledge. Consequently, the percentage of marked swans in the IP is declining. This makes it more difficult to census the population as previously mentioned, and it makes it very hard to keep track of migrants to determine winter habitat use and survival.

Management Strategy

All released swans should continue to be marked either with wing tags or collars to enable individual identification at a distance. Until winter migration population objectives have been met, individual flock managers should expand efforts to mark wild-reared swans. Techniques may vary for capturing and marking swans, but options include capturing cygnets on nesting marshes, capturing subadults on molting areas, or capturing family units with walk-in traps on staging or wintering areas. All marking will increase the ability to monitor movements later.

9. Reporting Swan Observations

Issue of Concern

Increased publicity as well as increased numbers of marked birds are needed to encourage observations of swans from the public, especially on wintering grounds where information is needed most. Most states lack a central contact person for observations and most coordination among states came through The Trumpeter Swan Society.

Obviously, the next 3 years (until 2001) are critical. Assuming that more swans are marked and more swans migrate, there will be a greater need to establish an observer network and reporting system.

Management Strategy

As part of this plan, each state has designated a contact person to whom observations can be reported and who can be called upon to answer questions about the program. Each state is encouraged to establish an observer network complete with information sheets on trumpeter swan restorations in the Midwest. Restoration efforts and the potential for encountering trumpeter swans in states to the south need to be publicized to encourage more public participation.

Observations should be reported directly to the contact person in the state where the swan was sighted. The contact person should provide this information on a monthly basis to whomever is assigned to maintain a central database and the distribution map of migrants. The Trumpeter Swan Society will fill this role until another agency is found. The contact person in the state in which the swan was originally marked should be notified by the contact person in the state where the swan was sighted within 1 week of receiving a sighting, at least for the next 5 years. Each state contact person should maintain a database for his or her state.

This entire procedure should be evaluated when population and migration objectives are met.

10. Recreational Benefits and Interpretive Programming

Issue of Concern

The trumpeter swan is relatively new to residents in the Midwest. Public awareness is low, and the species is not being used to its full recreational or educational potential.

Management Strategy

Observing, photographing and studying swans are important pastimes of people throughout the trumpeter's range. Continuation of these activities should be encouraged where and when it will least affect the birds. Increased understanding of these swans and their relationship to waterfowl management and wetland conservation, are recognized as integral parts of this plan. The Subcommittee for IP trumpeters will encourage and assist in developing viewing sites to allow access to swans without disturbance. The task will be made easier if specific sites are managed to attract swans, especially if these sites are in close proximity to human population centers. With assistance from The Trumpeter Swan Society, the states and participating private organizations should develop written and pictorial information for dissemination to the public on the life history of trumpeters and should publicize viewing locations.

11. Relationship with the Atlantic Flyway

Issue of Concern

A few trumpeter swans have been observed in the Atlantic Flyway as a result of occasional wanderings from Minnesota and Ontario. The number of trumpeters showing up on the Atlantic Coast and the eastern Great Lakes may increase as restored populations grow. Since tundra swan hunting is an important recreational activity in several Atlantic Flyway states, a need exists to coordinate management of both species. A management plan for trumpeter swans does not exist for the Atlantic Flyway.

The Atlantic Flyway Council was not included in the planning process for this IP revision, even though the Atlantic Flyway shares many of the same issues of concern with the Mississippi and Central Flyways. The joint drafting committee from the

Mississippi and Central Flyway Councils decided it would be premature to include the Atlantic Flyway in this plan, because they were not represented on the committee which prepared this plan.

Management Strategy

This Plan is specific to the Mississippi and Central Flyways. The Atlantic Flyway has been kept apprised of the planning process and has received copies of revised drafts. The Atlantic Flyway can develop and adopt a similar plan or elect to become a participant in this plan at any time. The Central and Mississippi Flyway Councils should reassess the need for more direct involvement by the Atlantic Flyway and for modification of the IP Management Plan by 2001.

12. Mute Swans

Issue of Concern

Mute swans have become a nuisance in most of the northeastern states and a few Canadian provinces. Some of these states and provinces are looking for ways to control these feral birds.

Several of these states and provinces are included in the range of the IP trumpeters. Since trumpeters will displace mute swans in most nesting situations, some managers hope trumpeter swans can be used to control mutes. Others question whether the trumpeter will cause problems similar to those created by mute swans.

Management Strategy

Mute swan control should not become a primary objective for a trumpeter swan restoration project. Trumpeters may displace mute swans on breeding habitat. However, they may not be as successful as mutes in rearing young in certain habitats, such as densely vegetated lakes with high snapping turtle populations or lakes with intensive human use. A reduction in the number of mute swans may result from trumpeter restoration in certain situations, but may not provide the control desired. Additional population control techniques will be necessary to keep mute swans in check. The public should be educated about problems that can be caused by mute swans, and they should know the differences among trumpeter, tundra and mute swans.

Trumpeters should not cause the same problems as mutes on summer habitat, because their territorial behavior will limit their density, and wild-reared trumpeters do not show the same aggressive tendencies toward people. Problems could develop on winter habitat such as cratering in cranberry bogs or rice fields, but it is premature to develop management strategies for problems that may never occur.

13. Funding

Issues of Concern

Funding for restoration projects in the Midwest has come almost exclusively from state/provincial nongame and wildlife programs or private sources, with the exception of the Lacreek flock which was restored by the USFWS. This mechanism for funding has been adequate to support restoration projects within states or provinces, but it has been inadequate to support aspects of restoration which transcend state or provincial boundaries. The USFWS supports the concept of restoration and the state initiatives, but large-scale financial support appears unlikely from this agency. Attempts to develop a migratory tradition and efforts to identify and manage wintering sites for the restored flocks have languished for lack of a centralized funding source.

Management Strategy

Restoration of the Interior Population of trumpeter swans must become a priority for all managing agencies and nongovernmental organizations (NGOs) involved with trumpeters, as opposed to managing for individual flocks as was done in the past. Coordination activities (staff time, distribution of informational materials, travel) should be funded as part of normal agency operations.

Funding for discreet management plan strategies should be given priority consideration in agency research and management planning efforts, with the emphasis on the establishment of agency/NGO partnerships.

Innovative state funding programs, such as Wisconsin's "Adopt-a-Swan" program, should be examined and considered by other states. Current alliances of NGOs, businesses, and state agencies should be evaluated to determine effective fund-raising strategies.

The Trumpeter Swan Society continues to provide coordination and communication services to states involved in the restoration effort. New ways must be found to increase funding to enable the Society to continue in these roles as long as it is asked to do so.

VII. INFORMATION NEEDS

Successful planning and implementation of the Interior Population Management Plan will require the development of information bases essential to meeting plan objectives. Research, monitoring, evaluation, management, and educational needs are addressed in this section. The following management strategies and related supportive actions are suggested to guide implementation of this plan. These strategies should be considered whenever applicable in implementing the principal management strategies in Section VI. It is recognized that it may be impossible to accomplish all of them.

- Describe suitable breeding habitat. Based on past surveys and available literature, including unpublished Federal and state reports, develop an adequate description of suitable breeding habitat.

- Describe suitable wintering habitat. Based on available literature, including unpublished Federal and state agency reports, develop an adequate description of suitable wintering habitat.

- Identify and assess known and potential nesting, migration, and wintering sites. Identify and rank sites based on clearly defined criteria.

- Conduct annual surveys of known and potential wintering habitat. An annual survey of known and potential wintering habitat within each state should occur where trumpeters have been known to winter. Aerial surveys may provide the most efficient method for documenting numbers of wintering swans, but ground surveys will be necessary to assess habitat quality and verify swan species.

- Develop and implement new methods for establishing migratory flocks. Are there other methods that have not been explored? What are they and what potential do they have? If birds can be translocated, what are the sources and for how long a period of time should translocation occur? What are the associated costs?

- Evaluate state reintroduction programs to determine which methods have proved effective in establishing a long-distance migratory tradition. Minnesota, Michigan, Wisconsin, and Iowa are utilizing different restoration strategies, with some similar captive-rearing methods. Sources of stock and techniques used need to be evaluated. Definitions of migration (short, medium, long-distance) need to be clarified and adopted uniformly.

- Determine if decoy birds should be used to influence migration and wintering distribution. The use of decoy birds to attract migrating trumpeters to quality sites should be thoroughly evaluated to determine if this technique is desirable and feasible to implement.

• Identify available infrastructure and management techniques to preserve and maintain traditional and potential nesting, migration, and wintering sites. Is there a sufficient infrastructure in place and adequate funding mechanisms to preserve these habitats? Partnerships between state, Federal, and private organizations will be essential. What can be done to improve management (i.e. seeding, manipulation of water levels, plantings, land acquisition) of wintering and breeding habitats?

• Train state and federal wildlife managers in delineation, development and management of breeding and wintering habitat.

• Develop a uniform data recording and reporting system for handling all observations of breeding and wintering swans. Standardized data forms should be prepared so that data will be compiled in a similar and systematic manner at the project and state level. This would ease consolidation and processing of data regionally for the IP, and facilitate reporting through a central information center.

- Observations of breeding and nonbreeding birds during summer should include the following: location (state/province, county, nearest town, latitude-longitude, and township, range and section if available), habitat description (especially important if nesting occurs), number and type of swans present (released or wild nesting/wild produced), collar/patagial tag codes, behavior, general health status, and number of cygnets produced and fledged.
- Wintering ground observations should include location, flock or family group size, number of white swans together and singly, habitat description, behavior of wintering swans, and sightings of marked birds.

All states in the Central and Mississippi Flyways should use this standardized format for recording and reporting swan observations.

• Establish a central information center, key contacts, and dates for submitting observations. This effort should be coordinated with the Flyway Technical Committees, individual states, other participating private groups, and The Trumpeter Swan Society.

• Investigate the need for a uniform protocol for monitoring the health of Interior Population swans. A uniform health protocol may be essential to introducing healthy migratory stock. Regular testing of a selected sample of stock will provide valuable information on the health status of IP birds, and it may help prevent the transmission of injurious diseases at locations throughout the region during migration and wintering. Health certification for captive-reared birds being released to the wild could be part of any restoration protocol. Necropsies on swans should occur routinely so that we know what pathogens are affecting them, and we can work to minimize these impacts.

• Develop appropriate information and education materials to promote optimal recreational benefits and enhance awareness of trumpeter swan restoration efforts. This should be a cooperative international, regional, state and local effort.

• Identify locations where the public may safely view wintering flocks without disturbing them or creating undesirable close encounters that may lead to habituating swans to people.

• Determine how to organize field trips locally during the nesting season to observe swan families from a distance. A "Friends" group or a state/provincial agency may take the lead in organizing field trips, especially in conjunction with a fundraising effort.

• Develop information and education materials to remind hunters of the differences between trumpeter swans and other waterfowl. Videos, slide shows, signs posted in public hunting areas, and printed hand-outs should be developed or adopted from existing state programs (Minnesota, Wisconsin, Michigan) and used in hunter education programs.

• Develop a network of NGOs and state/provincial/federal agencies to ensure impacts on hunting are minimized. A well-informed network should be established to respond to illegal harvest.

• Determine if both collars and patagial tags should be used and if and when collar codes can be changed. An evaluation of the use of collars and patagial tags should be conducted to compare results. There have been problems in Wisconsin with staining of green collars with white alphanumeric codes, which makes them difficult to read. The green collars have been more prone to icing in Minnesota than previous collars.

• Publish a detailed and comprehensive manual on IP swan restoration that includes a protocol on banding, marking, and reporting observations. A detailed and clearly written manual will be needed to guide managers and researchers in the Central and Mississippi Flyways.

VIII. PROGRAM REVIEW AND PLAN UPDATE

A procedure should be developed to monitor progress in implementation of the Plan and to periodically update the Plan. It is recommended that a joint IP Subcommittee be established within the Mississippi and Central Flyways to help implement and oversee the IPMP. It should meet annually or as needed to review progress toward achieving the goal and objectives of this Plan and to recommend revisions. The Subcommittee should report on accomplishments and shortcomings of the cooperative efforts involving the two flyway councils, and those state, provincial and federal agencies and other organizations having management responsibilities. The Subcommittee should report through the appropriate Flyway Technical Committees.

The Subcommittee should consist of representatives from the Technical Committees of the Central and Mississippi Flyway Councils, those state, provincial and federal agencies having management responsibility for this population, and The Trumpeter Swan Society. The Subcommittee should make recommendations to the technical committees to assure that the objectives and recommended management procedures of this plan are integrated and coordinated with those plans and activities of the various agencies and planning systems within their purview. Chairmanship should be rotated biennially, beginning October 1, 1998, between the Central and Mississippi Flyways. The Subcommittee would exercise the prerogative of inviting the participation of any individual, group, or representative whose expertise or counsel is required for the coordination and implementation of management programs.

The Subcommittee should meet annually in conjunction with the midwinter technical section meetings, alternating between the Central and Mississippi Flyways.

The Subcommittee will be responsible for developing by April 1, 1999, a monitoring and evaluation system to track progress in implementation of the Plan and to measure accomplishments. It is intended that the Plan be redrafted every 10 years, with 5-year update periods. Modifications will be necessary if the initial objectives are not met by 2001.

Until the Subcommittee is formed, The Trumpeter Swan Society will compile data and report on the implementation of the Plan. Reports will be submitted to the swan subcommittees of the two technical sections of the flyway councils.

IX. LITERATURE CITED AND SELECTED BIBLIOGRAPHY

Abel, R. 1993. Trumpeter swan reintroduction. Master's thesis, Univ. Wisconsin, Madison.

Alison, R. M. 1975. Some previously unpublished historical records of trumpeter swans in Ontario. Can. Field-Nat. 89:311-313.

Anderson, D. R., R. C. Herron, and B. Reiswig. 1986. Estimates of annual survival rates of trumpeter swans banded 1949-1982 at Red Rock Lakes National Wildlife Refuge, Montana. J. Wildl. Manage. 50:218-221.

Anderson, P. S. 1993. Distribution and habitat selection by wintering trumpeter swans *Cygnus buccinator* in the Skagit Valley, Washington. Master's thesis, Univ. Washington, Seattle.

Banko, W. E. 1960. The trumpeter swan, its history, habits and population in the United States. No. Amer. Fauna 63. U.S. Fish and Wildlife Service. Washington, DC. 214 pp.

Blus, L. J., R. K. Stroud, B. Reiswig, and T. McEneaney. 1989. Lead poisoning and other mortality factors in trumpeter swans. Environ. Toxicol. and Chem. 8:263-271.

Caithamer, D. F. 1996. 1995 survey of trumpeter swans in North America. U.S. Fish and Wildlife Service status report.

Compton, D. 1996. Interior Population status report, highlights and trends, December 1994 pages 18-37 in Proceedings and Papers of the Fifteenth Trumpeter Swan Society Conference. The Trumpeter Swan Society, Maple Plain, MN, 1995.

Cooper, J. A. 1979. Trumpeter swan nesting behavior. Wildfowl 30:55-71.

Degernes, L. A. and R. K. Frank. 1989. Minnesota trumpeter swan mortality, January 1988 - June 1989. Pages 111-113 in J. V. Englund, ed. Proceedings and Papers of the Twelfth Trumpeter Swan Society Conference, The Trumpeter Swan Society, Maple Plain, MN.

Degernes, L. A. and R. K. Frank. 1991. Causes of mortality in trumpeter swans *Cygnus buccinator* in Minnesota 1986-1980. Pp. 352-355 *in* Third Intl. Swan Symp., Wildfowl Suppl. no. 1. (J. Sears and P.J. Bacon, eds). Intl. Waterfowl and Wetlands Res. Bur., Slimbridge, U.K.

Gillette, L. N. and R. Shea. 1995. An evaluation of trumpeter swan management today and a vision for the future. Trans. 60th No. Am. Wildlife & Natural Resources Conf. pp. 258-265.

Hansen, H. A., P.E.K. Sheperd, J.G. King, and W.A. Toyer. 1971. The trumpeter swans in Alaska. Wildl. Monogr. 26. 83 p.

Henson, P. and T. A. Grant. 1991. The effect of human disturbance on trumpeter swan breeding behavior. Wildl. Soc. Bull. 19:248-257.

King, J. 1981. The status and future of the Alaska population of *Cygnus buccinator*. Pages 33-39 in G.V.T. Matthews and M. Smart, eds., Proceedings, Second International Swan Symposium, Intl. Waterfowl Res. Bur., Slimbridge, England.

King, V.E. and B. Conant. 1981. The 1980 census of trumpeter swans in Alaska nesting habitats. American Birds 35(5):pp. 789-793.

Leach, J. T. 1977. Lacreek area trumpeter swan behavior and migration study. M.S. thesis, Univ. South Dakota, Vermillion. 50 p.

LeMaster, D. B. 1981. Foraging ecology of a population of trumpeter swans wintering in southeast Alaska. Master's thesis, Idaho State Univ., Pocatello.

Lumsden, H. G. 1984. The pre-settlement breeding distribution of trumpeter, *Cygnus buccinator*, and tundra swans, *C. columbianus*, in eastern Canada. Can. Field-Nat. 98:415-424.

Lumsden, H. G., D. Compton, J. Johnson, S. Kittelson, P. Hines, S. Matteson and J. Smith. 1994. Trumpeter swan restoration in the Midwest. Pages 145-149 in D. C. Compton, M. H. Linck, H. K. Nelson, and J. R. Balcomb, eds. Proceedings and Papers of the 14th Trumpeter Swan Society Conference. The Trumpeter Swan Society, Maple Plain, MN.

Maj, M. E. 1983. Analysis of trumpeter swan habitat on the Targhee National Forest of Idaho and Wyoming. M.S. thesis, Montana State Univ., Bozeman. 102 p.

Matteson, S., S. Craven and D. Compton. 1995. The trumpeter swan. Cooperative Extension Publications. Madison, WI. 8 pp.

McEneaney, T. 1994. Mid-winter trumpeter swan survey. U.S. Fish and Wildlife Service, Red Rock Lakes NWR, Lakeview, MT. Unpub. Rpt. 10 pp.

McKelvey, R. W. 1979. Swans wintering on Vancouver Island, 1977-1978. Can. Field-Nat. 93(4):433-436.

McKelvey, R. W. 1981. Some aspects of the winter feeding ecology of trumpeter swans at Port Alberni and Comox Harbour, British Columbia. M.S. thesis, Simon Fraser Univ., Vancouver.

McKelvey, R. W. 1981. Winter habitat and food of *Cygnus buccinator* in British Columbia, Canada. Pages 249-260 in G. V. T. Matthews and M. Smart, eds., Proceedings, Second International Swan Symposium Intl. Waterfowl Res. Bur., Slimbridge, England.

McKelvey, R. W., M. C. Dennington, and D. Mossop. 1983. The status and distribution of trumpeter swans (*Cygnus buccinator*) in the Yukon. Arctic 36(1):76-81.

Mitchell, C. D., R. Shea, D. C. Lockman, and J. R. Balcomb. 1991. Demographic analyses of a trumpeter swan *Cygnus buccinator* population in western USA. P. 142 *in* Third Intl. Swan Symp., Wildfowl Suppl. no. 1. (J. Sears and P. J. Bacon, eds.). Intl. Waterfowl and Wetlands Res. Bur., Slimbridge, U. K.

Mitchell, C.D. 1994. Trumpeter swan *(Cygnus buccinator)*. In the Birds of North America, No. 105-39 (A. Poole and F. Gill, Eds) Philadelphia, The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Monnie, J. B. 1966. Reintroduction of the trumpeter swan to its former prairie breeding range. J. Wildl. Manage. 30(4):691-696.

Monson, M. A. 1956. Nesting of trumpeter swan in the lower Copper River Basin, Alaska. Condor 58(6):444-445.

Munro, J. A. 1949. Conservation of the trumpeter swan in Canada. Proc. 7th Pacific Sci. Congr. 4:

Nieman, D. J., and R. J. Isbister. 1974. Population status and management of trumpeter swans in Saskatchewan. Blue Jay 32(2):97-101.

Page, R. D. 1976. The ecology of the trumpeter swan on Red Rock Lakes National Wildlife Refuge, Montana. Ph.D. dissertation, Univ. Montana, Missoula. 143 p.

Paullin, D. G. 1973. The ecology of submerged aquatic macrophytes of Red Rock Lakes National Wildlife Refuge, Montana. M.S. thesis, Univ. Montana, Missoula. 171 p.

Proceedings and Papers of the 1st - 15th Trumpeter Swan Society Conference. The Trumpeter Swan Society, Maple Plain, MN. Copies available from The Trumpeter Swan Society, 3800 County Road 24, Maple Plain, MN, 55359.

Rogers, P. M. and D. A. Hammer. 1978. Ancestral breeding and wintering ranges of the trumpeter swan (*Cygnus buccinator*) in the eastern United States. Tennessee Valley Authority, Knoxville, TN. unpubl., rep.

Schorger, A. W. 1964. The trumpeter swan as a breeding bird in Minnesota, Wisconsin, Illinois and Indiana. Wilson Bul. 76 (4): pp. 331-338.

Scott, P. and the Wildfowl Trust. 1972. The swans. Houghton Mifflin Co., Boston, MA.

Shea, R. E. 1979. The ecology of the trumpeter swan in Yellowstone Park and vicinity. M.S. thesis, Univ. Montana, Missoula. 132 p.

Shea, R. E., D. C. Lockman, and C. D. Mitchell. 1991. Trumpeter swan *Cygnus buccinator* range expansion programs in northern Rocky Mountains, USA. Pp. 348-351 *in* Third Intl. Swan Symp., Wildfowl Suppl. no. 1 (J. Sears and P. J. Bacon, eds.) Intl. Waterfowl and Wetlands Res. Bur., Slimbridge, U. K.

Snyder, J. R. 1991. The wintering and foraging ecology of the trumpeter swan, Harriman State Park of Idaho. Master's thesis, Idaho State Univ., Pocatello.

Squires, J. R. 1991. Trumpeter swan food habits, forage processing, activities and habitat use. Ph.D. diss., Univ. Wyoming, Laramie.

Subcommittee on Rocky Mountain trumpeter swans. 1992. Pacific Flyway management plan for the Rocky Mountain Population of trumpeter swans. Pacific Flyway Study Comm. (c/o USFWS, MBMO, Portland, OR) Unpub. rept. 31 pp.

Subcommittee on Pacific Coast trumpeter swans. 1993. Pacific Flyway Management Plan for the Pacific Coast Population of trumpeter swans. Pacific Flyway Study Comm. (c/o USFWS, MBMO, Portland, OR).

Subcommittee on Pacific Coast trumpeter swans. 1993. Pacific Flyway management plan for the Pacific Coast Population of trumpeter swans. U. S. Fish & Wildl. Service, Portland, OR.

U.S. Fish and Wildlife Service. 1984. North American management plan for trumpeter swans. Office of Migratory Bird Management. Washington, DC. 62 pp.

U.S. Department of the Interior. 1986. North American waterfowl management plan. Fish and Wildlife Service, Washington, DC; Environment Canada, Ottawa, Ontario. 19 pp. Rev. 1994 and includes Mexico, de Desarrollo Social.

Wareham, B. and G. Fowler. 1994. The Comox Valley waterfowl management project. Pages 93-94 in D. C. Compton, M. H. Linck, H. K. Nelson, and J. R. Balcomb, eds. Proceedings and Papers of the Fourteenth Trumpeter Swan Society Conference. The Trumpeter Swan Society, Maple Plain, MN.

Appendix A. Detailed accounts of each individual trumpeter swan restoration program. Reports have been prepared by the program coordinators and are presented in chronological order.

South Dakota (Prepared by Rolf Kraft, Refuge Manager, Lacreek National Wildlife Refuge):

The first IP trumpeter swan restoration effort was initiated between 1960 and 1962 at Lacreek NWR, South Dakota, when 57 cygnets were translocated from RRL. Offspring from that initial release now nest in western South Dakota, western Nebraska and eastern Wyoming. Open water and food are provided during winter. The number of swans spending the winter at Lacreek increased steadily until it reached 282, including 221 adults and 61 cygnets in 1989, and has since declined to 152, including 118 adults and 34 cygnets in 1995. The fall count of breeding areas accounted for 214 swans, including 168 adults and 46 cygnets in 1995 (Appendix C, Table 1).

Since 1991, the winter peaks have been less than the total number of birds observed during respective summer aerial production surveys. Previously, the peak winter population had been significantly higher than the summer production survey total. Normally, the winter peak for cygnets is slightly less (average 12%) than the production survey count with additional mortality suspected as the reason. Since 1991, the winter cygnet count has been significantly less (30%) than the production survey count. These declines on the Lacreek wintering area have occurred while the summer breeding population remained relatively stable. In summation, the winter population at Lacreek has declined and now appears to have stabilized, while the production survey indicates a stable or slightly expanding population. If the high plains flock is increasing slightly but apparently not all returning to Lacreek to winter, fall pioneering to suitable winter habitat is a distinct possibility. Additional evidence of a rudimentary winter migration to the south is provided by a report of 13 unmarked trumpeter swans at Fort Cobb State Park in Caddo County, southwest of Oklahoma City, Oklahoma, on 12/3/94, and numerous other unmarked trumpeter sightings in Kansas, Oklahoma, and Texas.

Eight trumpeter swans marked near Greenwater Lake Provincial Park, Saskatchewan, were observed on Lacreek National Wildlife Refuge in 1994. Since all of the birds marked in eastern Saskatchewan are showing up at Lacreek National Wildlife Refuge in the winter, it is believed that the eastern Saskatchewan birds are part of the high plains flock and a new migration is developing to the north for breeding.

Minnesota

Hennepin Parks (Prepared by Larry Gillette, Wildlife Manager, Hennepin Parks):
Between 1966 and 1970, 40 trumpeters from RRL were given to Hennepin Parks (HP) (formerly known as Hennepin County Park Reserve District) in east central Minnesota. At first, the new arrivals were simply released, in hopes that they would restore themselves. It was soon realized that a much more intensive program would be needed to successfully restore trumpeters to the State. All remaining swans were put into a captive breeding program and all birds were kept captive until 1979, when eight were allowed to fly free. From 1979-95, a total of 159 trumpeters were released from HP locations. Most of the released birds were 2 years-of-age. Trumpeters released by HP have intermingled with the flocks of other restoration efforts in northern Minnesota and western Wisconsin.

In 1984, 28 trumpeters migrated in two groups from HP winter refuges to sites in the south. It was the first documented migration of RRL-origin trumpeters within a restoration project. One-third of the migrants were lost prior to returning to HP in the spring of 1985. In addition, one bird found its way to Chesapeake Bay to winter with mute swans that same year. Although some swans continue to migrate, the majority of Hennepin Parks' swans spend the winter on the Mississippi River near Monticello, MN.

The original goal of the HP program was to establish a flock of 100 free-flying, migratory swans, including at least 15 nesting pairs. In 1995, the flock numbered 155 trumpeters, including 17 pairs with 53 cygnets, most of which are still nonmigratory. The population goal has been increased to 500 swans for the State of Minnesota in conjunction with the State's program (Kittelson and Gillette, personal communication).

Minnesota Department of Natural Resources (Prepared by Steve Kittelson, Nongame Wildlife Specialist, MNDNR):
The MNDNR initiated efforts to restore trumpeter swans in western Minnesota during the early 1980's. The MNDNR initially received young swans from several zoos, HP and private aviculturists. The first swans were released in 1987 as 2-year-old pairs. Minnesota was the first state to obtain approval to collect eggs from the wild in Alaska for incubation, hatching, and release. Their original goal was to establish a migratory breeding population of at least 15 pairs of trumpeter swans in western Minnesota. The combined goal of HP and MNDNR has since been elevated to an overall flock of 500 swans. The MNDNR flock size was estimated at 195 in 1995 including 50 cygnets.

Ontario (Prepared by Harry Lumsden, Ontario Trumpeter Swan Project Coordinator, Ontario Ministry of Natural Resources, Retired):
Ontario began experimental work in 1982 to restore the trumpeter swan as a breeder to southern Ontario. Eggs from Grande Prairie, Alberta, were cross-fostered on feral mute swans. This technique resulted in a fledging rate of 27 percent compared to 77 percent for cygnets raised by captive trumpeters. The difference was due largely to predation by snapping turtles.

Appendix D. Members of the Drafting Committee for the Mississippi and Central Flyway Management Plan for the Interior Population of Trumpeter Swans.

Larry Gillette
The Trumpeter Swan Society and
Hennepin Parks
Maple Plain, MN 55359

Dave Graber
Missouri Dept. of Conservation
Columbia, MO 65201

Jeff Haskins
Region 2 Migratory Bird Coordinator
USFWS
Albuquerque, NM 87103

Joe Johnson
Kellog Bird Sanctuary
Hickory Corners, MI 49060

Marvin Kraft
Kansas Dept. of Wildlife & Parks
Emporia, KS 66801

Rolf Kraft
Lacreek National Wildlife Refuge
Martin, SD 57551

Sumner Matteson
Wisconsin Dept. of Nat. Resources
Bureau of Endangered Resources
Madison, WI 53707

Harvey Nelson
Retired, USFWS
Bloomington, MN 55437

Russell Studebaker
Swan Lake Waterfowl Society
Tulsa, OK 74120-7619

Spencer Vaa
South Dakota Games Fish & Parks
Brookings, SD 57007

Steve Wilds
USFWS
Region 3 Migratory Bird Coordinator
Ft. Snelling, MN 55111-4056